SCIENTIFIC EVIDENCE-BASED POLICY MAKING FOR ADDRESSING MICROPLASTIC POLLUTION IN ASEAN COUNTRIES – CASE STUDY IN THE PHILIPPINES

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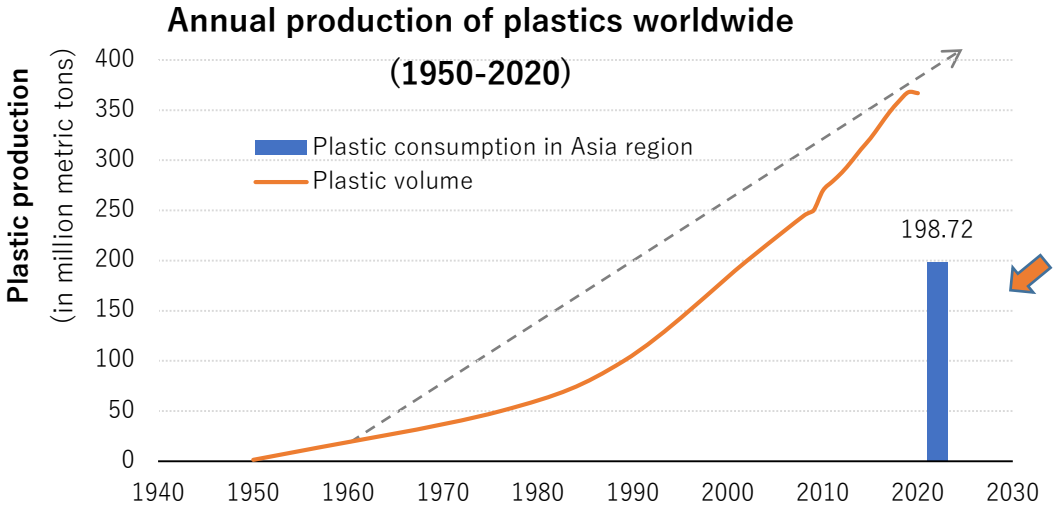
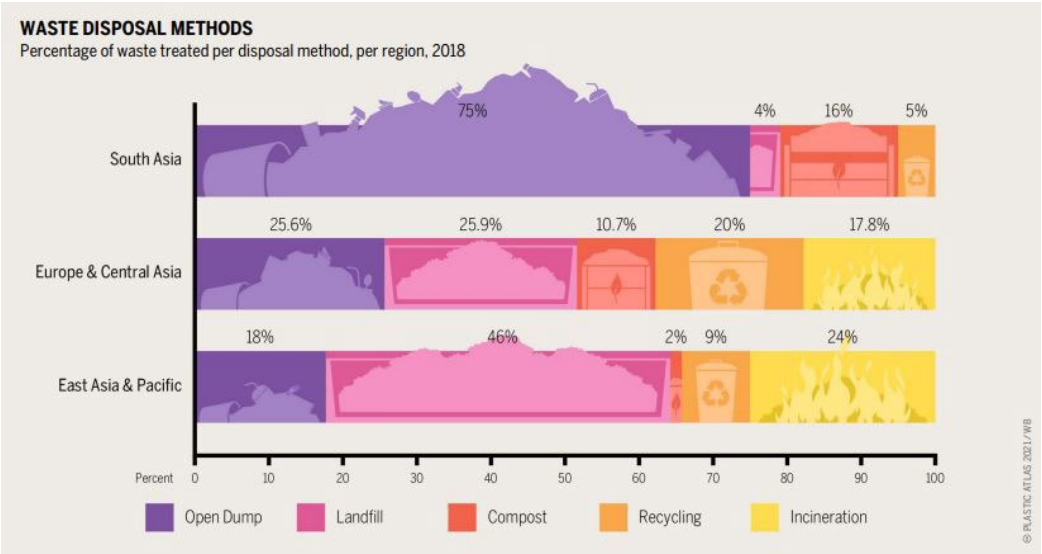
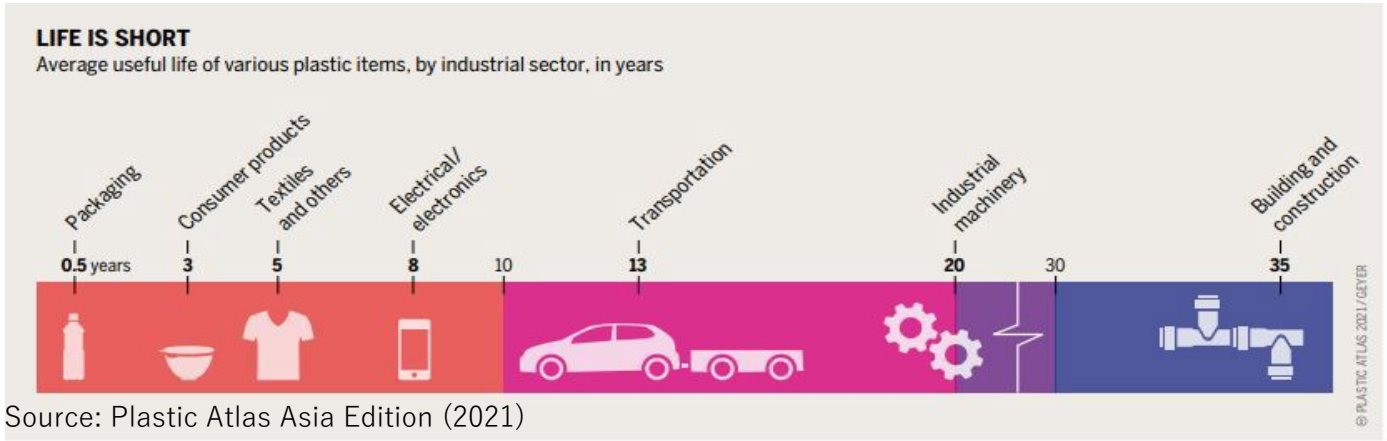
BACKGROUND ON PLASTIC PRODUCTION AND MISMANAGEMENT OF PLASTIC WASTE IN ASIA







Source: Plastic Atlas Asia Edition (2021)

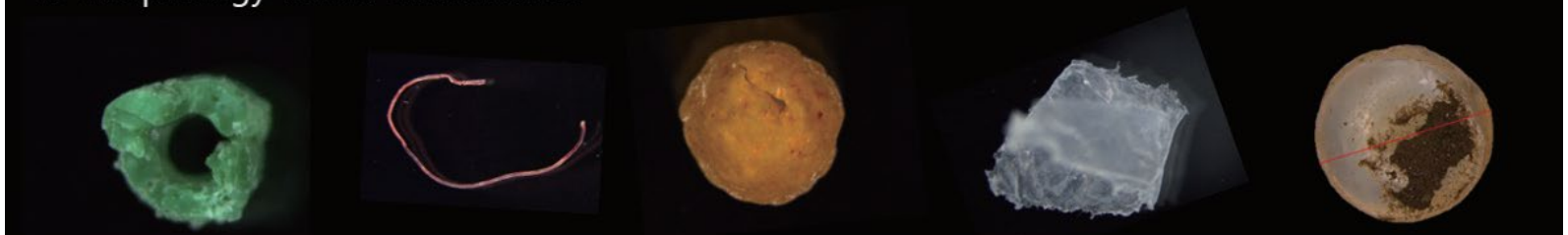
- Plastic has been extensively utilized almost in every type of products in packaging, building& construction, automotive, electrical and electronic, agriculture, household and others.
- Plastic consumption in Asia counting 51% of global plastic production, 3% in Japan and 31 % in China (2019).

- Mismanagement plastic waste and leakage to rivers and ocean have become a problem.
- Indonesia, the Philippines, Vietnam and Thailand were among top five countries throwing the most plastic waste into oceans in 2015.

CHARACTERISTICS FOR CATEGORISING PLASTIC DEBRIS
Size, Shape & Color

a. Size-based classification

b. Morphology-based classification



Fragments
Irregular particles, Crystals, Fluff, Powder, Granules, Shavings

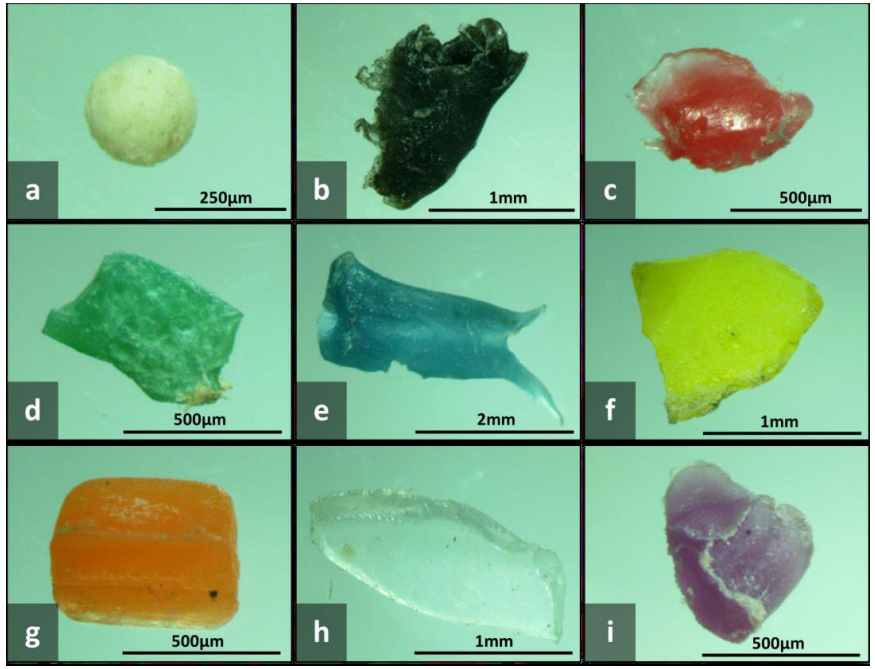
Fibers
Filaments, Microfibers, Strands, Threads

Beads/ Spheres
Grains, Spherical microbeads, Microspheres

Films/ Sheets
Grains, Spherical microbeads, Microspheres

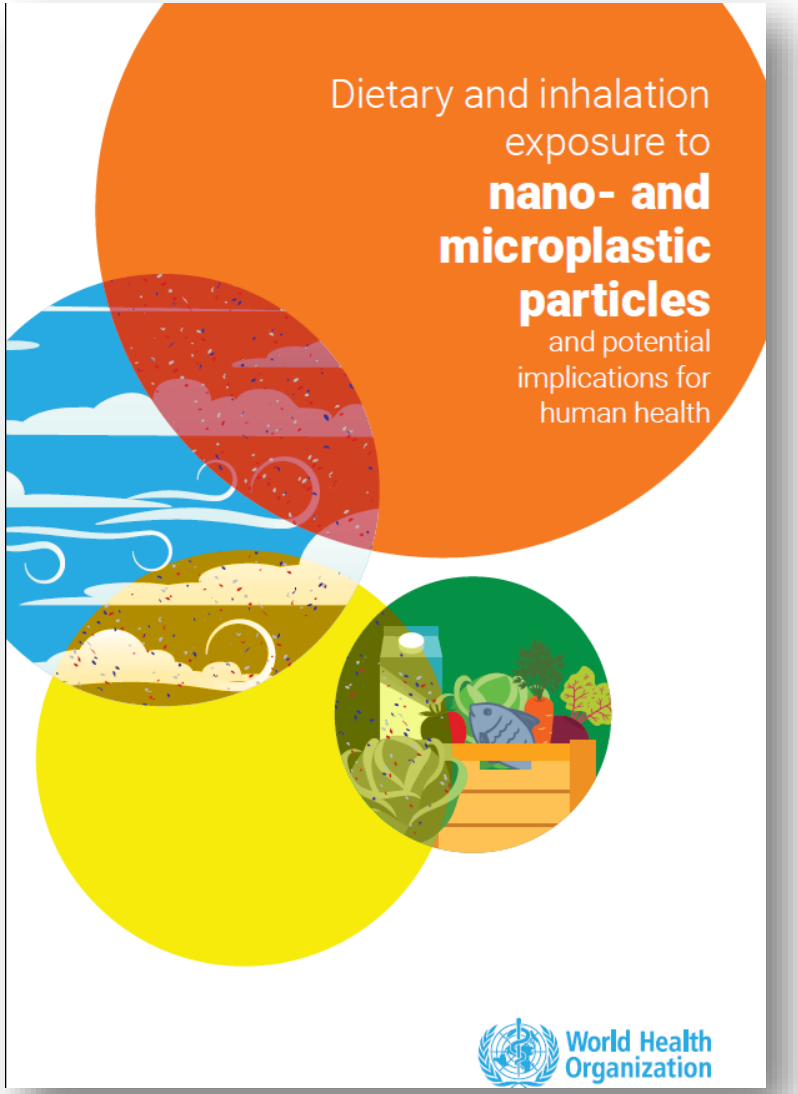
Pellets
Resin pellets, Nurdles, Pre-production pellets, Nibs

c. Color classification: (a) White, (b) Black, (c) Red, (d) Green, (e) Blue, (f) Yellow, (g) Orange, (h) Transparent, and (i) Violet



POTENTIAL IMPACTS OF MICROPLASTICS POLLUTION ON FOOD CHAIN AND HUMAN HEALTH

- Microplastics can also be ingested by planktons at the bottom of the aquatic food chain allowing plastics to **move to the next level of the aquatic food chain eventually affecting humans**.
- A study carried out by the University of California, Davis, and Hasanuddin University in Indonesia, 76 fish samples across 11 different species were collected from markets in Makassar, Indonesia. The study revealed that, **anthropogenic debris (plastic or fibrous material) was found in 28% of individual fish (in their guts) and in 55% of all species** (Rochman et al., 2015).
- In another study conducted in Japan, Tanaka and Takada (2016) also reported that **microplastics was detected in the digestive tracts of 49 out of 64 Japanese anchovy (77%) sampled in Tokyo Bay**. Among detected microplastics, polyethylene and polypropylene account for 52.0% and 43.3%, respectively. The results from this study also indicated that most of the detected plastics were fragments (86.0%), and 7.3% were beads or microbeads, which is similar to those found in facial cleansers.



REPORT ON THE DETECTION OF MICROPLASTICS IN HUMAN PLACENTA

- ✓ A recent study reported that the presence of MPs in human placentas may lead to adverse pregnancy outcomes including preeclampsia and fetal growth restriction.

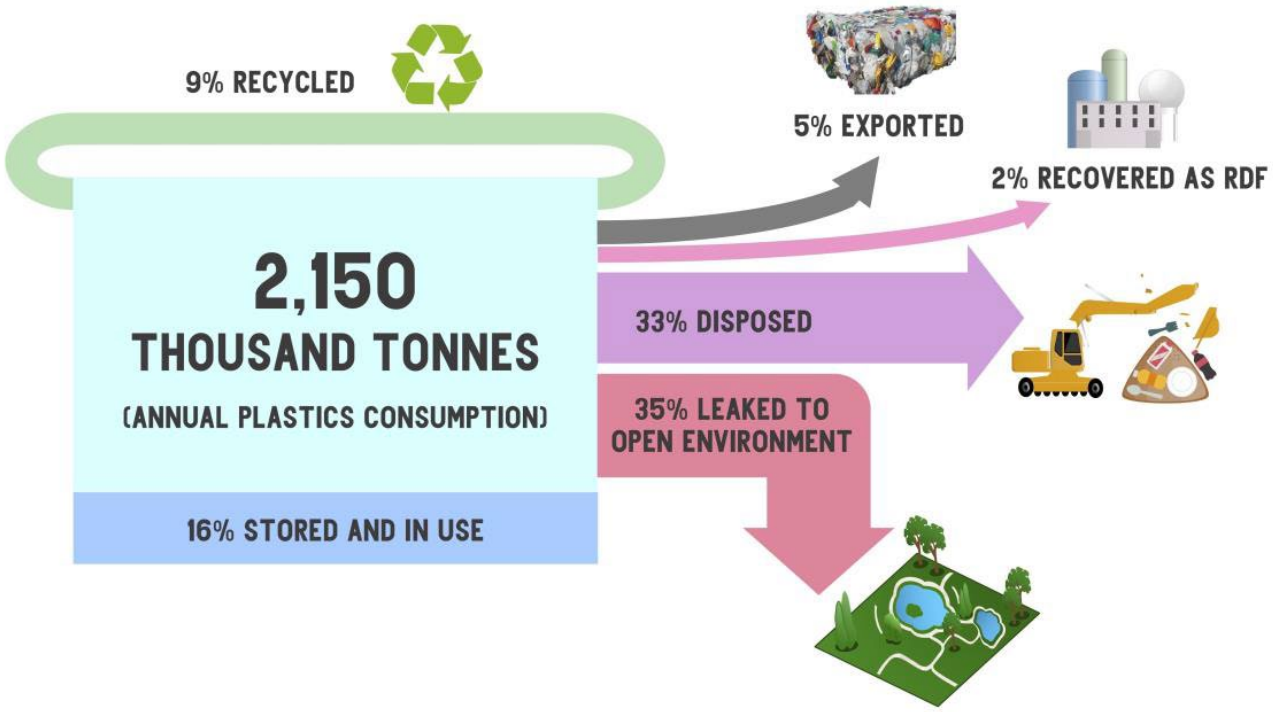
- ✓ This study observed the presence of **microplastic fragments ranging from 5 to 10 µm in size**, with spherical or irregular shape in placentas (5 in the fetal side, 4 in the maternal side and 3 in the chorioamniotic membranes), **which are possibly used for manmade coatings, paints, adhesives, plasters, finger paints, polymers and cosmetics and personal care products.**

"12 microplastic fragments (mostly 10 um in size), with spherical or irregular shapes were found in 4 placentas (5 in fetal side, 4 in the maternal side and 3 in the chorioamniotic membranes)"

(Source: Ragusa et al., 2021).

https://www.saindurenviro.com/evidence-of-microplastics-found-in-the-placentas-of-unborn-human-babies.html

Example of Plastic Flows in the Philippines



- ✓ The Philippines has been identified as the seventh largest contributor of mismanaged plastic wastes to the coastal environment globally.
- ✓ About 1.01 million tonnes of plastic wastes were calculated as mismanaged by the country in 2016.

- ❑ More than 163 million plastic sachet packets, 48 million shopping bags (or roughly 17.5 billion pieces a year) and 45 million thin film bags daily.
- ❑ Out of the 2.1 million tonnes of plastics that are available for local consumption in 2019, about 7.1 hundred thousand tonnes or 33% are disposed to landfills and dumpsites, 3.5 hundred thousand tonnes or 16% are stored and in-use, and 1.9 hundred thousand tonnes or 9% are being recycled.
- ❑ Around 7.61 hundred thousand tonnes or 35% are leaked to the open environment as plastic wastes wherein majority of these are bottles, containers, and single-use plastics (SUPs) such as bags and sachets recycled.
- ❑ These plastic wastes may retain in land and storm drains, enter the waterbodies, and be burnt.

(Source: WWF Philippines and AMH Philippines, Inc., 2020)

Investigations of Microplastic Emission Scenarios from Sources to River (e.g. Marikina River Basin)

Stormwater Drain

Stormwater Runoff

Upstream

Influent

Effluent

Households and Others
Domestic Sources

Combined Sewage and
Drainage Treatment Plants

Downstream

(Source: AMH and IGES, 2022)

RESULTS OF THE SAMPLING ANALYSIS:

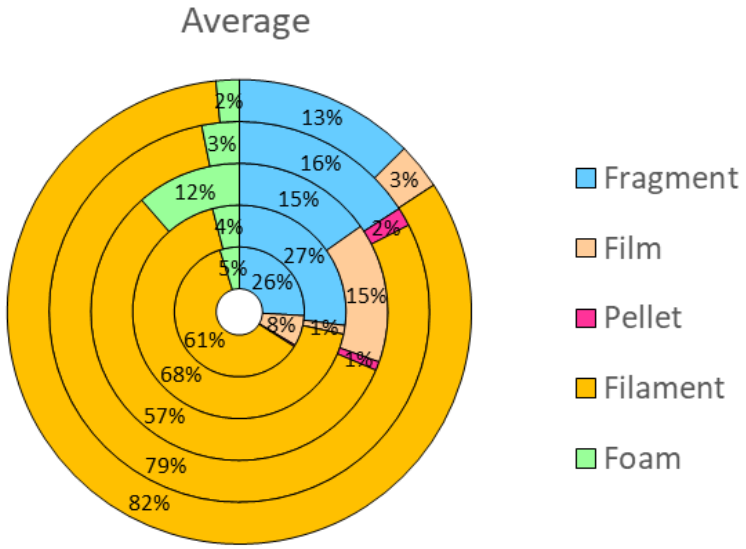
Source		Abundance (particles/m^3)
River	Upstream	525
	Downstream	445
Combined Sewage Treatment Plant	Influent	1,753
	Effluent	315 (Removal efficiency: 82%)
Stormwater Simulation		19,022

- **Filaments** were significantly the **most abundant shape in all sources**, ranging between 57% to 83% of the microplastics, while **blue** was significantly the **most found color among the rest**, ranging from 29% to 73%. **The predominant polymer** type for all samples **is polypropylene (PP).**

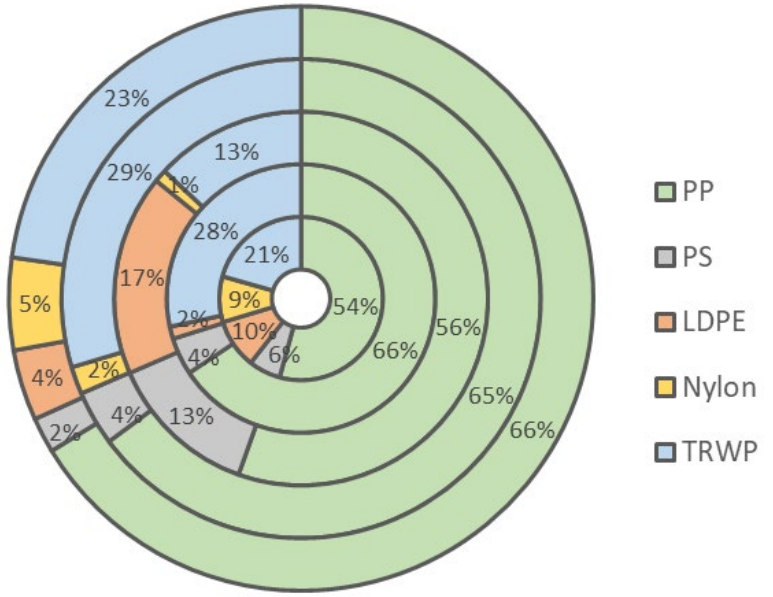
- Microplastic particles with sizes between **0.3 and 1.18 mm contributed the highest quantity in the stormwater samples**, while size range of 0.15 – 0.3 mm for upstream, downstream, and influent samples, and size range of 0.075 – 0.15 mm for effluent samples.

- On a business-as-usual (BAU) scenario, the downstream point of the river receives about 448 million microplastics daily wherein 347 million come from the upstream point, while **18 million are from the STP**. **The remaining 83 million microplastics are from the other sources** that come along in between the upstream and downstream.

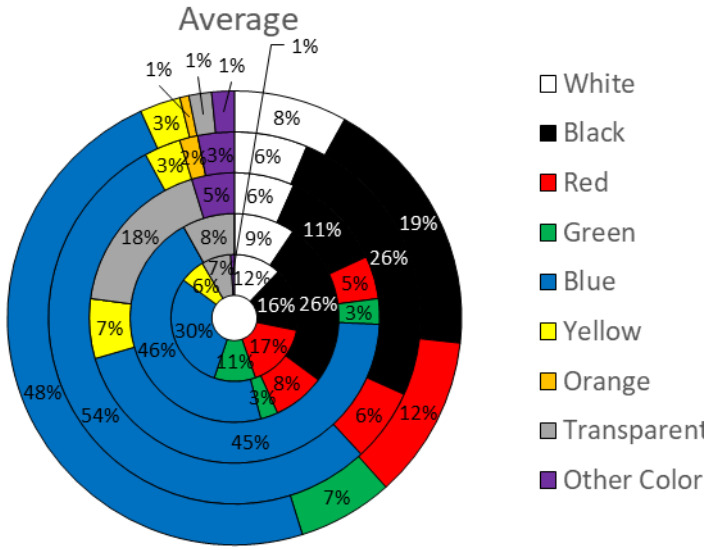
CHARACTERISATION OF MICROPLASTICS FOUND IN AN URBAN RIVER IN THE PHILIPPINES



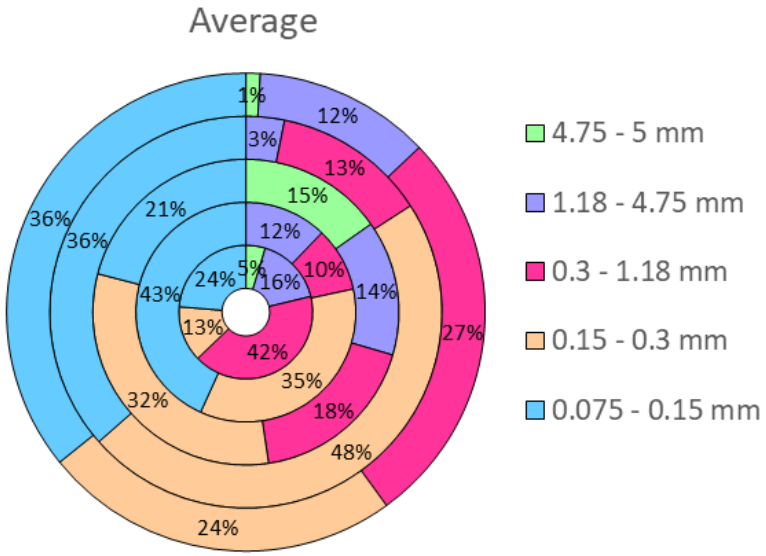
Distribution of microplastics according to **Shape** (AMH and IGES, 2022)



Distribution of microplastics according to **Polymer Type** (AMH and IGES, 2022)



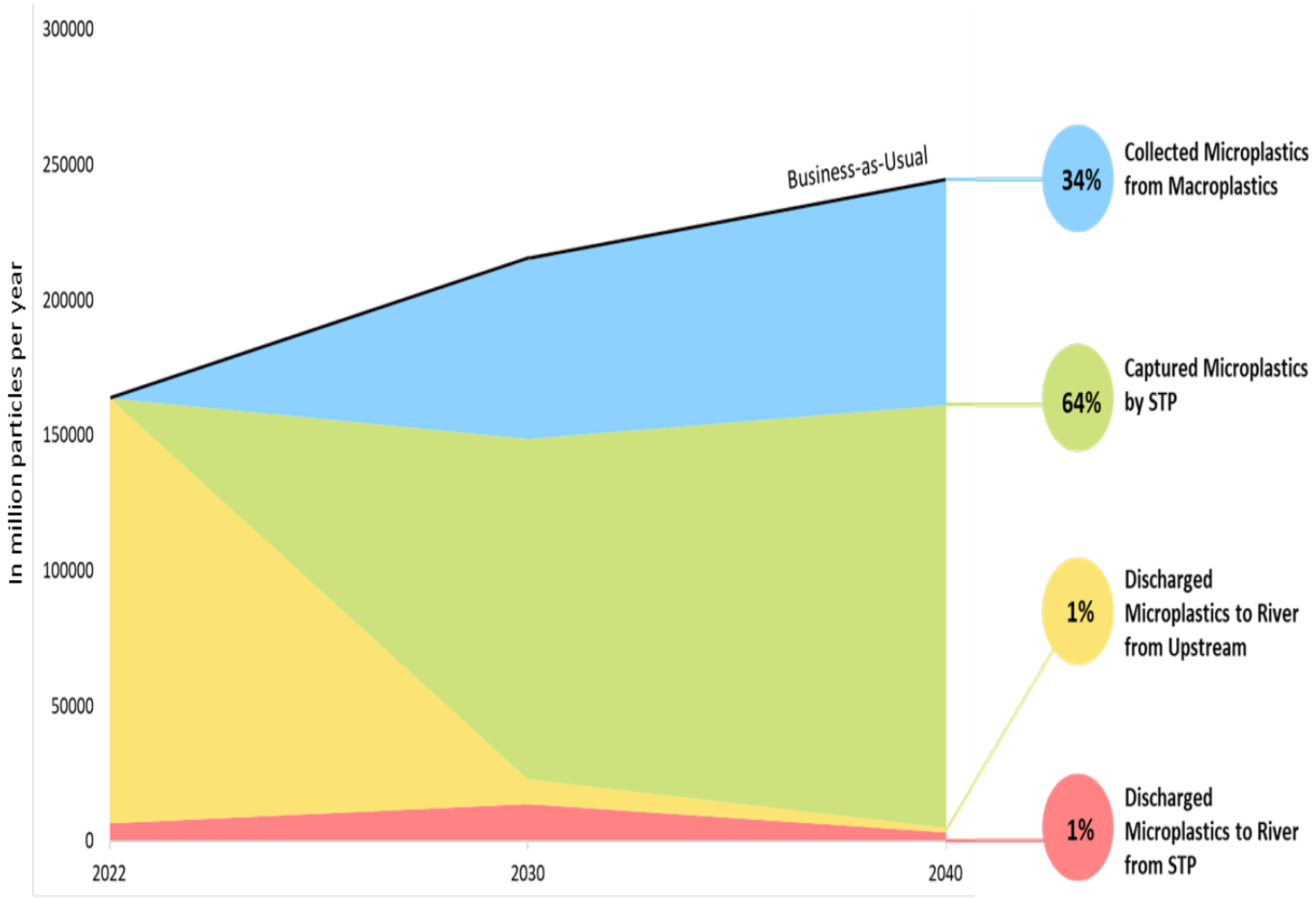
Distribution of microplastics according to **Color** (AMH and IGES, 2022)



Distribution of microplastics according to **Size** (AMH and IGES, 2022)

- This polymer type is the most extensively used plastics and most widely produced polymer around the world. PP is primarily used as rigid plastic tools and furnishings, such as sportswear, textile floor coverings, carpets, pipes, fishing tools and fishing nets

- The dominating occurrence of fragments and PP may originate from the degraded larger plastics that are mismanaged and leaked to the environment.



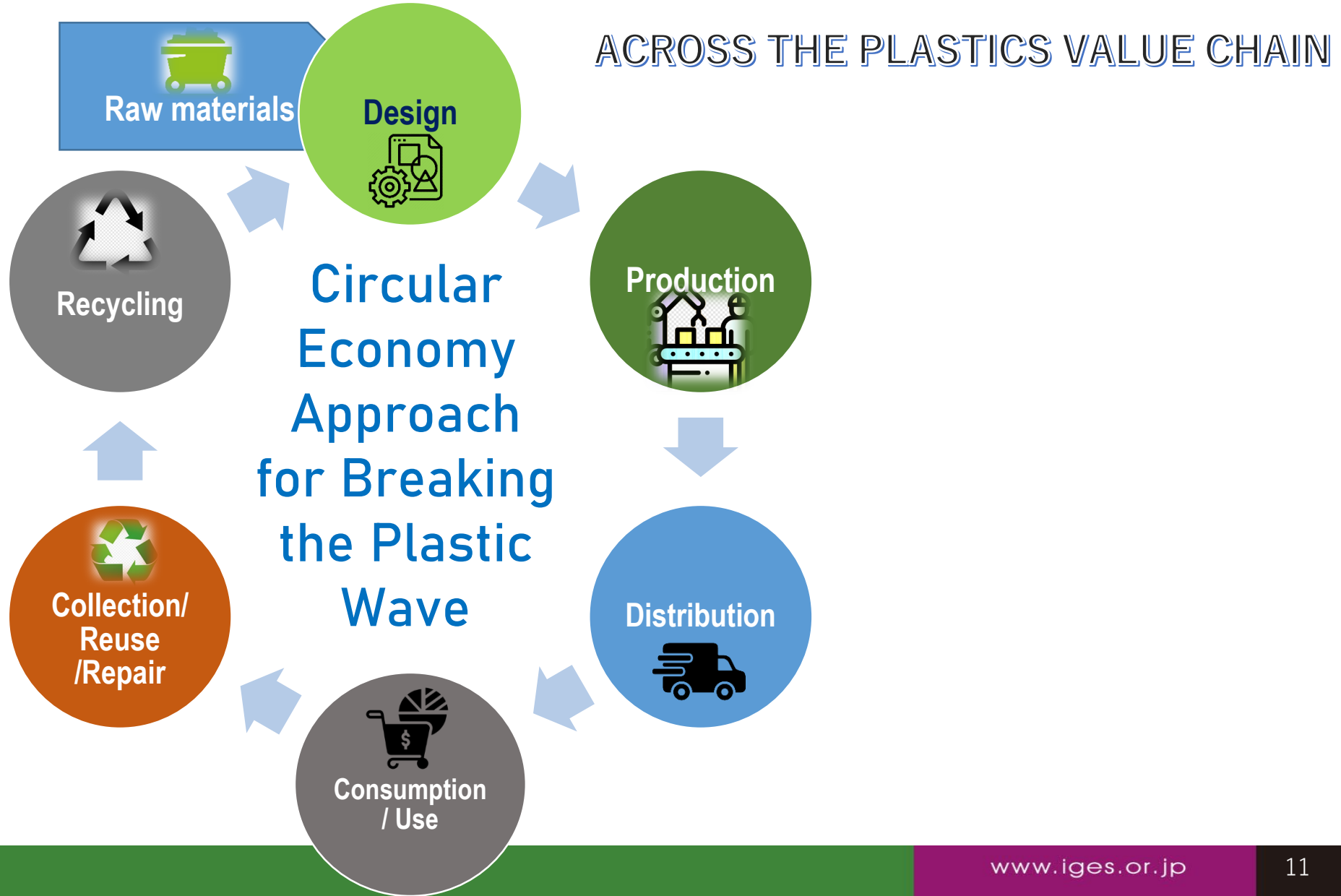
Microplastic fate in the Integrated System Change Scenario

- The **ideal scenario** is to have **a combined increase in waste collection and service coverage** up to 100%, and efficiency of the STP up to 98%. Under this scenario, the total **microplastic emissions to the downstream can be reduced up to 98%** from the estimated 448 million particles/day in the BAU case to 11 million particles/day.

- If these interventions together with recommended mitigation measures on both technical and policy aspects are being fully implemented by 2040 which is also the target year of National Plan of Action for the Prevention, Reduction, and Management of Marine Litter (NPOA-ML), then **only about 2% of the estimated microplastics on BAU scenario will be discharged to the river basin.**

(Source: AMH and IGES, 2022)

CIRCULAR PLASTIC ECONOMY APPROACH FOR CLOSING THE LOOP



SCIENTIFIC-BASED EVIDENCES FOR POLICYMAKING IN ADDRESSING MICROPLASTICS POLLUTION IN THE PHILIPPINES

1. Integration of **plastics and microplastics management** to existing laws, policies and regulations
2. **Stricter enforcement and implementation** of plastic bans and regulations
3. **Scientific-based evidences to facilitate policy/decision making process in addressing plastic pollution**
4. Introduce an appropriate policy approach of **Extended Producer Responsibility** to mitigate plastic pollution, especially in aquatic environments.

5. Properly manage plastic waste to avoid leakage into the water environment by **improving municipal solid waste collection, treatment and management services**
6. Construction of centralized **Materials Recovery Facilities (MRFs)**
7. Reduce the use of **single-use plastic products** and replace them with alternative products

8. Improve **Design of Plastic and Plastic Packaging Products**

9. **Monitoring of Plastic Leakage and Pollution**
10. Conduct of **Capacity Building Training**
11. Conduct of **Information, Education and Communications (IEC) Activities**
12. Conduct of **Clean-Up Drives**

THANK YOU SO MUCH FOR YOUR KIND ATTENTION!

For further information, please contact us at:
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