Plastic Pollution Legacy: Marine Plastic Pollution

Yuna Lee
Int'l Cooperation Team Manager
OSEAN (Our Sea of East Asia Network)

@GGGI

2024.08.22(Thu) 09:15-09:55

Hello,
this is Yuna

Researcher

- Majored in Int'l Devt.
- Int'l Coop Team Manager at OSEAN

Activist

- Founder of Responsible Divers

Diving Fanatic

- Scuba Diving Instructor
- Free Diver

24/7 Marine Debris

CONTENTS

01 Marine Plastics

Marine Debris is any persistent, manufactured or processed solid material discarded into the sea or rivers or on beaches (UNEP, 2009).

Now, **microplastics** are blurring the boundaries between solids and liquids.

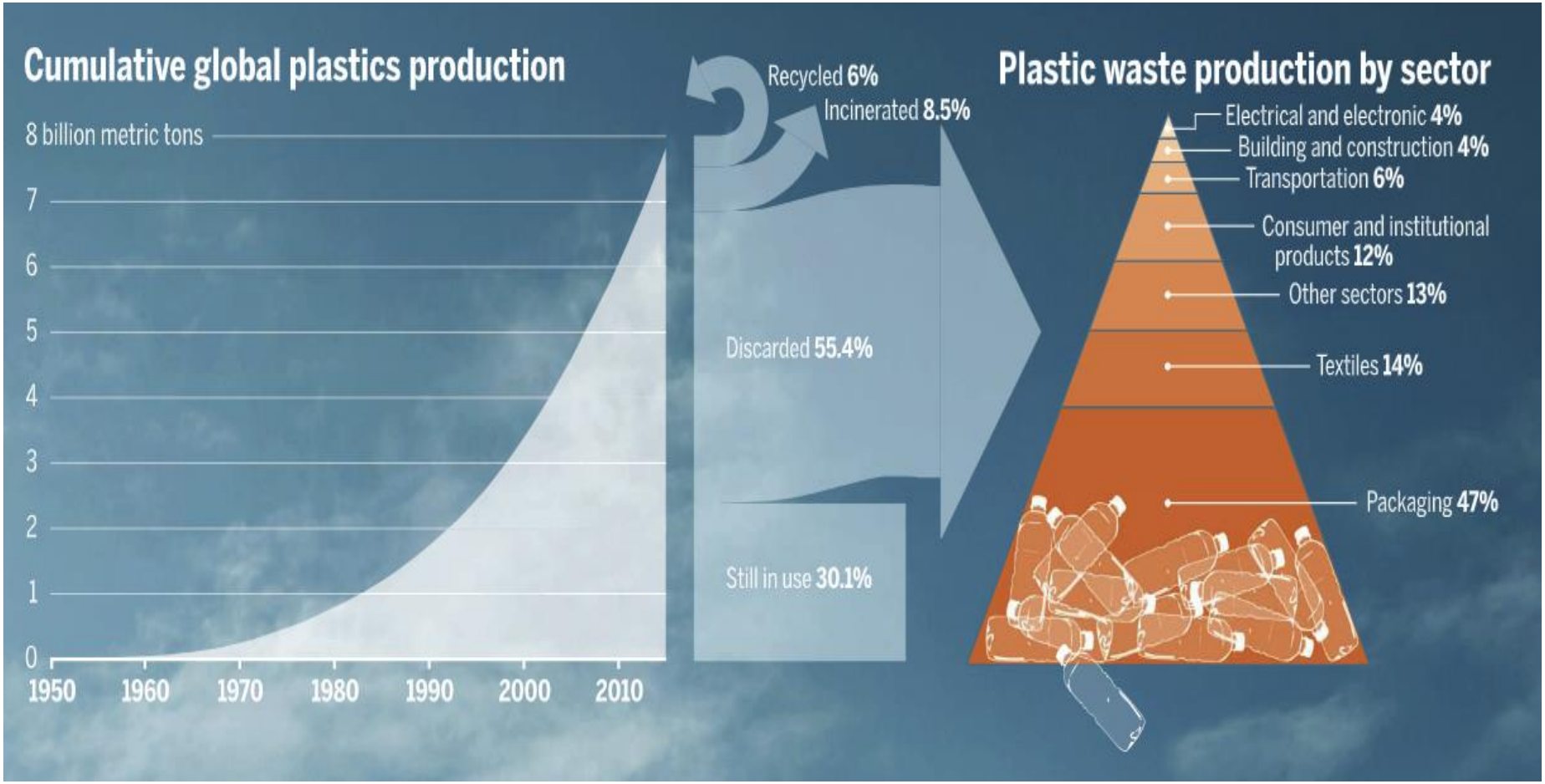
Coastal debris

Seafloor debris

Floating debris

Source: ReDi (2022) Introduction to Marine Litter (ppt)

Around 80% of Marine Litter is plastics, why?



Source: Jesse Smith, Sacha Vignieri ,A devil's bargain.Science373,34-35(2021).DOI:10.1126/science.abj9099

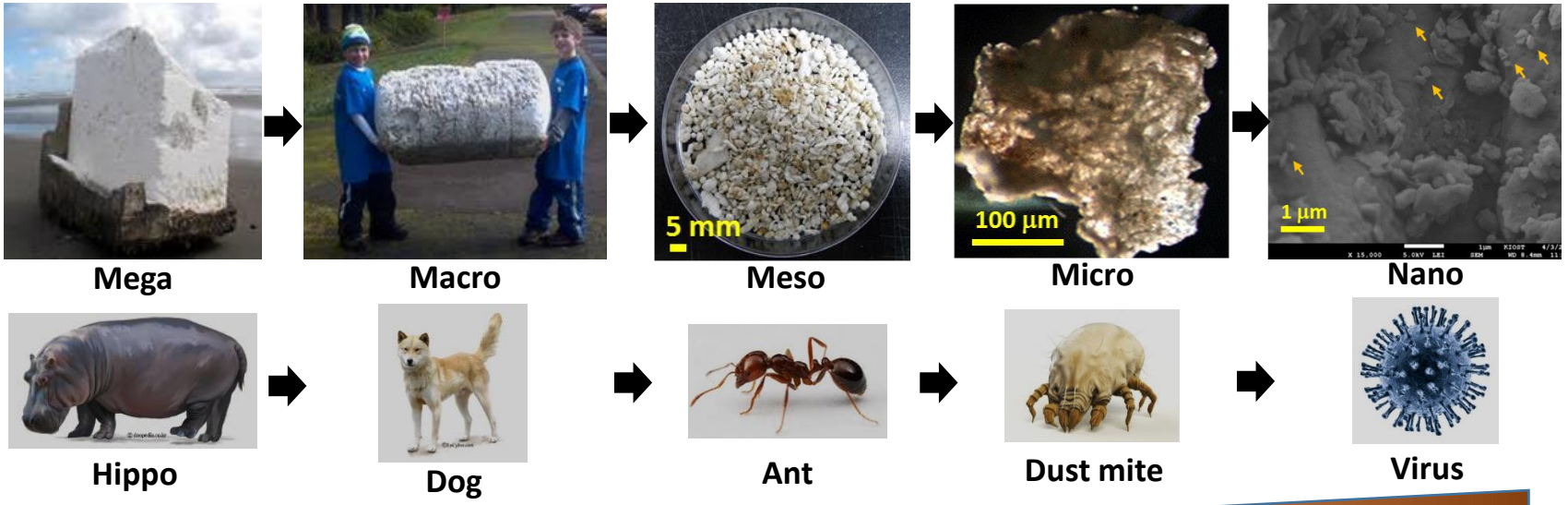
01. Marine Plastics

Source: Ibid.

Including rivers and lakes, 11% of plastics are dumped into the aquatic environment.

In 2016 alone, it was estimated to be up to 23MMT

A paradigm shift in marine plastic pollution



Increasing

- Numbers
- Bioavailability
- Target organisms
- Human exposure
- Toxicity
- Detection difficulty
- Cleanup difficulty

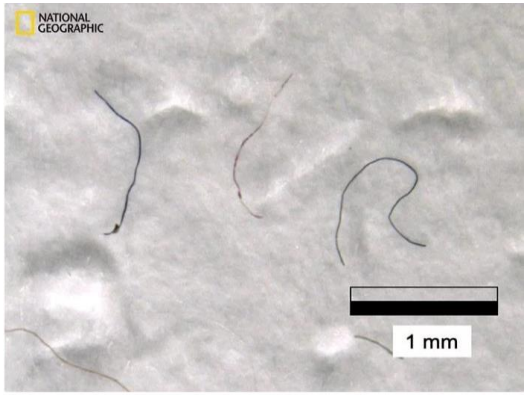
Decreasing

- Volume
- Entanglement
- Settling velocity

Source: Shim. WJ (2023) Plastic Ocean: Microplastics (ppt)

Ubiquitous – literally everywhere on earth

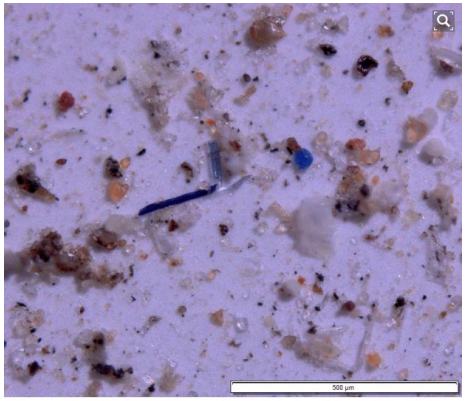
8,440 meters above the summit of Mt. Everest



▲ 8,440m 높이에서 수집된 눈 샘플에 미세플라스틱이 들어 있다.
© Imogen Napper / 내셔널 지오그래픽, NatGeo.com/Everest

Microplastic pollution along the water circulation system into the atmosphere

In raindrops & snow
(Approximately 1,000 tons in
U.S. Western National Park, Wildlife Sanctuary)



▲ 대기 중에서 비와 함께 섞여 내린 미세플라스틱 (사진=유타대학 연구진)

Underground water
(6.4 particles per liter
detected in 16 out of 17
locations in the U.S.)

피아주엘로 박사가 미주리 주의 한 동굴 입구에서 지하수를 채취하고 있다. ©Teresa Baraza Piazuelo

Even in the deepest Mariana Trench

And everywhere in our bodies

Discovered 'microplastics' in all organs and tissues of the human body

Microplastics detected in 47 organs and tissues of donated bodies
(Charles Rolsky, Arizona State University)

Impact on Human Body

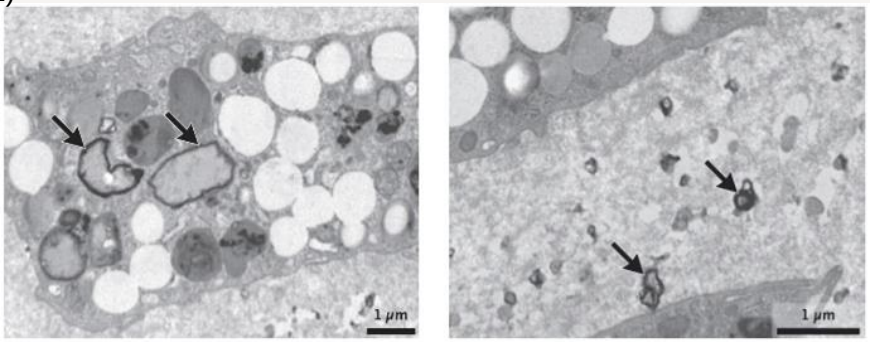
Chemical spillage of plastic interferes with the endocrine system -> well known

Recently, studies have revealed the harmfulness of physical existence itself

First study of the effects of particles themselves on human health

(Marfella, R. et al. (2024.03) Microplastics and Nanoplastics in Atheromas and Cardiovascular Events, *The New England Journal of Medicine*, Vol. 390 No.10, DOI: 10.1056/NEJMoa2309822)

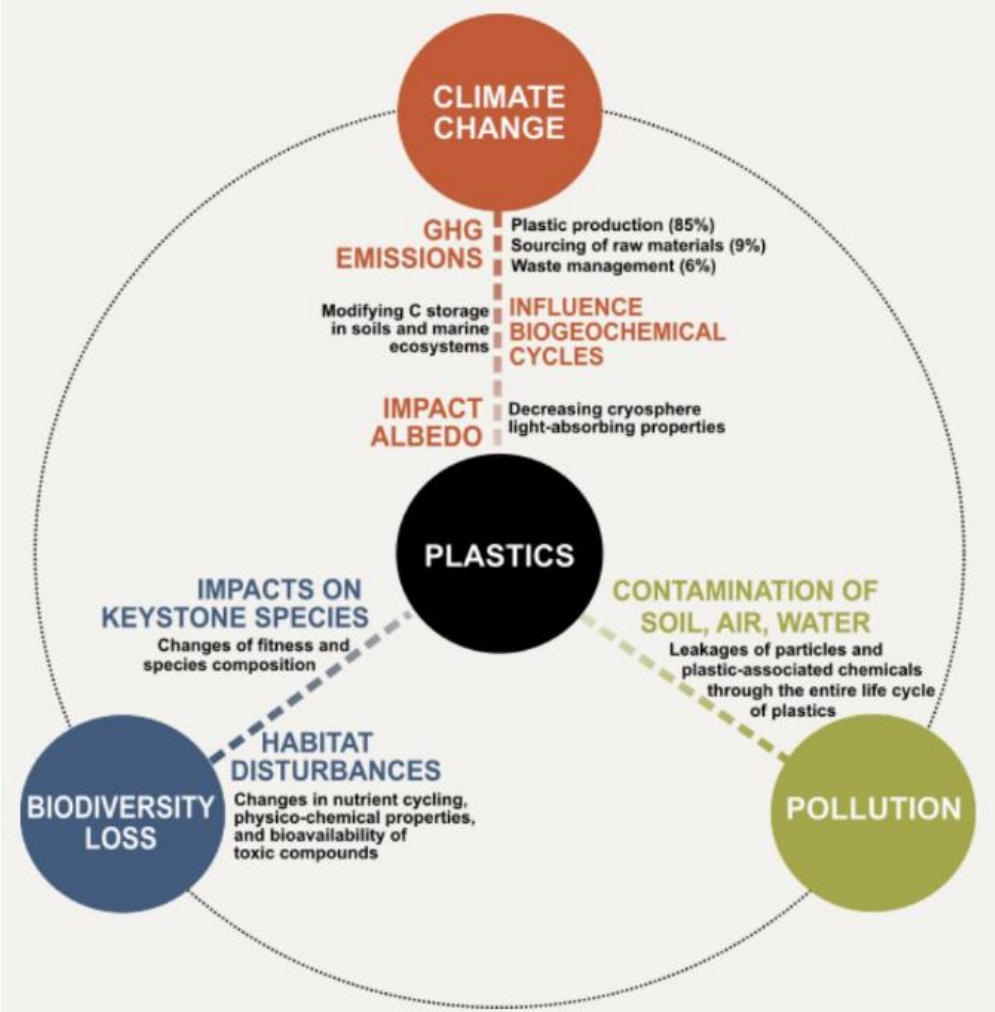
- 300 patients with atherosclerosis which increases risk of stroke, angina, and heart attach were investigated
- Microplastics found in carotid plaque (blood coalgu protein mixture)
- People with plastic-containing plaques are more than 4 times more likely to die over the next 3 years



The arrows in these microscope images point at microplastic particles—characterized by jagged edges—that were detected inside a macrophage cell (left) and free floating in plaque removed from patients' carotid arteries (right).

MICROGRAPH BY MARFELLA, ET AL., 2024 (LEFT) AND MICROGRAPH BY MARFELLA, ET AL., 2024 (RIGHT)

Key findings on plastic pollution (1)



- Accelerating Global Warming: plastic production, use, and processing account for 15% of the emissions permitted under the goal of limiting global warming to 1.5°C by 2050
- Biological Damage: Over 800 species of marine and coastal life are affected by plastic ingestion, entanglement, and contact
- Marine Pollution: Estimated at over 11Mt of ocean leakage per year, expected to triple by 2040 based on current trends

Source: Scientists' Coalition for an Effective Plastics Treaty (2024), Plastics and the Triple Planetary Crisis, DOI:10.5281/zenodo.10880588

Key findings on plastic pollution (2)

*Click the link for accessing documents

Since the adoption of UNEA 1. Res. 1/6 on 'Marine Plastic Debris and Microplastics' in 2014, numerous studies have found detrimental effects of plastics, but what is striking is the expected increase in plastic production and the potential difference we can make.

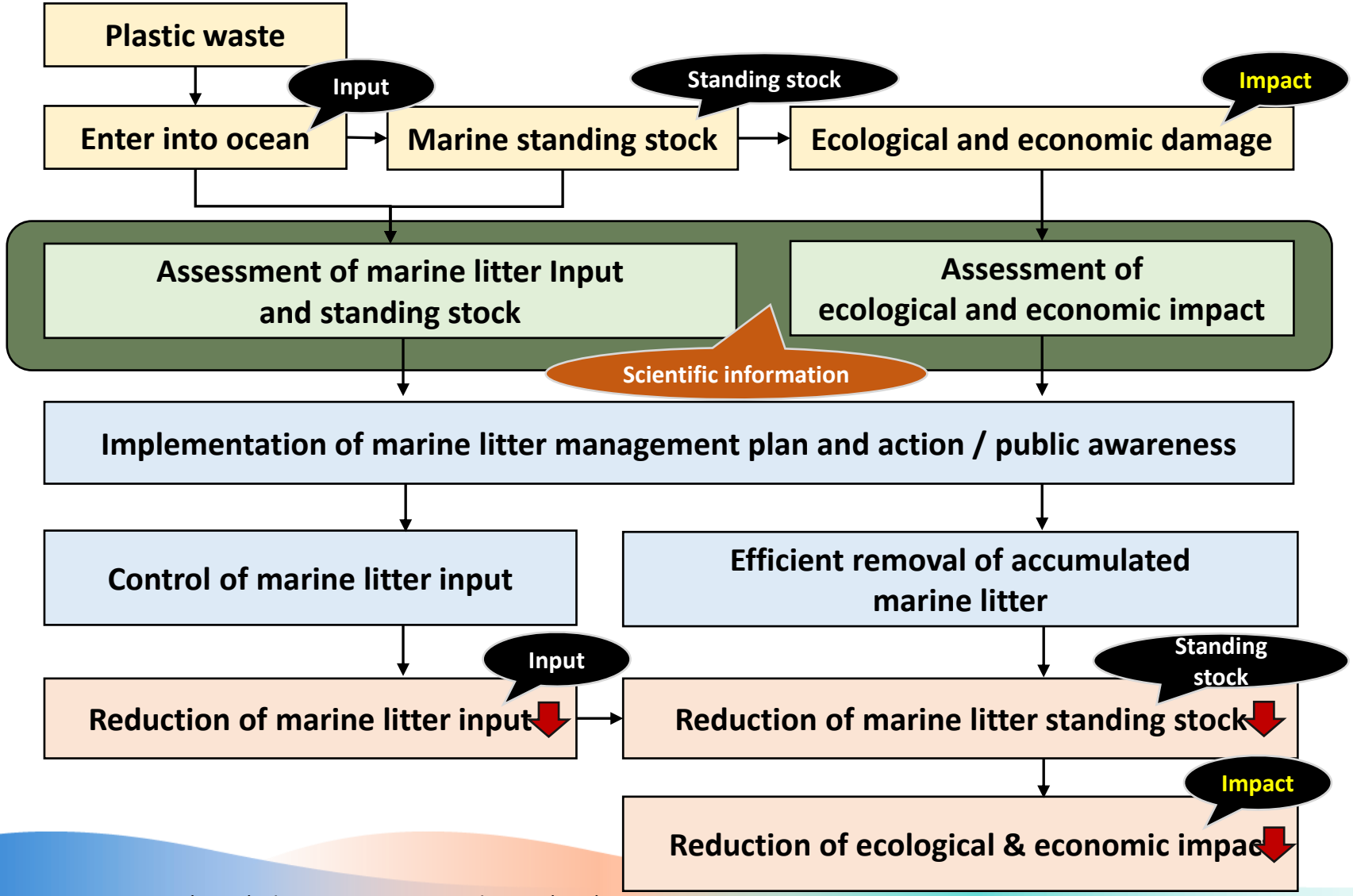
1. Increase in Plastic Production:

- Plastic production has risen from 2 million tons in 1950 to 348 million tons in 2017, projected to double by 2060 to 1.2 billion tons. This growth has transformed into a global industry valued at $522.6 billion.

2. Transition to a Circular Economy:

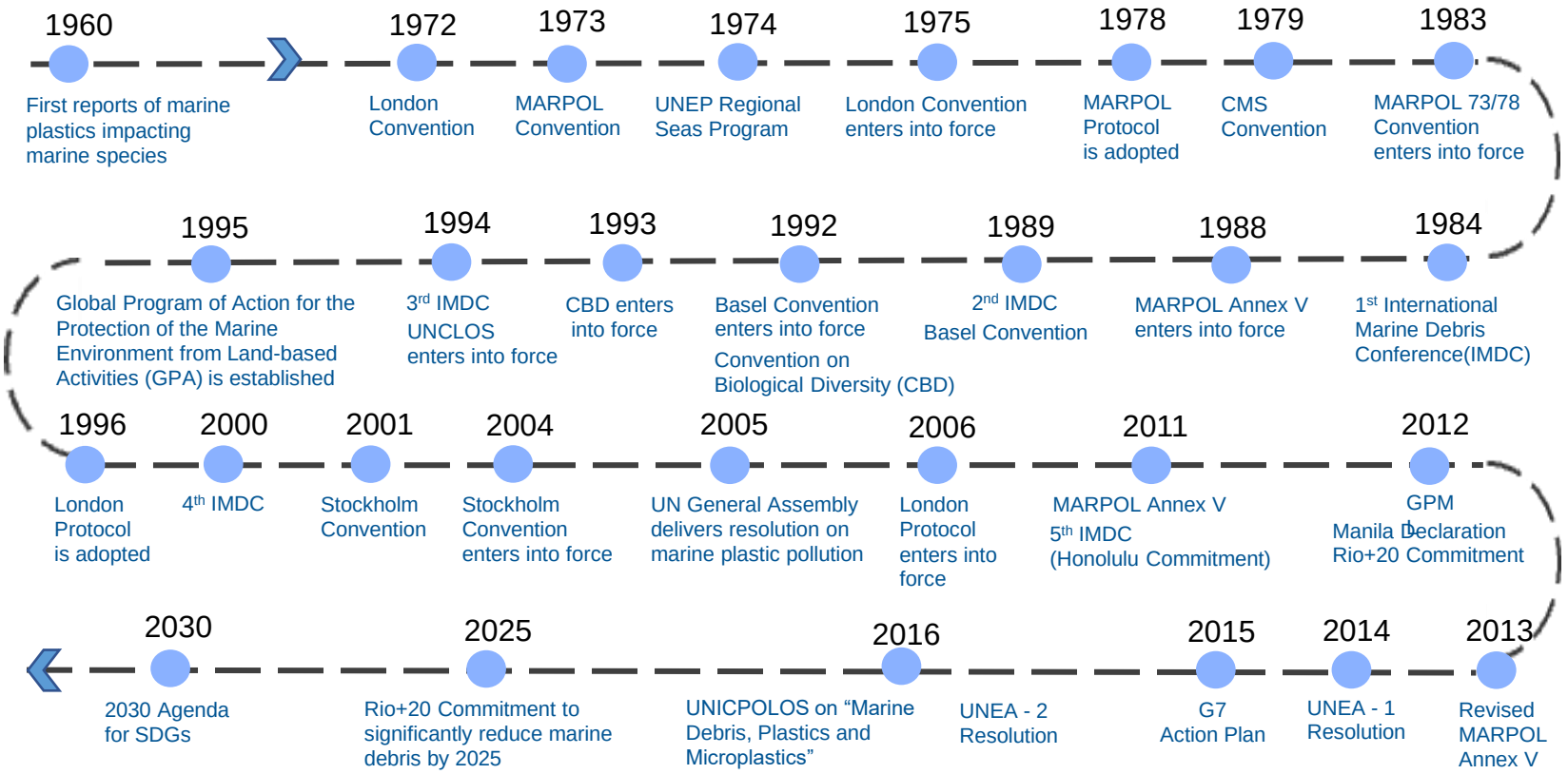
- Transitioning to a circular economy is expected to reduce plastic entering oceans by over 80% by 2040, cut new plastic production by 55%, save $70B, reduce greenhouse gas emissions by 25%, and create over 700k jobs in developing countries.

What do we need to do?



Source: SHIM Wonjun (2024) Plastic Ocean-Microplastics (PPT)

Marine Plastics Global Policy Timeline



Adapted from Mapphoto/Riccardo Pravettoni, 2018

05. Dealing with existing pollutions

Global efforts to regulate marine plastics

Classification	Name	Major Trend
International Organization	United Nations Environment Assembly(UNEA)	Adopting a resolution calling for an integrated approach to plastic and waste management
	Sustainable Development Goals(SDG)	Including reducing marine debris in the goal of marine ecosystem protection
	Global Partnership on Marine Litter (GPML)	Establishing a network of international organizations, governments, NGOs, researchers, businesses, and civil society organizations
	UN Clean Seas: A Campaign for Ocean Trash-Free Seas	Promoting campaigns to reduce the use of disposable items, microplastics, and excessive packaging
	Convention on Biological Diversity(CBD)	Adopting a resolution to reduce the impact of marine debris on biodiversity
	Convention on the Conservation of Migratory Species of Wild Animals(CMS)	Adopting a resolution to reduce the impact of marine debris on migratory species
	Basel Convention	Regulating the import and export of plastic waste
	International Maritime Organization(IMO)	Strengthening the management of ship-generated plastic and revising lost fishing gear reporting regulations
Local Conference	Regional Seas Programme	Advancing action plans for marine debris in the Northwest Pacific (NOWPAP) and East Asia (COBSEA) regions
	ASEAN (+3)	2019 ASEAN Framework of Action on Marine Debris
	G20	Setting target of zero additional marine plastic pollution by 2050
	APEC	Announcing a marine debris roadmap
Industries		Promoting self-rescue efforts through initiatives such as the "New Plastics Economy Global Declaration"

One of the most important treaties under UNEP

Decision BC-13/17

Urged the Convention to further address marine plastic litter and microplastics

Decision BC-14/12

New entries for hazardous and non-hazardous plastics are created by adopting Annex II, VIII, and IX

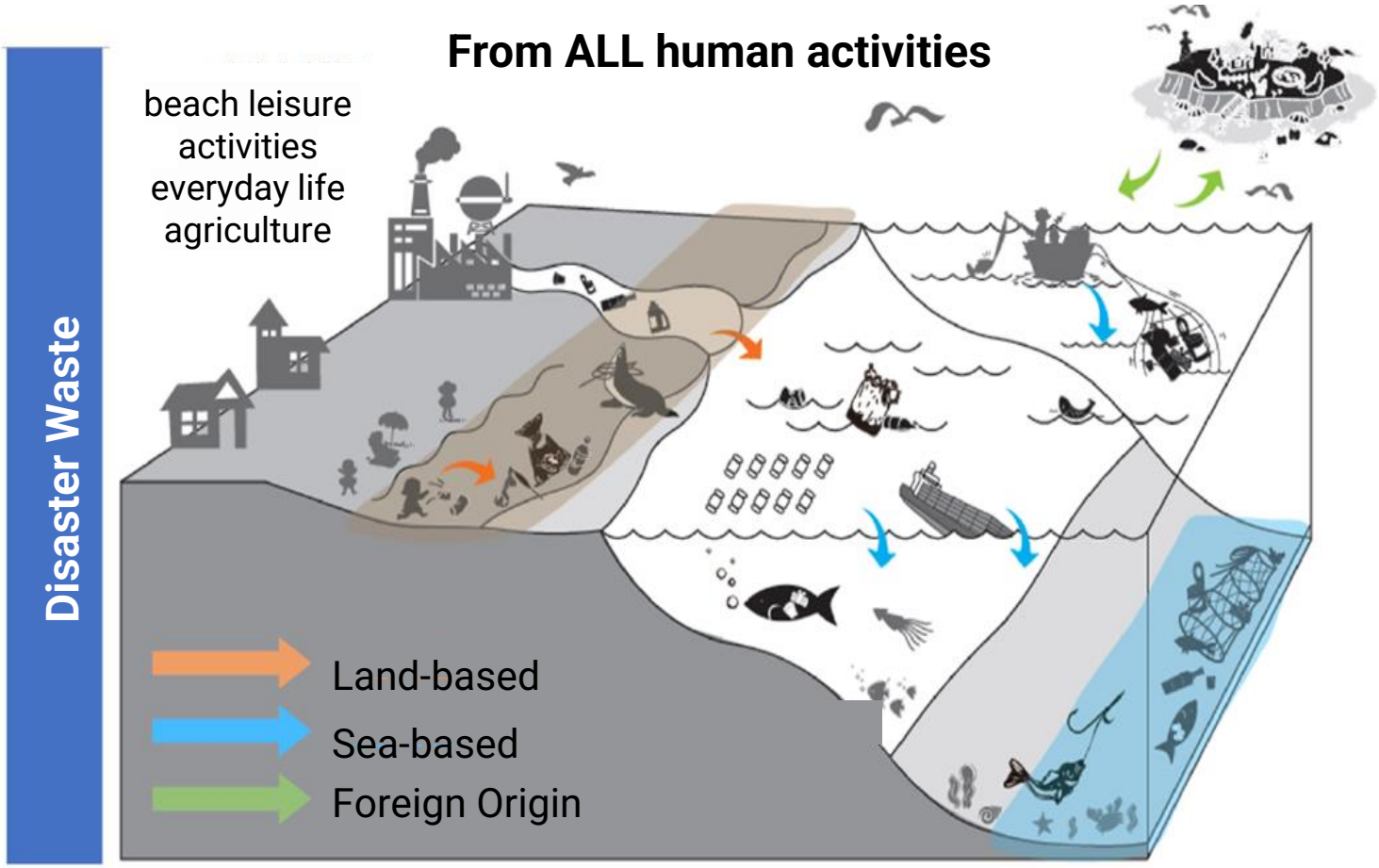
Decision BC-14/13

A need for preventing and minimizing the generation of plastics is emphasized

02

Preventing at source

Sources and pathways of Marine plastics

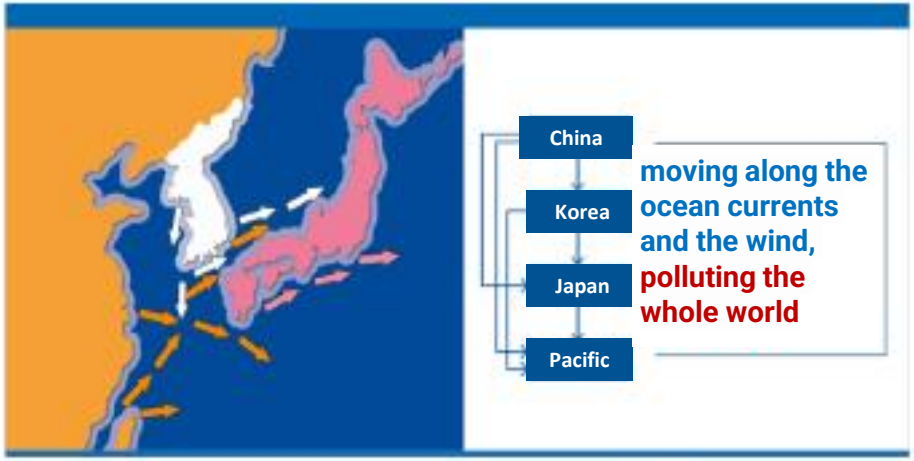


Source: MOF, KIMST, KIOST (2013), Hong et al. (2014)

Foreign origin - Transboundary issues

경기신문

Incheon Baekryeongdo Beach, a national ecotourism site covered with marine debris from China



The JoongAng

Gochujang containers, pesticide containers... "Hangul" trash on the coast of Japan

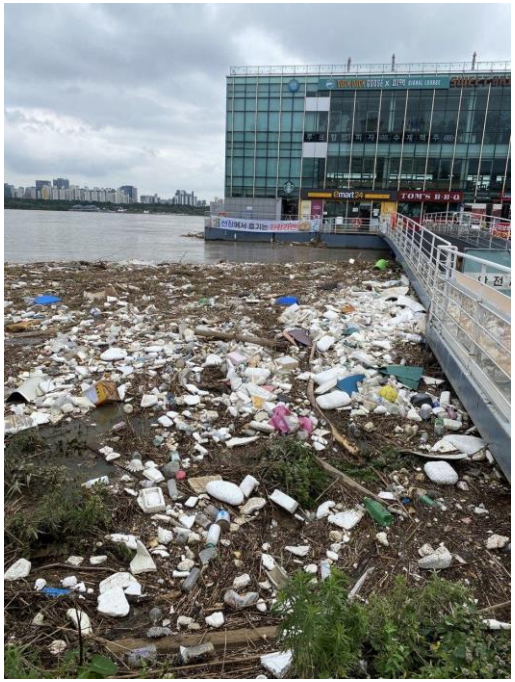
KBS NEWS

Korean garbage also accumulates on the 'North Pacific Garbage Island'

Surfrider Project Aims to Reduce Plastic Pollution, Protect Hawaiian Monk Seals

Disasters vs. Daily life

Mangwon Han River Park after the Seoul Flood



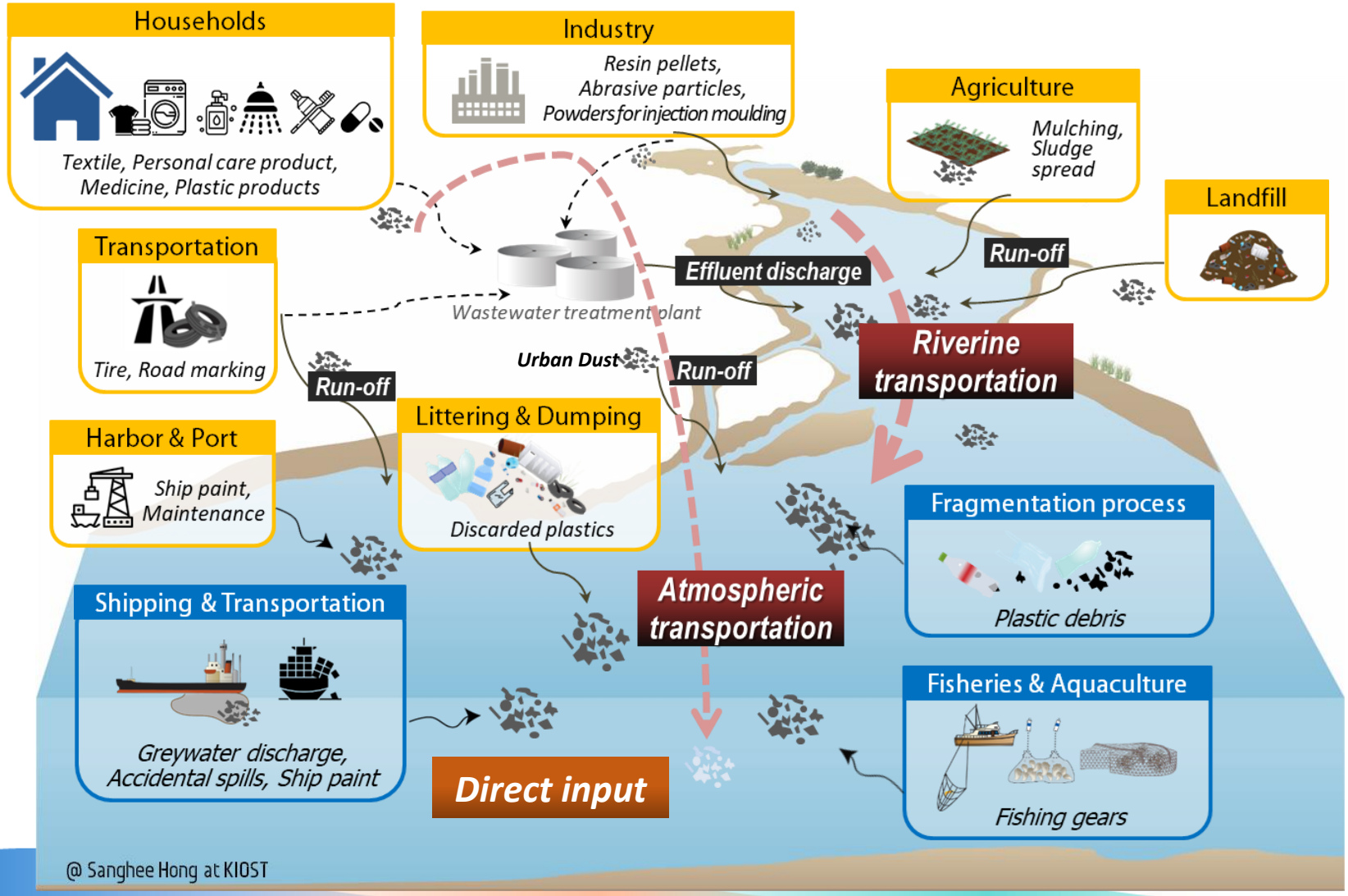
Source: HWANG Sangcheol, ReDi (2023.7.18)

2012.7.23 Lantau Island pellet spill in Hong Kong

Source :Plastic Free Seas

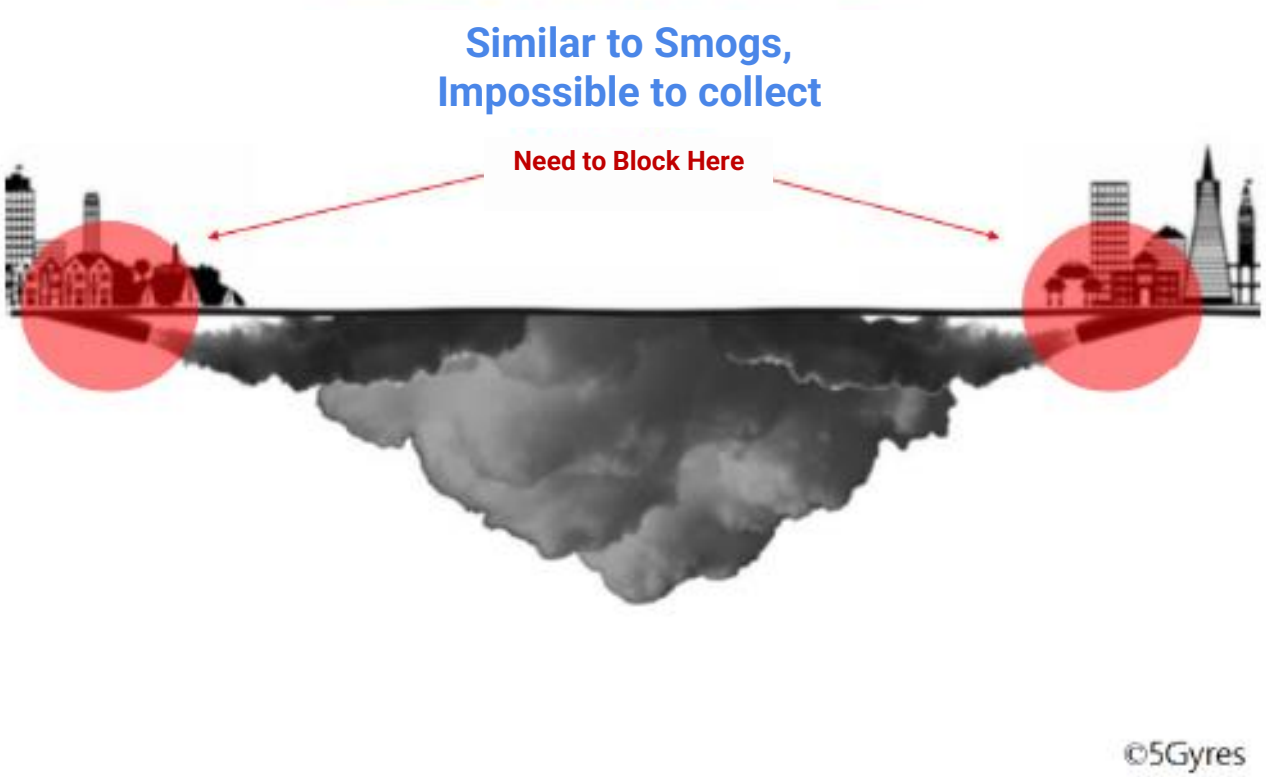
A disaster comparable to oil spills

Sources and pathways of Microplastics



ANSWER: TURN OFF THE TAP

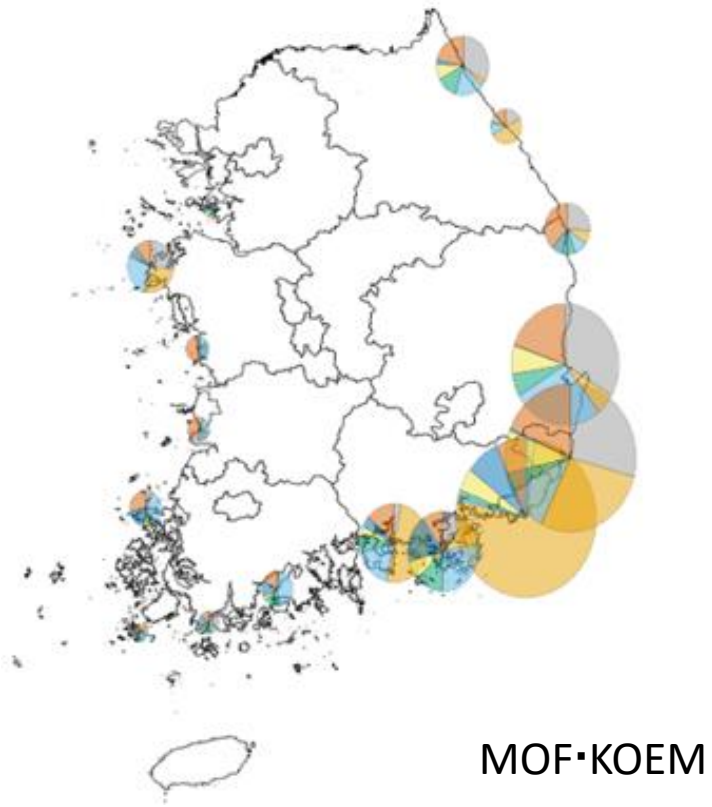
microplastic smog



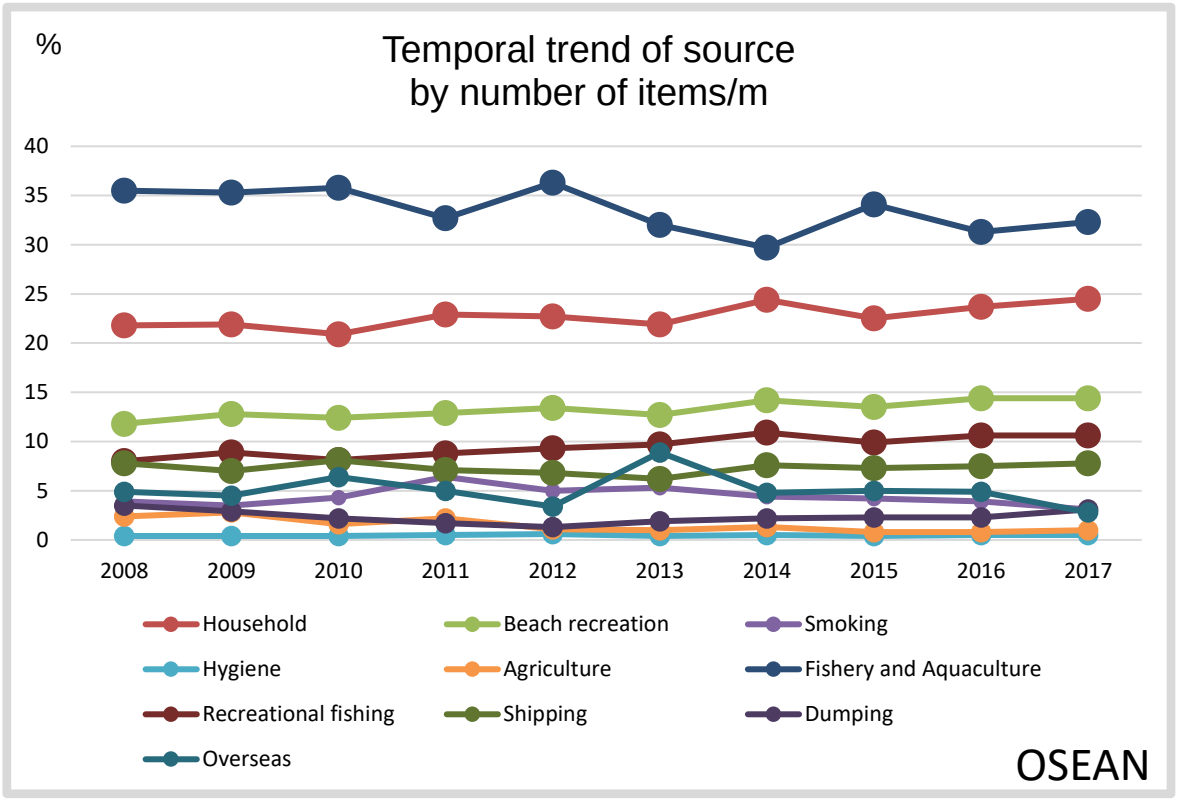
02. Preventing at source

Korean National Beach Litter Monitoring

Identifying Source, spatial distribution, temporal trend since 2008



MOF·KOEM



OSEAN

TENtoONE Campaign (2022 -)

Research and Public Campaign program to reduce top 10 priority items to 1/10
e.g. Ropes 74 -> 7.4 pieces/ 100m

Styrofoam buoy

Rope

Plastic beverage bottles & caps

Plastic bags

Plastic food packaging

Plastic band

Recreational fishing items

Cigarette butt

Firework supply

Eel trap

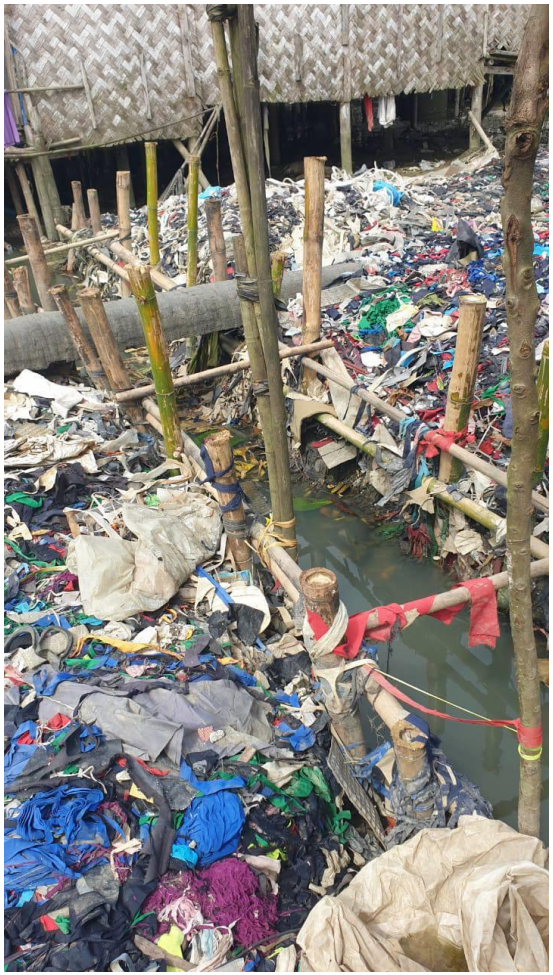
Sea-based - MARPOL Convention

MARPOL 73/78

- **ANNEX I** Regulations for Prevention of Pollution by Oil is entered into force on October 2, 1983
- **ANNEX II** Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk is entered into force on October 2, 1983
- **ANNEX III** Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form is entered into force on July 1, 1992
- **ANNEX IV** Prevention of Pollution by Sewage from Ships is entered into force on September 27, 2003
- **ANNEX V** Prevention of Pollution by Garbage from Ships is entered into force on December 31, 1988
- **ANNEX VI** Prevention of Air Pollution from Ships is entered into force on May 19, 2005

03 Safe Disposal

Road Construction…?



Road building site in an informal settlement in Yangon, Myanmar.

Mixture of sachets and garment cut offs, labels, etc.

Plastic litter → Burnt rice husk → construction waste → Ta-da

Source: Thant Myanmar

Dredging Project, but…

Climate change → more risk of Floods → Dredging needed → Mixture of mud and plastics → ?

Source: OSEAN

Recycle, okay, but sludges?

Grinding machines → Microplastics washed away with cooling water → Sludges with plastics

Source: OSEAN

Problems with Marine Plastics Disposal

1. **Salinity**
   - Many waste industry companies refuse marine litter due to salinity, as it may cause breakdown or rapid corrosion of machines/ facilities

2. **Weigh**
   - Soaked up marine litter (e.g. Ropes, nets, etc.) weighs much more, and needs to be dried up

3. **Logistics**
   - Sheer distance or lack of roads/transportations hinder proper disposal of marine debris

Source: OSEAN

04

Plastic exports

04. Plastic Exports

From where to where?

Unsustainable plastic production and limited waste management lead to waste exports to countries with lower costs. Importing countries lack infrastructure, causing recyclers to prioritize imported plastics over domestic systems.

Source: BFFP sourcing Plastic Waste Transparency Project and Basel Action Network

04. Plastic Exports

Matter of Compliance?

© Bernama News

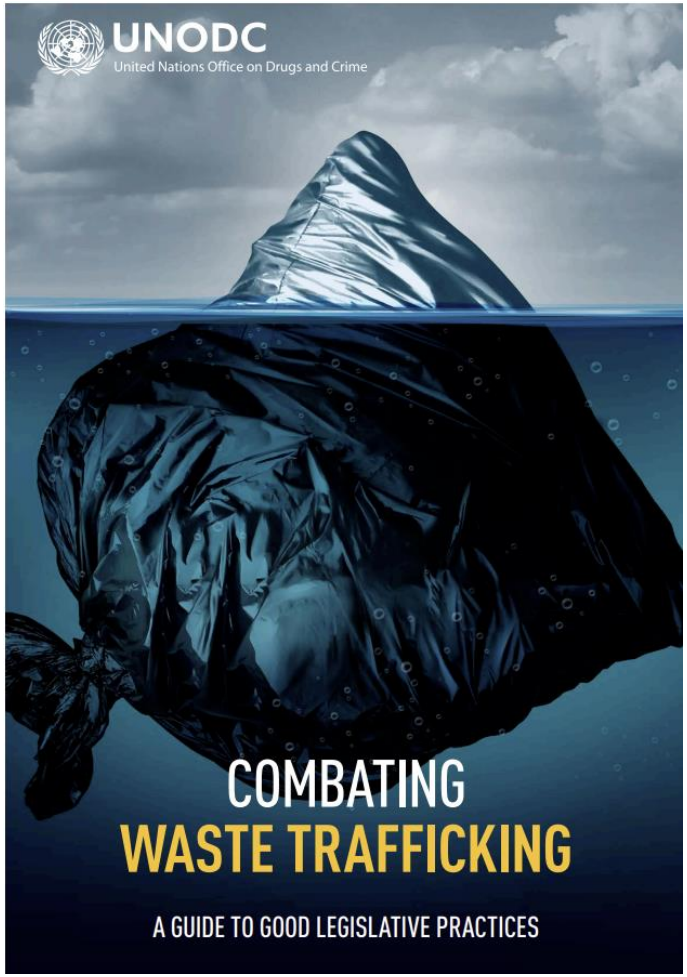
- Korea revised to restrict waste trades to abide by the 1992 Basel Convention which it signed in 1994.
- “Legal” exports to the Philippines and other countries are still on-going.

Global frameworks → supporting through National legislations

- Illegal waste shipments from South Korea, falsely declared as “plastic synthetic flakes,” with a total weight of 6,500 tons arrived at the Mindanao International Container Terminal (MICT) in Jul-Oct 2018.
- Upon agreement reached by the govts in Dec 2018, all were sent back to Korea in the following year and were incinerated until Dec 2020.

An employee of Greenpeace Southeast Asia's Filipino Office on Dec. 6, 2018, inspects some 5,100 tons of waste on Misamis Oriental in the Philippine's Mindanao Island, which were illegally exported from Korea earlier that year. Courtesy of Greenpeace

Legislative works



- Environmental crimes are among the most profitable and fastest-growing international criminal activities, often linked to corruption, money laundering, and terrorism financing.
- Defines “Waste trafficking” broadly, meaning importing, exporting, transporting, buying, selling, brokering, treating, processing, collecting, sorting, labelling, handling, utilizing, storing, recycling, disposing of and burning of scheduled wastes in breach of domestic law.
- Waste trafficking involves a variety of actors, including companies operating in the licit waste industry and organized criminal groups. Although the exact scale of waste crime is difficult to estimate, waste crime is considered to be **one of the most significant crimes that affect the environment**.

Intra-governmental action

E.g. WCO's Asia-Pacific Waste Project

- Strengthening the capacity of Customs administrations to mitigate and appropriately respond to environmental threats
- Especially on the implementation of the Basel Convention, and on matters related to plastic waste and the illegal shipment thereof.

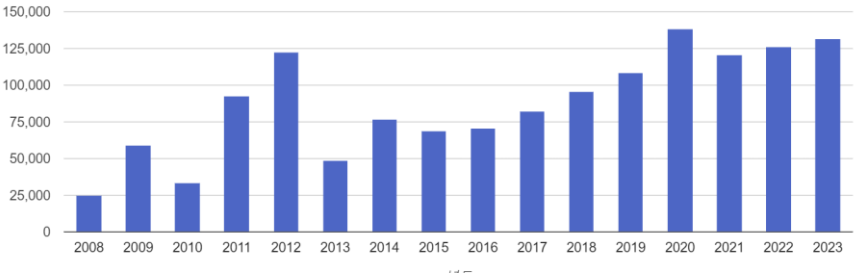
05

Dealing with existing pollutions

Korean Marine Litter Management System

Source: MOF

Collected Marine Litter in Mt (2008-2023)



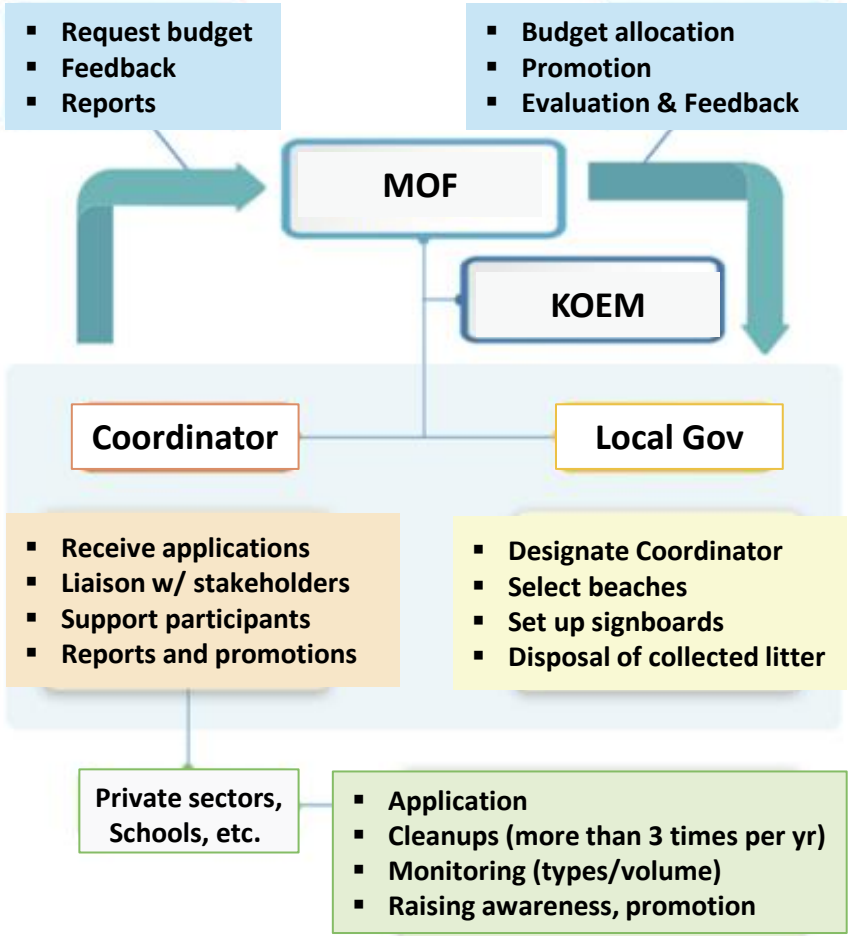
Source: MEIS

- Korea is exemplary when it comes to clean ups. MOF focuses on waste collection in the marine environment.

However,

- The cost of marine litter cleanup is approx. **5.7 times higher** than land-based cleanup, averaging KRW 2M per Ton (MOF).
- Best before entering the water ways.

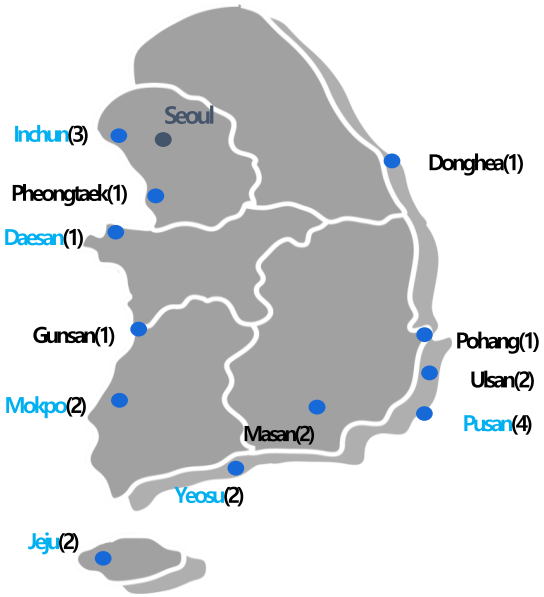
Korean Case 1) Adopt – A – Beach



Source: MOF

- Inspired by the "Adopt-A-Beach" program from Texas, U.S. (1986), Korea MOF launched the "Adopt-A-Beach" initiative in 2021.
- A public-private partnership to promote awareness in which companies, organizations and schools adopt a specific beach for two years.
- Beach litter data is recorded according to guidelines to support national beach waste management policy development and implementation.
- As of 2023, 121 beaches are adopted by 180 participating entities.

Korean Case 2) Clean-up Vessel

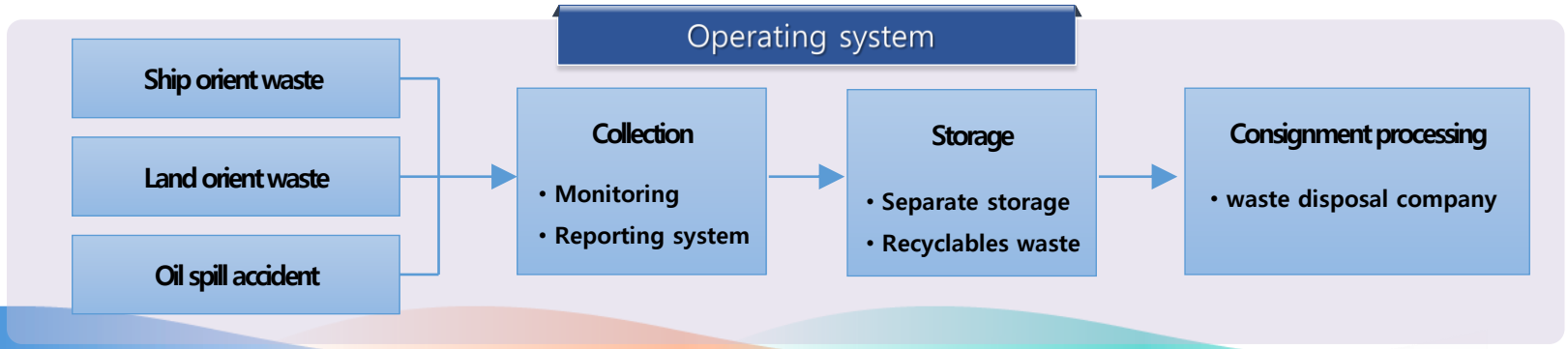


Marine Debris Collection:

- Immediately collect marine debris that obstructs navigation upon detection or request.
- Specifically target and remove land-based waste entering the sea, especially during summer monsoon and typhoon seasons.

Oil Spill Response:

- Deploy onboard response equipment for initial containment and cleanup of marine oil spills.
- Conduct rapid collection and mitigation of pollutants to minimize environmental impact.



Source: KOEM

Korean Case 3) Beach Guardians

Source: Wando News (26 May 2016) Beach Guardians collecting marine debris

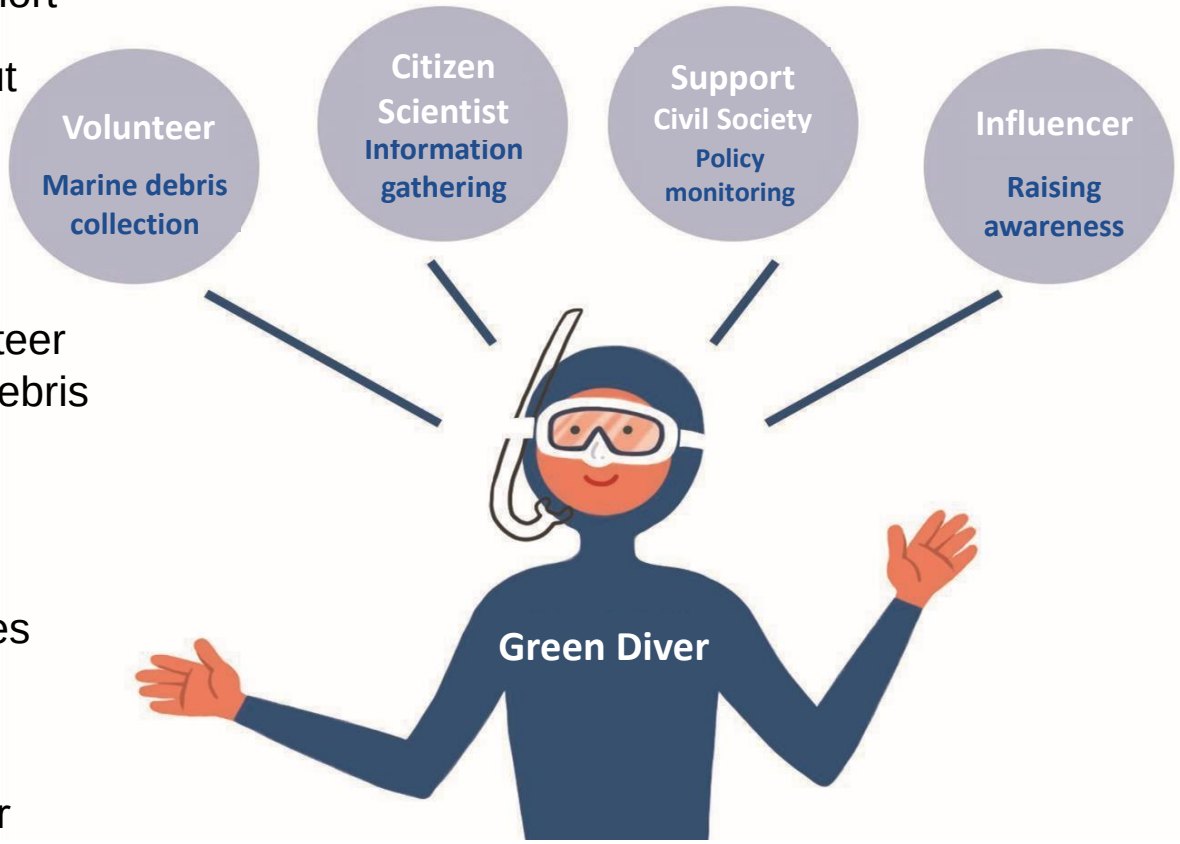
- Launched in Jeju Island in 2019 and subsequently implemented by various local governments.
- Recruitment of temporary workers as part of employment programs, designated for continuous marine debris collection.
- In 2020, 1,000 Guardians around the country cleaned up 33,000 Mt

Source: MOF

Volunteers

Why?

- Too many in vast/ remote area, Govt efforts inherently falls short
- Manual collection of small, but detrimental debris



In case of Korea,

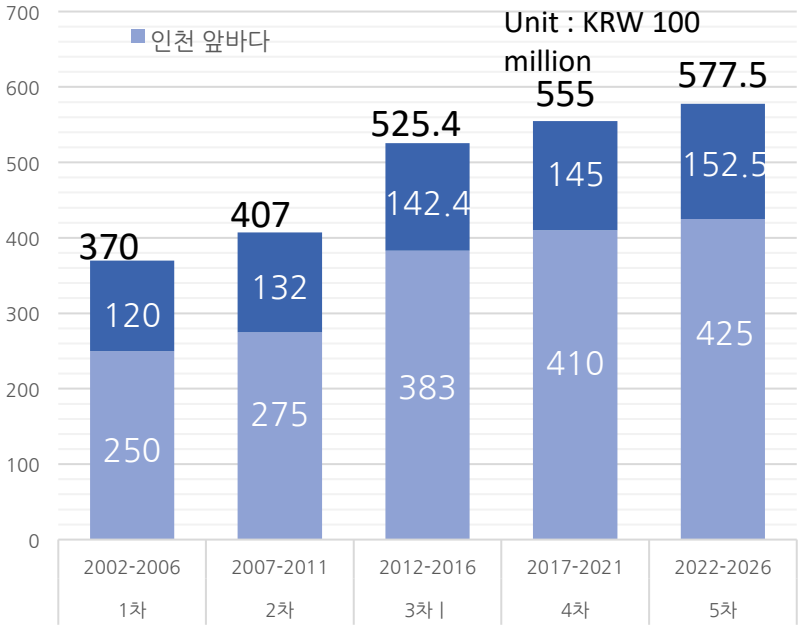
- Approx. more than 100 volunteer groups dedicated to marine debris collection
- The world's longest coastline relative to its land area
- Territorial waters are four times larger than the land area
- Over 3,500 islands
- One of the world's highest per capita plastic consuming countries

3. The Han River and The Sea

2) An immediate problem

Cooperation between local governments is successful, but…

5th Hangang River Mainstream / Convention on the Disposal of Waste Off the coast of Incheon (2022-2026)



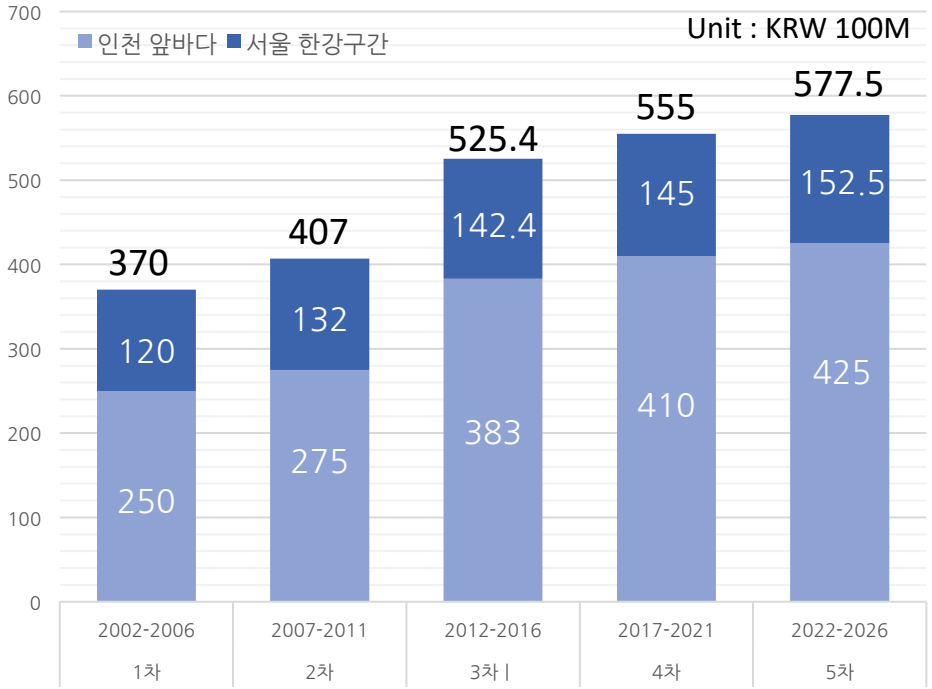
	The Han River section in Seoul	Off the coast of Incheon
Seoul	89.2%	22.8%
Incheon	2.5%	50.2%
Gyeonggi Province	8.3%	27%
The Ministry of Environment	-	13 years~ 1.7 billion won a year
Han River Water Fund	-	21 years ~ 1.6 billion Incheon contributions per year

Source : Information Disclosure Data of Incheon City(ReDi requested)

Food for thoughts…

Cooperation among upstream and downstream regions/ countries…

5th Han River Mainstream / Convention on the Disposal of Waste collected in the coast of Incheon (2022-2026)



Source : Incheon City (at the request of ReDi)

	The Han River section in Seoul	Off the coast of Incheon
Seoul	89.2%	22.8%
Incheon	2.5%	50.2%
Gyeonggi Province	8.3%	27%
The Ministry of Environment	-	2013 onwards KRW 1.7 B/yr
Han River Water Fund	-	2021 onwards, Adding KRW 1.6 B/ yr to Incheon's contribution

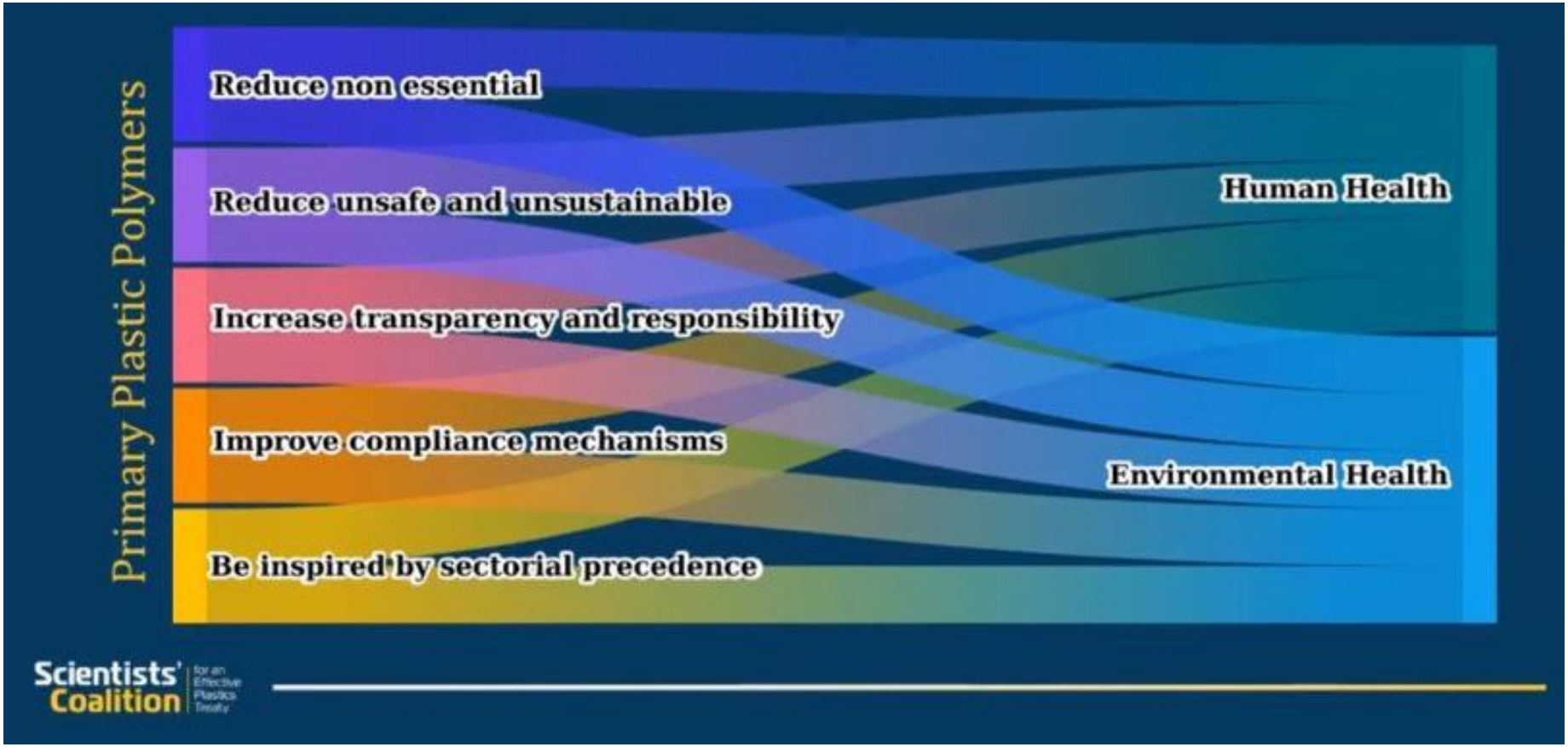
Again the answer is, to CLOSE THE TAP

No living organism on Earth, except humans, produces non-recyclable waste.

Humans can no longer sustain our current way of life.

Among the many complex solutions,
one thing is very clear: we must reduce
the excessive amount of plastic production.

Ways forward



Thank you

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osean@osean.net

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