

# Marine Debris: A Lesson in Conserving the Ecosystem

## Lesson Objectives:

- Students will be able to define marine debris and learn the common types and amounts of marine debris found in cleanups
- Students will gain an understanding of where marine debris comes from and how it finds its way into the environment
- Students will learn what they can do to help reduce marine debris and how to organize a cleanup

Vocabulary Words: biodegradation, buoyant, degradable, disposal, entanglement, ghost fishing, marine debris, medical waste, plastic resin pellets, recycling, source, stormwater runoff

This packet reprinted with permission from the United States Environmental Protection Agency Turning the Tide on Trash-A Learning Guide on Marine Debris.

Marine debris is trash that gets into the marine environment as a result of careless handling or disposal. There are several sources of marine debris, both in the ocean and on land. Careful

collection, handling, and disposal of trash, as well as attempts to reduce the amount of trash that must be disposed of, can help to reduce the marine debris problem.

## What is Marine Debris?

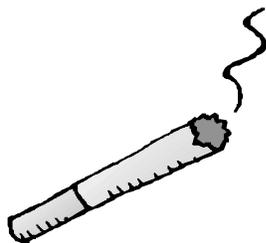


**Marine debris** includes all objects found in the marine environment (which consists of not only the ocean, but also salt marshes,

estuaries, and beaches) that do not naturally occur there. Although items such as tree branches and the bones of land animals can be considered marine debris, the term generally refers to trash (articles that have been made or used by people or discarded). The most common

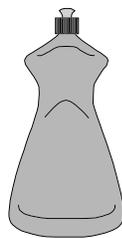
categories of marine debris are plastic, glass, rubber, metal, paper, wood, and cloth.

Since 1988, the Center for Marine Conservation (CMC) has organized and sponsored an annual National Beach Cleanup Campaign. Volunteers in all of the coastal states, as well as some of the states bordering the Great Lakes, collect marine debris and record their findings. CMC compiles the data and publishes the results, which have shown that significant quantities of marine debris litter U.S. coastlines. In 1991, the 12 most frequently collected marine debris items were: 1) cigarette butts, 2) plastic



pieces, 3) foamed plastic pieces, 4) plastic food bags and wrappers, 5) paper pieces,

6) glass pieces, 7) plastic caps and lids, 8) metal beverage cans, 9) glass beverage bottles, 10) plastic straws, 11) plastic beverage bottles, and 12) foamed plastic cups.



Although plastic is the most common type of marine debris, all debris causes problems in the marine environment.

Two characteristics of trash, **buoyancy** and ability to be blown around affect how easily the trash can enter the marine environment. Another characteristic, **degradability**, affects how long the trash will remain the marine environment. The more likely it is that a piece of trash will enter and remain in the marine environment, the greater, the greater the threat it poses to people, wildlife, and vessels.

Buoyant objects are those that float in the water. Buoyant objects are more likely to become marine debris than those that sink because they can be carried by water. Buoyant items can be washed into the ocean by heavy rainfall, carried out to sea by rivers and streams, or picked up off a beach by waves.

An object is degradable if natural forces cause it to be broken down into smaller pieces. In nature, materials most commonly are broken down through a process called **biodegradation**.

Biodegradation occurs when microorganisms (such as bacteria and fungi) **decompose** a material, causing it to be broken down into compounds (such as nutrients) that can be reused in the environment. Temperature and moisture level affect the speed of biodegradation. Generally, the higher the temperature (up to a certain point) and the greater the

moisture level, the greater the rates of biodegradation. Natural materials usually are more biodegradable than synthetic

materials. Plastic, glass, **synthetic** rubber and cloth, and metal typically are resistant to biodegradation.

## Where Does Marine Debris Come From?

Marine debris comes from many different sources. Trash that is improperly disposed of, as well as materials that are improperly transported or stored, can become marine debris. The main sources of marine debris are:

- Beachgoers
- Improper disposal of trash on land
- Stormwater sewers and combined sewer overflow
- Ships and other vessels
- Industrial facilities
- Waste disposal activities
- Offshore oil and gas platforms

Every year, thousands of people visit U.S. beaches. Many of these beachgoers leave behind materials that become marine debris, such as food packaging and beverage containers, cigarette butts, and toys like shovels, pails, and Frisbees. This trash can be blown into the ocean, picked up by waves, or washed into the water when it rains.

**Landlubbers** also can generate marine debris. Trash can be blown or washed directly into the ocean if it is littered or disposed of

carelessly. Even trash that is generated hundreds of miles inland can become marine debris if it is blown or washed into rivers or streams and carried to sea.

**Stormwater runoff** (the water that flows along streets or along the ground as a result of a storm) can carry street litter into sewer pipes, which convey this water and debris to a nearby river or stream, or even directly to the ocean.



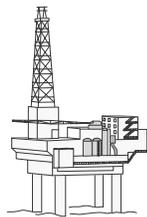
Boats of all kinds are also sources of marine debris. Sometimes, trash is purposefully thrown overboard. One major reason for overboard disposal of trash is that there is limited storage space aboard these vessels. Most of the time, however, trash is disposed of in the ocean by people who are unaware of the problems this can cause.

Trash can also accidentally fall, blow, or wash off of vessels into the water. In addition, fishing nets and lines, and other types of equipment, can be lost at sea accidentally and become marine debris.

Industrial facilities contribute to the marine debris problem when waste items generated by industrial processes (such as production scraps, flawed products, and packaging material) are improperly disposed of on land.

Waste disposal activities can cause a problem when trash is lost during collection or transportation, or when trash blows or is washed away from disposal facilities. For example, **landfills** (which are specially engineered sites for disposing of solid waste on land that are constructed to reduce any hazards to public health and safety) can generate marine debris. The trash in landfills periodically is covered with soil so that it will not be released into the environment, but the trash can blow or be washed from the landfill before it is covered up.

**Offshore oil and gas platforms** are structures that are



constructed in the ocean and form a base from which oil and gas drilling is conducted.

Because offshore oil and gas platforms are surrounded by water, any items that are lost from these structures become marine debris. Typical debris generated from these platforms includes data-recording tape, items like drill pipes and drill pipe protectors, hard hats, gloves, and 55-gallon storage drums.

Once the debris has found its way into the ocean, it is very difficult to trace the source of the debris. A plastic cup, for instance, could have been left by a beachgoer, littered in a city street and been washed into a storm sewer and out to sea, blown off of a recreational boat, used on a shipping vessel and disposed of overboard, and so on. Clearly, marine debris is a complex problem whose answer will require that many sources of marine debris be controlled.

## Reducing Marine Debris

The United States generates significant quantities of trash every year. In 1990, almost 196 million tons of trash was generated in this country. About 17% of this trash was recycled. Almost all of the rest was buried in landfills (67%)

or burned (16%). Disposal means permanently storing or removing the trash from the environment. Landfilling and burning are considered disposal methods.

**Recycling** is one way to reduce the amount of trash requiring disposal. Recycling is the collection and reprocessing of materials so they can be used again. Before materials can be processed for reuse, they must be separated into different types (such as plastic, glass, and metal). In 1990, over 8000 recycling programs existed in the United States.

Even better than recycling is to adopt “pollution prevention” strategies that produce less waste in the first place. Ways to produce less waste include reusing materials, using reusable items rather than disposable ones, and reducing the amount of packaging that is used.

Steps also can be taken to keep the waste that is generated from getting into the ocean. Most importantly, **littering** should be prevented. Boaters and beachgoers should ensure that trash and other items are not blown or washed away. Before trash is left out for collection, it should be tightly secured in bags or trashcans. Garbage trucks should always be covered, and landfills should be fenced in to capture any trash that may temporarily escape. Industrial facilities that produce **plastic resin pellets** can modify handling processes to control the release of pellets into the environment. All of these methods can help to ensure that trash is put, and stays, in its proper place.

## Animal Entanglement

The two primary problems that marine debris poses to wildlife are **entanglement** and **ingestion**.



Entanglement results when an animal becomes encircled or ensnared by debris.

Entanglement can occur accidentally, or when the animal is attracted to the debris as part of its normal behavior or out of curiosity. For example, an animal may use a piece of marine

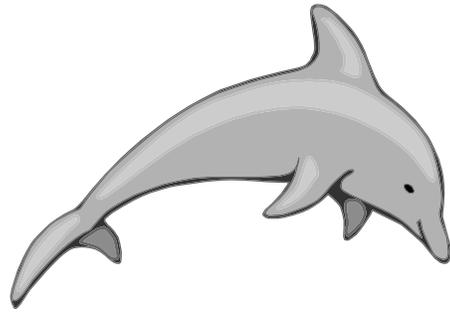
debris for shelter, as a plaything, or as a source of food (if other plants and animals are already trapped in the debris or if the debris resembles prey that is a normal part of its diet).

Entanglement is harmful to wildlife for several reasons. Not only can entanglement cause wounds that can lead to infections or loss of limbs, but it may also cause strangulation or suffocation. In addition, entanglement can impair an animal’s ability to swim, which

can cause drowning or difficulty in moving about, finding food, and escaping predators.

Ingestion occurs when an animal swallows marine debris. Ingestion sometimes happens accidentally, but generally animals feed on debris because it looks like food. Ingestion can lead to starvation or malnutrition if the ingested items block the intestinal tract and prevent digestion, or accumulate in the digestive track and make the animal feel “full” lessening its desire to feed. Ingestion of sharp objects can damage the digestive track or stomach lining and cause infection or pain. Ingested items may also block air passages and prevent breathing thereby causing death.

It is estimated that approximately 100,000 marine mammals die every year from entanglement or ingestion of marine debris. Of the different types of marine mammals, seals and sea lions are the most affected because of their natural curiosity and tendency to investigate unusual objects in the environment.



Nearly a million seabirds are thought to die from entanglement or ingestion each year. Since most seabirds feed on fish, they are often attracted to fish that have been caught or entangled in nets and fishing line. As many as 100 birds have been found in a single abandoned net.

Fish and crustaceans (such as lobsters and crabs) are frequently caught in lost or discarded fishing gear, in a phenomenon known as **ghost fishing**. Lost traps also continue to attract fish and crustaceans, which enter them in search of food or shelter. In New England alone, it is estimated that nearly one half million lobster pots are lost every year.

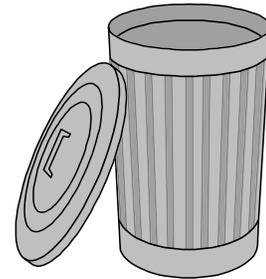
## What Can You Do?

While governments and private organizations have become increasingly active in combating marine debris, individual initiative remains one of the best ways to tackle ocean pollution. By taking action, whether properly disposing of all waste, cutting down on the amount of waste produced, organizing local marine debris projects or joining the efforts or larger organizations, citizens of all ages can help reduce marine debris and increase public awareness of the problem.

Since prevention is the simplest and most effective way to reduce marine debris, individuals can begin by examining their lifestyles, considering how much garbage they generate, and where it all ends up. People also can recycle as much trash as possible and practice waste reduction techniques, such as reusing items like bags and containers rather than throwing them away.

“Adopt a Beach” programs can be very effective ways to educate the community about the impact of marine debris and what needs to

be done to prevent it. (See the Organizing a Cleanup section) Young people can also take action to prevent marine debris and educate others about the problem through a variety of youth organizations, such as Kids Against Pollution and local chapters of Boy or Girl Scouts of the United States of America. Students can learn more about aquatic environments and the wildlife that lives there by visiting museums, aquariums, and nature reserves. They can also read books and magazines. In addition, young people individually can make a difference in their communities by organizing cleanups, by writing letters, and by talking about environmental issues with parents and friends.



At a time when many environmental problems seem beyond individual action, marine debris is an area where people of all ages can make, and have already made a real difference.

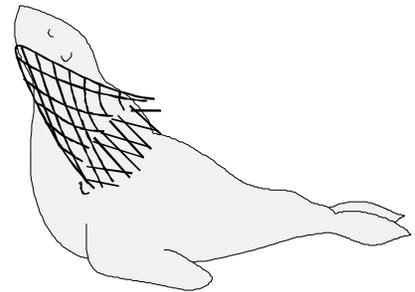
## Activity 1-1. All Tangled Up

*Objective:* To learn about wildlife entanglement by experiencing what it might be like to be a marine animal trapped in debris.

*Activity:* Students perform an experiment in which they wrap a rubberband around their fingers and try to disentangle themselves. As a class, students discuss their thoughts and reactions and relate to real animals.

Distribute rubberbands to students and have them follow the procedure below. (Note: You may want to have one or two students come up to the front of the room to perform the exercise with rubberbands as a demonstration; then include the entire class in the discussion.)

- Hold your hands up in front of your face, with the back of your hands towards your face.
- Hold the rubberband in your right hand and hook one end of it over the little finger of your left hand.
- Hook the other end of the rubberband over the left-hand thumb. The rubberband should be taught and resting across the bottom knuckles on the back of your left hand.
- Place your right hand on the bottom of your left elbow, and keep it there.
- Try to free your hand of the rubberband without using your right hand, teeth, face, or other body parts.

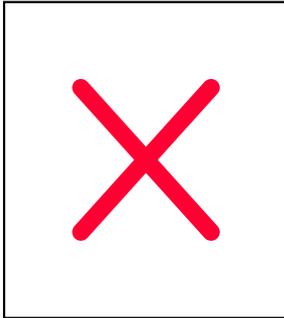


While students are struggling, ask the class to imagine that they are seagulls that have gotten pieces of fishing line, abandoned net, or other debris wrapped around their beaks or necks. Ask them the following questions:

- How would you feel after struggling like this all morning?
- How would you feel after missing breakfast?
- What would happen if you continued to miss meals and spend all of your strength fighting to get free?
- What would happen if a predator were chasing you?

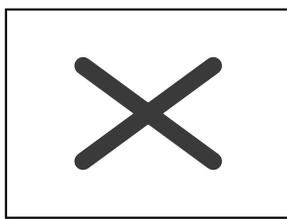
Encourage students to share their thoughts and feelings about being entangled. Remind them that their experience is similar to that of a bird or other marine animal that becomes entangled in debris.

## Activity 1-2. Most Wanted



Have students design a “Most Wanted” poster for the type of marine debris that they think is the most dangerous. The poster should include an illustration of the debris and list some of its “crimes.” Students might also mention a “reward” on the poster for the person who finds this type of debris and disposes of it properly or identifies it to the proper authorities for disposal.

## Activity 1-3. Seaside Community



Have students develop a bulletin board mural or model of a seaside community complete with swimming beach, fishing pier, restaurants, beachfront housing, and hotels. The community should also include people in different occupations and some wildlife. Then ask students to research one element of the community that can be affected by marine debris and prepare a brief presentation. When students have completed their reports, gather the class around the mural or model and have students get up one at a time, indicate the subject of their talk with a pointer, and give the presentation.

## Activity 1-4. Organizing a Beach Cleanup

Adapted from Sea Grant Education Publication No. 3, May 1989  
A Guide to Cleaning up Beach Debris in Alaska

One way to increase public understanding of the problem, and to get debris off our beaches, is to hold beach cleanups. Environmental groups, fishing organizations, individuals, and other users of the marine environment are starting to clean our coasts of the debris that washes ashore.

- *Funding*

Little funding is needed to start your cleanup activities. Garbage bags, gloves, and publicity can all be donated by local businesses.

- *Form a Committee*

Enlist the help of other interested persons and divide up the duties. Committee members will be needed for:

- Publicity
- Volunteer organization
- Solicitation of donations and prizes
- Supplies
- Data Collection
- Food organization

- *Set the Date & Time*

Be sure to consider local events in your area before selecting a date. The National Cleanup organized by the Center for Marine Conservation is held each year on the third Saturday of September.

- *Volunteers*

Some excellent sources for volunteers:

- Teachers & classmates
- Student Organizations
- Retiree Organizations
- Boy Scouts of America
- Girl Scouts of America
- Environmental Groups
- Sporting clubs
- Civic organizations such as Kiwanis, Rotary, Elks, Eagles
- Chamber of Commerce



- *Publicity*

Press releases are a terrific way of letting the public know about your cleanup.

Prepare flyers to post in your town. (Grocery stores, post office, etc.)

Banners in your hallways are great for generating excitement in your school.

- *Start-up supplies*

Each volunteer will need:

- Garbage bags
- Gloves
- Hat
- Sunglasses
- Water
- Insect repellent
- Sunscreen

- *Tips for volunteers*

- ⇒ Always wear gloves to avoid cuts and scrapes
- ⇒ Wear sneakers or boots, no sandals.
- ⇒ Be careful not to damage native vegetation.
- ⇒ Drink plenty of water.
- ⇒ Do not try to move containers that may contain hazardous materials. Alert your coordinator and they will arrange for its removal.
- ⇒ Beware of snakes, insects, and other dangerous wildlife.
- ⇒ Beware of poisonous plants.
- ⇒ Report unusual objects or circumstances, including injured wildlife to your coordinator.
- ⇒ Use caution around sharp objects and debris.

- *Organize into groups*

Have volunteers group into teams of three. One volunteer should carry the bag for trash and gather the debris. A second volunteer will carry another bag for recyclable items. The third volunteer will record the information on a data sheet.

- *Data*

You will want to document the types of marine debris and the quantities that are picked up during your cleanup.

- *Trash Removal*

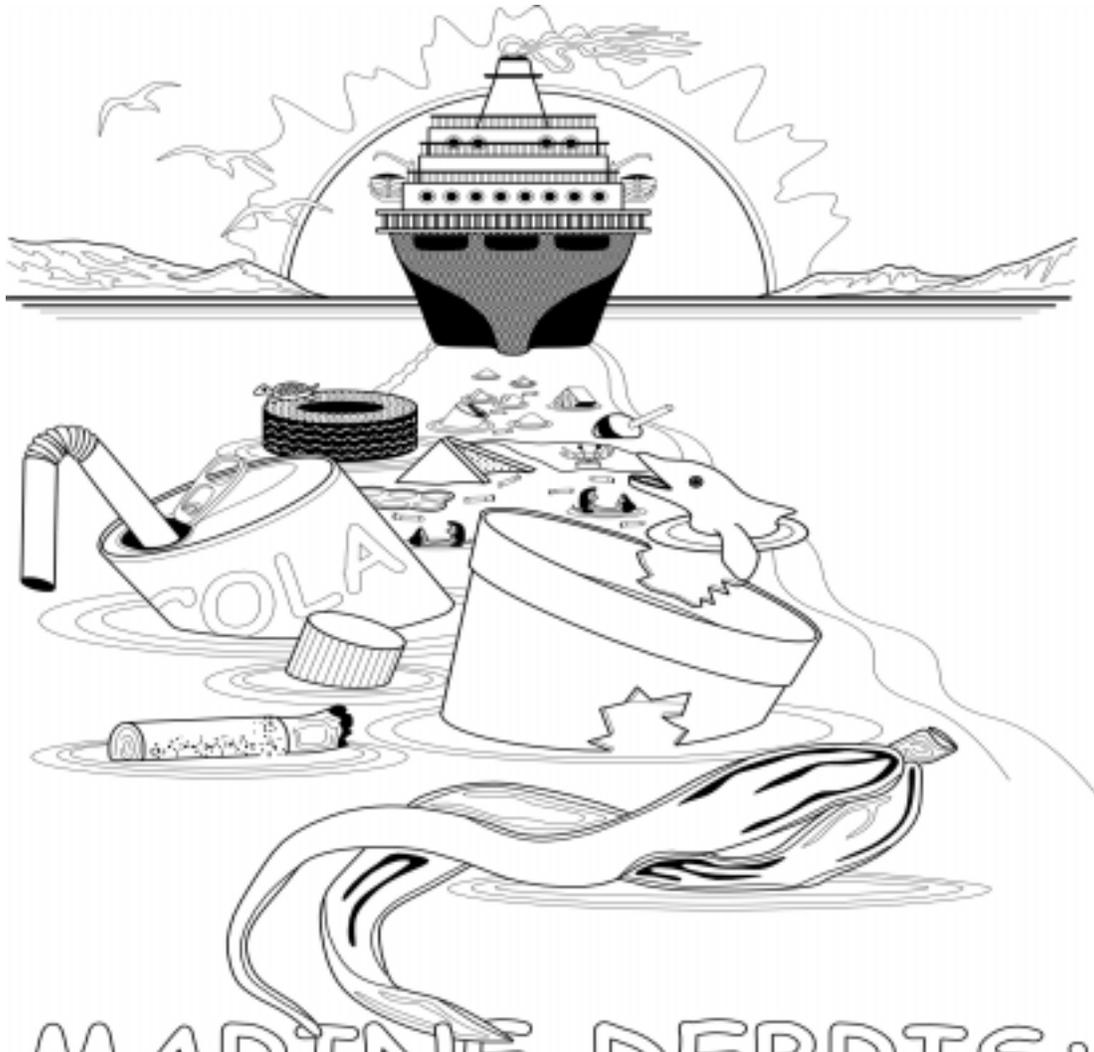
Many city sanitation companies will volunteer its services by providing a dumpster for your cleanup.

- *After the Cleanup*

Volunteers will be hungry after the cleanup is over. A picnic lunch is a great way to show appreciation and compare stories about the garbage that was found.

## Student Information Sheet. Marine Debris

- ◆ In the Pacific Ocean, one 1,500-meter long section of net was found that contained 99 seabirds, 2 sharks, and 75 salmon. The net was estimated to have been adrift for about a month and to have traveled over 60 miles.
- ◆ Even in Antarctica, one of the most isolated areas on earth, marine debris is commonly found washed up on shore by researchers studying the area. Antarctica is visited by so few people that most of this debris could not have come from the local area. Instead, the debris enters the oceans hundreds or even thousands of miles away, and then drifts to these remote beaches.
- ◆ Glass can be recycled to make new glass, insulation, and asphalt. In 1993, we recycled more than 600 tons of glass, sustaining 4,320 jobs.
- ◆ In 1997, worldwide, 342,026 volunteers removed more than 6.2 million pounds of trash on 9,022 miles of shoreline.
- ◆ In one Florida Cleanup, volunteers retrieved 254 miles of fishing line!
- ◆ For more information or joining the cleanup efforts  
→ Take part in the International Coastal Cleanup Day on September 18, 1999. Call 1-800-CMC-BEACH or visit the website at [www.cmc-ocean.org](http://www.cmc-ocean.org)



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