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Recent development of one-liter PET soda pop bottles has led to more plastic debris on our beaches.

Floatable Wastes in New York Coastal Waters

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INTRODUCTION

What are Floatables and When Did They Start Appearing?

Floatable debris in the marine environment is made up of a variety of materials such as plastics, rubber, wood, paper, cardboard, line, cloth, tar balls, grease balls, garbage and medical-type wastes. "Floatables" have been a concern in New York marine waters for well over a century. In the 1800s they contributed to New York City's image as one the filthiest urban centers in the world. Garbage, paper, bottles, degradable metal containers, and dead animals were often stranded on area beaches. Garbage and trash were commonly disposed of in the Hudson River and dumped outside the harbor in the New York Bight until a Supreme Court decision ended the practice in 1934.

By the 1960s, not only had the volume of floatables increased, but their character had changed as well. Increased reliance on disposable products encouraged production of more non-degradable items such as styrofoam cups and plastic diapers. Thus, more of these non-degradable items entered the waste stream.

The introduction of plastic tampon applicators in 1969 and the subsequent wash-ups of these items served to focus attention on inadequately treated sewage-related wastes in the 1970s. The development of the one-liter PET (Polyethylene terephthalate) soda pop bottle in 1977 led to even more noticeable amounts of plastic debris on our beaches. Most recently, wash-ups of medical-type wastes have caused public concern.

EFFECTS OF FLOATABLES ON PUBLIC HEALTH, THE ECONOMY AND ENVIRONMENT

Local Wash-ups Cause Beach Closings

Although waterborne waste materials have been washing ashore on Long Island's south shore beaches (as well as most of our nation's beaches) for many years, it was a major wash-up event in June1976, that first caught the public's attention. Tar balls, grease balls, and other sewage-related debris (e.g. tampon applicators, condom rings, and sanitary napkin liners) washing ashore caused the closing of beaches along much of the south shore of Long Island. It was estimated that the Long Island beach-related recreational industry lost $15 – $25 million during and shortly following that event.

How Much of a Threat to Human Health?

Recent floatable wash-ups along coastal New Jersey in 1987 and the south shore of Long Island in 1988 focused attention on a totally different set of waste products — medical-type wastes. Their volume is relatively small in comparison with other wastes (probably less than 1% of the total

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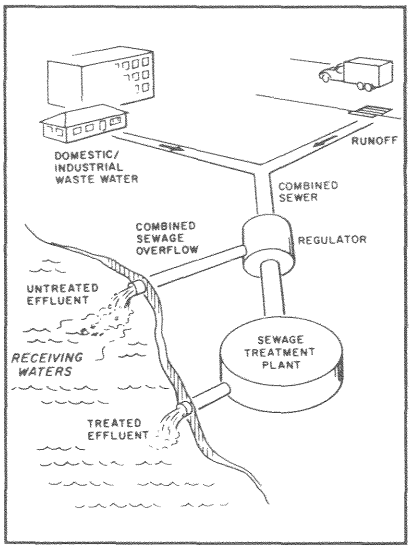
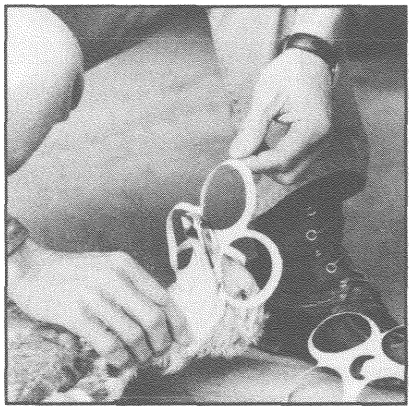


Figure 1. Diagrammatic drawing of combined sewer overflow from rainwater runoff draining into septic sewers and overflowing sewage treatment plant capacity.



volume), but as with sewage wastes, people are concerned about the issue of public health. However, there is no evidence that these items have any effect on the safety of fishery products or that they facilitate the transmission of AIDS. In fact, public safety, for example, the potential for injury resulting from a puncture by a syringe needle, is a more realistic issue of concern than the threath to public health from disease.

Most of the medical-type items found in wash-ups have been syringes, but also have included pill vials, doset bottles, surgical masks, gloves and other items. Many of these items are also found in the waste stream from non-medical sources. For example, face masks and gloves are often sold commercially and are used in non-medical research laboratories, businesses, and homes. Syringes are also widely used in non-medical laboratories and at home by diabetics and people suffering from allergies.

Besides the issue of public health, floatables in the water and on the beaches offend our sense of aesthetics. One reason people go to the shore is to enjoy the beauty, and litter on the beach detracts from the experience. But certain floating plastics can also be harmful to marine animals. Plastic fishing line, packing straps, rope, and the like can entangle birds, turtles, fishes, and seals. Some animals, turtles for example, mistake plastic bags and baloons for the jellyfish and ctenophores that they eat. These waste items can block their digestive tracts and cause them to die.

HOW DO FLOATABLES GET INTO THE WATER?

Potential floatables in the New York Bight come from both sea and land primarily from these sources:

(1) combined sewer overflows (CSOs),
(2) the accidental spillage and loss during transfer from trucks to barges and from barges to the landfill, and
(3) intentional disposal of litter on streets and in waterways.

Combined Sewer Overflows

CSOs occur because storm sewers and septic sewers were joined together 100 years ago in metropolitan New York and a few other older cities. During even moderate rainfall, the storm drains flood the septic drains, and the flow is too great for proper processing at sewage treatment plants (Fig. 1). At these times, much of the domestic sewage and stormwater with the street litter it contains, is released unscreened and untreated through CSOs directly into the New York Harbor and western Long Island Sound.

Approximately 680 CSOs discharge into local waters from New Haven, Connecticut to the Raritan River, New Jersey. Nearly 70 percent of New York City's 6,000 miles of sewers are served by CSOs. In municipalities served only by storm sewers and not CSOs, street runoff routinely flows directly out into coastal waters, without benefit of screening other than the grate on storm sewers.

Since combined sewer systems also handle sewage wastes, any item which is flushed into municipal sewage systems has the potential to become part of the floatable sewage waste problem. Such items include prescription bottles, diabetic syringes, illegal drug-related paraphernalia, tampon applicators, condoms, and plastic sheeting from disposable diapers.

Medical-type wastes (e.g., syringes, blood vials, needles, bandages, and intravenous tubing) represent a very minor component of the floatable waste stream. Those that have been reported probably were introduced to marine waters by malfunctioning sewage treatment plants, or by normal operations of storm sewers and CSOs.

Spillage During Garbage Disposal

Another major land-based source of floatables is the solid waste handling facilities associated with the transportation and disposal of municipal solid waste in New York City. To reduce the volume of truck traffic, the city transports garbage by barges from 10 transfer stations located in and around the metropolitan area (Fig. 2). Although there is no legalized direct dumping of garbage at sea, some garbage inevitably does enter the water during the loading

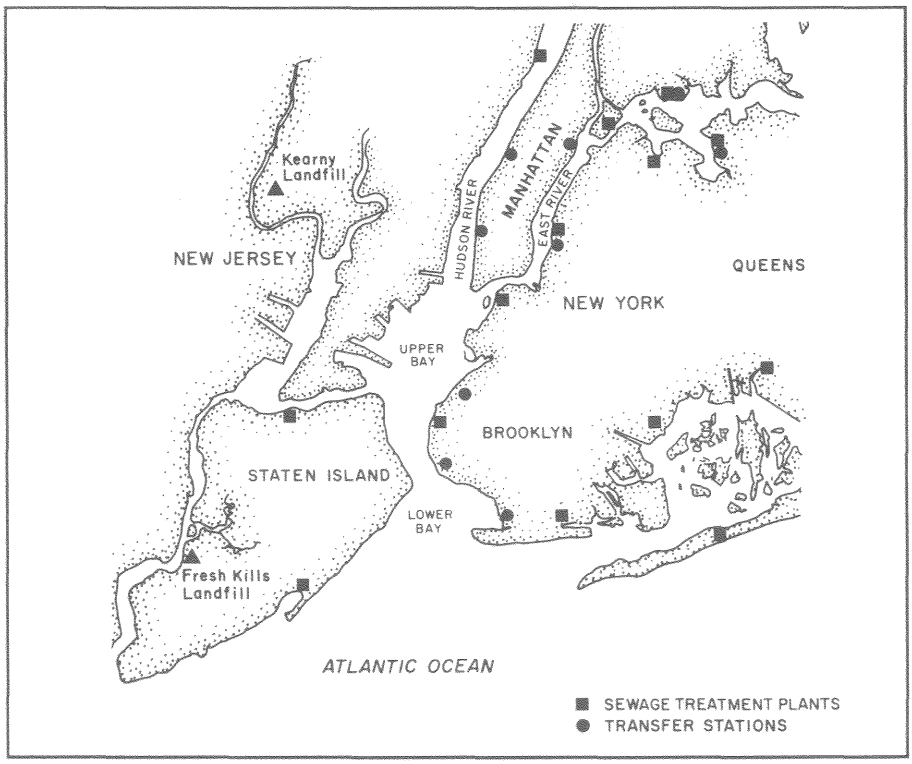


Figure 2. New York Harbor area showing locations of sewage treatment plants, garbage transfer stations, and landfills.

The Hudson Raritan Estuary and New York Harbor serve as the largest general contributor of floatable waste to the New York Bight and Long Island Sound.

and unloading of barges which transport garbage to the Fresh Kills landfill on Staten Island (Fig.2).

A large percentage (both by weight and by volume) of floatable debris (mainly wood) comes from the deterioration of boats and piers. Wooden pilings and debris from derelict vessels often break loose and become floatable debris during and after severe storm events or harsh winters.

Improper Disposal by People

The ultimate cause of litter is people. People flush plastics down toilets; beach users throw disposable cups, bottles and eating utensils on the beach; and at sea, merchant ships, fishing boats, and recreational boaters often toss garbage and trash overboard. The non-fishing debris from vessels include cargo-associated items such as containers, plastic strapping, sheeting, and pellets as well as crew-related items such as food scraps, disposable dishes and utensils, and six-pack rings. Fishing-related debris includes plastic nets, plastic pots and traps, and fishing line. Ship-generated waste water and bilge water, as well as accidental cargo spills, may also contribute sticky tar residues that form into floating tar balls in the marine environment.

In 1988 the United States adopted an international protocol to prevent pollution by ships (known as MARPOL Annex V), making it unlawful for any U.S. vessel to discard plastics at sea. At the same time, dumping of other types of trash and garbage was restricted within a range of three to 25 nautical miles from land, foreign vessels were restricted from dumping within 200 nautical miles of the U.S. coast, and ports were required to provide disposal facilities for ships' garbage. Time will tell how effective these rules and regulations, which are not easy to implement, will be.

HOW DO FLOATABLES WASH UP ON BEACHES?

Some NY Beaches More Vulnerable

New Jersey's shore and Long Island's south shore are more susceptible to large-scale debris wash-ups than is the north shore of Long Island because of the prevalent meteorological and oceanographic conditions — tides, winds, rainfall, and currents — of the New York Bight (Fig. 3). Certain areas along the north shore are prone to wash-ups because of local currents and tidal action, but no major wash-up events, such as those that took place on New York Bight beaches, have occurred along the north shore.

Although floatable debris has caused a number of temporary beach closures along New York Bight shores over the past few years, some closures, including those of Long Island's north shore beaches, have resulted from high counts of coliform bacteria in the water. The presence of high numbers of coliform bacteria—a type present in the intestines of warm-blooded animals—is taken to be an indication of sewage contamination resulting from inadequate sewage treatment. Although the matters of

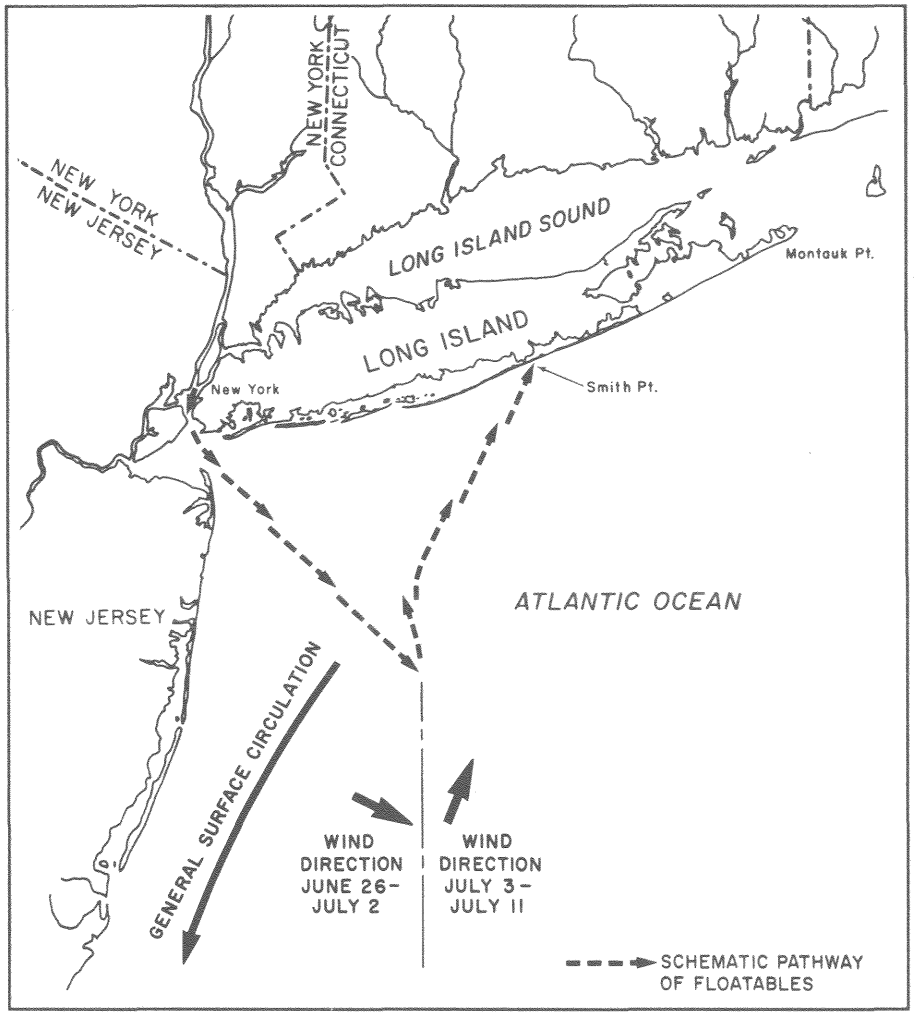


Figure 3. New York map showing schematic pathway of floatables and wind direction in Summer 1988 and general surface condition.

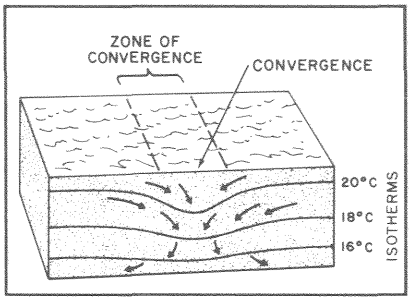


Figure 4. Diagrammatic drawing of zone where two water masses converge. The water here moves downward, sinking some materials, but floatables accumulate on the surface in this zone.

sewage contamination and floatables are related in that they share some of the same sources, they are separate issues, and must be managed as such.

Roles of Winds, Waves, Tides, and Currents

The Hudson-Raritan Estuary and New York Harbor serve as the largest general contributor of floatable waste to the New York Bight and Long Island Sound, since most of the sources tend to be located around the periphery of the estuary and harbor. Following the winter thaw in the upper Hudson River basin, floatables are flushed from the estuary, often resulting in the greatest loading of floatables in the New York Bight being at or near the start of the summer beach season.

Other than at the time of high river stages in spring, the floatable load flowing out of the estuary into the Bight at any time is largely a consequence of the relatively recent rainfall history. A heavy rainfall will produce the heaviest volume of floatable materials: streets will be cleansed, sewage treatment plants will be bypassed, and garbage transfer points and landfills flushed by runoff.

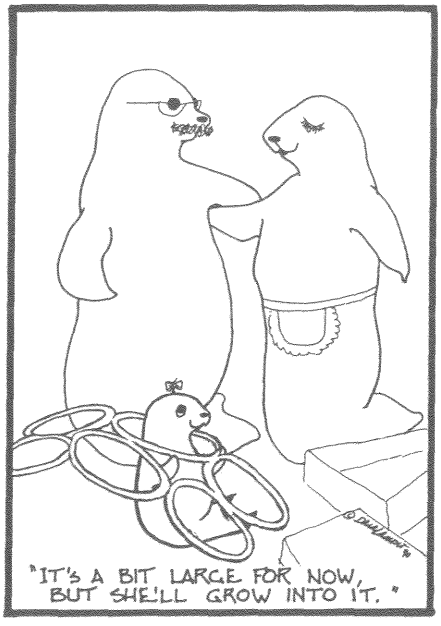
Once floatable materials are flushed into the Bight, they are subject to the physical oceanographic and meteorological forces — tides, currents, winds and waves — operating on Bight waters. The general flow of surface waters over the continental shelf is from the northeast to the southwest along the coast (Fig. 3). This flow pattern serves to carry floatable materials down the New Jersey coast with the fresh water of the Hudson-Raritan Estuary. In addition to the effects of surface currents, the transport of floatable materials is also influenced by winds.

During the summer months in particular, prevailing winds have a profound effect upon the distribution and fate of floatables. Typically, the prevailing wind in summer is from the south to southwest, intermittently shifting to other directions. These winds tend to transport debris to the north and east, so that much of the material will be well disbursed — some lost at sea and some creating the general clutter on both New Jersey and Long Island beaches.

Persistent Southerly Winds

Floatable materials tend to accumulate in zones where water masses converge (Fig. 4) such as at the edge of the Hudson River plume, where fresh water meets seawater. Thus streaks of floatable debris are often observed. These streaks are modified by nearshore currents so that they become parallel to the coast. This phenomenon explains why floatable materials often appear to wash ashore in waves.

The persistence of the prevailing winds is the major factor influencing the wash-up of debris. Persistent southerly winds, as occurred in both June 1976 and July 1988, may (assuming there is a source of floatable materials) result in



the wash-up of debris on Long Island's south shore. When the wind persistence is much less than the norm and blows periodically from the east, as it did in 1987, wash-ups along the coast of New Jersey can be expected.

In 1989, a year with record rains during much of the summer, there was an extremely large floatable load in local marine waters. But, because there was a floatable remediation program in effect (discussed in the next section) and because the winds were often from the west (offshore), there was not a major wash-up of floatables on the beaches.

SOME SOLUTIONS TO THE FLOATABLE PROBLEM

The most effective way to prevent the wash-up of floatable debris on our shores is to keep materials out of the marine environment in the first place. Numerous efforts have been implemented since the most recent wash-up events in 1987 and 1988 to realize this goal. Improved garbage handling operations such as covering garbage barges during transport and employing floating booms at transfer points to retain and recover lost waste have helped reduce the load entering the Hudson-Raritan Estuary and New York Harbor.

Some portion of the floatables that does escape into the estuary are removed by skimming boats before they can escape out into the Bight. The U.S. Army Corps of Engineers estimates that they skimmed about 50 metric tons of garbage and trash (excluding wood) from the Hudson-Raritan Estuary during three summer months in 1989. Area beach operators have begun cleaning beaches daily to prevent litter and stranded floatables left on the beaches from being refloated by the tides. Stricter penalties for illegal dumpers have been enacted, and $2 million in New York State funds have been allocated for enforcement of these new laws. Combined sewer overflow abatement plans in New York City are underway. However, CSO abatement and upgrading sewage treatment plants will be expensive and will not likely be completed in the near future.

The Waste Management Institute (WMI), the New York State Department of Environmental Conservation (NYSDEC), and the New York Sea Grant Institute have instituted a number of programs to educate boaters and the general public on the importance of preventing wastes from entering the environment. The WMI and the COAST Institute of the Marine Sciences Research Center have also coordinated the development of a Floatables Management Plan to define specific actions which might be taken to reduce the problems associated with floatable wastes and eventually minimize the floatable wastes themselves.

Whose Responsibility?

The ultimate responsibility for the floatable and beach wash-up problems resides with us. Individually, we must reduce the amount of waste and litter we generate by properly disposing of those items that cannot be recycled or reused. The saying, "What goes around, comes around," is especially true in the case of floatable wastes.

SUGGESTED FURTHER READING

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