# Prevention of marine littering : Leaning from Japan

**Shige Takada**

Tokyo University
of Agriculture and Technology

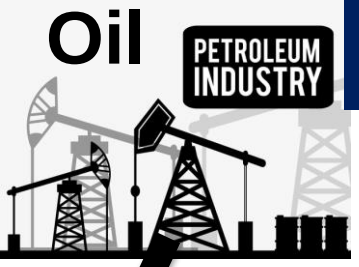
**River bank in Tokyo, Japan**


Microplastics

< 5mm

Microplastics collected in western Pacific ~1000 km off Japan

# Plastics are fragmented into microplastics




Synthesize

Waste management

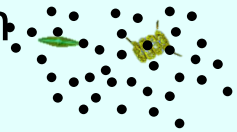

UV

UV

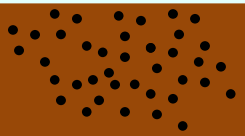

Fragmentation

Fragmentation

**Microplastics**



Bottom sediment



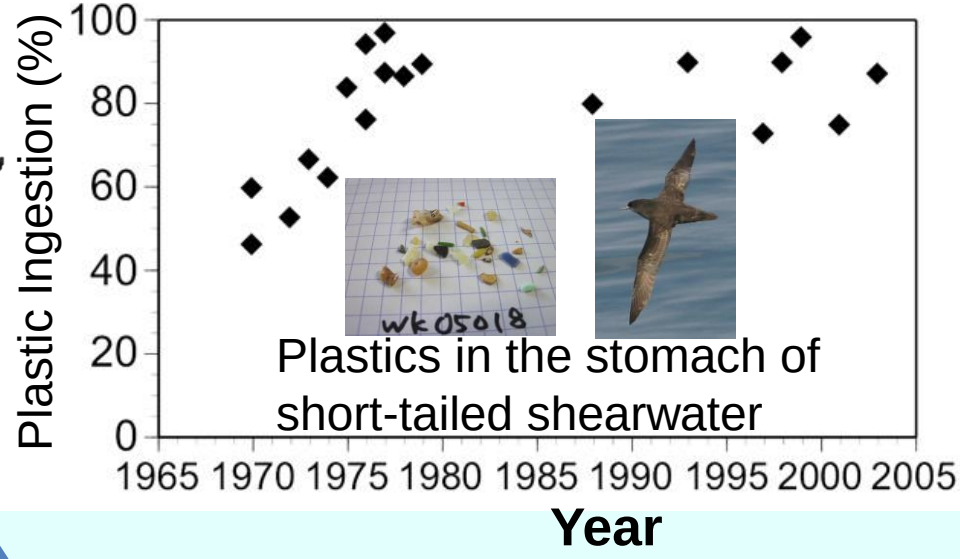
# Microplastics are ingested by marine organisms

Oil

PETROLEUM INDUSTRY

Synthesize

UV




Fragmentation

Fragmentation

Uptake

Ingestion

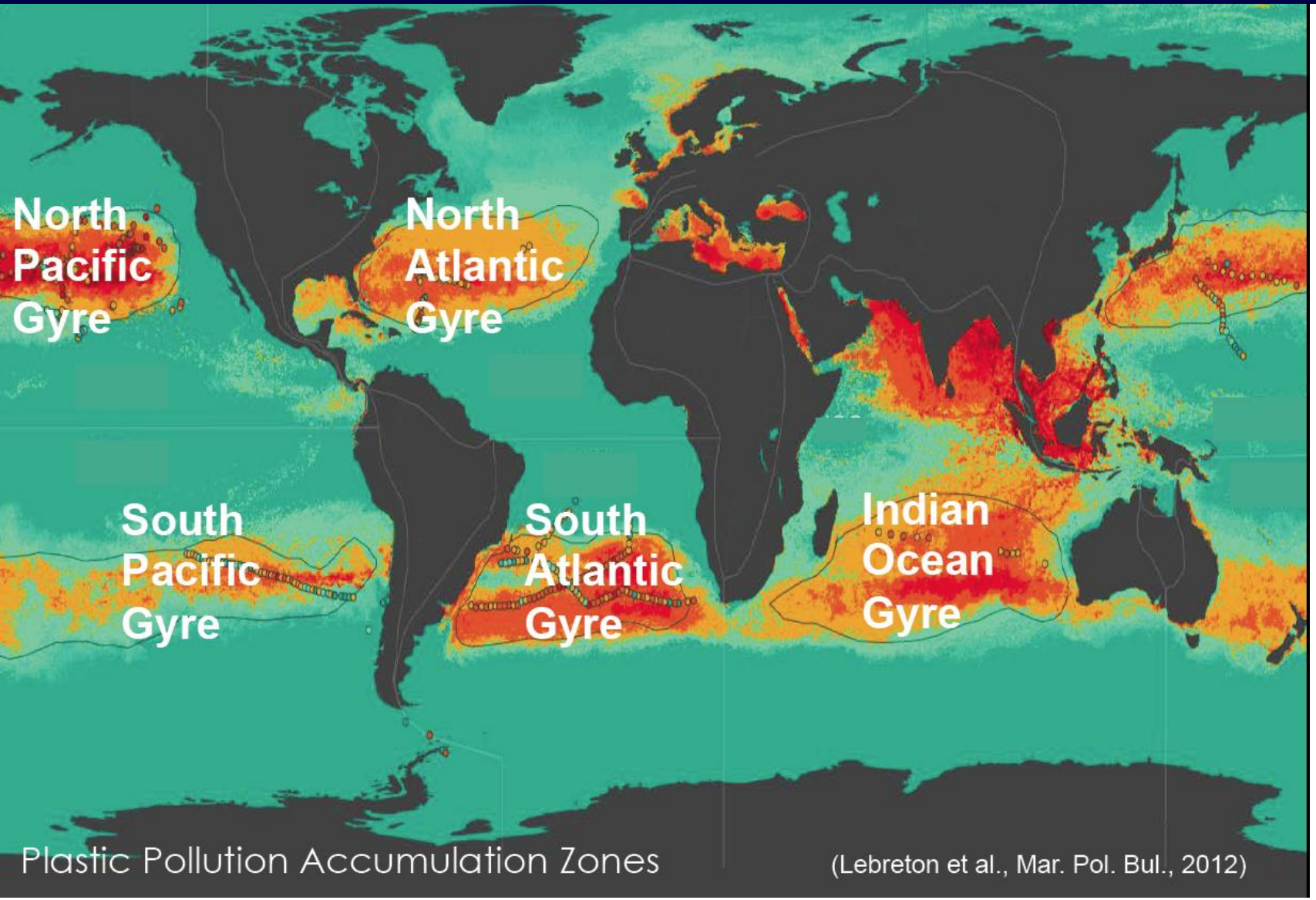
Ingestion

Concern about
Food security




Plastics in fish digestive tract

# 5 trillions of plastics floating on world ocean




(pieces/km$^2$)

After Dr. Marcus Eriksen

# Plastic waste inputs from land into the ocean

Jenna R. Jambeck,[1*] Roland Geyer,[2] Chris Wilcox,[3] Theodore R. Siegler,[4] Miriam Perryman,[1] Anthony Andrady,[5] Ramani Narayan,[6] Kara Lavender Law[7]

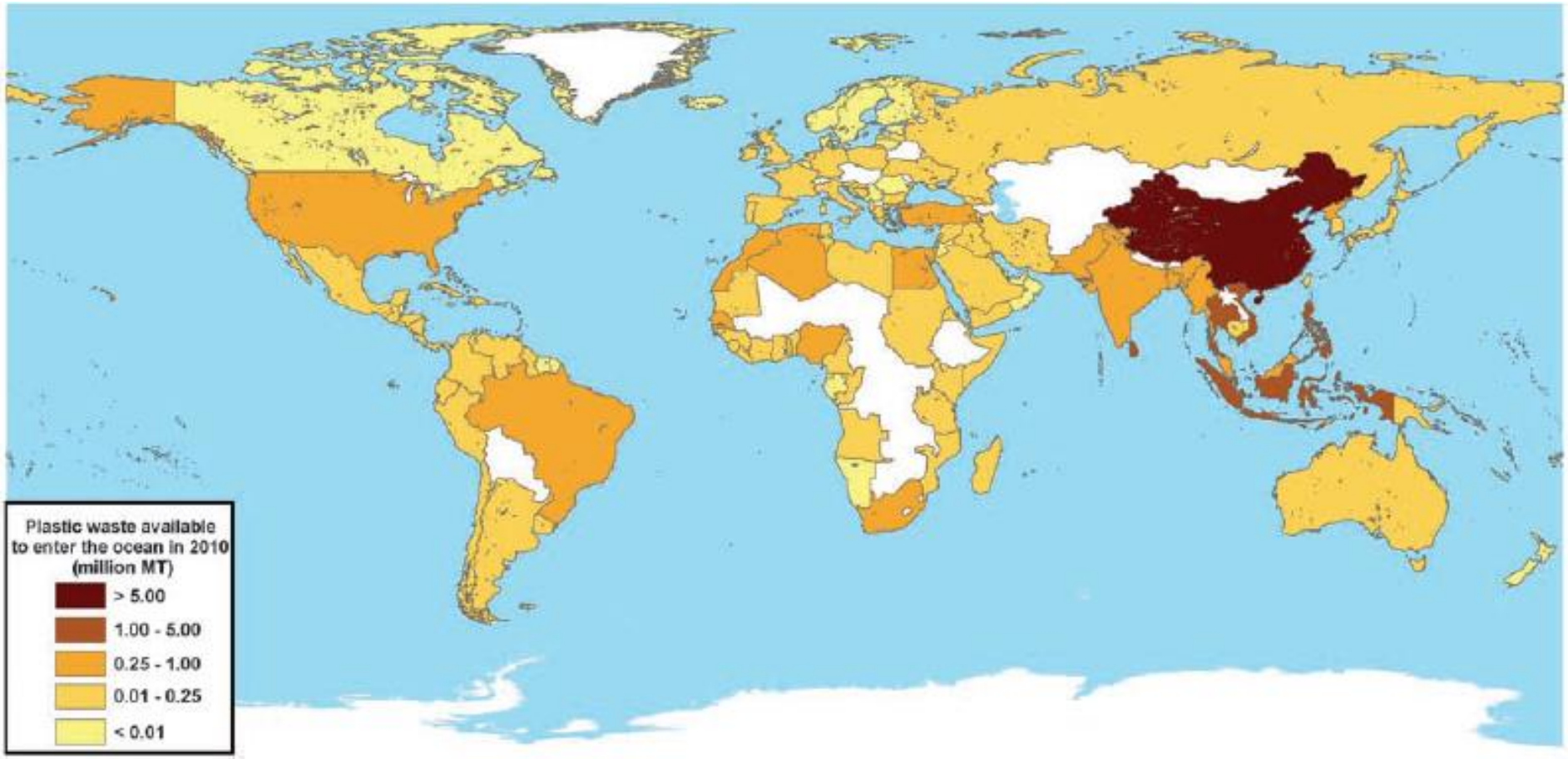



**Fig. 1. Global map with each country shaded according to the estimated mass of mismanaged plastic waste [millions of metric tons (MT)] generated in 2010 by populations living within 50 km of the coast.** We considered 192 countries. Countries not included in the study are shaded white.

# Plastic waste inputs to the sea will increase by a factor of **10 in coming 20 years**, if no action will be taken.

## Plastic waste inputs from land into the ocean

Jenna R. Jambeck,[1]* Roland Geyer,[2] Chris Wilcox,[3] Theodore R. Siegler,[4] Miriam Perryman,[1] Anthony Andrady,[5] Ramani Narayan,[6] Kara Lavender Law[7]

Plastic debris in the marine environment is widely documented, but the quantity of plastic entering the ocean from waste generated on land is unknown. By linking worldwide data on solid waste, population density, and economic status, we estimated the mass of land-based plastic waste entering the ocean. We calculate that 275 million metric tons (MT) of plastic waste was generated in 192 coastal countries in 2010, with 4.8 to 12.7 million MT entering the ocean. Population size and the quality of waste management systems largely determine which countries contribute the greatest mass of uncaptured waste available to become plastic marine debris. Without waste management infrastructure improvements, the cumulative quantity of plastic waste available to enter the ocean from land is predicted to increase by an order of magnitude by 2025.

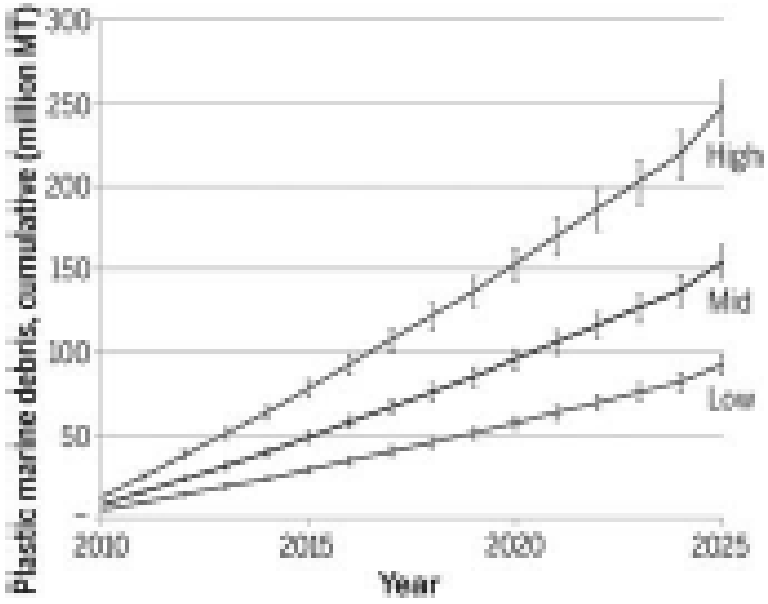


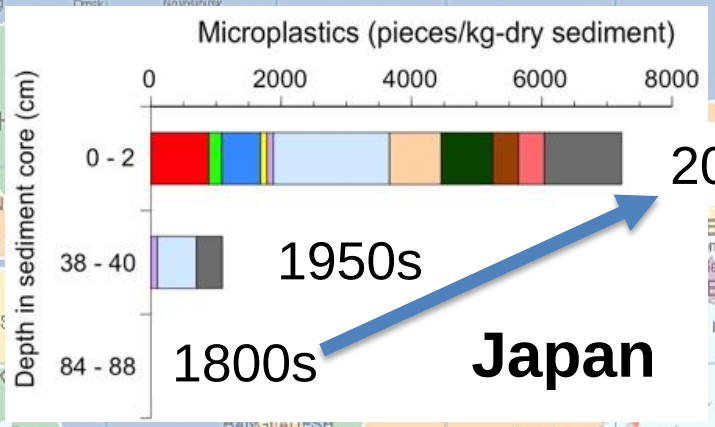

**Fig. 2. Estimated mass of mismanaged plastic waste (millions of metric tons) input to the ocean by populations living within 50 km of a coast in 192 countries, plotted as a cumulative sum from 2010 to 2025.** Estimates reflect assumed conversion rates of mismanaged plastic waste to marine debris (high, 40%; mid, 25%; low, 15%). Error bars were generated using mean and standard error from the predictive models for mismanaged waste fraction and percent plastic in the waste stream (12).

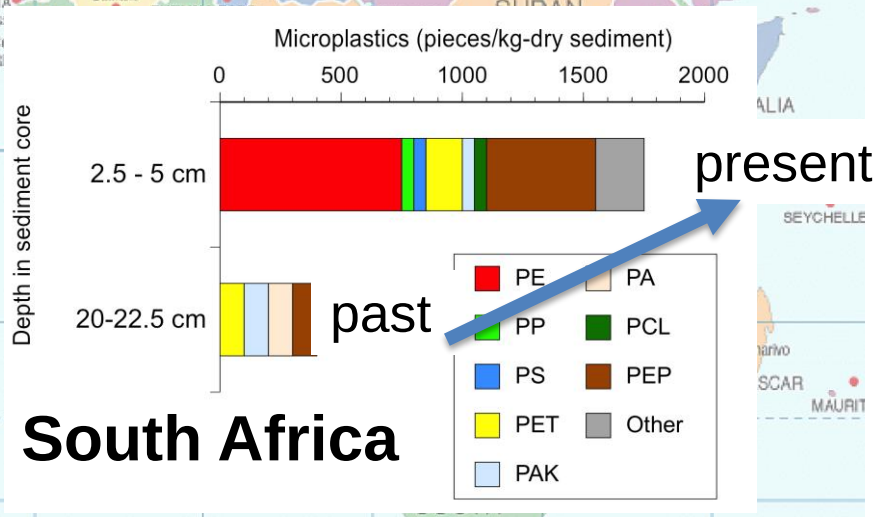
Jamebeck et al. (2015), Sceince

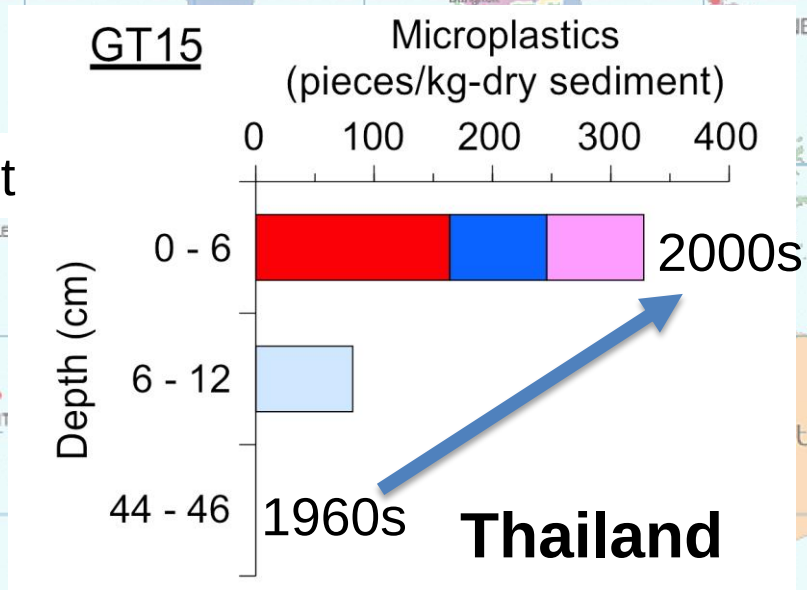
# Cosmopolitan phenomena : increasing trend in microplastics in sediment cores from Asian and African waters

Vertical profiles of microplastics in sediment cores from Asian and African waters.

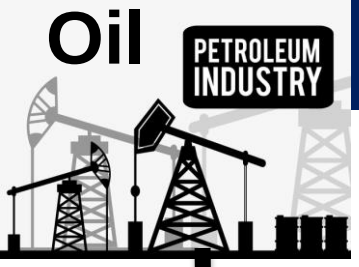
After Matsuguma et al. (2017)
*Archives of Environ. Contam. Toxicol.*



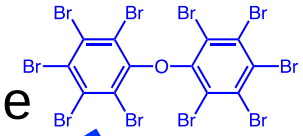



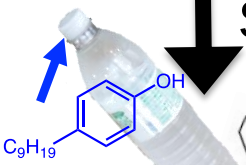
# Plastics bring toxic chemicals to ecosystem




Synthesize



Additives




Additives


UV

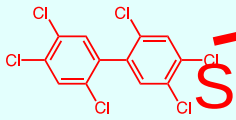
Ingestion

UV

Fragmentation

Fragmentation

Microplastics

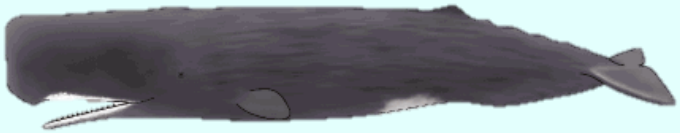


Sorption

Sorption

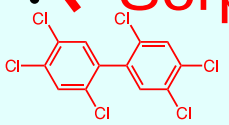
Ingestion

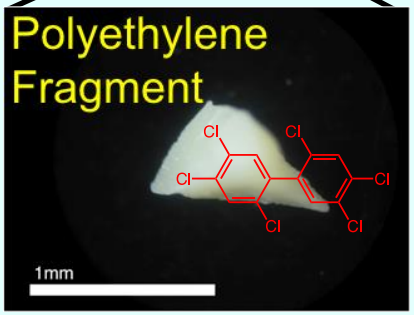
Ingestion



Uptake

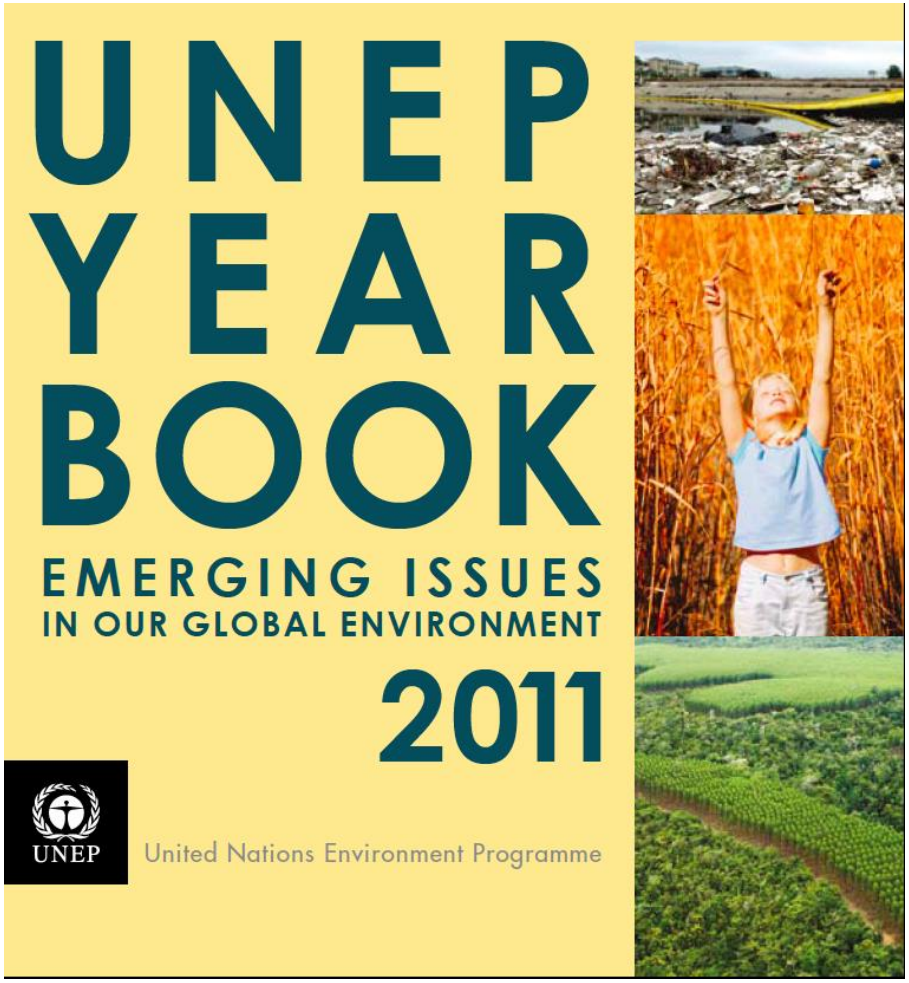
Sorption






Plastics in fish digestive tract

# Concern on marine plastic pollution by United Nation




## Plastic Debris in the Ocean

Every year large amounts of plastic debris enter the ocean, where it slowly fragments and accumulates in convergence zones. Scientists are concerned about the possible impacts of small plastic fragments—microplastics—in the environment. The role of plastics as a vector for transporting chemicals and species in the ocean is as yet poorly understood, but it is a potential threat to ecosystems and human health. Improved waste management is the key to preventing plastic and other types of litter from entering the ocean.

### Box 3: Plastic pellets

Plastic resin pellets are small granules, generally in the shape of a cylinder or disc, with a diameter of a few millimetres. These particles are an industrial raw material that is remelted and moulded into final products. They enter the ocean as a result of spills or accidental releases. Like other plastic particles, they have been shown to accumulate PBTs. In the case of thin plastic films, for example those 50 micrometres or less, it may take only a few days for this process of accumulation or release to occur (Adams et al. 2007). In the case of pellets, equilibrium between the concentration of a given compound in a pellet and in the surrounding water or sediment may take many weeks or months. Older pellets consequently tend to have higher concentrations of contaminants and have been used to map the distribution of pollution in coastal waters around the world (Ogata et al. 2009, International Pellet Watch 2011) (**Figure 5**). Their consistent size makes them a useful monitoring tool.

Transport by plastic particles does not represent a significant additional flux of PBTs on a global scale compared with atmospheric or water transport (Zarfl and Matthies 2010). However, the concentration of contaminants by microplastic particles presents the possibility of increasing exposure to organisms through ingestion and entrance into the food chain—with the prospect of biomagnification in top-end predators in the food chain such as swordfish and seals. Ingestion of small particles by a wide variety of organisms has been well reported. However, the basic information needed on the biochemical and physiological response of organisms to ingested plastics contaminated with PBTs in order to quantify the scale of the problem is currently unavailable (Arthur et al. 2009, GESAMP 2010). It is conceivable that PBTs in plastic particles will be less bioavailable than those from the surrounding water or food sources (Gouin et al. 2011).

Collected from beaches around the world, plastic pellets like these have been found to accumulate persistent, bio-accumulating and toxic substances. The pellets are used in the manufacture of plastic products and have been introduced into the ocean through accidental releases. They may also be released as a result of poor handling or waste management. While there is evidence that quantities entering the marine environment have been reduced as a result of improved industrial practices, pellets already released will persist for many years. *Credit: International Pellet Watch*

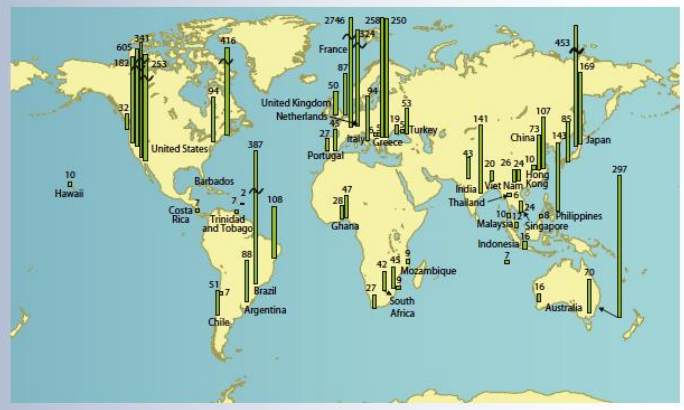



Figure 5: Concentration of PCBs in beached plastic resin pellets, in nanograms per gram of pellet. Samples of polyethylene pellets have been collected at 56 beaches in 29 countries and analyzed for concentrations of organochlorine compounds. PCB concentrations were highest in pellets collected in the United States, Western Europe and Japan. They were lowest in those collected in tropical Asia and Africa. This spatial pattern reflects regional differences in the use of PCBs. *Source: Ogata et al. (2009) with additional data provided by International Pellet Watch in 2010*

THE OCEAN CONFERENCE

UNITED NATIONS, NEW YORK, 5-9 JUNE 2017

Side event

# 3 R as the Basis for Moving Towards Zero Plastic Waste in Coastal and Marine Environment

“Issue of microplastics in the coastal and marine environment and 3R solutions” Hideshige Takada (Japan)

# Sustainable Development Goals


**14.1**
By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including **marine debris** and nutrient pollution

**14.1.1**
Index of coastal eutrophication and floating **plastic debris** density

THE OCEAN CONFERENCE

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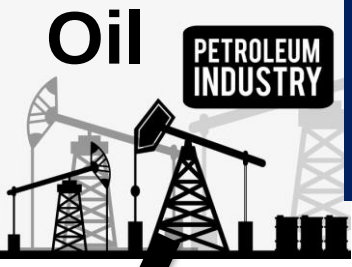
# 3 R as the Basis for Moving Towards Zero Plastic Waste in Coastal and Marine Environment

“Issue of microplastics in the coastal and marine environment and 3R solutions” Hideshige Takada (Japan)



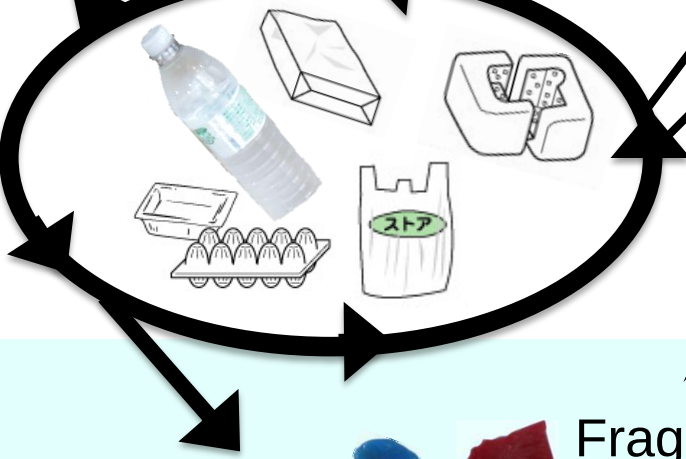

# 3R (Reduce, Reuse, Recycle) of plastic waste is the key

Reduce

Reuse
Recycle

landfill

incineration



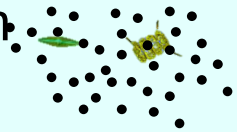

UV

UV

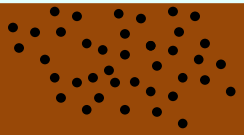

Fragmentation

Fragmentation

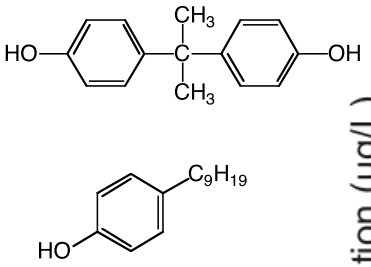
**Microplastics**



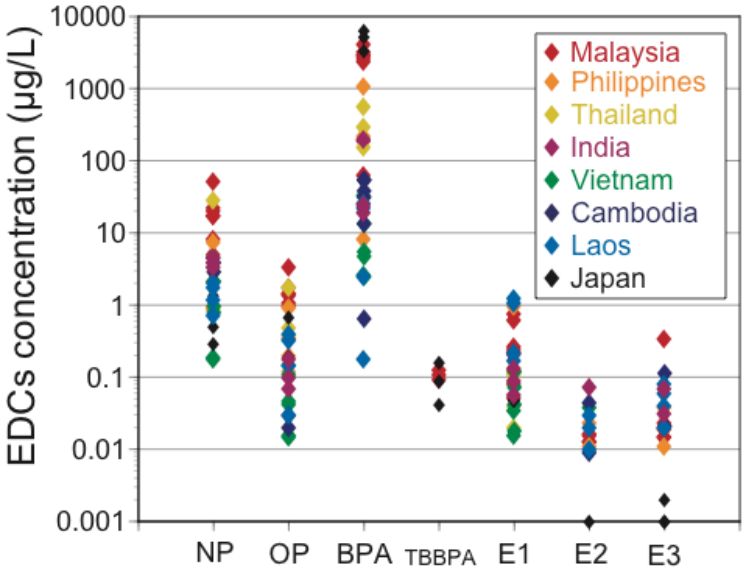
Bottom sediment



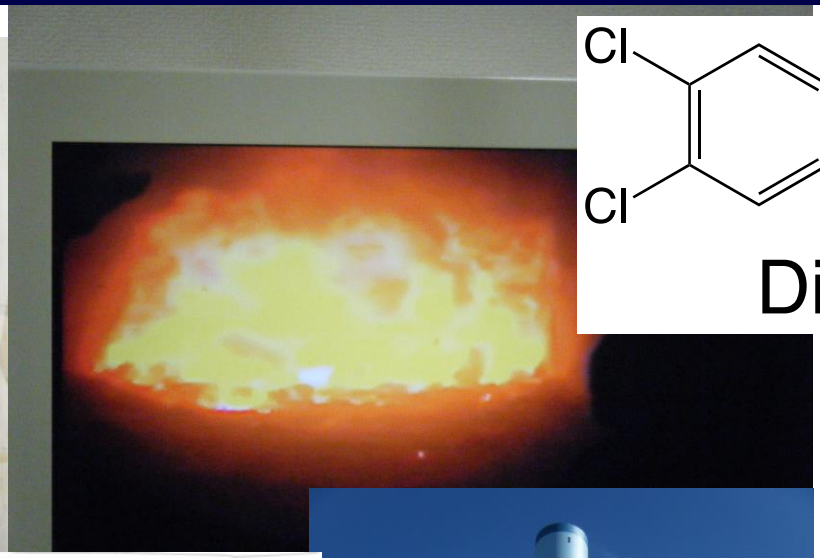
# Landfill release hazardous chemicals from plastics to surface water and groundwater

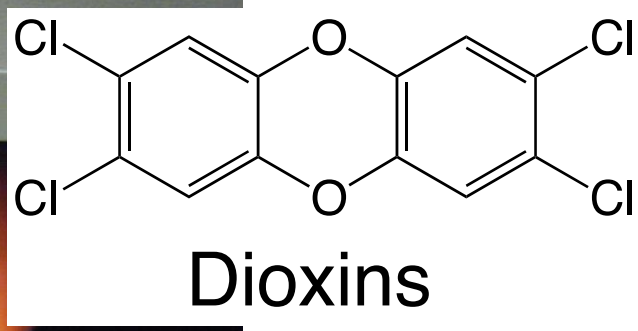



## Plastic-derived chemicals

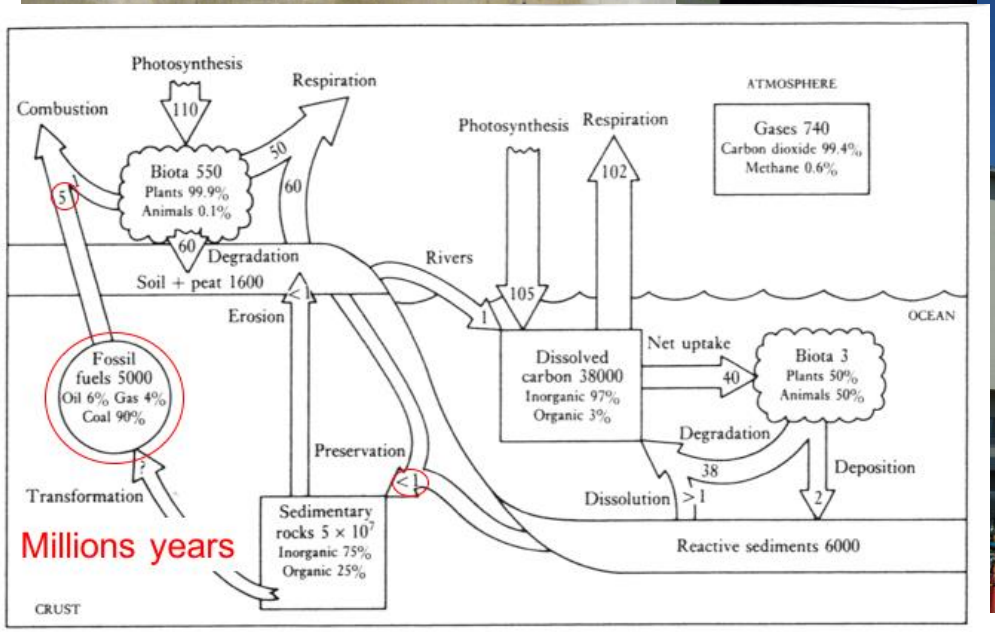


# Incineration of plastic waste release toxic chemicals and $CO_2$



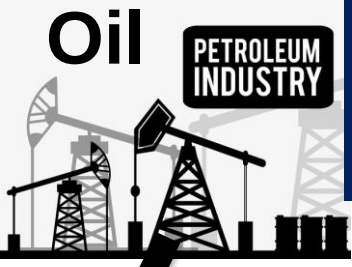



Dioxins




Incineration of plastic : net emission of $CO_2$

Inconsistent with Paris Agreement



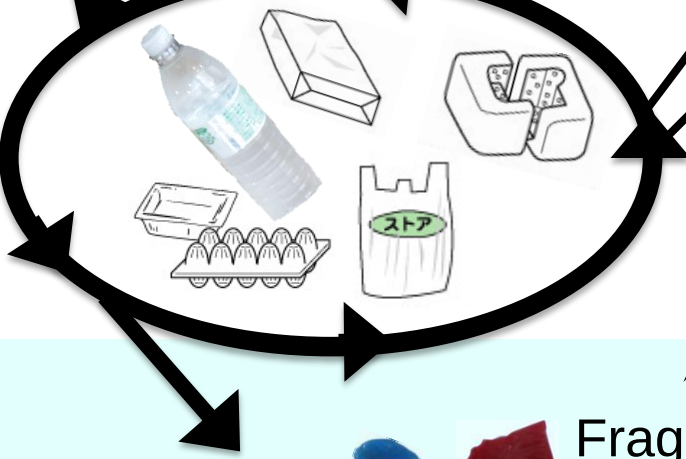

# 3R (Reduce, Reuse, Recycle) of plastic waste is the key

Reduce

Reuse
Recycle

landfill

incineration





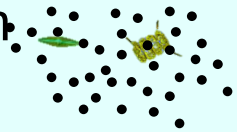
UV

UV

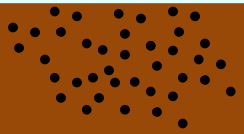
Fragmentation

Fragmentation

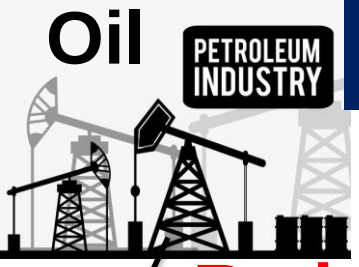
**Microplastics**



Bottom sediment



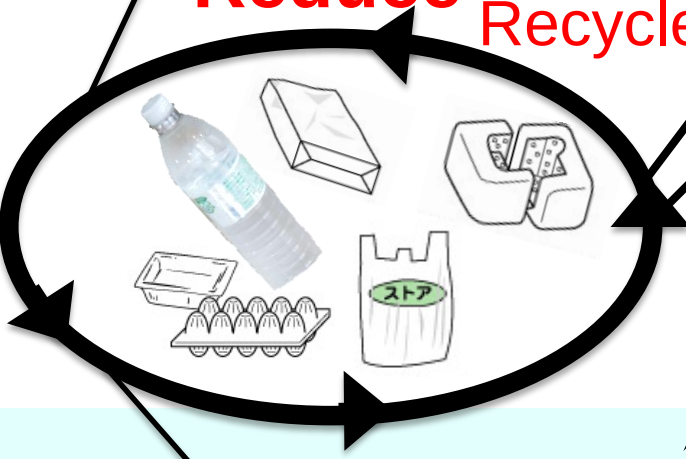
# Close the tap : Reduction of single-use plastics




**Reduce** Reuse Recycle

landfill ✗

incineration ✗



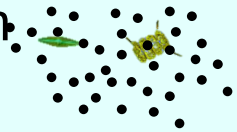

UV

UV

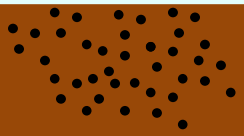

Fragmentation

Fragmentation

**Microplastics**



Bottom sediment



# General Assembly

Distr.: General
14 July 2017

**Seventy-first session**
Agenda items 19 and 73 (*a*)

## Resolution adopted by the General Assembly on 6 July 2017

[*without reference to a Main Committee (A/71/L.74)*]

### 71/312. Our ocean, our future: call for action

(*h*) Promote waste prevention and minimization; develop sustainable consumption and production patterns; adopt the 3Rs – reduce, reuse and recycle – including through incentivizing market-based solutions to reduce waste and its generation, improving mechanisms for environmentally sound waste management, disposal and recycling and developing alternatives such as reusable or recyclable products or products that are biodegradable under natural conditions;

(*i*) Implement long-term and robust strategies to reduce the use of plastics

# General Assembly

Distr.: General
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Agenda items 19 and 73 (*a*)

## Resolution adopted by the General Assembly on 6 July 2017

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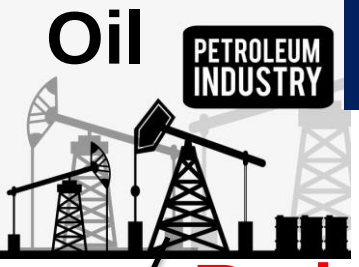
### 71/312. Our ocean, our future: call for action

(*i*) Implement long-term and robust strategies to reduce the use of plastics and microplastics, in particular plastic bags and single-use plastics, including by partnering with stakeholders at relevant levels to address their production, marketing and use;

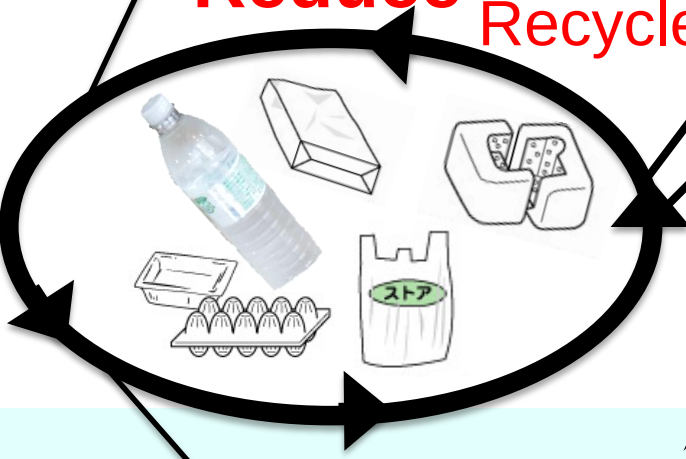
# Close the tap : Reduction of single-use plastics




**Reduce** Reuse Recycle

landfill ✗

incineration ✗




UV

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Fragmentation

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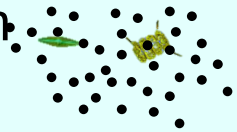
**Microplastics**



Bottom sediment