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THE INTERNATIONAL COMMUNITY CONFRONTS PLASTICS POLLUTION FROM SHIPS: MARPOL ANNEX V AND THE PROBLEM THAT WON'T GO AWAY

Paul E. Hagen*

"The capacity of the sea to assimilate wastes and render them harmless and its ability to regenerate natural resources are not unlimited."

- United Nations Conference on the Human Environment, Stockholm, 1972.

INTRODUCTION

Marine plastics pollution is a growing international dilemma that threatens marine resources from the crowded New Jersey shore¹ to the otherwise pristine and uninhabited beaches of Antarctica.² Plastic debris is found in oceans around the globe,³ and its durability ensures its

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1. See *Controlling and Reducing Pollution from Plastic Waste: Hearings on S. 559, S. 560 and S. 633 Before the Subcomm. on Environmental Protection of the Senate Comm. on Environment and Public Works*, 100th Cong., 1st Sess. 49, 50 (1987) [hereinafter *Hearings on Controlling and Reducing Pollution from Plastic Waste*] (statement of Sen. Lautenberg) (recounting a 1986 beach cleanup in Sandy Hook, New Jersey). In one hour 15 people collected 700 plastic containers and six-pack rings and 600 plastic tampon applicators and assisted in filling a flatbed truck with refuse, eighty percent of which was plastic. *Id.* Plastics pollution continues to threaten New Jersey's seven billion dollar per year coastal tourism industry. *Id.* During the summer of 1987, large volumes of marine debris washed onto beaches in the New York-New Jersey area, twice forcing beach closures. NAT'L OCEANIC AND ATMOSPHERIC ADMIN., DEPT. OF COMMERCE, REPORT OF THE INTERAGENCY TASK FORCE ON PERSISTENT MARINE DEBRIS 34 (1988) [hereinafter INTERAGENCY TASK FORCE]. Gateway National Recreation Area in New York and New Jersey spent over \$500,000 to clean 53 miles of beach in 1987. *Id.* During "COASTWEEKS '88" (September 17 - October 10) 250 volunteers in New Jersey cleaned 15 miles of shoreline and collected over 10,000 pounds of debris, 94% of which was plastic. CENTER FOR MARINE CONSERVATION, TRASH ON AMERICA'S BEACHES: A NATIONAL ASSESSMENT 1-9 (1989) [hereinafter TRASH ON AMERICA'S BEACHES]. The Center for Marine Conservation (formerly the Center for Environmental Education) in Washington D.C. is an excellent source for legal and statistical information concerning the problems of marine debris. Authorities cited in this article, to the extent practical, are on file with the Center.

2. See Pruter, *Sources, Quantities and Distribution of Persistent Plastics in the Marine Environment*, 18 MAR. POLLUT. BULL. 305, 309 (1987) (documenting reports of seaborne litter consisting of bags, food containers, and sheeting in Antarctic waters off the coast of Ross Dependency).

3. See *id.* at 307, 309 (discussing plastics pollution in many of the world's oceans); *infra* note 29 (discussing the international nature of the plastics debris problem).

presence for centuries to come.⁴ Although there are many sources of marine debris, the centuries-old maritime practice of disposing of ship wastes at sea is a primary source of marine plastics pollution.⁵

The National Academy of Sciences estimates that 6.4 million tons of trash is dumped into the world's oceans every year, 45,000 tons of which is plastic.⁶ Merchant fleets are estimated to deposit over 639,000 plastic containers into the ocean daily.⁷ Each night commercial fisheries of the Pacific Ocean set out enough synthetic gill netting to reach halfway around the globe,⁸ often losing nets up to 15 kilometers in length.⁹ These lost or discarded "ghost nets" continue to indiscrimi-

4. See UNITED STATES GENERAL ACCOUNTING OFFICE, DEGRADABLE PLASTICS—STANDARDS, RESEARCH AND DEVELOPMENT, REPORT TO THE SENATE COMMITTEE ON GOVERNMENTAL AFFAIRS at 8 (1988) [hereinafter DEGRADABLE PLASTICS—STANDARDS, RESEARCH AND DEVELOPMENT] (stating that traditional plastics may last for up to 200 to 400 years); see also NAT'L OCEANIC AND ATMOSPHERIC ADMIN., DEPT. OF COMMERCE, TECHNICAL MEMORANDUM NMFS F/NWR-23, DEALING WITH ANNEX V - REFERENCE GUIDE FOR PORTS 119 (1988) (indicating that a plastic six-pack cover will take approximately 450 years to decay); *Plastics Pollution in the Marine Environment: Hearings Before the Nat'l Ocean Policy Study of the Senate Comm. on Commerce, Science and Transportation*, 100th Cong., 1st Sess. 46, 59 (1987) [hereinafter *Nat'l Ocean Policy Study Hearings*] (statement of Roger E. McManus, President of the Center for Environmental Education) (confirming that a six-pack ring has an estimated life span of approximately 450 years).

5. See *Nat'l Ocean Policy Study Hearings*, *supra* note 4, at 46 (statement of Gary Mauro, Texas Land Commissioner) (commenting that "[a] 4,000 year maritime tradition of dumping ship garbage at sea posed little problem until World War II, but the advent of modern plastic just makes the practice totally unacceptable"). Historically, ships have disposed of their wastes at sea. *Id.* at 91 (statement of Joseph J. Cox, Director, Marine Affairs American Institute of Merchant Shipping). See also *infra* note 49 (discussing current waste disposal practices for ships at sea).

6. NAT'L ACADEMY OF SCIENCES, *Marine Litter in ASSESSING POTENTIAL OCEAN POLLUTANTS* 405, 408, 422 (1975) [hereinafter NAS, ASSESSING POTENTIAL OCEAN POLLUTANTS]. The study estimates that .07 percent of the estimated 6.36 million tons of waste produced at sea is plastic. *Id.* The NAS study is considered the most comprehensive survey of data on marine sources of debris, even though the work is dated and the sources lacked precision. INTERAGENCY TASK FORCE, *supra* note 1, at 42 n.1. The NAS study was based on 1972 surveys by five countries submitted to the International Maritime Consultative Organization (IMCO). EASTERN RESEARCH GROUP, FINAL REPORT TO THE UNITED STATES COAST GUARD, A REGULATORY EVALUATION OF REGULATIONS IMPLEMENTING ANNEX V TO MARPOL 4-3 (Dec. 7, 1988) [hereinafter REGULATORY EVALUATION OF ANNEX V].

7. Horsman, *The Amount of Garbage Pollution from Merchant Ships*, 13 MAR. POLLUT. BULL. 167, 168 (1982). Wastes from merchant ships include crew-generated domestic wastes and cargo-associated wastes such as dunnage, shoring pallets, wires, and plastic sheeting. *Id.*

8. Laist, *Overview of the Biological Effects of Lost and Discarded Plastic Debris in the Marine Environment*, 18 MAR. POLLUT. BULL. 319, 322 (1987).

9. See *id.* at 321 (noting two examples of synthetic fishing nets recovered in the Pacific Ocean that contained a variety of sea life). One of these nets was a 1500-meter gill net, the other a 15-kilometer drift net. *Id.* Commercial fisheries may generate as much as 135,000 metric tons of plastic debris annually. *Plastic Pollution in the Marine Environment: Hearings Before the Subcomm. on Coast Guard and Navigation of the*

nately kill marine life for years, impacting on both the marine ecosystem and commercial fisheries.¹⁰

Plastics in the ocean kill marine mammals, seabirds, turtles, and fish through entanglement or ingestion.¹¹ Plastic debris also damages vessels and degrades beaches world-wide.¹² In addition, significant cleanup and repair costs are incurred by governments and individuals due to the prevalence of this debris.¹³

The enormous growth of the plastics industry in recent years is largely responsible for the increasing plastics pollution of the world's oceans.¹⁴ In 1987, the United States produced over 55 billion pounds of plastic resin.¹⁵ Plastics are now used for a variety of consumer and industrial products previously fabricated from degradable materials.¹⁶ The lightness, buoyancy, strength, and durability of plastics render them increasingly popular for consumer and industrial products.¹⁷ Unfortunately, these same qualities cause plastic debris to seriously threaten living marine resources.¹⁸

On December 31, 1988, optional Annex V of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL), entered into force.¹⁹ Currently,

House Comm. on Merchant Marine and Fisheries, 99th Cong., 2d Sess. 13 (1986) [hereinafter *Hearings on Plastic Pollution*] (testimony of Carmen J. Blondin, Deputy Assistant Administrator for Fisheries Resource Management, National Oceanic and Atmospheric Administration).

10. See CENTER FOR ENVIRONMENTAL EDUCATION, *PLASTICS IN THE OCEAN: MORE THAN A LITTER PROBLEM*, iii (1987) (K. O'Hara and S. Iudicello principal authors) [hereinafter *PLASTICS IN THE OCEAN*] (explaining that discarded gill nets continue to catch large numbers of commercially valuable sea life). In 1985, Atlantic gill net fisheries lost approximately 30 miles of netting off the New England Coast. *Id.*

11. See *infra* notes 61-90 and accompanying text (detailing the environmental hazards posed by plastics pollution).

12. *PLASTICS IN THE OCEAN*, *supra* note 10, at iii.

13. See *infra* notes 97-114 (discussing the economic impacts of marine plastics pollution).

14. See *infra* notes 31-40 (discussing the growth of the plastics industry).

15. THE SOCIETY OF THE PLASTICS INDUSTRY, *FACTS AND FIGURES OF THE U.S. PLASTICS INDUSTRY*, 13 (1988) [hereinafter *FACTS AND FIGURES OF THE U.S. PLASTICS INDUSTRY*].

16. See Bean, *Legal Strategies for Reducing Persistent Plastics in the Marine Environment*, 18 MAR. POLLUT. BULL. 357, 358 (1987) (stating that garbage bags, cups, bottles, milk and beverage containers, and industrial products such as strapping bands, plastic sheeting, and packing materials are increasingly made of plastic).

17. See *infra* note 38 (discussing the properties of plastics).

18. Pruter, *supra* note 2, at 305; see Weisskopf, *Plastic Reaps a Grim Harvest in the Oceans of the World*, SMITHSONIAN MAR. 1988, at 59, 60 [hereinafter Weisskopf, *Grim Harvest*] (discussing the dangerous properties of plastics in marine environments).

19. International Convention for the Prevention of Pollution from Ships, 1973, Annex V: Regulations for the Prevention of Pollution by Garbage from Ships, I.M.C.O.

thirty-nine nations representing approximately fifty-seven percent of the world's gross shipping tonnage have ratified the Annex.²⁰ Annex V prohibits ship disposal of plastics into marine waters and imposes strict requirements for the disposal of other garbage.²¹ United States ratification of Annex V placed the shipping tonnage of parties to the Annex above the fifty percent required to bring the regulations into force.²²

Although ratification of Annex V of MARPOL renders the discarding of plastics into the sea unlawful, it is unclear whether Annex V will substantially reduce marine plastics pollution.²³ For example, difficult

Doc. MP/CONF/WP.21/Add.4 (1973), reprinted in 12 I.L.M. 1319 (1973) [hereinafter MARPOL Convention], as modified by Protocol of 1978 Relating to the International Convention for the Prevention of Pollution from Ships, 1973, opened for signature June 1, 1978, I.M.C.O. Doc. TSPP/CONF/11 (1973), reprinted in 17 I.L.M. 546 (1978) [hereinafter MARPOL Protocol]. The Convention and mandatory Annexes I and II came into force on October 2, 1983. THE INTERNATIONAL MARITIME ORGANIZATION 341 n.2 (S. Mankabady ed. 1984) [hereinafter INT'L MAR. ORG.]; see MARPOL Convention, art. 15(2) (stating that an Optional Annex shall enter into force 12 months after the date on which not less than 15 states, with combined merchant fleets constituting no less than 50% of the gross tonnage of the world's merchant shipping, have become parties). Eight months after the Reagan Administration formally submitted Annex V on February 9, 1987, the United States Senate voted 90 to 0 to give its advice and consent. 133 CONG. REC. S15,845-50 (daily ed. Nov. 5, 1987). Although the Senate ratified Annex V on November 5, 1987, the Reagan Administration did not deposit the instrument with the International Maritime Organization (IMO) until December 30, 1987, one day after President Reagan signed Public Law Number 100-220, which included domestic implementing legislation for Annex V. 53 Fed. Reg. 2384-85 (1988) (Advance Notice of Proposed Rulemaking for Regulations Implementing the Pollution Prevention Requirements of Annex V of MARPOL 73/78); see also IMO Letter of Acknowledgement (Jan. 11, 1988) (on file at the offices of the American University Journal of International Law & Policy) (acknowledging receipt on December 30, 1987, of the United States instrument accepting Annex V).

20. See United States Coast Guard Commandant Instruction M16450.30 from Rear Admiral J.D. Sipes, U.S. Coast Guard Chief, Office of Marine Safety, Security and Environmental Protection (May 31, 1989) (Copy on file with the American University Journal International Law & Policy) [hereinafter Coast Guard Commandant Instruction] enclosure 4, *Status of MARPOL 73/78* (stating that as of February 8, 1989, thirty-nine nations had ratified Annex V, constituting 56.60% of the world's shipping tonnage). The states party to optional Annex V are: Algeria, Antigua and Barbuda, Austria, Bahamas, Belgium, China, Columbia, Cote d'Ivoire, Czechoslovakia, Democratic People's Republic of Korea, Denmark, Egypt, Finland, France, Gabon, German Democratic Republic, Federal Republic of Germany, Greece, Hungary, Italy, Japan, Lebanon, Marshall Islands, Netherlands, Norway, Oman, Panama, Peru, Poland, Portugal, St. Vincent and Grenadines, Surinam, Sweden, Tunisia, Tuvalu, Union of Soviet Socialist Republics, United Kingdom, United States, Uruguay, and Yugoslavia. *Id.*

21. See *infra* notes 265-90 (discussing the requirements of Annex V).

22. MARPOL Convention, *supra* note 19, art. 15(1)-(2). Optional Annexes to the Convention enter into force one year after the date on which at least fifteen states representing not less than fifty percent of the world's gross shipping tonnage have become parties to the Annex. *Id.*

23. See generally Manheim, *Annex V of the MARPOL Convention: Will It Stop*

questions remain concerning state jurisdiction and enforcement powers under Annex V,²⁴ and whether states will provide adequate port facilities for receiving regulated wastes.²⁵ The limits of the Annex in diminishing the loss of synthetic fishing gear²⁶ and the environmental consequences of increased at sea incineration and ash disposal are also uncertain.²⁷

Part I of this Comment provides an overview of the primary sources and quantities of marine plastics pollution. The environmental and economic impacts of plastics in marine waters are also examined. Part II examines the regulation of plastic pollution from ships and analyzes the inadequacy of previous international and United States law governing vessel source plastics pollution. This section also surveys the role of the International Maritime Organization (IMO) and the evolution of the 1973 MARPOL Convention and Protocol of 1978. Part III discusses the enforcement regime of Annex V as well as United States implementing legislation and interim regulations. Part IV analyzes the limits of Annex V and United States implementing legislation in regulating plastic pollution from ships. This part also examines the problems likely to occur through increased and largely unregulated on-board incineration. The Comment concludes with recommendations for strengthening both domestic and international prohibitions on the disposal of ship generated plastic and ash at sea.

I. MARINE PLASTICS POLLUTION: AN INTERNATIONAL PLIGHT

A. SOURCES AND AMOUNTS OF MARINE PLASTICS POLLUTION

Plastics²⁸ pollute marine waters world-wide.²⁹ The plastics industry

Marine Plastic Pollution?, 1 GEO. INT'L ENVTL. L. REV. 71, 107 (1988) (providing an excellent discussion of Annex V requirements and limitations in reducing marine plastics pollution).

24. See *infra* notes 319-38 (addressing jurisdiction and enforcement under MARPOL).

25. See *infra* notes 339-47 and accompanying text (discussing the question of adequate port facilities under Annex V).

26. See *infra* notes 348-60 (discussing continued problems with lost nets).

27. See *infra* notes 363-91 (addressing the hazards of at-sea incineration).

28. See generally SOCIETY OF THE PLASTICS INDUSTRY, *PLASTICS: A.D. 2000—PRODUCTION AND USE THROUGH THE TURN OF THE CENTURY* 61 (1987) [hereinafter *PLASTICS: A.D. 2000*] (noting that plastics have two basic classifications: thermoplastics and thermostats). Thermoplastics can be repeatedly softened and hardened, while thermostats cannot be remelted and/or reprocessed. *Id.*

29. See Pruter, *supra* note 2, at 305, 309 (documenting studies on marine plastic pollution in the form of debris and/or pellets in the waters or on the shores of Japan, Alaska, Hawaii, New Zealand, Cape Cod, Java, Antarctica, Canada, Bermuda, Scot-

originated over 150 years ago,³⁰ but it grew substantially during World War II in response to the shortage of other materials.³¹ Total plastic production in the United States has grown from roughly 6 billion pounds in 1960 to over 55 billion pounds in 1987.³² Plastic production in other countries has continued to expand as well.³³ In 1985, the United States plastics industry produced over 138 billion dollars in finished goods.³⁴ The 1.2 trillion cubic inches of plastic produced that

land, Great Britain, France, Denmark, Lebanon, Spain, and Mediterranean Sea); see also NAT'L OCEANIC AND ATMOSPHERIC ADMIN., DEP'T OF COMMERCE, TECHNICAL MEMORANDUM NMFS-SWFC-54, PROCEEDINGS OF THE WORKSHOP ON THE FATE AND IMPACT OF MARINE DEBRIS (R. Shomura & H. Yoshida eds.) (Nov. 27-29, 1984) [hereinafter WORKSHOP ON MARINE DEBRIS] (discussing plastics pollution from ocean and land-based sources in the North Sea, the Northwest Atlantic Ocean, the wider Caribbean, and the Baja coast of the Pacific Ocean). A 1987 survey of over 209 kilometers of beach in the Netherlands found 30% of the litter originated from sources at sea and that plastics accounted for approximately 41% of the debris collected. *Dutch Beaches Litter Survey*, 19 MAR. POLLUT. BULL. 46 (1988).

A one day, 58-mile beach clean-up in 1987 of the Padre Island National Sea Shore in Texas recovered 3,646 plastic bags, 3,154 plastic caps, 3,039 plastic bottles, 3,037 pieces of styrofoam, 1,993 pieces of synthetic rope, and 1,087 six pack holders. INTER-AGENCY TASK FORCE, *supra* note 1, at 31. Recent studies indicate that Padre Island National Seashore receives approximately 580 tons of marine debris per year or over ten tons per mile of beach. *Id.* at 29; TRASH ON AMERICA'S BEACHES, *supra* note 1 (detailing a state-by-state analysis of marine debris collected in the United States during Coastweeks '88).

30. H. SIMONDS, A. WEITH, & M. BIGELOW, HANDBOOK OF PLASTICS 3 (1949) (stating that the plastics industry can be traced to the work of Braconnot of France in 1833 and Professor Schoenbein of the University of Basel, Switzerland, in 1845). This resulted from their discoveries pertaining to cellulose nitrate. *Id.*

31. FACTS AND FIGURES OF THE U.S. PLASTICS INDUSTRY, *supra* note 15, at 3; see *Nat'l Ocean Policy Study Hearings*, *supra* note 4, at 59 (statement of Roger McManus, President of the Center for Environmental Education) (affirming that shortages of rubber and other materials created a demand for plastics during the World War II).

32. FACTS AND FIGURES OF THE U.S. PLASTICS INDUSTRY, *supra* note 15, at 13 (showing that the annual plastic resin production in the United States has nearly quadrupled from approximately 14.4 billion pounds in 1967 to 55.7 billion pounds in 1987); see Interagency Task Force, *supra* note 1, at 38 (stating that the compound growth rate for the U.S. plastics industry for the years 1960-1985 is 8.4% for total production); Weisskopf, *Grim Harvest*, *supra* note 18, at 61 (noting that the plastics industry occupies a major role in the United States economy, employing over one million workers).

33. See, e.g., Statistical Office of the European Communities, Eurostat - Industrial Production, series 3, at 188 (1989) (indicating that plastic production in the Federal Republic of Germany grew from 7,506 metric tons in 1984 to 8,546 metric tons in 1987). The centrally-planned economies of Bulgaria, Czechoslovakia, German Democratic Republic, Hungary, Poland, Romania, and the USSR showed a 4.7% annual growth rate between 1974-1986. 1 Y.B. INDUSTRIAL STATISTICS 629 (1986) vol. 1, U.N. Sales No. E.88.XVII.9 (1988).

34. Weisskopf, *Grim Harvest*, *supra* note 18, at 61; see FACTS AND FIGURES OF THE U.S. PLASTICS INDUSTRY, *supra* note 15, at 19 (stating that plastic shipments for the United States in 1987 were valued at more than 23 billion dollars).

year nearly doubled the combined production of the steel, aluminum, and copper industries.³⁵ The Society for the Plastics Industry projects that demand for plastics in the United States will increase to 76 billion pounds by the year 2000.³⁶

Fishing gear such as ropes and netting are now almost exclusively fabricated from synthetic materials that resist disintegration when discarded in the marine environment.³⁷ Plastics are more durable than wood and rubber, lighter than metals, and less dangerous than glass.³⁸ Consequently, plastics continue to replace consumer and industrial products previously manufactured from degradable materials, and constitute an increasingly larger proportion of debris found in marine waters and on coastal shores.³⁹ Recent scientific breakthroughs promise to bring even more uses for plastics in the decades ahead.⁴⁰

Sources of plastic marine pollution are widespread and international

35. *Hearings on Controlling and Reducing Pollution from Plastic Waste*, *supra* note 1, at 319 (testimony of the Entanglement Network Coalition). In 1987, the manufacture of miscellaneous plastic products represented the fourth largest manufacturing industry in the United States, following petroleum refining, motor vehicle and car body manufacturing, and motor vehicle parts and accessory manufacturing. *FACTS AND FIGURES OF THE U.S. PLASTICS INDUSTRY*, *supra* note 15, at 21. The plastics industry also employed more than one million workers throughout the United States in 1987. *Id.* at 8. In 1984, the United States plastics industry produced more than 17 billion plastic bottles and nearly 1 billion pounds of plastic trash bags. *Nat'l Ocean Policy Study Hearings*, *supra* note 4, at 59 (statement of Roger McManus, President of the Center for Environmental Education).

36. *PLASTICS: A.D. 2000*, *supra* note 28, at 10 (projecting a 3.1% growth rate from the 48 billion pounds of plastics demanded in 1985).

37. See INTERAGENCY TASK FORCE, *supra* note 1, at 43-45 (stating that synthetic fishing nets and lines made principally from polyamide (nylon), polyethylene, and polypropylene almost completely replaced natural-fiber based materials by the late 1960s). Strength, durability, buoyancy, light weight, and lower costs are the principal reasons for the change to synthetic nets over previous materials of cotton, linen, hemp, manila, and sisal. Uchida, *The Types and Estimated Amounts of Fish Net Deployed in the North Pacific*, in *WORKSHOP ON MARINE DEBRIS*, *supra* note 29, at 27.

38. Weisskopf, *Grim Harvest*, *supra* note 18, at 61; see Johnson, *An SPI Overview of Degradable Plastics*, in *PROCEEDINGS OF SYMPOSIUM ON DEGRADABLE PLASTICS* (June 10, 1987) [hereinafter *PROCEEDINGS ON DEGRADABLE PLASTICS*] (stating that lightness, inertness, safety, permanence, and economics are the properties responsible for the increased use of plastics).

39. See INTERAGENCY TASK FORCE, *supra* note 1, at 38 (stating that the EPA estimates that plastic constitutes 7.2% of municipal solid waste); ENVIRONMENTAL DEFENSE FUND, *TO BURN OR NOT TO BURN: THE ECONOMIC ADVANTAGE OF RECYCLING OVER GARBAGE INCINERATION FOR NEW YORK CITY 25-26* [hereinafter *TO BURN OR NOT TO BURN*] (indicating that plastics represent 7.4% of the solid waste stream in New York City). In Europe, estimated domestic waste in 1986 totaled 100 million metric tons, of which plastics constituted approximately 7%. *Degradable Plastics in Europe*, in *PROCEEDINGS ON DEGRADABLE PLASTICS*, *supra* note 38, at 4.

40. See Manheim, *supra* note 23, at 71 n.2 (discussing advances in plastics technology that may lead to plastics capturing an even greater portion of the 100 billion container-per-year market for food packaging).

in nature.⁴¹ These sources of debris can be divided into two categories: debris from ocean sources and debris with land-based origins.⁴² Ocean sources generally include a variety of vessels and off-shore facilities.⁴³ This category is considered the primary contributor to marine plastics pollution.⁴⁴ Land-based sources of plastic pollution include: plastic manufacturing and processing activities,⁴⁵ sewer overflows and waste treatment plants,⁴⁶ solid waste management practices,⁴⁷ and littering in coastal areas by the general public.⁴⁸

41. See TRASH ON AMERICA'S BEACHES, *supra* note 1, at 2-1 to -21 (app. 2) (documenting plastic debris collected from beaches in the United States during Coastweeks '88 that originated from more than 46 different countries).

42. See INTERAGENCY TASK FORCE, *supra* note 1, at 41 (discussing sources of marine debris in terms of ocean and land-based sources); Pruter, *supra* note 2, at 305 (stating that shipping, rivers, drainage systems, and litter from beach visitors are the major inputs of plastic pollution).

43. See INTERAGENCY TASK FORCE, *supra* note 1, at 42-52 (listing fishing activities, merchant shipping, recreational vessels, military and research vessels, passenger ships, offshore petroleum platforms, and supply vessels as sources of sea-based plastics pollution); see also PLASTICS IN THE OCEAN, *supra* note 10, at 19-29 (discussing ocean sources of plastic pollution).

44. See PLASTICS IN THE OCEAN, *supra* note 10, at vii (stating that ocean sources are the primary contributors to plastics pollution). But see Kindt, *Solid Wastes and Marine Pollution*, 34 CATH. UNIV. L. REV. 37, 95 (1984) (stating that marine pollution through solid wastes are primarily attributable to land-based sources).

45. INTERAGENCY TASK FORCE, *supra* note 1, at 52-53. Petrochemical plants convert chemicals into raw plastic pellets. *Id.* Plastic pellets are transported in bulk by either train, car, or ship, in 50-100 pound bags. *Id.* Both manufacturing operations and processing facilities use wastewater processes that could lead to discharges of pellets into waterways. *Id.* at 53. Pellets may also be released during shipping operations by train, truck, or ship. *Id.* Raw plastic pellets are traded both domestically and internationally. Pruter, *supra* note 2, at 307. Heavy concentrations of plastic pellets in the vicinity of plastic processing industries indicate that the plastics are carried to sea by river systems. *Id.*

46. INTERAGENCY TASK FORCE, *supra* note 1, at 53-56. Sewage treatment plants that have insufficient capacity, breakdown facilities, or receive storm water that exceeds the plant's capacity in combined sewage and storm water run-off systems are all potential sources of plastics pollution. *Id.* at 54. Unknown quantities of sewage and plastics bypass treatment in these situations and are released into the marine environment. *Id.* Plastics associated with sewage facility discharges are primarily plastic tampon applicators, condoms, pieces of plastic sheeting, and disposable diapers. PLASTICS IN THE OCEAN, *supra* note 10, at 28.

47. INTERAGENCY TASK FORCE, *supra* note 1, at 56. Plastics may be inadvertently released from coastal landfills and from losses of debris during shiploading and over-water transport. *Id.* For example, the Fresh Kill landfill on Staten Island in New York receives seven hundred tons of trash daily. PLASTICS IN THE OCEAN, *supra* note 10, at 29. Plastics frequently blow into surrounding waters and are lost during barge loading operations. *Id.* Following a 1979 lawsuit by the Town of Woodbridge against New York City, the state of New Jersey and New York City signed a consent decree that requires New York City to install "superbooms" and hydraulic cranes to prevent the spilling of garbage. *Plan to Prevent Garbage Pollution of the New Jersey Shore*, 19 MAR. POLLUT. BULL. 152 (1988).

48. See INTERAGENCY TASK FORCE, *supra* note 1, at 52-58 (quoting a survey of

The centuries-old maritime tradition of disposing ship garbage at sea posed little problem to the marine environment until the advent of modern plastic.⁴⁹ The National Academy of Sciences estimates that ocean sources dispose of nearly 6.4 million tons of trash into the marine environment annually.⁵⁰ Forty-five thousand tons of this trash is plastic.⁵¹ The merchant shipping industry is estimated to dispose of more than 5.7 million tons of litter into marine waters each year.⁵²

39.5 miles of beach in Massachusetts that attributed 40% of the debris to beach visitors); *PLASTICS IN THE OCEAN*, *supra* note 10, at 27-29 (quoting studies showing that Los Angeles County beach-goers leave behind roughly 75 tons of trash weekly).

49. See *supra* note 5 (discussing the tradition of discharging wastes at sea). In written testimony before Congress, Ernest J. Corrado, President of the American Institute of Merchant Shipping, stated:

Historically, commercial merchant vessels have disposed of their garbage at sea in compliance with existing laws. . . . Generally, aboard merchant vessels on the high seas, wastes generated as a result of vessel operations and dock maintenance is disposed of directly overboard. Any of these materials which are non-plastic will sink or degrade in a short time. Wastes generated from the vessel's hotel areas (i.e. galley, crew accommodations, crew lounges, and dining rooms) are normally stored in sealed drums and placed in a garbage stowage area. The garbage is then discharged at sea through a disposal chute from the garbage stowage area or from the stern of the vessel. This must be done at regular intervals since garbage retained on board can quickly become unsanitary and even present a fire hazard. . . . It is common to have birds, marine mammals and fish follow vessels on their voyages to take advantage of these discharges.

Plastic Pollution in the Marine Environment: Hearings on H.R. 940 Before the Subcomm. on Coast Guard and Navigation of the House Comm. on Merchant Marine and Fisheries, 100th Cong., 1st Sess. 413-14 (1987) [hereinafter *Hearings on H.R. 940*].

50. NAS, ASSESSING POTENTIAL OCEAN POLLUTANTS, *supra* note 6, at 422.

51. *Id.*

52. *Id.* Surveys indicate that over 26% of wastes from merchant vessels are nonbiodegradable. Horsman, *supra* note 7, at 168. Wastes from merchant ships include crew-generated domestic wastes and cargo-associated wastes such as dunnage, shoring pallets, wires, and plastic sheeting. Pruter, *supra* note 2, at 305, 306. According to the NAS study, merchant ships are the largest contributor of marine debris. NAS, ASSESSING POTENTIAL OCEAN POLLUTANTS, *supra* note 6, at 422. The NAS Study used 1971 data on the number of merchant vessels over 1,000 tons. U.S. COAST GUARD, ENVIRONMENTAL ASSESSMENT FOR PROPOSED REGULATIONS FOR THE PREVENTION OF POLLUTION BY GARBAGE FROM SHIPS UNDER MARPOL 73/78 ANNEX V REGULATIONS 4 (1988) (Draft submitted to the Environmental Protection Agency on file at the office of the American University Journal of International Law & Policy) [hereinafter ENVIRONMENTAL ASSESSMENT]. Between 1971 and 1985 the size of the world merchant fleet increased by 27.7%, suggesting an even higher rate of refuse generation than indicated in the 1971 NAS Study. *Id.* Cargo freighters, replaced with container ships, bulk carriers and tankers, have declined 8%. *Id.* Cargo-associated wastes generated per ton of cargo in general bulk cargo freighters are 80 to 200 times greater than waste from container vessels. *Id.* Thus, changes in fleet composition may be offsetting the increase in merchant fleet size. *Id.*

Merchant marine traffic in United States waters is considerable. REGULATORY EVALUATION OF ANNEX V, *supra* note 6, at 2-2 to -26. Records of the United States Maritime Administration (MARAD) show that as of March 1, 1987, a total of 814 vessels of 1,000 tons or more were registered in the United States. *Id.* at 2-8. Of these, 265 are United States-owned and in noncommercial service, thereby exempt from

Commercial fisheries in the United States are reported to dispose of roughly 245 tons of plastic material into the oceans annually.⁵³ Other generators of plastics pollution at sea include military vessels such as the United States Navy,⁵⁴ passenger ships,⁵⁵ recreational vessels,⁵⁶ and

MARPOL Annex V. *Id.* at 2-8. The United States Coast Guard inspects 2,789 ocean-going vessels under 1,000 tons. *Id.* at 2-14. These vessels are likely to operate beyond three miles of shore and include: 54 freight ships, 15 tank ships, and 2,789 passenger vessels. *Id.* According to MARAD, United States companies owned 404 foreign-flagged ships as of January 1, 1987. *Id.* at 2-20. Additionally, the Coast Guard inspected 6,751 foreign vessels from 110 shipping nations on call at United States ports in 1987. *Id.* at 2-22. Lloyd's Register lists 75,266 merchant vessels in operation for 1986. LLOYD'S REGISTER OF SHIPPING, STATISTICAL TABLES 5 (1986) [hereinafter LLOYD'S REGISTER OF SHIPPING].

The Coast Guard's Regulatory Evaluation converts estimates of ship-generated garbage to garbage bag equivalents using a thirty gallon garbage bag projected to hold 4.01 cubic feet of plastic waste. REGULATORY EVALUATION OF ANNEX V, *supra* note 6, at 4-9. Vessels over 1,000 tons during a typical voyage are estimated to generate between 29 and 60 garbage bags of waste, 18 to 39 bags of which is plastic waste. *Id.* at 4-11. Large passenger vessels are estimated to generate 115 garbage bags of waste, 74 bags of which are plastic waste. *Id.* Tugboats and tow boats are projected to generate five garbage bags of waste, three bags of which may be plastic waste. *Id.*

53. Parker & Yang, *Development of Methodology to Reduce the Disposal of Non-degradable Refuse into the Marine Environment* (unpublished manuscript presented at the Sixth International Ocean Disposal Symposium, Apr. 21-25, 1986, Pacific Grove, California), cited in INTERAGENCY TASK FORCE, *supra* note 1, at 47. In 1985, the United States domestic fishing industry consisted of 129,800 fishing craft and 238,800 fishermen. REGULATORY EVALUATION OF ANNEX V, *supra* note 6, at 2-29. Of these vessels, 24,300 or 18.7% weigh five tons or more. *Id.* Boats in the 5 to 25 ton range are estimated to produce roughly 6 bags of wastes, 4 of which may be plastic waste; middle sized ships generate approximately 17 bags of plastic waste. *Id.* at 4-15. The largest vessels, over 1,000 gross tons, could generate up to 221 garbage bags of plastic garbage per voyage. *Id.* at 4-15. Fishing vessels represent the largest number of commercial vessels in the United States affected by MARPOL Annex V. *Id.* at 2-26. Lloyd's Register lists 20,974 fishing boats world wide. LLOYD'S REGISTER OF SHIPPING, *supra* note 52, at 12.

54. See INTERAGENCY TASK FORCE, *supra* note 1, at 49 (stating that the U.S. Navy employs nearly 285,000 people on board its approximately 600 vessels that operate around the world and discharge approximately four tons of plastic into the oceans on an average day). A survey of one Navy vessel indicated that plastics represented 6.7% of the total waste stream. REGULATORY EVALUATION OF ANNEX V, *supra* note 6, at 4-7 (citing a survey conducted by Koss and Mullenhard in 1988).

55. NAS, ASSESSING POTENTIAL OCEAN POLLUTANTS, *supra* note 6, at 422 (estimating that passenger ships serving United States ports dispose of approximately 28,000 tons of trash annually). But see REGULATORY EVALUATION OF ANNEX V, *supra* note 6, at 5-21 to -22 (stating that United States passenger ships weighing over 1,000 tons are largely in compliance with Annex V prohibitions on dumping due to concern for the sensitivities of passengers and the convenience of port disposal). The 2,720 passenger vessels under 1000 tons registered with the U.S. Coast Guard in 1987 are mainly ferries or charter fishing boats that do not make extended trips to sea. *Id.* at 2-15. Lloyd's Register lists 3,870 ferries and passenger vessels. LLOYD'S REGISTRY OF SHIPPING, *supra* note 52, at 12.

56. See PLASTICS IN THE OCEAN, *supra* note 10, at 26 (using the methodology of the NAS study for calculating waste generation and estimating that recreational vessels in 1984 deposited roughly 51,642 metric tons of trash into marine waters). The

off-shore oil activities.⁵⁷

Plastics in the marine environment include various consumer items, styrofoam, plastic strapping bands and sheeting used by industry, and ropes, line, nets and net fragments used in the fishing industry.⁵⁸ Plastic "pellets," the raw form of plastic before it is manufactured into consumer items, also contribute to the pollution problem.⁵⁹ Although the highest concentrations of plastic debris are found near coastal areas, plastics observe no political boundaries and are found in heavy concentrations in areas where winds or currents concentrate them.⁶⁰

U.S. Coast Guard in 1985 estimated that 9.6 million recreational boats were registered in the United States. REGULATORY EVALUATION OF ANNEX V, *supra* note 6, at 2-40. Approximately 241,000 recreational vessels operate beyond three miles from shore. *Id.* at 2-44. An average 16 million recreational vessels sail coastal waters, estuaries, or lower rivers that flow into coastal waters. INTERAGENCY TASK FORCE, *supra* note 1, at 48. These vessels dispose of various consumer items that pollute the marine environment. *Id.*

57. See INTERAGENCY TASK FORCE, *supra* note 1, at 51 (detailing plastic wastes from petroleum-associated industries as including: plastic sheeting, computer write-protect rings, seismic markers, and oil and air filters). The Minerals Management Service (MMS) of the United States estimates that 3,493 production platforms are active in the Gulf of Mexico. REGULATORY EVALUATION OF ANNEX V, *supra* note 6, at 2-47. Additionally, the U.S. Coast Guard estimates that there are 484 industry service vessels operating under the United States flag on the Outer Continental Shelf and 125 operating in foreign waters. *Id.* at 2-48. Approximately 124 active mobile offshore drilling units (MODUs) are also operating in federal waters. *Id.* at 2-46. MMS regulations prohibit the disposal of solid wastes from offshore gas and oil platforms. 30 C.F.R. § 250.40 (1989). The Clean Water Act also limits discharges of solid waste from offshore oil and gas platforms and offshore drilling units by requiring operators in federal waters to obtain National Pollution Discharge Elimination System (NPDES) permits. REGULATORY EVALUATION OF ANNEX V, *supra* note 6, at 5-6 (citing the Clean Water Act, 33 U.S.C. §§ 1251-1387). Despite these existing prohibitions, however, lost or discarded plastic items from oil industries continue to pollute Texas beaches. See INTERAGENCY TASK FORCE, *supra* note 1, at 51 (stating that the off-shore petroleum industry contributes significantly to the debris problem in Texas).

58. See Pruter, *supra* note 2 (discussing the components and types of common plastic debris).

59. See *id.* at 307, 309 (discussing plastic pellet pollution). Plastic pellets are the raw form of plastic after it is manufactured from polyethylene. *Id.* Pellets range in size from .1 millimeters to five millimeters and are found on beaches throughout the world. *Id.* at 308. Near industrial centers in New Zealand, concentrations of more than 10,000 pellets per linear meter of beach are common. *Id.* at 307. A 1984 study of North Atlantic waters between Cape Cod and Cape Canaveral found concentrations of more than 8,000 pellets per square kilometer of ocean. *Id.* Similar surveys of beaches in Lebanon showed plastic pellets and styrofoam to be common debris. *Id.* at 309.

The source of plastic pellet pollution in marine waters is uncertain. See O'Hara, *Plastics Debris and Its Effects on Marine Wildlife*, in AUDUBON WILDLIFE REPORT 1988/89 395, 411 (1988) (stating that the problem of pellet pollution has not been fully addressed and that it is uncertain whether manufacturing facilities or the shipping and handling of pellets result in their discharge into marine waters).

60. Pruter, *supra* note 2, at 307. Marine litter is often concentrated along coastlines because merchant marine shipping, fishing, and recreational activities usually occur near the shore. *Id.* The buoyancy of plastics allow them to be concentrated along

B. EFFECTS OF PLASTICS POLLUTION ON THE MARINE ENVIRONMENT

Plastic debris exacts a heavy toll on the world's living marine resources.⁶¹ Each year, through either entanglement and/or ingestion, plastics cause the deaths of tens of thousands of marine mammals, sea turtles, seabirds, and fish.⁶² The accumulation of plastics in current-generated rifts intensifies the threat to the environment because marine life also concentrates in these areas.⁶³ Plastic debris may also threaten entire animal populations.⁶⁴

Among the marine mammals most susceptible to entanglement in

lines of convergence between water masses and at the center of major current gyres. Laist, *supra* note 8, at 323. These same areas are often major feeding grounds for large populations of marine life. *Id.*; see Day & Shaw, *Patterns and Abundance of Pelagic Plastic and Tar in the North Pacific Ocean, 1976-1985*, 18 MAR. POLLUT. BULL. 311, 314 (1987) (stating that plastics generated from shipping around Japan move in response to the winds and currents of the North Pacific).

The origins of plastic debris is also testimony to the international nature of the problem. See Heneman, CENTER FOR ENVIRONMENTAL EDUCATION, PERSISTENT MARINE DEBRIS IN THE NORTH SEA, NORTHWEST ATLANTIC OCEAN, WIDER CARIBBEAN AREA, AND THE WEST COAST OF BAJA CALIFORNIA REPORT TO THE MARINE MAMMAL COMMISSION AND THE NATIONAL OCEAN POLLUTION PROGRAM OFFICE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DEPARTMENT OF COMMERCE III-7 (1988) [hereinafter PERSISTENT MARINE DEBRIS] (stating that of the 90% of identifiable debris found on Helgoland, a small German island, 39.5% was German, 17.8% was British, 16.5% was Dutch, 9.6% was Danish, and 3.5% was French). A similar one-year survey of a sixty-meter beach in Helgoland, Germany found that plastics constituted 75% of the items found, and that the objects were manufactured in 26 different nations. Vauk & Schrey, *Litter Pollution from Ships in the German Bight*, 18 MAR. POLLUT. BULL. 316, 316 (1987). A 1986 beach cleanup in Texas recovered a bottle of Bitter Lemon Crush from Great Britain, a shampoo bottle from Denmark, and a dishwashing detergent container from Singapore. *Nat'l Ocean Policy Study Hearings*, *supra* note 4, at 47 (statement of Gary Mauro, Texas Land Commissioner).

61. See PLASTICS IN THE OCEAN, *supra* note 10, at 30 (noting that plastic waste may be dangerous for entire marine ecosystems as well as for individual marine animals). Bioaccumulation of plastics through the food chain may also be a problem. O'Hara, *supra* note 59, at 407.

62. See *Hearings on Controlling and Reducing Pollution from Plastic Waste*, *supra* note 1, at 320 (statement of the Entanglement Network Coalition estimating that 300,000-700,000 birds and 100,000 mammals die annually from plastic debris).

63. See Carr, *Impact of Non-degradable Marine Debris on the Ecology and Survival Outlook of Sea Turtles*, 18 MAR. POLLUT. BULL. 352, 352 (1987); (stating that young sea turtles and their food supplies are drawn to ocean convergences, rifts, and driftlines, and that the concentration of boyant plastic debris in these areas exacerbates entanglement and ingestion problems); see also *supra* note 60 (discussing the concentration of plastic debris along lines of convergence between water masses).

64. See INTERAGENCY TASK FORCE, *supra* note 1, at 15 (stating that scientists have identified adverse impacts of plastics pollution on only a few wildlife populations). Marine debris may be a factor in the health of certain endangered, threatened, and commercially valuable species. *Id.*; see also PLASTICS IN THE OCEAN, *supra* note 10, at 30 (stating that entanglement in marine plastics impacts individual animals and may ultimately affect entire ecosystems).

plastic are a great variety of the world's seals⁶⁵ and sea lions.⁶⁶ Both seals and sea lions exhibit a deadly curiosity for buoyant debris.⁶⁷ Entanglements from net fragments and plastic strapping bands used in merchant shipping are the most frequently observed plastics that entangle seals.⁶⁸ Although the ultimate effect of plastic debris on animal populations is unclear,⁶⁹ studies of depleted northern fur seals⁷⁰ con-

65. Laist, *supra* note 8, at 320. Numerous seals are vulnerable to entanglement including Antarctic fur seals, New Zealand fur seals, northern fur seals, Hawaii monk seals, Cape fur seals, northern elephant seals, and California harbor seals. See Bonner & McCann, *Neck Collars on Fur Seals, Arctocephalus Gazella at South Georgia*, 57 BRIT. ANTARCTIC SURV. BULL. 73 (1982), cited in Manheim, *supra* note 23, at 78 n.36 (asserting that the Antarctic fur seal is vulnerable to entanglement); Cawthorn, *Entanglement in, and Ingestion of, Plastic Litter by Marine Mammals, Sharks, and Turtles in New Zealand Waters*, in WORKSHOP ON MARINE DEBRIS, *supra* note 29, at 336 (examining the vulnerability of the New Zealand fur seal to entanglement); Fowler, *Marine Debris and Northern Fur Seals: A Case Study*, 18 MAR. POLLUT. BULL. 326, 333 (1987) (estimating that 15% of the young northern fur seals in the Pribilof Islands die a debris-related death); Henderson, *A Review of Hawaiian Monk Seal Entanglement in Marine Debris*, in WORKSHOP ON MARINE DEBRIS, *supra* note 29, at 326 (explaining that Hawaiian monk seals are vulnerable to entanglement); Shaughnessy, *Entanglement of Cape Fur Seals with Man-Made Objects*, 11 MAR. POLLUT. BULL. 332 (1980) (discussing the entanglement problem relating to the Cape fur seal); Stewart & Yochem, *Entanglement of Pinnipeds in Synthetic Debris and Fishing Net and Line Fragments at San Nicolas and San Miguel Islands, California, 1978-1986*, 18 MAR. POLLUT. BULL. 336, 338 (1987) (reporting the entanglement of thirty-six northern elephant seals and reviewing the entanglement of Californian harbor seals).

66. See Laist, *supra* note 8, at 320 (noting that synthetic debris has entangled both California sea lions and Stellar sea lions). Between 1984 and 1986, sixty-nine California sea lions were reportedly entangled in synthetic materials at San Nicolas and San Miguel Islands in the Pacific. Stewart and Yochem, *supra* note 65, at 338; see also Calkins, *Stellar Sea Lion Entanglement in Marine Debris*, in WORKSHOP ON MARINE DEBRIS, *supra* note 29, at 308 (documenting the incidence of Stellar sea lion entanglement in closed plastic packing bands and netting).

67. See Laist, *supra* note 8, at 323 (noting that marine mammals may view plastic debris as an object of curiosity or play). These animals may also become attracted to and entangled in plastic debris by attempting to pluck fish already snared in the debris. *Id.*; see also Calkins, *supra* note 66, at 312 (noting that curiosity and attempts to remove trapped fish may cause sea lions to become entangled in synthetic debris).

68. PLASTICS IN THE OCEAN, *supra* note 10, at 31; see Laist, *supra* note 8, at 320 (stating that entanglement in lost or discarded gillnets, trawl nets, and strapping bands are probably the greatest threats to marine mammals). During commercial harvests on the Pribilof Islands from 1981 to 1984, 403 entangled northern fur seals were observed; of these, 268 seals were entangled in net fragments, 84 were entangled in plastic packing bands, and 51 were entangled in other debris such as rope, string, monofilament line, rubber bands, and six-pack holders. *Id.*

69. PLASTICS IN THE OCEAN, *supra* note 10, at 31. Although plastic injuries to many species of marine life are well documented, scientists have identified the impact upon only a few wildlife populations, such as the northern fur seals and endangered Hawaiian monk seals; see INTERAGENCY TASK FORCE, *supra* note 1, at 14, 15 (stating that although it is known that marine debris affects many endangered, threatened, and commercially valuable species, a considerable amount of additional data is needed to determine adverse impacts on entire populations).

70. See 53 Fed. Reg. 17,888 (May 18, 1988) (announcing that effective June 17,

clude that entanglement is a major contributor to the seals' four to eight percent annual population decline.⁷¹ An estimated 40,000 northern fur seals die each year from entanglement in plastic.⁷² Increased plastics pollution is suspected in similar population declines of other seal species.⁷³

Other species of marine life, such as whales and dolphins, are also victims of plastic pollution through entanglement⁷⁴ and ingestion.⁷⁵ Whales, in particular, are often reported dragging great lengths of synthetic lines and fishing gear.⁷⁶ Sea turtles of all kinds are susceptible to entanglement in plastic.⁷⁷ Even more devastating is the propensity of sea turtles to ingest plastic pellets and garbage bags mistaken for jellyfish or other food.⁷⁸

1988, the northern fur seal is a "depleted" species under the Endangered Species Act).

71. See Fowler, *An Evaluation of the Role of Entanglement in the Population Dynamics of Northern Fur Seals on the Pribilof Islands*, in WORKSHOP ON MARINE DEBRIS, *supra* note 29, at 291-306.

72. Weisskopf, *Grim Harvest*, *supra* note 18, at 61.

73. See Manheim, *supra* note 23, at 78 n.40 (stating that studies of Stellar sea lion and Hawaii monk seal populations indicate plastic debris may be accountable for population declines).

74. See INTERAGENCY TASK FORCE, *supra* note 1, at 20 (stating that observers throughout the world have reported incidents of whales and dolphins entangled in net fragments and other fishing gear).

75. See PLASTICS IN THE OCEAN, *supra* note 10, at 41 (quoting Smithsonian Institution of Natural History records documenting whale ingestion of plastic bags). These records indicate that Gervais beaked whales, Cuvier's beaked whales, Dwarf sperm whales, Pygmy sperm whales, Sperm whales, and Mink whales have all ingested plastic bags. *Id.* An autopsy performed on a beached Pygmy sperm whale that died after eleven days in captivity revealed that death was attributable to infections from a 30-gallon plastic garbage can liner, a plastic bread wrapper, and a corn chip bag found in the calf's stomach. Weisskopf, *Grim Harvest*, *supra* note 18, at 64.

76. See Laist, *supra* note 8, at 319, 320 (stating that in waters off the northeast Coast of the United States, between 1975 and 1986, 20 Humpback whales, 15 Mink whales, and 10 Right whales were observed entangled in lines from lobster pots or gill nets). It is not clear whether these entanglements are the result of active or derelict gear. *Id.* A detailed account of the individual trauma and dangers of entanglements to whales can be found in the report of Dr. Stormy Mayo, director of the Massachusetts based Cetacean Research Program, who worked over a 47-day period in 1985 to free Ibis, a Humpback whale entangled off the New England coast. *Fellow Travelers*, 12 CALYPSO LOG 17 (1985). A similar rescue of a Gray whale entangled in gill netting occurred one month later in the Pacific Ocean, and nearly took the life of a diver. *Id.* at 18, 19.

77. Carr, *supra* note 63, at 352.

78. *Id.* at 355, 356. Drifting turtle hatchlings often come into contact with large quantities of plastic debris, which they fatally mistake for food. *Id.* Leatherbacks, in particular, show a propensity to ingest plastic sheeting mistaken for jellyfish. *Id.* During Coastweeks '88, volunteers found a dead Green turtle entangled in fishing gear on a Florida beach and a dead Leatherback on a Maine beach that had ingested a plastic garbage bag. TRASH ON AMERICA'S BEACHES, *supra* note 1, at 29; see Sadove & Morreale, *Marine Mammal and Sea Turtle Encounters with Marine Debris in the New York Bight and Northeast Atlantic* (presented at the Second International Conference

A great variety of sea birds ingest plastic⁷⁹ and are susceptible to entanglement in synthetic debris. Young birds often fatally ingest plastic particles or pellets that the parents have ingested and regurgitated.⁸⁰ Entanglement in discarded fishing gear, six-pack rings, and monofilament line can lead to drowning, choking, and starvation.⁸¹ Observations in the German Bight indicate that plastics are responsible for up to twenty-six percent of Gannet mortality rates.⁸² Active Japanese salmon nets kill an estimated 250,000 seabirds during a two-month fishing season in United States waters.⁸³ Similarly, discarded ghost nets continue to capture both target and nontarget fish, ultimately attracting and entangling seabirds.⁸⁴ One drift net retrieved in the North Pacific contained over 350 dead seabirds.⁸⁵ As plastics become increasingly common in ocean waters, many endangered populations of seals,⁸⁶ whales,⁸⁷ porpoises,⁸⁸ turtles,⁸⁹ and birds⁹⁰ will be

on Marine Debris, Honolulu, Hawaii, Apr. 2-7, 1989) (Okeanos Ocean Research Foundation draft document on file at the office of the American University Journal of International Law & Policy) (recording plastic ingestion in ten Leatherbacks, three Loggerheads, and one Green turtle between 1979 and 1988).

79. See Day, Wehle & Coleman, *Ingestion of Plastic Pollutants by Marine Birds*, in WORKSHOP ON MARINE DEBRIS, *supra* note 29, at 346, 378 (noting that 50 of the world's 250 species of sea birds ingest plastic debris). It is suspected that birds confuse plastic for fish eggs and/or larvae that are similar in size and color. Laist, *supra* note 8, at 21. Ingestion appears most common in albatrosses, petrels, shearwaters, phalaropes, puffins, and auklets. *Id.* Ingestion may reduce feeding drives, block digestive systems, and/or damage stomach linings. *Id.* at 319. A study of the Laysan albatross showed that up to 90% of the birds studied had ingested plastic. *Hearings on Controlling and Reducing Plastic Waste*, *supra* note 1, at 319-20 (testimony of the Entanglement Network Coalition, presented by Albert M. Manville II, Chairman and Senior Staff Wildlife Biologist, Defenders of Wildlife).

80. INTERAGENCY TASK FORCE, *supra* note 1, at 23; see Van Franeker & Bell, *Plastic Ingestion by Petrels Breeding in Antarctica*, 19 MAR. POLLUT. BULL. 672 (1988) (documenting ingestion of plastics by young Southern Fulmar, Cape Petrel, Antarctic Petrel, and Wilson's Storm Petrels). "User plastics" constituted 73% of the plastic ingested. *Id.* Wilson's Storm Petrels had a mean of 4.4 plastic particles per bird with 16 particles found in the stomach of one chick. *Id.* The plastic may cause reduced food intake and increase body pollutants. *Id.* at 674.

81. INTERAGENCY TASK FORCE, *supra* note 1, at 21; see Weisskopf, *Grim Harvest*, *supra* note 18, at 63, 64 (describing the plight of brown pelicans in Florida that become entangled in plastic fishing line that later snags mangrove trees, a traditional roost for the birds).

82. Vauk & Schrey, *Records of Entangled Gannets (Sula bassana) at Helgoland, German Bight*, 18 MAR. POLLUT. BULL. 350, 351 (1987).

83. PLASTICS IN THE OCEAN, *supra* note 10, at 34.

84. *Id.*

85. Jones & Ferrero, *Observations of Net Debris and Associated Entanglements in the North Pacific Ocean and Bearing Sea*, in WORKSHOP ON MARINE DEBRIS, *supra* note 29, at 213. In 1978, ninety-nine seabirds were recovered from a 15 kilometer abandoned drift net. Laist, *supra* note 8, at 321. It is likely that additional seabirds decompose and drop from such nets before they are recovered. *Id.*

86. See *supra* note 70 (regarding the official listing of the northern fur seal as a

pushed closer to extinction.

C. ECONOMIC IMPACTS OF MARINE PLASTICS POLLUTION

Plastics pollution in the marine environment imposes heavy economic burdens on individuals, industries, and governments throughout the world.⁹¹ Plastics in marine waters impact commercial fishing stocks,⁹² damage sea vessels,⁹³ and require governments to incur heavy beach cleanup costs.⁹⁴ In addition, plastic debris affects property values⁹⁵ and coastal tourism.⁹⁶

Plastics in the marine environment kill large numbers of fish and compete with ongoing commercial fisheries for fish stocks.⁹⁷ Nets once

"depleted species"). Hawaiian monk seals are also threatened and are among the mammals endangered by plastics pollution. INTERAGENCY TASK FORCE, *supra* note 1, at 15. The seals are listed as an endangered species. 50 C.F.R. § 17.11(h) (1988).

87. See *Hearings on Controlling and Reducing Plastic Wastes*, *supra* note 1, at 320 (statement of the Entanglement Network Coalition) (listing endangered whales as threatened by persistent debris). Whales listed as endangered or threatened include: blue, bowhead, finback, gray, humpback, right, sei, and sperm. 50 C.F.R. § 17.11(h)(1988). A Bering Sea Beaked whale, one of the rarest whales in the world, washed ashore dead with a plastic bottle cap and a chunk of rubber in its stomach. *Rare Whale Beached in USA*, UNEP NEWS, May-June 1986, at supp. 4, cited in Mannheim, *supra* note 23, at 80. The species has been sighted only a few dozen times. *Id.*

The critically endangered West Indian manatee is also threatened by marine plastics through both ingestion and entanglement. See CENTER FOR ENVIRONMENTAL EDUCATION, MARINE WILDLIFE ENTANGLEMENT IN NORTH AMERICA 72-75 (1986) [hereinafter MARINE WILDLIFE ENTANGLEMENT IN NORTH AMERICA] (documenting incidents of manatee entanglements and ingestion off the coast of Florida); see also 50 C.F.R. § 17.11(h) (1988) (listing the West Indian (Florida) manatee as endangered).

88. *Hearings on Controlling and Reducing Plastic Waste*, *supra* note 1, at 320 (testimony of the Entanglement Network Coalition) (citing the threat of plastic debris to critically endangered Gulf of California harbor porpoise).

89. *Interagency Task Force*, *supra* note 1, at 23. Green, loggerhead, kemp's ridley, and hawksbill turtles, are known to ingest plastic, and are listed as threatened or endangered under the Endangered Species Act. *Id.*; see 50 C.F.R. § 17.11(h) (1988) (listing endangered and threatened sea turtles).

90. See MARINE WILDLIFE ENTANGLEMENT IN NORTH AMERICA, *supra* note 87, at 170 (listing the brown pelican as an endangered species that often interacts with and is threatened by marine plastic debris); see also 50 C.F.R. § 17.11(h) (1988) (listing the brown pelican among endangered sea birds).

91. See *infra* notes 97-114 (discussing the economic impacts of plastics pollution).

92. See *infra* note 97 (discussing the impacts of plastics on commercial fishing).

93. See *infra* note 109 (discussing the impacts of plastic debris on vessels).

94. See *infra* note 111 (discussing the costs associated with beach cleanups).

95. See generally REGULATORY EVALUATION OF ANNEX V, *supra* note 6, at 3-4 (stating that improvement in beach property values could occur as a result of decreased plastics pollution).

96. See *infra* note 114 (discussing plastic debris impacts on coastal tourism).

97. See PLASTICS IN THE OCEAN, *supra* note 10, at 47 (stating that the economic impact of lost fishing gear on fishery stocks may be the most severe cost attributed to marine debris). Lost nets may continue to kill target and nontarget fish for years. *Id.* Fish are known to ingest plastic, although the frequency is not well documented. IN-

made of cotton and other biodegradable materials that quickly disintegrated in salt water⁹⁸ are now almost exclusively constructed with synthetic materials.⁹⁹ The North Pacific salmon and squid fisheries of Japan, Taiwan, and the Republic of Korea set out an estimated 21,300 kilometers of drift net each night.¹⁰⁰ The North Pacific drift net fisheries are estimated to introduce approximately 1,624 miles of derelict fishing net into the Pacific each year.¹⁰¹ Synthetic fishing nets that are lost or thrown overboard in the marine environment remain strong enough to trap fish and wildlife for an estimated six years.¹⁰² Thus, ghost nets may deplete marine resources for years by ensnaring fish and thereby attracting predators that also become entangled.¹⁰³ In 1974, lost or discarded lobster traps off the coast of New England, primarily constructed with synthetic netting, accounted for an estimated annual loss of over 1,420,000 pounds of lobster valued at over \$248 million.¹⁰⁴ To minimize the impact of lost gear on its lobster fisheries, the state of Maine now requires a biodegradable vent in all lobster traps.¹⁰⁵ Similar trap and gear losses occur in other fisheries that are not required to use biodegradable panels.¹⁰⁶

INTERAGENCY TASK FORCE, *supra* note 1, at 28. One study showed 30% of fish examined ingested plastic pellets. *Hearings on Controlling and Reducing Pollution from Plastic Waste*, *supra* note 1, at 320 (testimony of the Entanglement Network Coalition) (noting that ingestion of pellets often obstructs digestive tracks, causes ulcers, and results in starvation).

98. Fjelstad, *The Ghosts of Fishing Nets Past: A Proposal for Regulating Derelict Synthetic Fishing Nets*, 63 WASH. L. REV. 677, 677 (1988).

99. See INTERAGENCY TASK FORCE, *supra* note 1, at 42-45 (stating that synthetic fishing nets and lines are made principally of polyamide (nylon), polyethylene, and polypropylene and that by the mid-1960s synthetic fibers in large part replaced natural-fiber-based materials). Strength, durability, and lower cost are among the reasons for the change to synthetic nets. *Id.* In the late 1940s, synthetic fibers replaced natural fibers such as hemp, linen, cotton, and manila in the construction of nets. PROCEEDINGS ON DEGRADABLE PLASTICS, *supra* note 38, at 22.

100. Laist, *supra* note 8, at 322.

101. Eisenbud, *The Pelagic Driftnet* (submitted to the Food and Agriculture Organization World Conference on Fisheries Management and Development, June/July 1984), *cited in* Fjelstad, *supra* note 98, at 679 n.9. The impact of lost nets is not well documented, but even a low rate of net loss from a large number of fisheries could eventually produce substantial quantities of net debris. Laist, *supra* note 8, at 322.

102. INTERAGENCY TASK FORCE, *supra* note 1, at 28.

103. REGULATORY EVALUATION OF ANNEX V, *supra* note 6, at 3-2.

104. PLASTICS IN THE OCEAN, *supra* note 10, at 36.

105. ME. REV. STAT. ANN. tit. 12 § 6433-A (1988).

106. See High, *Some Consequences of Lost Fishing Gear*, in WORKSHOP ON MARINE DEBRIS, *supra* note 29, at 430-31 (reporting that King crab and Dungeness crab fisheries in Alaska lose an estimated 10% of their pots annually). Due to the lack of degradable panels, up to 30,000 lost pots may still be in operating condition and in direct competition with crab fisheries. *Id.* Hawaiian spiny lobster fisheries lose up to 40% of their pots annually. *Hearings on Controlling and Reducing Pollution From Plastic Waste* *supra* note 1, at 165 (testimony of James E. Douglas, Acting Deputy

Plastic debris also commonly foul boat propellers and clog cooling water-intake systems for commercial fishing vessels and recreational boaters.¹⁰⁷ The United States Navy has experienced similar problems from plastic debris.¹⁰⁸ The damage often requires costly repairs and causes needless delays.¹⁰⁹ Foreign vessels report similar problems.¹¹⁰

Plastic debris imposes substantial beach cleanup costs on foreign nations¹¹¹ as well as state and local governments in the United States.¹¹² In 1987, after large amounts of debris, including medical waste and garbage, washed onto the shores of New York and New Jersey, the two states spent over \$500,000 to clean only fifty-three miles of public beach.¹¹³ Local economies dependent on tourism dollars are particu-

Asst. Adm. for Fisheries Service, National Oceanic and Atmospheric Administration).

107. REGULATORY EVALUATION OF ANNEX V, *supra* note 6, at 3-2.

108. *Id.*

109. *Id.* A survey of the Port of Newport, Oregon found 64% of fishermen (58 of 90 responses) encountered problems due to plastic waste. *Id.* The average cost of repairs and lost fishing time were estimated at \$1,897 per incident (\$110,000 total). *Id.* Damages in the fishing industry alone may be well into the millions of dollars. *Id.*; see PLASTICS IN THE OCEAN, *supra* note 10, at 48 (noting that plastics can damage commercial, recreation, Coast Guard, and Navy vessels, and that boating supply companies provide equipment to combat such problems).

110. See *Persistent Marine Debris*, *supra* note 60, at III-12 (stating that yachtsmen in the North Sea routinely report plastic and other debris fouling propellers).

111. See *id.* at III-11 (stating that 16 local governments in Denmark spent nearly \$200,000 cleaning roughly 337 kilometers of beach in 1985); Ryan, *The Marine Plastic Debris Problem Off Southern Africa: Types of Debris, Their Environmental Effects, and Control Measures*, in *Second International Conference on Marine Debris* held at Honolulu, Hawaii, Apr. 2-7, 1989 (Abstract) 4 (1989) (stating that in South Africa, approximately 10 million rand is spent annually to clean beaches of debris, 70% of which is plastic). The Bahamian government pays approximately \$8,800 per month to clean roughly 25 miles of beach on Grand Bahama Island. Telephone interview with David Jennette, Vice President and Managing Director for Sanitation Services, Sanitation Contractor for Bahama Port Authority (Mar. 10, 1989). Approximately 500 pounds of debris is collected daily, 18% of which is plastic. *Id.* Plastic sheeting and bags also kill large stretches of coral reefs in the Bahamas. *Id.*

112. See PLASTICS IN THE OCEAN, *supra* note 10, at 48-50 (discussing cleanup costs incurred by coastal municipalities). A survey of a 57-mile stretch of Texas coastline found an estimated 140 tons of debris, consisting primarily of plastic items. *Id.* Texas coastal cities and counties spend more than 14 million dollars each year cleaning beaches of debris. *Nat'l Ocean Policy Study Hearings*, *supra* note 4, at 149 (statement of Gary Mauro, Texas Land Commissioner); REGULATORY EVALUATION OF ANNEX V, *supra* note 6, at 3-3 to -4 (stating that Texas, New Jersey, New York, and Massachusetts are areas that have beach cleanup problems that are of particular concern). This is largely because these states receive wastes from principal ocean currents and are proximate to heavily traveled shipping routes or fishing regions. *Id.*

113. INTERAGENCY TASK FORCE, *supra* note 1, at 34, 35. Large amounts of floatable debris, including garbage and medical waste, washed onto the shores of the New York-New Jersey area three times during the summer of 1987. *Id.* A fifty-mile stretch of New Jersey beach closed for three days due to the debris. *Id.* In Nassau County, Long Island, the wastes caused beaches to close for two days. *Id.* Congress subse-

larly vulnerable to the economic impacts of plastic debris.¹¹⁴

II. THE REGULATION OF PLASTICS POLLUTION FROM SHIPS

A. THE INADEQUACY OF PREVIOUS LAW

Annex V of MARPOL is the primary international regime regulating at-sea disposal of ship-generated waste.¹¹⁵ Prior to ratification of Annex V, international law provided little authority regulating incidental plastics pollution from ships. An examination of international dumping conventions, customary international law as embodied in the Law of the Sea Convention, and regional and multilateral agreements reveals that prior international controls did not regulate the disposal of ship-generated solid wastes.¹¹⁶ United States domestic law prior to rati-

quently passed the United States Public Vessel Medical Waste Anti-Dumping Act of 1988. Act of Nov. 18, 1988, Pub. L. No. 100-688, 33 U.S.C.A. § 2501 (West Supp. 1989). The Anti-Dumping Act makes ocean disposal of medical waste a federal crime. *Id.* § 3201. In a similar incident during the summer of 1976, New York state spent over \$100,000 cleaning up unusually heavy amounts of reportedly plastic debris; see *Persistent Marine Debris*, *supra* note 60, at IV-20 (discussing the 1976 "floatables" incident).

114. See *Persistent Marine Debris*, *supra* note 60, at IV-20 (stating that following the 1976 "floatables" incident in New York, the local recreational fishing business lost an estimated 30% of its business, restaurants suffered a 20% loss, and beach attendance was down by 30-50%). Local business lost an estimated 30 million dollars as a result of the debris, most of which was plastic. *Id.* Improper disposal of medical waste and other garbage resulted in an estimated loss of \$1.3 billion in tourist income for Long Island business during July and August, 1988. *EPA Issues Medical Waste Regulations*, 19 Env't Rep. (BNA) 2463 (Mar. 17, 1989). The debris on Long Island, while attributable to a variety of ocean and land-based sources, are illustrative of the potential impact of plastic debris.

Eighteen of 254 Texas counties border the Gulf of Mexico, but account for more than one-third of the state's 16 billion dollar tourism industry. *Hearings on H.R. 940*, *supra* note 49, at 166, 167 (statement of Gary Mauro, Texas Land Commissioner). Despite efforts to clean the beaches of debris, many tourists leave Texas beaches disgusted. *Id.*; see *PLASTICS IN THE OCEAN*, *supra* note 10, at 50 (noting that since the establishment of the Padre Island National Sea Shore in Texas in 1962, 99% of the complaints received concern the beach litter problem). Plastics pollution also threatens New Jersey's seven billion dollar per year coastal tourism industry. *Hearings on Controlling and Reducing Pollution from Plastic Waste*, *supra* note 1, at 49-50.

115. See S. REP. NO. 100-8, 100th Cong., 1st Sess. 18 (1987) [hereinafter S. REP. NO. 100-8] (statement of Rear Admiral J. William Kime, Chief, Office of Marine Safety, Security and Environmental Protection, U.S. Coast Guard) (stating that MARPOL is the primary international regime aimed at preventing unnecessary and uncontrolled pollution from ships). Annex V is specifically tailored to address the global problem of at-sea disposal of ship-generated garbage. *Id.*

116. See O'Hara, *supra* note 59, at 41 (discussing the limits of the London Dumping Convention and the MARPOL Protocol prior to adoption of Annex V); Gosliner, *Legal Authorities Pertinent to Entanglement by Marine Debris* in WORKSHOP ON MARINE DEBRIS, *supra* note 29, at 18-19 (noting the limits of the London Dumping

fication of Annex V was similarly incapable of addressing plastics pollution from ships.¹¹⁷

1. International Law

a. The London Dumping Convention

The London Dumping Convention (LDC),¹¹⁸ the only dumping convention that the United States is a signatory to, is the most comprehensive international convention on marine waste disposal.¹¹⁹ The LDC prohibits the deliberate disposal of dangerous wastes,¹²⁰ including plastics and other persistent synthetic materials, that float or remain suspended in marine waters in a way that may materially interfere with fishing, navigation, and other legitimate uses of the sea.¹²¹ A license is

Convention and the MARPOL Protocol); Manheim, *supra* note 23, at 84 (noting that the U.N. Law of the Sea Convention leaves adoption of specific regulations on pollution to states acting directly or through competent international organizations).

117. See S. REP. NO. 100-8, *supra* note 115, (Statement of Rear Admiral J. William Kime, Chief, Office of Marine Safety, Security and Environmental Protection, U.S. Coast Guard) (stating that current United States statutes do not adequately address the at-sea disposal of ship-generated garbage). MARPOL Annex V, however, is specifically tailored to address this global problem. *Id.*

118. Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, *done at* London, Dec. 29, 1972, 26 U.S.T. 2403, T.I.A.S. No. 8165, 1046 U.N.T.S. 120 (entered into force Aug. 30, 1975) [hereinafter London Dumping Convention]. United States implementing legislation is found in the Marine Protection, Resources and Sanctuaries Act of 1972, 33 U.S.C. §§ 1401-1445 (1982). The London Dumping Convention is the first IMO agreement dealing with persistent marine debris other than tar. *Persistent Marine Debris*, *supra* note 60, at VII-7.

119. See OFFICE OF TECHNOLOGY ASSESSMENT, WASTES IN MARINE ENVIRONMENTS 149 (1987) [hereinafter WASTES IN MARINE ENVIRONMENTS] (stating that the London Dumping Convention is the primary agreement dealing with marine waste disposal); see also J. KINDT, MARINE POLLUTION AND THE LAW OF THE SEA 1097 (1986) (stating that the London Dumping Convention, also commonly referred to as the Ocean Dumping Convention, is the most comprehensive international convention on ocean dumping). The London Dumping Convention should remain the primary legal instrument for marine waste dumping even after acceptance of the U.N. Law of the Sea Convention. *Id.* As of January 1, 1988, 65 nations were parties to the London Dumping Convention. UNITED STATES DEPARTMENT OF STATE, UNITED STATES TREATIES IN FORCE, 322-23 (1988) [hereinafter UNITED STATES TREATIES IN FORCE]. In October 1988, the member countries to the London Dumping Convention decided to phase out incineration at sea, with termination of the practice by December 31, 1994. *Ban on Marine Incineration*, 19 MAR. POLLUT. BULL. 648 (1988).

120. London Dumping Convention, *supra* note 118, art. III, § 1(a).

121. *Id.* at Annex I, para. 4. Article IV of the London Dumping Convention prohibits the dumping of extremely dangerous "black list" substances defined in Annex I as:

1. Organohalogen compounds.
2. Mercury and mercury compounds.
3. Cadmium and cadmium compounds.
4. Persistent plastics and other persistent synthetic materials, for example, net-

required for ocean dumping of other less harmful substances.¹²² The stated purpose of the LDC is to promote effective control of all sources of marine pollution.¹²³ A further purpose of the LDC is the prevention of ocean pollution caused by dumping of waste and other matter that may create hazards to human health, impact on living marine resources, damage amenities, or hinder legitimate uses of the sea. Each contracting party under the LDC must enforce the Convention and exercise jurisdiction over vessels and aircraft which are: first, of that state's registry or flying its flag; second, loading matter to be dumped within the state's territory or territorial seas; and third, vessels and platforms under a member parties' jurisdiction believed to be engaged in dumping.¹²⁴

Despite the strong language banning the dumping of plastics, the LDC does not regulate wastes generated during the normal operation of ships.¹²⁵ The LDC expressly permits the disposal of wastes or other

ting and ropes, which may float or remain in suspension in the sea in such a manner as to interfere materially with fishing, navigation or other legitimate uses of the sea.

5. Crude oil, fuel oil, heavy diesel oil, and lubricating oils, hydraulic fluids, and any mixtures containing any of these, taken on board for the purpose of dumping.

6. High-level radioactive wastes or other high-level radioactive matter, defined on public health, biological or other grounds, by the competent international body in this field, at present the International Atomic Energy Agency, as unsuitable for dumping at sea.

7. Materials in whatever form (e.g. solids, liquids, semi-liquids, gases or in a living state) produced for biological and chemical warfare.

London Dumping Convention, *supra* note 118, Annex I.

Annex I permits disposal of substances that are rapidly rendered harmless through physical, chemical or biological breakdown provided these materials do not render edible marine organisms unpalatable or endanger the health of humans and domestic animals. *Id.* at para. 8. Trace contaminants of the substances allowed in Annex I may be discharged subject to Annexes II and III. *Id.* at para. 9.

122. London Dumping Convention, *supra* note 118, art. IV(b)-(c). Wastes listed in Annex II (grey list) require special permits, while dumping of all other wastes requires a general permit. *Id.* Contracting parties to the London Dumping Convention are currently reviewing the classifications and assessment of wastes dumped at sea to remedy inconsistencies and ambiguities within the London Dumping Convention. *LDC Black/Grey Lists Reviewed*, 19 MAR. POLLUT. BULL. 504 (1988).

123. London Dumping Convention, *supra* note 118, art. I.

124. *Id.* art. VII. Placing enforcement authority with contracting states instead of establishing an independent enforcement agency has been criticized on the basis that it permits a party to ignore the London Dumping Convention's requirements. J. KINDT, *supra* note 119, at 1128. Consequently, much of the protection is subject only to various national measures. *Id.* Furthermore, the absence of an international authority means large areas of the ocean are outside any real protection. *Id.*

125. See Gosliner, *supra* note 116, at 6 (discussing exceptions to dumping of wastes derived from normal operations of ships); see BEAN, United States and International Authorities Applicable to Entanglement of Marine Mammals and Other Organisms in Lost or Discarded Fishing Gear and Other Debris, Report to the Marine Mammal

matter incidental to, or derived from the normal operation of vessels.¹²⁶ This broad exception in the LDC permits deliberate disposal of ship wastes such as packaging materials from merchant ships or synthetic fishing gear from fishing vessels since such actions are arguably incidental to normal operations.¹²⁷ Consequently, although the LDC provides authority to regulate the deliberate ocean dumping of municipal wastes taken to sea for disposal, it fails to prevent disposal of plastics and other garbage generated in the day-to-day operations of ships.¹²⁸

b. *The United Nations Law of the Sea Convention*

The United Nations Convention on the Law of the Sea (LOS Convention)¹²⁹ seeks to establish a uniform law over the use and conservation of marine resources.¹³⁰ The LOS Convention includes provisions

Commission, 32-34 (1984)[hereinafter United States and International Authorities Applicable to Entanglement] (discussing the London Dumping Convention's exclusion of wastes derived from the "normal operations" of vessels).

126. London Dumping Convention, *supra* note 118, art. III, para. 1(b). Article III provides a brief definition of "dumping." *Id.* A conspicuously longer definition of what dumping is not follows:

(b) "Dumping" does not include:

- (i) the disposal at sea of wastes or other matter incidental to, or derived from the normal operations of vessels, aircraft, platforms or other man-made structures at sea and their equipment, other than wastes or other matter transported by or to vessels, aircraft, platforms or other man-made structures at sea, operating for the purpose of disposal of such matter or derived from the treatment of such wastes or other matter on such vessels, aircraft or structures;
- (ii) placement of matter for a purpose other than the mere disposal thereof, provided that such placement is not contrary to the aims of this Convention.

Id.

127. See United States and International Authorities Applicable to Entanglement, *supra* note 125, at 32-34 (distinguishing the London Dumping Convention and optional Annex V as the difference between the regulation of wastes carried to sea for disposal and wastes discarded in the normal course of operation). Bean sets forth the following example: "[I]f a fisherman damages his gear at sea and discards it there, his action is contrary to the MARPOL Convention; if, however, he returns to port and gives it to a junk dealer who then hauls it to sea and dumps it overboard, the junk dealer's action is contrary to the London Dumping Convention." *Id.* at 33.

128. See Lentz, *Plastics in the Marine Environment: Legal Approaches for International Action*, 18 MAR. POLLUT. BULL. 361, 363 (1987)(stating that the London Dumping Convention is generally applied only to discharges which originate from land-based sources and has not been applied to ship-generated garbage).

129. United Nations Convention on the Law of the Sea, *opened for signature* Dec. 10, 1982, U.N. Doc. A/CONF.62/122 (1982), *reprinted in* 21 I.L.M. 1261 (1982) (not yet in force) [hereinafter LOS Convention].

130. *Id.* at preamble, para. 4. With the exception of provisions for deep seabed mining and dispute settlements, many states and experts view the LOS as customary international law. Oxman, *The New Law of the Sea*, 69 J. AMER. BAR ASSOC. 156 (1983); see L. HENKIN, R. PUGH, O. SCHACHTER & H. SMIT, *INTERNATIONAL LAW* 1381 (2d ed. 1987) (stating that substantive pollution provisions of the LOS Convention are accepted as customary law).

addressing marine pollution¹³¹ from dumping¹³² and vessel sources.¹³³ The LOS Convention, which has not entered into force,¹³⁴ obligates signatory states to "protect and preserve the marine environment."¹³⁵ In addition, the LOS Convention requires states individually and/or jointly to take necessary measures consistent with the LOS Convention to prevent, reduce, and control pollution of the marine environment from "any source."¹³⁶

The LOS Convention directs states to pass laws that will prevent, avoid, diminish, and control pollution of the marine environment from ocean dumping.¹³⁷ However, similar to the LDC, the LOS Convention defines dumping as "deliberate disposal" and expressly excludes dispo-

131. LOS Convention, *supra* note 129, pt. I, art. 1, para. 1(4). The LOS Convention defines pollution as:

(4) pollution 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.

Id.

132. *Id.* pt. XII, sec. 5, art. 210. Article 210 requires states to "adopt laws and regulations to prevent, reduce and control pollution of the marine environment by dumping." *Id.* para. 1.

133. *Id.* pt. XII, sec. 5, art. 211. Article 211 requires states to act through a competent international organization to establish international rules to prevent, reduce, and control vessel source pollution. *Id.* The International Maritime Organization, although not expressly mentioned in article 211, is considered the "competent international organization" governing vessel source pollution. J. KINDT, *supra* note 119, at 1,174, 1,198.

134. UNITED NATIONS, MULTILATERAL TREATIES DEPOSITED WITH THE SECRETARY-GENERAL, STATUS AS OF 31 DECEMBER 1988, 752, U.N. Sales No. E.89.V.b (1989). Although 159 states have signed the LOS Convention, only 39 states have formally ratified or acceded to the Convention. *Id.* Sixty nations are required to ratify or accede to the Convention to bring it into force. LOS Convention, *supra* note 129, Pt. XVII, art. 308.

135. LOS Convention, *supra* note 129, pt. XII, sec. 1, art. 192.

136. *Id.* pt. XII, sec. 1, art. 194, para. 1. The Convention directs states to use the most practical means available and those that they are capable of exercising to prevent, reduce, and control marine pollution from land-based sources, from the atmosphere, and from vessel dumping. *Id.* at paras. 1-3. The regulation of "any source" would appear to include incidental pollution from ships; however, article 194 limits measures to those "consistent with this Convention" and incidental dumping is expressly excluded from the LOS Convention definition of "dumping." *Id.* art. 1, para. 1(5). *See infra* note 138 (discussing the exclusion of incidental dumping from the Law of the Sea definition). Additionally, the LOS Convention limits coastal states to enforcing generally accepted international rules established through the competent international organization within their exclusive economic zones. *Id.* art. 211(4); *infra* notes 331-37 and accompanying text (discussing the LOS Convention's limitations on coastal state powers within the exclusive economic zone).

137. LOS Convention, *supra* note 129, pt. XII, sec. 4, art. 210.

sal incidental to normal operations of a vessel at sea.¹³⁸ Disposal of ship-generated garbage is therefore not within the scope of the general prohibition on dumping.¹³⁹

The LOS Convention also instructs states to establish international rules¹⁴⁰ and adopt laws governing their own flagships that prevent, reduce, or control pollution from ships.¹⁴¹ Under the LOS Convention, coastal states are permitted to adopt and enforce environmental regulations governing all ships within their territorial waters.¹⁴² Regulation of foreign ships in the Exclusive Economic Zone (EEZ),¹⁴³ however, must

138. *Id.* pt. I, art. 1, para. 1(5)(b). "Dumping" is defined as "(i) any deliberate disposal of wastes or other matter from vessels, aircraft, platforms, or other man-made structures at sea; (ii) any deliberate disposal of vessel, aircraft, platforms or other man-made structures at sea." *Id.* at para. 1(5)(a). Dumping under the LOS Convention does not include: "(i) the disposal of wastes or other matter incidental to, or derived from, the normal operations of vessels, aircraft, platforms, or other man-made structures at sea." *Id.* at para. 1(5)(b)(i).

139. *See* J. KINDT, *supra* note 119, at 1138 (stating that article 1, paragraph 1(5)(b) excludes wastes incidental to the normal operations of vessels from the definition of dumping).

140. LOS Convention, *supra* note 129, pt. XII, sec. 4, art. 211, para. 1. This paragraph directs states acting through the competent international organization or general diplomatic conference to establish "international rules and standards to prevent, reduce, and control pollution of the marine environment from vessels." *Id.*

141. *Id.* art. 211, para. 2. Unilateral actions of states to prohibit plastics pollution from ships under their flag, however, will not provide the universal regime necessary to reduce the potential harm to marine resources. *See supra* note 60 (discussing the ubiquitous nature of marine plastics pollution).

142. LOS Convention, *supra* note 129, pt. XII, sec. 4. *Id.* art. 211, para. 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." *Id.* The laws may not interfere with the right of such vessels to innocent passage. *Id.* States imposing special requirements regarding vessel pollution that are not in accordance with generally accepted international law must publicize such requirements and notify the International Maritime Organization. *Id.* at para. 3. Under the LOS Convention, states have a right to establish territorial seas of up to 12 nautical miles, measured from the "baseline." *Id.* The LOS Convention defines the "baseline" as the low-water line along the coast as shown on charts the states officially recognize. LOS Convention, *supra* note 129, pt. II, sec. 2, arts. 3-5.

143. *See Id.* pt. V, arts. 55-75 (providing coastal states with sovereign rights over natural resources in a 200-mile Exclusive Economic Zone (EEZ) adjacent to a state's territorial sea). More than 100 states have claimed jurisdiction over the EEZ or similarly labelled zone. Weisburd, *Customary International Law: The Problem with Treaties*, 21 VAND. J. TRANS. L. 1, 18-19 (1988). The International Court of Justice (ICJ) has ruled that the concept of a 200-mile zone has become customary international law. *Id.* (citing Case Concerning the Continental Shelf (Tunisia v. Libya), 1982 I.C.J. 18, 74 (Judgment of Feb. 27, 1982); *see also* Presidential Proclamation on the Exclusive Economic Zone of the United States, Proclamation No. 5030, 48 Fed. Reg. 10,605 (1983) (proclaiming jurisdiction over the EEZ). In 1983, President Reagan proclaimed United States jurisdiction over the Exclusive Economic Zone of the United States, which extends 200 nautical miles from the baseline of United States territorial seas. *Id.*

give effect to generally accepted international rules and standards.¹⁴⁴ Thus, even if the LOS Convention is viewed as the best evidence of customary international law,¹⁴⁵ absent an international convention or conference under the auspices of the IMO, the LOS Convention does not establish independent duties pertaining to the disposal of ship-generated wastes.¹⁴⁶

The LOS Convention, however, gives legitimacy to global efforts to control marine plastics pollution by directing states to cooperate in conserving living marine resources and requiring them to protect and preserve the marine environment.¹⁴⁷ The LOS Convention encourages states to develop domestic and international rules and regulations to protect the environment, but stops short of providing specific enforceable duties that prevent disposal of incidental plastics wastes from ships.

c. Regional Agreements

Many multilateral regional agreements on marine pollution control negotiated independently or under the auspices of the United Nations Regional Seas Programme¹⁴⁸ seek to conserve and protect the marine

144. LOS Convention, *supra* note 129, pt. XII, sec. 5, art. 211(5). The LOS Convention limits coastal states to enforcing generally accepted international rules established through the competent international organization within their Exclusive Economic Zones. *Id.* Consequently, even if the LOS were ratified prior to ratification of Annex V of MARPOL, which established international rules on vessel source garbage pollution, coastal states under the LOS Convention would have had no international rules to enforce. Arguably, a prohibition on the disposal of ship-generated garbage within their Exclusive Economic Zones would violate customary international law. *Id.*

145. See *supra* note 130 (noting that pollution provisions of the LOS Convention are considered customary international law).

146. See J. KINDT, *supra* note 119, at 1195-96 (stating that the gravamen of article 211, paragraph 5 of the LOS Convention is to control vessel source pollution in economic zones through enforcement of established IMO regulations). With the exception of ocean dumping or regulation of ice-covered areas, a coastal state may not promulgate stricter regulations than IMO standards within its economic zone. *Id.*

147. See United States and International Authorities, *supra* note 125, at 39 (stating that while the LOS Convention does not offer any new basis for resolving entanglement problems, it may be useful in adding force and legitimacy to other efforts); Lentz, *supra* note 128, at 361 (stating that although the LOS Convention does not specifically concede that a marine plastics problem exists, it provides support for the development of domestic laws and addressing global marine pollution problems internationally).

148. See generally P. SAND, MARINE ENVIRONMENTAL LAW IN THE UNITED NATIONS ENVIRONMENT PROGRAMME, 24 NATURAL RESOURCES AND THE ENVIRONMENTAL SERIES (1988) (providing a detailed discussion of the United Nations Environmental Programme (UNEP) Regional Seas Programme including the texts of various regional agreements). The UNEP Regional Seas Programme creates 11 regions which include more than 120 of the approximately 130 coastal states in the world. Lentz, *supra* note 128, at 364. UNEP works with states in each region to form "action plans" that outline areas of cooperation and which are incorporated into conventions. *Id.* Under UNEP, regional "action plans" are in place for the eleven regional areas, and

environment.¹⁴⁹ These conventions may obligate states to undertake measures to prevent, abate, and combat pollution from both ocean and land-based sources.¹⁵⁰ Since the problem of plastics pollution is ubiquitous and the geographic areas subject to regional agreements are often limited, such agreements cannot provide the global regime necessary to remedy the international problem of plastics pollution from ships.¹⁵¹

For example, the Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention)¹⁵² addresses marine pollution from all sources, including ship-generated wastes, dumping, land-based sources, and pollution from seabed exploration and exploitation. Ships are prohibited from discharging plastics, with the exception of accidental losses of synthetic fishing gear.¹⁵³ This ban on disposal of ship-generated garbage in the Baltic Sea, however, appears to encourage ships to dispose of garbage in the North Sea either just prior to entering or upon leaving waters subject to the regional

conventions exist in six. *Id.* The six conventions are: (1) Convention for the Protection of the Mediterranean Sea Against Pollution, *done at* Barcelona, Feb. 16, 1976, *reprinted in* 15 I.L.M. 290 (1976) (entered into force Feb. 12, 1978); (2) Kuwait Regional Convention for Cooperation on the Protection of the Marine Environment from Pollution, *done at* Kuwait, April 23, 1978, 1140 U.N.T.S. 133, *reprinted in* 17 I.L.M. 511 (1978) (entered into force June 30, 1979); (3) Convention for Co-operation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region, *done at* Abidjan, Mar. 23, 1981, *reprinted in* 20 I.L.M. 729 (1981) (not yet in force); (4) Convention for the Protection of the Marine Environment and Coastal Area of the South-East Pacific, *done at* Lima, Peru, Nov. 12, 1981, *reprinted in* UNEP/GC/INF.11, at 185 (not yet in force) (text reprinted in SANDS, *supra* note 148, at 84); (5) Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment, *done at* Jiddah, Feb. 14, 1982, UNEP/GC/INF.11 at 191 (entered into force Aug. 20, 1985) (text of Convention reprinted in SANDS, *supra* note 148, at 114); (6) Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region, *done at* Cartagena, Mar. 24, 1983, *reprinted in* 22 I.L.M. 221 (1983) (entered into force Nov. 10 1986).

149. See Lentz, *supra* note 128, at 363 (concluding that regional agreements such as the Oslo Convention, Helsinki Convention, and UNEP Regional Seas Programme offer a promising forum for addressing marine pollution issues). Regional agreements have the advantage of addressing problems beyond the power of individual nations and can tailor provisions to the needs of a specific region. *Persistent Marine Debris*, *supra* note 60, at VII-10. Regional agreements can also enter into force when nations in a particular region agree to address pollution problems as a region rather than wait for broad global support. *Id.*

150. See, e.g., The Convention on the Protection of the Marine Environment of the Baltic Sea Area, *done at* Helsinki, 1974, U.N. Doc. A/CONF.62//C.3/L.1, *reprinted in* 13 I.L.M. 546 (1974) [hereinafter Helsinki Convention] (addressing ship-generated wastes, dumping, and land-based sources of marine pollution).

151. See *supra* note 60 (discussing the international nature of plastics pollution).

152. See Helsinki Convention, *supra* note 150, (addressing ship-generated wastes, dumping, and land-based sources of marine pollution).

153. *Id.* Annex III, reg. 8 (b)(1)(a)(1).

agreement.¹⁵⁴ The ability to avoid disposal in waters subject to regional agreements, coupled with the movement of debris by wind and currents,¹⁵⁵ underscores the limitations of regional agreements in addressing marine plastics pollution.

Other regional agreements, such as the Convention for the Prevention of Marine Pollution By Dumping from Ships and Aircraft (Oslo Convention),¹⁵⁶ concern the dumping of plastics,¹⁵⁷ but fail to prohibit the discharge of wastes incidental to ship operations.¹⁵⁸ Many regional agreements do not concern solid waste disposal from ships.¹⁵⁹ Other regional agreements express an intent to conserve and protect marine resources and encourage actions to further such goals.¹⁶⁰

154. See *Persistent Marine Debris*, *supra* note 60, at III-8, VII-11 (stating that in response to the Helsinki Convention's ban on pollution from ships, disposal of trash may occur just before ships enter or just after ships leave the Baltic Sea). According to the Danish Ministry of the Environment, the North Sea entrance to the Baltic and adjacent Danish coast have become problem areas. *Id.* at III-8.

155. See *supra* note 60 (discussing the movement and concentrations of plastics pollution).

156. The Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft, *done at* Oslo, Feb. 15, 1972 U.N. Doc. A/AC.138/SC.III/L.9 (1972), *reprinted in* 11 I.L.M. 262 (1972) (entered into force on Apr. 7, 1974) [hereinafter Oslo Convention]. In June 1988, the Oslo Commission decided to terminate at sea incineration of hazardous waste no later than December 31, 1994, and to restrict marine incineration as an interim measure. *Oslo and Paris Commissions Meet*, 19 MAR. POLLUT. BULL. 498 (1988).

157. Oslo Convention, *supra* note 156, Ann. I, para. 6. Article V of the Oslo Convention prohibits dumping of wastes listed in Annex I, including "persistent plastics and other persistent synthetic materials which may float or remain in suspension in the sea, and which may seriously interfere with fishing and navigation, reduce amenities, or interfere with other legitimate uses of the sea." *Id.* The Oslo Convention prohibits dumping of plastics and synthetic materials in much the same way as the London Dumping Convention. *Supra* note 121.

158. Oslo Convention, *supra* note 156, art. 19, para. 1(a). Dumping is defined by the Oslo Convention as "any deliberate disposal of substances and materials into the sea by or from ships or aircraft other than: (a) any discharge incidental to or derived from the normal operations of ships and aircraft and their equipment." *Id.*

159. See, e.g., The Agreement for Cooperation in Dealing with Pollution of the North Sea By Oil, *done at* Bonn, June 9, 1969, 704 U.N.T.S. 3 (not yet in force) [hereinafter Bonn Convention]. The Bonn Agreement is the first regional agreement to promote contingency plans for responding to oil spills. WASTES IN MARINE ENVIRONMENTS, *supra* note 119, at 149.

160. See, e.g., Convention on the Conservation of Antarctic Marine Living Resources, *done at* Canberra, May 20, 1980, 80 Stat. 271, T.I.A.S. 10,240, *reprinted in* 19 I.L.M. 841 (1978) (entered into force on Apr. 7, 1982) [hereinafter Canberra Convention]. The Canberra Convention establishes a commission for the conservation of Antarctic marine living resources made up of members from each of the states party to the agreement. *Id.* art. VII. The commission is charged with facilitating research on conservation needs, compiling data, and formulating conservation measures for the protection of the Antarctic marine environment. *Id.* The 21 party commission has agreed to maintain records of lost fishing gear, collect derelict marine debris, survey beaches, and maintain an inventory of all netting used in the Convention area. Manheim, *supra*

Regional agreements may be best suited for regulating and abating land-based sources of plastics pollution.¹⁶¹ Moreover, regional agreements provide a mechanism for identifying marine pollution problems and developing mitigation plans.¹⁶² Such agreements, however, provide only limited authority for preventing the disposal of ship-generated wastes into the world's oceans.

2. *United States Domestic Law*

Federal efforts to control marine pollution began roughly two decades ago with the passage of the Marine Protection, Research, and Sanctuaries Act and the Clean Water Act.¹⁶³ Prior to the enactment of the Marine Plastic Pollution Research and Control Act of 1987 (MP-PRCA),¹⁶⁴ which implements the requirements of MARPOL Annex V, Congress did not provide effective federal authority for regulating ship disposal of incidental solid wastes into marine waters.¹⁶⁵ At least one

note 23, at 94, n.139.

161. See Manheim, *supra* note 23, at 87-88 (stating that a global approach to land-based sources of pollution may not be appropriate and that regional agreements may more effectively address land-based sources of plastics pollution). The Convention for the Prevention of Marine Pollution from Land-Based Sources, *done at Paris*, Feb. 21, 1974, ST/LEG/SER.B/18 at 547 *reprinted in* 13 I.L.M. 352 (1974) (entered into force May 6, 1978) [hereinafter Paris Convention] is a regional agreement concerned solely with pollution from land-based sources. All the contracting parties to the Oslo Convention except Finland ratified the convention. *Persistent Marine Debris*, *supra* note 60, at VII-10. The Paris Convention requires contracting parties to implement programs regarding marine pollution from land-based sources by substances listed in Part I of Annex A. Paris Convention, *supra*, art. 4. Among the substances to be eliminated are "[p]ersistent synthetic materials that may float, remain in suspension or sink, and which may seriously interfere with legitimate uses of the sea." *Id.* Annex A, pt. I, para. 4.

162. See *Persistent Marine Debris*, *supra* note 60, at VII-12-13 (discussing the Cartagena Convention developed under UNEP, and stating that the action plan and the Convention provide mechanisms for the region to identify issues and plan mitigation for the area).

163. See WASTES IN MARINE ENVIRONMENTS, *supra* note 119, at 143-56 (discussing the adoption of the Marine Protection, Research, and Sanctuaries Act and Clean Water Act in 1972). Congress adopted the statutes in response to the growing environmental concerns of the late 1960s and early 1970s as well as a number of government reports issued in 1970 recommending development of a national policy for controlling ocean waste disposal. *Id.* at 143. An excellent overview of significant marine pollution legislation, treaties, and events is included in the legislative history of the Act to Prevent Pollution from Ships; see also *Report on the Act to Prevent Pollution from Ships*, H.R. REP. NO. 1224, 96TH CONG., 2D. SESS. 5 (1980), *reprinted in* 1980 U.S. CODE CONG. AND ADMIN. NEWS 4849 [hereinafter *Report on the Act to Prevent Pollution from Ships*].

164. Marine Plastic Pollution Research and Control Act, Pub. L. No. 100-220, tit. II, 101 Stat. 1458 (1987), 33 U.S.C. §§ 1901-1912 (Supp. V 1988) [hereinafter MP-PRCA].

165. See *Hearings on Plastic Pollution*, *supra* note 9, at 3 (testimony of Admiral

law that Congress passed creates an incentive for at sea disposal of ship wastes.¹⁶⁶ Existing laws relevant to marine plastics pollution may be roughly categorized as laws regulating ocean dumping, general pollution control statutes, and fish and wildlife conservation laws.¹⁶⁷

a. Ocean Dumping

The Rivers and Harbors Act of 1899 (Refuse Act)¹⁶⁸ prohibits the discharge of refuse matter of any kind into waters of the United States, other than refuse flowing from streets and sewers and passing in a liquid state.¹⁶⁹ The Refuse Act does not specifically address persistent plastics pollution, but may be used to prohibit discharges of plastics and other garbage from vessels within the navigable waters of the United States, extending to three miles from shore.¹⁷⁰

Unfortunately, the limited jurisdictional reach of the Refuse Act and the difficulty of enforcing its criminal provisions against individual polluters restrict the Act's effectiveness.¹⁷¹ Under the Refuse Act, ships are permitted to freely discard wastes into waters beyond three miles from shore.¹⁷² Vast numbers of international merchant ships, commer-

John W. Kime, Chief, Office of Marine Safety Security and Environmental Protection, United States Coast Guard) (concluding that the Refuse Act, Federal Water Pollution Control Act, and the Marine Protection, Research and Sanctuaries Act do not adequately address the problem of at sea disposal of ship-generated garbage).

166. See REGULATORY EVALUATION OF ANNEX V, *supra* note 6, at 5-9 (stating that the costs associated with foreign ship compliance with the Pest Act provide an economic incentive for foreign ships to discharge ship wastes at sea). The United States Department of Agriculture has delegated broad powers under various pest statutes to its Animal and Plant Health Inspection Service (APHIS), 7 C.F.R. § 2.51 (1989). APHIS requires food wastes from foreign ships to be incinerated or steam-sterilized to prevent the spread of disease and pests. 7 C.F.R. § 330.400 (1988) and 9 C.F.R. § 94.5 (1988). According to 1987 U.S. Department of Agriculture figures, virtually all shipping garbage is dumped at sea, with only 1,731 of the 73,614 ships surveyed off-loading garbage in the United States. *Hearings on H.R. 940, supra* note 49, at 172 (testimony of Gary Mauro, Texas Land Commissioner).

167. See REGULATORY EVALUATION OF ANNEX V, *supra* note 6, at 5-2 (listing legislation influencing ocean disposal and activities); O'Hara, *supra* note 59, at 412-16 (listing United States legislation relevant to the problem of marine debris and framing the discussion in terms of ocean dumping controls, pollution controls, and laws protecting marine wildlife).

168. 33 U.S.C. § 401 to 407 (1982).

169. 33 U.S.C. § 407 (1982).

170. See INTERAGENCY TASK FORCE, *supra* note 1, at 92 (stating that the authority to issue permits under the act is now subsumed by the National Pollutant Discharge Elimination System (NPDES) of the Clean Water Act, although the Refuse Act may still be used to prohibit discharges of plastics in United States territorial waters).

171. See generally PLASTICS IN THE OCEAN, *supra* note 10, at 84, 85 (discussing the applicability of the Rivers and Harbors Act and concluding that a federal agency could not invoke the Act against individual polluters).

172. See *Nat'l Ocean Policy Study Hearings, supra* note 4, at 12 (testimony of

cial fishing vessels, and recreational boats operate beyond this distance and are beyond the scope of the Refuse Act.¹⁷³ The Refuse Act does not impose civil fines for violations, but instead carries minor criminal penalties.¹⁷⁴ Accordingly, the United States Coast Guard, the enforcement agency under the regulations, is not empowered to impose penalties itself.¹⁷⁵ Instead, it must refer cases to the United States Department of Justice for enforcement actions.¹⁷⁶ The Coast Guard has described the Refuse Act as not only difficult to enforce, but ineffective in controlling the international problem of ocean plastics pollution.¹⁷⁷

The Marine Protection, Research and Sanctuaries Act (MPRSA),¹⁷⁸ establishes a permit process for the dumping of authorized substances to satisfy the requirements of the London Dumping Convention.¹⁷⁹ The MPRSA regulates domestic transportation of any material for the purpose of dumping¹⁸⁰ and prohibits the dumping of any material transported from a location outside the United States into the territorial sea

Rear Admiral William Kime, United States Coast Guard)(stating that the Refuse Act only prohibits at sea disposal of garbage into the United States territorial sea).

173. See REGULATORY EVALUATION OF ANNEX V, *supra* note 6, at 2-62 (indicating that in 1985, a total of 53,531 United States and foreign vessels entered United States ports from foreign waters). The U.S. Army Corps. of Engineers collects data on "vessel entrances" to determine the level of activity at United States ports. *Id.* at 2-62. A "vessel entrance" is recorded for a United States port when a ship arrives at its first U.S. port of call. *Id.* In 1987, the United States registered numerous ships expecting to travel beyond its territorial waters, including: 814 ocean going vessels of 1,000 tons or more, 2,789 vessels under 1,000 tons, and 129,800 fishing vessels. *Id.* at 2-8 to -28.

174. 33 U.S.C. § 407 (1982).

175. See *Hearings on Plastic Pollution*, *supra* note 9, at 95 (statement of Admiral John W. Kime, Chief, Office of Marine Safety Security and Environmental Protection, U.S. Coast Guard) (stating that the Refuse Act of 1899 imposes criminal sanctions requiring prosecution). Admiral Kime testified that "[i]t is very difficult to get the U.S. Attorney to focus on a criminal act for throwing a sack of garbage over the side of a ship when they are faced with many other things, such as drugs, et cetera." *Id.*

176. *Id.*

177. *Id.* at 3.

178. Marine Protection, Research, and Sanctuaries Act (MPRSA), 33 U.S.C. § 1401 to 1445 (1982).

179. MPRSA § 104, 33 U.S.C. § 1414 (1982).

180. See Gosliner, *supra* note 116, at 20 (noting that Congress decided to regulate transportation rather than to explore a direct prohibition on dumping in order to avoid violating principles of international law). The right of a state to exercise jurisdiction over commerce moving from the ports of that state, whether domestic or foreign vessels, is well established in international law. *Id.* Congress thereby concluded that "[a]sserting jurisdiction to regulate transportation by persons subject to the jurisdiction of the United States for the purpose of dumping in the oceans (whether they be high seas or not) attains the same objective as a direct prohibition of dumping without doing violence to principles of international law." *Id.* (citing S. REP. NO. 451, 92d Cong., 2d Sess., reprinted in U.S. CODE CONG. & ADMIN. NEWS 4234, 4246 (1972)); see also PLASTICS IN THE OCEAN, *supra* note 10, at 91 (stating that transportation is used as a basis for jurisdiction to avoid international conflicts).

or contiguous twelve mile zone.¹⁸¹ Thus, the dumping of plastics is not permitted.¹⁸² Similar to the London Dumping Convention and the LOS Convention, however, the MPRSA does not prohibit the disposal of wastes incidental to the normal operation of ocean vessels.¹⁸³

The Outer Continental Shelf Lands Act (OCSLA)¹⁸⁴ seeks to support exploration, development, and production of minerals on the Outer Continental Shelf without adversely affecting surrounding waters. Department of the Interior operating regulations promulgated under OCSLA prohibit the disposal of all solid wastes, including plastic, from vessels and structures operating over the Outer Continental Shelf.¹⁸⁵ The prohibitions, however, only apply to a limited number of vessels and structures operating under federal leases.¹⁸⁶ Compliance with even this narrow prohibition is suspect because Texas beaches are overwhelmed with large amounts of plastic debris, much of which is attributed to offshore oil operations.¹⁸⁷

The Act to Prevent Pollution From Ships (APPS)¹⁸⁸ is the United States implementing legislation for MARPOL. Prior to the incorpora-

181. MPRSA § 101, 33 U.S.C. § 1411(b) (1982). The United States declaration of a 200 mile EEZ followed the enactment of the MPRSA; Gosliner, *supra* note 116, at 22. Congressional intent to prohibit dumping within coastal waters under United States jurisdiction apparently extends MPRSA's prohibitions and permit requirements to the 200-mile EEZ limit. *Id.* Amendments to the MPRSA were introduced in Congress in 1985 and 1986 to extend the jurisdiction of the Act to the 200-mile limit, but Congress failed to act on them. PLASTICS IN THE OCEAN, *supra* note 10, at 90.

182. 40 C.F.R. § 227.5(d) (1988). The Environmental Protection Agency (EPA) will not issue approval for dumping of persistent, inert synthetic or natural materials that may float or remain suspended in marine waters. *Id.*

183. See Gosliner, *supra* note 116, at 20 (stating that MPRSA appears on its face to be inapplicable to disposal of fishing gear or debris from other vessel classes because such materials are not transported with the intent of disposal). It is, however, possible to read a blanket prohibition on the dumping of nondegradable fishing debris into the MPRSA. *Id.* at 20-22.

184. 43 U.S.C. §§ 1331 to 1356 (1982).

185. REGULATORY EVALUATION OF ANNEX V, *supra* note 6, at 5-5; see 30 C.F.R. § 250.40(b)(6) (1988) (prohibiting at sea disposal of equipment, cables, chains, containers, and other materials).

186. See REGULATORY EVALUATION OF ANNEX V, *supra* note 6, at 2-47 (stating that roughly 3,493 active production complexes operate in the Gulf of Mexico, 779 of which are manned). Few exist elsewhere in United States waters. *Id.* The Coast Guard estimates that there are 484 offshore service vessels working within the Outer Continental Shelf. *Id.* at 2-48.

187. See *Hearings on H.R. 940*, *supra* note 49, at 178 (statement of Gary Mauro, Texas Land Commissioner) (indicating that reports show that up to 15% of debris collected on Texas beaches may be attributed to offshore oil operations); REGULATORY EVALUATION OF ANNEX V, *supra* note 6, at 5-37 (stating that a variety of plastic items common to the oil field operations including gloves, hardhats, plastic wrap and drilling wastes, are regularly found on Texas beaches).

188. The Act to Prevent Pollution from Ships (APPS), 33 U.S.C. §§ 1901-1912 (1982 & Supp. 1987)

tion of implementing legislation for Annex V,¹⁸⁹ the APPS only regulated the discharge of oil and other hazardous substances into the navigable waters of the United States.¹⁹⁰ Consequently, the APPS did not regulate ship-generated plastic waste.¹⁹¹

b. General Pollution Control Statutes

General pollution control statutes also fail to provide adequate authority to address plastics pollution from ships.¹⁹² For example, the Federal Water Pollution Control Act (Clean Water Act)¹⁹³ seeks to "restore and maintain the chemical, physical, and biological integrity" of the waters of the United States.¹⁹⁴ Under the Clean Water Act, a National Pollutant Discharge Elimination System (NPDES) permit is required for discharging any pollutant¹⁹⁵ from a point source into navigable waters¹⁹⁶ of the United States. The Clean Water Act's require-

189. MPPRCA, 33 U.S.C. §§ 1901 to 1912 (Supp.V 1987).

190. See 33 U.S.C. § 1901(2) (1982) (defining "Convention" under the APPS to include Annexes I and II of MARPOL).

191. See *United States v. Ohio Barge Lines*, 410 F. Supp. 625, *aff'd* 531 F.2d 574 (5th Cir. 1975) (holding that the APPS applies only to substances specifically listed as pollutants).

192. See O'Hara, *supra* note 59, at 415 (discussing the limits of the Clean Water Act, Resource Conservation and Recovery Act, and Toxic Substances Control Act in limiting the hazards of marine plastic pollution).

193. Federal Water Pollution Control Act (FWPCA or Clean Water Act), 33 U.S.C. §§ 1251-1387 (1982).

194. FWPCA § 101, 33 U.S.C. § 1251(a) (1982 and Supp. V. 1987).

195. FWPCA § 502, 33 U.S.C. § 1362(6) (1982). Under the Clean Water Act, "pollutant" is defined as dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water. *Id.* The problem of plastic ingestion in marine life could arguably bring marine plastics pollution within the definition of "toxic pollutant" as defined below:

[T]hose pollutants, or combinations of pollutants, including disease causing agents, which after discharge and upon exposure, ingestion, inhalation or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will, on the basis of information, cause death, disease, behavioral abnormalities, cancer, genetic mutations (including malfunctions in reproduction), or physical deformations, in such organisms or their offspring. FWPCA § 502, 33 U.S.C. § 1362(13) (1982).

196. FWPCA § 502, 33 U.S.C. § 1362(7) (1982). Navigable waters are defined as waters of the United States, including the territorial seas that extend three nautical miles from the line of ordinary low tide. *Id.*; see *Hearings on Plastics Pollution*, *supra* note 9, at 3 (testimony of Admiral John W. Kime, Chief, Office of Marine Safety Security and the Environmental Protection, United States Coast Guard) (discussing NPDES permit requirements and noting that the Clean Water Act includes garbage as a pollutant). The Clean Water Act makes disposal without an NPDES permit unlawful. 33 U.S.C. § 1311(a) (1982); *supra* note 195 and accompanying text (listing garbage as a pollutant under the Clean Water Act). Ships are considered point sources in

ments include disposal of wastes from ships, but the provisions are not enforced.¹⁹⁷ The Clean Water Act also requires a NPDES permit for pollutant discharges from point sources into the contiguous zone or ocean (i.e. beyond three miles from shore), but specifically exempts vessels and floating crafts.¹⁹⁸ Plastic debris is not a listed hazardous substance¹⁹⁹ under applicable regulations, and the Clean Water Act's hazardous pollutant requirements are not likely to be enforced against ships discharging plastic debris in territorial waters.²⁰⁰ Although the Clean Water Act is used to regulate oil platforms²⁰¹ and plastic manufacturing facilities,²⁰² it does not adequately address the disposal of plastic and other garbage from ships.²⁰³

navigable waters, including the territorial sea. 33 U.S.C. § 1362(12)(A) (1982). Plastics should be considered within the term "garbage" in the definition of pollutant. *PLASTICS IN THE OCEAN*, *supra* note 10, at 94.

197. *See* Bean, *supra* note 16, at 358 (stating that section 301 of the Clean Water Act prohibits ships from discharging wastes into territorial waters, however, nonenforcement is the norm). Unfortunately, the EPA's NPDES permits are currently used to deal with effluent, rendering the Clean Water Act only effective against plastic manufacturing facilities or municipal waste treatment plants. *PLASTICS IN THE OCEAN*, *supra* note 10, at 94.

198. FWPCA § 502, 33 U.S.C. § 1362(12)(B) (1982). "Discharge of pollutants" under the Act means any addition of pollutant to the waters of the contiguous zone or the ocean from any craft other than a vessel or floating craft. *Id.*;

199. *See* 40 C.F.R. § 116.4 (1988) (listing over 300 hazardous substances pursuant to section 311 of the Clean Water Act). Congress declared a policy against discharges of oil and hazardous substances into navigable waters, shorelines, and waters of the contiguous zone. 33 U.S.C. § 1321(b)(1) (1982 and Supp. V. 1987). The Administrator is charged with promulgating regulations designating hazardous substances. 33 U.S.C. § 1321(b)(2)(A) (1982 and Supp. V. 1987). Congress defines these as elements or compounds that, when discarded in any quantity, present an "imminent and substantial danger to the public health or welfare, including, but not limited to fish, shellfish, wildlife, shorelines and beaches." *Id.*

It is difficult to classify plastic debris as an element or compound, and the EPA presently uses a narrow interpretation that regulates toxic chemicals. *See* Gosliner, *supra* note 116, at 23 (stating that all of the substances listed pursuant to the Clean Water Act are toxic chemicals). However, plastics are already listed among extremely dangerous substances under the London Dumping Convention. *Supra* note 121.

200. *See* Gosliner, *supra* note 116, at 22, 23 (stating that the EPA lists only toxic chemicals, and that a creative interpretation of "hazardous substances" is required to bring plastics under the ban on discharges of hazardous substances under The Clean Water Act).

201. *See* REGULATORY EVALUATION OF ANNEX V, *supra* note 6, at 5-6 (stating that all platforms and rigs operating in federal waters are required to obtain a NPDES permit for disposal of solid wastes).

202. *Id.* The Clean Water Act does regulate the pH discharges of plastic manufacturing plants, but does not presently restrict the discharge of raw plastic materials. *Id.* The Center for Environmental Education notes that the Clean Water Act's definition of garbage might include plastic pellets from plastic manufacturing facilities, and thereby require an NPDES permit for discharge from a point source. *PLASTICS IN THE OCEAN*, *supra* note 10, at 93-94.

203. *See* *Hearings on Plastic Pollution*, *supra* note 9, at 3 (statement of Admiral

The Resource Conservation and Recovery Act of 1976 (RCRA)²⁰⁴ and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or Superfund)²⁰⁵ also fail to regulate or prohibit ship disposal of plastics and similar debris because plastics are not considered "hazardous" under the acts.²⁰⁶ The Toxic Substances Control Act (TSCA)²⁰⁷ may offer a vehicle for requiring more readily recyclable or degradable plastics, but TSCA does not regulate waste disposal.²⁰⁸ Thus, these statutes primarily regulate toxic and reactive

John M. Kime, Chief, Office of Marine Safety, Security and Environmental Protection, United States Coast Guard) (stating that the Refuse Act of 1899, the Federal Water Pollution Control Act, and the Marine Protection, Research and Sanctuaries Act do not adequately address the problem of at sea disposal of ship-generated garbage).

204. Resource Conservation and Recovery Act of 1976 (RCRA), 42 U.S.C. §§ 6901-6991(i) (1982 and Supp. V 1987). RCRA provides a "cradle to grave" system that formally identifies wastes as hazardous, tracks all waste shipments and certification through a permit system that imposes standards for safe treatment, storage, and disposal of wastes. F. ANDERSON, D. MANDELKER & D. TARLOCK, ENVIRONMENTAL PROTECTION: LAW AND POLICY 558 (1984) [hereinafter F. ANDERSON & MANDELKER].

205. Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA), 42 U.S.C. §§ 9601-9675 (1982 & Supp. IV 1986), *as amended by* Superfund Amendments and Reauthorization Act of 1986 (SARA), Pub. L. No. 99-499, 100 Stat. 1613 (1986); *see* F. ANDERSON & D. MANDELKER, *supra* note 204, at 568-603 and 1988 Supp. (analyzing CERCLA and the 1986 SARA amendments). CERCLA places a tax on oil and chemicals to generate an \$8.5 billion fund used for government cleanup of waste sites. *Id.*

206. *See* PLASTICS IN THE OCEAN, *supra* note 10, at 96, 100 (concluding that neither RCRA nor CERCLA regulate plastic debris because plastics are not considered hazardous substances under the acts). Plastic debris is probably a solid waste covered by RCRA. *Id.* at 96. However, solid wastes must be "hazardous" in order for RCRA standards to apply. *Id.*; F. ANDERSON & D. MANDELKER, *supra* note 204, at 558 (stating that "[t]he trigger for regulatory action under RCRA is formal designation of a solid waste as hazardous").

CERCLA defines hazardous substance through reference to substances designated as hazardous under the Clean Water Act, Clean Air Act, RCRA, and Toxic Substances Control Act. 42 U.S.C. § 9601(14) (1982 & Supp. IV 1986). Marine debris is not a hazardous substance under these statutes, and does not appear to rise to the level of an imminent and substantial endangerment under CERCLA section 104; consequently, the Act is unlikely to apply to plastics pollution. PLASTICS IN THE OCEAN, *supra* note 10, at 100 (discussing the applicability of CERCLA to the marine debris problem).

207. Toxic Substances Control Act, 15 U.S.C. §§ 2601-2671 (1988) [hereinafter TSCA]. The purpose of TSCA is to regulate chemical substances and mixtures whose "manufacture, processing, distribution in commerce, use or disposal presents an unreasonable risk of injury to health or the environment." 15 U.S.C. § 2605(a) (1982).

208. *See* INTERAGENCY TASK FORCE, *supra* note 1, at 97 (stating that under TSCA the EPA could regulate constituent substances of persistent marine debris and determine the advantages of degradable versus nondegradable plastics); *see also* PLASTICS IN THE OCEAN, *supra* note 10, at 97 (noting that unlike RCRA, CERCLA, and the Clean Water Act, TSCA does not regulate disposal of debris, but instead regulates chemical substances, thereby enabling the EPA to regulate substances used in plastic manufacturing). Under TSCA, the Administrator of the Environmental Protection Agency may prohibit or regulate the manufacture or distribution of a chemical sub-

substances, not discarded inert plastics from ships.²⁰⁹

c. *Fish and Wildlife Conservation Statutes*

Wildlife statutes and fisheries laws designed to protect marine fisheries,²¹⁰ endangered species,²¹¹ marine mammals,²¹² or birds²¹³ are essen-

stance upon a finding that the manufacture, distribution, or disposal of such substance or mixture presents "an unreasonable risk of injury to health or the environment." TSCA, 15 U.S.C. § 2605(a) (1988).

209. See Gosliner, *supra* note 116, at 24 (stating that the RCRA, similar to the Clean Water Act, lists hazardous substances that are primarily toxic chemicals). RCRA, like other pollution control statutes is primarily designed to regulate toxic and reactive chemicals, and not inert substances such as fishing gear and other debris. *Id.*

210. Magnuson Fishery Conservation and Management Act (FCMA), 16 U.S.C. §§ 1801-1822 (1988). The FCMA seeks, in part, to conserve and manage fishery resources off the coast of the United States. *Id.* The Act requires foreign fishermen to obtain a permit to fish within the fishery conservation zone, which is the 200 mile EEZ the United States claims. INTERAGENCY TASK FORCE, *supra* note 1, at 94. Except in cases of emergency or as specifically authorized, regulations under the Act prohibit foreign fishing vessels from intentionally placing into the fishery conservation zone (EEZ) any article, including abandoned fishing gear and plastic items that may interfere with fishing or cause damage to any fishery resource or marine mammal. 50 C.F.R. § 611.12(c) (1988). The ban on discarding wastes, however, is limited to foreign vessels, and does not apply to domestic fishermen. Gosliner, *supra* note 116, at 28.

211. Endangered Species Act of 1973 (ESA), 16 U.S.C. §§ 1531-1544 (1988). The purposes of the ESA are to preserve ecosystems on which threatened or endangered species depend and to conserve endangered and threatened species themselves. 16 U.S.C. § 1531(b) (1988). Sea turtles, brown pelicans, East Indian manatees, and certain seal species are among the endangered species plastic marine debris threaten. *Supra* notes 86-90 and accompanying text. The ESA prohibits any person, subject to the jurisdiction of the United States, from "taking" an endangered or threatened species. 16 U.S.C. § 1333 (1988); 50 C.F.R. § 227 (1988). Discharging marine debris that subsequently harms an endangered or threatened species could be considered a violation of the Act, although Federal agencies and the courts have not enforced such an interpretation. INTERAGENCY TASK FORCE, *supra* note 1, at 95. Ownership of the debris, however, must be determined. *Id.*

212. Marine Mammal Protection Act of 1972 (MMPA), 16 U.S.C. §§ 1361-1407 (1988). The MMPA prohibits the taking of marine mammals from waters under the jurisdiction of the United States. *Id.* The act prohibits American citizens from taking marine mammals anywhere in the world. *Id.* A violation of the Act may occur once discarded debris harms a marine mammal, but again, identification of the owner of the debris is required. PLASTICS IN THE OCEAN, *supra* note 10, at 101. The Fur Seal Act of 1966 (FSA), as amended, makes it unlawful for any person subject to the jurisdiction of the United States to harm fur seals in the North Pacific. 16 U.S.C. § 1152 (1988). The discarding of plastic debris that harms a fur seal may be a violation of the Act, but is subject to the same restrictions limiting the MMPA. INTERAGENCY TASK FORCE, *supra* note 1, at 96.

213. Migratory Bird Treaty Act (MBTA), 16 U.S.C. §§ 701-712 (1988). The MBTA prohibits the taking of birds protected under the following four treaties: Convention for the Protection of Migratory Birds, Aug. 16, 1916, United States-Great Britain, 39 Stat. 1702 T.S. No. 628; Convention for the Protection of Migratory Birds and Game Mammals, Feb. 7, 1936, United States-Mexico, 50 Stat. 1311 T.S. No. 912; Convention for the Protection of Migratory Birds and Birds in Danger of Extinction, and Their Environment, with Annex, Mar. 14, 1972, United States-Japan, 25 U.S.T.

tially unenforceable against vessels generating plastics pollution.²¹⁴ Although the Fishery Conservation and Management Act²¹⁵ makes it unlawful for foreign fishing vessels to discard fishing gear in the United States' EEZ,²¹⁶ wildlife conservation laws do not generally prohibit ships from discharging wastes at sea.²¹⁷ Ship disposal of plastic debris at sea may entangle, kill, or harm a protected resource and violate a particular wildlife statute.²¹⁸ The spatial and temporal distance from disposal to injury, however, may be so remote and the debris so common that enforcement of wildlife statutes against ships discharging plastics at sea is virtually impossible.²¹⁹

B. THE INTERNATIONAL CONVENTION FOR THE PREVENTION OF POLLUTION FROM SHIPS, 1973, AS MODIFIED BY THE PROTOCOL OF 1978 (MARPOL)

The International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978,²²⁰ arose from the heightened concern for the marine environment following the *Torrey*

3329 T.I.A.S. No. 7990; Convention Concerning the Conservation of Migratory Birds and Their Environment, Nov. 19, 1976, United States-U.S.S.R., 29 U.S.T. 4647, T.I.A.S. No. 9073. Harm to protected birds from discarded plastics may be a violation of the MBTA, but it is very difficult to enforce because the debris is not traceable. INTERAGENCY TASK FORCE, *supra* note 1, at 96.

214. See INTERAGENCY TASK FORCE, *supra* note 1, at 95-96 (examining the Endangered Species Act of 1973, Migratory Bird Treaty Act, and Fur Seal Act of 1976, and concluding that a violation of the acts may occur as a result of a ship discarding persistent debris, but that enforcement is difficult because the debris is hard to trace).

215. FCMA, 16 U.S.C. §§ 1801-1822 (1988).

216. 50 C.F.R. 611.12(c) (1988). The National Marine Fisheries Service promulgate regulations that prohibit the intentional disposal of abandoned fishing gear and other wastes, such as plastic bags and toxic chemicals, into the fishery conservation zone which may interfere with fishing gear or vessels, or damage fishery resources or mammals. *Id.* The fishery conservation zone extends seaward 200 miles from the baseline of the territorial sea of the United States. 16 U.S.C. § 1821 (1982 and Supp. V 1987); see *supra* note 210 and accompanying text (discussing the Magnuson Fishery Conservation and Management Act). Bean suggests a similar regulation governing U.S. fishing vessels, which although difficult to enforce without observers, may result in voluntary compliance. United States and International Authorities Applicable to Entanglement, *supra* note 125, at 24.

217. See PLASTICS IN THE OCEAN, *supra* note 10, at 101 (stating that disposal of fishing gear does not generally violate wildlife conservation laws).

218. Gosliner, *supra* note 116, at 25. Generally, no violation of wildlife protection laws occurs until an animal is taken; thus, absent a mechanism for identifying the discharger, enforcement of these provisions is nearly impossible. *Id.*

219. See Bean, *supra* note 16, at 358 (stating that in practice it is almost impossible to link a particular deliberate or negligent act with the subsequent killing of a protected animal).

220. MARPOL Convention, *supra* note 19.

Canyon accident.²²¹ The Convention was signed in London in 1973, but the Protocol of 1978 Relating to the International Convention for the Prevention of Pollution from Ships, 1973²²² modified and procedurally absorbed the parent Convention before its ratification.²²³ The 1973 MARPOL Convention and 1978 MARPOL Protocol are read as one instrument²²⁴ and entered into force on October 2, 1982.²²⁵ Under Annexes I and II pertaining to oil and noxious liquid discharges respectively, MARPOL currently regulates more than eighty percent of the world's shipping tonnage.²²⁶

The 1978 Protocol²²⁷ is the result of the Tanker Safety and Pollution Prevention Conference that convened in London in February 1978 under the auspices of the Intergovernmental Maritime Consultative Or-

221. See Abecassis, *Liability for Oil Pollution from Ships*, in INT'L MAR. ORG., *supra* note 19, at 277 (stating that after the April 1967 *Torrey Canyon* incident, the IMO paid great attention to oil pollution and the international community adopted the 1973 International Convention for the Prevention of Pollution from Ships (MARPOL)).

222. *Report on the Act to Prevent Pollution From Ships*, *supra* note 163, at 4,850-51; see UNITED STATES TREATIES IN FORCE, *supra* note 119, at 323 (noting that the 1978 Protocol incorporates, with modifications, the provisions of the International Convention of Pollution from Ships, signed at London on November 2, 1973).

223. INT'L MAR. ORG. *MARPOL 73/78*, in FOCUS ON THE IMO 10 (1988). The Convention for the Prevention of Pollution from Ships, 1973, was not in force at the time of the convening of the International Conference on Tanker Safety and Pollution Prevention in 1978 and consequently could not be amended. *Id.* New measures were thus incorporated into the Protocol. *Id.* Difficulties concerning Annex II presented problems to early ratification of the MARPOL Convention. *Id.* As the Conference sought primarily to change Annex I, the Conference decided to adopt changes to Annex I while allowing contracting states to defer implementation of Annex II for three years after the date the Protocol entered into force. *Id.* This procedure effectively resulted in the Protocol absorbing the parent Convention. *Id.* States ratifying the Protocol give effect to the Provisions of the 1973 Convention as well, obviating the need to ratify the 1973 Convention. *Id.* Consequently, the two instruments are read as one and often referred to as MARPOL 73/78. *Id.*

224. *Id.*

225. See UNITED STATES TREATIES IN FORCE, *supra* note 119, at 323 (noting that fifteen states constituting not less than 50 percent of the world's gross merchant shipping tonnage were required to ratify the Convention before it could enter into force).

226. See Coast Guard Commandant Instruction, *supra* note 20, at enclosure 4 (listing the states party to MARPOL as of February 8, 1989). The parties to MARPOL are: Algeria, Antigua and Barbuda, Australia, Austria, Bahamas, Belgium, Brazil, Brunei Darussalam, Bulgaria, Burma, China, Colombia, Cote d'Ivoire, Czechoslovakia, Democratic People's Republic of Korea, Denmark, Egypt, Finland, France, Gabon, German Democratic Republic, Federal Republic of Germany, Greece, Hungary, Iceland, India, Indonesia, Israel, Italy, Japan, Lebanon, Liberia, Marshall Islands, Netherlands, Norway, Oman, Panama, Peru, Poland, Portugal, Republic of Korea, St. Vincent and Grenadines, South Africa, Spain, Surinam, Sweden, Switzerland, Syrian Arab Republic, Tunisia, Tuvalu, Union of Soviet Socialist Republics, United Kingdom, United States, Uruguay, and Yugoslavia. *Id.*

227. MARPOL Convention, *supra* note 19.

ganization (IMCO).²²⁸ Following sixteen oil tanker accidents in and around United States waters during the winter of 1976-77, the United States requested the Conference.²²⁹ The IMCO is a specialized agency of the United Nations concerned solely with maritime affairs.²³⁰ The following section briefly discusses the role of the IMCO (now referred to as the International Maritime Organization or IMO)²³¹ in establishing international safety and environmental standards for ships.

1. *The Role of the International Maritime Organization*

Under the auspices of the IMO, member states have approved twenty-one international conventions,²³² adopted more than five-hundred resolutions and set forth numerous codes and guidelines pertaining to marine shipping, safety and the environment.²³³ The IMO has implemented rules and adopted protocols regulating ship construction and

228. *Report on the Act to Prevent Pollution from Ships*, *supra* note 163, at 4,851. The United States signed MARPOL 73/78 subject to Senate ratification on June 27, 1978. *Id.* The Senate gave its advice and consent on July 2, 1980. *Id.*

229. *Id.* The accidents served as a catalyst for President Carter's March 17, 1977 message to Congress proposing a series of domestic and international measures aimed at reducing pollution from oil tankers. *Id.* The Conference also established the Protocol of 1978 Relating to the International Convention for the Safety of Life at Sea, 1974, creating stricter safety requirements for vessels. *Id.* at 4851.

230. INT'L MAR. ORG., *supra* note 19, at 2 (1984). The Convention on the Inter-Governmental Maritime Consultative Organization (IMCO) established the IMCO in 1958. Convention on the Inter-Governmental Maritime Consultative Organization, Mar. 6, 1948, 9 U.S.T. 621, T.I.A.S. No. 4044, 289 U.N.T.S. 48 [hereinafter IMCO Convention]. The IMCO Convention required the acceptance of twenty-one states, including seven with at least one million gross tons of shipping each. INT'L MAR. ORG., *supra* note 19, at 2. The Convention's requirements were fulfilled in 1958 and the first IMCO Assembly met in London in January, 1959. *Id.* The Convention established the IMCO for the purpose of coordinating and promoting cooperation among governments on matters affecting international shipping and the marine environment. *Id.* at 3; *see* IMCO Convention, *supra*, art. X(a)i-iii (stating as objectives marine safety, efficiency of navigation and prevention and control of pollution). The IMO has six bodies that oversee the adoption or implementation of conventions; they are the main organs of the Assembly and Council and the Maritime Safety Committee, Marine Environment Protection Committee, Legal Committee and the Facilitation Committee. INT'L MAR. ORG., *A Summary of IMO Conventions*, in FOCUS ON IMO 4, 5 (1987) [hereinafter *Summary of IMO Conventions*]. The committees meet more often than the main bodies and are the forum for initial proposals which, if approved, go to the Council and, as necessary, to the Assembly. *Id.*; *see also* D. CUSINE & J. GRANT, *THE IMPACT OF MARINE POLLUTION* 75 (1980) (providing a detailed discussion of the institutional structure of the IMCO and the organization's role in controlling marine pollution).

231. *See* UNITED STATES TREATIES IN FORCE, *supra* note 119, at 266. In 1982, an amendment to the IMCO Convention changed its name to the International Maritime Organization (IMO). *Id.*

232. *Summary of IMO Conventions*, *supra* note 230, at 4.

233. INT'L MAR. ORG., *supra* note 20, at xix.

design,²³⁴ ship tonnage measure requirements,²³⁵ cargos,²³⁶ containers,²³⁷ navigation and collision rules,²³⁸ standards of training and certification for seafarers,²³⁹ and maritime transport and trade.²⁴⁰

The IMO is also responsible for instruments protecting the marine environment.²⁴¹ Following the 1967 *Torrey Canyon* oil tanker disaster off the coast of England,²⁴² the IMO served as a prominent forum for the establishment of international conventions and protocols addressing marine pollution.²⁴³ Subsequent multilateral treaties adopted under the IMO include instruments pertaining to the intervention at sea to respond to pollution threats,²⁴⁴ liability for oil pollution from ships,²⁴⁵ and

234. See The International Convention for the Safety of Life at Sea (1974), 32 U.S.T. 47, T.I.A.S. No. 9700, reprinted in 14 I.L.M. 963 (1975) [hereinafter SOLAS Convention] (regarding minimum standards for the construction, equipment, and operation of ships); The International Convention on Load Lines, Apr. 5, 1966, 18 U.S.T. 1857, T.I.A.S. No. 6331, 640 U.N.T.S. 133 (preamble) (regarding "uniform principles and rules with respect to the limits to which ships on international voyages may be loaded").

235. See *Summary of IMO Conventions*, supra note 230, at 54-55 (discussing the provisions and adoption of the International Convention on Tonnage Measurements of Ships, 1969, which entered into force July 18, 1982). The Convention implemented a universal tonnage measurement system. *Id.*

236. See *Summary of IMO Conventions*, supra note 230, at 16 (discussing IMO's development of the International Maritime Dangerous Goods Code (IMDG) that regulates the classification, labeling, handling, and packaging of dangerous goods).

237. See The International Convention for Safe Containers, done at London, Oct. 20, 1972, 29 U.S.T. 3709, T.I.A.S. No. 9037, 1060 U.N.T.S. 3 (entered into force Dec. 2, 1977) (regulating the construction and inspection of freight containers to ensure the safety of dock and ship workers).

238. International Regulations for Preventing Collisions at Sea, June 17, 1960, 16 U.S.T. 294, T.I.A.S. No. 5813 (1972) (effective July 15, 1977).

239. See *Summary of IMO Conventions*, supra note 230, at 27 (discussing adoption of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978). This Convention established basic training and certification requirements on an international level for seafarers. *Id.*

240. See Convention on Facilitation of International Maritime Traffic, Apr. 9, 1965, 18 U.S.T. 411, T.I.A.S. No. 6251, 59 U.N.T.S. 265 (as amended in 1973) (establishing standardized procedures to facilitate maritime traffic). The changes included simplifying formalities, mandating documentary and procedural requirements on arrival, and staying departure of ships engaged in international travel. *Id.*

241. See INT'L MAR. ORG., supra note 19, at 277 (discussing various IMO protocols addressing marine pollution); *Summary of IMO Conventions*, supra note 230, at 30-42 (summarizing IMO Conventions pertaining to marine pollution).

242. See McDorman & Gold, *Intervention at Sea*, in INT'L MAR. ORG., supra note 19, at 280-82 (recounting the grounding of the *Torrey Canyon*). After grounding in English territorial waters, the *Torrey Canyon* spilled over 50,000 tons of oil. *Id.* The wreck caused significant economic damage to the coastal interests of England and France. *Id.* England eventually bombed the ship to abate the pollution threat. *Id.*

243. See Abecassis, supra note 221, at 301 (stating that the *Torrey Canyon* incident highlighted the absence of an International Convention dealing with liability for oil pollution from ships and that the IMO provided nations with an appropriate forum to address the issue).

244. See The International Convention Relating to Intervention on the High Seas

an international oil pollution compensation fund.²⁴⁶

2. MARPOL 73/78

MARPOL seeks to eliminate intentional polluting of the marine environment with oil and other harmful substances and to minimize the accidental discharge of such substances.²⁴⁷ MARPOL built upon the framework established in the International Convention for the Prevention of Pollution of the Seas by Oil, 1954 (OILPOL).²⁴⁸ OILPOL established "prohibited zones" and limited the discharge of oil mixtures to at least 50 miles from the nearest land.²⁴⁹ MARPOL, however, deals not only with the discharge of oil and oil mixtures, but also with a broad range of ship-generated marine pollution.²⁵⁰

in Cases of Oil Pollution Casualties, *done at* Brussels, Nov. 29, 1969, 26 U.S.T. 765, T.I.A.S. No. 8068, *reprinted in* 9 I.L.M. 25 (1970) (entered into force May 6, 1975). This Convention empowers coastal states to take measures on the high seas necessary to prevent, mitigate, or eliminate danger to coastal interests posed by oil pollution. *Summary of IMO Conventions*, *supra* note 230, at 41.

245. International Convention on the Civil Liability for Oil Pollution Damage, 1969, *done at* Brussels, Nov. 29, 1969, 970 U.N.T.S. 3, *reprinted in* 9 I.L.M. 45 (1970) (entered into force, June 19, 1975). This Convention imposes strict liability on registered ship owners for oil pollution damage and requires ships to be insured against such liability. *Summary of IMO Conventions*, *supra* note 230, at 43.

246. International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage, 1971, *reprinted in* 11 I.L.M. 284 (1972) (entered into force Oct. 16, 1978).

247. MARPOL Convention, *supra* note 19, at 1 (preamble).

248. *Report on the Act to Prevent Pollution from Ships*, *supra* note 163, at 4,849-50; International Convention for the Prevention of Pollution of the Sea by Oil, 1954 (with Annexes) *done at* London, Apr. 11, 1962, 12 U.S.T. 2989, T.I.A.S. No. 4900, 327 U.N.T.S. 3 [hereinafter OILPOL].

249. *Id.* In March, 1962, a conference convened by the IMCO reviewed and amended the 1954 OILPOL Convention to prohibit discharges of oil and/or oily substances from vessels into restricted areas or within 50 miles of land. *Id.* The amendments also required oil record books for cleaning and discharges of oil. *Id.* On September 1, 1966, Congressional approval of amendments to the Oil Pollution Act of 1961 brought the amendments into force in the United States on May 18, 1967. *Id.* Subsequent amendments in the form of an IMCO Resolution dated October 21, 1969, accepted internationally on October 14, 1971, abandoned the prohibited zone limitations, and generally prohibited any discharges within 50 miles of land. *Id.* Under these amendments, tankers may discharge operational wastes while en route only if the rate of discharge does not exceed 60 liters per mile and the total oil discharged on a ballast voyage does not exceed one part per 15,000 of total cargo capacity. *Id.* MARPOL incorporated these discharge rates with slightly more stringent standards for new vessels. MARPOL Convention, *supra* note 19, reg. 9(1)(a). *See infra* note 268 (comparing MARPOL and OILPOL).

250. MARPOL Convention, *supra* note 19, art. 2, para. 2. MARPOL defines harmful substance as "[a]ny substance which, if introduced into the sea is liable to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea." *Id.* The Convention provides three exceptions to the regulation of discharges. *Id.* at para. 3. The term "dis-

MARPOL contains five annexes, the first two of which are binding on states party to the agreement. Annex I concerns oil pollution prevention, regulating primarily oil tankers of 150 gross tons and above and/or ships of 400 gross tons or more.²⁵¹ Annex I also sets standards for ship construction, oil, and oil mix discharge limits, and completely prohibits the discharges of oil substances in "special areas."²⁵² Annex II sets detailed discharge requirements for all ships carrying chemicals in bulk.²⁵³ Like Annex I, Annex II designates special areas with more stringent requirements and requires maintenance of cargo record books tracking shipments on a tank-to-tank basis.²⁵⁴ In addition, both Annex I and II require contracting states to maintain adequate reception facilities at ports that receive the regulated substances.²⁵⁵

Annexes III, IV, and V are "optional annexes" that a contracting state to the agreement may decline to accept.²⁵⁶ Annex III regulates the shipping of harmful substances in packaged forms; freight containers, portable tanks, and road and rail tank wagons.²⁵⁷ This Annex establishes packaging and label requirements, stowage regulations, and quantity limitations designed to minimize potential threats to the marine environment.²⁵⁸ Annex IV establishes discharge limitations that regulate at sea discharges of sewage pollution from ships.²⁵⁹ Annex V regulates the disposal of garbage from ships. It is the only Annex that has entered into force.²⁶⁰ It is within this context that Annex V of

charge" does not include: (1) the dumping of land-generated wastes regulated under the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Dumping Convention); (2) the release of harmful substances arising from the exploration and exploitation of sea-bed mineral resources; or (3) the release of harmful substances pursuant to legitimate scientific research into pollution abatement or control. *Id.*

251. MARPOL Convention, *supra* note 19, Annex I, reg. 4, para. 1, reg. 5, para. 1.

252. *Id.* reg. 10, para. 1. The special areas under Annex I are the Mediterranean Sea, the Baltic Sea, the Black Sea, the Red Sea, and other specific Gulf areas. *Id.*

253. *Id.* Annex II, reg. 2, para. 1.

254. *Id.* reg. 9.

255. *Id.* Annex I, reg. 12, para. 1; Annex II, reg. 7, para. 1.

256. *Id.* art. 14, para. 1.

257. *Id.* Annex III, reg. 1, para. 1. As of February 1989, 48.23% of the world's gross shipping tonnage have ratified Annex III. Coast Guard Commandant Instruction, *supra* note 20, enclosure 4.

258. *Id.* regs. 1-8.

259. *Id.* Annex IV, reg. 10, para. 1. Annex IV establishes standards for sewage treatment, limits the discharge of treated sewage to beyond 12 nautical miles, and requires those states party to the Convention to provide adequate sewage reception facilities at all ports. *Id.* regs. 8-10. As of February, 1989, 40.61% of the world's gross shipping tonnage have ratified Annex IV. Coast Guard Commandant Instruction, *supra* note 20, enclosure 4.

260. See *infra* notes 261-64 and accompanying text (discussing United States ratification of MARPOL).

MARPOL is addressed in the following section.

III. IMPLEMENTATION OF OPTIONAL ANNEX V OF MARPOL

Optional Annex V entered into force world-wide on December 31, 1988, following United States Senate ratification a year earlier.²⁶¹ The Annex, drafted in 1973, prohibits ships from disposing of any plastics at sea and severely restricts the discharge of certain other ship-generated wastes.²⁶² United States implementing legislation and regulations apply to all domestic ports, foreign ships within the 200 mile Exclusive Economic Zone,²⁶³ and to vessels of United States registry anywhere in the world.²⁶⁴

A. ANNEX V OF MARPOL

Annex V expressly prohibits all ships from discharging any plastics into marine waters, including such debris as synthetic ropes, synthetic fishing nets, and plastic garbage.²⁶⁵ Unlike Annexes I and II that apply

261. See *supra* note 19 (discussing the entry into force of Annex V); see also S. EXEC. REP. NO. 100-8, *supra* note 115, at 22 (testimony of Rear Adm. J. William Kime, United States Coast Guard) (stating that the recent Soviet Union ratification brought the shipping tonnage party to Annex V to roughly 48%, thus leaving the door open for the United States with 4.91% of the world's tonnage to bring Annex V into force).

262. See MARPOL Protocol, *supra* note 19, Annex V (indicating no change from the 1973 Convention).

263. MPPRCA § 2102, 33 U.S.C. § 1902(a)(3) (Supp. V 1987). Congress expressly intends jurisdiction under the MPPRCA to extend to the 200-mile EEZ. *Id.*

264. MPPRCA § 2102, 33 U.S.C. § 1902(a)(1) (Supp. V 1987). The MPPRCA amends the Act to Prevent Pollution from Ships, 33 U.S.C. 1901-11 (Supp. V 1987). Under the MPPRCA, Annex V requirements apply to the navigable waters of the United States, as well as to all other waters and vessels within the United States jurisdiction. *Id.* at § 2101, 33 U.S.C. § 1901(5)(b) (1982 and Supp. V 1987). The MPPRCA governs ships of United States registry anywhere in the world and foreign vessels in the navigable waters or the EEZ of the United States. MPPRCA § 2102, 33 U.S.C. § 1902(a)(3) (Supp. V 1987). The MPPRCA also extends Annex V requirements to any port or terminal in the United States. MPPRCA § 2102, 33 U.S.C. § 1902(a)(4) (Supp. V 1987).

265. MARPOL Convention, *supra* note 19, Annex V, reg. 3(1)(a). Although Annex V does not define the term "plastic," the IMO draft guidelines for the implementation of Annex V provide the following definition:

Plastic is any high polymer nonmetallic compound, synthetically produced (usually from organic compounds), and combined with other ingredients, such as curatives, fillers, reinforcing agents, colorants, plasticizer, etc.; the mixture can be formed by heat, pressure or injection molding (ejection of a measured amount of material into a mold in liquid form). Plastics have material properties ranging from hard and brittle to soft and elastic. Plastics are used for a variety of marine purposes including, but not limited to, packaging (vapor-proof barriers, structures, siding, piping, insulation, flooring, carpets, fabrics, paints and finishes, ad-

to certain types of vessels, regulations under Annex V apply to all ships from the largest supertanker to the smallest recreational craft.²⁶⁶ Floating platforms and oil rigs are also regulated.²⁶⁷ Similar to the prohibitions on oil discharges in OILPOL of 1954 and Annexes I and II of MARPOL, Annex V establishes strict requirements for the disposal of other ship-generated wastes within certain distances from land.²⁶⁸ Disposal for dunnage and packing materials that float is banned within twenty-five nautical miles of the nearest land.²⁶⁹ Similarly, ships are not permitted to deposit food wastes or any other garbage, including paper products, rags, metal, glass, bottles, or crockery into marine waters within twelve nautical miles of land.²⁷⁰ Annex V permits disposal of this latter category of food and other wastes into waters beyond three nautical miles when commuted or ground to allow passage through a screen with openings not greater than twenty-five millime-

hesives, electrical and electronic components), disposable eating utensils and cups, bags, sheeting, floats, fishing gear, strapping bands, rope and line.

INTERNATIONAL MARITIME ORGANIZATION, *Draft Guidelines for the Implementation of Annex V, Regulations for the Prevention of Pollution by Garbage from Ships* at Annex para. 1.5.4. (Working Paper 10 of the 25th Session of Marine Environment Protection Committee (MEPC)) reprinted in UNITED STATES COAST GUARD, ANNEX V OF MARPOL 73/78, A Compendium of Implementing Materials in the United States A-5 (Jan. 11, 1989) (compiled by ps1 L. Berney) [hereinafter MEPC/25 *Draft Guidelines*]. The United States Coast Guard has included biodegradable and photodegradable plastics within the definition of plastics. Interim Regulations Implementing Annex V of MARPOL 73/78, 54 Fed Reg. 18,403-04 (1989).

266. MARPOL Convention, *supra* note 19, Annex V, reg. 2.

267. *Id.* reg. 4. Fixed or floating oil drilling rigs and support vessels within 500 meters of such facilities are not allowed to dispose of any materials. Annex V does, however, provide exception for rigs more than 12 nautical miles from shore which can dispose of commuted food wastes capable of passing through a screen with openings of 25 millimeters. *Id.*

268. Compare MARPOL Convention, *supra* note 19, Annex V, reg. 3(1)(b) (prohibiting discharges of lining and packing materials that float within 25 nautical miles, and food wastes within 12 nautical miles) with OILPOL, *supra* note 248 (prohibiting oil discharges in particular zones and generally within fifty miles of land). For parties to MARPOL, MARPOL 73/78 supercedes OILPOL and its subsequent amendments. OFFICE OF THE SPECIAL REPRESENTATIVE OF THE SECRETARY-GENERAL FOR THE LAW OF THE SEA, THE LAW OF THE SEA 33 (1985). In addition to banning all plastics disposal and providing limits on waste disposal near land, Annex V requires that all garbage be disposed of as far as possible from the nearest land. MARPOL Convention, *supra* note 19, Annex V, reg. 3. See *supra* note 249 (discussing oil discharge limitations in OILPOL).

269. MARPOL Convention, *supra* note 19, Annex V, reg. 1(2). The term from the nearest land is measured from the baseline of the territorial sea of the state in question and is established in accordance with customary international law. *Id.* The territorial sea under the LOS Convention is measured seaward from the coast or baseline delimiting internal waters; see Oxman, *supra* note 130, at 150 (discussing the LOS Convention legal map of the sea).

270. MARPOL Convention, *supra* note 19, Annex V, reg. 2(1)(b)(ii).

ters.²⁷¹ Mixed garbage warrants the more stringent criteria.²⁷²

Annex V provides three general exceptions to the garbage disposal requirements.²⁷³ First, the requirements do not apply in instances where disposal of garbage from a ship is necessary to secure the safety of a ship and its passengers or to save a life at sea.²⁷⁴ Second, the discharge of garbage resulting from damage to a ship or its equipment is exempted, provided that all reasonable precautions were taken prior to and after the occurrence to minimize the release.²⁷⁵ Third, the regulations do not apply to the accidental loss of synthetic fishing nets or synthetic material incidental to the repair of such nets, provided that all reasonable precautions were taken to prevent such loss.²⁷⁶

MARPOL confers port state²⁷⁷ and flag state²⁷⁸ jurisdiction. Port state jurisdiction authorizes a state to initiate proceedings under its own laws against ships voluntarily in the state's ports for violations of MARPOL occurring in the state's jurisdiction.²⁷⁹ The port state may inspect foreign vessels in its ports to determine whether a violation of MARPOL has occurred.²⁸⁰ Flag state jurisdiction authorizes a state to refer violations of MARPOL by foreign vessels in a state's jurisdiction to the state in which the violating ship is registered for appropriate enforcement action.²⁸¹ Annex V's comprehensive regime applies to all

271. *Id.* reg. 3(1)(c).

272. *Id.* reg. 2(2).

273. *Id.* reg. 6(a)(c).

274. *Id.* reg. 6(a).

275. *Id.* reg. 6(b). MARPOL does not elaborate on what actions are "reasonable" although the MEPC/25 *Draft Guidelines* outlines procedures for reducing the amount of potential garbage and handling and storage of garbage against which the handling of wastes might be measured. MEPC/25 *Draft Guidelines*, *supra* note 265, para. 3.4.

276. MARPOL Convention, *supra* note 19, Annex V, reg. 6(c); *see infra* notes 351-54 and accompanying text (discussing proposed United States amendments to Annex V narrowing the exemption for discharges of plastics arising from the repair of fishing nets).

277. *See* MARPOL Convention, *supra* note 19, art. 4(2)(a) (stating that upon a ship's violation of the Convention within the jurisdiction of a party, that party may initiate proceedings under its own law).

278. *See id.* arts. 4(2)(b) (stating that upon a ship's violation of the Convention within the jurisdiction of a party, that party may furnish information and evidence of the violation to the administration of the ship); art. 4(1) (stating that upon finding sufficient evidence of a violation, the administration shall initiate proceedings against the ship in accordance with its domestic law as soon as possible).

279. *See supra* note 277 (citing MARPOL port state provisions).

280. MARPOL Convention, *supra* note 19, art. 6(2).

281. *See supra* note 278 (citing flag state jurisdictional provisions in MARPOL). Flag state jurisdiction is criticized because the state in which the ship is registered often determines that no violation occurred. *Hearings on H.R. 940*, *supra* note 49, at 451 (testimony of Sally Ann Lentz, member of the Entanglement Network Coalition) (noting that the United States often reports violations occurring in the territorial sea, contiguous zone, and EEZ to the flag state for enforcement and that flag state gener-

ships under the flag of states that are party to the agreement, as well as to nonparty state vessels in the jurisdictional waters of coastal states party to the Annex.²⁸² Violations of Annex V within the jurisdiction of a state party to MARPOL require that the member state either initiate proceedings under its own law or furnish information and evidence to the government of the ship's registry for enforcement.²⁸³

Like Annex I and II, Annex V designates "special areas" in which discharges of any wastes are banned due to particular oceanographical, ecological, and vessel traffic characteristics.²⁸⁴ Presently, the Mediterranean Sea, Baltic Sea, Black Sea, Red Sea, and "Gulfs area" are designated as special areas.²⁸⁵ The United States is currently pursuing an amendment to Annex V that would give special area status to the Gulf of Mexico.²⁸⁶ A number of European countries and the European Com-

ally reports back that no violation occurred). *Id.* For example, a French study found over 120 cases of reported ship violations made to flag states in which no action is known to have been taken by the flag state. *Controlling Vessels in Foreign Ports*, 19 MAR. POLLUT. BULL. 556-57 (1988). Even states with a strong tradition of reporting violations to flag states and with regulations governing infringements in territorial waters are slow to punish reported violations in foreign waters or on the high seas. *Id.*

282. See MARPOL Convention, *supra* note 19, Annex V, reg. 2 (stating the provisions of Annex V shall apply to all ships). Parties to MARPOL must apply the requirements of the Convention to nonmembers to ensure that more favorable treatment is not given to such ships. *Id.* art. 5(4).

283. MARPOL Convention, *supra* note 19, art. 4(2).

284. Compare MARPOL Convention, *supra* note 19, Annex V, reg. 1(3) (defining special area as a region that, because of its recognized oceanographical and ecological conditions and its vessel traffic, requires the adoption of special mandatory methods for the prevention of sea pollution) with *id.* Annex I, reg. 1(10) (relating to oil pollution) and *id.* Annex II, reg. 1(7) (relating to noxious liquid substances). All three annexes provide virtually identical language defining special areas and simply substitute the terms garbage, oil, and noxious substances. *Id.* Annex I, reg. 10 and Annex V, reg. 1(3). Annex I and V each designate as special areas the Mediterranean Sea, Baltic Sea, Black Sea, Red Sea, and the Gulfs area. *Id.* Annex I, reg. 10 and Annex V, reg. 5. Annex II only designates the Baltic Sea and the Black Sea as special areas. MARPOL Convention, *supra* note 19, Annex II, reg. 1(7).

285. MARPOL Convention, *supra* note 19, Annex V, reg. 5. Disposal of all plastics and other garbage is prohibited in special areas and food wastes may be disposed in special areas as far as practicable from land, but not into waters less than 12 nautical miles from land. *Id.* reg. 2(b).

286. See 133 CONG. REC. S15,846 (daily ed. Nov. 5, 1987) (statement of Senator Bentsen) (introducing an amendment to the Senate Resolution that urges the United States government to make reasonable efforts to obtain a special area designation for the Gulf of Mexico). The United States delegation to the IMO previously announced its intention to seek approval for the designation. *Id.* The U.S. Coast Guard has prepared an economic impact analysis designating the Gulf of Mexico as a special area under Annex V. EASTERN RESEARCH GROUP, ECONOMIC ANALYSIS OF DESIGNATING THE GULF OF MEXICO AS A "SPECIAL AREA" UNDER ANNEX V OF THE MARPOL PROTOCOL B-56 (1988) (submitted to the U.S. Dept. of Transportation). The analysis projects that compliance costs for United States vessels and offshore oil operations will be \$2,175,890 over the projected \$5,652,710 in compliance costs associated with current Annex V regulations. *Id.*

munity have also requested special area designation for the heavily travelled North Sea.²⁸⁷

Annex V requires the government of each signing party to ensure the provision of adequate waste reception facilities at its ports and terminals for receiving garbage from vessels without undue delay.²⁸⁸ Governments are directed to notify the IMO of all cases where facilities pertaining to Annex V are allegedly inadequate.²⁸⁹ Annex V, however, does not set a deadline for nations to establish adequate waste reception facilities.²⁹⁰

B. UNITED STATES IMPLEMENTING LEGISLATION AND INTERIM REGULATIONS

The Marine Plastic Pollution Research and Control Act of 1987 (MPPRCA)²⁹¹ implements Annex V requirements in the United States and delegates rulemaking authority to the United States Coast Guard.²⁹² The MPPRCA amends the Act to Prevent Pollution from Ships that contains United States implementing legislation for Annexes I and II.²⁹³ Both Annex V and United States implementing legislation became effective December 31, 1988.²⁹⁴ The Coast Guard promulgated interim regulations implementing much of the MPPRCA on April 28, 1989.²⁹⁵

287. See *North Sea Declared 'Special Area'*, 19 MAR. POLLUT. BULL. 551 (1988) (stating that the United Kingdom, France, Denmark, Federal Republic of Germany, Netherlands, Norway, Sweden, and the European Community submitted a proposal to the MEPC during its 26th session in September 1988 for the purpose of declaring the North Sea a special area under Annex V of MARPOL).

288. MARPOL Convention, *supra* note 19, Annex V, reg. 7(1).

289. *Id.* reg. 7(2).

290. *Id.* at para. 2. Annex V requires simply that "[t]he Government of each party to the Convention undertakes to ensure the provisions of facilities at port and terminals for the reception of garbage, without causing undue delay to ships, and according to the needs of ships using them." *Id.* The IMO is currently working on guidelines to assist ports and terminals in determining the waste disposal needs of ships. MEPC/25 *Draft Guidelines*, *supra* note 265.

291. MPPRCA, 33 U.S.C. §§ 1901-1912 (Supp. V 1987).

292. See 33 U.S.C. § 1901(7) (1982 & Supp. V 1987) (defining "Secretary" as the Secretary of the department in which the Coast Guard is operating); see, e.g., MPPRCA § 2102, 33 U.S.C. § 1902(c) (Supp. V 1987) (requiring the Secretary to prescribe regulations applicable to ships not party to MARPOL that are no more favorable than those accorded to ships of states parties to MARPOL).

293. MPPRCA § 2101, 33 U.S.C. § 1901-1912 (Supp. V 1987).

294. See MPPRCA § 2002, 33 U.S.C. § 1901 (Supp. V 1987) (note discussing effective date of amendments to the APPS) (stating that Title II of Pub. L. No. 100-220 shall be effective on the date in which Annex V to MARPOL enters into force in the United States); see also MARPOL Convention, *supra* note 19 and accompanying text (discussing the effective date of MARPOL Annex V).

295. Regulations Implementing the Pollution Prevention Requirements of Annex V

The MPPRCA applies Annex V regulations to all foreign and domestic ships, ports, and terminals in the navigable waters or the EEZ of the United States.²⁹⁶ It further applies Annex V waste disposal limitations to ships either of United States registry or nationality or any ship operated under the authority of the United States anywhere in the world.²⁹⁷ Notwithstanding the exemptions in MARPOL for warships, navy vessels, and other vessels in government service,²⁹⁸ the MPPRCA requires United States government vessels to comply with Annex V regulations no later than December 31, 1993.²⁹⁹

The MPPRCA empowers the Coast Guard to inspect any vessel in United States territorial waters to verify whether the ship disposed of garbage in violation of Annex V or the MPPRCA.³⁰⁰ Both vessels of United States registry or nationality and vessels operating under the authority of the United States may be inspected at any time to verify a violation of the MPPRCA.³⁰¹ Unlike the Refuse Act of 1899, the MPPRCA permits the Coast Guard to issue civil penalties of up to \$25,000 for each violation of the MPPRCA and \$5,000 for each misstatement or misrepresentation.³⁰² In addition, criminal sanctions with fines up to \$50,000 and/or imprisonment of up to five years may be imposed upon persons who knowingly violate MARPOL, the MP-

of MARPOL 73/78, Interim Rule with Request for Comments, 54 Fed. Reg. 18,384 (1989) (to be codified at 33 C.F.R. §§ 151, 155, 158; 46 C.F.R. § 25). The Coast Guard is to issue final regulations in early 1990. *Id.* at 18,385.

296. See *supra* notes 263-64 and accompanying text (discussing jurisdiction under the MPPRCA). The ban on plastics disposal also extends to inland lakes and rivers. MPPRCA § 2101, 33 U.S.C. § 1901(5)(b) (Supp. V 1987). MARPOL states that jurisdiction under the Convention is to be construed according to the general norms of international law at the time the Convention is applied or interpreted. MARPOL Convention, *supra* note 19, art. 9(3).

297. MPPRCA § 2102, 33 U.S.C. § 1902(a)(1) (Supp. V 1987). The MPPRCA applies to "[a] ship of United States registry or nationality, or one operated under the authority of the United States wherever located." *Id.*

298. MARPOL Convention, *supra* note 19, art. 3(3). MARPOL does not apply to "any warship, naval auxiliary or other ship owned or operated by a state and used, for the time being, only on government non-commercial service." *Id.* States party to the agreement are obligated within reasonable and practicable bounds to adopt measures for operating ships in a manner consistent with the Convention. *Id.*

299. MPPRCA § 2102, 33 U.S.C. § 1902(b)(2)(A) (Supp. V 1987). In response to the adoption of Annex V, the U.S. Navy initiated research on compliance measures and canceled an order for 11 million plastic shopping bags. *Marine Affairs: Plan Developed to Help U.S. Navy Stop At-Sea Disposal of Plastic Waste*, 19 *Env't. Rep.* (BNA) 337 (July 8, 1988).

300. MPPRCA § 2104, 33 U.S.C. § 1907(d)(1) (Supp. V 1987). The MPPRCA permits at sea inspections of foreign vessels when the vessels are in the navigable waters of the United States or within its EEZ. *Id.*

301. MPPRCA § 2104, 33 U.S.C. § 1907(b)(e)(1) (Supp. V 1987).

302. 33 U.S.C. § 1908(b) (1982); see *supra* notes 168-77 and accompanying text (discussing the limitations of the Refuse Act and its failure to provide civil penalties).

PRCA, or United States regulations promulgated thereunder.³⁰³

In accordance with MARPOL, the Coast Guard, in coordination with the Secretary of State, may choose to refer alleged violations of ships under the registry of another state party to Annex V to that flag state for appropriate action.³⁰⁴ However, the APPS permits the Coast Guard to proceed under United States law against violators under flag states not party to MARPOL³⁰⁵ and in instances where referral procedures have proven ineffective.³⁰⁶

The MPPRCA requires the Coast Guard to inspect and issue certificates of adequacy to certain ports or terminals in order to ensure adequate waste reception facilities.³⁰⁷ It empowers the Coast Guard to deny ships entry to a port or terminal that does not provide adequate waste reception facilities in accordance with regulations issued under the Act.³⁰⁸ Civil and criminal penalties may also be levied against persons that fail to comply with appropriate port regulations or that make false representations to the government.³⁰⁹

The MPPRCA also directs the Coast Guard to promulgate regulations that require sea-going ships subject to Annexes I and II to maintain refuse record books, waste management plans, and notification

303. 33 U.S.C. § 1908(a) (1982 & Supp. V 1987). Courts are permitted to award an amount equal to no more than one-half the fine assessed to any person for providing information leading to a conviction under the APPS as amended. MPPRCA § 2105, 33 U.S.C. § 1908 (Supp. V 1987).

304. 33 U.S.C. § 1908(f) (1982). MARPOL permits party states, upon a determination that sufficient evidence of a violation exists, to either cause proceedings to be taken in accordance with its own law, or furnish to a violating ship's government with the information and evidence it possesses relating to the violation. MARPOL Convention, *supra* note 19, art 4(2).

305. *See* MPPRCA § 2102, 33 U.S.C. § 1902(a)(3) (Supp. V 1987) (applying Annex V requirements to any foreign ship in the United States navigable waters or EEZ).

306. 33 U.S.C. § 1908(f) (1982); *see* MARPOL Convention, *supra* note 19, art. 4(2) (permitting a state to either bring proceedings against a violator or refer the incident to the state of the ship's registry for action).

307. MPPRCA § 2103, 33 U.S.C. § 1905(c) (Supp. V 1987). Certificates of Adequacy for Reception Facilities for Garbage are required for ports or terminals that: (1) receive ocean-going tankers or vessels of 400 gross tons or more; (2) receive vessels carrying noxious liquid substances; and (3) fishing vessels that off-load more than 500,000 pounds of commercial fishery products in a calendar year. Interim Regulations Implementing Annex V, 54 Fed. Reg. 18,408 (1989) (to be codified at 33 C.F.R. § 158.135). All ports and terminals under the jurisdiction of the United States receiving foreign vessels other than from Canada must be capable of receiving APHIS-regulated garbage on 24 hours notice. *Id.* at 18,409 (to be codified at 33 C.F.R. § 158.410); *see supra* note 166 and accompanying text (discussing APHIS waste handling requirements).

308. 33 U.S.C. § 1905(d)(5)(2) (Supp. V 1987).

309. 33 U.S.C. § 1908(a)(b) (1982).

placards alerting passengers and crews of Annex V requirements.³¹⁰ In addition, Congress directed the Coast Guard to seek an international agreement that would employ similar requirements to similar vessels subject to Annex V of MARPOL.³¹¹ The Coast Guard announced its intention to propose international requirements for refuse record books for certain ships under MARPOL at the meeting of the IMO's Marine Environment Protection Committee (MEPC) in 1989.³¹²

IV. LIMITS OF ANNEX V IN REDUCING MARINE PLASTICS

The MPPRCA clearly implements the requirements of Annex V in United States jurisdictional waters.³¹³ Annex V, however, only concerns plastics pollution from ships and mineral resource platforms at sea and will not curtail the tremendous volume of plastic debris entering marine waters from land-based sources.³¹⁴ Moreover, difficult questions per-

310. MPPRCA § 2107, 33 U.S.C. § 1903(b)(2)(A)(i) (1982 and Supp. V 1987). The Coast Guard chose not to address these requirements in its interim regulations; see Interim Regulations Implementing Annex V to MARPOL 73/78, 54 Fed. Reg. 18,405 (1989) (reserving sections 151.55-59 pertaining to recordkeeping requirements, waste management plans, and placards). The Coast Guard has proposed regulations that would require manned United States ocean-going ships 79 feet or more in length engaged in commerce and manned, fixed, or floating platforms to maintain a refuse record book that documents the disposal of garbage. Prevention of Pollution from Ships, 54 Fed. Reg. 37,084 (1989) (to be codified at 33 C.F.R. § 151.55 (proposed Sept. 6, 1989)). Under the proposed rules, all ocean going ships 40 feet or more in length are required to maintain a waste management plan detailing waste handling practices. *Id.* (to be codified at 33 C.F.R. § 151.57). Information placards summarizing Annex V waste discharge requirements must be posted by persons in charge of ships 26 feet in length or more under the proposed rules. *Id.* (to be codified at 33 C.F.R. § 151.59).

311. MPPRCA § 2107, 33 U.S.C. § 1903(b)(2)(B) (Supp. V 1987). The MPPRCA also directs the Secretary of Commerce to report to Congress on the progress of securing international requirements for refuse books, waste management plans, and display placards on ships two years from the enactment of the statute. MPPRCA § 2107, 33 U.S.C. § 1903(b)(2)(c) (Supp. V 1987).

312. See UNITED STATES COAST GUARD, ANNEX V OF MARPOL 73/78, A COMPENDIUM OF IMPLEMENTING MATERIALS IN THE UNITED STATES B-67 (Jan. 11, 1989) (compiled by ps1 L. Berney) [hereinafter COMPENDIUM OF IMPLEMENTING MATERIALS] (stating that the Coast Guard does not favor establishing recordkeeping requirements for United States vessels without having exhausted the possibility of consistent and mandatory international requirements for ships subject to MARPOL). The Coast Guard announced its intention to propose international recordkeeping requirements at the 27th Session of the MEPC in March of 1989. *Id.*

313. See Manheim, *supra* note 23, at 98 (confirming that amendments to the Act to Prevent Pollution from Ships made by the Marine Plastic Pollution Research and Control Act extend Annex V provisions to ships of United States registry and/or nationality, foreign ships, and United States ports and terminals).

314. See MARPOL Convention, *supra* note 19, Annex V, regs. 2, 4 (stating that Annex V applies to all ships and also covers fixed or floating platforms); see also *supra* notes 45-48 and accompanying text (discussing the land-based sources of plastics

taining to Annex V remain. For example, issues concerning enforcement,³¹⁵ adequate reception facilities,³¹⁶ the continued loss of fishing gear,³¹⁷ and at sea incineration,³¹⁸ must still be resolved. Resolution of these difficulties will determine the long-term success of Annex V and United States implementing legislation in protecting marine resources from plastics pollution.

A. ENFORCEMENT AND JURISDICTION

MARPOL Annex V uniquely regulates all ships, irrespective of size.³¹⁹ Although Annex V is far more inclusive than Annexes I and II, MARPOL fails to impose recordkeeping requirements for the handling of garbage comparable to those for oil and hazardous chemicals.³²⁰ Accordingly, enforcement actions against ships suspected of discharging wastes in violation of Annex V will not include reviews of waste record books,³²¹ an approach included in Annexes I and II.³²² Failure to in-

pollution).

315. See Manheim, *supra* note 23, at 100-06 (discussing problems of enforcement and jurisdiction under Annex V).

316. *Id.* at 105.

317. See Fjellstad, *supra* note 98, at 689 (stating that current deficiencies in gear marking systems limit enforcement of Annex V against ships disposing of synthetic fishing gear).

318. See 53 Fed. Reg. 43,625 (1988) (discussing discharge limitations MARPOL 73/78) (proposed Oct. 27, 1988) (stating that the United States Coast Guard is concerned that further study is needed on the issue of incinerator ash disposal). The Coast Guard has also requested that the guidelines concerning at sea incineration and ash disposal be addressed by the MEPC of the IMO. *Id.*

319. MARPOL Convention, *supra* note 19, Annex V, reg. 2; see Interim Regulations Implementing Annex V of MARPOL 73/78, 54 Fed. Reg. 18,384 (1989) (stating that the rules apply to marine craft of any size or type).

320. See MARPOL Convention, *supra* note 19, Annex I, reg. 20 (requiring oil tankers of 150 gross tonnage or more and ships of 400 gross tonnage or more to maintain oil record books tracking the loading, transfer, disposal, and unloading of oil); *Id.* Annex II, reg. 9 (requiring a cargo record book to be maintained for tracking chemical cargos on a tank-to-tank basis).

321. See MARPOL Convention, *supra* note 19, Annex V (prohibiting the discharge of plastics and regulating the discharge of other wastes, but not requiring the maintenance of records for waste handling). In determining whether a violation of Annex V has occurred, the United States Coast Guard will review such factors as: (1) records or receipts of garbage discharge at port; (2) ship log entries; (3) presence and operability of waste treatment equipment such as incinerators, grinders, and comminuters; (4) adherence to written waste management plans; (5) absence of plastics in ship stores; (6) educational programs and; (7) shipboard spaces for storing plastic waste. Interim Rules Implementing Annex V of MARPOL 73/78, 54 Fed. Reg. 18,406 (1989) (to be codified at 33 C.F.R. § 151.63). A prima facie case for establishing a violation of Annex V entails proof that: (1) there is an absence of plastics for disposal on board; (2) an inspection indicates that plastics are used on the vessel; (3) there is not an operating incinerator or other reasonable explanation of lawful disposal; and (4) there is no evidence of proper disposal since the ship's arrival in port. Coast Guard

clude record keeping requirements in Annex V greatly increases the difficulty of ensuring proper disposal of ship-generated wastes because it is difficult to police the world's oceans³²³ and often impossible to link wastes to a particular ship.³²⁴

Jurisdictional restrictions on actions a state may take against vessels outside its territorial waters also limit effective enforcement of Annex V.³²⁵ Article six of the MARPOL Convention authorizes port-state jurisdiction,³²⁶ declaring that a ship subject to the Convention in any port or terminal of a member state is subject to inspection by that state's authorities to determine whether the ship has disposed of any harmful substances in violation of MARPOL regulations.³²⁷ Similarly, states party to the Convention are allowed to inspect a ship within the state's jurisdiction at the request of another state party to MARPOL, provided that the state requesting the inspection provides sufficient evidence showing a discharge in violation of MARPOL.³²⁸

State enforcement options under MARPOL do not specifically include at sea inspection.³²⁹ MARPOL states that "jurisdiction" is to be construed under the general norms of international law in force at the time the Convention is applied or interpreted.³³⁰ Accordingly, "coastal

Commandant Instruction, *supra* note 20 at 2-2.

322. See *supra* note 320 (discussing oil and cargo record books under MARPOL Annexes I and II).

323. See Prevention of Pollution from Ships, 54 Fed. Reg. 37,084 (stating that the Coast Guard proposes Refuse Record Books for ocean-going ships 79 feet in length or more because these ships generate and discharge garbage "in areas where there is little outside incentive to comply with the regulations concerning the disposal of garbage"). The Coast Guard expects the Refuse Record Books to be a useful enforcement tool that will also provide data on waste handling). *Id.* The United States Congress recognized the use of log books tracking waste disposal as a useful enforcement tool that would help to increase the awareness of vessel operators under the requirements of Annex V. H.R. REP. 100-360, 100th Cong., 1st Sess. 14 (1987).

324. See *supra* note 219 and accompanying text (stating that it is virtually impossible to link debris with a particular violator).

325. *Nat'l Ocean Policy Study Hearings*, *supra* note 4, at 74 (statement of Sally Ann Lentz, Staff Attorney for the Oceanic Society) (discussing the limited rights of coastal states to respond to violations of international and domestic environmental laws within their respective EEZ).

326. MARPOL Convention, *supra* note 19, arts. 4-6. Additionally, article 14 places both flag ships of member states party to Annex V and nonparty vessels under the jurisdiction of the Convention for purposes of the Annex. *Id.*

327. MARPOL Convention, *supra* note 19, art. 6(2).

328. See *id.* art. 6(5) (noting that a request for inspection must be made by a party to the Annex and accompanied by "sufficient evidence"). Sufficient evidence is not defined in the Convention. *Id.*

329. See MARPOL Convention, *supra* note 19, arts. 3-6 (discussing flag-state jurisdiction and state jurisdiction over vessels in ports or terminals of a member state, but not addressing jurisdiction over ships at sea).

330. MARPOL Convention, *supra* note 19, art. 9(3).

state" jurisdiction, as embodied in the United Nations Law of the Sea Treaty,³³¹ is arguably applicable to at sea enforcement under Annex V.³³²

Coastal state jurisdiction under the LOS Convention, nevertheless, limits the rights of coastal states in responding to violations of domestic or international law occurring within a state's EEZ.³³³ If there are clear grounds for suspecting a vessel has violated domestic or international laws or rules while in a coastal state's navigable waters or within its EEZ, the coastal state's response is limited to demanding information from the vessel to determine if a violation has occurred.³³⁴ A coastal state under the LOS may physically inspect a ship within its territorial sea or EEZ waters only if the vessel refuses to supply requested information, provides information manifestly at variance with the evident factual situation, or if the violation has resulted in a "substantial discharge" that causes or threatens significant pollution.³³⁵ Beyond this inspection hurdle, coastal state jurisdiction permits a state to detain and prosecute a vessel only if the discharge causes or threatens major damage to a state's coastline or marine resources.³³⁶ Disposal of plastics and ship-generated wastes are unlikely to meet this high standard set out under the LOS Convention. Accordingly, a state detaining and prosecuting a vessel under Annex V in its own EEZ may be in violation of customary international law.³³⁷ Thus, the effective enforcement of Annex V against ships that continue at sea disposal of wastes on the high seas and within exclusive economic zones of other states is uncertain.³³⁸

331. LOS Convention, *supra* note 129, pt. XII, sec. 6, art. 220.

332. See Manhiem, *supra* note 23, at 103 (stating that, although coastal state jurisdiction is limited, "coastal state jurisdiction derived from the LOS treaty may be invoked under MARPOL Annex V"). The United States Congress has adopted port-state, flag-state and coastal-state jurisdiction under the MPPRCA. *Id.*

333. See *Nat'l Ocean Policy Study Hearings*, *supra* note 4, at 74 (statement of Sally Ann Lentz, Staff Attorney for the Oceanic Society) (discussing the limited rights of coastal states within their respective EEZ).

334. LOS Convention, *supra* note 129, pt. XII, sec. 6, art. 220, para. 3.

335. *Id.* art. 220, paras. 5-6.

336. *Id.* para. 6.

337. *But see* Coast Guard Commandant Instruction, *supra* note 20, at 2-1 (stating that the Coast Guard does not expect to conduct additional boardings exclusively for Annex V enforcement but instead will conduct inspections when Coast Guard boarding officers encounter vessels during other routine activities such as fisheries patrols, pollution investigations, marine casualty investigations, or other law enforcement activities).

338. See LOS Convention, *supra* note 129, pt. XII, sec. 6, art. 220, para. 3 (stating that for ships suspected of violating international standards for pollution prevention in a state's EEZ, states are limited to obtaining information for at sea enforcement). States party to MARPOL may not, however, readily detain and prosecute violators operating outside the member state's port or territorial waters. *Id.* at para. 6 (stating

B. THE QUESTION OF ADEQUATE FACILITIES

Annex V requires that states party to the agreement provide adequate facilities at ports and terminals for receiving garbage from ships without undue delay.³³⁹ As with those facilities required under Annexes I and II, the United States has chosen to allow ports and terminals to individually fulfill the facilities requirement.³⁴⁰ It is important to note that while Annex V is currently in force and governs a vast number of diverse ports, it does not mandate the provision of adequate facilities by a certain date.³⁴¹

At the present time, ports may not have adequate facilities due to the absence of regulations or the costs of improvements.³⁴² As nations incorporate the requirements of Annex V into domestic law, it is likely that ports will at best sporadically comply with the requirements.³⁴³ Many nations will undoubtedly provide ports with generous opportuni-

that under the LOS Convention, a state may institute proceedings and detain a vessel in the EEZ only if a discharge causes or threatens "major damage" to a state's coastline or related interests). Since a state could request information on registration, destination and the like, it is arguable that proceedings against the vessel could be undertaken the next time the vessel is in the state's ports. *Id.* at para. 1 (permitting a state to initiate proceedings against a vessel voluntarily in port for violations of pollution prevention standards in the EEZ). Similarly, once information on future ports of call is obtained a state party to MARPOL could forward "sufficient evidence" to a subsequent state party to MARPOL for enforcement. MARPOL Convention, *supra* note 19, art. 6(5). States, however, are reluctant to prosecute vessels for violations occurring in foreign or international waters. *Supra* note 281.

339. MARPOL Convention, *supra* note 19, Annex V, reg. 7(1). States are also required to notify the IMO of all cases where facilities are alleged to be inadequate for purposes of alerting other states party to the Annex. *Id.* reg. 7(2).

340. See Interim Regulations Implementing Annex V of MARPOL 73/78, 54 Fed. Reg. 18,409 (1989) (to be codified at 33 C.F.R. § 158.410) (stating that a person in charge of a port or terminal is responsible for ensuring adequate facilities, which may include the handling of APHIS regulated waste and medical waste).

341. See *supra* notes 288-90 and accompanying text (discussing state obligations for ensuring adequate waste reception facilities).

342. See *Report of the Working Group on Law and Policy* (draft Aug. 1989) from the Second International Conference on Marine Debris, held at Honolulu, Hawaii, Apr. 2-7, 1989 (copy on file at the offices of the American University Journal of International Law & Policy) (noting that many signatories are lagging in implementation efforts and that most ports do not yet have adequate waste facilities for receiving plastics and other garbage). Annual costs for waste facilities imposed on the 243 principle ports in the United States alone is estimated to be 375,000 dollars for the nation's largest 25 ports and 1.82 million dollars for the 243 remaining ports. REGULATORY EVALUATION OF ANNEX V, *supra* note 6, at 6-58.

343. See, e.g., Memorandum from J.D. Sipes, Chief, Office of Marine Safety, Security and Environmental Protection (Jan. 13, 1989), reprinted in COMPENDIUM OF IMPLEMENTING MATERIALS, *supra* note 312, at C-10, 11 [hereinafter Sipes Memorandum] (stating that there are no specific requirements in the MPPRCA which require adequate facilities at ports and that enforcement of Coast Guard regulations of ports and facilities for purposes of MARPOL will not commence until June 1989).

ties to upgrade facilities, while some ports may be closed to ships for failure to provide waste reception facilities.³⁴⁴ Ships that are turned away from a port or that visit a port without adequate facilities will be forced to journey elsewhere to properly dispose of their wastes, including plastics.³⁴⁵ These inadequacies provide an incentive for ships to illegally discharge wastes and also unduly burden those ships attempting to comply with Annex V. In addition, short term inadequacies make on-board incineration an attractive and predictable solution to the waste disposal requirements for many of the world's merchant ships.³⁴⁶ Shipboard incineration poses its own significant threats to the marine environment.³⁴⁷ The absence of enforceable international standards for waste reception facilities also increases the likelihood that facilities will not be properly maintained, thereby perpetuating these short-term problems associated with inadequate waste facilities.

C. THE CONTINUED PROBLEMS OF GHOST NETS

The threat to living marine resources from lost or discarded synthetic fishing nets and equipment will continue unless additional measures are taken to limit fishing equipment losses and lessen the impact of such abandoned equipment on the oceans.³⁴⁸ The United States submitted amendments to the IMO that seek to strengthen Annex V regulations over fishing gear, but greater changes are needed to effectively prevent the loss of synthetic gear.³⁴⁹ Annex V clearly prohibits intentional disposal, but it is practically silent on the standards imposed on commercial fisheries to avoid accidental loss.³⁵⁰

344. See, e.g., MPPRCA § 2103, 33 U.S.C. 1905(d) (Supp. V 1987) (discussing Coast Guard ability to deny entry of ships into ports with inadequate waste facilities).

345. See, e.g., Sipes Memorandum, *supra* note 343, at C-10 (indicating that individual ships must make arrangements for disposal of their garbage until port regulations are promulgated).

346. See *infra* notes 382-87 and accompanying text (noting that to avoid costly port delays ships may choose on-board incineration).

347. See *infra* notes 367-78 (discussing the hazards of plastic incineration).

348. See Fjeldstad, *supra* note 97, at 699 (stating that while a legal framework is in place, absent measures to reduce the amount of netting introduced into the marine environment and working incentives to cleanup existing debris, lost or discarded nets will continue to kill large numbers of marine animals annually). Nations of the South Pacific Forum are presently seeking a total ban on drift net fishing in South Pacific waters. *Move to Outlaw Drift-Netting*, 20 MAR. POLLUT. BULL. 422-23 (1989). The move toward a ban is primarily in response to incidental catch problems. *Id.*

349. See *Regulations for the Prevention of Pollution by Garbage from Ships (Annex V of MARPOL 73/78)*, *Message from the President of the United States*, Treaty Doc. 100-3, 100th Cong., 1st Sess. (1987) [hereinafter *Message from the President Transmitting Annex V*] (letter from Secretary of State George P. Schultz accompanying transmittal) (discussing some of the features and purposes of Annex V).

350. See MARPOL Convention, *supra* note 19, Annex V, reg. 6(c) (stating that

The United States raised concerns over the adequacy of Annex V regulations for accidental loss of fishing gear prior to adopting the Annex.³⁵¹ The United States indicated that the exemptions found in regulation six of Annex V, addressing the loss of synthetic materials incidental to the repair of synthetic nets, permitted disposal of materials and netting used to repair and maintain the nets.³⁵² The Marine Environment Protection Committee (MEPC), at its 23rd session, agreed to a requested amendment proposed by the United States that deletes the words "or synthetic material incidental to the repair of such nets"³⁵³ from the regulations of Annex V. The amendment will become effective unless, according to MARPOL procedures, one-third of the parties to Annex V or members representing fifty percent of the world's gross shipping tonnage formally object.³⁵⁴ The amendment narrows the exemptions for disposal related to repairs of synthetic gear, but does little to strengthen the enforceability of provisions banning the negligent loss or intentional disposal of fishing gear.

Losses of synthetic gear are exempted from Annex V provided that "reasonable precautions" are taken to prevent such loss.³⁵⁵ Unlike Annex I and II that provide detailed standards for the proper construction of oil and chemical cargo vessels, however, neither Annex V nor the Draft MEPC guidelines establish any standards relating to fishing gear construction, handling, or performance against which a loss may be measured.³⁵⁶ Consequently, enforcement of the regulation beyond witnessed disposal or linkage of a particular net to a vessel is unlikely.³⁵⁷ Congress, however, enacted the Driftnet Impact Monitoring, Assessment, and Control Act of 1987,³⁵⁸ concurrently with Annex V implementing legislation, which requires that the Coast Guard pursue international agreements that would monitor drift net losses and impacts.³⁵⁹

the Annex does not apply to the "accidental loss of synthetic material . . . provided all reasonable precautions have been taken to prevent such loss") (emphasis added).

351. *Message from the President Transmitting Annex V*, *supra* note 349, at IV.

352. *Id.*

353. *Id.*

354. MARPOL Convention, *supra* note 19, art. 16(2)(f)(iii).

355. *Id.* Annex V, reg. 7(b).

356. *See* MEPC/25 *Draft Guidelines*, *supra* note 265, at para. 3.5 (encouraging the development of identification systems and standards for equipment, but providing no standards against which the loss of nets may be measured).

357. *See* Gosliner, *supra* note 116, at 31, 32 (recommending gear marking and a bounty system for both identifying and recovering lost fishing gear).

358. The Driftnet Impact Monitoring, Assessment and Control Act of 1987, Pub. L. No. 100-220, tit. IV, 101 Stat. 1477 (1987).

359. *Id.* § 4007 (directing the Coast Guard to immediately initiate negotiations for international agreements monitoring drift net losses). The Coast Guard is also directed to evaluate methods of drift net marking, registry, tracking systems, and a bounty sys-

Absent further agreements that establish international standards for gear marking, care, and equipment requirements, Annex V will have a limited impact on driftnet losses.³⁶⁰

D. THE INCENTIVES AND HAZARDS OF AT SEA INCINERATION

The potential difficulties encountered at port facilities³⁶¹ and escalating costs associated with solid waste disposal on land³⁶² create incentives for ships to choose on-board incineration to satisfy their garbage disposal needs under Annex V.³⁶³ Both the MARPOL Convention and United States regulations clearly intend onboard incineration to be an option under Annex V.³⁶⁴ The practice of at sea incineration of ship wastes is largely unregulated under either international or United States domestic law.³⁶⁵ Moreover, ship-board incineration and ash dis-

tem for retrieval of nets. *Id.* § 4008.

360. Fjelstad, *supra* note 98, at 699.

361. *See infra* note 383 and accompanying text (noting that the cost of labor for handling ship wastes is often uncertain).

362. *See infra* note 382 and accompanying text (discussing the growing limitations and costs associated with landfills).

363. *See* Notice of Proposed Rulemaking Regarding Automatic Auxiliary Boilers, 54 Fed. Reg. 47,229 (proposed Nov. 13, 1989) (stating that "the Coast Guard is expecting a large influx of incinerator approval requests" resulting from the adoption of MARPOL Annex V).

364. *See* MEPC/25 *Draft Guidelines*, *supra* note 265, pt. 1.5.15 (defining incinerator ash as all other garbage under Annex V); Interim Regulations Implementing Annex V of MARPOL 73/78, 54 Fed. Reg. 18,406 (1989) (to be codified at 33 C.F.R. §151.67) (stating that "all garbage containing plastics . . . must be discharged ashore or incinerated").

365. *See Hearings on H.R. 940*, *supra* note 49, at 457 (testimony of Sally Anne Lentz, Staff Attorney for the Oceanic Society) (stating that emissions from ocean-based solid waste incinerators are presently unregulated); *see also* MEPC/25 *Draft Guidelines*, *supra* note 265, pt. 5.4 (noting that marine incinerator technology is at a "primitive level" primarily because the constraints on hazardous air emissions and requirements for hazardous wastes have not been applied to marine incineration). Some harbors of the world have requirements for the control of air pollution. *Id.* Ships can meet these requirements by not using incinerators in those harbors and instead using the burners while in other marine waters. *Id.*

At sea ash disposal of incinerated incidental ship wastes is currently unregulated in the United States, beyond the discharge requirements of Annex V. Incinerator residue is specifically listed as a regulated material under the MPRSA. 40 C.F.R. § 220.2(d) (1988). As discussed earlier, however, incidental ship wastes not brought to sea for dumping are exempt from the MPRSA. *Supra* note 183. Therefore, ash disposal from on board incineration of incidental ship wastes is not within the scope of prohibited acts under the MPPRCA or the MPRSA. *Supra* notes 178-83 (discussing United States dumping laws). The Clean Water Act also prohibits the discharge of incinerator ash. 33 U.S.C. § 1362(6) (1982) (including "incinerator residue" in the definition of pollutant). The Clean Water Act prohibits discharges of wastes into territorial waters but is not enforced. *Supra* note 197. Although incinerator ash is a regulated pollutant, discharges from ships operating in the contiguous zone or EEZ are exempted from the Act. 33 U.S.C. § 1362(12)(B) (1982).

posal may have devastating effects on the marine environment.³⁶⁶

Plastics require high incineration temperatures and incineration technology has not perfected the complete destruction of such materials.³⁶⁷ Toxins such as dioxins can be generated if plastics are burned at inadequate temperatures.³⁶⁸ The incineration of solid waste releases air emissions that may contain a variety of acidic gases, particulate lead, cadmium, and other toxic metals, as well as hazardous organic compounds such as dioxins.³⁶⁹ These emissions from land-based solid waste incinerators are a suspected health threat to humans and the environment.³⁷⁰ The bottom and fly ash that result from incineration is also hazardous. The ash, similar to the emissions, may contain toxic levels of cadmium and lead, as well as dioxins.³⁷¹

Dioxins are extremely toxic and persistent compounds that bioaccumulate³⁷² in the environment.³⁷³ Similarly, disposing of toxic metals

Senator Wilson introduced legislation in the 101st Congress that would amend the Clean Air Act by extending the Act's provisions to cover air pollution on and over the Outer Continental Shelf. S. 782 101st § 327 Cong., 1st Sess. (1989). The Oslo Convention will ban at sea incineration of wastes as of December 31, 1994. *Oslo and Paris Commissions Meet*, 19 MAR. POLLUT. BULL. 498 (1988). It is unclear whether this ban will include the incineration of wastes incidental to the operation of ships. A similar phaseout of marine incineration is to take effect under the London Dumping Convention. *Ban on Marine Incineration*, 19 MAR. POLLUT. BULL. 648 (1988). As the London Dumping Convention specifically exempts wastes incidental to the operation of ships, it is likely that the prohibition on incineration will not extend to such wastes. See *supra* notes 125-28 (discussing incidental wastes under the London Dumping Convention).

366. See *infra* notes 367-78 (discussing the hazards of at sea incineration and ash disposal).

367. REGULATORY EVALUATION OF ANNEX V, *supra* note 6, at 6-18.

368. *Id.*; see *supra* note 365 (noting that the MEPC guidelines consider shipboard incineration technology to be at a "primitive level").

369. See TO BURN OR NOT TO BURN, *supra* note 39, at 78 (noting that even with modern pollution control, emissions levels may remain harmful to human health); see also Laversuch, *Incineration*, MODERN PLASTICS, May 1989, at 34-35 (noting public concern over by-products of plastic incineration). These by-products may include dioxins and furans, heavy metals such as lead and cadmium, and various acidic gases. *Id.*

370. United States Environmental Protection Agency, Assessment of Municipal Waste Combuster Emissions under the Clean Air Act, 52 Fed. Reg. 25,398, 25,407 (1987) (announcing the EPA's intent to regulate certain emissions from solid waste incinerators because they are potential threats to human health).

371. See UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, CHARACTERIZATION OF MWC ASHES AND LEACHATES FROM MSW LANDFILLS, MONOFILLS, AND CO-DISPOSAL SITES ES-3-4 (1987) (noting that researchers have often found toxic levels of cadmium, lead, and traces of other heavy metals in solid waste incinerator ash). In 1989, Congress considered amendments to RCRA that would regulate ash from municipal garbage incinerators. *Broad Support for Ash Bill Voiced*, 20 Env't Rep. (BNA) 140 (May 19, 1989) (discussing H.R. 2162 that would treat ash as a "special waste" and noting that incinerator ash contains toxic levels of metals).

372. See WASTES IN MARINE ENVIRONMENTS, *supra* note 119, at 92 (defining bioaccumulation as the process whereby a substance enters an organism through the

such as cadmium³⁷⁴ and lead³⁷⁵ in the marine environment is, as one commentator observed, paramount to placing them "at the gates of the food chain where they can poison not only significant quantities of marine life, but also the human population at the top of the food chain."³⁷⁶ Although the United States Coast Guard has adopted interim regulations permitting ash disposal at sea,³⁷⁷ the Environmental Protection Agency (EPA) strongly opposes at sea disposal of incinera-

water or through ingestion and is stored in the tissue of the organism).

373. See E. MEYER, CHEMISTRY OF HAZARDOUS MATERIALS 396-97 (2d ed. 1989) (noting that 2,3,7,8-tetrachlorodibenzo-p-dioxin, often called dioxin or TCDD, is one of the most toxic of all substances, is extremely stable, and bioaccumulates in the environment); see also SYRACUSE RESEARCH CORPORATION, TOXICOLOGICAL PROFILE FOR 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN 1, 72-74 (Report prepared for the United States Health Service Agency for Toxic Substances and Disease Registry) (June, 1989) (noting that incineration of municipal wastes is a source of dioxins and that photodegradation in water is slow); *Dioxin: A Highly Toxic, Persistent Contaminant in ENVIRONMENTAL DEFENSE FUND/ ENVIRONMENTAL INFORMATION EXCHANGE, FACT SHEET* (available from the Environmental Defense Fund) (stating that dioxins are among the most toxic substances known, and that the compounds tend to "bioconcentrate" in the food chain due to their resistance to chemical or biological breakdown). Research suggests that dioxins form as a result of incomplete combustion of municipal wastes. Laversuch, *supra* note 369, at 34-35. Scientists have also linked dioxin to birth defects, cancer, and immune system failure. *Id.* Increased amounts of dioxin in marine environments continue to concern researchers around the globe. *Dioxin Problems in the Aquatic Environment*, 19 MAR. POLLUT. BULL. 347 (1988) (discussing a symposium addressing dioxins held at the University of Nevada, Las Vegas, October 4-9, 1987, attended by representatives from seventeen nations).

374. See LIFE SYSTEMS, INC., TOXICOLOGICAL PROFILE FOR CADMIUM 59 (Report prepared for the United States Public Health Service Agency for Toxic Substances and Disease Registry) (March 1989) (noting that the largest source of cadmium release into the environment is the burning of petroleum products and incineration of municipal wastes). Cadmium bioaccumulates in marine organisms hundreds or thousands of times higher than concentrations in the water. *Id.* at 61. Bioconcentration is greatest in invertebrates such as mollusks and crustaceans, followed by fish and plants. *Id.* See generally *GESAMP: Cadmium, Lead and Tin in the Marine Environment*, GESAMP (IMO/FAO/UNESCO/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Pollution); UNEP Regional Seas Reports and Studies No. 56, 6-23 (1985) [hereinafter *Cadmium, Lead and Tin in the Marine Environment*] (discussing the effects of cadmium on marine biota and human health).

375. See *Cadmium, Lead and Tin in Marine Environments*, *supra* note 374, 40-43 (discussing the effects of lead on marine biota and human health). Lead bioaccumulates in organisms through the pathways of ambient water, sediments, and ingestion. *Id.* at 34. Exposure to lead can cause significant harm to central and peripheral nervous systems in humans. *Id.* at 36. Marine organisms, particularly mollusks and birds, can accumulate lead from the environment. *Id.* at 53.

376. J. KINDT, *supra* note 119, at 800. The problem of mercury in tuna is one example of bioaccumulation of toxic metals. *Id.*

377. Interim Regulations Implementing Annex V of MARPOL 73/78, 54 Fed. Reg. 18,406 (1989) (to be codified at 33 C.F.R. § 151.69(a)(2)); The term "garbage" includes "operational wastes," which by definition includes ash and clinkers from ship-board incineration. *Id.* at 18,403 (to be codified at 33 C.F.R. § 151.05); see MARPOL Convention, *supra* note 19, Annex V, reg. 3(1)(b)-(c) (discussing permitted discharges for commuted wastes).

tor ash under Annex V.³⁷⁸

In complying with Annex V, ships generally have five options for waste disposal: first, waste separation, with storage of plastic waste on-board the ship for disposal in port; second, storage of all garbage for disposal in port; third, waste separation, with compaction and storage of plastics for port disposal; fourth, incineration; and fifth, product substitution.³⁷⁹ The Marine Environment Protection Committee of the IMO promulgated Draft Guidelines for Annex V that expressly includes "ash and clinkers" in the term "all other garbage."³⁸⁰ Ships may discard ash into the sea beyond twelve nautical miles from the nearest land or beyond three miles if the ash is capable of passing through a screen with openings no greater than twenty-five millimeters.³⁸¹

As the fees for discharging plastics and other garbage at ports rise, the competitive cost of ship board incineration makes it a viable economic alternative.³⁸² Shipping companies note that the availability and cost of labor to unload wastes in ports is often uncertain.³⁸³ The uncertainty of whether ports will have adequate facilities and labor, coupled with the costs of onshore waste disposal provide strong incentives for shipboard incinerators as a predictable means of waste disposal.³⁸⁴ Furthermore, foreign ships visiting the United States are required to comply with Animal and Plant Health Inspection Service (APHIS) regulations for the proper handling of foreign wastes that come in contact with food.³⁸⁵ These costs can also be avoided through onboard incinera-

378. See Letter from Richard E. Sanderson, Office of Federal Activities, United States Environmental Protection Agency to Commandant, United States Coast Guard (Nov. 29, 1988) [hereinafter EPA Comments] (on file at the office of the American University Journal of International Law and Policy) (discussing ash disposal under interim Coast Guard regulations and recommending that the Coast Guard not endorse or encourage at sea ash disposal under Annex V regulations).

379. REGULATORY EVALUATION OF ANNEX V, *supra* note 6, at 6-8.

380. MEPC/25 *Draft Guidelines*, *supra* note 265, at para. 1.5.15.

381. See *supra* note 377 (discussing permitted discharges of incinerator ash).

382. See REGULATORY EVALUATION OF ANNEX V, *supra* note 6, at 6-24 (stating that disposal costs are rapidly increasing due to diminished landfill capacity in the United States). The EPA estimates that one third of the existing landfills in the United States will be full by 1991. ENVIRONMENTAL PROTECTION AGENCY, OFFICE OF SOLID WASTE, THE SOLID WASTE DILEMMA: AN AGENDA FOR ACTION 14 (1989).

383. REGULATORY EVALUATION OF ANNEX V, *supra* note 6, at 6-45. Vessels that incinerate incidental garbage can avoid waste-associated scheduling problems and onshore waste handling regulations. *Id.*

384. *Id.*; see *supra* notes 339-47 and accompanying text (discussing the likelihood of inadequate facilities in the absence of enforceable international requirements).

385. See *supra* note 166 and accompanying text (discussing APHIS requirements for foreign ships off-loading garbage). Under the Coast Guard's interim rules, ports receiving foreign ships other than from Canada must be capable of receiving APHIS-regulated garbage on 24-hour notice. Interim Regulations Implementing Annex V of MARPOL, 54 Fed. Reg. 18, 409(1989) (to be codified at 33 C.F.R. § 158.410(A)(1)).

tion and subsequent ash disposal at sea. Finally, because the ash brought to port in the United States will be subject to RCRA disposal requirements, ships will probably dump most incinerator ash at sea in order to avoid disposal and compliance costs.³⁸⁶ Increased international awareness of the hazards of incinerator ash may lead to similar waste handling requirements, costs and incentives in the ports of other nations.³⁸⁷

The regulation became effective on August 28, 1989. *Id.*

386. See EPA Comments, *supra* note 378 (stating that APHIS will require ports to meet RCRA requirements in handling ship wastes); see also Interim Regulations Implementing Annex V of MARPOL 73/78, 54 Fed. Reg. 18,402 (1989) (stating that RCRA may restrict shore disposal of ash and clinkers from onboard incinerators). Regulations promulgated under RCRA exempt "household waste" and ash residue from the incineration of such refuse resulting from municipal incinerators. 40 C.F.R. § 261.4(b) (1988); 45 Fed. Reg. 33,098-99 (1980) (explaining EPA's decision to exclude "waste streams generated by consumers at the household level" from RCRA hazardous waste regulations). Residues such as incinerator ash from incineration of household waste are also excluded under these provisions. *Id.* The legislative history notes that "[RCRA] is not to be used to control the disposal of hazardous substances used in households or to extend control over general municipal wastes based on the presence of such substances." S. REP. NO. 94-988, 94th Cong., 2nd Sess. 16 (1976).

Since the incinerator ash from the incineration of wastes at sea would likely arise from commercial shipping, it may not constitute a solid waste arising from the household waste stream. *Id.* The term "household waste" is defined as "any material" derived from households. 40 C.F.R. § 261.4(b)(1) (1988). The exclusion extends to multiple residences, hotels, motels, bunk houses, ranger stations and crew quarters. *Id.* Although resource recovery facilities incinerating household wastes are exempt from RCRA regulations, ships at sea incinerating and disposing the ash residue of solid wastes not arising from the household waste stream appear to be subject to existing RCRA regulations. *Id.*

Additionally, any ship that imports hazardous waste into the United States must comply with "manifest" documentation and control requirements under RCRA. 40 C.F.R. § 262.60 (1988). Manifest regulations require documentation of the planned vehicles and facilities handling the hazardous waste as well as information on the generation of the waste. 40 C.F.R. § 262.20(a) (1988). If incinerator ash is found to be a hazardous waste under RCRA, these regulations can be interpreted to require compliance with importation requirements as part of on shore or at sea disposal of incinerator ash. *Id.*

387. See EPA Comments, *supra* note 378 (stating that several incidents involving attempts to export ash for disposal in foreign nations have renewed international interest in the discharge of ash at sea). In one such incident, the *Khian Sea*, a ship carrying 14,000 tons of incinerator ash from Philadelphia, searched for 27 months for a port where it could dispose of its cargo; see also *Econotes*, 14 GREENPEACE 4 (Mar./Apr. 1989) (detailing the journey of the *Khian Sea*). The ship dumped 4,000 tons of ash in Haiti by listing the cargo as fertilizer on applicable permits. *Id.* It then changed its name while at port in Yugoslavia, and after being denied entry to a number of foreign ports, it dumped its load at sea. *Id.* The recent adoption of the Basel Convention also lends support to the view that nations around the world will further regulate hazardous wastes. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, *adopted and opened for signature* March 22, 1989, *reprinted in* UNITED NATIONS ENVIRONMENTAL PROGRAMME, *BASEL CONVENTION ON THE CONTROL OF TRANSBOUNDARY MOVEMENTS OF HAZARDOUS WASTES AND THEIR DISPOSAL: FINAL ACT* [hereinafter *BASEL CONVENTION*], *also reprinted in* 28 I.L.M.

Currently, neither international law nor the Clean Air Act regulates emissions from at sea incinerators.³⁸⁸ Coast Guard regulations pertaining to onboard incineration concern only design, construction, and repair standards for incinerators and do not regulate air emissions or ash disposal.³⁸⁹ Neither Congress nor the EPA has established standards for air emissions from ocean-based incinerators or for disposal of bottom ash from land or sea-based incinerators.³⁹⁰ The Coast Guard, however, has requested the MEPC of the IMO to consider the issue of ocean ash disposal, expressing concerns that the organization has not given the issue adequate attention.³⁹¹

V. RECOMMENDATIONS TO ENHANCE THE EFFECTIVENESS OF ANNEX V

Annex V is the first global regime addressing at sea disposal of ship generated plastic wastes. Amendments to Annex V and separate multinational regional agreements will be necessary, however, to effectively protect the world's marine environment from plastics pollution from ships. Fortunately, MARPOL includes procedures that facilitate the adoption of amendments.³⁹² Additionally, United States federal, state,

649 (1989).

388. See *Nat'l Ocean Policy Study Hearings*, *supra* note 4, at 80 (statement of Sally Ann Lentz, Staff Attorney for the Oceanic Society) (stating that ocean-based incinerators are currently unregulated); *supra* note 365 (discussing S. 782 introduced in the 101st Congress that would extend the Clean Air Act to cover air pollution on and over the Outer Continental Shelf).

389. See 46 C.F.R. §§ 50-64, 110-113 (1988) (relating to design construction and repair of shipboard incinerators).

390. See Darcy, *100th Congress Kept Busy with Waste Disposal Bills*, 32 *WORLD WASTES* 55 (Jan. 1989) (noting that representatives introduced two bills regulating emissions control and three others that would have regulated ash from municipal solid waste). Congress adopted none of them. *Id.*

391. See Regulations Implementing the Pollution Prevention Requirements of Annex V, 53 Fed. Reg. 43,625 (1988) (notice of proposed rulemaking, Oct. 27, 1988) (stating that the Coast Guard believes that the issue of incinerator ash disposal requires further study and that it has requested the MEPC of the IMO to review the issue).

392. See MARPOL Convention, *supra* note 19, art. 16 (stating that an amendment to an Annex shall be considered accepted in accordance with article 16, section (2)(f)(ii)). Article 16, section 2 states in pertinent part:

[A]n amendment to an Appendix to an Annex to the Convention shall be deemed to have been accepted at the end of a period to be determined by the appropriate body [of the IMO] at the time of its adoption, which period shall be not less than ten months, unless within that period an objection is communicated to the Organization by not less than one-third of the Parties or by the Parties the combined merchant fleets of which constitute not less than fifty percent of the gross tonnage of the world's merchant fleet which ever condition is fulfilled.

Id.

and local governments can take initiatives that will significantly reduce at sea disposal of plastic wastes.

A. EXPAND THE JURISDICTION OF ANNEX V

The nations party to Annex V should seek to expand the jurisdictional reach of the Annex by encouraging those nations already party to MARPOL to ratify Annex V. These same nations should also collectively encourage countries allowing "flags of convenience"³⁹³ to become parties to the MARPOL Convention. In addition, the international community should ratify the LOS Convention in order to expand the jurisdictional reach of marine pollution conventions and to take advantage of LOS provisions that grant port-state jurisdiction for violations of internationally accepted pollution standards on the high seas.

Although fifty-five nations constituting more than eighty percent of the world's shipping tonnage are party to MARPOL, only 39 nations have ratified Annex V.³⁹⁴ The broad support for United States ratification of Annex V from environmental groups, the merchant shipping industry, and the plastics industry suggests that Annex V offers a practical response to the global problem of marine plastics pollution.³⁹⁵ Accordingly, the IMO with the support of the nations that are party to Annex V and the United Nations Environment Programme should encourage all nations party to MARPOL to ratify Annex V. Such efforts could prove successful as nations party to MARPOL have already recognized the need for international solutions to vessel source pollution through their adoption of Annexes I and II.

The United States and other nations party to Annex V should also encourage states offering flags of convenience to ratify Annex V. Liberia, for example, represents more than 13 percent of the world's gross shipping tonnage and has not ratified the Annex.³⁹⁶ Nations such as

393. See B. BOCZEK, *FLAGS OF CONVENIENCE* 4-5 (1962) (stating that the term "flag of convenience" refers to flags of states that permit the registration and operation of ships with minimum taxation and lower legal standards of social security) (citation omitted). The countries of Panama, Liberia, Honduras, and Costa Rica are considered the main flags of convenience. *Id.*

394. Coast Guard Commandant Instruction, *supra* note 20, enclosure 4. States party to MARPOL that have not yet ratified Annex V are Australia, Brazil, Brunei Darussalam, Bulgaria, Iceland, India, Indonesia, Liberia, Republic of Korea, South Africa, Spain, Switzerland, and the Syrian Arab Republic. *Id.*

395. See 133 CONG. REC. H8569 (daily ed. Oct. 13, 1987) (statement of Rep. Studds) (supporting adoption of United States implementing legislation for Annex V). Representative Studds observed that "[T]his is a simple proposal. It reflects good sense, as few do, and it deserves support. The shipping industry supports it, environmentalists support it, the fishing industry supports it, and the Administration supports it." *Id.*

396. See S. REP. NO. 100-8, *supra* note 115, at 30-31 (indicating that Liberia

Honduras and Costa Rica should be encouraged to ratify MARPOL, including Annex V, in order to expand regulation of pollution from the world's shipping fleets.³⁹⁷

The jurisdictional reach and effectiveness of Annex V could be greatly expanded by international adoption of the LOS Convention.³⁹⁸ First, the LOS Convention requires states to ensure that vessels flying their flag comply with international rules established under the IMO for the prevention and control of pollution.³⁹⁹ If ratified, the LOS Convention would require all nations party to the Convention to adopt rules regulating disposal of ship wastes that are no less stringent than Annex V.⁴⁰⁰ The LOS Convention also contains significant jurisdictional provisions that mandate flag and coastal state enforcement of dumping conventions.⁴⁰¹

representing 13% of the shipping tonnage worldwide, has not ratified Annex V). Panama, representing roughly 10% of the world's shipping tonnage is the only state offering a flag of convenience that has ratified Annex V. *Id.*

397. See Coast Guard Commandant Instruction, *supra* note 20, encl. 4 (indicating that, as of February 1989, neither Honduras nor Costa Rica is party to MARPOL).

398. See *supra* note 134 (discussing the status of the LOS Convention).

399. LOS Convention, *supra* note 129, pt. XII, sec. 6, art. 217, para. 1. The LOS Convention obligates flag states to ensure that vessels under their flag comply with standards established by the IMO and its diplomatic conferences for the prevention regulation and control of pollution. *Id.* Flag states are required to investigate and prosecute violations of IMO standards and regulations irrespective of where the violation occurred. *Id.* art. 217, para. 4; see J. KINDT, *supra* note 119, at 1188 (discussing flag-state enforcement).

400. LOS Convention, *supra* note 129, pt. XII, sec. 5, art. 211, para. 2. Article 211 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 [IMO] or general diplomatic conference.*

Id. (emphasis added). Although the exact meaning of "generally accepted international rules" and similar phrases in the LOS Convention has been debated, some observers interpret the language as obligating parties to the LOS Convention to adopt rules and standards in other conventions established through the competent international organization to which the state need not or may not be a party. See, e.g., Boyle, *Marine Pollution Under the Law of the Sea Convention*, 79 AM. J. INT'L L. 347, 356 (1985) (discussing generally accepted rules under the LOS Convention). Some observers argue that a convention must achieve the status of customary law before it can be regarded as setting an international rule or standard. *Id.*

401. LOS Convention, *supra* note 129, pt. XII, sec. 6, art. 216. Article 216 states:

Laws and regulations adopted in accordance with this convention and applicable international rules and standards established through competent international organizations or diplomatic conference for the prevention, reduction, and control of pollution of the marine environment by dumping, shall be enforced:

- a) by the coastal State for dumping within its territorial sea or its exclusive economic zone, or on its continental shelf;
- b) by the flag State with regard to vessels flying its flag or vessels or aircraft of

Finally, the LOS Convention establishes port state jurisdiction over ships that violate international discharge standards on the high seas or outside the internal waters, territorial sea, or EEZ of a port state.⁴⁰² Accordingly, if ratified, the LOS Convention would permit a nation to undertake investigation and enforcement actions against a vessel voluntarily within the state's ports to determine whether the ship discharged garbage outside the nation's EEZ in violation of Annex V, the applicable international standard.⁴⁰³ Such enforcement authority would supplement existing flag state enforcement powers for violations on the high seas.⁴⁰⁴ Extended port state jurisdiction under Article 218 of the LOS Convention would provide an especially effective enforcement regime if Annex V is amended to require that vessels maintain refuse record books and waste management plans.⁴⁰⁵ The LOS Convention

its own registry;

c) by any State with regard to loading of wastes or other matter occurring within its territory or at its off shore terminals.

Id.; see J. KINDT, *supra* note 119, at 1140 (stating that article 216 appears to require international enforcement of the Ocean Dumping Convention (London Dumping Convention) because the Convention is a preexisting, widely accepted agreement established through a competent diplomatic conference). Accordingly, coastal states under the LOS Convention may be bound to enforce the London Dumping Convention even when they are not a party. *Id.* Enforcement of IMO dumping conventions, such as the London Dumping Convention, through the LOS Convention regime, would significantly increase the jurisdictional reach of such conventions, protecting roughly 33% of the world's oceans. *Id.*

402. LOS Convention, *supra* note 129, pt. XII, sec. 6, art. 218, para. 1. Article 218 states:

When a vessel is voluntarily within a port or at an off-shore terminal of a State, that State may undertake investigations and, where the evidence so warrants, institute proceedings in respect of any discharge from that vessel *outside* the internal waters, territorial sea or exclusive economic zone of that State in violation of applicable international rules and standards established through the competent international organization [IMO] or general diplomatic conference.

Id. (emphasis added); Some commentators consider port state enforcement for violations on the high seas one of the most innovative provisions of the LOS Convention. J. KINDT, *supra* note 119, at 1,189.

403. See *supra* note 133 (noting that the IMO is considered the competent international organization). Annex V was drafted under the auspices of the IMO and would constitute the applicable international standard to which vessels on the high seas could be held. *Supra* note 228 and accompanying text (discussing the development of MARPOL 73/78). Some delegations at the LOS Conference viewed MARPOL as the appropriate international rules under the LOS Convention. Boyle, *supra* note 401, at 355 (discussing MARPOL relative to the appropriate rules under the LOS Convention) (citing REPORTS OF THE UNITED STATES DELEGATION TO THE THIRD UNITED NATIONS CONFERENCE ON THE LAW OF THE SEA 131-33 (M. Nordquist & C. Park eds. 1983)).

404. See *supra* notes 278-81 (discussing flag-state enforcement duties with regard to vessel source pollution).

405. See *infra* notes 407-12 (discussing the need for international requirements for refuse record books).

also requires states to provide technical and scientific assistance to developing countries either directly or through international organizations.⁴⁰⁶ Such requirements could facilitate the transfer of degradable and recyclable plastics technology to lesser developed countries.

B. INTERNATIONAL REQUIREMENTS FOR REFUSE RECORD BOOKS AND WASTE MANAGEMENT PLANS

Nations party to Annex V must recognize the jurisdictional limitations on enforcement actions⁴⁰⁷ and amend Annex V to require maintenance of refuse record books and waste management plans. The United States⁴⁰⁸ and Norway,⁴⁰⁹ for example, already require log entries for the discharge of ship-generated wastes. Waste tracking and handling requirements for the world's shipping fleets, although not capable of documenting the loading or disposal of all plastics, could track much of the packaging, sheeting, and dunnage used by ships to ensure its proper disposal. Failure to properly document waste log books or maintain waste management plans could serve as a rebuttable presumption that a violation of Annex V occurred.⁴¹⁰ The recordkeeping requirements

406. LOS Convention, *supra* note 119, pt. XII, sec. 3, art. 202. The LOS Convention directs states to promote scientific, education, and technical programs for developing states that concern the prevention and control of marine pollution. *Id.*

407. *See supra* notes 277-83 and accompanying text (discussing enforcement and jurisdiction under Annex V).

408. *See* MPPRCA § 2107, 33 U.S.C. § 1903(b)(2) (Supp. V 1987) (requiring the Coast Guard to promulgate regulations requiring ocean-going vessels to maintain refuse record books, waste management plans, and notice placards of Annex V requirements for passengers and crew); *supra* note 310 (discussing proposed rules).

409. *See* Regulations Concerning the Prevention of Pollution from Ships, Ch. V § 5-7 (June 16, 1983) (stating "[i]n ships where a deck log shall be kept, appropriate entries concerning the disposal of ship's garbage shall be made"). Chapter V concerning the prevention of pollution by garbage from ships entered into force on April 1, 1989. Letter from Mette Kongshem, Counselor of the Royal Norwegian Embassy to Paul Hagen (Apr. 10, 1989) (discussing Norwegian implementing legislation for Annex V and providing copies thereof) (copy on file with the office of the American University Journal International Law & Policy). Mobile installations are also required to make entries concerning the disposal of garbage in relevant record books. *Id.*

410. *See* Notice of Proposed Rulemaking for Annex V Regulations, 53 Fed. Reg. 43,622, 43,643 (1988) (to be codified at 33 C.F.R. § 151.63(b)) (stating that if a master or person in charge of a ship is unable to demonstrate that plastics are not used aboard the ship or comply with Annex V handling options for plastics, a violation of Annex V will be presumed). The interim rule removed this presumption, but the Coast Guard is still considering it as a means of promoting compliance. Interim Regulations for Annex V of MARPOL 73/78, 54 Fed. Reg. 12,389 (1989). The use of presumptions is not new under United States law. Anderson, *Natural Resources Damages, Superfund, and the Courts*, 16 B.C.L. REV. 405 (providing a detailed discussion of Superfund's rebuttable presumption for natural resource damage claims). In addition to Superfund, numerous state workers' compensation laws and the federal Coal Mine Health and Safety Act of 1969 for persons suffering from Black Lung disease also

would increase awareness of Annex V requirements among vessel crews and provide an effective instrument for enforcement.⁴¹¹

Absent an amendment to Annex V, member nations should follow the lead of the United States and Norway by imposing recordkeeping requirements on vessels under their own flag. Unilateral adoption of such requirements could facilitate international approval of a similar amendment to Annex V.⁴¹² Parties to MARPOL should also amend Annex V to require a deadline on which all major international ports must be in compliance with minimum waste handling requirements as set out in the MEPC draft guidelines.⁴¹³

C. INCREASED INTERNATIONAL REGULATION OF COMMERCIAL FISHING

Parties to Annex V should amend the Annex to impose strict liability on all fishing vessels for the loss of synthetic fishing gear.⁴¹⁴ Such an amendment could define factors for assessing fines and also require states of registry to issue "certificates of adequacy" for all commercial fishing vessels of a certain size similar to certificates used in Annexes I and II. The certificates would certify the type of synthetic gear being used and that the gear is marked so as to permit identification for an agreed upon period of time. An amendment to Annex V need only set forth the principle of strict liability for lost fishing gear, factors for assessing fines, and the minimum marking requirements. Individual nations could meet these requirements individually or work within regional fishery agreements to address the specific needs and gear characteristics within particular fisheries. Fishing vessels could be required to maintain log books on equipment used and consequent losses in accor-

make use of rebuttable presumptions. *Id.* An amendment to MARPOL Annex V making the failure to maintain waste log books and management plans a violation of the Annex or a rebuttable presumption that a violation occurred would greatly increase the enforceability of Annex V.

411. See *Hearings on H.R. 940*, *supra* note 49, at 455 (statement of Sally Ann Lentz, on behalf of the Entanglement Network)(stating that management plans and garbage record books would ensure consideration of compliance options and facilitate enforcement).

412. See *Report on the Act to Prevent Pollution from Ships*, *supra* note 163, at 4,849 (noting that Congress viewed amendments to the Tanker Safety Act in 1980 that imposed reception facility requirements on United States ports as a means of materially influencing other maritime nations to ratify MARPOL).

413. See *MEPC/25 Draft Guidelines*, *supra* note 265, at para. 6.1 (setting forth guidelines for port reception facilities pertaining to garbage).

414. See *Fjelstad*, *supra* note 98, at 696 (proposing strict liability for lost nets similar to the liability for unintentional violations of the Migratory Bird Treaty Act). Fines could be based on the size of the net, whether marine life was taken, and the time between loss and recovery of the net. *Id.*

dance with the certificates. The use of unapproved, unlogged, or unmarked equipment could constitute a violation of Annex V.

Strict liability and certificates of adequacy for commercial fishing vessels would deter careless handling and the discharge of gear, while encouraging retrieval efforts. Similarly, the MEPC of the IMO should encourage states to adopt reporting requirements for the loss of synthetic gear both to develop a data base on such losses and to encourage others to retrieve such gear for either recycling or bounty awards.⁴¹⁵ Such amendments would avoid the difficulty of determining whether "reasonable precautions" were taken to avoid the loss of fishing gear. Routine inspections of United States and foreign vessels by the United States Fisheries Service and United States Coast Guard could ensure proper gear use, marking, and reporting.

Fishery conservation agreements and United States domestic law should also encourage the use of degradable materials in the construction of fishing nets and crab traps in order to accelerate the breakdown of lost or discarded gear. Requiring a permit and fee for the use of synthetic gear could make natural fibers economically competitive, thereby encouraging their use. In addition, such gear could be exempt from the strict liability requirements under any such amendment to Annex V. The use of bio or photodegradable plastic materials, however, should be encouraged only after careful study determines that the use of such plastics does not transform the entanglement problem into one of ingestion.

D. INTERNATIONAL PROHIBITION ON ASH DISPOSAL AT SEA

The United States and other nations party to Annex V should review the potential environmental hazards associated with shipboard incinerator emissions and at sea disposal of incinerator ash. Similar to Annex V's prohibition on plastics disposal, parties to MARPOL should adopt similar amendments prohibiting the disposal of incinerator ash at

415. Reporting requirements for the release of hazardous materials are common. See, e.g., CERCLA, 42 U.S.C. § 9603 (1982 and Supp. IV 1986) (requiring persons in charge of vessels or facilities to notify the national response center upon knowledge of a release of a hazardous substance); Clean Water Act, 33 U.S.C. § 1321 (b)(B)(5) (1982) (requiring any person in charge of a vessel or facility to notify the appropriate government agency upon knowledge of a discharge of oil or hazardous substance). See generally United States and International Authorities Applicable to Entanglement, *supra* note 125, at 18 (proposing a systemized gear inventory system under the Fishermen's Protective Act, 22 U.S.C. §§ 1971-1980 (1982)). Such amendments to the Fishermen's Protective Act could be a useful tool in determining the amount of fishing gear entering the marine environment. *Id.*

sea.⁴¹⁶ The amendments should also establish stringent and universal performance and construction standards for shipboard incinerators in order to minimize the release of emissions containing heavy metals, dioxin, and acidic gases into the marine environment.⁴¹⁷ Limits should also be placed on the rate and toxicity of incinerator emissions at sea.⁴¹⁸ Similar to Annex III requirements concerning noxious liquid substances, international recordkeeping and tracking procedures for incinerator ash should be established under Annex V to ensure the proper disposal of ash from vessels using on board incinerators.⁴¹⁹

A total ban on the incineration of incidental wastes would appear to be in concert with recent decisions of nations party to the London Dumping Convention and the Oslo Convention to ban the practice of at sea incineration by 1994.⁴²⁰ Similarly, recent adoption of the Basel Convention concerning the transboundary shipment of hazardous waste indicates a growing international awareness of the dangers of hazardous waste and suggests possible support for at least prohibiting at sea disposal of incinerator ash.⁴²¹ Like the problem of plastics pollution itself, an international approach is needed to adequately address the pollution threat to marine waters resulting from increased incineration at sea.

416. See MARPOL Convention, *supra* note 19, Annex V, reg. 3 (banning the disposal of plastics into marine waters). Additionally, the MEPC should promulgate efficiency and emission standards for shipboard incinerators in its Draft Guidelines to prevent both air and sea contamination through emissions and fly ash. Cf. Draft MEPC/25 *Draft Guidelines*, *supra* note 264 (placing no efficiency and emissions standards on shipboard incinerators).

417. Precedence for international construction and performance requirements can be found in the provisions of Annex I to MARPOL governing construction of oil tankers. See MARPOL Protocol, *supra* note 19, Annex I, regs. 13, 18 (requiring certain oil tankers to be constructed with segregated ballast tanks and pumping, piping, and discharge equipment that minimize oil retention).

418. See MARPOL Convention, *supra* note 19, Annex I, reg. 9 (establishing discharge limits and rates for oil which could serve as a model for regulation of emissions from ships).

419. See *id.* Annex III, reg. 9 (requiring all ships transporting noxious liquid substances to maintain a Cargo Record Book on a tank-to-tank basis).

420. See *Oslo and Paris Commissions Meet*, 19 MAR. POLLUT. BULL. 498 (1988) (discussing the June 1988 meeting of the Oslo Commission during which the Commission decided to terminate the practice of at sea incineration by December 31, 1994); *Ban on Marine Incineration*, 19 MAR. POLLUT. BULL. 648 (1988) (stating that the member states to the London Dumping Convention decided in October, 1988 to phase out the practice of at sea incineration by December 31, 1994).

421. BASEL CONVENTION, *supra* note 387. Cadmium, which is often found in incinerator residue, is already recognized as a threat to marine resources and is among the London Dumping Convention's list of extremely dangerous substances that cannot be discharged under dumping regulations. *Supra* note 121 (listing Annex I substances under the London Dumping Convention).

E. INCREASED USE OF DEGRADABLE PLASTICS AND RECYCLING

Nations party to Annex V should promote the recycling of all types of plastics at all ports in order to lessen the costs of compliance with Annex V.⁴²² Moreover, the IMO should establish procedures for the transfer of recycling and degradability technology relating to plastics,⁴²³ especially plastics relating to maritime uses. Presently, the plastics industry lags far behind other industries in the area of recycling.⁴²⁴ Accordingly, the United States and other states should create incentives for recycling plastics through the imposition of taxes on plastics that cannot be recycled and granting tax breaks for plastics that can be recycled.⁴²⁵ Developed nations should assist the plastics industry in establishing demonstration projects at ports for recycling and encourage the development of recyclable plastic products for consumer and maritime use.⁴²⁶ In the United States, for example, government agencies,

422. See *New Uses for Plastics*, 1 WORLD WASTES 23 (Jan. 1988) (discussing the uses of Syntal, a recycled plastic product that has uses similar to lumber). Annual projected compliance costs for vessels in the United States alone is roughly \$41.7 million, apportioned as follows: \$2.9 million for merchant fishing, \$33.9 million for commercial fishing, \$1.4 million for recreational boating, \$900,000 for offshore oil and gas operations, \$400,000 for miscellaneous vessels and \$2.2 million for ports. REGULATORY EVALUATION OF ANNEX V, *supra* note 6, at 6.

423. See DEGRADABLE PLASTICS—STANDARDS, RESEARCH AND DEVELOPMENT, *supra* note 4, at 10 (stating that photodegradation and biodegradation are the most common means of degrading plastics). Photodegradation relies on the sun's ultraviolet rays to break up the physical and chemical composition of plastic. *Id.* Biodegradation relies on microorganisms to break down the plastic. *Id.*; see also *Degradable Plastics Show Promise in Fight Against Trash*, N.Y. Times, Apr. 11, 1989, at C1 (providing an overview of degradable plastics and noting that 16 states require six pack yokes to be degradable). The ability of plastics to quickly and completely break down through biodegradation is uncertain. *Chemistry of Plastics Casts a Negative Vote*, MODERN PLASTICS, Aug. 1989, at 48 (noting that plastics can be more easily made photodegradable than biodegradable). Degradable plastics, however, may not be compatible with recycling technology. *Id.*

424. See, e.g., *Second Life for Styrofoam*, TIME, May 22, 1989, at 84 (stating that less than 1% of all plastic is recycled as compared with 25% of all aluminum). Three major plastic resin suppliers, Du Pont, Goodyear, and Amoco have recently announced plans to begin plastic recycling programs. *As Recycling Gains Momentum, More Resin Suppliers Get into the Action*, MODERN PLASTICS, June 1989, at 170.

425. See Manheim, *supra* note 23, at 110 (discussing a New Jersey law that taxes manufacturers, wholesalers, and distributors of "litter-generating products").

426. See *Key Role for Additives: Upgrade Polymer Recycle*, MODERN PLASTICS, Oct. 1988, at 85 (stating that the use of additives can increase the performance value of reclaimed plastics). The Toxic Substances Control Act may provide the EPA with authority to require special additives that enhance the recyclability of certain plastics. *Supra* note 207-08. See, e.g., H.R. 500, 101st Cong., 1st Sess., 135 CONG. REC. E 657 (daily ed. Mar. 6, 1989) (introduced by Rep. Hochbruekner) (encouraging scientific research and development of technologies pertaining to the recycling of plastics). H.R. 500 seeks to establish an office of Recycling Research and Information. *Id.* § 6. The bill proposes grants for research into recycling of nondegradable materials. *Id.* § 6(c)(3); see also H.R. 3463, 101st Cong., 2d Sess., 135 CONG. REC. H7042 (daily ed.

public interest groups, and the plastics industry have already successfully cooperated in establishing educational campaigns relating to marine plastics debris.⁴²⁷

The United States should also adopt laws similar to House Resolution 5117⁴²⁸ that bans nondegradable plastic beverage ring carriers, in an effort to encourage the use of more readily degradable or recyclable packaging materials. Similarly, state and local governments must not overlook their powers to require degradable materials for fishing gear⁴²⁹ and their ability to ban synthetic fishing gear and particular consumer items or packaging that contribute to marine pollution.⁴³⁰ The United

Oct. 12, 1989) (introduced by Rep. Owens) (requiring the federal government to recycle bottles, cans, paper and plastics).

427. See, e.g., SOCIETY OF THE PLASTICS INDUSTRY, PLASTICS AND MARINE DEBRIS—SOLUTIONS THROUGH EDUCATION (March 1989) (discussing the educational campaign aimed at reducing the discharge of wastes from ships that the Society for the Plastics Industry, the Center for Marine Conservation, and the National Ocean and Atmospheric Administration coordinated). The Board of Directors of the Society for the Plastics Industry adopted a policy statement on September 1987 that supported United States ratification of Annex V, committing the Society to resolving issues of plastic pellet discharges and to furthering educational efforts. *Id.* at 3.

428. H.R. 51,175, 100th Cong., 2d Sess., 134 CONG. REC. H9529 (July 28, 1988) (banning nondegradable plastic ring holders within two years of the enactment of the bill).

429. See, e.g., ME. REV. STAT. ANN. tit. 12 § 6433-A (1988) (requiring all lobster traps to be equipped with a biodegradable ghost panel designed to release lobsters from lost traps); V.I. CODE ANN. tit. 12 § 319(h) (1988) (requiring traps and pots to contain an opening covered with untreated fiber of biological origin or non-galvanized sixteen gauge black iron wire).

430. See Suffolk County, N.Y. Local Law no. 10 simplifying solid waste management by requiring certain uniform packaging practices within the county of Suffolk (1988) (on file at the office of the American University Journal of International Law and Policy) (banning the use of items such as plastic grocery bags, styrofoam cups, meat trays, and similar nonbiodegradable food packaging originating in retail establishments in answer to increased limits in landfilling capacity). Although the Suffolk County law banning the use of non-biodegradable packaging received nation-wide media attention, the law was stayed pending the preparation of an Environmental Impact Statement in accordance with state law. *Society for the Plastics Industry v. The County of Suffolk*, No. 88-11262 (Sup. Ct. N.Y. June 2, 1989). See also *Is Minneapolis' Anti-Plastics Law a Blueprint for the Future?*, MODERN PLASTICS, May 1989, at 10 (stating "Suffolk County, New York was tough; Minneapolis is tougher" in describing recent bans on plastic packaging). Both Suffolk and Minneapolis have passed ordinances that ban the use of plastic carry-out bags, and related food packaging that is not degradable. *Id.* In 1988 and 1989, legislatures throughout the United States introduced some 400 bills regulating the use of plastic packaging. *Recycling Programs Proliferate as Industry Faces Tangle of Taxes and Bans*, MODERN PLASTICS, May 1989, at 100. Local governments should use the option to ban plastics in an effort to encourage the plastics industry to establish pilot recycling facilities within their jurisdictions. Following the adoption of legislation in Suffolk County banning the use of certain plastics for consumer items, Amoco corporation constructed a demonstration recycling plant in Brooklyn, New York to recycle wastes from 19 McDonald's restaurants. *Plastic Trash: Silk Purses Sought*, N.Y. Times, May 3, 1989, at D1.

States Supreme Court in *Minnesota v. Clover Leaf Creamery Co.*⁴³¹ upheld a Minnesota law banning the use of plastic gallon milk containers, basing its decision on the validity of the state's environmental and conservation concerns. Moreover, the effectiveness of state regulation over fishing practices in state marine waters may soon be increased by an extension of the territorial sea from three to twelve miles.⁴³²

CONCLUSION

Ratification of Annex V of the MARPOL Convention represents a significant international effort to prevent plastics pollution of the world's marine waters. The global regime established under Annex V for the prevention of plastics pollution places enforceable duties not only on nations and industries, but also upon individuals stewarding vessels into marine waters under flags of thirty-nine nations around the world.⁴³³ In this respect, Annex V represents an important step for the international community which faces a broad range of transboundary environmental problems.⁴³⁴

Although Annex V will not eliminate marine plastics pollution,⁴³⁵ it will significantly reduce such pollution from ships, both through enforcement of its regulations and through greater education.⁴³⁶ Increased awareness of the hazards of plastics in the marine environment

431. *Minnesota v. Clover Leaf Creamery, Co.*, 449 U.S. 455, *reh'g denied*, 450 U.S. 1027 (1981).

432. See *Extension of U.S. Territorial Sea*, 20 MAR. POLLUT. BULL. 57 (1989) (stating that the United States is considering an extension of the territorial sea from 3 to 12 miles). The proposed extension would likely give states broader jurisdiction over waters beyond the current three mile limit for state jurisdiction because the states could claim the enlarged coastal zone. *Id.*

433. See *supra* note 20 (listing states that have ratified Annex V).

434. See generally KINDT, *International Law and Policy: An Overview of Transboundary Pollution*, 23 SAN DIEGO L. REV. 583, 584-88 (1986) (providing an overview of transboundary environmental problems that include destruction of the ozone layer, global warming, and marine pollution); WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT—OUR COMMON FUTURE (1987) (discussing in detail global challenges that include poverty, sustainable development, changes in international institutions, species and ecosystem protection, food security, and energy production and conservation); Anderson, *Of Herdsmen and Nation States: The Global Environmental Commons*, 5 AM. U.J. INT'L L. & POL'Y 217 (1990) (discussing the need to reassess traditional notions of state sovereignty and the roles of international organizations in response to the degradation of the global commons).

435. See *supra* notes 45-48 and accompanying text (discussing land-based sources of plastic debris).

436. *Nat'l Ocean Policy Study Hearings*, *supra* note 4, at 16 (statement of Rear Admiral J. William Kime, United States Coast Guard) (borrowing an expression from the New Jersey Department of Environmental Protection and stating that the elements to solving the garbage problem at sea are the "three E's": engineering, education, and enforcement).

should accompany Annex V world-wide.⁴³⁷

Significant work remains for both individual nations and the IMO in broadening the jurisdiction of Annex V and amending it to facilitate enforcement and limit the hazards of at sea incineration. The United States, which waited for over fifteen years to ratify Annex V, now has the opportunity to lead nations in promulgating effective domestic regulations and proposing amendments to MARPOL that address unresolved environmental and enforcement difficulties. The dedication and success of these efforts may well determine the long-term effectiveness of Annex V in limiting the global economic and environmental impacts of marine plastics pollution.

437. See MEPC/25 *Draft Guidelines*, *supra* note 265, at para. 2 (recommending that nations institute training, education, and information programs to ensure a successful fight against marine plastics pollution); see also P. Debenham, *Education and Awareness: Keys to Solving the Marine Debris Problem* (1989) (presented at the Second International Conference on Marine Debris, Honolulu, Hawaii, Apr. 2-7, 1989) (stating that several international conferences have emphasized the need for educational programs to address the marine debris problem, including the 1984 International Conference on the Fate and Impacts of Marine Debris, the North Pacific Rim Fishermen's Conference on Marine Debris, and the Oceans of Plastic Fishermen's Workshop). Noting the difficulty in enforcing international and national legislation relating to marine plastics pollution, the Center for Marine Conservation has developed educational campaigns, publications, and hands-on educational events such as Coastweeks '88 beach cleanups in an effort to prevent the discharge of debris. *Id.*