Marine Debris

Solutions to a persistent problem.

by Mr. David Major
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In 2007, the *Cosco Busan* oil spill in San Francisco Bay soiled a vast area and killed thousands of animals.[1] Public concern and significant media attention galvanized the recovery efforts of federal, state, and local agencies; nonprofit organizations; and Bay Area fishermen. In the wake of the spill, policy makers are looking to the lessons learned and developing strategies to better serve the marine environment.

Beyond spills, oil plays another significant role in marine pollution: oil is the raw material used to construct plastics, the major persistent debris problem in the ocean environment. Like oil spills, marine debris is known to harm marine animals and degrade the quality of American beaches.

Unlike oil spills, marine debris is usually not connected with a single, tangible event, and the lack of a unifying focal point for this form of environmental degradation may be the reason for the lack of media attention in the past decades.

As a compliance and enforcement agency, the U.S. Coast Guard regulates items that may become marine debris. Beyond this regulatory role, the U.S. Coast Guard provides support and leadership for a variety of anti-marine debris activities.

Persistent Materials

Depending on context, the term "marine debris" may encompass a wide variety of man-made items that persist in the marine environment. While shipwrecks and other artifacts indicate that man-made items are already present in the marine environment, the social and technical changes of modern times have added a new dimension to the marine debris problem.

Replacing natural fibers with synthetic fibers has exacerbated the marine debris problem. Fishing nets, for example, used to be made with natural materials such as cotton, hemp, or flax. Modern nets are typically made of synthetic materials and have numerous advantages: They are stronger and more durable than their predecessors, since they are impervious to photo-, mechanical, and biodegradation. In addition to resisting decay, modern nets are more likely than their natural counterparts to maintain positive buoyancy.

A seal is entangled in marine debris. Photo courtesy of the National Oceanic and Atmospheric Administration.

Coast Guard Seaman Bryan Grebe works to offload a mountain of fishnet from the Coast Guard Cutter *Walnut*. The *Walnut* and NOAA vessel *Townsend Cromwell* joined efforts to remove marine debris from Lisianski Island, Pearl and Hermes Reefs, and Midway Atoll in the Northwest Hawaiian Islands. USCG photo by PA3 Jacquelyn Zettles.

Increased use of persistent materials on land, such as product packaging, has the power to severely impact the marine environment. Since the 1960s widespread consumer use of persistent, single-use beverage containers, such as aluminum cans and plastic bottles, took hold in the U.S. Today, the "individual retail package" is a common sight on the shores of many American beaches.

In the case of consumer plastics, the advances in durability of synthetic fibers combined with a lifestyle based on throwaway goods can also create a significant threat to the marine environment. In fact, plastic straws, beverage bottles, and bags are the most commonly found marine debris items in the national marine debris monitoring program study.[2]

Plastic is also a key part of products many consumers would not associate with the persistent material—cigarette butts, for example. Given the widespread use of plastic products in the economy, it is unsurprising that the resin pellets, the raw units of plastic production, also find their way into the marine environment. From their first reported appearance on U.S. shores in the 1970s, the plastics industry's pellets had become one of the most commonly found items in American harbors by 1993, according to the EPA.[3]

Transportation of Marine Debris

Marine debris can enter the marine environment through a variety of vectors. Land-based debris may enter the marine environment as a result of:

- urban runoff,
- sewer overflow,
- inadequate garbage management,
- industrial activities,
- terrestrial dumping and littering activities.

Sea-based vectors include cruise ships, cargo ships, recreational boats, fishing vessels, and platforms.

One unique problem with marine debris prevention stems from the ocean's ability to move and circulate the debris. The combination of ocean currents and atmospheric winds can transport debris across great distances. It can also retain and concentrate items for later deposition.

Nets and other fishing gear may come from fisheries far from the marine ecosystem that suffers the impact; more than 80 percent of the northwest Hawaiian Islands' recovered derelict gear comes from seine or trawl fisheries operating hundreds or even thousands of miles away from the islands.[4] Furthermore, derelict fishing gear may circulate for years in areas like the North Pacific.

The Environmental Toll

Persistent items play a significant role in the degradation of the marine environment. As the result of human introduction, these items can injure and kill marine species. The negative effect is suffered not only by animals, but also by humans who interact with these coastal resources.

Marine debris is known to cause mortality among marine species. Even after being lost or discarded, fishing gear can continue to kill fish in a process known as "ghost fishing." In some cases, catch rates achieved by ghost nets can approach active gear rates.[5] Ghost nets can also entrap and kill species that were never intended to be netted. In 2003, the endangered Hawaiian monk seal had one of the highest entanglement rates of any seal worldwide.[6]

Items that were never intended to enter the marine environment have the potential to harm marine species when ingested. Seabirds may mistake fragments of plastic such as styrofoam products and bottle caps for

food. This may cause intestinal blockages or reduction in the absorption of nutrients. Small plastic pellets, including those from disintegration of plastic as well as those derived from industrial loss, may be mistaken for planktonic organisms and consumed.[7]

The large ratio of small plastic pieces to plankton in the environment is not just a risk to birds; filter-feeding organisms may be unable to distinguish between debris and plankton. Once ingested by these smaller marine animals, plastic accumulates within the marine food chain.[8]

Marine debris degrades all types of marine habitats. Derelict nets can become entangled with coral reefs and, as a result of natural wave movement, break off coral heads. Medical waste on beaches may make shorelines unusable; beaches were closed in New Jersey during the late 1980s due to the presence of potentially hazardous debris items.[9]

Coast Guard Activities to Prevent Marine Debris

The U.S. Coast Guard combats marine pollution by regulating the at-sea discharge of vessel-generated waste under the authority of the Act to Prevent Pollution from Ships. The discharge of plastic is prohibited and minimum discharge distances from land have been established for other types of garbage. For areas designated as "special areas" even greater restrictions exist.[10]

On larger vessels, Coast Guard regulations require records covering:

- the type of discharge operation,
- the date and time of the operation,
- the location of the discharge,
- the amount of garbage involved and when discharging at sea,
- the type of material discharged.

Certain vessels over 40 feet must maintain a written document that provides for compliance with Annex V of MARPOL 73/78 and U.S. law, including a description of procedures for collecting, processing, storing, and discharging garbage. Placarding is required for the smallest class of vessels.[11]

To ensure that garbage does not enter the marine environment at the port, the Coast Guard regulates reception facilities. Ports and terminals must comply with MARPOL Annex V under the criteria established for reception facilities for garbage in 33 C.F.R. Subpart D. For the larger ports and terminals, operation is conditioned upon meeting the requirements of a Coast Guard-issued certificate of adequacy.

Members of the Coast Guard cutter *Walnut* offload marine debris at Coast Guard Integrated Support Command, Honolulu. The debris was collected from the Papahanāumokuākea Marine National Monument during a multi-agency removal effort. USCG photo by Petty Officer 3rd Class Michael De Nyse.

The Coast Guard also ensures compliance with U.S. regulations related to marine environmental protection through inspections and boardings. In fulfillment of MARPOL Annex V obligations, the U.S. Coast Guard inspects U.S. commercial vessels annually and examines foreign vessels through the port state control program. For recreational and commercial fishing vessels that are not required by law to be inspected, boardings (such as domestic fisheries protection, marine sanctuaries protection, and random "at-sea" boardings) allow the Coast Guard to ensure environmental compliance.

Annual facility inspections and harbor patrol spot checks ensure compliance among reception facilities. When a vessel is found to have violated regulations, we may issue written warnings, impose monetary civil penalties, and, for the most serious instances, refer the case to the Department of Justice for criminal prosecution or civil ju-

dicial enforcement action. Many pollution violation penalties are imposed through the U.S. Coast Guard's notice of violation process, which in essence allows the U.S. Coast Guard to write tickets for violations.

As the head of the United States delegation to the International Maritime Organization (IMO), the Coast Guard plays an important role in maintaining high international standards on marine pollution. The IMO is the lead international organization that develops the regulatory framework for the shipping industry. Its multi-national decisions form the basis of member-state marine pollution enforcement regimes, including port state inspections, self-reporting, and recordkeeping.

The Plastic Bag

The marine debris story may best be told by the ubiquitous plastic bag. This synthetic item has proliferated both in the marketplace and the marine environment. Beyond its fragmentation into smaller, yet still dangerous pieces, plastic bags persist in the ocean and perpetrate pervasive environmental damage.

Although only introduced in the last 25 years, plastic bags have captured at least 80 percent of the grocery and convenience store market. Its ascendancy is attributable to key design features as well as cost—a plastic bag is 25 percent the price of a paper bag. The low cost of plastic bags allows for their large-scale production and use, resulting in the worldwide use of at least 500 billion bags a year.[1]

These plastic bags may enter the marine environment by a multitude of vectors. In many instances, consumer plastic items enter the marine environment from land-based areas (urban runoff). Plastic bags can also enter the marine environment from a marine source. In the case of *United States v. Cook*, the Department of Justice successfully prosecuted a mariner for the dumping of asbestos–filled plastic bags.

Plastic bags can be found in the marine environment from Spitsbergen 78° North [latitude] to Falklands 51° South [latitude].[2] Due to lower temperatures and the ocean's shielding from UVB radiation, plastic bags will degrade at an even slower rate than on land; it is likely that even "biodegradable" plastic bags will persist in the marine environment.[3]

In the marine environment, plastic bags have a particularly insidious effect due to their resemblance to jellyfish and squid. Marine vertebrates may ingest these items, which they have mistaken for prey. In 1995, it was discovered that bags were the most common plastic item ingested by green, loggerhead, leatherback, hawksbill, and Kemp's Ridley sea turtles.[4] This can obstruct the esophagus or perforate the bowels of a turtle. Intake of plastic is one of the main non-natural causes of death for sea turtles.[5]

Endnotes:

1. John Roach, "Are Plastic Grocery Bags Sacking the Environment?," National Geographic News (September 2, 2003).
2. Ibid
3. "Degradable Plastic Debris in the Marine Environment. Degradable Plastics: Breaking News Down Under," Australian Government Department of the Environment and Heritage, Canberra, Australia.
4. Committee on Shipborne Wastes.
5. Rita Mascarenhas et al., "Plastic Debris Ingestion by Sea Turtle In Paraiba, Brazil," Marine Pollution Bulletin 354 (2004).

Beyond Regulation: Finding Solutions to a Persistent Problem

During discussions at a Coast Guard-sponsored meeting in Irvine, Calif., marine industry members highlighted the strides they have taken to minimize waste. Some cruise ships have voluntarily developed advanced programs for waste minimization and waste stream management. One practical example is using beverage containers without plastic rings.

Concerned civic organizations in Southern California recently banded together to promote a "Day Without a Bag." Stores donated reusable bags and offered discounts and rebates to reusable bag users. Twenty-two local governments designated December 20, 2007 as a "Day Without a Bag." These efforts spread awareness of the link between consumer activity and marine debris.

Shippers are developing and promoting a "code of best practice" to prevent the loss of containers. For example, Maersk and Germanischer Lloyd have combined forces to investigate the potential causes of container loss.[12] Through the International Standards Organization, the U.S. Coast Guard works with its industry counterparts to develop an industry-initiated shipboard garbage standard.

Through the "Sea Partners" campaign, U.S. Coast Guard and Coast Guard Auxiliary personnel educate the maritime industry and boating public on pollution issues via public education classes, vessel safety checks, voluntary commercial vessel exams, public marine events, and annual pollution prevention conferences. Through school visits and educational materials, the

"Officer Snook" program communicates Sea Partners' marine pollution mission to children.

Looking Forward

Within this persistent problem, the Coast Guard has authority over a mere fragment of items that might be considered marine debris. However, it is fitting that the solution to a problem composed of small persistent fragments is found in the aggregate effect of small contributions to marine debris prevention and reduction.

Through its traditional regulatory authorities, the U.S. Coast Guard can continue to limit the amount of persistent items entering the environment from sea-based sources. As a partnering organization, it can cooperate with international counterparts to prevent the deposition of debris beyond U.S. jurisdiction; work with government agencies to develop a policy that will reduce marine debris; remove items that pose significant harm to the environment; and assist industry to develop strategies that exceed legal obligations, especially in regard to garbage handling and source reduction.

Most importantly, the U.S. Coast Guard can educate a concerned public about the dangers of marine pollution and their ability, as individuals, to ensure that marine debris will become less pervasive.

Picking up the Trash

Beyond the scope of traditional missions, the U.S. Coast Guard uses its assets to reduce the amount of debris in the marine environment. One of the nation's most significant marine debris removal projects is the northwest Hawaiian Island partnership in the Papahānaumokuākea Marine National Monument.

To aid the partnership, the U.S. Coast Guard provides platforms and personnel on an "as-available" basis to support marine debris removal operations. Over the course of the partnership's history, Coast Guard buoy tenders and NOAA (National Oceanic and Atmospheric Administration) vessels have recovered more than 563 tons of marine debris.

In 2008, CGC *Walnut* assisted in the recovery of over 28 tons of debris. On various occasions, Coast Guard aviation has provided aircraft to transport Coast Guard, NOAA, and other agency personnel to conduct land-based marine debris removal.

In the aftermath of Hurricane Katrina, the Coast Guard worked to remove debris from the waterways of Louisiana, Mississippi, and Alabama.

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Endnotes:

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3. United States Environmental Protection Agency Office of Water, "Plastic Pellets in the Aquatic Environment: Sources and Recommendations."
4. Mary Donohue, "Eastern Pacific Ocean Source of Northwest Hawaiian Islands Marine Debris Supported by Errant Fish Aggregating Device," Marine Pollution Bulletin 887, 2005.
5. Ilse Kiessling, "Finding Solutions: Derelict Fishing Gear and Other Marine Debris in Northern Australia," National Oceans Office, 2003.
6. Molly A. Timmers, Christina A. Kistner, & Mary J. Donohue, "Marine Debris of the Northwest Hawaiian Islands: Ghost Net Identification," Hawaii Sea Grant Publication: UNIHI-SeaGrant-AR-05-01.
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9. Douglas D. Ofiara & Joseph J. Seneca, "Biological Effects and Subsequent Economic Effects and Losses from Marine Pollution and Degradations in Marine Environments: Implications From Literature," Marine Pollution Bulletin 857, 2006.
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11. 33 C.F.R. § 151.57 (2007)
12. Janet Porter, "Maersk Teams Up With GL to Tackle Box Losses," Lloyd's List, May 2008.