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Stemming the Tide of Marine Debris Pollution: Putting Domestic and International Control Authorities to Work

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Stemming the Tide of Marine Debris Pollution: Putting Domestic and International Control Authorities to Work

Donald C. Baur*
Suzanne Iudicello**

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The debris from ships from hundreds of miles around is piled on this beach—mountains of sea-washed piles of it, mixed in with bottles and cans and pieces of clothing. It is the termination of some great sweeping in the Pacific.¹

INTRODUCTION

In July 1989, two Taiwanese fishing vessels slipped into United States waters in the North Pacific Ocean, apparently intent on poaching salmon.² The Sung Ching No. 1 and the Tong Foong No. 11, part of the Taiwanese squid fishing fleet, carried the plastic gillnets that are used to sweep ocean waters for commercially valuable marine life. Although highly efficient at catching salmon and squid, gillnets do not discriminate. As a result, each time a net is placed in the water it invariably entangles and drowns nontarget species of marine mammals, birds, and fish.

The Sung Ching and the Tong Foong became the target of an elaborate U.S. Government sting operation to apprehend outlaw fishing vessels. Government agents using a U.S. commercial cargo ship, the Redfin, lured the captains of the two vessels aboard with the prospect of a quick sale of salmon caught illegally in U.S. waters. While the captains bargained with the crew of the Redfin over prices, a U.S. Coast Guard cutter and C-130 aircraft arrived on the scene, prompting the Sung Ching and Tong Foong to run for international waters. As the cutter Morgenthau pursued the Sung Ching, the deputized Redfin chased the Tong Foong. In its attempt to escape, the crew of the Tong Foong threw a large section of its gillnet overboard in an unsuccessful attempt to foul the Redfin's propeller. Two and one-half days later, with the two captains imprisoned in the ship's temporary brig, the Redfin broke off the chase under orders to return to Alaska.

Although the skippers of the Tong Foong and Sung Ching are now under indictment³ for violating the Lacey Act,⁴ the Tong Foong's discarded net has not been accounted for. In all likelihood, it continues to drift in the North Pacific Ocean entangling and drowning any marine life it intercepts. Although this net entered the marine environment in an extraordinarily dramatic fashion, the environmental impact it causes is all too common. Indeed, lost and discarded plastic fishing nets are only one example of the debris that routinely enters coastal and marine waters. These items, ranging from plastic six-pack rings and food packag-

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ing to syringes and blood vials, pose an aesthetic nuisance, a threat to vessels and marine organisms and, in some cases, a public health risk.

In 1987, two important legal responses to the problem of marine debris pollution emerged. First, on December 31, 1987, the parties to the International Convention for the Prevention of Pollution from Ships ratified Annex V of the Convention's 1978 Protocol (MARPOL). Annex V prohibits the disposal of plastic and other forms of solid waste from ships. Second, the United States implemented Annex V domestically by enacting the Marine Plastic Pollution Research and Control Act (MPPRCA). This law governs the disposal of plastics and other debris from ships and the collection of such wastes for disposal at ports and terminals. In certain respects, MPPRCA goes beyond Annex V by directing federal agencies to study the marine debris pollution problem and to seek technological solutions. If these legal authorities are effective, a tremendous amount of solid waste previously dumped at sea should be retained aboard ships and disposed of on shore.

This Article discusses some of the steps that can and should be taken to begin this undertaking. The first section provides background information on the marine debris pollution problem. The second section reviews applicable domestic and international control authorities, emphasizing MPPRCA and Annex V of MARPOL. The third section sets forth recommendations for meeting the requirements of these authorities, implementing effective pollution control mechanisms, and achieving long-term solutions.

Controlling marine debris pollution will require a concerted effort by port authorities, shipping and cruise line companies, fishing interests, recreational boaters and beachgoers, waste management firms, the general public, and government agencies. Moreover, these efforts must be


6. Annex V, supra note 5, reg. 3(1)(a).


coordinated internationally. A vigorous domestic program by the United States will be an important contribution, but solid waste in the marine environment does not respect boundaries. This Article concludes that implementing and strengthening domestic and international control authorities can stem the tide of marine debris pollution.

I
THE NATURE AND SCOPE OF MARINE DEBRIS POLLUTION

A. Background

Only recently has it become apparent that inert plastic items and other forms of persistent debris pose a substantial threat to the marine environment. In 1984, in response to growing concerns about the effects of plastic and other persistent materials in the marine environment, the U.S. Marine Mammal Commission (MMC), the National Oceanic and Atmospheric Administration (NOAA), the U.S. Fish and Wildlife Service, and regional fishery management councils sponsored an international workshop on the fate and impact of marine debris. The proceedings provided a comprehensive review of the harmful effects of discarded plastic items on marine life and the marine environment.

Subsequent investigations have confirmed that plastic discarded in the marine environment causes a variety of harmful effects. Marine animals die from entanglement in plastic debris and ingestion of pieces of plastic. Fishery resources are depleted as derelict fishing gear continues to trap commercially valuable species of finfish and shellfish years after the gear has been lost. Coastal communities spend millions of dollars to clean beaches littered with plastic trash. The 1984 workshop also showed that existing ocean pollution laws had not effectively controlled the problems created by plastic and other forms of persistent marine debris.

10. The presentations at this workshop are included in Proc. of the Workshop on the Fate and Impact of Marine Debris (R. Shomura & J. Yoshida eds. 1985) [hereinafter Workshop Proc.].
12. Id.
13. See infra text accompanying notes 54-56 for a discussion of beach cleanup.

A followup to the 1984 workshop was held in Hawaii in April 1989. This session generated considerable new information on the extent of marine debris pollution and identified directions that should be taken to address the problem. The proceedings of the 1989 workshop are expected to be published sometime in 1990. Another important session dealing with this issue was the Sixth International Ocean Disposal Symposium held in April 1986. The papers presented at that symposium were published at 18 Marine Pollution Bull. 303 (1987).
Since the 1984 workshop, persistent marine debris has been recognized as one of our most significant environmental problems. In 1985, marine debris and the associated entanglement and ingestion of plastic by marine animals ranked near the bottom of a list of fifty priorities of the National Marine Pollution Program Office. By 1987, it was among the top five.

B. Types and Sources of Persistent Marine Debris

Persistent marine debris includes plastic, metals, petroleum byproducts (such as tarballs and other forms of viscous and solidified oil), glass, lumber, and paper products. Plastic is the principal nondegradable

15. The 1985 five-year plan gave low priority to the entanglement of marine life in debris and the ingestion of persistent debris particles by marine life. NATIONAL MARINE POLLUTION PROGRAM OFFICE, DEP’T OF COMMERCE, FEDERAL PLAN FOR OCEAN POLLUTION RESEARCH, DEVELOPMENT AND MONITORING FOR FISCAL YEARS 1985-1989, at 196-97 (1985) [hereinafter FIVE-YEAR PLAN]. Describing marine debris pollution as an "emerging issue," the FIVE-YEAR PLAN recommended that the National Oceanographic and Atmospheric Administration conduct research to evaluate the potential threats to wildlife. Id. at 315.


At the request of 30 senators, the White House in 1987 appointed an interagency task force to look into what the federal government was doing to address marine debris pollution. See Letter from 30 Senators to the President (Apr. 2, 1987); INTERAGENCY TASK FORCE ON PERSISTENT MARINE DEBRIS, REPORT OF THE INTERAGENCY TASK FORCE ON PERSISTENT MARINE DEBRIS, app. A. (1988) [hereinafter INTERAGENCY TASK FORCE REPORT]. The task force made five general recommendations to assist federal agencies in addressing marine debris pollution within existing budgetary and program constraints. The recommendations call for: (1) federal leadership and cooperation with other governmental bodies and private groups, (2) a public awareness and education program, (3) implementation of existing laws related to marine debris (4) beach cleanups, and (5) research aimed at identifying and quantifying the harmful effects of marine debris, identifying land-based sources, and assessing potential uses of degradable plastic products. Id. at 8-13.


17. See B. HENEMAN & CENTER FOR ENVIRONMENTAL EDUCATION, PERSISTENT
threat to the marine environment.\textsuperscript{18} The durability that makes plastic so convenient also makes it a persistent and nondegradable presence in the environment.\textsuperscript{19} In a survey conducted in 1984, fifty-six percent of all human source debris observed in the North Pacific Ocean was plastic.\textsuperscript{20} A 1979 survey in the Mediterranean Sea estimated that plastic accounted for sixty to seventy percent of the observed debris.\textsuperscript{21}

1. Ocean-Based Sources of Marine Debris

Although some materials, such as household products and food packaging, come from both onshore and ocean sources,\textsuperscript{22} much of the

\begin{itemize}
  \item Plastic items that affect the marine environment fall into one of two categories: (1) manufactured articles or (2) raw resin pellets or beads from which plastic articles are manufactured. Coleman & Wehle, \textit{Plastic Pollution: A Worldwide Oceanic Problem}, \textit{Parks}, Apr.-June 1984, at 9. Manufactured items such as bottles, food containers, nets, and six-pack rings are the visible signs of marine debris pollution. They also present the greatest threat of entanglement. Because they are small, plastic pellets present a major problem for birds and other animals that mistake them for food and ingest them. \textit{Id.}


  Dahlberg & Day, \textit{Observations of Man-made Objects on the Surface of the North Pacific Ocean}, \textit{Workshop Proc.}, \textit{supra} note 10, at 204. Foamed polystyrene accounted for 29.7\%. \textit{Id.}


  During Coast Weeks 1988 (a nationally coordinated program in which standardized data cards were provided to all cleanup programs), volunteers collected information on the types, sources, and amounts of coastal debris. These data are being compiled into a national "debris database." In past cleanups where similar data were gathered, the composition of the trash has been shown to be dependent on the type of marine activity in the offshore area. For example, Oregon cleanups have collected mostly items related to commercial fishing, while New York cleanup programs gather primarily items from land-based sources. \textit{Center for Environmental Education, Results of the Center for Environmental Education's Pilot Beach Cleanup at Sebastian Inlet State Recreation Area, Brevard County, Florida} 3 (1988). Beachgoers in Los Angeles County discard approximately 75 tons of trash each week. \textit{B. Heneman & Center for Environmental Education, supra} note 17, at xi.

  In Texas, where data have been collected systematically for several years, the composition of beach debris has been one-half plastic items—mostly plastic beverage containers—and one-half items composed of other materials, such as rubber, glass, metal, paper, and wood. \textit{Center for Environmental Education, Marine Debris on the Texas Coast} 67-82 (1988). One recent study reveals the following breakdown of principal sources of plastic debris in different areas: Alaska-67.1% fishing gear, 8.8% foamed polystyrene; Maine-27.4% foamed polystyrene, 13% bottles and containers, 11.5% fishing gear, 10.4% bags and sheets; Texas-
plastic debris from ocean-based sources is distinguishable from that which enters the marine environment from dry land. For example, discarded fishing gear usually originates at sea, while tampon applicators and plastic-lined diapers generally enter the ocean from land-based sources. Ocean-based sources include commercial fishing vessels, merchant shipping and passenger vessels, offshore oil and gas platforms, and military, recreational, and sport-fishing vessels. Worldwide, it is estimated that ocean sources generate more than 6.4 million metric tons of plastic debris per year.

Commercial fishing is heavily dependent on a variety of plastics used for traps, pots, buoys, ropes, floats, and nets. In particular, high seas fisheries in the North Pacific Ocean set over 20,000 miles of driftnet every night during the fishing season. Driftnets, which are composed of panels of plastic webbing, are suspended vertically in the water and are designed to catch fish by entanglement. Marine commercial fisheries discarded, on average, about 340,000 tons of plastic debris in 1975 alone.

Crew-and cargo-associated wastes from the world’s merchant shipping fleet also contribute substantially to persistent ocean debris. Merchant ships generate about 6 million metric tons of solid waste annually. Crew wastes include food packaging, containers for household items used at sea, six-pack rings, eating utensils, plates, and cups. Cargo wastes include dunnage, shoring, pallets, wire, and covers.

The U.S. Navy typically disposes of its crew-generated and operational wastes by dumping at sea. With about 600 vessels carrying approximately 285,000 people, the Navy produces more than 850,000 pounds of crew waste per day, including as much as 2,850 pounds of raw resin pellets, which are shipped worldwide, may escape during unloading and handling. They are also used as packing around larger items in ships' holds and to reduce friction while moving large items on deck.
plastic. The Navy is developing alternative means for handling shipboard wastes and is investigating a type of biodegradable bag used by the British Royal Navy.

Recreational boating and fishing wastes include monofilament fishing line, plastic bags and utensils, six-pack rings, and food-packaging materials. There are no estimates of the total amount of debris generated by recreational vessels. However, a 1988 statewide beach cleanup in Florida collected 231,500 pounds of plastic, including 305 miles of monofilament line, from 915 miles of beach.

Offshore oil and gas activities also generate plastic waste. Debris from this source consists of plastic sheeting, computer write-protect rings, seismic markers, drilling pipe thread protectors, diesel oil and air filters, and deck light bulbs.

2. Land-Based Sources of Marine Debris

Land-based sources of plastic debris include plastic manufacturers and processors, solid waste disposal sites, combined sewer overflows, sewer systems, litter, and illegal dumping. Evidence suggests that industries that produce plastic articles from resin pellets contribute to marine pollution by directly discharging pellets during manufacturing.

Municipal sewage systems contribute to persistent marine debris in three ways. First, floating items escape during periods of heavy rainfall when sewer systems and storm runoff systems are flooded and untreated material is swept away. Second, some primary and secondary treatment plants discharge wastewater without removing all floating material. Third, treatment processes do not filter off all plastic from sewage sludge that is dumped in the ocean.

A new threat to coastal areas became apparent in the summers of 1987 and 1988 when medical wastes washed ashore, resulting in beach

35. Id.
36. Id.
38. INTERAGENCY TASK FORCE REPORT, supra note 16, at 43, 51.
39. Id. at 41.
40. PLASTICS IN THE OCEAN, supra note 18, at 28. Sediment samples taken in rivers below outlet pipes from such factories frequently contain high concentrations of this material. Id.
41. Id.
42. Id.
closures and calls for congressional action. Oversight hearings in the House and Senate led lawmakers to conclude that improper handling and disposal were the primary sources of the syringes, blood vials, and other medical wastes that washed ashore.

About 3.2 million tons of medical waste are generated each year by hospitals alone. This figure—which represents two percent of the municipal waste stream—does not include wastes from private offices, clinics, and laboratories. Medical waste enters the marine environment from a variety of sources, including sewer outfalls, improper solid waste handling, wastewater discharges, and vessel use.

C. Environmental Impacts of Marine Debris and Plastic Pollution

1. Beach Degradation

The fouling of beaches and other coastal areas has been costly and controversial. Medical debris has produced the greatest outcry because as much as fifteen percent of medical waste is infectious and could pose public health risks. To date, however, there are no records of disease contraction from the accumulation of medical debris on beaches. The aesthetic impacts of syringes, blood bags, used bandages, and enema bottles are particularly offensive.

Regardless of potential health consequences, all forms of debris have aesthetic and economic costs. Many coastal communities must pay for their own routine beach cleanup. Local governments in Texas, for exam-

44. See Rockaway Reopens But a Residue of Mistrust Is Now Found Ashore, N.Y. Times, July 31, 1988, § 1, at 20, col. 1. See also The Dirty Seas, TIME, Aug. 1, 1988, at 44.
45. See, e.g., Regulation of Medical Waste: Hearings before the Subcomm. on Transportation, Tourism, and Hazardous Materials of the House Comm. on Energy and Commerce, 100th Cong., 1st and 2nd Sess. 2 (1988) (Statement of J. Winston Parker, Assistant Administrator for the Office of Solid Waste and Emergency Response, EPA). But see also Medical Wastes and Sewage Contamination: Hearings Before the Subcomm. on Fisheries and Wildlife Conservation and the Environment of the House Comm. on Merchant Marine and Fisheries, 100th Cong., 2d Sess. 79 (1988) (testimony of Langdon Marsh, Executive Deputy Commissioner of the New York State Department of Environmental Conservation) (“To date, we have no evidence of illegal dumping of medical wastes into coastal waters.”). Apparently, many of the syringes were of the type used at home by diabetics and might have come from sewer systems. K. O’HARA, supra note 37, at 24.
47. Id. The report notes that the amount of medical waste being generated is increasing rapidly. Id.
48. Id. at 29.
49. INTERAGENCY TASK FORCE REPORT, supra note 16, at 14-36.
50. See MEDICAL WASTE POLICY COMMITTEE, supra note 46, at 1, 6.
51. Id. at 6.
ple, spend approximately $14 million per year to clean their beaches. In New Jersey, a marine police unit of sixty to seventy officers based in New York Harbor enforces dumping regulations. In Newport, Oregon, the city provides receptacles for recyclable materials to encourage recycling and proper disposal.

While cleanup is expensive, the economic impact on tourism and related industries may be far greater. The strong negative public reaction to debris washing ashore on Long Island and in New Jersey in recent summers demonstrates the economic consequences of debris-littered coastlines. In Long Island, beach closures due to medical wastes and the subsequent drop in tourism cost the local economy an estimated $921.2 million in 1987 and 1988. The seafood industry has also been affected. In response to public concern about contamination, fish prices were depressed in 1987-88, producing an economic loss estimated at $24 million in New York.

2. Vessel Damage

Vessels may be damaged when plastic sheeting, lines, or pieces of net foul propellers and clog water intake valves. Propellers have been fouled in lost gillnets, wrapped in garbage bags or large pieces of sheeting, and tangled in strands of monofilament line. There is even a report

55. Id. at 85.
56. Id. at 86.

In mid-July, which should have been the peak of the tourism season along the New Jersey coast, rentals and revenues were down as much as 50-60% because of pollution-caused beach closures. Svitek, supra note 57, at A.2.

59. Svitek, supra note 57, at A.3 (citing Waste Management Institute, State University of New York at Stonybrook, Use Impairments and Ecosystem Impacts of the New York Bight (1989)).

60. Interviews with commercial fishermen at one port in Oregon reported losses of about $1,000 per vessel each year as a result of marine debris damage. Washington Action Plan, supra note 9, at 7. See Carr, Hulbert & Amaral, Underwater Survey of Simulated Lost Demersal and Lost Commercial Gill Nets Off New England, Workshop Proc., supra note 10, at 438-47.

61. Plastics in the Ocean, supra note 18, at 47-48.
of a submarine becoming entangled in a discarded gillnet and sustaining $6,000 in damage.⁶²

Information about these occurrences is mostly anecdotal, but advertising, which is presumably market driven, reflects the problem. Boat supply manufacturers, for example, now tout products that cut through monofilament line, nylon net, and rope.⁶³

3. Marine Wildlife Injury

The impacts of plastic marine debris on marine organisms are pronounced and thoroughly documented.⁶⁴ Seals and sea lions appear to be hurt the most, partly as a consequence of their tendency to investigate floating objects.⁶⁵ They may become immobilized and drown, incur wounds and infections, or have trouble feeding and swallowing.⁶⁶ Although the number of animals affected is unknown, the level of mortality and serious injury appears to be significant: an estimated 50,000 fur seals from the Pribilof Islands population in the North Pacific Ocean die each year as a result of entanglement in marine debris.⁶⁷

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⁶² INTERAGENCY TASK FORCE REPORT, supra note 16, at 34.
⁶³ PLASTICS IN THE OCEAN, supra note 18, at 49.

⁶⁵ Laist, supra note 64, at 329. See also Fowler, supra note 64, at 18-31.
⁶⁶ Wallace, supra note 64, at 268-69. See also Fowler, supra note 64, at 302-03; Hoover, supra note 64, at 175-76; Scordino, supra note 64, at 283. The majority of the incidents of Steller sea lion entanglement are caused by closed packing bands and net material. Hoover, supra note 64, at 175.
Like marine mammals, birds and sea turtles also become entangled in monofilament fishing line and common domestic debris. Birds also ingest plastic debris, small plastic pellets, and other fragments floating in the water that resemble food items. Debris ingestion may interfere with normal eating and digestion. The resulting malnutrition can cause long-term physical deterioration and decreased reproductive performance.

Debris also threatens fish and shellfish that are important to commerce and recreation. In particular, lost or abandoned driftnets, trawl nets, traps, and pots continue to "fish" after they become derelict. When "ghost nets" eventually sink, they may continue to trap crab and other commercially valuable benthic species indefinitely. Data on the mortality of nontarget species is sparse. A 1989 Commerce Department report to Congress indicated serious damage to the ocean environment, but could not quantify the extent of the impact of driftnet fisheries. The most reliable information available covers the Japanese high seas salmon driftnet fishery. In that fishery, an estimated average of 2,335 Dall's porpoises and 165,000 seabirds died every year.

68. See Piatt & Nettleship, Incidental Catch of Marine Birds and Mammals in Fishing Nets Off Newfoundland, Canada, 18 MARINE POLLUTION BULL. 344 (1987); Schrey & Vauk, Records of Entangled Gannets (sula bassana) at Helgoland, German Bight, 18 MARINE POLLUTION BULL. 350 (1987); Wallace, supra note 64, at 266.

69. See, e.g., Wallace, supra note 64, at 266-68.

70. See Day, Wehle & Coleman, supra note 64, at 359; see also Fry, Fefer & Sileo, supra note 64, at 339; Furness, supra 64, at 103-06; Hays & Cormons, supra note 64, at 44; Van Franeker, supra note 64, at 367-69.

71. Day, Wehle & Coleman, supra note 64, at 374-76.

72. See, e.g., Wallace, supra note 64, at 270-71. Other types of commercial losses can occur. For example, certain seabird species are harvested commercially for meat, eggs, and stomach oil. Id. Guano production from marine birds also could be affected in certain areas if large numbers of birds are killed because of entanglement. Id. Pots and traps that are lost present a similar threat by reducing the available supply of crab and other shellfish. See WASHINGTON ACTION PLAN, supra note 9, at 8.


74. This figure, which was derived as a result of monitoring conducted pursuant to a Marine Mammal Protection Act incidental take permit for salmon fishing, represents the average take between 1981 and 1987. See MARINE MAMMAL COMMISSION, 1988 ANNUAL REPORT OF THE MARINE MAMMAL COMMISSION 159 (1989). These deaths occurred before the fishery was prohibited from operating in the U.S. Exclusive Economic Zone when a Marine Mammal Protection Act incidental take permit could not be obtained. To fish in the U.S. Exclusive Economic Zone, the Japanese fisheries needed authorization under the Marine Mammal Protection Act to permit incidental takes of Dall's porpoises, northern fur seals, and northern sea lions. When the National Marine Fisheries Service reissued the Japanese salmon fishing federation's permit, it only dealt with the incidental taking of Dall's porpoises. The failure to obtain authorization to take the other marine mammals resulted in litigation that
II
THE LEGAL RESPONSE TO MARINE DEBRIS POLLUTION

Three categories of laws apply directly or indirectly to marine debris pollution: authorities that govern dumping and waste disposal at sea, authorities that regulate water quality and land-based disposal of wastes, and fish and wildlife conservation authorities. This section discusses the more important international and domestic authorities in these categories, including recent legislation in the United States directed precisely at persistent marine debris.

A. International Authorities

International authorities concerned with ocean dumping and marine debris include the London Dumping Convention (LDC),\(^7\) the International Convention for the Prevention of Pollution from Ships and its 1978 Protocol (MARPOL),\(^6\) agreements concluded under the United Nations Regional Seas Programme and other regional agreements,\(^7\) and the Law of the Sea Convention.\(^7\) MARPOL is the most significant of these, but each authority plays an important role. MARPOL addresses the disposal of wastes incidental to ship operations.\(^7\) The LDC covers ocean dumping and waste disposal.\(^8\) The Law of the Sea Convention and regional agreements cover all aspects of the problem, including wastes from land-based sources.\(^8\)

I. Convention for the Prevention of Pollution from Ships (MARPOL)

Maritime and coastal nations sought to control operational wastes from vessels through the International Convention for the Prevention of Pollution from Ships of 1973, the MARPOL Convention.\(^8\) After the


76. MARPOL, supra note 5.

77. See infra text accompanying notes 113-42.


80. Id. at 91.

81. Id. at 83.

82. MARPOL, supra note 5. The Convention, which was negotiated through the Intergovernmental Maritime Consultative Organization, now referred to as the International Maritime Organization, seeks to eliminate ship source pollution. The International Maritime Organization is a specialized agency of the United Nations.

While MARPOL is primarily an outgrowth of dissatisfaction with existing regulatory
1973 agreement failed to enter into force, the parties agreed to the 1978 MARPOL Protocol. This Protocol incorporated the 1973 agreement with some revision and is now the recognized text of the Convention. The MARPOL Protocol entered into force in 1983. Fifty-four nations representing a substantial portion of the world’s merchant fleet are signatories.

Each of the five regulatory annexes to MARPOL deals with a different kind of pollution. Plastic pollution falls under Annex V, “Regulations for the Prevention of Pollution by Garbage from Ships.” The United States ratified Annex V in 1987 and it entered into force internationally on December 31, 1988. It is now binding on the member nations. Each country is to implement the Annex through domestic legislation.

Annex V prohibits the disposal of any plastics, including synthetic ropes, fishing nets, and plastic garbage bags, in the sea. It also regu-
lates disposal of garbage from ships into the sea. Floatable nonplastic dunnage, lining, and packing materials may not be disposed of within twenty-five nautical miles of the nearest land,90 and disposal of food wastes and all other garbage is prohibited within twelve nautical miles.91 “Garbage” includes “all kinds of victual, domestic and operational waste excluding fresh fish and parts thereof, generated during the normal operation of the ship and liable to be disposed of continuously or periodically.”92 When refuse is mixed with other harmful substances having different disposal or discharge requirements, the more stringent provisions apply.93 The discharge provisions exempt (1) disposal necessary for the safety of the ship and those on board or saving life at sea, (2) escape resulting from damage to a ship or its equipment, and (3) accidental loss of synthetic fishing nets or synthetic material incidental to repair.94

Annex V prohibits disposal of all plastics, paper products, rags, glass, metal, bottles, crockery, dunnage, lining, and packing materials in “special areas” of environmental sensitivity.95 Food wastes must be discarded “as far as practicable” from lands bordering these special areas, but not less than twelve miles.96 Nations that border special areas must provide reception facilities as soon as possible.97 The special areas currently designated under Annex V are the Mediterranean Sea, Black Sea, Baltic Sea, Red Sea, and the “Gulfs Area” between Iran and the Arabian Peninsula.98

The Annex V prohibitions apply to all ships registered with party governments or within the jurisdiction of a party state.99 They also apply to platforms engaged in mineral exploration, exploitation, and associated offshore processing.100

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90. “Nearest land” is defined as the distance from land measured from the baseline from which the territorial sea of the territory in question is established. Annex V, supra note 5, reg. 1(2).
91. Id. reg. 3(1)(b)(ii).
92. Id. reg. 1(1).
93. Id. reg. 3(2). For example, when food waste and floating materials are mixed together, disposal restrictions for floating materials apply. Id.
94. Id. reg. 6. An amendment deleting the exception for material lost during repair has tentatively been approved. See MARINE MAMMAL COMMISSION, 1989 ANNUAL REPORT OF THE MARINE MAMMAL COMMISSION 132 (1990).
95. Id. reg. 5(2)(a). A special area is defined as “a sea where for recognized technical reasons in relation to its oceanographical and ecological condition and to the particular character of its traffic the adoption of special mandatory methods for the prevention of pollution by garbage is required.” Id. reg. 1(3).
96. Id. reg. 5(2)(b).
97. Id. reg. 5(4)(a).
98. Id. reg. 5(1). The North Sea has tentatively been added to this list. MARINE MAMMAL COMMISSION, supra note 94, at 132.
99. Id. reg. 2.
100. Except for disposal of ground food wastes, Annex V prohibits all garbage disposal from offshore platforms or ships alongside or within 300 meters of such platforms. Id. reg. 4(1).
Under Marpol, the flag state maintains primary responsibility for regulating its ships and enforcing Annex V regulations, but a coastal state has exclusive jurisdiction within its territorial waters, except for innocent passage. This jurisdictional division results in an uneven application of requirements because some flag states traditionally have been lax in enforcement. Convenience flag nations may not be party to MARPOL or may choose not to enforce it vigorously. This fundamental problem arises in many multilateral marine pollution agreements and points to the need for centralized international enforcement mechanisms.

Annex V also specifies that governments party to the Convention must provide "facilities at ports and terminals for the reception of garbage, without causing undue delay to ships, and according to the needs of the ships using them." The Marine Environment Protection Committee of the International Maritime Organization has developed Annex V compliance guidelines designed to assist port officials in determining whether their facilities are adequate and to encourage member nations to undertake studies of reception facilities and disposal technology. The guidelines provide methods for calculating the types and quantities

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101. See MARPOL, supra note 5, art. II, § 5, art. III, § 1; see also Manheim, supra note 79, at 103. The "flag state" is the state of registry for the vessel. Id. The United States is the flag state for its registered merchant and recreational vessels. As a result, U.S. law applies to these vessels wherever they are located. MPPRCA, 33 U.S.C. § 1902(a)(1) (1982 & Supp. V 1987).

102. See Law of the Sea Convention, supra note 78, arts. 2, 17; see also Manheim, supra note 79, at 103. A ship's passage through foreign waters is innocent so long as the ship does not engage in fishing, smuggling, wilful and serious pollution, spying, surveying, military activity, or any other action not related to actual passage. See Law of the Sea Convention, supra note 78, arts. 18-19.

103. See, e.g., Manheim, supra note 79, at 73 (noting that the Annex has been largely ignored for the last 15 years).

104. Wang, supra note 83, at 331-33. Because some nations are more lenient in their registration requirements, they become flag states "of convenience." Merchant and fishing vessels owned by foreigners may register in convenience flag nations such as Panama or Liberia. Id.

105. Annex V, supra note 5, reg. 7(1).

106. The International Maritime Organization consists of states (127 as of 1985) with a special interest in maritime affairs. Since its organization in 1959, it has adopted multilateral treaties on a number of subjects concerned especially with the safety of shipping and the prevention of pollution from ships. International Maritime Organization, Focus on IMO (August 1985).


108. Id. §§ 6.3.2, 6.3.2.1 to 6.3.2.3. The Annex V contracting parties are urged, "at the earliest opportunity," to initiate studies of the adequacy of facilities in their respective countries and to consider alternatives appropriate to each particular offloading location. Id. § 6.3.2.2 to 6.3.2.3. Such alternatives might include special handling procedures, recycling options, and devices to contain debris spilled at port.
of garbage that vessels are likely to generate. Factors used to determine the quantity of garbage on a per ship basis include the ship type and design, the number of persons on board, and the time spent in port. The guidelines are useful, but make only general recommendations rather than providing specific guidance. Moreover, the guidelines lack the force and effect of binding commitments. As a result, they have not prompted aggressive action on the part of member states.

2. Regional Conventions

The United Nations Environment Program (UNEP) Regional Seas Programme is designed to assess the quality of a region's marine environment and the causes of its deterioration and to direct actions aimed at combating environmental problems. Regional agreements developed under UNEP include the Barcelona Convention (for the Mediterranean Sea), the Kuwait Regional Convention for Cooperation on the Protection of the Marine Environment from Pollution, the Jeddah Regional Convention for the Red Sea and Gulf of Aden Environment, the Convention for the Protection of the Marine Environment and Coastal Area of the South-East Pacific, the Abidjan Convention for the West and Central African Region, and the Caribbean Convention.

109. Id. § 6.3.
110. Id. §§ 6.3.1.2, 6.3.1.4, 6.3.1.7.
111. Manheim, supra note 79, at 106-07.
112. Id. at 111.
The UNEP Regional Seas Programme focuses on areas that are significantly vulnerable to environmental degradation.\textsuperscript{115} Regional boundaries were drawn to reflect physical and geographic characteristics.\textsuperscript{116} The basic approach is for member nations to enter into a convention that prescribes a general framework for the region with appropriate supplementary protocols to cover specific issues.\textsuperscript{117} Comprehensive regional plans can then be developed to achieve convention objectives.\textsuperscript{118} The entire program reflects the premise that issues related to the marine environment can best be addressed if all of the countries with an interest in the affected area cooperate toward common ends. In this regard, the UNEP Regional Seas Programme has catalyzed regional consideration of marine pollution concerns.

The Caribbean Convention is a typical regional seas agreement. It provides a cooperative mechanism through which coastal states may formulate regional strategies to reduce and control pollution in the convention area.\textsuperscript{119} Parties to the Convention have agreed to conclude bilateral or multilateral agreements for protection of the marine environment.\textsuperscript{120} The parties also agreed to take all appropriate measures to prevent, reduce, and control pollution from ships,\textsuperscript{121} dumping,\textsuperscript{122} and coastal disposal or discharges from internal waters.\textsuperscript{123}

As an important step in the Convention, the contracting parties have agreed to pursue two protocols relevant to marine debris.\textsuperscript{124} One protocol concerns specially protected areas and wildlife; the other addresses land-based sources of pollution.\textsuperscript{125}

The draft Protected Areas and Wildlife Protocol contains several provisions pertinent to marine debris. For example, it would obligate each party to “regulate and, where necessary, prohibit activities having adverse effects on [designated] areas and species.”\textsuperscript{126} Measures to safe-

\begin{enumerate}
\item \textsuperscript{115} Johnston & Enomoto, \textit{supra} note 113, at 325.
\item \textsuperscript{116} \textit{Id.}
\item \textsuperscript{117} \textit{Id.}
\item \textsuperscript{118} \textit{Id.}
\item \textsuperscript{119} Caribbean Convention, \textit{supra} note 114, art. 4, § 1. To date, the party nations to the Caribbean Convention that also have ratified Annex V are the Bahamas, Panama, St. Vincent and Grenadines, France, the United Kingdom, and the United States. \textit{See} United States Ratification of Annex V of the MARPOL Convention, \textit{supra} note 86, at 133.
\item \textsuperscript{120} Caribbean Convention, \textit{supra} note 114, art. 3, § 1.
\item \textsuperscript{121} \textit{Id.} art. 5.
\item \textsuperscript{122} \textit{Id.} art. 6.
\item \textsuperscript{123} \textit{Id.} art. 7.
\item \textsuperscript{124} UNEP, \textit{REPORT OF THE SECOND MEETING OF EXPERTS FOR THE DEVELOPMENT OF A PROTOCOL CONCERNING SPECIALLY PROTECTED AREAS AND WILDLIFE TO THE CONVENTION FOR THE PROTECTION AND DEVELOPMENT OF THE MARINE ENVIRONMENT OF THE WIDER CARIBBEAN REGION} I (1989) [hereinafter UNEP CARIBBEAN REPORT].
\item \textsuperscript{125} \textit{Id.}
\item \textsuperscript{126} Draft Protocol Concerning Specially Protected Areas and Wildlife to the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Re-
\end{enumerate}
guard protected areas would include the "regulation or prohibition of the
dumping or discharge of wastes and other substances,"127 the "regulation
or prohibition of coastal disposal or discharges causing pollution,"128 and
the regulation of other ship activities that would have adverse environ-
mental effects.129 Similar measures are directed to protect listed spec-
ies.130 The Protocol would also obligate the parties to draft
management plans and guidelines to ensure the quality of protected
areas,131 to develop public awareness programs,132 and to participate in
cooperative scientific, technical, and management measures to achieve
the Protocol's objectives.133 All of these provisions could be the basis for
undertaking marine debris control efforts.

There are other regional agreements, in addition to UNEP pro-
grams, that are applicable to the persistent marine debris problem. Twel-
ve European countries entered into the Convention for the Preven-
tion of Marine Pollution by Dumping from Ships and Aircraft, com-
monly known as the Oslo Convention.134 The Oslo Convention covers
the Northeast Atlantic Ocean, the North Sea, and parts of the Baltic and
Mediterranean Seas.135 It prohibits the dumping of specified harmful
substances listed in its annex I, including plastics, subject to limited ex-
ceptions.136 The Convention prohibits the dumping of shipping contain-
ers, scrap metal, tar-like substances, and several poisons, unless a permit
is obtained from the "appropriate national authority or authorities."137
Permits may be granted only after compliance with annex III criteria
limiting dumping locations, waste characteristics, and potential interfer-
ence with other legitimate uses of the covered regional area.138 The Con-
vention prohibits all other dumping unless the relevant national

gion, art. 3.2, reprinted in UNEP CARIBBEAN REPORT, supra note 124, annex V, at 6 [hereina-
fter Draft Protocol].
127. Id. art. 5.2(a), reprinted in UNEP CARIBBEAN REPORT, annex V, at 8.
128. Id. art. 5.2(b).
129. Id. art. 5.2(c) (alternative 2).
130. Id. arts. 10-11, reprinted in UNEP CARIBBEAN REPORT, annex V, at 12-15.
131. Id. art. 6.2(a), reprinted in UNEP CARIBBEAN REPORT, annex V, at 9.
132. Id. art. 6.2(d).
133. Id. art. 18, reprinted in UNEP CARIBBEAN REPORT, annex V, at 18.
134. The Oslo Convention was executed in 1972 and entered into force in 1974. Conven-
tion for the Prevention of Marine Pollution by Dumping from Ships and Aircraft, Feb. 15,
1972, 932 U.N.T.S. 3, reprinted in 11 I.L.M. 262 (1972). The parties are: Belgium, Denmark,
Federal Republic of Germany, Finland, France, Iceland, the Netherlands, Norway, Portugal,
Spain, Sweden, and the United Kingdom. Id.
135. Id. art. 2.
136. Id. art. 5. Other substances listed in annex I include cadmium, mercury, toxic organ-
ohalogen and organosilicon compounds, and carcinogens. Id. annex I.
137. Id. art. 6.
138. Id. annex III.
authority grants approval. If such approval is obtained, the annex III criteria apply.

The parties to the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) agreed to several actions related to marine debris. These include inventorying and marking nets, recording lost gear, collecting derelict gear, conducting marine debris surveys, and posting shipboard notices of the prohibition on intentional disposal of plastics and other wastes. As these requirements only recently came into effect, they have yet to be tested. Nonetheless, since identifying the source of debris is essential for enforcement, gear marking should be a major step in controlling waste disposal at sea. The success of the CCAMLR gear-marking program may help guide similar efforts under other authorities. Due to the importance of public education in reducing debris, the posting requirement should also yield positive results.

These regional agreements reflect the fundamental importance of cooperative international efforts and the focus on regional responses to address marine pollution. However, standing alone they are insufficient to reduce marine debris contamination significantly. To date, they have been directed primarily at other pollution problems, such as deliberate ocean dumping, and are not always enforced stringently. Furthermore, the agreements do not cover sufficient oceanic and coastal areas.

To be more effective, regional efforts should focus control and enforcement mechanisms directly on the marine debris pollution problem in a manner similar to that used in Annex V of MARPOL. Although

139. Id. art. 7.

140. Id. Denmark, Finland, the German Democratic Republic, Poland, the Soviet Union, and Sweden entered into the Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention). Convention on the Protection of the Marine Environment of the Baltic Sea Area, done at Helsinki, 1974, reprinted in 13 I.L.M. 546. The Helsinki Convention generally parallels the London Dumping Convention, but it is not limited to ships and it prohibits dumping related to seabed mining. Id. arts. 3, 10. This agreement was entered into pursuant to article VIII of the London Dumping Convention, which encourages individual signatories to execute regional agreements. Id. annex VI. The Barcelona Convention concerning the Mediterranean Sea, supra note 114, was also entered into pursuant to article VIII even though its secretarial functions are carried out through UNEP as part of the Regional Seas Programme.

141. Convention on the Conservation of Antarctic Marine Living Resources, done May 20, 1980, 80 Stat. 10240, T.I.A.S. 837 [hereinafter CCAMLR]. Twenty-one parties participate in the Convention. The original purpose of the Convention was to regulate krill harvests, but it applies to all living marine resources of the Antarctic region. Steps taken pursuant to CCAMLR are intended to prevent any decrease in the size of harvested populations to levels below those which ensure stability, maintain related ecological systems and restoration of depleted populations, and prevent changes or minimize the risk of changes to the marine ecosystem. Id. art. II(3).

142. COMMISSION FOR THE CONSERVATION OF ANTARCTIC MARINE LIVING RESOURCES, REPORT OF THE SEVENTH MEETING OF THE COMMISSION, paras. 28-30 (1988). See CCAMLR, supra note 141, art. IX.
not specifically directed at the gear problem, the Specially Protected Areas and Wildlife Protocol to the Caribbean Convention could and should serve as a prototype for using regional agreements to establish the type of obligations and action-forcing mechanisms needed to address marine debris pollution. Even this protocol, however, is not directed specifically at the debris problem.

3. The London Dumping Convention

One of the earliest noteworthy international agreements to address refuse disposal in the marine environment was the London Dumping Convention, which entered into force in 1977. The London Dumping Convention prohibits the dumping of wastes at sea, unless a permit is issued. Certain wastes, listed in annex I of the Convention, cannot be dumped at all. Included in annex I are "persistent plastics and other persistent synthetic materials, for example, netting 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." Thus, the London Dumping Convention prohibits the disposal of many items that are the principal causes of entanglement and other adverse environmental effects.

A limitation of the London Dumping Convention is that "dumping" is defined as "any deliberate disposal at-sea." As a result, the London Dumping Convention does not regulate all sources of plastic pollution and other debris because its provisions apply only to waste carried to sea for the purpose of disposal. Arguably, the London Dumping Convention does not cover the disposal of wastes generated during the routine operation of ships, apparently a greater source of marine debris than ocean disposal of land-generated wastes. Strict enforcement of the London Dumping Convention, however, might make an important contribution by keeping much persistent waste generated on shore from being dumped at sea along with sewage sludge and other permitted wastes.

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143. Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, supra note 75. The purpose of the London Dumping Convention is to promote the "effective control of all sources of pollution of the marine environment . . . by [prohibiting] dumping of waste and other matter that 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. art. I.
144. Id. art. IV, § 1.
145. Id. art. IV, § 1(a).
146. Id. annex I, § 4.
147. Id. art. III, § 1(a).
148. See Bean, supra note 14, at 33.
149. See, e.g., Johnson, Deposition of Entanglement Debris on Alaskan Beaches, in FISHERMEN'S CONF. PROC., supra note 19, at 207, 211.

The Third United Nations Conference on the Law of the Sea produced the Convention on the Law of the Sea.\textsuperscript{150} Even though the Law of the Sea Convention is not in force, and the United States is not a signatory,\textsuperscript{151} it is widely accepted as a codification of customary international maritime law and carries considerable moral force.\textsuperscript{152} Thus, as one commentator has noted, "while not offering any new basis for resolution of the entanglement problem, [the Law of the Sea Convention] may be useful by giving added force and legitimacy" to other efforts.\textsuperscript{153} Given the support it has from many nations, the Convention probably will come into force some day. Its marine pollution provisions then will become even more important.

The Law of the Sea Convention requires that parties take all measures necessary to prevent pollution of the sea from any source.\textsuperscript{154} In this regard, it is far broader than any existing international agreement. Each coastal state has the right to determine appropriate measures to maintain its marine resources\textsuperscript{155} and to protect and preserve the marine environment within its Exclusive Economic Zone.\textsuperscript{156} All states must comply with the coastal state's regulations, including those applying to vessels and equipment.\textsuperscript{157} Coastal states must, however, continue to respect the

\begin{footnotesize}
\begin{itemize}
\item \textsuperscript{150} Law of the Sea Convention, \textit{supra} note 78, art. 194 (1). \textit{See J. Kindt, supra} note 113, at 194-203.
\item \textsuperscript{151} The Reagan administration opposed the Convention's provisions on deep seabed mining and refused to sign. Nevertheless, President Reagan announced that the U.S. accepted most of the provisions of the Convention as customary international law. President's Statement on United States Ocean Policy, 19 \textit{WEEKLY COMP. PRES. DOC.} 383 (Mar. 10, 1983).
\item \textsuperscript{152} Before the 1972 Stockholm Conference, the international law of the sea regarding pollution derived principally from the 1958 Convention on the High Seas, which imposed general obligations on states to regulate discharges of oil from ships or pipelines and to take measures to prevent pollution from the dumping of radioactive wastes. Convention on the High Seas, \textit{done} Apr. 29, 1958, 13 U.S.T. 2312, T.I.A.S. No. 5200, 450 U.N.T.S. 82. \textit{See also} Convention on the Continental Shelf, \textit{done} Apr. 29, 1958, 1 U.S.T. 471, T.I.A.S. No. 5578, 499 U.N.T.S. 311 (art. 5.1 activities shall not interfere unjustifiably with the conservation of living resources of the sea); Convention on Fishing and Conservation of the Living Resources of the High Seas, \textit{done} Apr. 29, 1958, 1 U.S.T. 138, T.I.A.S. No. 5969, 559 U.N.T.S. 285 (art. 1, parties have the duty to adopt measures to conserve living resources of the high seas).
Multilateral and regional conventions, such as the London Dumping Convention and the Oslo Convention, along with the principles established at Stockholm, served as the framework for the development of a comprehensive marine environmental protection regime during the Law of the Sea Convention. \textit{See Manheim, supra} note 79, at 83.
\item \textsuperscript{153} Bean, \textit{supra} note 14, at 39.
\item \textsuperscript{154} Law of the Sea Convention, \textit{supra} note 78, art. 194(1). The Convention also directs contracting parties to prevent or control all pollution, which is defined as "the introduction by man, directly or indirectly, of substances . . . into the marine environment . . . which results or is likely to result in such deleterious effects as harm to living resources and marine life." \textit{Id.} art. 1.1(4).
\item \textsuperscript{155} \textit{Id.} art. 61.
\item \textsuperscript{156} \textit{Id.} art. 56, § 1(b)(iii).
\item \textsuperscript{157} \textit{Id.} art. 62.
\end{itemize}
\end{footnotesize}
navigation rights of vessels and not impair the "right of innocent passage."158 Flag states are responsible for regulating vessel source pollution on the high seas.159

The Law of the Sea Convention imposes a duty to establish international rules and standards to prevent, reduce, and control pollution from vessels.160 Member states must act to conserve living resources,161 and states must also adopt laws and regulations to prevent, reduce, and control pollution by dumping162 and from land-based sources.163

Should the Law of the Sea Convention enter into force, these provisions will serve as the basis for taking additional steps to regulate marine debris pollution. In the meantime, the Convention assumes significance for four reasons. First, by preserving navigational rights and protecting the right of "innocent passage" as a fundamental principle of international law, the Law of the Sea Convention prevents that issue from impeding pollution control efforts. International negotiations frequently break down in the face of unresolved concerns about navigational rights.164 Preserving navigational rights eliminates a hurdle that pollution control negotiations would otherwise have to overcome.

Second, the Law of the Sea Convention enumerates a general framework for addressing all aspects of marine pollution, including persistent debris. Third, it recognizes that individual states have an affirmative duty to protect the global marine environment.

Finally, it recognizes the need for a centralized international body that can establish rules and standards for controlling marine pollution.165

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158. Id. art. 15.
159. Id. arts. 211, 217.
160. Id. art. 211.
161. Id. art. 117.
162. Id. art. 210. The Law of the Sea Convention, like the London Dumping Convention, defines dumping as deliberate disposal, and excludes disposal incidental to normal operations of vessels. Id. arts. 1.1(5)(a), 1.1(5)(b)(i).
163. Id. art. 213.
164. An example of this problem is presented by the negotiations over the Specially Protected Areas and Wildlife Protocol of the Caribbean Convention. The United States communicated its unwillingness to enter a protocol that would not provide adequate safeguards for navigational rights. The United States proposed, as an alternative, that Law of the Sea Convention language protecting navigational rights be used. However, several Caribbean countries objected to this language. See UNEP CARIBBEAN REPORT, supra note 124, at 5, annex V, at 8. At the January 1990 Conference of the Plenipotentiaries, the parties resolved the problem by referencing certain terms used in the Law of the Sea Convention that define navigational rights. See Final Act of the Conference of the Plenipotentiaries Concerning Specially Protected Areas and Wildlife in the Wider Caribbean Region art. 5(2)(c) (January 15-16, 1990). As a result, the parties adopted the Protocol. Telephone interview with Miranda Wecker, Council on Ocean Law, World Resources Institute (Feb. 2, 1990).
165. Law of the Sea Convention, supra note 78, art. 211(5). Article 211(5) requires that coastal state regulations for the control of vessel source pollution should be consistent with "generally accepted international rules and standards established through the competent international organization or general diplomatic conference." Id.
The International Maritime Organization has assumed this position and thus can help lead the pursuit of marine pollution control.\textsuperscript{166} The International Maritime Organization is already playing an important role in setting guidelines for marine debris under MARPOL's Annex V.\textsuperscript{167}

By encompassing all forms and sources of marine pollution, the Law of the Sea Convention presents the kind of comprehensive approach that source-specific and geographically-specific conventions lack. Moreover the Law of the Sea Convention affirms that preventing marine pollution is a global responsibility. The general duties established by the Law of the Sea Convention are not likely to supplant MARPOL for controlling vessel-related pollution or the London Dumping Convention for regulating ocean dumping. Nonetheless, the Law of the Sea Convention obligations could fill important gaps in the current regulatory regime, for example, by addressing pollution from land-based sources and by giving greater weight to International Maritime Organization recommendations. Finally, the Convention should serve as the springboard for additional cooperative efforts in enforcement, scientific assessment, and financial and technical assistance.

\subsection*{B. Domestic Marine Debris Legislation Enacted Since 1986}

After recognizing that existing legal tools did not adequately control marine debris pollution, Congress in 1987 passed two laws specifically directed at the problem: the Marine Plastic Pollution Research and Control Act (MPPRCA)\textsuperscript{168} and the Driftnet Impact Monitoring, Assessment, and Control Act (Driftnet Act).\textsuperscript{169} MPPRCA is the more sweeping of the two. It is aimed at regulating the major types of marine debris pollution, especially plastics. The Driftnet Act, on the other hand, focuses on the taking of United States marine resources by large-scale, pelagic driftnets; it also addresses lost and discarded materials.\textsuperscript{170} In 1988, Congress enacted the Shore Protection Act\textsuperscript{171} and two statutes controlling medical waste.\textsuperscript{172} These statutes represent the principal fed-

\textsuperscript{166} The International Maritime Organization is commonly recognized as the article 211(5) "competent international organization." See Boyle, supra note 82, at 361.

\textsuperscript{167} See supra text accompanying notes 107-12.


\textsuperscript{170} Id. The Act attempts to improve the federal response to adverse impacts on the marine resources by both active driftnet fishing and lost and discarded driftnets. This Article addresses only those provisions of the Driftnet Act that relate to lost and discarded driftnet material.


eral statutory responses specifically directed at the marine debris problem.

I. The Marine Plastic Pollution Research and Control Act (MPPRCA)

MPPRCA represents a comprehensive statement by Congress that marine debris, particularly plastic, requires a coordinated federal response. MPPRCA amends the Act to Prevent Pollution from Ships (APPS), which implemented Annexes I and II of MARPOL. MPPRCA addresses the marine debris problem in four ways. First, the Act regulates pollution generated by ships. Second, the Act requires adequate reception facilities at ports and terminals. Third, it directs federal agencies to conduct studies and make recommendations regarding plastic pollution. Finally, the Act requires the first steps toward restoring the New York Bight, which now suffers severe marine debris pollution.

a. Regulation of Ships

MPPRCA regulates the most identifiable, and probably the predominant, contributors to marine debris pollution—ships operating on ocean, coastal, and inland waters. MPPRCA imposes two important types of controls on vessels. First, it implements the requirements of Annex V as


H.R. 940 was the vehicle for eventual enactment of MPPRCA. It was combined with H.R. 537 as H.R. 3674, which passed the House on December 18, 1987, 133 CONG. REC. H11,727-45 (daily ed. Dec. 18, 1987), and the Senate on December 19, 1987, 133 CONG. REC. S18,491-96 (daily ed. Dec. 19, 1987).


United States law. Second, it prescribes special domestic requirements to assist in administration and enforcement, including the extension of disposal prohibitions to all navigable waters of the United States.

Under MPPRCA, Annex V applies to all U.S. ships wherever located. Annex V covers foreign ships in all navigable U.S. waters and throughout the U.S. Exclusive Economic Zone. Given the broad Annex V definition of the term "ship," the restrictions of MPPRCA apply to virtually all watercraft, including small recreational boats.

MPPRCA also establishes restrictions not required by Annex V. By December 30, 1989, the Secretary of Transportation was required to promulgate regulations requiring certain ships to maintain refuse record books and shipboard waste management plans; other ships will have to


Pub. L. No. 100-220, which contained MPPRCA was signed into law on December 29, 1987. 23 WEEKLY COMP. PRES. DOC. 1563 (Dec. 29, 1987). On the following day, the U.S. Government deposited its instrument of ratification for Annex V with the International Maritime Organization. Manheim, supra note 79, at 95.


180. Id. § 1902(a)(2), (3). As stated in the legislative history, "navigable waters" means, "[t]he territorial seas of the United States; internal waters of the United States that are subject to tidal influence; and nontidal waters that, first, are or have been used, or are susceptible for . . . substantial interstate or foreign commerce, or second, a governmental or nongovernmental body, having expertise in waterway improvement, determines to be capable of improvement at a reasonable cost to provide, by themselves or in connection with other waters, highways for substantial interstate or foreign commerce." 133 CONG. REC. H11,729 (daily ed. Dec. 18, 1987) (statement of Rep. Hammerschmidt).

181. Under MARPOL, a ship is "a vessel of any type whatsoever operating in the marine environment and includes hydrofoil boats, air-cushion vehicles, submersibles, floating craft, and fixed or floating platforms." MARPOL, supra note 5, art. 2, para. (4). This definition is carried over to the Act to Prevent Pollution from Ships, 33 U.S.C. § 1901(a)(8) (1982), and applies to the Marine Plastic Pollution Research and Control Act. See also MPPRCA, § 2102, 33 U.S.C. § 1902 (Supp. V 1987). The U.S. Coast Guard confirmed the sweeping application of the MPPRCA disposal prohibition in its implementing regulations, where it explained that the definition of "ship" is "very broad" and includes "privately owned recreational vessels, uninspected vessels, cargo ships, . . . platforms and associated vessels such as derrick barges and pipelaying barges." Regulations Implementing the Pollution Prevention Requirements of Annex V of MARPOL 73/78, 54 Fed. Reg. 18,388 (1989) (advance notice of proposed rulemaking proposed) [hereinafter Annex V Regulations].

MARPOL exempts warships, naval auxiliary ships, or other government-owned or operated ships used only for noncommercial service. MARPOL, supra note 5, art. 3, § 2. Generally, MPPRCA exempts ships excluded by MARPOL. 33 U.S.C. § 1902(b)(1)(B) (Supp. V 1987). However, the Act exempts "[w]arships, naval auxiliary vessels, and other ships owned or operated by the United States when engaged in noncommercial service" from Annex V for only five years. Id. §§ 1902(b)(1)(A), 1902(b)(2)(A). But, these ships are exempted permanently "during time of war or a declared national emergency." Id. § 1902(b)(2)(B).
display placards describing Annex V prohibitions.\textsuperscript{182} These requirements are intended to assist in enforcement and improve waste management on ships.\textsuperscript{183} The Act also directs the Secretary of Transportation to seek an international agreement to require foreign vessels to adopt equivalent measures.\textsuperscript{184}

Several MPPRCA provisions address enforcement of the prohibition of dumping refuse from ships. First, the Act expressly authorizes the U.S. Coast Guard to inspect ships for violations of Annex V and to take enforcement actions based on the evidence obtained.\textsuperscript{185} Second, it authorizes rewards for information leading to a conviction or the assessment of a civil penalty for the unlawful disposal of refuse.\textsuperscript{186} Third, penalties for violation include imprisonment, forfeiture, and fines of $25,000 per day of violation.\textsuperscript{187} Fourth, the Act permits the Secretary to forego the penalties and refer violations detected on ships of MARPOL party nations to those countries for appropriate action.\textsuperscript{188} The Secretary may also impose civil or criminal penalties on party and nonparty flag ships, consistent with international law.\textsuperscript{189}

\textsuperscript{182} 33 U.S.C. § 1903(b)(2)(A) (Supp. V 1987). Proposed regulations for this purpose were published September 6, 1989. Prevention of Pollution From Ships, 54 Fed. Reg. 37,084 (1989). The proposed regulations would require manned U.S. oceangoing ships 79 feet or more in length to maintain refuse record books. \textit{Id.} Ships 40 feet or more in length would have to maintain waste management plans. \textit{Id.} Vessels 26 feet or more in length would have to post placards with notification of the disposal prohibition. \textit{Id.} at 37,086-87.

\textsuperscript{183} MPPRCA's legislative history emphasized the value of these requirements for enforcement purposes. The refuse log books, for example, would be used to record every disposal, either by shipboard incineration or offloading at a reception facility. H.R. REP. NO. 360, supra note 174, at 14. Significant discrepancies between log book entries and estimated amounts of ship-generated cargo could suggest unlawful disposal and be the basis for enforcement actions. \textit{Id.} at 21.

\textsuperscript{184} 33 U.S.C. § 1903(b)(2)(B) (Supp. V 1987). If the Secretary has not obtained such agreements by December 30, 1990, he must report to Congress on the advisability of applying such requirements to all vessels calling at U.S. ports. \textit{Id.} § 1903(b)(2)(C).

\textsuperscript{185} \textit{Id.} § 1907(d), (e). This authority applies to foreign ships operating in U.S. navigable waters or the U.S. Exclusive Economic Zone. \textit{Id.} § 1907(d). U.S. ships may be inspected anywhere at any time. \textit{Id.} § 1907(e). The House Report provides an example of how at-sea activities can be monitored from shore. As a condition of port entry, for example, vessels could be required to offload garbage or demonstrate shipboard incineration capability. For vessels without incinerators, failure to offload garbage would suggest disposal occurred at sea. H.R. Rep. No. 360, supra note 174, at 13.

\textsuperscript{186} 33 U.S.C. § 1908(a), (b) (Supp. V 1987). Up to one-half the amount of the fine or penalty may be paid to persons providing information. \textit{Id.}

\textsuperscript{187} Criminal penalties are $50,000 and 5 years imprisonment. 33 U.S.C. § 1908(a) (1982). Civil penalties are $25,000 for each violation. \textit{Id.} § 1908(b)(1). False reports are subject to $5,000 fines. \textit{Id.} § 1908(b)(2). Each day of continuing violation is a separate violation. \textit{Id.} § 1908(b). Ships operated in violation of APPS are liable \textit{in rem} for any fine. \textit{Id.} § 1908(d). Vessel clearance approval also may be refused or revoked. 33 U.S.C. § 1908(e) (1982 & Supp. V 1987).

\textsuperscript{188} 33 U.S.C. § 1908(f) (1982).

\textsuperscript{189} 33 U.S.C. §§ 1902, 1912 (1982 & Supp. V 1987). MPPRCA declares that nonparty ships shall not be treated more favorably than ships of countries that are subject to MARPOL. \textit{Id.} § 1902(c).
The U.S. Coast Guard began implementing MPPRCA through interim rules published on April 28, 1989. Because the Act's shipboard waste management plan requirements were not scheduled to become effective until the end of 1989, the regulations focus primarily on MPPRCA's garbage disposal requirements. By codifying the Annex V prohibitions on garbage disposal, the regulations specifically address plastic disposal, garbage disposal within special areas and from fixed and floating platforms, and the shipboard control of garbage. The rules also establish performance standards for shipboard grinders and comminuters.

Of particular importance is the requirement that ship operators give port or terminal officials at least twenty-four hours notice before an intended discharge of waste regulated by the Animal and Plant Health Inspection Service. This advance notice should assist port and terminal

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190. Annex V Regulations, supra note 181, codified at 33 C.F.R. pts. 151, 155, 158 and 46 C.F.R. pts. 25, 33 (1989). These regulations have the full force of final regulations, but the agency continues to consider comments and retains the option to make additional changes. Id. at 18,385.

191. Compare Annex V, supra note 5, regs. 3-5, at 7-23, with Annex V Regulations, supra note 181, at 18,405-407.

192. Annex V Regulations, supra note 181, at 18,405-406. The U.S. Coast Guard's interim rules implementing the Act define "plastic" as "any garbage that is solid material that contains as an essential ingredient one or more synthetic organic high polymers and is formed or shaped during either manufacture of the polymer or fabrication into a finished product by heat or pressure or both." 33 C.F.R. § 151.05. Degradable plastics are included. Id. The regulations flatly prohibit the discharge of garbage into the navigable waters of the United States. Id. § 151.66. The discharge of plastic, or garbage mixed with plastic, into the sea or U.S. navigable waters is prohibited, and such material must be offloaded on shore or incinerated. Id. § 151.67. Within Annex V special areas, ships may not dispose of garbage, except for victual waste, which may be discharged only if beyond 12 nautical miles from the nearest land. Id. § 151.71. Outside of special areas, ships may dispose of garbage separated from plastic if, in the case of dunnage and packing materials that float, the distance is at least 25 nautical miles. Id. § 151.69. Except for victual waste that has been ground or comminuted and will be discharged at least 12 nautical miles from the nearest land, no garbage may be disposed of from a mineral exploration or exploitation floating or fixed platform or any ship within 500 meters of such a platform. Id. § 151.73 Outside of special areas, nonplastic garbage that has been ground or comminuted so that it is capable of passing through a one inch mesh screen may be disposed of beyond three nautical miles of the nearest land. Id.

Important restrictions on the shipboard control of garbage also are set forth. The person in charge of the ship is responsible for compliance. Factors considered to assess compliance include: adequate records of disposal practices, log entries of discharges, the presence of onboard disposal equipment (grinders, comminuters, incinerators), the adherence to waste management plans, the absence of plastic onboard, ongoing educational programs, and the presence of adequate garbage collection spaces. Id. § 151.63. It is the responsibility of the person in charge of the ship to ensure that garbage is properly deposited in reception facilities. Id. § 151.63(a).


194. See id. § 151.65. The Animal and Plant Health Inspection Service is an agency within the Department of Agriculture. Its responsibilities include regulating pests and possible disease vectors associated with foodstuffs. 9 C.F.R. pts. 1-167 (1989).
operators in meeting demands for special waste handling and help prevent undue delay to ship operators.

b. Regulation of Ports and Terminals

By applying Annex V to United States ships everywhere and foreign ships within U.S. waters, MPPRCA seeks to control marine debris pollution at its primary source. Such an effort would be ineffective, however, without the means to provide for the ultimate disposal of ship-generated refuse. Accordingly, MPPRCA requires ports and terminals to provide reception facilities.

The Act’s reception facility requirements build upon the provisions of Annex V. Under Annex V, each state must “ensure the provision of facilities at ports and terminals for the reception of garbage, without causing undue delay to ships, and according to the needs of the ships using them.” MPPRCA requires the Secretary of Transportation to set “criteria for determining the adequacy of reception facilities for garbage at a port or terminal, and [to] stat[e] such additional measures and requirements as are appropriate to ensure such adequacy.” The duty to provide adequate reception facilities, or ensure that they are available, is imposed on “[p]ersons in charge of ports and terminals.” Failure to provide adequate reception facilities carries significant consequences. Ships may be denied entry to any port or terminal that does not comply with the act’s regulatory standards.

MPPRCA’s reception facility requirements raise two issues. First, the ports and terminals that are to be covered must be identified. Second, reception facility standards must be defined. The U.S. Coast Guard interim rules offer a broad approach to these issues by requiring adequate garbage reception facilities at all ports and terminals. The expansive definition of “terminal” encompasses a wide variety of facilities, ensuring

197. Annex V, supra note 5, reg. 7(1) at 32. Parties are to notify the International Maritime Organization of the facilities “alleged to be inadequate.” Id. reg. 7(2) at 32.
199. Id.
200. Id. § 1905(e)(2).
201. 33 C.F.R. § 158.133 (1989). The term “port” is defined to include a single geographic port or a cooperative of separate terminals that desire to be treated as a single port for purposes of sharing regulations. Annex V Regulations, supra note 181, at 18,387.
202. “Terminal” is defined as any onshore facility or offshore structure “used, and intended to be used, as a port or facility for the transfer or other handling of a harmful substance.” Annex V Regulations, supra note 181, at 18,388. “Harmful substance” includes garbage within the scope of Annex V, including plastic. Id. at 18,387. This definition includes any substance that is liable to “create hazards to human health, harm living resources and marine life, damage amenities, or interfere with other legitimate uses of the sea.” Id. The preamble to the regulations explains that commercial fishing facilities, recreational boating facilities, and mineral and oil shorebases are all included under the definition of terminal. Id.
ing general application of the reception facility requirement in the United States.

Under the regulations, a port or terminal must meet the following five criteria to constitute an adequate reception facility: (1) the port or terminal must be capable of receiving Animal and Plant Health Inspection Service regulated garbage within twenty-four hours of a vessel’s call at port, unless it receives only ships that operate exclusively between ports in the continental United States and Canada;203 (2) the facility must be able to receive medical204 and hazardous wastes;205 (3) the reception facilities must be convenient to mariners and must not interfere with port and terminal operation;206 (4) ports and terminals must situate the facilities to ensure that garbage will not reenter the water after disposal;207 and (5) facilities must satisfy all federal, state, and local garbage handling requirements.208

The interim rules also require facilities to have the capacity to handle all the garbage that a ship wishes to discharge.209 Facilities, however, need not be able to receive large quantities of spoiled or damaged cargo, nor garbage from ships not having commercial transactions with the port or terminal.210 The latter exception appears contrary to the spirit, if not the letter, of the Annex V reception facility requirement, which recognizes no such limitation.211

The regulations direct ports and terminals to obtain a certificate of adequacy if they receive ocean-going ships subject to MARPOL Annexes I or II,212 or if they are commercial fishing facilities that receive more

204. Id. § 158.410(a)(2). The term "medical wastes" is defined in 33 C.F.R. § 158.120 as "isolation wastes, infectious agents, human blood and blood products, pathological wastes, sharps, body parts, contaminated bedding, surgical wastes and potentially contaminated laboratory wastes, dialysis wastes, and such additional items as prescribed by the Administrator of the EPA by regulation."
205. Id. § 158.410(a)(2). A facility may be exempted if it can identify an alternative party to transport and treat such wastes. Id.
206. Id. § 158.410(a)(3), (4).
207. Id. § 158.410(a)(5).
208. Id. § 158.410(a)(6).
209. Id. § 158.420. The U.S. Coast Guard’s advance notice of proposed rulemaking included a worksheet to determine sufficient capacity. See Regulations Implementing the Pollution Prevention Requirements of Annex V of MARPOL 73/78; Advance Notice of Proposed Rulemaking, 53 Fed. Reg. 23,889-892 (1988). The worksheet estimated the amount of garbage generated by (1) domestic waste from harbor vessels, inland and coastal waterways vessels, seagoing cargo vessels, and passenger vessels, (2) cargo-associated waste, and (3) all other garbage waste. Although the worksheet does not appear in the interim final regulations, it is a useful guide for determining if a particular port or terminal can handle the volume of garbage it is likely to receive.
210. 33 C.F.R. § 158.420(a), (b) (1989).
211. See Annex V, supra note 5, reg. 7.
212. 33 C.F.R. § 158.135 (1989). Annex I covers all ships carrying cargo, though it is
than 500,000 pounds of fish annually.213 A port or terminal must hold one or more certificates of adequacy to be permitted to continue to receive ships.214

Under this standard, slightly over 2,000 U.S. ports and terminals would be required to obtain certificates; this is approximately twenty percent of the more than 10,000 ports and terminals used by vessels to which Annex V applies.215 The U.S. Coast Guard limited the reach of the certificate of adequacy requirement to balance the requirements of Annex V and MPPRCA with "the potential burden on the public and Coast Guard resources, if all ports or terminals were required to apply for certificates of adequacy."216

The significant benefits of the certificate of adequacy requirement should be extended to all ports and terminals rather than only the largest facilities. The certificate of adequacy requirement effectively ensures compliance with Annex V because it requires a showing of adequacy and places the burden of demonstrating sufficiency on the facilities. The certificates assist enforcement by identifying ports and terminals that have not met Annex V standards. Certification also enhances practical efficiency by helping vessels identify the ports and terminals that can receive their waste.

c. Plastic Pollution Studies

Congress demonstrated its intent to revisit the marine debris issue in Subtitle B of the Marine Plastic Pollution Research and Control Act.217 That subtitle requires comprehensive studies on the causes and effects of plastic pollution and recommended solutions. Subtitle B has four elements: (1) compliance reporting, (2) a public education program, (3) a study of the effects of plastic pollution on the marine environment, and (4) a plastic pollution reduction study.218


214. Id.
216. Id.
217. H.R. REP. NO. 360 discusses Congress' intent to revisit the problems caused by land-based sources of pollution:

To generate additional information on land-based plastic pollution, the Committee has included section 203 of H.R. 940, requiring a review of the problem by EPA. The Committee expects that the specific problems described above will be addressed in the report.


The compliance reporting and public education elements of Subtitle B aim to maximize the effectiveness of the Marine Plastic Pollution Research and Control Act's disposal prohibitions. The Secretary of Transportation must report biannually to Congress until 1994 on compliance with Annex V in U.S. waters. The MPPRCA public education program, already under way, will continue until at least 1991. The program is intended to educate recreational boaters, fishermen, and other users of the marine environment about the harmful effects of plastic pollution and the need to recycle plastics, reduce marine disposal of plastics, and undertake cleanup programs. The program also encourages the formation of volunteer "citizen pollution patrols" to assist in the "monitoring, reporting, cleanup, and prevention of ocean and shoreline pollution."

To improve understanding of the marine debris problem, MPPRCA directed the Secretary of Commerce to submit a comprehensive report to Congress on the effects of plastic materials on the marine environment by September 30, 1988. The report was to: (1) identify and quantify harmful effects, (2) assess their impact on living marine resources, (3) point out the types and classes of plastics that pose the greatest hazards, and (4) analyze plastic materials capable of reduction to environmentally benign subunits. Based on this information, the Secretary of Commerce was directed to recommend legislation that is necessary "to prohibit, tax, or regulate sources of plastic materials that enter the marine environment."

EPA's Administrator was directed to submit to Congress "a study of the adverse effects of the improper disposal of plastic articles on the environment and on waste disposal, and the various methods to reduce or eliminate such adverse effects." Specifically, Congress asked EPA to address the feasibility and desirability of substitutes for the identified

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220. The National Marine Fisheries Service administers a considerable number of public education programs, which include special efforts directed at shipping interests, fishing interests, and the general public. During fiscal years 1985, 1986, and 1987, the National Marine Fisheries Service's educational efforts focused on: (1) education program development and implementation, (2) beach cleanups and reports, (3) developing a manual of standards for assessing debris in the marine environment, and (4) evaluating program effectiveness. See Coe & Bunn, Description and Status of Tasks in the National Oceanic and Atmospheric Administration's Marine Entanglement Research Program for Fiscal Years 1985-1987, in Fishermen's Conf. Proc., supra note 19, at 320-21.
222. Id.
223. Id. § 2203.
224. Id. The Secretary of Commerce must conduct the analysis of reducible materials in consultation with the Director of the National Bureau of Standards. Id.
225. Id.
226. Id. § 2202(a).
contributors to plastic pollution, the feasibility of recycling plastics, and, the possibility of using readily degradable materials for those items that present the greatest threat to the marine environment.  

**d. New York Bight**

Subtitle C of the Marine Plastic Pollution Research and Control Act addresses the marine debris pollution problem in a particular geographical area, the New York Bight.  

The subtitle aims both to control polluant discharges into the Bight and to clean up and restore an area that "has been ravaged by pollution for decades." EPA's Administrator must submit a "New York Bight Restoration Plan" to Congress by December 31, 1990. The plan must identify and assess pollution inputs, determine the pollutants' fate, and evaluate their health and environmental consequences. The plan must then identify technological and waste management controls, devise an economically feasible implementation plan, and recommend a funding and coordinating mechanism. Finally, the plan must assess alternatives to the dumping of municipal sludges and the burning of timber in the Bight.

**2. The Driftnet Impact Monitoring, Assessment, and Control Act**

The Driftnet Act attempts to reduce the significant mortality of nontarget marine animals that become entangled in plastic driftnets used by foreign fisheries operating in the North Pacific Ocean and the Bering Sea.

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227. *Id.* § 2202 (b)(4)-(6).
228. *Id.* §§ 2301-2305. This was the only provision of MPPRCA for which Congress authorized an appropriation of funds. *Id.* § 2305.
230. MPPRCA §§ 2301(a), 2303(c), 33 U.S.C. § 2267 (Supp. V 1987). EPA must submit the Restoration Plan in consultation with the Administrator of National Oceanic and Atmospheric Administration and other unspecified government entities. EPA must also provide opportunity for public comment. *Id.*
231. MPPRCA § 2301 (b)(1)-(3), 33 U.S.C. § 2267 (Supp. V 1987). Pollution inputs to be studied range from sewage discharges to atmospheric fallout. *Id.* § 2301(b)(1).
232. *Id.* § 2301(b)(4)-(7). In analyzing controls, EPA must consider their costs and impediments to their application. *Id.* § 2301(b)(5).
While the Act focuses on the adverse impacts of active fishing with driftnets, it also contains provisions applying to nets that are lost, abandoned, or discarded. This Article discusses only the provisions related to lost and discarded driftnets.

As an initial step, the Driftnet Act establishes an action-forcing mechanism to develop reliable information on the number and kinds of marine animals that are “killed and retrieved, discarded, or lost” by foreign vessels involved in driftnet fishing.235 The Driftnet Act requires immediate initiation of negotiations with foreign governments whose nationals conduct authorized driftnet fishing operations in waters outside the Exclusive Economic Zone that affect U.S. marine resources such as anadromous fish.236 The negotiations are intended to lead to cooperative agreements for monitoring and assessing the impacts of these operations on U.S. marine resources.237 In 1989 the Secretary of Commerce inconclusively reported to Congress on the results of these negotiations and on the nature, extent, and consequences of driftnet fishing operations.238

As a second step, the Driftnet Act requires the Secretary of State to negotiate with foreign nations to effectively enforce legal controls over driftnet fishing operations.239 These negotiations are to seek more effective methods for detecting and successfully prosecuting violations of foreign or domestic legal requirements “applicable to the location, season,
and other aspects of the operations of the foreign governments' driftnet fishing vessels." Enforcement of Annex V prohibitions on the disposal of synthetic fishing nets appears to fall within the scope of the Driftnet Act. The Driftnet Act allows the United States to embargo the fish products of any nation whose government fails to enforce Annex V restrictions on driftnet disposal.

The Secretary of State was to have concluded negotiations with driftnet fishing nations by July 1989. Japanese and American negotiations had reached an earlier agreement in May, but members of Congress, fisherman, and environmentalists charged that this agreement did not go far enough in requiring observers, patrols, and other measures to ensure compliance with the Driftnet Act. The Secretary of Commerce rejected the proposed agreement. After further negotiations, the Japanese agreed to improvements that made the deal acceptable to the United States.

Because neither Taiwan nor Korea had, by June 29, come to any accord with U.S. negotiators on observers and enforcement measures on their driftnet fleets, the Secretary of Commerce triggered the certification process under the Act. Certification of the failure to reach an agreement gave the President the option to impose trade sanctions on each

240. Id.
241. See id.
242. Id. § 4006(a). Any foreign government that fails to implement such a driftnet monitoring and enforcement agreement by June 30, 1989 is to be certified to the President by the Secretary of Commerce under section 8(a) of the Fishermen's Protective Act of 1967, 22 U.S.C. § 1978(a) (1982). Driftnet Act, § 4006(b), 16 U.S.C. § 1822 (Supp. V 1987). Under section 8(a), known as the Pelly Amendment, upon certification the President may direct the Secretary of Commerce to embargo fish products from the offending nation. Although the President's embargo authority has been invoked rarely, when it has, "the results have been encouraging in promoting the effectiveness of international conservation agreements." H.R. REP. No. 489, 100th Cong., 1st Sess. 24 (1987). The threat implied in certification alone appeared to prompt Taiwan and Korea to conclude appropriate agreements shortly after certification. See infra text accompanying notes 247-50.

The 1988 amendments to the Marine Mammal Protection Act strengthened the Pelly Amendment by defining "fish products" to include "any aquatic species (including marine mammals and plants) and all products thereof exported from an offending country, . . . or packed, processed, or otherwise prepared for export in such country." 22 U.S.C.A. § 1978(h)(4) (West Supp. 1989).


245. U.S. Faults Accord on Large Driftnets, supra note 244 at 18, col. 4.

246. Letter from Horohisa Tonoka, Director General, Fisheries Agency, Government of Japan, to Dr. Frederick N. Bernthal, Assistant Secretary for Oceans and Int'l Institutions and Scientific Affairs, Dep't of State, and Dr. William E. Evans, Under Secretary, Dep't of Commerce (June 26, 1989) [hereinafter Tonaka-Bernthal-Evans Letter].

247. Taiwan, South Korea Fail to Reach Agreement with the U.S. on Driftnets, Assoc. Press wire report, June 29, 1989.
nation after sixty days.\textsuperscript{248} Taiwan came to the table first and concluded an agreement with the United States on August 24.\textsuperscript{249} The U.S.-Korea driftnet agreement was finished September 8.\textsuperscript{250}

Although the specific terms vary in significant ways, all three agreements contain requirements allowing the United States to board foreign vessels suspected of violating the agreements. The agreements provide for joint patrols of the driftnet fishing area, and a limited number of onboard observers.\textsuperscript{251} The agreements also provide for stepped-up flag state enforcement programs, including limitations on the transfer of fish caught with driftnets.\textsuperscript{252} Critics maintain, however, that the provisions are not strong enough to provide either statistically reliable data for scientific purposes, or reliable verification for enforcement purposes.\textsuperscript{253} Specific proposals include a more comprehensive onboard observer program and a requirement that all driftnet vessels carry radio position transmitters to aid enforcement.\textsuperscript{254} The pacts also limit either the size or the location of the three fleets during the term of each agreement.\textsuperscript{255}

\textsuperscript{249} Letter from Mou-Shih Ding, Representative of Coordination Council for North American Affairs, to David N. Laux, Chairman and Managing Director of the American Institute in Taiwan (Aug. 24, 1989) (accepting proposed agreement in substance).
\textsuperscript{251} Annex to Exchange of Letters Between The American Institute in Taiwan (AIT) and the Coordination Council for North American Affairs (CCNAA) Regarding The High Seas Driftnet Fishing in the North Pacific by Vessels of the Territory Represented by CCNAA, arts. IV-VI (June 30, 1989) [hereinafter Annex to Exchange of Letters]; Letter from Hoo Soo Lee, Deputy Administrator, Nat’l Fisheries Administration, Republic of Korea, to Ambassador Edward E. Wolfe, Deputy Assistant Secretary, Oceans and Fisheries Affairs, U.S. Dep’t of State, and James W. Brennan, Assistant Ambassador for Fisheries, U.S. Dep’t of Commerce (Sept. 8, 1989) (announcing that the Korean Government will implement the driftnet monitoring program); Record of Discussions Between Representatives of the United States and the Republic of Korea to Discuss Matter Pertaining to High Seas Driftnet Fishing Activities in the North Pacific Ocean (Sept. 8, 1989); Letter from Richard J. Smith, Principal Deputy Assistant Secretary of State, to Clement V. Tillion, U.S. Commissioner, INPFC (May 5, 1989) (discussing U.S. Department of State’s recent successful driftnet negotiations with Japan and Canada); Tonoka-Bernthal-Evans Letter, supra note 246 (clarifying Japan’s monitoring and enforcement programs); Letters from Kazwo Shima, Councillor, Fisheries Agency, Gov’t of Japan, to Richard Smith, Deputy Assistant Secretary of State, and James W. Brennan, Assistant Administrator for Fisheries, Dep’t of Commerce, with attachments (May 2, 1989) (announcing that the Japan Squid Driftnet Fishery Association plans to take voluntary measures to accept observers on association vessels).
\textsuperscript{252} Annex to Exchange of Letters, supra note 251, arts. III -VI.
\textsuperscript{253} Floor statement of Sen. Frank Murkowski Expressing the Sense of the Senate Regarding the Recently Concluded Agreement with the Government of Japan Regarding Driftnet Fishing in the North Pacific Ocean 3 (July 19, 1989) (press release accompanying submission of amendments to S. 1160. Submission of amendment is cited at 135 CONG. REC. S8282 (daily ed. July 19, 1989)).
\textsuperscript{254} Floor Statement of Sen. Frank Murkowski, supra note 253, at 1.
\textsuperscript{255} Annex to Exchange of Letters, supra note 251, art. 1.
The agreements focus on reducing salmon interception, and not on the disposal of nets, net debris, or options for net marking. By limiting the scope of driftnet fishing operations, however, these agreements may indirectly diminish the amount of plastic pollution resulting from discarded nets and other gear. More should be done in future negotiations to address debris-related issues such as gear identification.256

Beyond the negotiation requirements, the Driftnet Act directs the Secretary of Commerce to evaluate the feasibility of and develop recommendations for “the establishment of a driftnet marking, registry, and identification system.”257 The system should provide a “reliable method for the determination of the origin by vessel, of lost, discarded, or abandoned driftnets and fragments of driftnets.”258 The Secretary must also study and make recommendations on three other approaches to driftnet pollution prevention.259 These include using quickly degradable materials for driftnets, paying bounties for the retrieval of driftnet material and plastic fishing refuse from Exclusive Economic Zone waters, and monitoring the location of driftnet fishing operations through a cooperative driftnet fishing vessel tracking system.260 Actions taken to follow up on these recommendations should not be limited to high seas fisheries. They also should be applied, as appropriate, to other fisheries, including domestic driftnet and gillnet operations.

3. The Shore Protection Act

While the Marine Plastic Pollution Research and Control Act is concerned with disposal practices, the Shore Protection Act of 1988261 focuses on the transportation of waste products in coastal waters. The Shore Protection Act requires a permit for the transportation of municipal and commercial waste in the coastal waters of the United States.262 The Secretary of Transportation may deny a permit to an applicant with a record of repeated violations of the Shore Protection Act, the Solid Waste Disposal Act, the Refuse Act, the Marine Protection, Research, and Sanctuaries Act, or the Clean Water Act.263 Surprisingly, violations

256. The agreements with Japan and Korea include provisions for flag state gear-marking programs. Enclosure to Letter from Richard J. Smith, Principal Deputy Assistant Secretary of State, to Steve Cowper, Governor of Alaska (May 17, 1989) (Japan); Letter from Hoo Soo Lee, supra note 251, annex I. Pending amendments to the Fishery Conservation and Management Act call for an international moratorium on driftnets. See, e.g., S. 1684, 101st Cong., 1st Sess. (1989).
258. Id.
259. Id. § 4007(b).
260. Id. § 4007(d).
262. Id.
263. Id. § 4102(d). The Secretary must deny permits for serious offenders on the request of the EPA Administrator. Id.
of MPPRCA do not expressly limit a party's ability to receive a Shore Protection Act permit. Nonetheless, there is no reason the Secretary cannot consider MPPRCA violations and limit the permit to a "probationary" period shorter than the five year maximum. Special permit restrictions could also require specified practices to ensure that violations of MPPRCA, the Shore Protection Act, or other authorities do not occur.

The Shore Protection Act also specifies waste-handling practices for loading, receiving, and offloading municipal and commercial waste transported in coastal waters. Owners and operators of the waste source, the transporting vessel, and the receiving facility share responsibility for Shore Protection Act compliance. In addition, the owner of the receiving facility is responsible for cleaning up any waste deposited in coastal waters.

To implement the Shore Protection Act, EPA must prescribe regulations to ensure that waste sources, receiving facilities, and vessels will not deposit waste accidentally in coastal waters. EPA may also require these parties to maintain operation and maintenance manuals and to implement waste-tracking systems.

4. Medical Waste Authorities

Although medical waste is a relatively small proportion of marine debris, it elicits the strongest public concern and can lead to substantial economic losses. In response, Congress recently enacted two laws to deal with this type of debris, the Medical Waste Tracking Act (MWTA) and the U.S. Public Vessel Medical Waste Anti-Dumping Act. Both statutes establish stringent controls of this form of marine debris pollution.

264. Permits may be issued under the Shore Protection Act only for a period of "not more than 5 years." Id. § 4102(c)(2). Because this period is discretionary, a period shorter than five years could be used as a kind of "probation" for parties with a record of MPPRCA violations.

265. The Secretary of Transportation is to prescribe standards for maintaining a permit in any event. Id. § 4102(f)(1).

266. Id. § 4103.

267. Id. § 4103(a).

268. Id. § 4103(a)(4).

269. Id. § 4103(b)(1).

270. Id. § 4103(b)(2).

271. Id. § 4103(b)(3). By November 18, 1990, EPA is to submit a report to Congress on the effectiveness of additional tracking systems. Id. § 4201.

272. Medical waste constituted one to ten percent of marine debris found on northeastern beaches during the summer of 1988. MEDICAL WASTE POLICY COMMITTEE, supra note 46, at 16.


At the core of the Medical Waste Tracking Act is a two-year demonstration program for a cradle-to-grave tracking system for medical waste. The program should provide for tracking of the transportation of waste from the generator to the disposal facility and establish a system under which the generator is assured that the waste is received at the disposal facility. The program should also use a uniform waste tracking system and establish protective handling requirements. At the end of the demonstration period, EPA is to submit a comprehensive report to Congress detailing the success of the program and recommending additional measures to improve medical waste handling.

The demonstration program may also yield insights that are useful for controlling other forms of marine debris, especially those such as synthetic fishing nets that can be tracked.

The Public Vessel Medical Waste Anti-Dumping Act prohibits the disposal of potentially infectious medical waste into the ocean from U.S. vessels, with several narrow exceptions. The Public Vessel Medical Waste Anti-Dumping Act also amends the Clean Water Act and the Marine Protection, Research, and Sanctuaries Act to add the dumping and discharge of medical waste to the acts prohibited under each statute.

C. Domestic Laws Indirectly Applicable to Marine Debris Pollution

Several earlier United States statutes could control some sources of marine debris. The wildlife conservation and water pollution laws do not focus on the persistent debris problem, but their broader restrictions

275. MWTA § 11003, 42 U.S.C.A. § 6992b (West Supp. 1989) (tracking system); id. § 11001(d), 42 U.S.C.A. 6992(d) (two year limitation). Originally five states (Connecticut, New Jersey, New York, Rhode Island, Louisiana), the District of Columbia, and Puerto Rico were in the program. In August 1989, EPA granted the requests of Louisiana and the District of Columbia to drop out. Louisiana had to drop out because a state law, passed at the behest of hospital lobbyists, prohibited participation in the program due to its costs. The District of Columbia asserted that its program would not be in place until the end of the two-year study period and therefore would be of little value. EPA Approves Louisiana, D.C. Petitions to Get Out of Federal Tracking Program, 20 Env't Rep. (BNA) 748 (Sept. 1, 1989).


278. There are exceptions when the health and safety of individuals on board are threatened or during time of war or national emergency, so long as the waste is disposed of more than 50 miles from shore and has been properly packaged, sufficiently weighted, and perhaps sterilized. Public Vessel Medical Waste Anti-Dumping Act § 3104, 33 U.S.C.A. §§ 2503 (West Supp. 1989).

279. Id. §§ 3201(b) (amending the Marine Protection, Research, and Sanctuaries Act); id. § 3202(b) (amending the Clean Water Act).
could be applied to limit the discharge of plastics and other debris into the marine environment.

I. Wildlife and Fisheries Laws

Several wildlife laws could potentially help curb marine debris pollution, particularly from ocean-based sources. These laws do not prohibit the disposal of debris; rather, they outlaw the frequent end result of such disposal—the killing or injuring of marine wildlife. By prohibiting the “taking” of migratory birds, marine mammals, and endangered and threatened species and by proscribing damage to fishery resources, these statutes provide additional enforcement mechanisms against marine pollution. The principal drawback to using these laws to control marine pollution is the difficulty of linking a taking with an act of marine debris disposal. If the federal government implemented a debris tracking system, however, these authorities would be more useful as pollution control tools.

The Migratory Bird Treaty Act implements four bilateral treaties protecting migratory birds. The statute makes it unlawful to pursue, hunt, take, capture, or kill migratory birds or to attempt to do so.

280. For additional discussion of these authorities see Bean, supra note 14, at 43-48; Gosliner, supra note 11, at 24-29. These laws are discussed generally in M. Bean, The Evolution of National Wildlife Law (1983).


Courts have construed the Migratory Bird Treaty Act to impose strict liability prohibiting even unintentional takes. Thus, if it can be established that debris from a particular source caused migratory bird mortality, the Migratory Bird Treaty Act’s penalties may be applied.

The Marine Mammal Protection Act and the Endangered Species Act taking prohibitions also cover unintentional takes. There are, however, exceptions. Under the Marine Mammal Protection Act, for example, the Fish and Wildlife Service or the National Marine Fisheries Service may issue incidental take authorizations for fisheries and nonfishery activities. In addition, either agency can issue a waiver of the Marine Mammal Protection Act’s moratorium on taking after satisfying rigorous and seldom used procedural standards. The 1988 amendments to the Marine Mammal Protection Act granted most domestic commercial fishing operations a five year exemption from the taking prohibition. At the end of this period, a new prohibition will come

may be allowed as compatible with the underlying treaty. Id. § 704.

288. See, e.g., United States v. Corbin Farm Serv., 444 F. Supp. 510, 529 (E.D. Cal. 1978), aff’d, 578 F.2d 259 (9th Cir. 1978) (strict liability is proper for spraying pesticide on a field where waterfowl feed); United States v. FMC Corp., 572 F.2d 902, 908 (2d Cir. 1978) (strict liability imposed for not preventing a toxic chemical from escaping into a pond and killing birds).

289. Strict liability offenses are misdemeanors punishable by up to six months imprisonment and fines up to $500. Migratory Bird Treaty Act, 16 U.S.C. § 707(a) (1988). Certain knowing violations are felonies carrying fines up to $2000 and/or prison terms up to two years. Id. § 707(b). Violators of the Migratory Bird Treaty Act risk forfeiture of the vessels and equipment involved. Id. § 707(c).

Two opinions issued by the Department of the Interior Solicitor’s Office further undercut the Migratory Bird Treaty Act. One holds that the Act’s prohibitions do not apply to U.S. citizens in foreign countries. The other asserts that foreign nationals are subject to Migratory Bird Treaty Act provisions only within the U.S. territorial sea, rather than throughout the Exclusive Economic Zone. The opinions have been criticized. See Eisenbud, Problems and Prospects for the Pelagic Driftnet, 12 B.C. ENVTL. AFF. L. REV. 473, 487-88 (1985).


292. Id. § 1371(a)(5).

293. Id. § 1371(a)(3). The agency must determine that the waiver is compatible with the Act’s purposes and requirements and is in accord with sound principles of resource conservation. Id. A waiver may not be granted for species designated as “depleted.” Id. § 1371(a)(3)(B).

294. Id. § 1383a(a)(1). The exemption was granted to facilitate the collection of data needed to assess the interaction between commercial fishing operations and marine mammals without forcing fishermen either to forgo fishing or to risk substantial penalties for violating the Marine Mammal Protection Act. Taking of Marine Mammals Incidental to Commercial Fishing Operations; Interim Exception for Commercial Fisheries, 54 Fed. Reg. 16072 (1989) (notice of final list of fisheries).

For regulations implementing the exemption, see id.; Taking of Marine Mammals Incidental to Commercial Fishing Operations; Interim Exception for Commercial Fisheries, 54
REDUCING MARINE DEBRIS POLLUTION

into effect, subject to special exemption procedures, which have yet to be defined.295

Like the Marine Mammal Protection Act, the Endangered Species Act includes limited exceptions to its taking prohibition. The Fish and Wildlife Service and the National Marine Fisheries Service may authorize incidental takings of endangered or threatened species in the course of otherwise lawful federally permitted activities, but the activities must not jeopardize the continued existence of affected species or impair critical habitat.296 The federal permitting agency and, in certain circumstances, the private party involved, must comply with measures specified by either the Fish and Wildlife Service or the National Marine Fisheries Service to minimize the impact of such takings on the affected species.297 Thus, disposal restrictions could be imposed as conditions of the permitted activity.

For example, an incidental take permit might be issued for the production of oil or gas from offshore platforms in an area where the disposal of debris and waste could harm a listed species. Permit conditions could mandate waste management plans to control debris discharges. Permits could also require that plastic items not be used unless necessary and that the permittee clean up periodically in the vicinity of the authorized activities.

The Endangered Species Act and the Marine Mammal Protection Act both authorize the Fish and Wildlife Service and the National Marine Fisheries Service to promulgate regulations to govern conduct likely to result in takings.298 Pursuant to this authority, the Fish and Wildlife Service has closed certain areas in Florida to boating to protect


295. During the five-year exemption period, the Secretary of Commerce is required to develop and recommend to Congress a program under which incidental take authorizations may be granted to certain fisheries. 16 U.S.C § 1383a(b)(5)(A) (1988).

296. Endangered Species Act, 16 U.S.C. § 1536(b)(4) (1988). These authorizations are issued as part of the consultation requirements of the Endangered Species Act. Under this requirement, each federal agency must ensure that activities it undertakes, authorizes, or funds will not jeopardize an endangered or threatened species or adversely modify designated critical habitat. Id. § 1536(a)(2). The agency must consult with the Fish and Wildlife Service or the National Marine Fisheries Service, depending on the species, to obtain an expert “biological opinion” concerning the effects of the proposed action. The “jeopardy determination” reached in this opinion is generally considered controlling as to whether the activity will comply with this provision of the Endangered Species Act. As part of the biological opinion process, the Fish and Wildlife Service and the National Marine Fisheries Service may specify permissible levels of incidental take, provided protective measures are also specified. Id. § 1536(c). In addition to takings from federally permitted activity, the Endangered Species Act authorizes incidental take permits for private activities that do not require federal approval. 16 U.S.C. § 1539.

297. See M. BEAN, supra note 280, at 354, 358-70 for a more detailed discussion of how this procedure works.

the endangered West Indian manatee. Under this authority, the Fish and Wildlife Service and the National Marine Fisheries Service could close areas or otherwise restrict fishing and other activities when discarded gear or other refuse is likely to entangle wildlife. The Marine Mammal Commission, for example, has recommended using the Marine Mammal Protection Act to establish an "ecosystem protection zone" around the Aleutian Islands within which foreign driftrent fishing would be prohibited.

Another relevant wildlife statute is the Fishery Conservation and Management Act, which gives the United States exclusive management authority over fish and other forms of marine life throughout a 200-mile fishery conservation zone. The Fishery Conservation and Management Act requires that the resources within the fishery conservation zone be managed under comprehensive plans developed by regional fishery management councils.

Foreign fisheries must obtain permits to fish within the zone. Among other conditions, the Fishery Conservation and Management Act permits prohibit foreign fisheries from intentionally disposing of any article, including abandoned fishing gear, that may interfere with fishing operations or damage any fishery resource or marine mammal.

Unfortunately, the regional management councils have largely failed to use their Fishery Conservation and Management Act authority to reduce marine debris from domestic fisheries. Councils could impose restrictions such as gear-marking requirements and incentives to use recyclable materials, but they have largely limited their regulatory actions in this regard to foreign fisheries. As a result, the Fishery Conservation and Management Act has not lived up to its potential as a pollution control mechanism. Instead, it has served almost exclusively to set harvest quotas.

302. Id. § 1822(c). Fishery Conservation and Management Act authority does not reach marine mammals, birds, or highly migratory species. Id.
303. Id. §§ 1821-1852 (1988).
304. Permits require foreign fisheries to comply with U.S. regulations and carry observers. Id. § 1821(c). The Act also establishes catch limits allocated by nation. Id.; see also id. § 1821(d), (e).
305. 50 C.F.R. § 611.12(c) (1988).
307. Id. Recently, however, councils have begun to use gear restrictions as a means of conserving fishery stocks. See id.
2. Marine Protection, Research, and Sanctuaries Act

The Marine Protection, Research, and Sanctuaries Act implements the London Dumping Convention in the United States and regulates the dumping of all types of materials in the ocean.\textsuperscript{308} The Act requires permits for dumping within the territorial sea and for transporting materials for the purpose of ocean dumping.\textsuperscript{309} EPA issues Marine Protection, Research, and Sanctuaries Act dumping permits for all substances except dredged materials, which are controlled by the U.S. Army Corps of Engineers.\textsuperscript{310}

EPA will not issue permits for the dumping of persistent, floatable materials, including plastics.\textsuperscript{311} Unfortunately, this prohibition has not controlled persistent floating wastes that enter the marine environment. EPA has failed to require that such materials be filtered or skimmed off during treatment operations. The floating waste problem is particularly severe off the Northeast Coast.\textsuperscript{312}

The 1988 amendments to the Marine Protection, Research, and Sanctuaries Act prohibit all dumping of sewage sludge and industrial waste after December 31, 1991.\textsuperscript{313} In addition, no new dumping permits may be issued to any party that did not have such a permit on September 1, 1988.\textsuperscript{314} To obtain a new permit, a party must enter into a compliance agreement or an enforcement agreement.\textsuperscript{315} These agreements are intended to require the permittee to phase out ocean dumping through the design, construction, and use of alternative waste management systems.\textsuperscript{316} These prohibitions and the development of new waste management systems should greatly reduce the amount of persistent debris that makes its way into the marine environment as a result of ocean dumping. The phaseout of ocean dumping is long overdue. EPA must carefully review the proposed alternative systems, however, to ensure that they do not become new sources of marine debris.

\textsuperscript{308} 33 U.S.C. §§ 1401-1445 (1982).
\textsuperscript{309} Id. § 1411(b).
\textsuperscript{310} Id. § 1412(a).
\textsuperscript{311} 40 C.F.R. § 227.5(d) (1988).
\textsuperscript{314} Id. § 1002(a)(2).
\textsuperscript{315} Id. § 1002(a)(1)(A)(i).
\textsuperscript{316} Id. §§ 1002(c)(2), (3).
3. **Clean Water Act**

The Federal Water Pollution Control Act (Clean Water Act or CWA)\(^{317}\) requires permits for pollutant discharges from any point source into navigable waters. Under CWA, the National Pollutant Discharge Elimination System (NPDES) governs permit issuance.\(^{318}\) Although the Clean Water Act does not specifically mention plastics and other synthetic materials, its definition of "pollutants"\(^{319}\) is broad enough to include them within the section 301 prohibitions on discharge.\(^{320}\) No discharge of such pollutants can be authorized, however, unless it complies with EPA guidelines restricting degradation of the marine environment.\(^{321}\) Thus, the Clean Water Act can be applied to control plastics and other forms of persistent debris from point sources.

In addition to the discharge prohibitions of section 301, section 311 sets guidelines for substances, other than oil, that present imminent and substantial danger to the public health and welfare when discharged into the territorial sea and oceans.\(^{322}\) Imminent and substantial harm is a high threshold, but danger to fish, shellfish, wildlife, shorelines, and beaches can meet this standard.\(^{323}\) While the harmful effects of marine debris could conceivably equal those of listed hazardous substances, the agency's interpretation has been much narrower.\(^{324}\) EPA has shown no inclination to use its authority over hazardous wastes to regulate plastic pollution.

Section 402 of the Clean Water Act could be used to control land-based point sources that discharge plastic and other persistent wastes into the water without a comparable change in agency direction. This provision does not require a finding that a hazardous substance is discharged, but requires permits for all discharges into navigable waters.\(^{325}\) NPDES permits could regulate industrial discharges of raw plastic pel-

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318. *Id.* § 1342. The Clean Water Act defines "discharge of a pollutant" as "(A) any addition of any pollutant to navigable waters from any point source" and "(B) any addition of any pollutant to the waters of the contiguous zone or the ocean from any point source other than a vessel or floating craft." *Id.* § 1362(12). It defines "source" as "any building, structure, facility, or installation from which there is or may be the discharge of pollutants." *Id.* § 1316(a)(3).
319. See *id.* § 1362(6).
320. *Id.* § 1311(a).
321. *Id.* § 1343(c)(1).
322. *Id.* § 1321(b)(2)(A).
323. *Id.*
The permit system could also supplement the Marine Protection, Research, and Sanctuaries Act permit system by forcing municipal waste treatment operations to filter out floatable debris when sewage is treated in preparation for ocean dumping.

III
MARINE DEBRIS POLLUTION CONTROL STRATEGIES

The preceding section identifies several legal authorities that can be used to control marine debris pollution. Some of these, such as Annex V and the Marine Plastic Pollution Research and Control Act, focus directly on the problem. Others, such as the Endangered Species Act and Marine Mammal Protection Act, address different issues, but nonetheless could be applied to certain aspects of marine debris pollution.

This section draws on these authorities and proposes a variety of steps that should be taken to make international and domestic marine debris pollution control programs more effective. The discussion covers three topics: controlling land-based sources, reducing ocean dumping and accidental discharges, and developing long-term solutions.

A. Controlling Land-Based Sources

The principal land-based sources of marine debris are sewer and stormwater systems, solid waste handling facilities, plastic manufacturing and processing plants, and litter on beaches and throughout watersheds. As discussed in the preceding section, various laws regulate the disposal of persistent wastes from these sources to some degree. To achieve maximum reduction of marine debris from land-based sources, however, vigorous enforcement and creative application of existing authorities must be augmented by improved technology and increased public awareness.

326. Id.; see also id. § 403, 33 U.S.C. § 1343.
1. Strengthening Domestic Control Programs

a. Wastewater Treatment Facilities

Many of the more than 2,000 sewage treatment plants in coastal counties of the United States discharge treated effluent directly into coastal waters. In addition, many large plants have combined sewer overflows which carry stormwater runoff as well as treated wastewater. During periods of heavy precipitation, the additional water flow from streets and sewers may exceed the capacity of these treatment plants and prevent the plants from skimming off plastics and other floating wastes. The wastes are then carried into coastal and marine waters. Similar discharges may occur because of plant breakdowns or maintenance problems.

The first step toward controlling this source of persistent debris is to assess the size of the problem. In a program now under way for the northeastern portion of the New York Bight, federal, state, and local agencies are jointly monitoring and collecting floating debris in the New York-New Jersey Harbor. The report will evaluate the debris in an effort to minimize beach washups of floatable debris and to help direct future regulatory efforts. Similar studies in other areas where concentrated runoff and treatment plant discharges occur would improve our understanding of the types of debris items for which locales could profitably institute tracking systems. Such knowledge is needed to tailor solutions appropriate for the wastes prevalent in particular areas.

Although additional information is needed, much can be done with existing regulatory tools to control marine debris from wastewater treatment plants. For example, EPA can prohibit the discharge of visible floatable material through NPDES permit conditions. Amended NPDES permits might require existing facilities with significant discharge problems, or those located in especially sensitive areas, to retrofit their facilities with filtration and extraction devices. Municipalities and states might impose similar restrictions in their respective solid waste disposal laws.

329. There were 2,307 municipal sewage plants operating in coastal counties in 1987. Interagency Task Force Report, supra note 16, at 54 (1988). Of these, 570 discharged treated effluent directly into the ocean or estuaries. Id.
330. Id. at 55.
331. Coastal Waters in Jeopardy, supra note 58, at 12.
333. EPA, Office of Community and Intergovernmental Relations Memorandum 2 (Mar. 10, 1989). The agencies involved are EPA, the U.S. Army Corps of Engineers, the U.S. Coast Guard, the New York State Department of Environmental Conservation, the New Jersey Department of Environmental Protection, and the New York City Departments of Sanitation and Environmental Protection. Id.
334. See id.
EPA could also condition new construction permits for publicly owned treatment works in coastal areas on the use of systems and technologies that reduce the discharge of floatable plastics to the maximum extent practicable. For example, EPA could require systems that would screen runoff at its most likely outlets. Treatment systems could also be required to extract floatable wastes before discharge or to contain and skim off such material upon discharge.

b. Solid Waste Handling Practices

Plastic accounted for 10 million of the 158 million tons of municipal solid waste generated in the United States in 1986, and it is expected to exceed 20 million tons by the year 2000. While most of this waste is placed in landfills, EPA expects one-third of domestic landfill capacity to be exhausted in the next few years. Rising disposal costs may cause an increase in illegal dumping, with a corresponding adverse effect on the marine environment.

In all likelihood, long-term solutions to the growing domestic and international solid waste disposal problem will require fundamental changes in the way we deal with solid waste in everyday life. Recycling, reuse, solid waste reduction, and other potential solutions are discussed later in this section.

The present regulatory system for municipal solid waste prohibits ocean dumping and sets standards for landfill operation. Unlike the strict laws governing disposal of hazardous wastes, federal nonhazardous solid waste disposal requirements give state and local governments primary enforcement responsibility. While the federal statutes encourage planning, source reduction, and recycling, they do not mandate those actions.

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338. Id.

339. Id.

340. See infra notes 412-44 and accompanying text.


A cradle-to-grave tracking and control system like the one used for hazardous substances is unnecessary and would place unduly burdensome handling and recordkeeping requirements on the public. Other kinds of control mechanisms, however, could minimize accidental releases of debris into the marine environment. A requirement that barges and other vessels transporting solid waste be covered would prevent debris from dropping or blowing into the water. Load size and stacking-height limits for barges and other waste transportation systems would further reduce marine debris. Transfer facilities could be required to cover stored wastes and maintain booms, skimmers, and other equipment to remove waste that enters the marine environment. In promulgating its Shore Protection Act regulations, the U.S. Coast Guard will have an excellent opportunity to establish these and similar restrictions.

c. Plastic Manufacturing and Processing

After reviewing practices at major plastics manufacturing facilities, the Society for the Plastics Industry concluded that current processes for handling resin pellets should prevent significant losses of that material into the environment.\textsuperscript{343} The Society for the Plastics Industry believes that most of the pellets found in the marine and coastal environment were discharged before the 1970’s. Since then, many plants have installed collection equipment that prevents the escape of the pellets during the manufacturing process.\textsuperscript{344}

Controlling releases at pellet manufacturing sites solves only part of the problem. Releases also result from practices involved in transporting plastic pellets and in molding final products. The Society for the Plastics Industry is trying to improve the handling of plastic pellets through an industrywide awareness campaign that explains the pellet escape problem and how to avoid it.\textsuperscript{345} Government-sponsored public education efforts should also focus on the plastics manufacturing and utilization process. These efforts would supplement the Society for the Plastics Industry’s activity and could reach the shippers and product manufacturers that are not included in the society’s program.

Notwithstanding these important education efforts, regulatory measures may be needed. Should the studies required under MPPRCA demonstrate that significant discharges of plastic pellets are occurring, it

\textsuperscript{343} Telephone interview with Ron Brunner, Vice President, Communications, Society for the Plastics Industry (Mar. 6, 1989).
\textsuperscript{344} \textit{Id.}
\textsuperscript{345} \textit{Id.}
probably will be necessary to invoke regulatory authority under the Clean Water Act. EPA could require NPDES permits for the discharge of resin pellets. EPA could also demand specified technologies or operational standards for those aspects of plastics manufacturing, packaging, processing, and transportation that may result in marine pollution.

d. Reducing Litter

Increasing public awareness of the sources and consequences of persistent marine debris pollution offers particular promise because much of the problem derives from the habits of individuals. There are signs that education and public awareness programs are working. Participation in volunteer beach cleaning has expanded from one state and 2,000 volunteers in 1984 to twenty-five states and territories and 47,000 volunteers in 1988. Vehicles for promoting awareness of the problem include "coastweeks," beach cleanups, brochures, posters, television and radio public service announcements, and special meetings and events in coastal communities.

2. Strengthening International Control Programs

Like all aspects of the marine debris problem, effective control of land-based sources of pollutants requires a coordinated international response. Progress achieved using U.S. authorities could be largely futile if nearby countries do not take similar steps to control discharges into shared bodies of water such as the oceans, the Gulf of Mexico, and the Great Lakes. Accordingly, the United States should encourage other countries to pursue measures that will help control runoff pollution and the discharge of persistent wastes.

Regional agreements may be more suited to controlling land-based pollution of the marine environment than are comprehensive international regimes. Because persistent debris from land-based sources can be traced to states adjacent to an affected marine area, a focused response that does not require the participation of numerous parties should be

346. The Interagency Task Force Report calls for vigorous enforcement of existing laws that reduce marine plastic pollution. INTERAGENCY TASK FORCE REPORT, supra note 16, at 125. Every NPDES permit issued under the Clean Water Act prohibits discharge of solid materials, as well as floatables. See PLASTICS IN THE OCEAN, supra note 18, at 93-94.

347. Telephone interview with Patty Debenham, Director, Marine Debris Information Office, Center for Marine Conservation (Mar. 6, 1989).

348. The Port of Newport, Oregon, established a Marine Debris Project Advisory Group with broad-based community representation. As part of the publicity campaign, newspaper articles discussed the quantity of plastic found on local beaches, financial costs related to marine debris, and actions that could address the problem. Television and radio coverage provided additional visibility. The outreach campaign also used posters at U.S. Coast Guard facilities and marinas, free trash bags handed out at marinas, and even an educational program for local schools. See Recht & Mohr, Implementation — Making It Work, in FISHERMEN'S CONF. PROC., supra note 19, at 414-16.
more effective. Special regulatory approaches can be more easily crafted when fewer nations are involved. Moreover, regional bodies might take more action. The problem would be closer to home and the participants in a regional agreement would be generally more able and likely to share technology and cooperate in enforcement.

Existing regional agreements concerning pollution of defined geographical areas serve as the starting point. Under the general framework of these conventions, protocols or other agreements directed at land-based sources should be established. The parties to the Caribbean Convention have already resolved to develop such a protocol. As a party to this Convention, the United States should ensure that the land-based pollution protocol includes provisions specifically directed at marine debris. In this process the United States should take the lead by developing recommendations and position papers that will guide efforts to enact such a protocol. Recommended measures could include specified procedures to govern the transportation and handling of wastes in coastal areas, prohibitions on the outright disposal of plastics from shore-based sources, and commitments to undertake public awareness programs.

The United States could play a similar role in other conventions to which it is a party, such as the South Pacific Convention. In addition, the United States could assist UNEP in encouraging the members of other conventions to pursue land-based pollution protocols that include provisions on marine debris. Such assistance could take the form of special funding as well as recommendations and proposed action plans submitted for consideration in forums conducted under other conventions.

The Law of the Sea Convention could be useful as well. Article 207 of the Convention requires that parties “adopt laws and regulations” to control land-based pollution. Guidelines to implement Article 207, similar to the Marine Environment Protection Committee Annex V guidelines, could be developed through UNEP to advise parties on land-based source regulation. The United States should lead a comprehensive international effort by stringently enforcing its own laws and offering its expertise in drafting international guidelines. The United States should particularly emphasize the value of public education programs as control techniques in developing countries, as those nations frequently lack the economic resources to establish costly control technologies.

349. UNEP CARIBBEAN REPORT, supra note 124, at annex V.
350. Support for using regional agreements to address marine pollution is addressed in J. KINDT, supra note 113, at 21-23.
351. Law of the Sea Convention, supra note 78, art. 207(1). Paragraph 3 provides support for regional controls by calling on parties to bring their efforts together “at the appropriate regional level.” Id. art. 207(3).
B. Controlling the Disposal and Loss of Persistent Debris from Water-Borne Sources

1. Strengthening Domestic Control Programs

The United States could pursue three avenues to improve its control of water-borne persistent marine debris. First, new methods could be used to bring about rigorous enforcement of the existing disposal prohibitions. Second, regulation of on-shore handling of waste generated at sea needs to become more effective. Finally, when feasible, the United States should apply and enforce federal wildlife conservation authorities against dischargers.

a. Ensuring Compliance with the Prohibition of Disposal

The most important element of the effort to control marine debris pollution is effective implementation of the Annex V and Marine Plastic Pollution Research and Control Act prohibitions on the disposal of plastic and other waste from vessels. Ensuring compliance with these bans will be difficult, however, because much waste disposal occurs on the high seas and is not easily detected or policed. Furthermore, the Annex V exceptions for unintentionally lost fishing nets and materials discarded to protect vessel or personal safety also limit enforcement. Thus, the achievement of desirable compliance levels may ultimately depend upon voluntary obedience. Nevertheless, establishing a visible and credible enforcement presence should provide sufficient deterrence to make the Annex V prohibitions substantially effective.

Successful enforcement of the sweeping prohibitions of MPPRCA will require innovative approaches. The statute provides little guidance. Domestic enforcement should follow a three-pronged approach consisting of citizen participation, at-sea inspection and observation by enforcement authorities, and monitoring of refuse record books. If these tactics do not succeed, technology-forcing requirements or a more elaborate system for tracking waste material generated on vessels may be necessary.

Citizen participation should be most productive in detecting violations from vessels that operate in areas frequented by the public. MPPRCA encourages citizen involvement through its public education program. Education should emphasize the importance of reporting observed violations and promote the formation of citizen pollution patrols. Though these patrols are likely to be most effective in cleanup ef-

352. See Manheim, supra note 79, at 100-06.
353. Annex V, supra note 5, reg. 6(c), 6(a). Though few situations should justify these exceptions, the availability of these excuses could preclude prosecution if evidence of unlawful disposal were not otherwise available. See, Manheim, supra note 79, at 100.
forts, they can also monitor vessel activity and report violations. MPPRCA also requires vessels to carry placards to inform crew and passengers of the Annex V disposal prohibitions. These notices should alert the public to the need to report violations.

The Act’s reward provisions also encourage citizen participation. Courts may pay up to one-half of the fine levied against a vessel as a reward to any informant. These rewards could amount to several thousand dollars as fines can reach $50,000.

Vessel inspections, at sea and portside, will also play an important role. MPPRCA’s inspection program will be most effective if the U.S. Coast Guard delegates this authority to state marine patrols and federal agencies such as the Animal and Plant Health Inspection Service, the Fish and Wildlife Service, and the National Marine Fisheries Service. Indeed, MPPRCA’s legislative history indicates that Congress expected cooperative efforts of this kind. Delegation of authority in this manner has proved feasible in other enforcement contexts involving federal environmental laws and should be pursued vigorously under MPPRCA.

Refuse record books can also make enforcement easier. By December 31, 1989, the U.S. Coast Guard must promulgate regulations that require certain ships of United States registry or nationality to maintain refuse record books. Congress intended that they be reviewed for enforcement purposes. MPPRCA does not indicate what kind of vessels

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356. Id. § 1908.
357. Id.
359. As stated in House Report No. 360:

The Department of Agriculture can be instrumental in the enforcement of Annex V. The USDA currently boards a significant percentage of vessels which may be carrying contaminated garbage from foreign sources. . . . During these inspections the USDA personnel shall—based on the garbage brought ashore—assess whether it is likely that the vessel has discarded garbage overboard in violation of Annex V. . . . If it appears that a violation may have occurred, the USDA personnel shall review the refuse record book, and if it appears likely that a violation has occurred, shall contact the Coast Guard.


360. For example, the Fish and Wildlife Service, the National Marine Fisheries Service, and the Animal and Plant Health Inspection Service have entered into a cooperative agreement for administration and enforcement of programs related to the maintenance of marine mammals in captivity. The agreement allows each agency to apply its expertise to advance the Marine Mammal Protection Act requirements pertaining to public display. See Agreement between the NMFS, NOAA, Department of Commerce, FWS, Department of the Interior and APHIS (1979).

are to be covered, but recordkeeping should be required for all commercial vessels.

The U.S. Coast Guard could review refuse records during vessel inspections. The Coast Guard should be able to estimate the amount of waste that different vessel classes routinely generate. If the amount of waste on hand was far less than that accounted for by disposal in port-certified record books, the evidence would suggest unlawful discharge.\textsuperscript{363} Vessel operators should then have the burden of proving that MPPRCA requirements had not been violated.

Refuse records could also sharpen after-the-fact monitoring. If ports kept accurate records of the amount of waste offloaded from each vessel, inspectors could cross-check refuse record books from vessels. Notable discrepancies would indicate that record books had probably been falsified. If the waste was not accounted for, enforcement actions could be considered. The U.S. Coast Guard regulations implementing the MPPRCA refuse book requirement should spell out this enforcement scheme in detail.

One more stringent enforcement regime would employ persistent marine debris tracking systems similar to those used under the Resource Conservation and Recovery Act (RCRA) and the Medical Waste Tracking Act.\textsuperscript{364} This mechanism should be applied only to those materials that could be practically marked and monitored from cradle to grave. Trackable items include fishing gear and offshore drilling materials.\textsuperscript{365} Tracking systems would likely be too expensive and impractical for many commonly occurring and frequently used materials such as plastic bags, small containers, foamed polystyrene cups, and monofilament line, but

\textsuperscript{363} \textit{Id.} at 13-14.
\textsuperscript{365} Arguably, authority to promulgate regulations for this purpose is included in the MPPRCA directive to “require certain ships . . . to maintain refuse record books and shipboard management plans.” 33 U.S.C. § 1903(b)(2)(A)(i) (Supp. V 1987). A mandatory manifest list or other tracking system would seem to fall within the scope of both the “refuse record book” and “shipboard management plan” requirement.

Another possibility would be to establish technology-forcing requirements mandating that ships install and maintain operable onboard incinerators, comminuters, compactors, and other refuse-handling equipment. Although permissible for purposes of complying with Annex V, the use of shipboard incinerators could cause other environmental problems such as air pollution and the production of potentially hazardous ash and byproducts, which still must be disposed of. \textit{See} M. Bean, Redressing the Problem of Persistent Marine Debris Through Law and Public Policy: Opportunities and Pitfalls 9-12 (April 1989) (paper presented at the Second International Conference on Marine Debris in Honolulu).

Although there is no guarantee that ships would use these devices, there would be little reason for vessel operators not to employ them after installation. Unlike a recordkeeping system for which authority exists under MPPRCA, new statutory authority probably would be required for a mandatory equipment program.
large materials that are capable of marking could be monitored with relative ease.

b. Implementing Effective Land-Based Handling and Disposal Systems

Keeping persistent pollutants out of the marine environment addresses only part of the problem. Without an effective system for handling and disposing of the waste onshore, large amounts of trash and plastic waste will have nowhere to go, and one problem will have been solved at the expense of creating another. MPPRCA and Annex V anticipate this, in part, by requiring that adequate disposal facilities be made available. The immediate challenge is to implement the adequate reception facility directive in a manner that is cost-effective as well as convenient and reliable enough to ensure use by vessel operators.

i. Reception Facilities

Many large ports in the U.S. have waste management systems that should satisfy the adequate facility requirement, although they may need to increase capacity and improve efficiency and convenience. Small and medium-sized ports and terminals may have to take aggressive steps to meet the requirement.

As noted above, the U.S. Coast Guard's interim rules require ports and terminals to provide adequate reception facilities only for ships having commercial transactions with the port or terminal. Thus, a port would not have to provide adequate reception facilities for recreational vessels that do not purchase fuel or engage in some other commercial transaction. This limitation appears inconsistent with the basic objective of facilitating waste handling. If a port or terminal establishes reception facilities sufficient to handle waste from commercial traffic, a small increase in capacity would probably accommodate other classes of vessels. In future MPPRCA rulemakings, the U.S. Coast Guard should mandate waste-handling capacity sufficient to meet the needs of all vessels reasonably expected to call at a particular port.

Another deficiency in the U.S. Coast Guard regulations is the limitation of certificate of adequacy requirements to a small proportion of ports and terminals. Small marinas serving recreational craft may need compliance monitoring the most. While commercial ports must have some reception capability or ships will go elsewhere, recreational marinas are not likely to have to provide disposal services to retain business. Accordingly, the U.S. Coast Guard should extend the certificate of adequacy requirements to all ports and terminals. The Coast Guard could mitigate any resulting administrative and paperwork burdens by

366. See supra note 210 and accompanying text.
367. See supra notes 212-16 and accompanying text.
phasing in the uniform application of the certificate of adequacy requirement over several years.

Finally, the U.S. Coast Guard regulations fail to specify how much waste-handling capacity is "adequate." Admittedly, this is difficult to judge. The development of an accurate estimation technique may take several years of trial and error. If the adequate reception facility requirement is to be enforceable, however, the U.S. Coast Guard must promptly devise some method for determining if facilities measure up.

Experience demonstrates that effective waste management systems can be developed at ports and terminals. In a pilot project, the Port of Newport, Oregon, established a successful refuse-handling system meeting the MPPRCA/Annex V requirements. This system succeeded by restructuring the port's existing refuse-handling program, increasing mariner awareness, and focusing community attention on the program. The port provided clearly labeled bins for plastics, nets, cable, line, and oil at dockside and water level locations. The port set aside a separate reception area for large nets and other items. The port also dispensed litter bags at marine locations and placed windscreens around disposal areas. By using a coordinated refuse handling system to recycle and separate materials, the Port of Newport reduced the total cost of its refuse system by eight percent during the first nine months of the program despite increases in the volume of refuse and the amount of labor required.

The Port of Newport program depended heavily on public awareness and citizen involvement. The port's public involvement effort, an excellent model for other locations, aimed at affected users and the community at large. The port had notable success with both groups as a result of local media exposure, contacts with individual users, and the encouragement of peer pressure. Such intense public involvement dem-

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368. See generally Recht & Mohr, supra note 348. The National Marine Fisheries Service funded the pilot program. Newport's program had to handle large quantities of waste generated during fishing activities. Refuse returned to port from recreational and international trade, primarily in logs and lumber, also had to be handled. See id. at 405.

369. Id. at 412. Previously, trash containers for unsegregated refuse were located only at boat ramps, discouraging frequent use. Id.

370. Id.

371. Id. at 413.

372. Id.

373. Id. at 414.

374. Fishermen have been willing participants in the Newport program, serving on the Project's advisory board, keeping records voluntarily, participating in public service announcements, retrieving derelict gear not their own, and exerting peer pressure on others to abide by the disposal guidelines. Marinas also have been enthusiastic participants, encouraging the use of litter bags and advertising the program. Schools have sponsored educational programs. Id. at 415-16.

375. Television, radio, and magazines publicized the program. Numerous newspaper articles covered the program and the problems caused by debris. Id. at 414.
onstrates that public concern about marine debris pollution can translate into solid support for achieving MPPRCA/Annex V goals and assisting in the enforcement effort.

ii. Waste Management After Reception at Port

Several waste-handling issues arise after refuse is brought to port. Most materials probably will be hauled to landfills for ultimate disposal by private contractors, municipal trash services, or port authorities themselves.376 This option may not be available or desirable in locations where landfill capacity is already overburdened, or for certain types of materials, such as plastics and potentially contaminated items. Ports and terminals, in conjunction with waste management firms,377 can develop effective disposal systems using regional waste-handling networks and full service waste-handling ports. Local municipalities, which benefit economically from ports and marinas, should be willing to assist in making local disposal systems available.

In a regional refuse disposal network, participating ports and terminals would coordinate refuse collection, hauling, and distribution to recycling centers, landfills, and treatment facilities. Such a service could be provided by a private contractor, perhaps, or through an association of ports, terminals, and shipping interests.

Regional waste handling would offer several advantages arising from high volume and centralized management. First, all reception facilities could take advantage of the most efficient and environmentally acceptable options for permanent disposal. Second, many ports that cannot handle Animal and Plant Health Inspection Service regulated waste could meet treatment requirements without major capital expenditures. Third, economies of scale would make expanded recycling programs feasible. Fourth, regional handling should be cost effective, reducing the expenses to ports and terminals and regulated user groups alike. Finally, the involvement of a number of ports, business entities, and coastal communities in a common effort to control marine debris pollution should enhance public awareness, benefiting both enforcement and pollution control efforts.

376. The Port of Newport, for example, determined that purchase and use of a port garbage truck was the most efficient approach. Id. at 413.

377. Private waste management companies have testified that they would be able to assist ports and terminals in meeting their waste management needs. See, e.g., Plastic Pollution in The Marine Environment: Hearings on H.R. 940, supra note 16, at 386-88, 423-31, 435-44 (statements of James R. Greco, Browning-Ferris Industries and Dr. William Y. Brown, Waste Management, Inc.). "Handling the increased volume of garbage that would be brought into the port, once Annex V takes effect, will in our view, create no measurable strain on the ability of the private waste hauling companies to properly manage that waste." Id. at 387 (statement of James R. Greco).
The flip side of regional management practices is the establishment of centralized, "one-stop shopping" for vessels needing to unload refuse. Centralized facilities could establish effective recycling systems because large quantities of waste delivered on a regular basis would be ensured. For certain classes of vessels along certain routes, such as cruise ships in the Caribbean and merchant vessels traveling along coastal routes, frequently visited ports can be identified for this purpose. Because most of the costs of waste handling will be passed on to vessels, ports might profit from establishing the most cost-efficient, state-of-the-art, and convenient reception facilities. Vessels could be expected to store refuse for disposal at the least costly reception facility on a major route. A well-planned, centralized reception facility might be able to reduce costs to shippers, make a profit for its operators, and enhance the overall marine refuse control effort. Provided that the market for waste disposal operates efficiently, competition among ports for this business should produce an optimal number of facilities equipped to handle debris in compliance with Annex V. This, in turn, would reduce the amount of debris offloaded at less competitive ports and allow them to reduce their debris-handling capacity while still complying with MPPRCA.

For this system to work, international minimum standards for reception facility adequacy must be set. Otherwise, ports could be tempted to offer cost-effective handling by using less than adequate facilities. This would encourage the dumping of waste in ports solely on the basis of cost rather than because of facility adequacy.

c. Applying Wildlife Laws

Effective implementation of U.S. fish and wildlife laws could reduce the incidental entanglement of marine life resulting from the operations of domestic fisheries. Members of the fishing industry, whose livelihoods are tied to the resources of the oceans, have willingly participated in the debris reduction effort through educational programs and adoption of debris reduction guidelines. The federal government should encourage similar efforts by other industries.

i. Marine Mammal Protection Act

The Driftnet Act acknowledges the need to gather reliable information on the harmful effects of debris generated by foreign driftnet fishing activities. For domestic fisheries, this information can be obtained

378. All ports will still have to meet Annex V requirements. Annex V, supra note 5, reg. 7.
379. See generally, Bean, supra note 14, for a discussion of the possible methods for reducing incidental entanglement of marine life.
380. ALASKA SEA GRANT COLLEGE PROGRAM, supra note 328, at 30.
381. See supra text accompanying notes 257-60.
through the new observer and reporting program established by the 1988 Marine Mammal Protection Act amendments. Observers will be able to collect a broad range of data if they are placed on fishing fleets that have frequent interactions with marine mammals and on others that voluntarily participate. Observers could assess the amount of gear lost during fishing operations, the quantity and location of derelict gear and entangled marine life, and any incidents of intentional disposal.

Reports prepared by the observers could be used to estimate, with unprecedented accuracy, the amount of gear that is lost or discarded by domestic fishing operations and the resulting environmental consequences. Information gathered from individuals engaged in commercial fishing could also help quantify the extent of the gear-loss problem. This information could establish a record upon which to promulgate regulatory restrictions under the Marine Mammal Protection Act, the Endangered Species Act, or the Fishery Conservation and Management Act. The new data could help agencies determine the kind of gear that should be used, methods for handling gear, and areas that should be closed to fishing because of high gear-loss rates or sensitive environmental conditions.

Gear identification would permit enforcement agencies to trace derelict materials to their source. The Driftnet Act requires the Secretary of Commerce to study and make recommendations on driftnet marking, registry, and identification. The recommendations should be applied to domestic fishing operations. For example, gear-marking and retrieval requirements could be included as conditions for the incidental take exemptions granted to most domestic fisheries. Exemption conditions might also require the use of degradable materials whenever economically feasible and environmentally sound.

382. 16 U.S.C. § 1383a(e) (1988). Fisheries that cause frequent incidental takings of marine mammals are required to have observers monitoring not less than 20% nor more than 35% of their fishing operations. Id. § 1383a(e)(1). With the consent of the vessel owner, observers may be placed on vessels engaged in fisheries that do not have high incidental take rates. Id. § 1383a(e)(3). The information collected by Marine Mammal Protection Act observers or reported by fisheries is not necessarily limited to the incidental takes of marine mammals in actively fished gear, but can cover other wildlife impacts. Data not related to incidental takes may be collected if requested by a fishery management council, a state fishery, the state, or, in the case of seabird data, by the Secretary of the Interior. Id. § 1383a(e)(4).

383. See supra text accompanying notes 257-60.

384. 16 U.S.C. § 1383a(d) (1988). Although this provision does not confer direct authority on the Secretary of Commerce for this purpose, it does authorize the establishment of programs to “enhance the quality of and verify information received from” fishing interests. Id. § 1384(d)(1). This can be done through “information gathering and verification activities that will enable the Secretary to determine reliably the nature, type, and extent of the incidental taking of marine mammals that occurs in a fishery.” Id. § 1384(d)(1)(C). Net marking and retrieval requirements would be such activities. Regulations may be promulgated for this purpose. Id. § 1383a(k).
The proposed regime to govern the incidental-taking of marine mammals after 1993 should include these restrictions, even if they are not incorporated into the current Marine Mammal Protection Act interim incidental take exemptions. Because lost and discarded fishing gear causes marine mammal mortality, failure to address this problem in the Marine Mammal Protection Act incidental take review would appear to be inconsistent with the requirements in the 1988 amendments that the incidental take program “be based on sound principles of wildlife management, and be consistent with and in furtherance of the purposes and policies set forth in [the Marine Mammal Protection Act].”

Direct regulatory action under the Marine Mammal Protection Act can also protect any geographic region of particular significance to marine mammals or any marine ecosystem especially sensitive to impacts caused by marine debris. Section 112 of the Marine Mammal Protection Act confers broad authority to “prescribe such regulations as are necessary and appropriate to carry out the purposes of [the Marine Mammal Protection Act].” As noted previously, this authority has been used to close certain areas in Florida to all water-borne activity, including vessel traffic, in order to protect endangered West Indian manatees. It has also served as the basis for a Marine Mammal Commission recommendation that a zone excluding all foreign driftnet fishing be established around the Aleutian Islands. The broad statutory purposes of the Marine Mammal Protection Act, including the maintenance of the health and stability of the marine ecosystem, would justify section 112 regulations requiring steps such as gear marking, use of gear that is degradable or designed to reduce the likelihood of loss or entanglement, and reasonable efforts to recover debris lost in areas that are particularly sensitive to the impact of marine debris pollution.

385. Id. § 1383a(1). The 1988 amendments exempt most commercial fisheries from the Marine Mammal Protection Act’s incidental take requirements for five years. Id. § 1383a(a)(1). At the end of five years, a permanent program to authorize this kind of incidental take is to be recommended to Congress by the Secretary of Commerce. Id. § 1383a(i). If legislation is necessary, Congress will address this matter. See id. If additional authority is necessary to require gear marking, retrieval, and the use of degradable materials, such requirements might be imposed then.

386. Id. § 1383a(c)(1)(B). The Marine Mammal Protection Act provides that marine mammals “should be protected to the greatest extent commensurate with sound policies of resource management” and states that the Act’s primary objective is to “maintain the health and stability of the marine ecosystem.” Id. § 1361(6). Controlling marine debris pollution certainly falls within the scope of both goals.

387. Id. § 1382(a).


389. See supra note 300 and accompanying text.

390. The Fishery Conservation and Management Act, as the principal fisheries management statute, would appear to be the logical authority under which to establish such controls. However, the Marine Mammal Protection Act could be more useful for achieving controls because the regional fishery management councils have been reluctant to develop debris-pre-
Similarly, conditions imposed under the Marine Mammal Protection Act’s nonfisheries incidental take requirements might require the oil and gas industry and other nonfisheries activities to take steps to prevent marine debris pollution that could result in incidental takes. For example, an oil company might seek an authorization to conduct offshore seismic operations. If the activity would likely result in the loss of packing materials and other persistent debris where marine mammals would be affected, a Marine Mammal Protection Act incidental take permit could require that potentially harmful items not be used when substitutes are available and that recyclable materials be used whenever feasible.  

i. The Fisheries Conservation and Management Act

Fishery management councils under the Fisheries Conservation and Management Act could establish requirements for fisheries similar to those discussed above. Councils may impose such terms and conditions to manage and protect most marine resources; these restrictions would not have to be tied directly to impacts on marine mammals or their habitat. Under the Fisheries Conservation and Management Act, each fishery management council could include gear-marking and retrieval requirements in the regional plans that are implemented through regulations by the Secretary of Commerce. While the councils have not been inclined to impose these requirements, the concern that U.S. fishermen have demonstrated over the impacts of marine debris could lead to greater council activity.

iii. Governing International Fishery Agreements

Governing International Fishery Agreements provide additional leverage over foreign fisheries in U.S. waters. The United States negotiates these agreements with each foreign nation whose nationals desire to fish within the U.S. Exclusive Economic Zone. Under each Governing International Fishery Agreement, foreign fishing vessels operating in U.S. waters must comply with all requirements of the applicable fishery

ventive gear requirements. See supra notes 306-07 and accompanying text.

391. This approach is authorized under the Marine Mammal Protection Act, § 101(a)(5)(A)(ii)(I), 16 U.S.C. § 1371(a)(5)(A)(ii)(I) (1988), which directs the Secretary to authorize the incidental take of marine mammals in nonfishing activities through regulations that prescribe, among other things, the “means of effecting the least practicable adverse impact on [the affected] species or stock and its habitat.” Id.

392. See supra text accompanying notes 303-07.

393. The Fishery Conservation and Management Act asserts regulatory control over fish and “all other forms of marine, animal, and plant life, other than marine mammals, birds, and highly migratory species.” 16 U.S.C. § 1802(7) (1988). Tuna are considered highly migratory species. Id. § 1802(14).

394. Id. § 1853(b)(4).

395. See supra note 307 and accompanying text.

management plan.\textsuperscript{397} Governing International Fishery Agreements could impose on nondriftnet fisheries the provisions for gear marking and cooperative enforcement required by the Driftnet Act.

\textit{iv. Endangered Species Act}

The Endangered Species Act's incidental take permit authority could also help control marine debris in some circumstances. A permit allows the holder to conduct activities that would result in otherwise illegal incidental taking, if the holder produces and follows an adequate "conservation plan."\textsuperscript{398} Permits are usually conditioned on the permittee agreeing to take specific measures to protect or enhance defined habitat areas in exchange for authorization to take members of the listed species through habitat modification.

To date, these permits have been used only for terrestrial species,\textsuperscript{399} and the concept is more difficult to apply to marine species that migrate over extensive areas that generally cannot be purchased and set aside by private parties. Nonetheless, the permit program could be useful for the protection of marine species. For example, if a fishery inevitably loses nets that will adversely affect endangered marine species, it could obtain a permit for those takes on condition that gear be marked, derelict gear be retrieved when sighted, and degradable gear be used when practicable.

The agencies can also impose stipulations under section 7 of the Endangered Species Act on federally permitted activities that result in incidental takes.\textsuperscript{400} Such stipulations might therefore control actions that are believed to result in entanglement of endangered and threatened species. Fisheries that are required to have federal permits could be required to employ the practices outlined in the preceding paragraph.

2. \textit{Strengthening International Control Programs}

The entry into force of Annex V is a major step toward focusing international efforts on marine debris pollution control. The international community should now strive to secure the participation of nations not yet party to the Annex, ensure effective implementation by member nations, and fine tune Annex V's regulatory mechanisms.

The foremost goal should be to expand the roster of signatory parties. Several major maritime nations, including Canada, Mexico, and Li-
beria, have not ratified Annex V. Because wastes that originate in Mexican and Canadian waters affect United States coastal regions, the United States should initiate direct negotiations with these nations to encourage them to join Annex V.

Ratification of Annex V is only the first step for each participating country. Domestic implementation and enforcement of the Annex V disposal prohibitions and reception facility requirements will determine the ultimate success of the program. Here the International Maritime Organization can play an important role. The existing Marine Environment Protection Committee guidelines are a start. The Marine Environment Protection Committee should prepare more detailed guidelines to assist individual port and terminal operators in establishing efficient and cost-effective reception facilities. Facility guidance could set out methods of waste offloading, storage and transportation, and ways to make vessel use easier. Facility guidance could also show how to establish recycling systems and reduce costs through refuse separation, placement of reception facilities, and proper use of outside contractors. These guidelines could also serve as the minimum standards of adequacy to identify ports that comply with Annex V. Indeed, parties to Annex V may wish to establish a mechanism similar to the U.S. Coast Guard’s certificate of adequacy requirement to identify adequate ports.

In addition, the Marine Environment Protection Committee should develop guidelines for shipboard waste management. The guidelines should mandate procedures for storing and offloading, reducing the amount of waste generated, and reporting and tracking lost or discarded waste, especially synthetic fishing nets. Given its leadership in the Annex V program, the United States should take the lead in shipboard waste control. The United States should submit an “information paper” to the Marine Environment Protection Committee that recommends steps to encourage effective Annex V implementation.

Marine Environment Protection Committee guidance could also help establish economic incentives to reduce the amount of waste generated and to enhance handling and disposal capabilities. Graduated fees for offloading various kinds of waste, with lower fees for plastics, would

401. See TREATIES IN FORCE, supra note 5, at 334.
402. Ideally, the United States should use traditional international diplomacy to secure voluntary participation by Mexico and Canada. One forum for doing so is the International Maritime Organization, where other nations can be enlisted to apply political pressure. Another possibility is direct bilateral negotiations between the United States and these countries. Negotiations could occur in the context of other deliberations, including trade agreements or general environmental discussions such as those between the United States and Canada on acid rain.
403. See supra text accompanying notes 107-12.
404. Of course, this type of guidance also can be generated under other international programs, such as UNEP, or by individual nations.
reduce the incentive to discard items that persist in the marine environment. Refund systems could assign higher purchase costs to certain kinds of plastic items and provide refunds at port when these materials are returned. Governments could grant tax credits or exemptions for recycling efforts or for the purchase of garbage storage and processing equipment. Countries could raise taxes on items composed of nondegradable materials, such as plastic bags, that can be readily replaced by less environmentally damaging products, such as paper bags.

Regional seas agreements should be used more energetically to control water-borne sources. All Annex V special area restrictions for water-borne sources need to become effective as soon as possible. To this end, nations adjacent to these areas should implement and enforce domestic laws requiring adequate reception facilities. Special regional agreements could speed development of adequate port facilities. Guidelines or binding requirements responsive to unique circumstances may be necessary within special areas or for areas subject to regional seas agreements. Special working groups could be established to guide implementation of action plans and compliance guidelines. The Specially Protected Areas and Wildlife Protocol of the Caribbean Convention would establish a Scientific and Technical Committee as such a working group.

New special area designations should be pursued vigorously. While the U.S. has announced its intent to pursue special area designation for the Gulf of Mexico, that initiative must wait until Mexico becomes a party to Annex V. However, the Mexican Government has indicated its agreement in principle to the stringent special area dumping controls. Cuba and Venezuela have also announced their agreement in principle, but advocate the inclusion of the entire Caribbean Sea. Meanwhile, countries bordering the North Sea are moving ahead with special area designation for that region.

To help focus international control efforts, the Marine Environment Protection Committee should establish a clearinghouse for data on the sources and effects of marine debris pollution. The international exchange of research and information is essential for identifying sources of debris and initiating enforcement actions. International workshops like those held in 1984 and 1989 should occur at regularly scheduled intervals

405. The obvious disadvantage of this proposal is that it may encourage illegal dumping of the more costly types of waste.
408. See TREATIES IN FORCE, supra note 5, at 334.
410. Id.
411. Id.
in order to eliminate significant data gaps and verify the effectiveness of control programs. The Marine Environment Protection Committee should also create a system for reporting inadequate port facilities or vessels that violate Annex V prohibitions. This information could be used for enforcement and to bring international pressure to bear on nations that are not effectively implementing Annex V.

C. Achieving Long-Term Results: Source Reduction, Recycling, and Degradable Materials

With the entry into force of Annex V and enactment of the Marine Plastic Pollution Research and Control Act, U.S. vessels will have to change the way they dispose of operational plastic wastes and other persistent debris. In the short term, the most likely alternatives are simple retention of all waste for offloading at port, or onboard incineration for vessels equipped with appropriate technology. Incineration is not an option for small vessels. Moreover, it only converts plastic into air pollutants and ash that may present public health risks. Thus incineration might not be favored as a long-term solution. The most promising long-term approaches include reducing the amount of plastics and other persistent materials taken aboard ships, recycling, and promoting the development and widespread use and reuse of more readily degradable materials.

1. Source Reduction

Unlike a technology applied at the end of the useful life of a product, source reduction requires action at the design, manufacture, and use stages. At one regulatory extreme, source reduction could take the form of bans or surcharges on the use of certain materials in manufacturing. Some municipalities have restricted point-of-sale packaging. Others are considering disposal fees, surcharges on nondegradable containers, bans on retail sales of food in nonrecyclable containers, and mandatory deposit fees.

The U.S. Navy, which must comply with MPPRCA by the end of 1992, is now exploring this approach. The advisory panel convened

413. Id. at 39.
414. Id.
415. See id.
417. Id.
for this purpose recommended that the Navy reduce the amount of plastic packaging found on nearly every item in its vast supply of goods.\textsuperscript{419} In response, the Navy cancelled a contract for 11 million plastic shopping bags.\textsuperscript{420} Shipping companies, the fishing industry, and recreational boaters should follow the Navy’s example and reduce their own use of materials that contribute to waste disposal difficulties.

Congress has asked EPA to report by the end of 1989 on steps needed to encourage source reduction.\textsuperscript{421} The Agency has pointed out that a major obstacle to source reduction is the throwaway consumption pattern of American society, but it sees promise in the increased public attention given to the solid waste problem.\textsuperscript{422}

EPA recommends a multipronged approach to source reduction beginning at the manufacturing stage and ending with the consumer. Industry should consider designing for ultimate disposal and using recycled or degradable materials.\textsuperscript{423} On the other end of the waste stream, citizen awareness must be raised to encourage the use of products that last longer, have less packaging, and are recyclable.\textsuperscript{424} Finally, local governments and the waste management and recycling industries need to work together to plan and integrate waste management strategies for communities.\textsuperscript{425}

Most critical to the process of source reduction, however, are changes in consumer behavior. Consumer responses to packaging, the convenience of disposable, single-use items, and the propensity to opt for new products rather than to repair or reuse old ones all contribute to the throwaway society. Consumers must understand their role in both creating and solving the garbage problem by considering the ultimate fate of the products they purchase and by changing their buying habits. Citizen education, which can translate into consumer pressure on manufacturers and retailers, is the key to source reduction.

Pending federal legislation would set the goal of eliminating ten percent of the municipal solid waste flow through source reduction by 1993.\textsuperscript{426} The legislation provides for centralized federal oversight over source reduction efforts.\textsuperscript{427} A new federal Product and Packaging Advi-
sory Board would recommend ways to minimize the quantity of packaging and other material in the solid waste stream. Source reduction, which does not rely on dispersed enforcement or legal penalties, may prove to be the most successful method for reducing persistent marine debris pollution and related solid waste disposal dilemmas.

2. Recycling

Recycling has immediate appeal, but may not be practical for all vessels, nor for all types of plastic and other materials that become marine debris. There are two major obstacles to recycling plastic wastes on marine vessels. First, only a few types of plastic polymer are used as a feedstock for recycling operations. Second, regulatory requirements preclude recycling plastics that have been in contact with foreign foodstuffs.

The plastic polymer used for most commercial plastic recycling operations is polyethylene terephthalate (PET), which is used to make carbonated beverage containers. Some waste plastic from ships can be recycled if items such as milk jugs and soda bottles are separated from other wastes and delivered to onshore recycling channels. However, at present, there are no markets for other plastic items commonly used on ships, with the possible exception of some kinds of fishing gear that can be used again. Nonetheless, the common perception is that such markets eventually will emerge. The Japanese already recycle some nylon and driftnets and other plastic fishing products.

To recycle shipboard plastic wastes, crews would have to clean, separate, and store recyclable plastic items on board, and ships would need access to plastics recycling operations in ports. Even if vessel operators were able and willing to recycle plastics, Animal and Plant Health Inspection Service sterilization requirements for potentially contaminated items could restrict onboard recycling. These requirements could be modified to allow the use of sterilization procedures that do not destroy...
recyclable materials. Another solution would be to separate plastic waste onboard to reduce the amount that comes into contact with food wastes.

In any case, plastics recycling is a viable option onshore and for vessels that do not call in foreign ports (and therefore are not subject to the Animal and Plant Health Inspection Service requirements). The latter category includes most of the U.S. fishing fleet. Incentives could make recycling programs more successful. Such incentives could include clear marking of recyclable plastic items to aid consumers and waste handlers, economic incentives such as those created by "bottle bills," and increased homogeneity in polymers used so that more plastic products would be recyclable.

Recycling of paper, glass, wood, and metal has succeeded in small fishing ports. The pilot project at Newport, Oregon is expanding into other states with the aid of National Marine Fisheries Service grants. For example, a current California project will design a statewide program for marine waste recycling, including an education campaign to inform fishermen of the program. Like the Port of Newport project, the California program is designed to be economically self-sustaining after the pilot period. The success of these efforts may lead to the widespread establishment of recycling systems at facilities subject to MPPRCA.

3. 

Developing Degradable Plastics

All plastics ultimately break down or "degrade." Their rate of degradation can be enhanced by various chemical means that make them more susceptible to photodegradation, deterioration from exposure. Mixing plastic polymers with starches can increase biodegradability, deterioration from microorganisms that consume the starches.439

436. The present sterilization process involves heat. It may be possible to use a chemical process that does not destroy the polymers of recyclable plastic items. See id.
438. Id. at 1-3.
439. See INTERAGENCY TASK FORCE REPORT, supra note 16, at 106-08. The National Marine Fisheries Service recently completed a study of plastic debris items most likely to be found in the ocean and their rates of degradation in simulated marine conditions. Northwest and Alaska Fisheries Center, National Marine Fisheries Service, U.S. Department of Commerce, NWAFC Processed Report 88-19, Experimental Demonstration of Controlled Photodegradation of Relevant Plastic Compositions Under Marine Environmental Conditions 1 (Sept. 1988) [hereinafter NWAFC Report 88-19]. The study concluded that polypropylene strapping tape, polyethylene film, rubber balloons, and photodegradable polyethylene beverage connectors deteriorated more slowly in seawater than on land. Id. at 53-54. Trawl netting material, however, deteriorated at the same rate in either location. Id. Foamed polystyrene, the type used for cups, food trays, and some packaging, degraded more quickly in seawater than on land. Id. at 12, 53-54. The report suggested further study to determine whether plastic degradation at sea results in leachates that are harmful to marine species. Id. at 63-64.
The appropriateness of degradable plastics for marine use has yet to be determined. Environmentalists have expressed concerns over placing too much reliance on degradable materials until there is some indication whether the byproducts of their decay cause any environmental impacts. Moreover, Annex V and the Marine Plastic Pollution Research and Control Act prohibit ocean disposal of even degradable plastics.

The 1988 amendments to the Solid Waste Disposal Act address the problems presented by nondegradable six-pack rings. The amendments require that beverage connectors soon be composed of naturally degradable material. EPA must define the period during which decomposition should occur, but the period must be "the shortest period of time consistent with the intended use of the item and the physical integrity required for such use." Similar restrictions should govern other items, including plastic bags and sheets, food and beverage containers, and some types of fishing gear.

The development of degradable plastics does not, of course, address the fundamental issue of using the ocean for waste disposal. The new technology simply makes the consequences of those practices less obvious. Ultimately, a significant reduction in the amount of persistent marine debris will depend on the successful accomplishment of a number of measures. Eliminating or reducing the amount of waste released into the marine environment will be the most important step. Degradable materials may have a place in the overall scheme, but they are not a panacea and do not provide an alternative to modifying human behavior and social norms. Reliance on degradable products, even if proven to be environmentally acceptable, should not be allowed to detract from source reduction and recycling efforts.

CONCLUSION

Oceans and coastal seas have long been used as receptacles for all kinds of waste materials. They provided a dumping ground that was out of sight and out of mind. Few questions were asked until marine animals strangled in plastic and medical wastes began to foul our beaches.

Once the scope and impacts of persistent marine debris pollution became apparent, political institutions responded quickly. Annex V entered into force after nine years of delay, and Congress enacted tough marine pollution control laws, including the Marine Plastic Pollution Research and Control Act. Federal agencies have now promulgated regula-

441. See M. Bean, supra note 365, at 1;
443. Id. § 103, 42 U.S.C.A. § 6914b-1.
444. Id.
tions prohibiting at-sea disposal of most substances. The government has also launched comprehensive studies of the problem and possible solutions. Even the public has become involved by participating in volunteer beach cleanups. Without question, these actions will play an important role in reducing the severity of the marine debris pollution problem. This Article offers a number of regulatory suggestions to enhance these beginnings.

Lasting success in reducing marine debris depends primarily on translating current public awareness of the marine debris problem into modifications of the way people conduct their everyday activities. It does not occur to most people that the persistent marine debris problem is closely tied to a more fundamental problem: the tremendous amount of solid waste generated every day. Both problems arise because industries, commercial enterprises, communities, households, and individuals are accustomed to discarding used products without thinking about what happens to those items after disposal.

This Article identifies three ways to change this attitude and thus to lessen the impact of commonly pursued waste disposal activities on the marine environment—source reduction, recycling, and the judicious use of environmentally safe degradable products. None of these requires a dramatic sacrifice in comfort or convenience. Nevertheless, all three call for instilling public understanding of the problems presented by solid waste disposal practices in the vicinity of the ocean and coastal areas.

Public education undoubtedly is central to capitalizing on public concern for the marine environment. Over time, however, institutional mechanisms will be needed to sustain this concern and force action. Incentives can be marshaled to encourage recycling, source reduction, and the use of degradable materials. Command and control authorities can mandate waste restrictions, recycling, and other useful measures. Where necessary, outright prohibitions can be imposed on the manufacture and use of certain harmful items. If Congress, agencies, and international

bodies establish these mechanisms now, a lasting improvement in the quality of the marine environment should be attainable. Prompt and thorough action can keep beaches and waters free of debris long after washups of medical waste and plastic trash have become a distant memory.