



# Plastic Debris Washed Ashore



Is this a photograph of a coastal landfill or an uninhabited beach on a island in the middle of the Pacific Ocean?

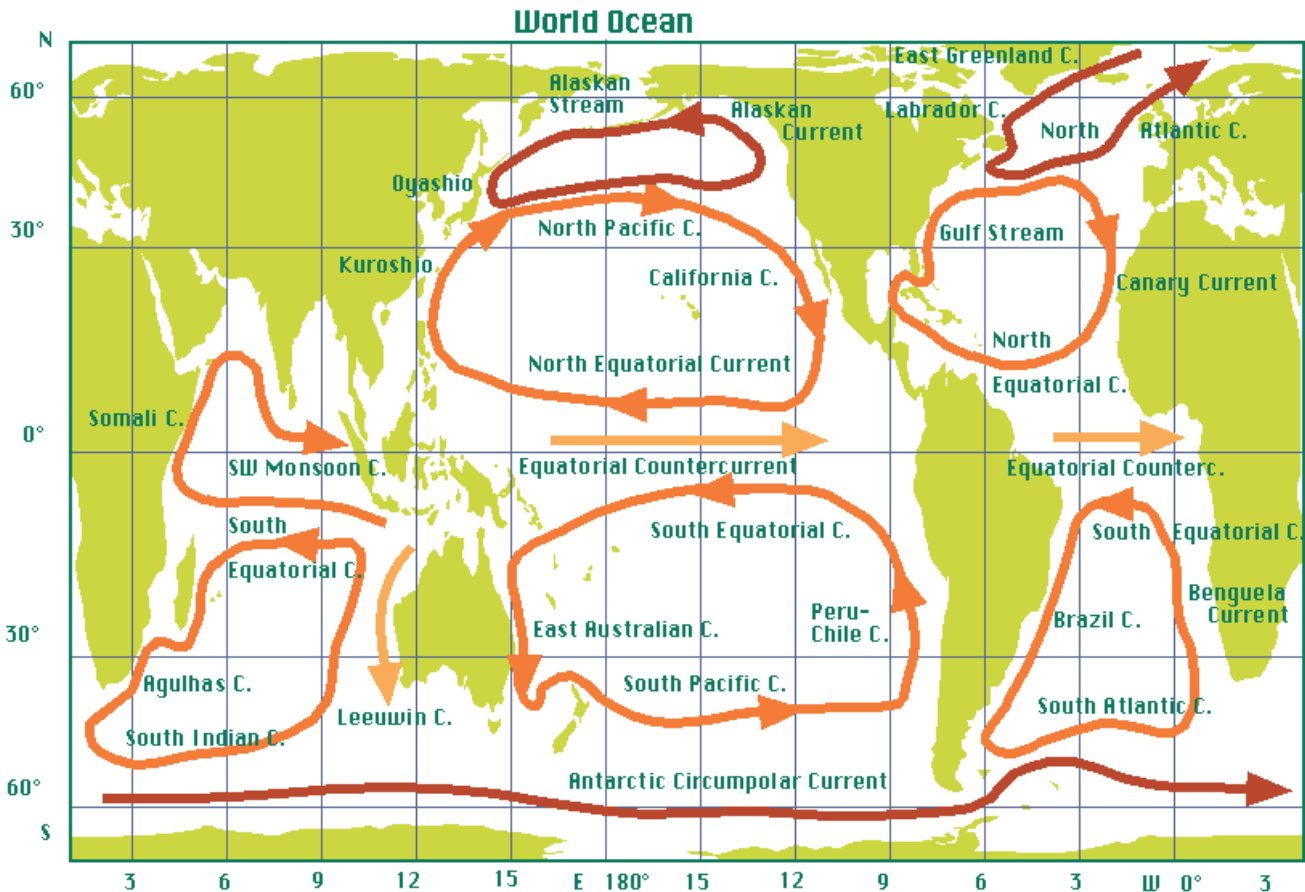
Beaches around the world are littered with plastic debris. Even the most remote islands, uninhabited by human beings, are becoming inundated with non-biodegradable plastics. Researchers from the Marine Science Department at the University of Hawaii analyzed plastic debris from nine remote locations throughout the Hawaiian Archipelago. Their findings are alarming.

A total of 22 20-liter buckets of sand scooped from the surface of the remote beach were collected from the nine sites. The samples were sieved for pieces that were between 1mm and 15mm in size. 28% of the sample, by weight, was plant material, fragments from mollusk shells, or large grains of sand.

**Of the sample collected, 72 % was plastic!**

19,100 pieces of plastic were sorted from the sample. 11% were pre-production pellets, called “nurdles”.

# Plastic Debris on the Move



## A Floating Landfill in our Ocean Gyres

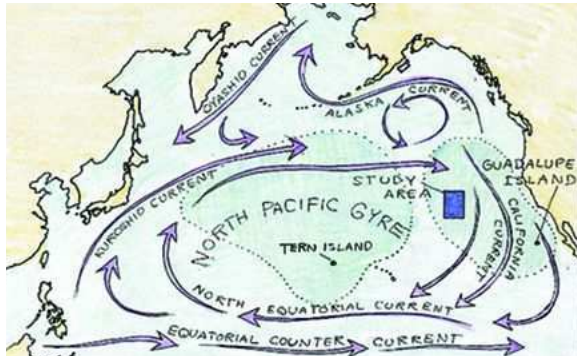
Oceanic gyres are circular ocean currents created by rotating high-pressure systems. Nine major oceanic gyres around the world have become accumulation zones for plastic debris, drawing hundreds of tons of plastic into their centers.

## Plastic is Forever

Plastic debris in an oceanic gyre may never leave. After decades of floating about, plastic may break down into smaller particles, get absorbed into the food chain, or sink and become part of ocean bottom sediment.

# Plastic Debris Adrift in the Pacific Ocean

The North Pacific Gyre is chosen as the study site to explore drifting plastic debris.



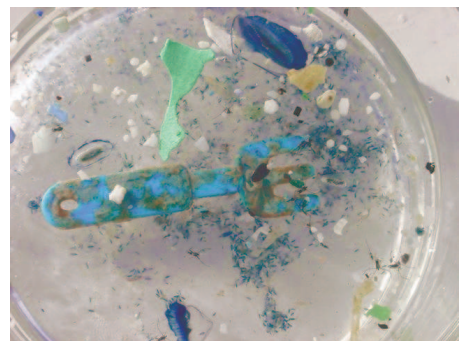
## Plastic debris is collected.

A large net with a 333 micron mesh, called the manta trawl, skims the surface of the ocean in the North Pacific Gyre. Samples of zooplankton and plastic debris are taken back to the Algalita Lab in Los Angeles.



	Size:		
(1-2.5mm)	(2.5 -4.75mm)	(>4.75mm)	
	Type:		
(fragment)	(film)	(foam)	(filament)

Sorted samples of plastic and zooplankton are dried and weighed.



## Conclusions and future questions

Plastic debris in the North Pacific Gyre outnumbers zooplankton by a ratio of 6:1 by mass, and is increasing.

Why are there fewer red and yellow pieces of plastic debris in the North Pacific Gyre than samples of the ocean surface collected near shore?

# Plastic Debris in the Ocean Water Column

Researchers from the Algalita Marine Research Foundation and the Southern California Coastal Water Research Project have found plastic debris throughout the ocean water column.



Two trawl surveys were conducted at three depths in the Santa Monica Bay, before and after a rain event, using three different 333 micron mesh nets.

Before the storm, abundance of debris was greatest near the bottom and least in the middle of the water column.

After the storm, abundance of debris was greatest on the surface. Debris also increased at midwater, especially close to shore reflecting inputs from land-based runoff and resuspended matter.

Plastic was found throughout the water column. The USEPA estimates that 46% of manufactured plastic sinks.

## Some Plastic Debris Floats



Nurdles

## Some Plastic Debris is Neutrally Buoyant



Aluminized chip bag

## Some Plastic Debris Sinks



Photo credit: National Geographic –Dec. 2004.

Plastic cup found among wreckage of the Titanic.



# Sources of Pollution in our Watershed

## Point-source Plastic Pollution

### Plastic Manufacturing Factory

Pre-production plastic pellets, used to create nearly all commercially consumed plastic products, are carelessly handled in places where they are produced and transported.



## Nonpoint-source Plastic Pollution



### Cigarette Butts are Plastic!

Those cigarette filters you see littering the ground are made from cellulose acetate – a type of plastic. They do not biodegrade.

### Plastic Debris Flows to Sea

After a heavy rain in Southern California, many tons of plastic debris flows down river and is sometimes caught by giant booms. Unfortunately, they often break because of the weight of plastic and the force of the current.



### Fast Food and Snack Food Packaging

Each day, in the United States alone, over 2500 tons of non-biodegradable plastic packaging is thrown away.



# “Nurdles”

## Pre-production Plastic Pellets

Hydrocarbons extracted from underground are processed into fuel, lubricants and plastics. Before plastics are molded into the products we use, they are first produced as pellets the size of rice grains. These pre-production pellets are transported around the world.

Pre-production plastic pellets arrive in California on trains, and are carelessly unloaded.



Millions of pellets spill onto the ground.



The pellets travel around the world.

During rainstorms, pellets flow into storm drains, through the watershed and into the Pacific Ocean.



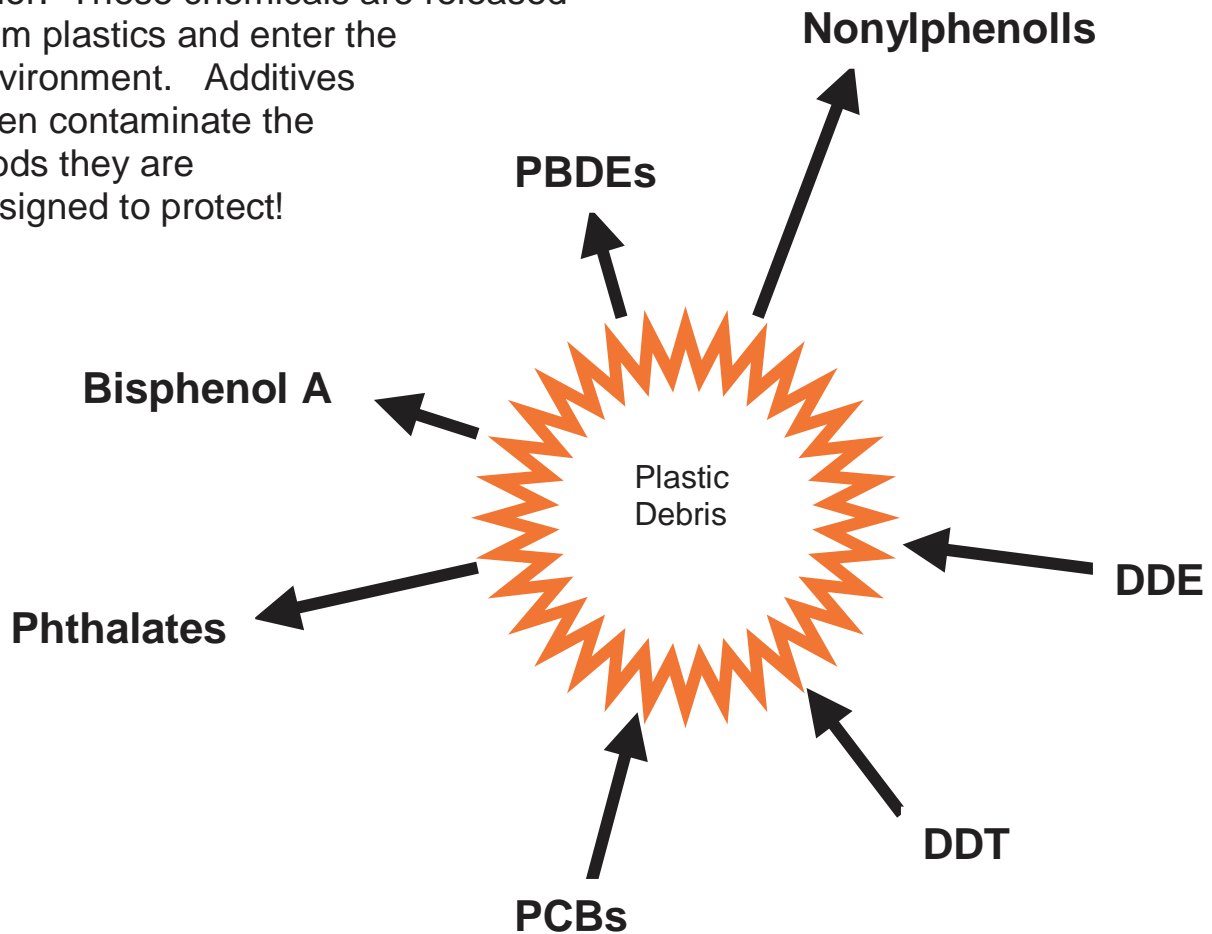
In an analysis of nine square meters on Hawaiian beaches uncovered 19,100 fragments of plastic. 2100 were plastic pellets, **that's 11%!**



# Chemical Pollutants from Plastic

## Plastics Release Pollutants

Additives like, Nonylphenols, PBDEs, Phthalates, and Bisphenol A, are added to plastic during production to catalyze monomers into polymers and give it different properties like flexibility, durability and color. These chemicals are released from plastics and enter the environment. Additives even contaminate the foods they are designed to protect!



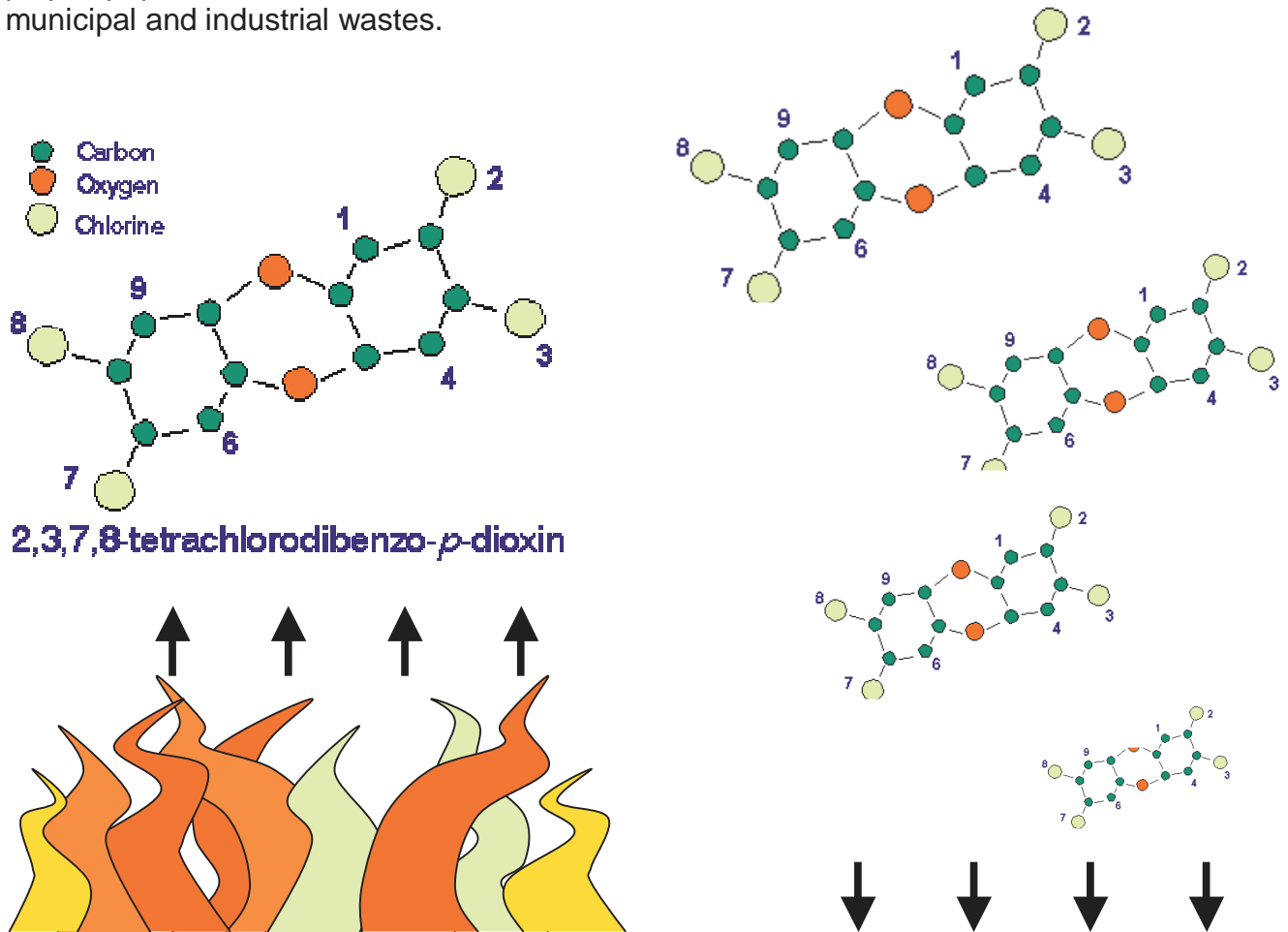
## Plastics Absorb, Transport and Release Hydrophobic Pollutants

Nonylphenols, PCBs and DDE are absorbed and released by plastic debris. PCB, DDT and DDE are three of the hydrophobic pollutants carried by plastic particles.

# Pollutants from Plastic Incineration

## Burned Plastics Release Dioxins

Many plastics, particularly PVC, when burned result in emissions of the deadly poisons named dioxin. Dioxins ( $C_{12}H_4Cl_4O_2$ ) are byproducts of a wide variety of industrialized activities, such as chlorine bleaching of pulp in paper mills and incineration of municipal and industrial wastes.



## Dioxin Poisons the Food Chain

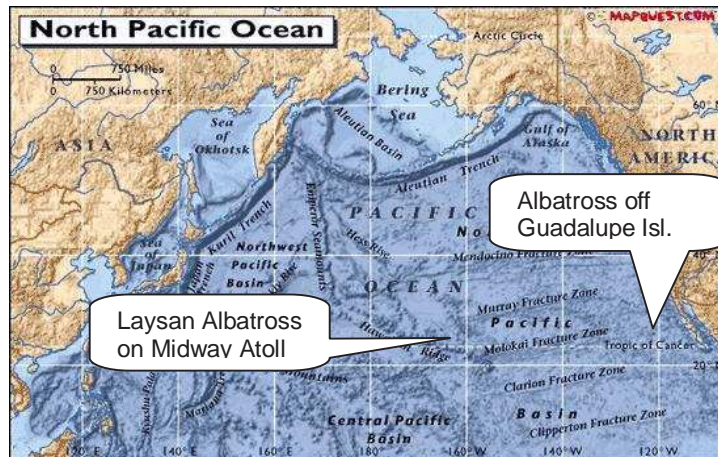
Dioxins are highly persistent compounds, with the potential to become increasingly concentrated in living tissues as they move up the food chain. The toxicity of dioxin to animals is well-established. It is often considered to be the man-made compound most toxic to animals. One human health effect from exposure to dioxin is a skin rash called chloracne. Dioxin is also considered a carcinogen on the basis of animal studies.

# Peril of the Albatross



**Adult Albatross feed in the North Pacific Gyre for squid and small fish to feed their young, unknowingly consuming plastic debris that mimics food.**

- 1 Albatross have been found to consume all kinds of plastics:** disposable cigarette lighters, bottle caps, syringes, fishing line, buttons, toys, balloons, dishwashing gloves, pens and markers, tooth brushes, and unidentified fragments of plastic and PVC.



- 2 Adult Albatross regurgitate food for their chicks.** Albatross parents, both the mother and the father, share the responsibility of finding food and keeping the chick warm. They take turns feeding in the North Pacific Gyre and then return to Midway Atoll to regurgitate food for their chicks. The chicks ingest food directly from the parents stomach, including plastics.



- 3 The fledgling albatross continue to ingest plastic from their parents.** With a stomach full of plastic that will not digest, there's no longer room for food. This causes reduced appetite, dehydration, lockage in the digestive tract, weight loss, and contamination by toxic chemicals in albatross chicks.



- 4 The albatross dehydrate and starve.** Many never leave the island. Piles of bones, feathers and plastic debris litter the beaches.

# Plastic Debris Pollutes the Food Chain



Plastic debris enters the marine environment

Small fish ingest toxins from food mimics.



Salp with plastic filtered from seawater while feeding.



## Bioaccumulation

Toxins, like mercury, DDE and PBC's accumulate in the tissues of marine organisms. Birds, sea turtles and large fish consume contaminated fish, and plastics that mimic food.



Toxins accumulate in the tissues of marine mammals.



Toxins that imitate estrogen effect fish populations, turning males to females.



Dead bird with plastics in gut. Egg shells are thin.



Leatherback turtle washed ashore w/ plastic bag lodged in its throat.

## Biomagnification

Concentration of toxins increase up the food chain, and are highest in predatory animals.

Inuit communities in Greenland primarily consume marine mammals they hunt.

Pollutants from plastics, pesticides, and municipal power plants, bioaccumulate and biomagnify in the muscle and fat of the animals they eat.

The average levels of PCBs and mercury in newborn babies' umbilical cord blood and women's breast milk are a staggering 20 to 50 times higher than women in U.S. cities. Infants exposed to PCBs, DDT, mercury and lead, have suffered greater rates of infectious disease, lower birth rate, impaired memory skills, and difficulty in processing new information.

Source: "Dozens of Words for Snow, None for Pollution," by Marla Cone, in Mother Jones, Jan.-Feb. 2005

# Stopping Pollution in our Watershed



## Create Environments for Bio-remediation

Coastal wetland habitat is important incubating nursery for ocean-bound fish and invertebrates. Also, salt marshes are critical nesting grounds for numerous species of waterfowl, both native and migrating species. Much of our salt marsh habitat has been built upon, leaving less than 10% of California's coastal wetland habitat.



## Install Catch-basin Inserts in Your Neighborhood

Catch basin inserts effectively prevent plastic debris from entering the watershed and ultimately the ocean.



## Contain and Curtail Plastic Manufacturing Waste on Site

Pre-production plastic pellets, called "nurdles", are carelessly handled where they are produced, transported and processed. They enter the watershed through storm drains, and then around the world via the ocean, where they are mistakenly consumed by wildlife or accumulate on distant shores.



## Maintain Your Vehicle

Oil drips on city streets become oil slicks on swollen rivers each time it rains. Place a pan or old towel in your driveway to contain or absorb oil leaks.

## Pick Up After Your Pet

High levels of fecal coliform bacteria polluting California coasts after rainstorms can be attributed directly to pet waste.



## Enforce Litter Laws

Signs and fines are less effective without real consequences for littering. Citizens are encouraged to report illegal dumping. Even a kind reminder to others not to litter can have a long lasting positive effect. To report illegal dumping in your neighborhood call 1-888-CLEAN LA.



# Changing How We Think About Plastic



“Plastics, like diamonds, are forever.”

Captain Charles Moore

## Problem

## Solution

### **Culture of Convenience**

We are a “Throw away” society that creates long-term pollution problems in exchange for short-term ease of living. This only burdens the future further.

### **Culture of Sustainability**

Buy less.  
Buy quality products and maintain them.

### **Excess Packaging**

Non-recyclable packaging.

### **Reduce Consumption**

Buy in bulk.  
Buy 100% recyclable.  
Return to glass and metal packaging.

### **Consumer Responsibility**

Consumer assumes a majority of the responsibility for the end use of products.

### **Consumer and Producer Share Responsibility**

Support legislation that encourages producer liability for the end result and true cost of their products.

### **Plastic Accumulation Worldwide**

Plastic doesn't biodegrade. Beaches around the world are inundated with plastic debris.

## Change How We Think About Plastic