

Bin It

Understanding Plastic Pollution



भारतीय वन्यजीव संस्थान
Wildlife Institute of India

GNAMAMI
GANGE

Team Leaders

Dr Dhananjai Mohan

Dr Bitapi C. Sinha

Concept

Dr Bitapi Sinha

Text Compilation

Pragya Bhatt, Kuldeep Chauhan, Malvika Pandey, Mohit Kashyap and Ravi Sharma

Content & Editorial Support

Suchita Sinha and K.K.Shrivastava

Design & Layout

Anjali Pathak

Illustrations

Taniya Trivedi and Anjali Pathak

Artwork

Poonam Pal

Photo Credits

Ravi Sharma (Cover Photo), Gayatri Dutta and miscellaneous sources.

Citation

WII-NMCG, 2020 Bin It

Wildlife Institute of India, Dehradun

About Wildlife Institute of India

Established in 1982, Wildlife Institute of India (WII) is an internationally acclaimed Institution, which offers training programs, academic courses and advisory in wildlife research and management. The Institute is actively engaged in research across the breadth of the country on biodiversity related issues. The Institute's idyllic campus that has been carefully developed to create state-of-the-art infrastructure encourages scholarly work.

Our Mission

To nurture the development of wildlife science and promote its applications in the field in a manner that accords with our economic and socio-cultural milieu.



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**GNANAMI
GANGE**

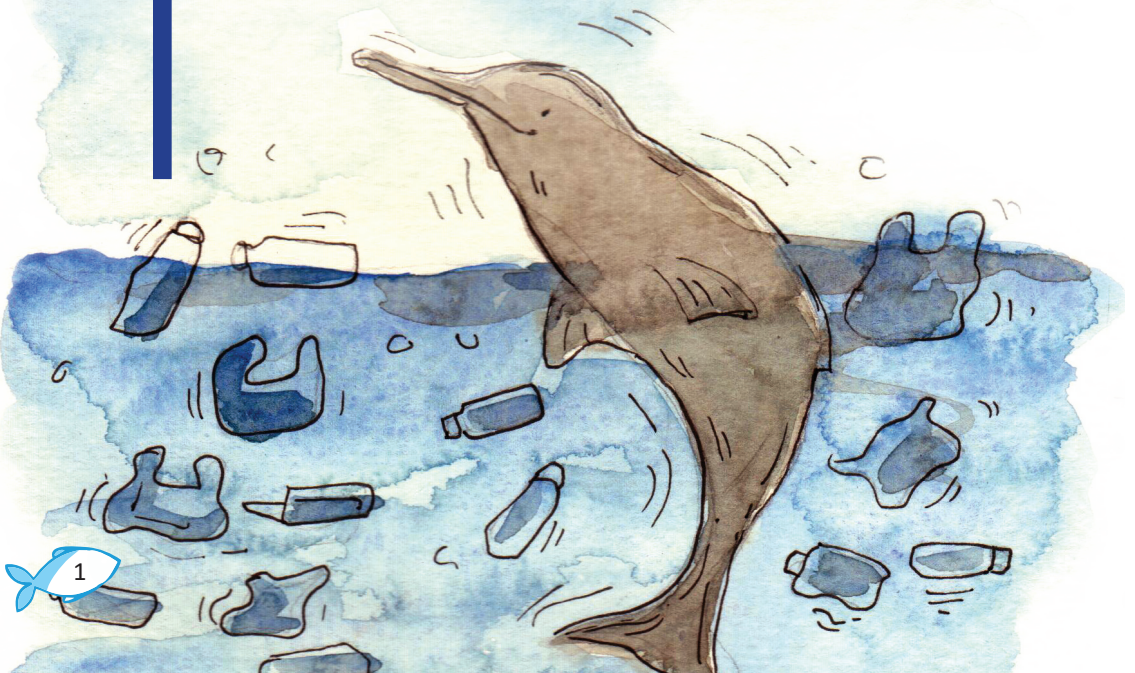
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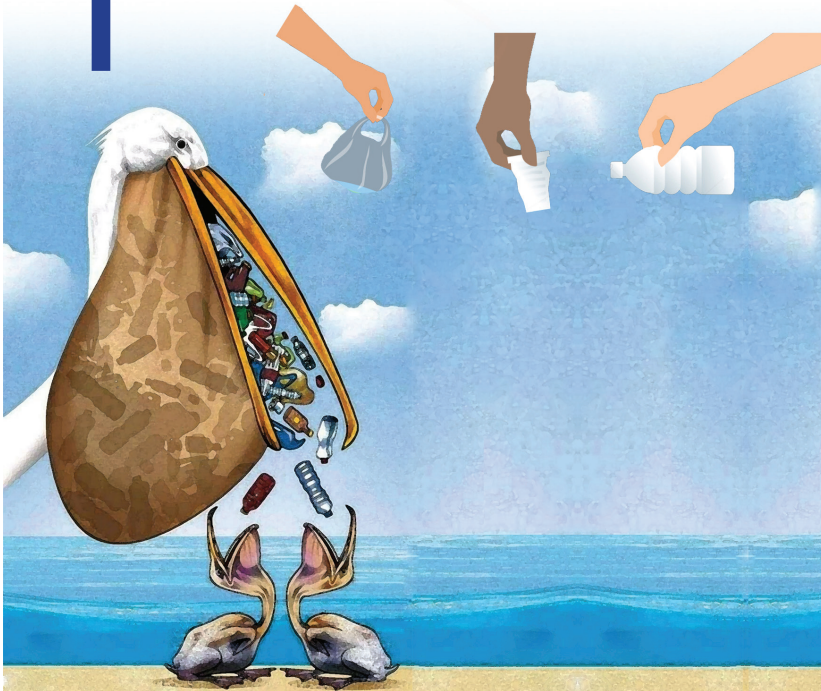
INTRODUCTION

Plastics have marked themselves as the eminent members of many different technological industries. They became distinctly notable in the early 1960s, when their first use as electrical insulators was discovered. The approach towards plastic products has substantially grown over the decades but their abuse apparently left the environment in ruins. The non-biodegradable plastics has a disheartening impact on the biodiversity causing it to lose its capacity to rejuvenate as well as sustain. The influence of plastics has caused aesthetic and ecological devastation and to control their effects was beyond help. The researchers started to opt for methods to master the new plastic pollution that was leaving its impression on land and water quality and hence the movement 5Rs i.e. Reducing, Reusing, Refusing, Removing and Recycling of plastics came into force.



WHAT IS PLASTIC?

The word plastic comes from the Greek word “Plassein” that means “pliable and easily shaped”. Plastic is a versatile, lightweight, flexible, moisture resistant, strong and relatively inexpensive polymer.

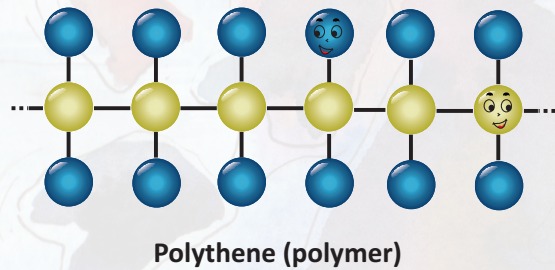
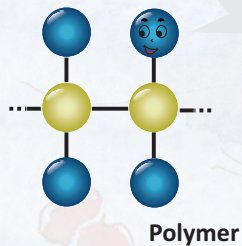
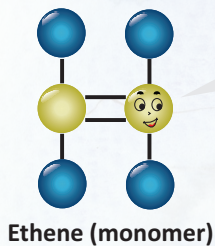


WHAT IS PLASTIC MADE OF?

They are mostly human made polymers, that is a chemical substance consisting of large molecules made from many smaller and simpler molecules e.g. nylon is an artificial polymer whereas protein and DNA are natural polymers.

 = Hydrogen

 = Carbon



PROPERTIES OF PLASTIC



Plastics have
water resistance



Unbreakable and
doesn't easily wear
or tear



They are
*corrosion proof



Cheaper to
produce so they
act as cost effective
alternatives
instead of steel or
aluminum



They are light
weight, odorless,
flexible and
durable as they
don't easily
biodegrade so can
last for a very long
time



They can be
mostly reused and
recycled

*gradual destruction of metals by
chemical and/or electrochemical
reaction with their environment.

DOWN THE MEMORY LANE

First synthetic polymer invented by John Wesley Hyatt. The synthetic polymer celluloid was invented to replace ivory made billiards balls

1869

Polythene created at a chemical plant in Northwich, England

1933

1907

Leo Baekeland invented Bakelite, the first fully synthetic plastic

1939-45

Expansion of plastic industry in United States

The BBC's Blue Planet II increases global concern about plastics and how they impact oceanic animals

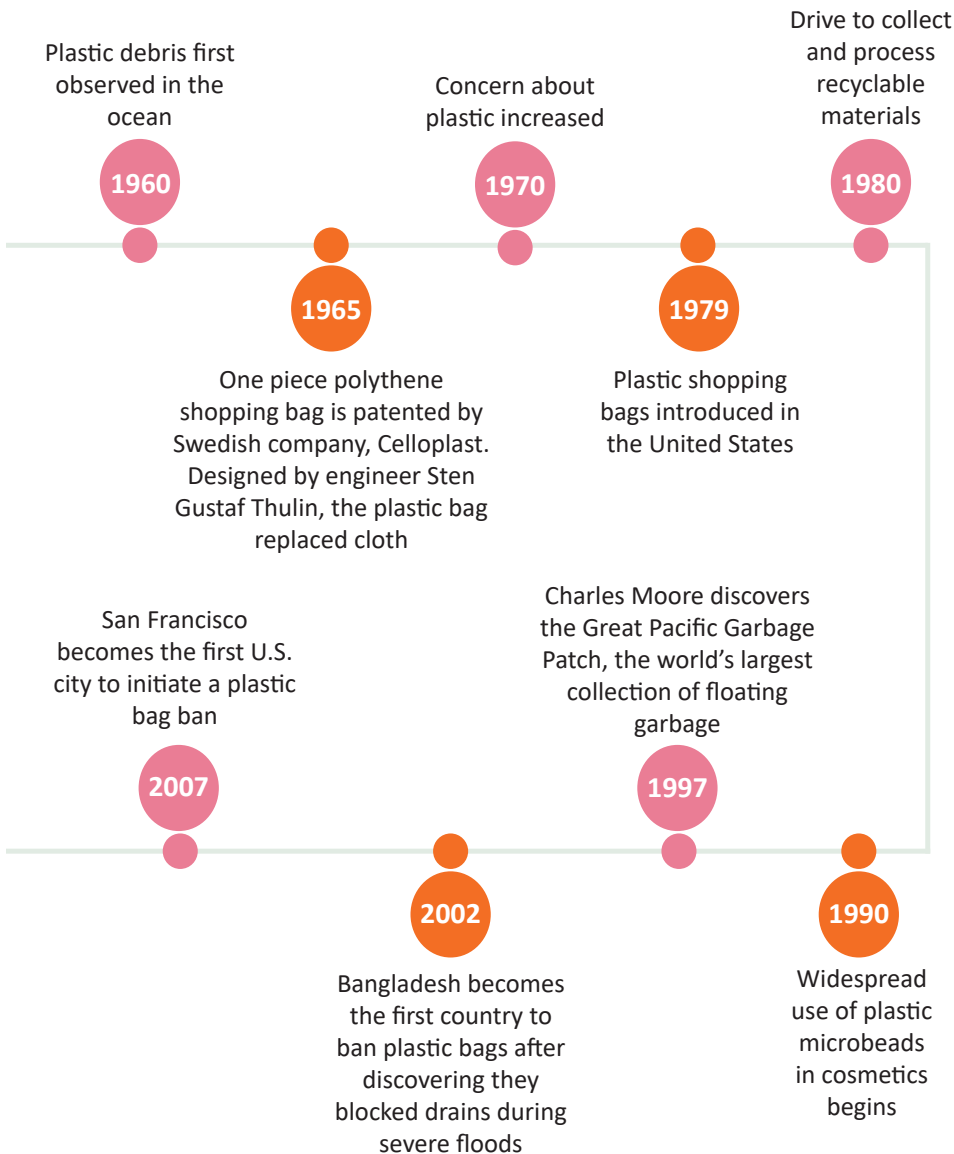
2017

2018

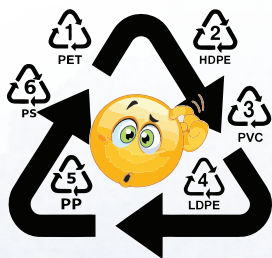
The World Environment Day, 2018 theme "Beat Plastic Pollution" focusing on ending plastic pollution by 2020

2014

The Netherlands becomes the first country to ban microbeads in cosmetics



Source: www.ecowatch.com; www.unenvironment.org



What Do These Letters And Numbers Mean?



HDPE

**HIGH DENSITY
POLYETHYLENE**

They also can be recycled. It is mostly chemical resistant so are used in chemical, detergent bottles.



PETE

**POLYETHYLENE
TEREPHTHALATE**

They are hard and have high heat and solvent resistance, therefore are good for using in microwaves. It can be recycled.



PVC

POLYVINYL CHLORIDE

One of the most used type of plastic, flexible, rigid and can be recycled.



LDPE

LOW DENSITY POLYETHYLENE

They are tough and durable. They can be occasionally recycled.



PP

POLYPROPYLENE

It is strong and flexible and can be recycled.



PS

POLYSTYRENE

Hard and rigid gets affected by fats and solvents. It can be recycled.



OTHER

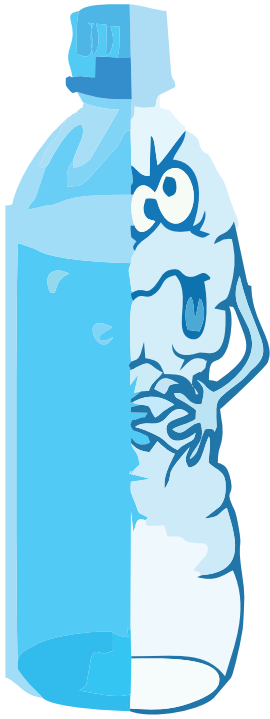
OTHER

Different plastics that cannot be categorized and recycled.

ACTIVITY 1

Before the arrival of plastic households used items that were reusable and environment friendly. Some are still being used. Can you list the items listed below that have been replaced by plastics?

S.No	ITEMS	TRADITIONAL ITEMS
1.	Plastic Bottle 	
2.	Disposable Coffee/Tea Mugs 	
3.	Single-use Plastic Bag 	
4.	Plastic Cutlery 	
5.	Plastic Straw 	
6.	Plastic Chair 	



72 billion gallons of water
wasted for plastic
production annually

.....

By **2021**, **1.2** million
plastic bottles would be
sold/minute

583.3 billion/year

Source: www.plasticmenance.com

DID YOU KNOW?

Current efforts to improve waste
management capacity across the
planet are insufficient to stop
a predicted 104 million metric
tons of plastic at risk of leakage
into nature in 2030

Source: Solving plastic through accountability (WWF Report, 2019)

SINGLE-USE PLASTICS



Single-use plastics are the plastics that are used once and then discarded. The single use plastics account to 70% of the generated waste that ends up in our landfills and water bodies. These include polythene bags, plastic water bottles, straws, Shampoo sachets, and packaging materials like gift ribbons, food wrappers to name a few of the categories. India alone generates 9.46 million tonnes of plastic waste each year out of which 43% comprises of single use plastics. These single use plastics directly impact the environment by harming the wildlife and its rich cultural heritage.

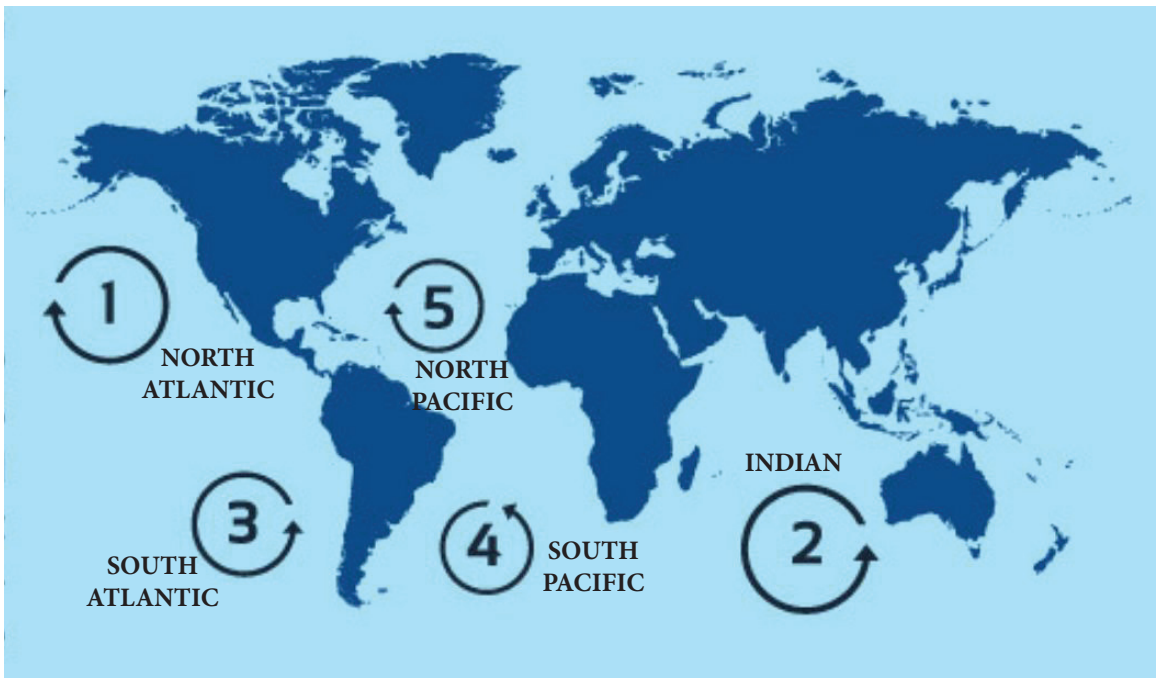


PLASTIC POLLUTION

In India, the first ever plastic product dates back to the time when the British reigned in India. The British established a market and sold plastic goods at a marginal price so that it could be used by the locals. Slowly traditional items gave way to plastic items as a replacement in day to day life. The plastic took a hike during the industrial revolution, right after independence. The plastic industry flourished thoroughly in India and soon became the ninth largest importer of plastic products.

Looking at the current scenario, mud/clay pottery has been replaced by plastic, while cloth/jute bags have been replaced by plastic carry bags. Even the food in weddings that was once served in plates made of leaves (locally called as *pattal*) is now served in plastic plates along with plastic cutlery and tissue papers. The neighbourhood grocery shop that once gave edible oil for cooking in glass bottles or steel containers, now has neatly and beautifully packaged products in plastic that is displayed on their racks. Slowly the production, need and usage of plastic has grown massively into our lives.

The global agenda that revolves around plastic has been its production over the centuries and how no proper reforms and policies have been developed for its disposal. Even though plastic is effective, reusable and user friendly, the concerns around its disposal needs to be addressed with laws that can be practically implemented on its usage and disposal. An estimate suggests that about 83.5 billion of plastic litter has been generated from 1950s out of which only 9% has been recycled globally. The rest of it is still available ranging from landfill and water bodies to large plastic garbage patches in the oceans which are responsible for death of large number of marine species bringing them to the edge of extinction.



WHAT IS GYRE?

A gyre is a large scale system of wind driven and moon driven tidal waves which are caused by *Coriolis Effect*. Due to the rotation of the Earth the wind deflections are varied towards the right and the left directions in accordance to the north and the south poles, this is known as the Coriolis Effect. There are five main subtropical gyres-located in the north and south Pacific, the north and south Atlantic, and the Indian Ocean which are known as massive circular current systems. The plastic that flows through different river channels such as Nile River basin or Ganges River basin largely empties into the oceans therefore creating a large garbage patch. The Yangtze River in China is the first largest contributor of plastic debris in oceans, closely followed by Ganges on number sixth (Gray, A., 2018).

ABOUT THE GYRES

- Home of 'The Great Pacific Garbage Patch'
- Estimated 3.2 million tonnes of trash
- About the size of Texas by some accounts
- Located between Hawaii and California

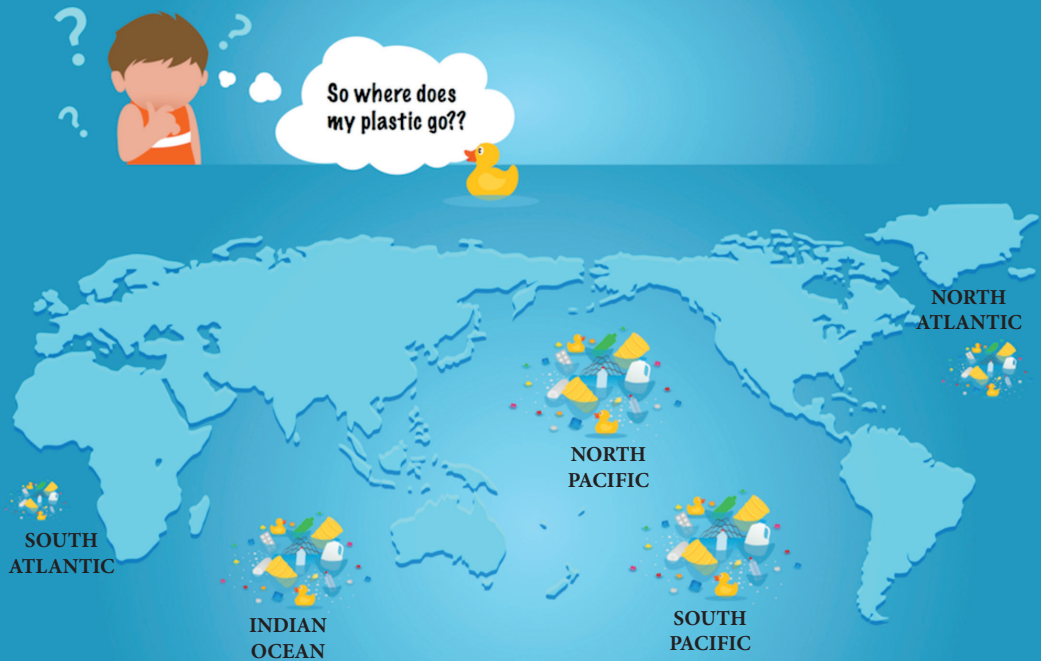
- Research trips between Bermuda and Azores document floating garbage
- Soup of micro-particles similar to the 'Great Pacific Garbage Patch'

44% of all seabird species documented with plastic in or around their bodies

Plastics have entangled birds and turned up in fish bellies

Searchers for Malaysian Airlines Flight 370 have found ocean garbage instead of crash evidence.

Accumulation of Plastic in Gyre



The accumulation zones of plastic that form in the five subtropical gyres are a result of the diminished winds and currents occurring at latitudes synonymous with continental deserts. Basically, plastic is trapped within these currents, taking at least 10 years to cycle back out—if it doesn't first get eaten by marine life or sink to the bottom.



THE UGLY JOURNEY OF OUR TRASH

Marine debris is the rubbish of our everyday lives, it travels over land, down streams, rivers and storm drains to the ocean. It can drift thousands of miles leaving a wake of destruction in its path. Every year, debris kills thousands of marine animals and sea birds, chokes coral reefs, smothers critical environments and contaminates our beaches and recreation sites. Better information about sources and impacts is extremely important to drive changes in infrastructure and waste management policies. Who is responsible? All of us. Together we can help prevent and clear up this mess for a clean, healthy ocean planet.

Globally annual plastic production has boomed from 1.7 million tons in 1950 to almost

300 MILLION

As much as **250 MILLION METRIC TONS** of plastic could make its way into the ocean by 2025¹

Plastics cost approximately **US \$13 BILLION** a year in environmental damage to marine ecosystems²

All seven **SEA TURTLE** species, over half marine mammal species and almost two thirds of all seabird species have ingested or become entangled in marine debris³

95% 95% of northern fulmars washed up dead in the North Sea had ingested plastic debris⁴

92% PLASTIC Almost 400 different species have ingested or become entangled in marine debris – plastics are the culprit in 92% of cases⁵

More than **1 in 10** species ingesting or becoming entangled in marine debris are threatened with extinction⁶

As much as **70%** of marine litter has been estimated – to end up on the seabed⁷



Scuba divers everywhere are standing up to the onslaught of debris – fins on and off. We are removing debris underwater and logging the data to influence change at all levels. On land, we can work together to stop rubbish from entering the ocean. We can help inform community action and identify local solutions.

DON'T LET YOUR DIVES GO TO WASTE. TAKE A GIANT STRIDE AND DIVE AGAINST DEBRIS. WWW.PROJECTAWARE.ORG

Sources: ¹PlasticsEurope (2014). Plastics – The Facts 2014: An Analysis of European Plastics Production, Demand and Waste Data; ²J. Jambeck, et al. (2015). Plastic waste inputs from land into the ocean. Science, 347 (6223), 768-771; ³UNEP (2014). Valuing Plastics: The Business Case for Measuring, Managing and Disposing Plastic Use in the Consumer Goods Industry; ⁴J. A. van Franeker, et al. (2011). Monitoring plastic ingestion by the northern fulmar, *Fulmarus glacialis* in the North Sea. Environmental Pollution, 159 (10), 2609-2615; ⁵S. Gall, R. Thompson. (2015). The impact of debris on marine life. Marine Pollution Bulletin, 92 (1-2), 170-179; ⁶UNEP (2005). Marine Litter, an analytical overview

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Plastic Waste Footprint

**MORE THAN
5 TRILLION
PLASTIC PIECES AFLOAT**

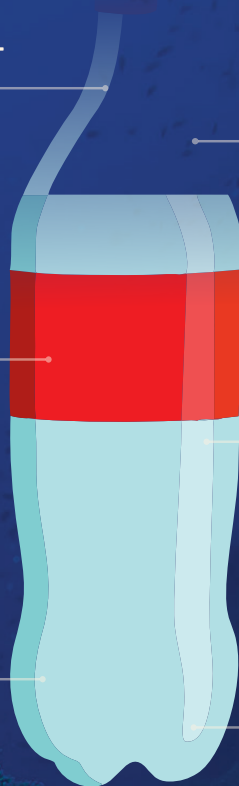
**6.6%
RECYCLED
PLASTIC
USED IN THE BOTTLES**

**WEIGHING MORE THAN
250,000 TONNES**

**2M TONNES
A YEAR
PLASTIC BOTTLES
SOLD BY THE TOP 6
GLOBAL FIRMS**

**MARINE ORGANISMS
10 KM DEEP
HAD INGESTED PLASTIC
FRAGMENTS**

**NONE
HAVE COMMITMENTS
TO REDUCE THE
AMOUNT OF SINGLE-
USE BOTTLES**



SOURCES

- <http://www.bbc.com/news/science-environment-39299352> | March 2017
- <http://journalsplus.org/plastic/article?id=101371/journalplus010913>
- <http://www.the-guardian.com/environment/2017/feb/13/extraordinary-levels-of-toxic-pollution-found-in-10km-deep-mariana-trench> | February 2017
- <http://www.independent.co.uk/news/uk/home-news/government-plastic-bottle-tax-tackle-household-waste-public-beaches-landfills-environment-a75370686.html> | January 2017

ACTIVITY 2

FIND THE WORDS

PLASTIC

COMPOST

GANGES

COASTAL

DISPOSABLE

ENVIRONMENT

MANAGEMENT

REUSE

REDUCE

LANDFILL

POLLUTION

OCEAN

PAPER

WASTE

O P H K D I S P O S A B L E T L
 C C Q W E R T Y U I O P A N S A
 E O D F R E U S E G H J E V K N
 A Z A X C V B N M L K M P I O D
 N A S S D F V B N G E E W R R F
 Z M N B T B C V A G A Q W O R I
 A Q C R P A V T A R T N N N Q L
 P R Y U O L L N V E C V G M P L
 O V W P L Q A O T M V P Q E O O
 L D F G H M J S K L P M N N S G
 L Y T I W X A I T Z O L I T G R
 U M M U K W M A S I V O W A P E
 T B R H Q M P Z W V C N Q J E P
 I K C O M P O S T G E O P P S A
 O R T Y U I D M Q U W T A L O P
 N T E J B N S I A U E C U D E R

Accumulation of Plastic Waste in the Natural Environment

- The durability of plastic products and their widespread use as disposable items has led to the accumulation of plastic debris to such a large extent.
- Almost all aspects of our daily life involve plastics, including clothing, footwear, transport, and telecommunication, as well as packaging materials for food, drinks and other goods.
- In India, scrap plastics are accumulated on the banks of all major rivers as well as on the famous beaches.
- The plastics being non-degradable break down into smaller pieces and despite being buoyant in nature these plastics sink to the seabed.
- The plastics in the seabed decompose slower due to absence of sunlight and colder temperatures.
- It seems inevitable that the quantity of the debris in the environment as a whole will continue to increase unless we make changes in our practices. (*Thompson et al. 2009*).



It is hard to imagine packaging without the use of plastics. Whether it is shampoo, shower gels, liquid detergents or household cleaners – everything reaches the shelves in containers made of PP, HDPE, or PET. There's a soupy mix of plastic trash swirling in the North Pacific Ocean. This so-called Great Pacific Garbage Patch has grown over the years as we use and throw away ever more disposable stuff.

Source: <https://www.recycling-magazine.com/2017/07/22/starlinger-processes-detergent-bottles/>
<https://www.henkel.com/spotlight/2019-12-16-how-a-detergent-bottle-redesign-cut-3500-tonnes-of-plastic-waste-1012636>
<https://www.fastcompany.com/1678872/methods-plastic-madness-ocean-trash-to-detergent-bottles>

DETERGENTS



MILK PLASTIC BAGS



An interesting “garbage audit” done by an NGO, *Chintan*, which works specifically on solid waste management, found that 36 per cent of the total branded plastics collected in a sample of mixed garbage in Delhi is just “low-recyclable value cups and tetra packs”. Of the “single-layer plastic” garbage analysed, 57 per cent was just milk packets which otherwise have “high-recycle value,” but the companies don’t have any established collection or recycling mechanism. This leaves the entire process to the unorganised sector of ragpickers only. As a result, only a small fraction of the milk pouches are recycled while most of them end up clogging drains, floating in rivers or rotting in landfills.

Source: <https://www.indiatoday.in/mail-today/story/plastic-city-discarded-milk-packets-clog-delhi-1294171-2018-07-24>

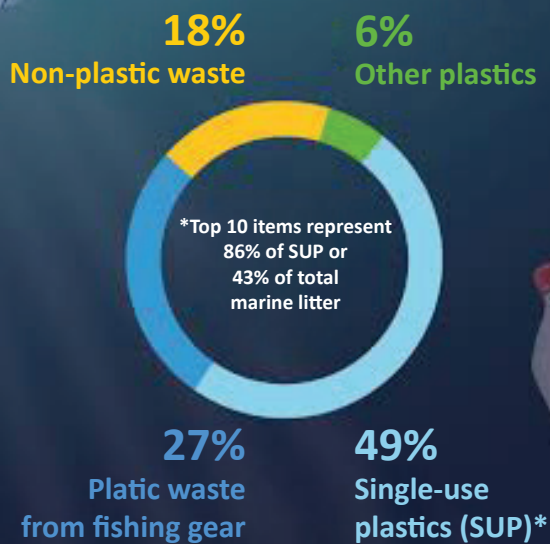
Electronic waste (e-waste) is the fastest growing waste on the planet, with an annual growth rate of 3–4%. It is estimated that e-waste generation will reach 52.2 million tonnes per annum by 2021. Presently, only 15% of e-waste is recycled. Despite several technological developments, their recycling is largely hindered due to presence of flame retardants.

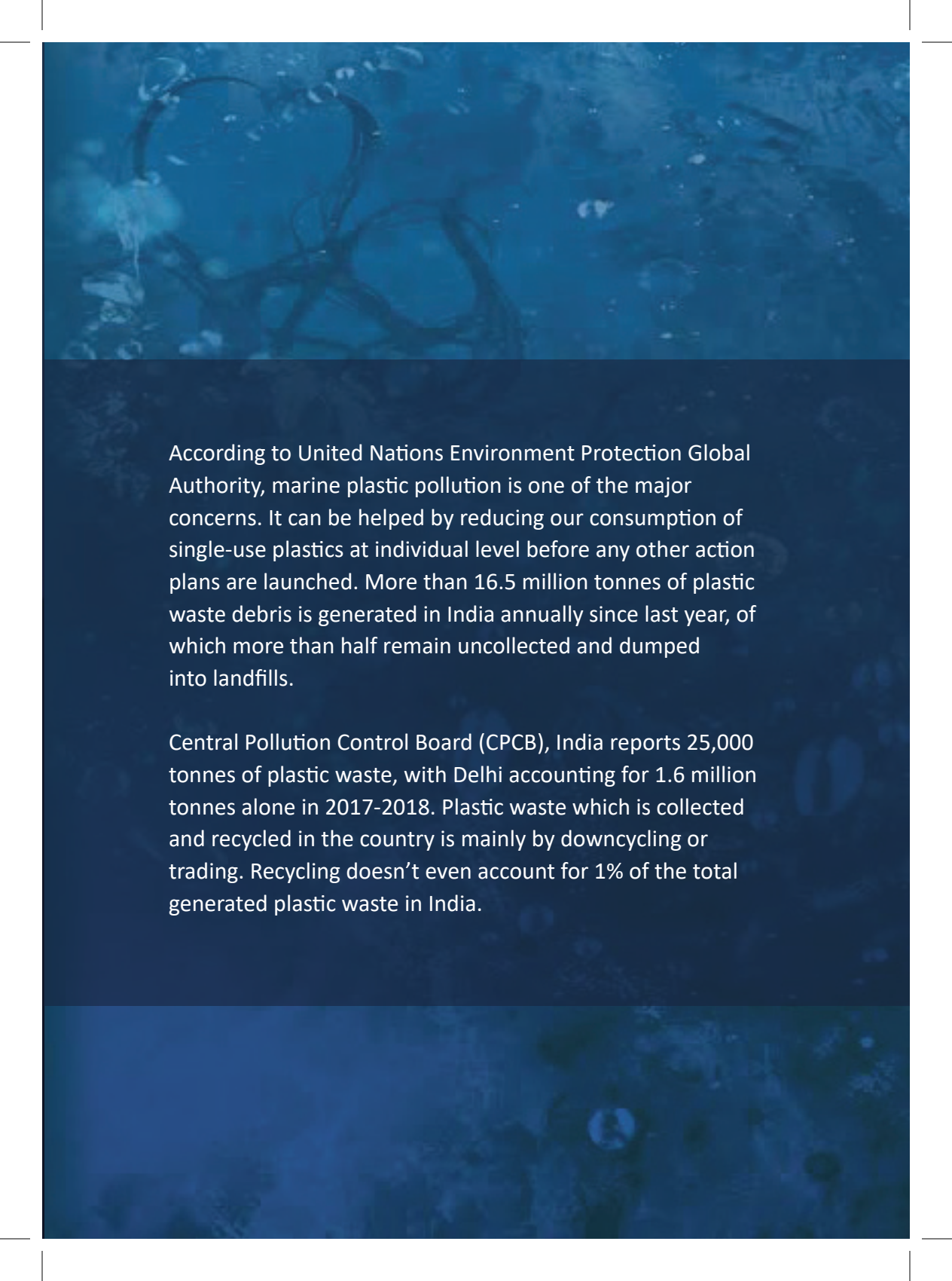
Source: Veena Sahajwalla and Vaibhav Gaikwad., The present and future of e-waste plastics recycling, Centre for Sustainable Materials Research and Technology (SMaRT), The University of New South Wales, Sydney, NSW 2052, Australia

E PLASTIC WASTES



MARINE LITTER BY TYPE



An underwater photograph showing a tangled mass of dark, thin plastic debris, possibly fishing nets or ropes, floating in clear blue water. The debris is illuminated by natural light, creating highlights and shadows. The background is a deep blue, suggesting the ocean's depth.

According to United Nations Environment Protection Global Authority, marine plastic pollution is one of the major concerns. It can be helped by reducing our consumption of single-use plastics at individual level before any other action plans are launched. More than 16.5 million tonnes of plastic waste debris is generated in India annually since last year, of which more than half remain uncollected and dumped into landfills.

Central Pollution Control Board (CPCB), India reports 25,000 tonnes of plastic waste, with Delhi accounting for 1.6 million tonnes alone in 2017-2018. Plastic waste which is collected and recycled in the country is mainly by downcycling or trading. Recycling doesn't even account for 1% of the total generated plastic waste in India.

ACTIVITY 3

ROLE PLAY

OBJECTIVE

Understand the impact of plastic on the ecosystem.

ACTIVITY

Explain the students that we will play the role of human, wildlife and plastic in order to understand how these things harm the environment.

KEYWORDS

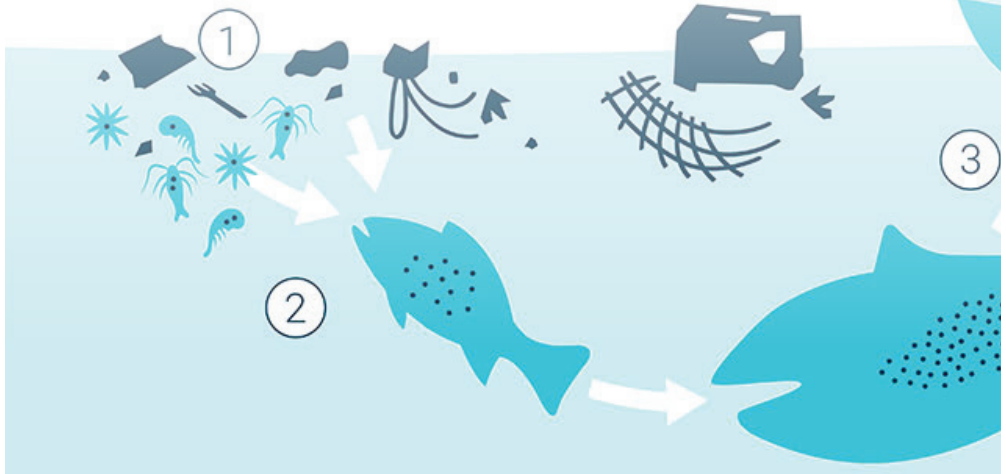
Plastic

MATERIAL

Long strings and character cards (human, plastic, wildlife)

METHOD

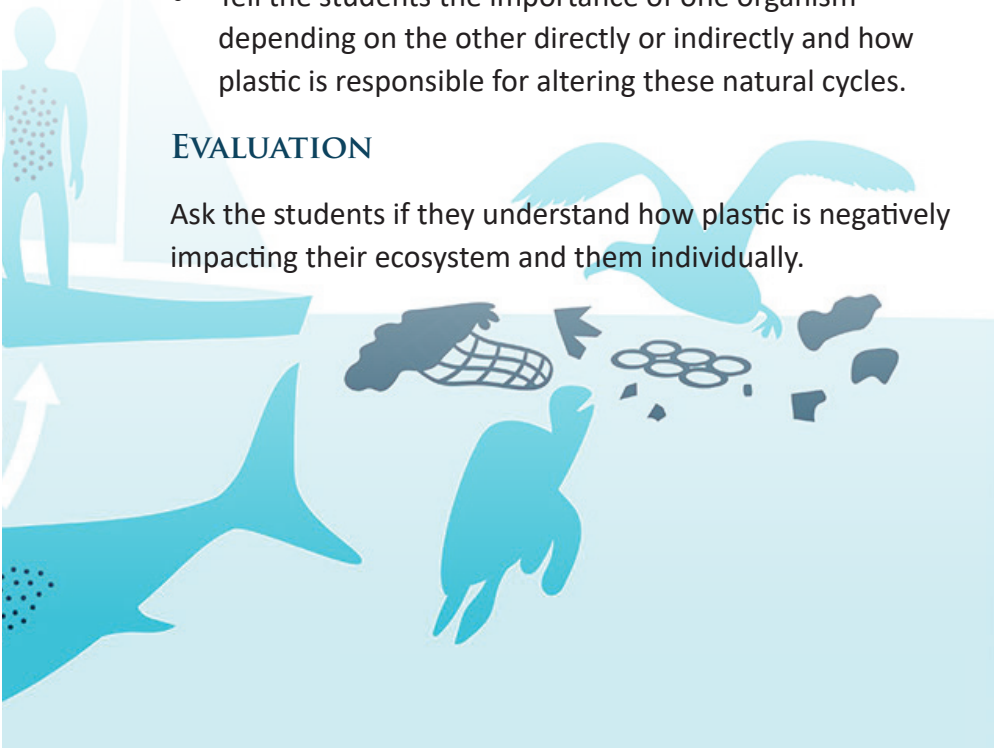
- Select a group of students.
- Take them out in a playground and gather them in a circle.

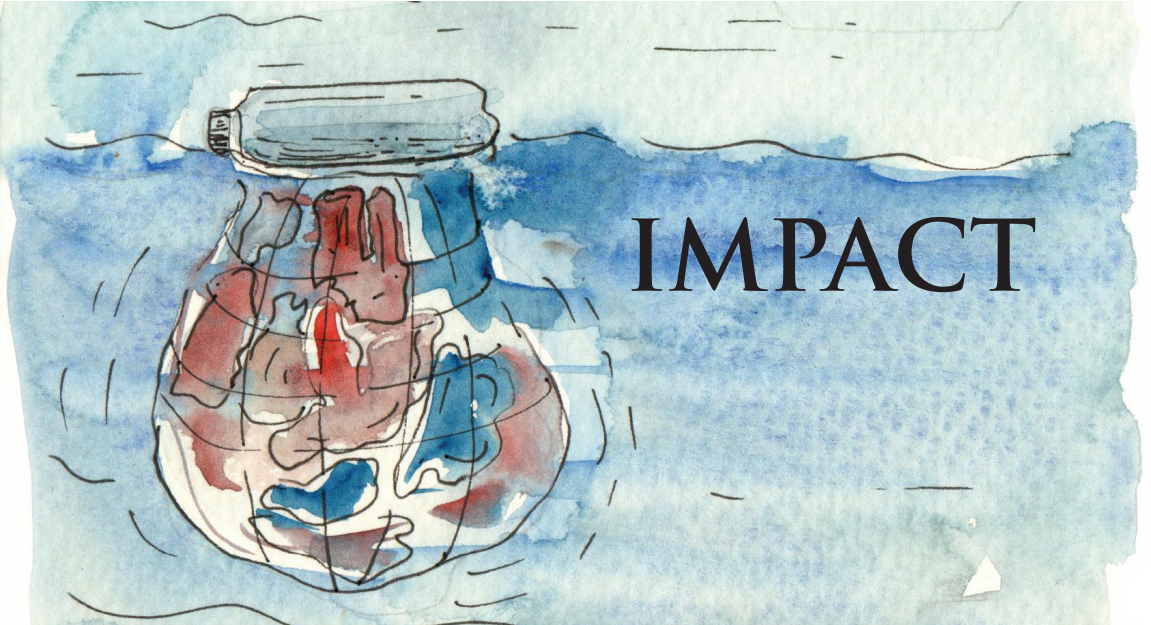


- Each student will be allotted a particular character card and they will take on to the role.
- Ask a volunteer to go first and give him/her one end of the string. Pass the string one by one to different characters according to the manner in which the harm is being transferred to each individual member. Every student involved should eventually feel the tugging of the string as being stuck.
- Tell the students that this is an example of how a plastic thrown by human returns back to their body.
- As each organism is harmed by plastic in different manner, the string becomes loose, indicating its significance in the food web.
- Tell the students the importance of one organism depending on the other directly or indirectly and how plastic is responsible for altering these natural cycles.

EVALUATION

Ask the students if they understand how plastic is negatively impacting their ecosystem and them individually.





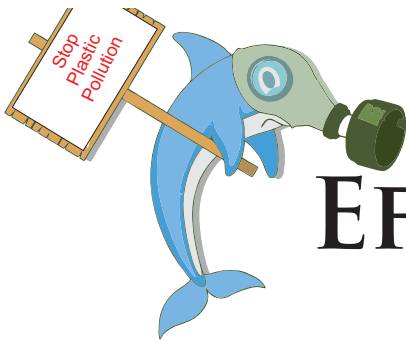
IMPACT

Plastic is used to manufacture and transport larger forms and quantities of goods without the bulk of heavy packaging. But plastic is also buoyant and tends to float causing problems in the oceans. The real impact of plastic can be observed on both aquatic and terrestrial wildlife. A huge number of aquatic animals such as whales, dolphins, turtles, sea birds, fishes, crocodiles etc die, due to exhaustion or suffocation and ingestion because of plastic entanglement by discarded fishing nets, ropes, plastic bags.

Plastic debris affects at least 267 species worldwide, including 86% of all sea turtle species, 44% of all seabird species, and 43% of all marine mammal species

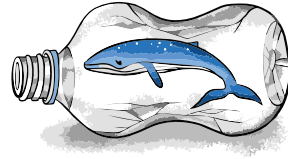
Indian palm squirrels (*Funambulus palmarum*) are using plastic bags, plastic threads and cigar butts along with natural materials in urban areas as nesting materials instead of leaves, twigs, shredded bark, mosses and other soft materials.

Dr Mewa Singh and K Mohan at the Bio-psychology Laboratory and Institute of Excellence, University of Mysore, have made this observation in female palm squirrels in Mysuru, and have reported their findings in March, 2018 issue of journal Current Science.



EFFECTS OF PLASTIC

Plastic is a hazardous pollutant, and harmful to the environment causing all forms of land, air and water pollution.



The growing industrialization require single use plastic such as disposables for tea, coffee and fast foods including plastic water bottles and plastic food packaging, which gets accumulated.



Plastic is non-biodegradable, and it stays on the earth for centuries even when thrown in garbage dumps.

Plastic waste flows into drains and empty into rivers. This waste finally reaches the oceans leading to water pollution and affecting the aquatic life in it.



ON ANIMALS

Many animals such as cows, dogs, and birds feed from the landfill sites where all our household waste is dumped. Along with the food sources, plastic waste is also consumed by mistake which causes painful death of these animals.



ON AQUATIC LIFE

Many aquatic animals eat plastic pieces mistakenly thinking them as a food source. Plastic gets accumulated in the body with time and kills the animal slowly and painfully.



ON HUMANS

Plastic waste enters into associated food chains involving animal, birds, microbes and humans. They cause major diseases like cancer, birth defects, liver and kidneys problems along with damage to our central nervous system.

Plastics can be passively and actively consumed by organisms and thus represent a new addition to the ecological food web.

Effects of Plastic Debris in the Environment and on the Wildlife

- Toxic chemicals leach out of the plastics buried deep in the landfills contaminating the groundwater, flowing streams and rivers. These chemicals not only harm the water quality but also kill the good microbes in the soil that speed up the decomposition process in nature.
- Solid wastes in the form of litter specifically plastic pollution threaten the aquatic biodiversity.
- Many species of turtles, birds and fishes either get entangled in fishing nets or ingest micro-plastics considering it as food resulting in maiming or their untimely death due to organ bleeding or stomach ulcers.
- In addition to the physical problems associated with plastic accumulation the ingestion and leaching of plastic has the potential to enter into our food web by the process of biomagnification.
- One of the indirect impacts of plastic debris arise due to collection of plastic wastes on the banks of rivers, forests, zoological parks, sanctuaries, hotels, resorts and camps posing more threats for wildlife.
- Waste generation and the capacity to manage it is the greatest impact.



SEA TURTLES

Sea turtles often mistake floating plastic garbage for food. They can choke, sustain internal injury and die or starve. Plastic can also create pockets of air in their gut, making diving difficult.

SOURCES

<https://www.undercurrent.org/news-and-features/story/fatal-attraction-turtles-and-plastic>
<https://www.marineconservation.org.au/pages/ban-the-bag.html>

1,000 turtles

(at least!) die each year from being tangled in plastic waste.



*Queensland

70% of loggerhead turtles found dead in Qld* have eaten plastic.

52% of all sea turtles have eaten plastic particles.

PLASTIC POLLUTION



Last year Lizzy Foreman took part in the Mini Transat and hopes to race in the Vendée Globe one day. In this series the experienced racer takes us on a journey through the lives of racing sailors looking at the challenge these men and women face. This month Lizzy looks at an issue that affects us all – plastic pollution.

Plastic pollution is an undeniable problem facing our world's oceans; a staggering eight million metric tons finish up in it each year.

A lot of this waste eventually ends up in five of the Earth's major subtropical gyres, which are large circular systems of ocean currents caused by global wind patterns and forces resulting from the rotation of the Earth.

Due to currents flowing around the gyres being very strong, plastic waste, which has travelled from land or been dumped directly in the sea by passing ships, gets sucked in to the centre. Here it is unable to escape, and so giant garbage patches form. Some are known to be twice the size of France.

Few countries have accepted responsibility for the pollution, as the origin of the plastic is difficult to trace and the gyres are far from any coastline.

It has come down to the individual to realise a moral obligation to protect the environment through recycling and reduced consumption of plastic.



Image: Trevor Morton

ECONOMIC IMPACT

Plastic pollution greatly affects the economies and inhabitants of coastal and waterside communities worldwide. It causes increased expenditure for beach cleaning, public health and waste disposal.

The fishing industry has been affected by reduced catches, damaged equipment and contaminated fish, while shipping industries face high costs for waste management, engine repair and removal of plastic from harbours and marinas.



A Surfer Against Sewage beach clean. Image: Chris McLean

MERMAIDS' TEARS

Mermaids' tears, also known as resin pellets or nurdles, are used in the manufacturing of plastic products.

Although plastic is resistant to natural biodegradation processes, it does degrade by exposure to the sun, a process called photo-degradation. Plastic particles thinner than a human hair are ingested by zooplankton, the basis of the food chain. Eventually humans could also consume these microplastics. Research into the effects on human health is ongoing.

Microplastics are also used in the manufacturing of cosmetics and cleaning products, but the UK government has pledged to ban these by the end of 2017. You can check if you are using plastic-free products at www.banthebottlecad.org.

TOXIC SUBSTANCES

When plastics decompose they release numerous toxins into the oceans such as BPA, DEHP and BBP. These toxins are easily ingested by marine life, posing



The Indian Ocean, North Atlantic Ocean and North Pacific Ocean all have significant patches. Image: National Aquarium

a risk of global contamination and a threat to human health.

For example, BPA is an oestrogenic, turning male fish into female fish when metabolised. Some of the affected fish have been found in British waters, and it has a huge negative impact on the fish population.

The toxic chemicals released from plastics have also been associated with:

- Asthma and allergies in children
- Some types of cancer
- Thyroid disruption and resulting weight gain
- Reproductive and developmental problems
- Brain and nervous system defects
- Heart disease
- Adverse effects on red blood cells and internal organs

Plastic debris kills an estimated 100,000 marine mammals annually, as well as

millions of birds and fish. M food and causing entrapment debris can result in starvation infection and suffocation.

CORAL REEF DESTROY

Old fishing gear, which is m plastic, can be destructive by breaking off coral heads, bags can cover and suffocate Although only covering one the Earth's surface, coral reef the highest marine biodiversity world while more than 500 people depend on them for and recreation.

Let us hope this year sees bigger united force to tackle pollution – taking part in a clean and reducing our own of plastic waste would certainly good resolution.

Lizzyracing.com

Squirrel pictured building nest out of plastic



Harrison Jones Tuesday 25 Feb 2020 11:13 am



1.7k SHARES



This could be one of the first pictures of a squirrel using plastic to build its nest (Picture: SWNS)

CLEAN DAN IS HAZARDOUS WASTE BEING DISPOSED OF PROPER

RED OUR CITY OF ITS TRASH TO ENHANCE OUR QUALITY OF LIFE AND CUT DOWN ON

IS HAZARDOUS WASTE BEING DISPOSED OF PROPER

KSPCB claims compliance of disposal of bio-medical waste by hospital

Alison Thomas

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PLASTIC POLLUTION IN GANGA

Today, the watercourse of Ganga is enormously polluted in the world with all kinds of plastics wastes. According to an IUCN report (2016) the river receives 3,000 million litres of untreated sewage annually therefore accounting it to be the sixth most polluted river globally. The river that was known for its purity is just the dumping site of plastics, chemicals, industrial, environmental and cremation wastes now. This not only degrades the water quality and raises endangerment to biodiversity but is also a threat to the people living in the river basin both upstream and downstream.

Anthropogenic activities have lead to the introduction of chemical and physical pollutants into the river on an unprecedented scale.

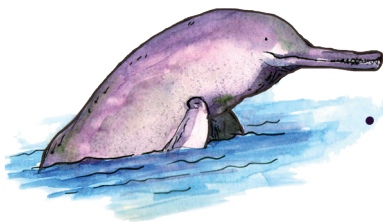


DID YOU KNOW?

The sacred river of Ganga covers a distance of 2,525 km and flows through five different States in India that compose the largest river basin covering an area of 8,61,000 km².

The subtropical gyre formed in the Indian Ocean has massive collection of plastic debris that empties into the Bay of Bengal from various tributaries of Ganga. Ganga is the second largest plastic containing river in the world after Indus. Scrap plastic, like wrappers, pouches, packets, styrofoam cups and plates, other kinds of non-biodegradable plastics, fishing nets etc. is accumulated on the banks in vast quantities and their disposal is a huge concern. Due to these adverse impacts over the degrading quality of water, India approved its purpose to help in reducing the marine plastic wastes in their discharges under the UN Environment Assembly (2017) that was held at Kenya. The major challenge for today is to manage the ecological integrity of the river system that greatly includes problems like plastic wastes causing land, air and water pollution. It leads to the unsustainable usage of water resources.

According to Central Pollution Control Board, 60 major cities produce combined 25,940 tonnes of plastic waste everyday. Although 60% is recycled, the rest stays on land as litter or slowly makes its way into our waterways.



Dolphin chokes to death on plastic:

- According to reports, a dolphin was found dead along the Sutrapada coast, Gujarat. It was recorded to be 14.4 feet long and about 1 ton in weight.
- During the autopsy 4 thick plastic bags were found from the stomach of the dolphin that had choked the animal to death.

Source: [//economictimes.indiatimes.com/articleshow/31430573.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst](https://economictimes.indiatimes.com/articleshow/31430573.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst)



Composition of Solid Waste in India

According to a report by Central Pollution Control Board (2016) the municipal solid wastes are categorized into the following categories:

- Biodegradable wastes comprise of approximately 40% organic food wastes.
- Recyclable papers and items comprise around 20% of the waste coming from homes, offices and institutions.
- Inert wastes, domestic hazardous wastes and composite wastes form the remaining 40% including plastic bottles, microplastics from tetra packs, plugs, charging cables, disposable cups, plastic utensils, waste clothing, light bulbs, waste medicines, batteries, detergents, cleaning agents, polythene bags, etc.

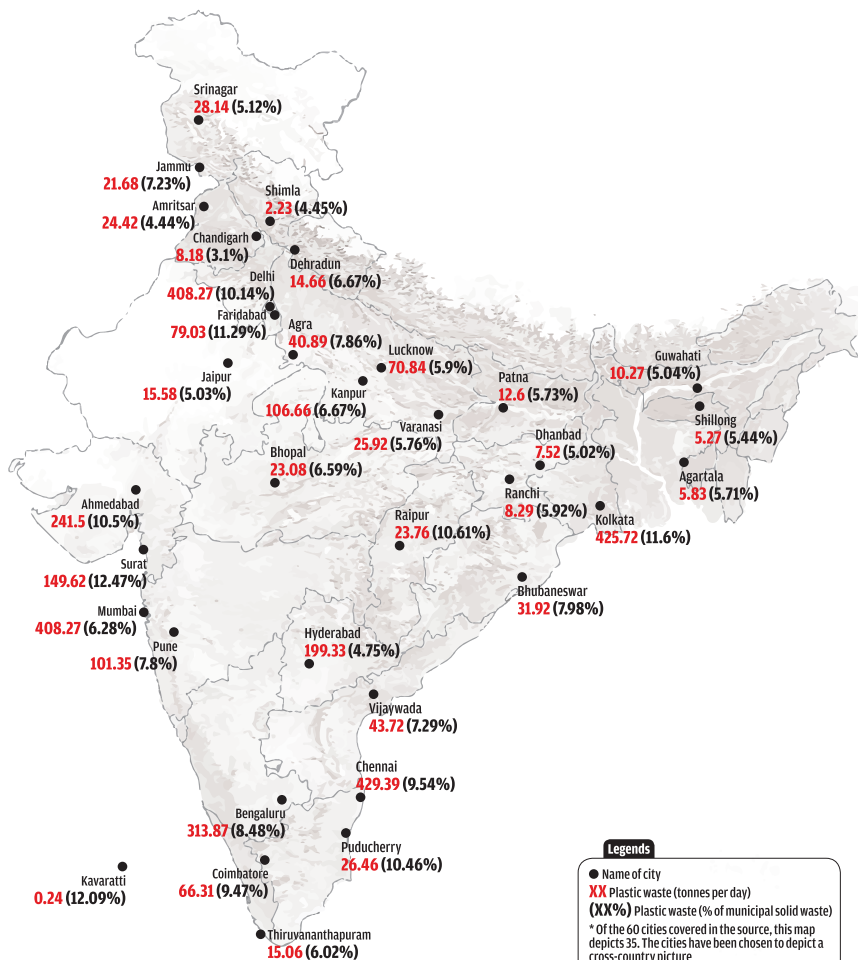
Municipal wastes are mainly categorized into two categories organic and inorganic wastes. In India organic and plastic wastes hold the largest accumulation deposits.



DID YOU KNOW?

In 2016, globally, around 396 million metric tonnes of plastic was generated. That is equivalent to 53 kilograms of plastic for each person on the planet

<https://www.plasticcollective.co/wwf-report/> (2019)



Legends

- Name of city
- XX Plastic waste (tonnes per day)
- (XX%) Plastic waste (% of municipal solid waste)
- * Of the 60 cities covered in the source, this map depicts 35. The cities have been chosen to depict a cross-country picture



Prepared by DTE/CSE Data Centre

Infographics: Raj Kumar Singh

Analysis: Snigdha Das

Source: Consolidated Guidelines for Segregation, Collection and Disposal of Plastic Waste, CPCB, September 2017

For more such infographics visit: www.downtoearth.org.in/infographics

Average plastic waste generation
in India (tonnes per day)

4,059.18

Average plastic waste share in
municipal solid waste in India

6.92%

**DID YOU
KNOW?**

Bangla Sahib Gurudwara, the biggest heritage Sikh shrine in New Delhi has banned disposable plates, glasses, spoons, cup-plates and other single-use plastics

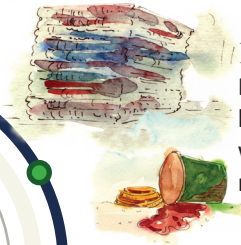
Source: <https://www.indiatoday.in/author/ians> (October, 2019)

TYPES OF WASTE AND ITS SOURCES



HOUSE WASTE

Vegetable wastes, food scraps, garden wastes, decaying leaves and fruits



INSTITUTIONS

Papers, newspapers, cardboards, boxes, paper envelops and bags, wrapping papers, paper cups, medical wastes and hotel wastes

ORGANIC



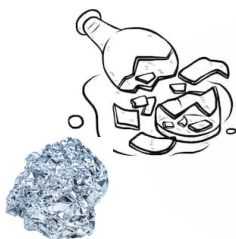
SEWAGE

Untreated sewage, animal and human carcasses



EUTROPHICATION

Algal biomass, Aquatic plants biomass



HOUSE WASTE

Bottles, sanitary pads, diapers, packaging, plastic furniture, polythene bags, plastic utensils, glass bottle, cans, foils, broken glassware, pens, construction wastes

INORGANIC



INDUSTRIES

Lamps, light bulbs, leather, rubber, textiles, appliances, railings, agricultural wastes like fertilisers and pesticides, construction debris like cement and brick kiln wastes, hospital and hotel wastes



E-WASTES

Computers, mobiles, CDs, pendrives, external hard disks, cables, laptops, medical machines, electronic devices



AUTOMOBILES

Cars, industrial machineries, batteries, engines

Important Indian Laws

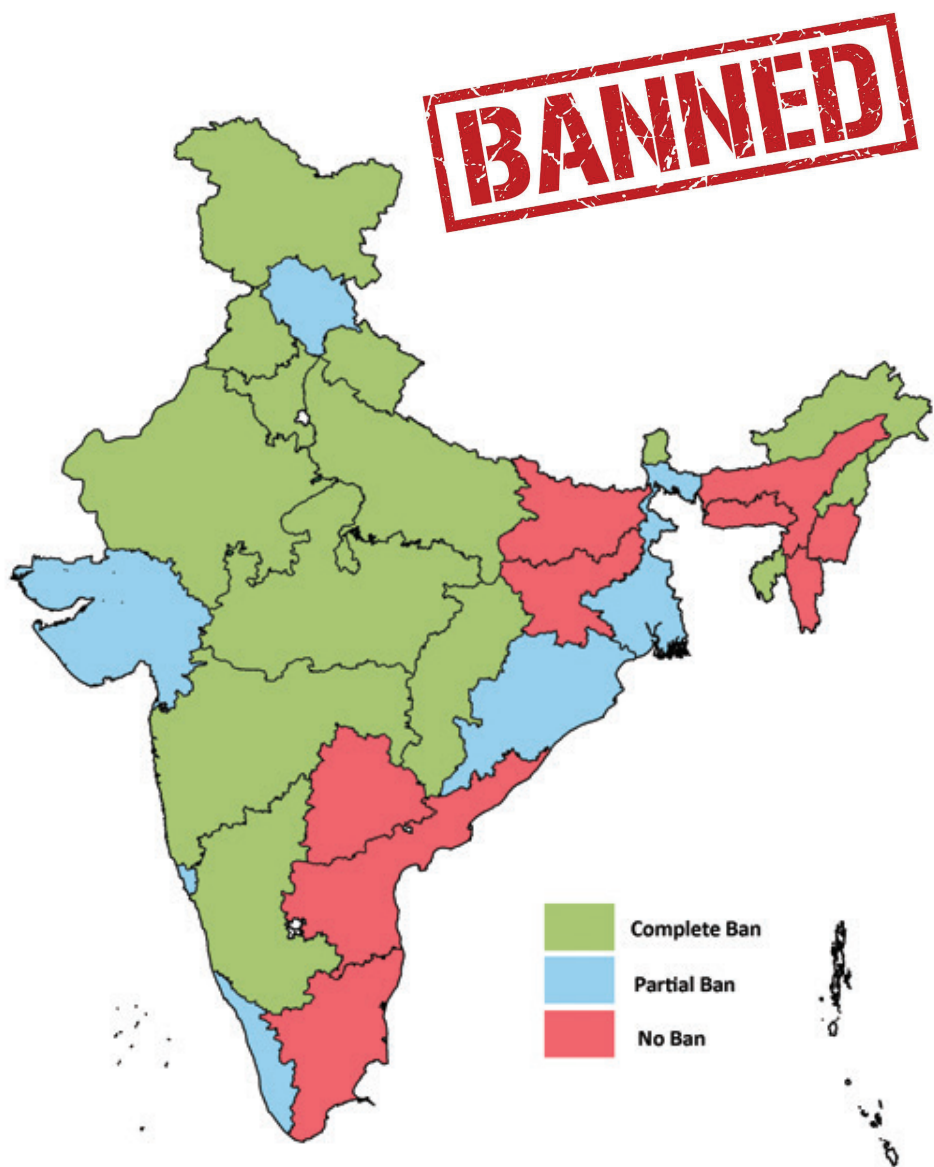
- 1986 Government of India enacted the Environmental Protection Act, 1986.
- 1991 Coastal Regulation Zone (CRZ) notification introduced by Government of India
- 2014 Swachh Bharat Mission by Government of India
- 2016 Plastic Waste Management Rules by Government of India



DID YOU KNOW?

People join hands against single-use plastic in Dehradun on 5th November 2019, form a 50 km long human chain to raise awareness. Residents of Dehradun came together to say a firm 'NO' to plastic. More than one lakh citizens joined hands.

Source: <https://swachhindia.ndtv.com/people-join-hands-against-single-use-plastic-in-dehradun-form-a-50-km-long-human-chain-to-raise-awareness-39667/> (November, 2019)



Source: Central Pollution Control Board

INITIATIVES IN INDIA

Indian government has largely funded many research projects that help in awareness activities and develop strategies that deal with the disposal of plastic wastes in a suitable manner. The then Minister of Environment, Forests and Climate Change, announced on the World Environment Day i.e. 5th June 2018 that India will eliminate all single-use plastics by 2022.

- Major big states of India such as Maharashtra, Odisha, Tamil Nadu, Himachal Pradesh, Telangana have imposed a ban on single-use plastics at the state level.
- The Government of India issued rules as Plastic Waste Management (Amendment) Rules, 2018 applicable to every plastic waste generator, these rules aim at reducing the plastic waste generated by people everyday.
- Carry bags used by vendors cannot be less than fifty microns in their thickness quotient.
- Government bodies are authorised to fine waste generators (like institutions and event organisers) if they do not sort and segregate plastic waste before handing it to the deemed government body.
- In the last few years, states like Tamil Nadu, Maharashtra, Madhya Pradesh, Assam, Uttar Pradesh, Punjab, Kerala have started using discarded/seized plastic for road construction activities.
- Apart from building roads using plastic waste, many states are also making pavements tiles using discarded plastic-like polybags, chips packets, plastic bottles, bottle caps etc.

- Gram Panchayat is authorized to spread awareness over waste sorting in their rural communities and assigning responsibility among different identified stakeholders in the villages.
- Chhattisgarh became India's first country to open up one-of-its-kind garbage café, wherein food to the poor and homeless is being provided free of cost in lieu of plastic waste.

DID YOU KNOW?

According to United Nations Environment Programme (UNEP), each year an estimated eight million tones of plastic ends up in the ocean which is equivalent to a truck filled with garbage.

DID YOU KNOW?

According to the Dalmia Cement Bharat Ltd Group CEO and CMA President, "Plastic would be used as a replacement of coal, if it is rightfully used. If you burn plastics otherwise, then it may emit foul gasses. When it gets burnt at 1,400 degrees Celsius, its hydrocarbons gets fully burnt so it becomes environmental friendly".

Source: Indo-Asian news service (October 2019)



THE DECISION MAKERS

SIKKIM (*May, 1998*): Complete ban on sale and use of single use disposable items (Plates, cup, spoons, containers, etc.)

NAGALAND (*January 1, 2004*): Ban on sale, use and transportation of plastic carry bags

RAJASTHAN (*August 1, 2010*): Complete ban on use, store and sale of plastic bags

KERALA (*November 22, 2010*): Complete ban on plastic bags in districts of Thiruvananthapuram, Kannur, Kottayam district during the pilgrimage season

JAMMU AND KASHMIR (*November 22, 2010*): Complete ban on sale, use and production of plastic bags

GUJARAT (*June 28, 2011*): Complete ban on plastic products in Gandhinagar

ODISHA (*December 7, 2011*): Complete ban on use and sale of plastic bags near the surrounding districts and villages of chillika lake

ARUNACHAL PRADESH (*July 3, 2012*): Complete ban on manufacture, storage, import, transportation and sale of plastic carry bags

HARYANA (*August 20, 2013*): Ban on manufacture, transport, sale, stock, and use of carry bags, caps, forks, paper plates and spoons

TRIPURA (*March 10, 2015*): Ban on sale, use and transportation of plastic carry bags

GOA (*March 16, 2015*): Ban on manufacture, transport, sale, stock sale and use of plastic carry bags, caps forks, paper plates and spoons

UTTAR PRADESH (*December 22, 2015*): Ban on sale, use and transportation of plastic carry bags

CHHATTISGARH (*December 24, 2015*): Partial ban on manufacture, stock, import, transportation, sale and use of plastic carry bag

PUNJAB (*February 18, 2016*): Complete ban on manufacture, stock, distribution, sale, and use of plastic carry bag

KARNATAKA (*March 11, 2016*): State government banned the plastic specifically (21 items ban products used in state)

UTTARAKHAND (*January 1, 2017*): Ban on sale, use and transportation of plastic carry bags

MAHARASHTRA (*March 18, 2017*): Complete Ban on sale, production, use, storage of plastic carry bag

MADHYA PRADESH (*May 24, 2017*): Ban on production, storage and transportation, sale and use of plastic bags

HIMACHAL PRADESH (*July 7, 2019*): Ban on carry bag (irrespective of size), polythene, non-biodegradable material, plastic, cups, plates and glasses

WEST BENGAL (*October 2, 2019*): Complete ban of single-use plastic bags in cities and majorly in religious and historical places

YET TO MAKE A START

JHARKHAND

TELANGANA

TAMIL NADU

MANIPUR

ANDHRA PRADESH

ASSAM

MEGHALAYA

BIHAR

MIZORAM

DID YOU KNOW?

Akshar school in Guwahati has launched first of its kind fee structure as students bring with them bag full of plastic waste and give it to the school as fees

Source: <https://www.indiatimes.com/trending/human-interest/guwahati-school-leads-by-example-accepts-plastic-waste-as-school-fees-366722.html> (June, 2019)

ACTIVITY 4

MEASURE YOUR TRASH

- Be sure students understand that they will not be looking through any trash cans. Rather, students will eat their lunch as normal, but before disposing any of the material, they will take notes of all the trash they have generated.
- Provide students with this tally sheet (Lunchtime Trash Survey below).

S.No.	Name of items	Tick (√)
1.	Chips packet	
2.	Toffee wrapper	
3.	Chocolate wrapper	
4.	Plastic bags	
5.	Plastic spoon, fork	
6.	Straws	
7.	Disposable cups and plates	
8.	Cold drink (Can/bottle)	
9.	Juice Tetrapack	
10.	Water Bottle	
11.	Aluminum foil	
12.	Food plastic packaging	

PEOPLE AND PLASTIC

Other than producers and consumers of plastic, there is another section of people that utilize plastic and plastic products to generate livelihood. The disposable plastic product sellers faced a major hit with the ban of single-use plastic in 2019. With the danger of risking livelihood of many people, the ban on single-use plastic to phase it out by 2022 (according to the central government) is still left to various state governments.

Yet, 2019 also saw the Vijaywada Municipal Corporation (VMC) take up the task of eliminating single-use plastic from its neighbourhoods. Unlike others, VMC employed ragpickers, who are dependent on waste collection as a source of livelihood. These ragpickers would collect single-use plastics from various localities and based on the quality of the segregated plastic, this civic body would pay remuneration to the ragpickers.

Here, it is very important to understand how plastic is also a part of a huge employment chain. From its production to selling to use and then disposal, a large number of people are involved in the life of a plastic product.



INDIAN PLASTIC WASTE WARRIORS

India generates 9.46 million tonnes of plastic waste every year, of which 40% remains uncollected and 43% is used for packaging, most of it single-use.

8.3 billion tonnes of plastic has been produced around the world since the early 1950s, of which 60% has ended in land.

1. Forest Department in Andaman use bamboo pots rather than plastic bags to grow saplings.
2. Inmates in Agra jail have made plastic filled bricks in order to recycle plastic waste.
3. Under the Chhattisgarh's Municipal Corporation, the country's first garbage cafe gives a full meal in exchange for plastic waste.
4. The Lucknow Development Authority is constructing heavy-duty roads using plastic waste. Cities like Pune, Jamshedpur, Chennai and Indore are using the same methods.
5. A Hyderabad based mechanical engineer is making petrol out of used plastic.
6. On a very local level, in a city of Sikkim called Lachung, cab drivers are helping people run the most successful single-use plastic bottle ban in the country.
7. An artist from Mangaluru turns discarded bottles on the beach into beautiful art pieces.
8. Kerala youngsters build waiting shed with used plastic bottles, sheets and tyres, named as bottle hub, the shed at the bus stop at Kinar area near Thrissur in Kerala is a unique initiative of recycling and reusing.
9. Students from Ambikapur's school are sending empty plastic wrappers of chips, biscuits and other food items to food companies urging them to find a biodegradable alternative.

These form some of the most creative examples of reusing, recycling, reducing and refusing the use of plastic.



SWACHH BHARAT MISSION

Swachh Bharat Mission was initiated by the Prime Minister of India, Mr Narendra Modi in 2014 to start a cleanliness drive for citizens to know their responsibility towards cleanliness and not littering around in public places.

OBJECTIVES

- Swachh Bharat is a campaign that aims to clean up the streets, roads and rivers in rural and urban areas.
- It focuses on eliminating open defecation by spreading awareness among the masses as well as stating the importance of construction of toilets in houses.
- It is initiated by the Government of India and has established its place by developing mechanism for building community toilets and monitoring their use.

- Swachh Bharat Mission aims to construct 90 million toilets in rural areas with an estimated cost of 1.96 lakh crore by the 150th birth anniversary of Mahatma Gandhi on 2nd October, 2019.
- The target is also to simultaneously work in achieving the Sustainable Development Goal 6 ensures access to water and sanitation facilities for all.

NEED

India as a developing country is fighting its way to achieve a level of cleanliness. Firstly to reduce health issues and secondly for development of easier ways to collect wastes throughout the country. Large population of the country do not have toilets at home, causing major health and sanitation issues like open defecation and urination. The need here is to change the mindsets of the people and make them understand why keeping their country clean is of national importance.



ACTIVITY 5

BLOCK THE DATES

S.No.	Date/ Year
1.	June, 5
2.	October 2, 2014
3.	June 5, 2018
4.	October, 1-7
5.	August, 2017
6.	April, 22
7.	March, 22

S.No.	Important day/ Initiatives
a.	World Water Day
b.	World Environment Day/ Beat Plastic Pollution
c.	Banning of Plastic Bags<50microns
d.	Swachh Bharat Mission
e.	World Wildlife Week
f.	World Environment Day
g.	World Earth Day

S.No.	Date/ Year	S.No.	Important day/ Initiatives
8.	1856	h.	Coastal Regulation Zone notification revised
9.	2011	i.	0.28 million MT of micro-plastic waste contributed by Indian rivers
10.	1960	j.	Plastic waste management rules by GoI
11.	2016	k.	First report on impact of plastic on marine species and birds
12.	2010	l.	Alexander Parkes introduced man-made plastic
13.	2018	m.	Beating Plastic Pollution (World Environment Day)

DID YOU KNOW?

Each year, an estimated eight million tones of plastic ends up in the ocean-equivalent to a full garbage truck dumped into the sea every minute

Source: United Nations Environment Programme (UNEP)



WASTE MANAGEMENT CHALLENGES

Segregation, collection and transport of plastic wastes

There is no planned segregation of waste in any sector, be it residential, industrial or agricultural in India. Awareness about the importance of sorting the wastes is very low.

Only few people know the difference between dry wastes and solid wastes, biodegradable or non-biodegradable wastes.



DISPOSAL

Waste disposal methods follow the same rules and regulations in India that they did a decade ago. Large quantities of wastes are dumped in open land areas degrading the land value and the water sources. With such increase in population, factors like social, financial, environmental and sustainable management are the key elements to be considered while implementing waste disposal methods.





1. REDUCTION OF WASTES

The reduction of the waste from point source not only involves help from the production industries but also from the consumers that can be done through awareness activities such as teaching individuals as to why it is important, its prevention methods, and minimization rules along with reusing activities.

2. RECYCLING OF WASTE

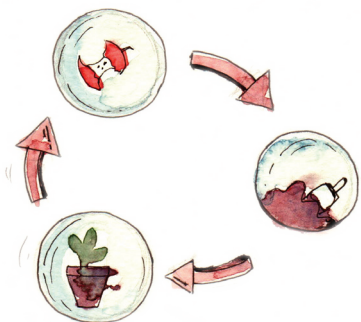
Recycling of waste involves the collection of used and discarded materials, processing them and making them into newer usable products. India's informal scrap pickers recover a significant quantity of recyclable discarded materials and help in the recycling process. The leftover non-usable waste can be disposed through. The discards mainly include metal, glass and plastic items.



3. AEROBIC AND ANAEROBIC COMPOSTING

In India, maximum waste generated is organic wastes. Organic wastes include vegetable peels, uprooted crop plants, papers, boxes, paper bags, etc. This type of waste is generally decomposed by aerobic and anaerobic microbes through two different processes.





a) **Aerobic process:** The aerobic microbes utilize oxygen to degrade organic waste. Vermicomposting is an example of this.

b) **Anaerobic process:** The microbes in this work in the absence of oxygen, often utilizing carbon dioxide and water to form methane. This process occurs in spaces like landfills.

The end product of both these processes can be used in the production of biogas and can be used as fuel.

4. INCINERATION

Incineration is a process of burning of waste to reduce its quantity. Even though it is a quick remedy to reduce waste, it releases hazardous pollutants like fly ash. Thus, its preference as a solution is very low and is used to remove hospital generated medical waste.



5. LANDFILL

Landfill is a site for disposal of waste materials by dumping in a pit. A landfill unlike a compost pit does not decompose much of the trash. This leads to contamination of groundwater along with land, air and soil pollution leading to a number of health problems for people living adjacent to the landfill site.



ACTIVITY 6

IMPROMPTU

OBJECTIVE

Plastic is a boon or bane

METHOD

- Select the group of interested students from all the classes.
- Divide them in two groups
- Categorize them in two teams one for and one against.
- Each team gets fifteen minute to talk for and against the topic.
- Evaluate the student's knowledge and ideas
- Allow a healthy debate amongst the participants and come up with implementable ideas.

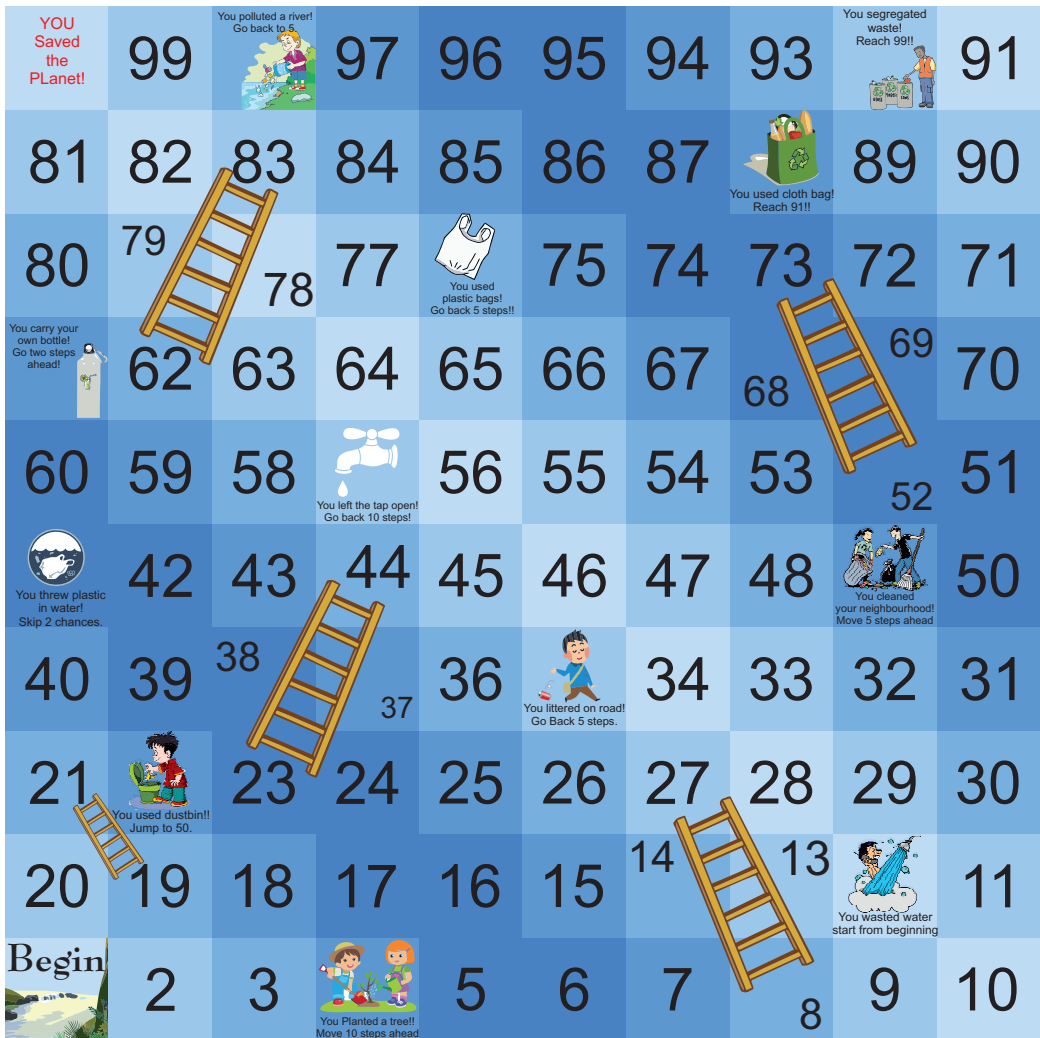
DID YOU KNOW?

The case of 52 kg of plastic waste (Aluminum foil, Maggi and ParleG wrappers etc.) recovered from the stomach of a cow at Tamil Nadu Veterinary and Animal Sciences University

Source: http://tamil1003.rssing.com/chan-68101436/all_p361.html

ACTIVITY 7

STEP FORWARD



5R

- REFUSE
- REDUCE
- REUSE
- RECYCLE
- REMOVE

REFUSE: We should refuse to use plastic unnecessarily. Try to remember about carrying your own glass for the roadside sugarcane juice or coffee/tea next time.

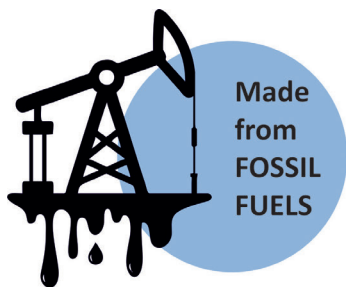
REDUCE: Minimise the use of plastic as much possible. Say 'yes' to counterparts of plastic-like glass and steel.

REUSE: Reuse as much plastic products to avoid adding more plastic in the environment.

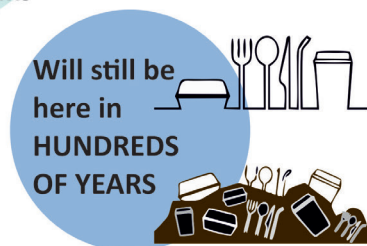
RECYCLE: Waste plastic collected can be recycled to be used again to minimise the production of new plastic products. According to UNEP, in 2015 only 9% of plastic waste produced was recycled while 79% of it went into landfills. Thus, remember to contribute a bit to recycling.

REMOVE: The plastic waste that can neither be reused nor be recycled needs to be removed properly from the system and environment.

Remember to throw the waste in designated waste bins to reduce littering. A clean environment keeps a healthy body.



Reasons to **REFUSE** single-use **PLASTIC**



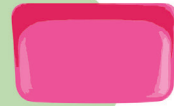
**REUSABLE
WATER
BOTTLES**



**GLASS OR
STAINLESS
STRAW**



**SILICON BAGS
VERSUS PLASTIC
ZIPLOCK BAGS**



Ways to **REDUCE PLASTIC**

**SWITCH TO
GLASS
TUPPERWARE**

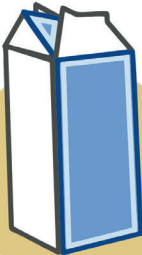


Opt out of plastic
produce bags in
grocery stores and
**BRING YOUR OWN
GROCERY TOTE BAGS**

**USE CLOTH NAPKINS
OR REUSABLE TOWELS
IN THE KITCHEN**
to avoid extra trash



**BUY CARTONS
OR GLASS
WHENEVER
POSSIBLE**



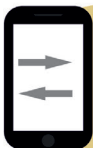
**MAKE YOUR OWN
HOUSEHOLD
PRODUCTS** like
cleaning sprays, body scrubs etc.



**REUSABLE TEA/
COFFEE MUGS**



**FIND LOCAL
"DO NOT TRASH
GROUPS"** to pass on
your unused stuff
to avoid waste or
donate it to needy person



**USE/BUY LESS
PACKAGED FOODS
CONSUME LOCAL
PRODUCE**



PLASTIC TAR ROAD

The plastic waste coated aggregate is mixed with hot bitumen and the resulting mix is used for road construction.

These roads are constructed using:

- PLASTIC WASTE
- SAVES BITUMEN
- COSTS LESS
- COVERTS SOLID WASTE INTO MANURE
- AND ARE BETTER THAN CONCRETE ROADS



Ways how PLASTIC is being REUSED



PLASTONE (Synthetic Granite)

Plastone is formed by using waste plastic, low graded stones, ceramics, concrete debris etc.

- IT REDUCES CO₂ EMISSIONS
- BEAR LOAD UPTO 300 TONS
- MALLEABLE AND DUCTILE
- DOESN'T HAVE ANY CEMENT, ADHESIVE, BITUMEN, SAND OR WATER



TEXTILES FROM RECYCLED PLASTIC

Bottles are filtered, sorted, shredded, cleaned, coloured and recycled to PET fibre. They are then mixed into hosiery waste and spun together into yarn. This yarn finally ends up in power looms.

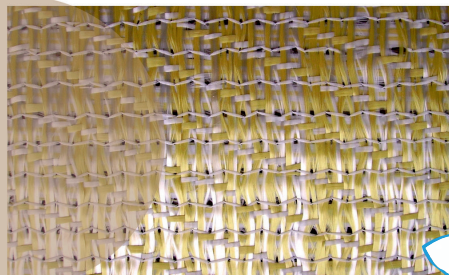
- ROOFING SHEETS

are created from polymer coated card board

- CORROSION PREVENTION

in iron rods

- SEMI-CONDUCTOR SHEETS





Types of PLASTIC We Can RECYCLE



PLANT POT
from empty
plastic bottles



**TOOTHBRUSH
STAND**
from empty
plastic bottles



Ways to REUSE PLASTIC

**VERTICAL
GARDEN**
from empty
cold drink bottles



**FOOD
STORAGE**
in empty
plastic bottles



WALL HANGING
from plastic
bottle caps



BASKET
with single-use
plastic bags



ACTIVITY 8

DO IT YOURSELF

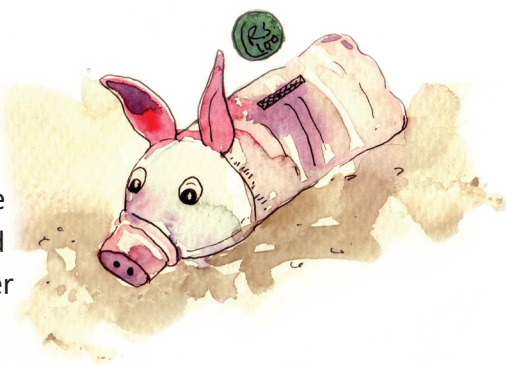


› PENCIL STAND

Cut the bottle into half and arrange the upper half as a fixed cap to the lower half. Decorate and paint your pencil stand as per your choice and place it beautifully on your study desk.

› PIGGY BANK

Cut the bottle into half and fix it into another half part. Make a hole in the middle of the two for adding in the saving penny. Decorate and color your piggy bank as per your choices.





› BOTTLE CAP PHOTO FRAMES

Make a frame for the photo using a cardboard. Fix the photo inside and decorate the front frame using different colored plastic bottle caps. Or you can simply decorate any photo frame with the bottle caps using an adhesive.

› LAMPS OR BULB HOLDERS

Cut the bottle into a half and one by one start vertical cut the plastic attached to the cup. Pull through a bulb after decorating your plastic lamp and hang it beautifully over your bulb reflecting different light colours.



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NOTES

NOTES

WILDLIFE INSTITUTE OF INDIA

Chandrabani, Dehradun - 248003

Uttarakhand, India

Tel: +91 135 2640114-15

+91 135 2646100

Fax: +91 135 2640117



भारतीय वन्यजीव संस्थान
Wildlife Institute of India

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