CHAPTER 18

Reducing Marine Debris

The trash and other waste that drifts around the global ocean and washes up on the nation's shores pose a serious threat to fishery resources, wildlife, and habitat, as well as human health and safety. Marine debris is difficult to address because it comes from a wide variety of sources, both on and off the shore. While marine debris is a global problem requiring international cooperation, many of its negative impacts are experienced at the local level and require local involvement. Because of its role as the nation's lead ocean agency, re-establishing a marine debris program within the National Oceanic and Atmospheric Administration would help address its broad range of issues, as would better coordination at all scales—international, national, state, and local. Greater commitment to public education and outreach, partnerships with local governments, communities, and industry, and enhanced research, monitoring, and source identification will also help reduce marine debris.

Assessing the Sources and Consequences of Marine Debris

Most trash has the potential to become marine debris; cigarette filters, plastic bags, bottles, cans, and straws can all be found scattered along beaches and in the oceans. Marine debris degrades slowly and is buoyant, often traveling for thousands of miles in ocean currents. Approximately 80 percent of debris is washed off the land, blown by winds, or intentionally dumped from shore, while 20 percent comes from vessels and offshore platforms.[1]

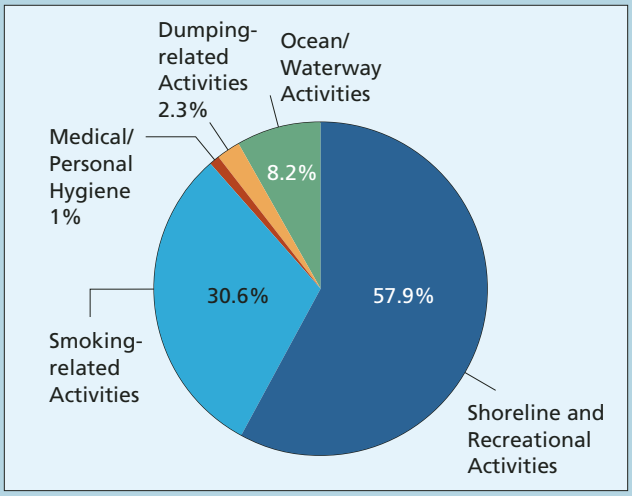
Shoreline and recreational activities were sources of the majority of debris found during the 2002 International Coastal Cleanup (Figure 18.1).[2] Litter associated with cigarette smoking was the second largest source. Ocean-based activities, including cruise ship operations, commercial fishing, recreational boating, commercial shipping, military vessel operations, and offshore oil drilling, were also a significant source of debris. Cargo lost overboard from freighters poses another concern. Large containers have broken open and released their contents—including everything from sneakers to computer monitors—into the ocean.

Another growing concern is that plastic materials, accumulating in the ocean over decades, are breaking down into microscopic particles that are now washing up on beaches, floating in coastal and ocean waters, and settling in sediment. A single one-liter soda bottle could break down into enough fragments to put one fragment on every mile of

beach in the entire world.[3] A study done in the North Pacific found plastic particles in the stomachs of eight of eleven seabird species caught as bycatch.[4] Not only can these tiny plastic particles be ingested by marine life but, as they float around, they can also accumulate toxic chemicals, including DDT and PCBs. Plastic particles have been found to concentrate such chemicals to one million times the levels found in the water itself.[5]

Marine debris poses a serious threat to wildlife, habitat, and human health and safety. Marine debris threatens wildlife primarily through entanglement and ingestion. A 1997 study found that at least 267 species have been affected by marine debris worldwide, including 86 percent of all sea turtle species, 44 percent of all seabird species, and 43 percent of all marine mammal species, as well as numerous fish and crustaceans.[6] Entanglement can wound animals, impair their mobility, or strangle them. Birds, sea turtles, and marine mammals can swallow debris such as resin pellets, convenience food packaging, and plastic bags, which interfere with their ability to eat, breathe, and swim. Sea turtles often ingest floating plastic bags, mistaking them for jellyfish. "Ghost fishing"—entanglement of fish and marine mammals in lost fishing gear—represents a serious threat to marine life, including endangered species such as Hawaiian monk seals and North Atlantic right whales.

Figure 18.1 Trash at the Beach Comes from Many Sources



In 2002, more than 8.2 million pounds of debris were collected and analyzed as part of a worldwide beach cleanup effort. The largest source of marine debris was from land-based human activities; shoreline and recreational activities alone contributed almost 58 percent of the number of items collected. Over 1 million cigarette butts, 444,000 food wrappers or containers, 220,000 bottles, 190,000 plastic bags, 32,000 pieces of fishing line, and 8,000 tires were collected.

Source: The Ocean Conservancy. *The 2002 International Coastal Cleanup.* Washington, DC, 2003.

Coral reefs, seagrass beds, and other fragile coastal habitats have been harmed by trash in the oceans. Derelict fishing gear, pushed by wind and waves, can become snagged on coral reefs and other structures. This global problem is particularly evident in the Northwest Hawaiian Islands, which include 69 percent of all U.S. coral reefs by area. Floating debris can also transport non-native, potentially invasive species over long distances.

Marine debris also has significant consequences for people. Broken glass and medical waste on beaches, as well as ropes and lines dangling in the ocean, pose threats to beachgoers, boaters, and divers. Debris can damage boats and strand their occupants when propellers become entangled on lines, or engines stall when plastic bags are sucked into intake pipes. Beach closures and swimming advisories due to marine debris can have direct economic impacts by reducing coastal tourism. For example, New Jersey lost an estimated $2 billion in tourist revenue as a result of debris washing ashore in the 1987 and 1988 beach seasons. The state has chosen to invest $1.5 million annually in beach cleanup to avoid similar losses in the future.[7]

Addressing Marine Debris Nationally

Existing Programs

Efforts to reduce marine debris must take place at all levels, from international to local. Internationally, marine debris is addressed by Annex V of the International Convention for the Prevention of Pollution from Ships (MARPOL), which prohibits all overboard disposal of plastics and limits other discharges based on the material and the vessel's location and distance from shore. The Convention on the Prevention of Marine Pollution by

Dumping of Wastes and Other Matter (known as the London Convention) is another international agreement that addresses the problems of marine debris. (For a listing of ocean-related international agreements, see Table 29.1.)

Domestically, a number of federal laws focus on marine debris, including the Act to Prevent Pollution from Ships (which prohibits the disposal of all garbage within 3 nautical miles of the coast and enforces Annex V of MARPOL), the Marine Plastic Pollution Research and Control Act, the Clean Water Act, Title I of the Marine Protection, Research, and Sanctuaries Act (commonly referred to as the Ocean Dumping Act), the Beaches Environmental Assessment and Coastal Health Act, and the Shore Protection Act. (Appendix D includes a summary of ocean-related federal laws.) Some states also have their own laws to address marine debris. Other states have made substantial progress through voluntary programs.

Reductions in marine debris have been the focus of a number of agency initiatives and volunteer efforts, ranging from local adopt-a-beach programs to international beach cleanups. The Ocean Conservancy, a nonprofit ocean advocacy group, coordinates the annual International Coastal Cleanup campaign with support and funding from the U.S. Environmental Protection Agency (EPA) and private and corporate foundations. The one-day event takes place in September, with volunteers from all over the world collecting trash along the coasts and in the oceans. Since its inception in 1986, the campaign's original 2,800 volunteers have grown to almost 392,000 in 2002.

From 1986 to 2002, the International Coastal Cleanup removed 89 million pounds of debris from more than 130,000 miles of shoreline. Starting in 1995, more than 108,000 divers also collected 2.2 million pounds of trash in over 3,900 miles of underwater habitat.[8] The program is effective not only because of the visibility it receives as the largest single-day volunteer event for the marine environment, but also because of the amount of data collected during the event. Debris collection results are posted by source, calling attention to the activities that create the most debris with the hope of improving prevention.

The vast data collection potential demonstrated during International Coastal Cleanup events led to development of the National Marine Debris Monitoring Program, implemented by The Ocean Conservancy with EPA funding. This program is designed to systematically assess the success of Annex V of MARPOL by identifying sources and trends of marine debris. Volunteers at 180 randomly selected study sites along the U.S. coast collect and submit monthly information on the incidence of 30 specific marine debris items.

EPA and The Ocean Conservancy also created the Storm Drain Sentries program in response to research indicating that storm drains are significant sources of marine pollution. This program raises public awareness of the consequences of dumping trash and other pollutants into sewer systems. Volunteers stencil educational messages on, and collect information on the types of contaminants found around, storm drains.

The Coral Reef Ecosystem Investigation is a multi-agency program, headed by the National Oceanic and Atmospheric Administration (NOAA), to assess, monitor, and mitigate the impact of marine debris on coral reef ecosystems of the U.S. Pacific Islands. The Coral Reef Ecosystem Investigation began as a pilot study in 1996, primarily to remove fishing gear in and around Hawaiian monk seal habitat. Since then, the program has grown to involve a number of federal, state, local, nongovernmental, and private partners in the large-scale removal of marine debris, including derelict fishing gear.

NOAA's Role

Concerns about marine debris came to public attention during the 1980s, with mounting evidence of entanglement and other harm to marine mammals, sea turtles, birds, and fish, as well as images of medical waste and other trash washing up on beaches. In 1985, Congress appropriated $1 million in funding for the development of a comprehensive marine debris research and management program (which became the Marine Entanglement

Research Program), directed by NOAA in consultation with the U.S. Marine Mammal Commission. In 1995, a report by the National Research Council called for a long-term program to monitor the flux of plastics to the oceans and noted that NOAA would be best suited to lead such a monitoring effort.[9] Despite this recommendation—and the ongoing problem of marine debris—the Marine Entanglement Research Program ended in 1996.

Although EPA has some programs to address marine debris (described above), the problem is also closely related to NOAA's mission and management responsibilities, including fisheries, marine mammals, endangered marine species, beach and shoreline management, and coral reefs. While NOAA currently addresses matters related to debris in the marine environment in connection with other activities, there is a need to coordinate, strengthen, and increase the visibility of such efforts within NOAA by creating a clear, centralized marine debris program within the agency.

Recommendation 18–1

The National Oceanic and Atmospheric Administration should establish a marine debris management program that expands on and complements the U.S. Environmental Protection Agency's program in this area. The NOAA program should be closely coordinated with EPA's activities, as well as with the significant efforts conducted by private citizens, state, local, and nongovernmental organizations.

In keeping with its mission, it would be logical for NOAA's marine debris program to focus on reducing derelict fishing gear, addressing entanglement of marine life, and preventing debris from harming coral reefs while EPA's efforts continue to address beach and river cleanups. Also, because most of the debris that makes its way to the coasts and oceans comes from land, it makes sense for EPA to continue its national education efforts. Regardless of how the responsibilities are divided, the two programs should be closely coordinated so that gaps are filled and duplication is avoided.

Expanding Marine Debris Efforts

A marine debris program within NOAA will help bring greater attention to this problem. Efforts at both NOAA and EPA will need to focus on education and outreach, working with communities and industry, and improving source identification, monitoring, and research.

Education and Outreach

Reducing marine debris will require preventing litter from entering the marine environment in the first place by pursuing a long-term public education campaign. While existing education and cleanup initiatives have made a substantial contribution to improving the ocean environment, the volumes of trash that continue to appear on beaches and in the oceans indicate that many people and communities have not yet changed their behavior. While some consider their actions to be negligible when compared with those of large-scale polluters, the cumulative impact of continuous, small-scale insults can be significant. What's more, actions far inland can have impacts on distant coastal and marine waters. Because comprehensive monitoring and enforcement of individual behavior would be impractical and undesirable, people need the knowledge, training, and motivation to voluntarily change their behavior. (Public education and outreach opportunities are addressed in greater detail in Chapter 8.)

In addition to educating the general public, marine debris education campaigns can target the tourism industry, packaging companies, local government officials, recreational boaters, and commercial fishermen. For example, it is important to educate both commercial fishermen and recreational boaters who take items out to sea with them to ensure that they are returning to shore with their plastic and other trash. As the National Marine Fisheries Service conducts dockside inspections, there is an opportunity to deliver educa-

The message has to come out to people that they share responsibility for the [marine debris] problem. They have to appreciate what the impacts are, and that basically they—by polluting, by littering—are contributing.

—Suzanne E. Schwartz, *Director, Oceans & Coastal Protection Division, U.S. Environmental Protection Agency, testimony to the Commission, May 2002*

tional materials on marine debris to fishermen. Similarly, as the U.S. Coast Guard and the Coast Guard Auxiliary conduct recreational boating programs, they could distribute educational materials and remind recreational boaters to properly dispose of their trash. Many nongovernmental organizations whose membership is comprised of fishermen or boaters could also educate their members about the marine debris issue.

Working with Communities

Cigarette filters, food wrappers, caps, and lids accounted for nearly half of all debris collected in the 2002 International Coastal Cleanup. For the past thirteen years, cigarette filters have been the most commonly found debris item.[10] It is apparent that implementation and enforcement of local anti-litter regulations have been inadequate.

Not only is trash left on beaches and shores, allowing it to wash into the oceans, litter is also washed off streets and parking lots, and through storm drains far inland. People generally have not made the connection between actions taken far from the coast and their impacts on the shore and ocean areas.

While public education can send the message not to litter, active management of debris entering and exiting sewer systems can also be improved by adding controls for local sewer systems, such as screens and netting, and making catch-basin modifications. Floatable controls can help reduce or eliminate solid waste emitted from sewer systems. Placing sufficient trash receptacles throughout communities can also make it easier for people to dispose of the materials that might otherwise end up in the marine environment.

Working with Industry

Cooperation with industry, especially companies whose products are ending up on the shores and in the oceans, presents another opportunity to reduce marine debris. Industry efforts to reduce the overall amount of packaging being produced and to develop more environmentally friendly materials can help. Because plastics comprise about 60 percent of the trash found on beaches[11] and about 90 percent of the debris found floating in the water,[12] industry support for reducing plastic trash and encouraging greater recycling rates could reduce the amount of litter reaching the coasts and oceans. Fishing gear manufacturers can also play a role in educating vessel owners and crews about the impacts of derelict gear.

Many companies are already supporting marine debris cleanup and education efforts. The Coca-Cola Company, Dow Plastics, and Philip Morris are all examples of companies that have helped sponsor the International Coastal Cleanup. Morton Salt, the maker of products used by many commercial shrimp boats to treat their catches at sea, took action after blue plastic bags with the Morton Salt label started washing up on Gulf of Mexico beaches. Since the company started printing reminders like "Stow It, Don't Throw It" on the bags, fewer Morton Salt bags have been reported as washing up on shores.

In addition, the offshore petroleum industry, working in concert with the Minerals Management Service, has instituted marine debris education training for personnel working on offshore platforms, mobile drilling rigs, and other facilities in the Gulf of Mexico. This initiative requires the posting of marine debris reminder signs and the mandatory viewing by all personnel of a film demonstrating proper waste disposal practices and the impacts of marine debris on the ocean.

Source Identification, Monitoring, and Research Efforts

The implementation of effective control measures is currently hampered by a lack of consistent monitoring and identification of sources of debris. A 1995 National Research Council report found that most available data are obtained from beach surveys, with relatively little information on debris that ends up in the sea or on the seabed.[13] Collection of such data would require a systematic, international effort. Information about the behavior of debris in the marine environment and its ecological effects is even scarcer. These effects cannot be

established simply on the basis of available surveys, due primarily to the absence of a common framework for data collection, centralized data analysis, and information exchange. Once a framework and suitable information protocols are in place, these data should be linked with the national Integrated Ocean Observing System (discussed in Chapter 26).

Recommendation 18–2

The National Oceanic and Atmospheric Administration and U.S. Environmental Protection Agency should coordinate and implement expanded marine debris control efforts, including: enforcement of existing laws; public outreach and education; partnerships with local governments, community groups, and industry; monitoring and identification; and research.

Interagency Coordination

The Marine Plastic Pollution Research and Control Act of 1987 established an interagency marine debris coordinating committee with membership comprised of senior officials from NOAA, EPA, the Coast Guard, and the U.S. Navy. The committee was charged with furthering public outreach, education, and information sharing efforts. However, Congress allowed the committee to lapse in 1998, and it has not been re-established.

Although strengthening NOAA's work on marine debris through establishment of an office within the agency is an important step, an interagency committee under the National Ocean Council will still be needed to unite all appropriate federal agencies on this issue. Such a committee could support existing marine debris efforts by agencies and nongovernmental organizations.

Recommendation 18–3

The National Ocean Council (NOC) should re-establish an interagency marine debris committee, co-chaired by the National Oceanic and Atmospheric Administration and U.S. Environmental Protection Agency, and placed under the oversight of the NOC's Committee on Ocean Resource Management.

Reducing Derelict Fishing Gear

One source of marine debris that requires special attention is derelict fishing gear, composed of both whole and large sections of nets, as well as discarded fishing line and plastic parts associated with traps and nets (Box 18.1). Whether intentionally discarded or unintentionally lost during storms or fishing operations, derelict fishing gear poses serious threats around the world, entrapping marine life, destroying coral reefs and other habitat, and even posing danger to humans. Currently, almost all of the fishing nets used outside of subsistence fisheries are made of synthetic fibers that are highly resistant to degradation.[14] Although derelict fishing gear is a global problem, currently no international treaties or plans of action address it.

In the past four years alone, federal, state, and non-governmental partnerships have hauled over 150 tons of nets and line off reefs in State waters in the Northwestern Hawaiian Islands.

—Gilbert Coloma-Agaran, *Chairperson, Board of Land and Natural Resources, Hawaii, testimony to the Commission, May 2002*

Recommendation 18–4

The U.S. Department of State and National Oceanic and Atmospheric Administration, working with the United Nations Food and Agriculture Organization and other appropriate entities, should develop a detailed plan of action to address derelict fishing gear around the world, to be implemented within large multi-national regions.

One approach taken by the National Marine Fisheries Service domestically is to require that all gear be marked to make it easier to identify the fishery of origin. Better enforcement of these rules, and international cooperation to require the marking of non-U.S. fishing gear, would help identify the fisheries that pose the largest problems of lost gear and entanglement.

Box 18.1 Abandoned Fishing Nets Catch a Wave to Hawaii

The two most prevalent types of nets recovered in the Northwest Hawaiian Islands (measured by weight) are trawling nets and monofilament gill nets, despite the fact that no commercial trawl or gillnet fisheries exist in the area.[i] The nets are carried to the islands via ocean currents from domestic and foreign fisheries in the North Pacific. Finding a solution to the problem of derelict fishing nets and other gear will require international cooperation.

[i] U.S. Department of State. *Promotion of Implementation and Enforcement of MARPOL 73/78 and Related Codes. MARPOL Annex V and Marine Debris.* London, England: International Maritime Organization, 2001.

Ultimately, a strong public-private partnership will be needed to prevent, remove, and dispose of derelict fishing gear. Appropriate education and incentives can minimize the practice of throwing unwanted nets overboard and encourage all boaters to bring abandoned gear back to shore if possible. Other options include: assessing fees on net sales and imports to pay for their recovery; attaching locator devices to gear; providing incentives to industries that are developing biodegradable fishing gear; requiring sizeable deposits on nets when they are purchased; increasing gear recycling and reuse; and providing compensation to those who bring discarded gear back to shore.

Recommendation 18–5

The National Oceanic and Atmospheric Administration should work with all interested parties, governmental and private, to implement incentives or other effective programs for prevention, removal, and safe disposal of derelict fishing gear.

Ensuring Adequate Facilities for Disposal of Garbage from Ships

Annex V of MARPOL contains several provisions that address marine debris. Under its requirement for *port reception facilities,* ports in member nations must be prepared to receive garbage from ships. Unfortunately, many ports still do not provide adequate facilities for this purpose.

Another provision of Annex V allows Special Areas of the ocean to be designated where a higher level of protection is required than in other areas. Such Special Areas have been designated in many parts of the world, including areas of the Mediterranean, Baltic, Black, Red, and North Seas, the Antarctic, and the Wider Caribbean region, which includes the Gulf of Mexico and the Caribbean Sea. For a Special Area to receive extra protection, adequate port reception facilities must be in place to receive ship wastes. However, some important Special Areas, such as the Wider Caribbean region, are not yet eligible for increased protection because of inadequate facilities.

Recommendation 18–6

The U.S. Department of State should increase efforts internationally to ensure that there are adequate port reception facilities available for disposal of garbage from ships, particularly in Special Areas designated under Annex V of the International Convention for the Prevention of Pollution from Ships.

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