

# The threat of plastic to the future sustainability of the food system in Southeast Asia, the world's largest archipelagic region

International Symposium “ Marine Plastic Debris and its Countermeasures in Asia:  
Impact on Ecosystems and International Cooperation”

- 6 February 2023 -

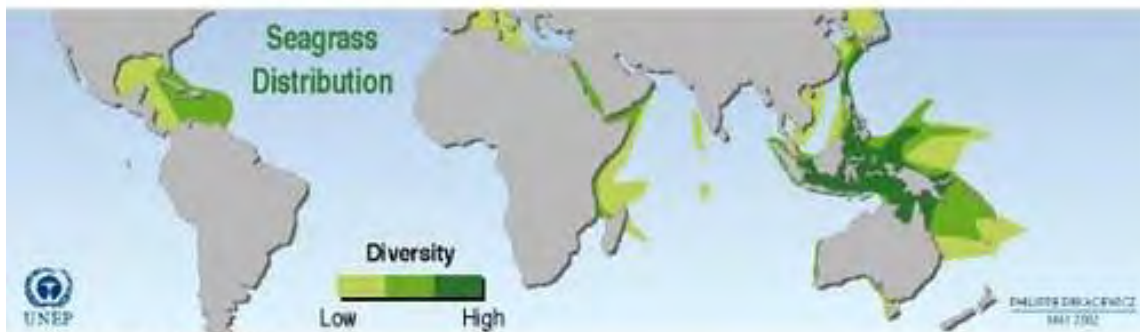
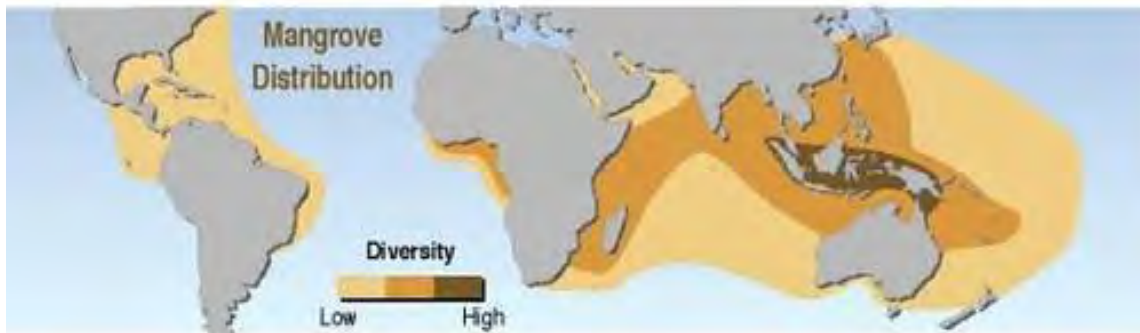
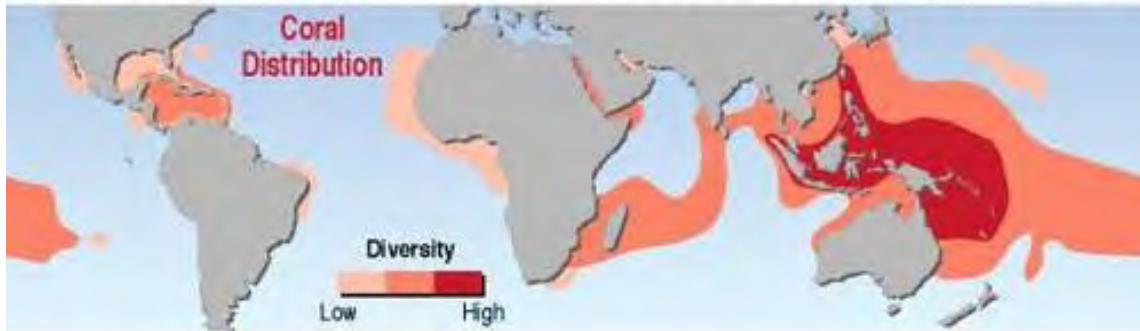


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# Southeast Asia: the world's largest archipelagic region

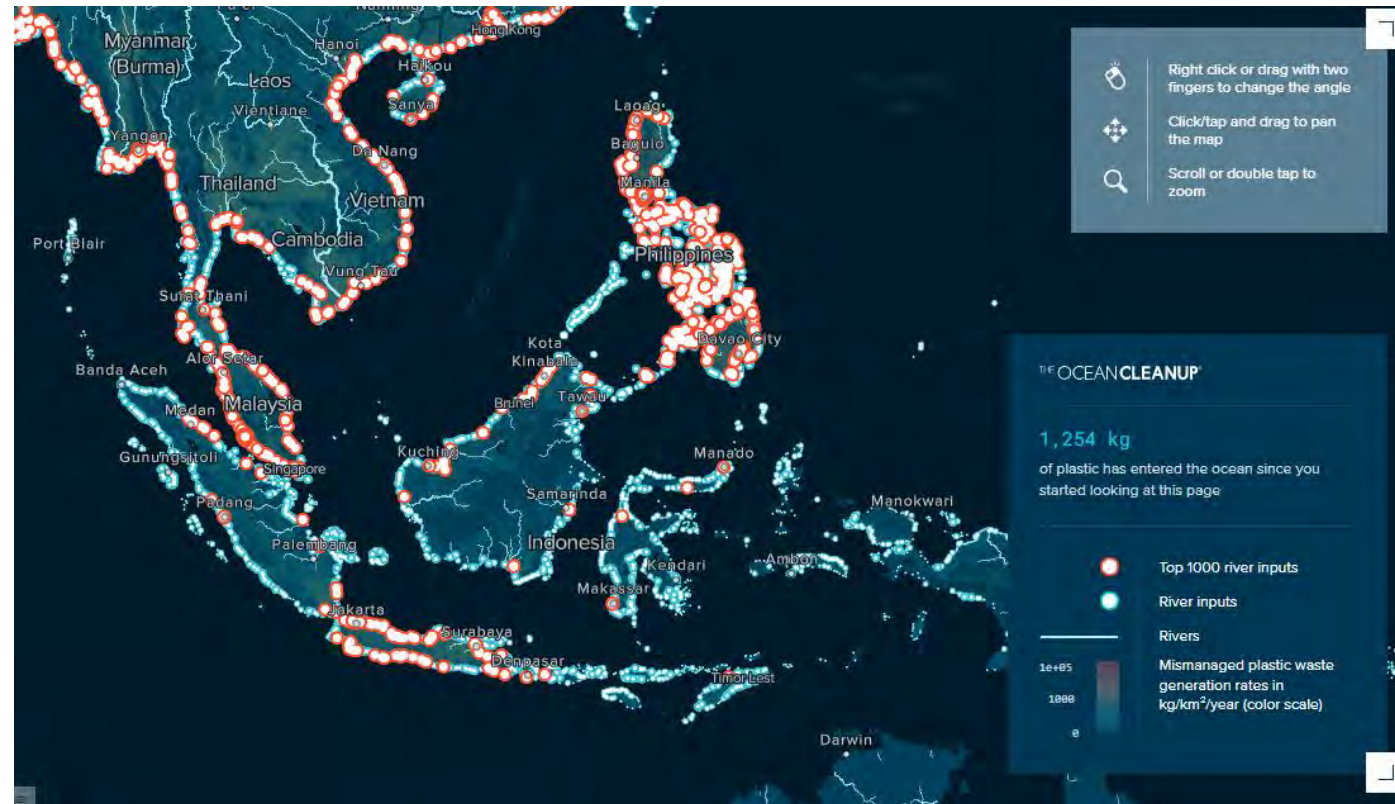
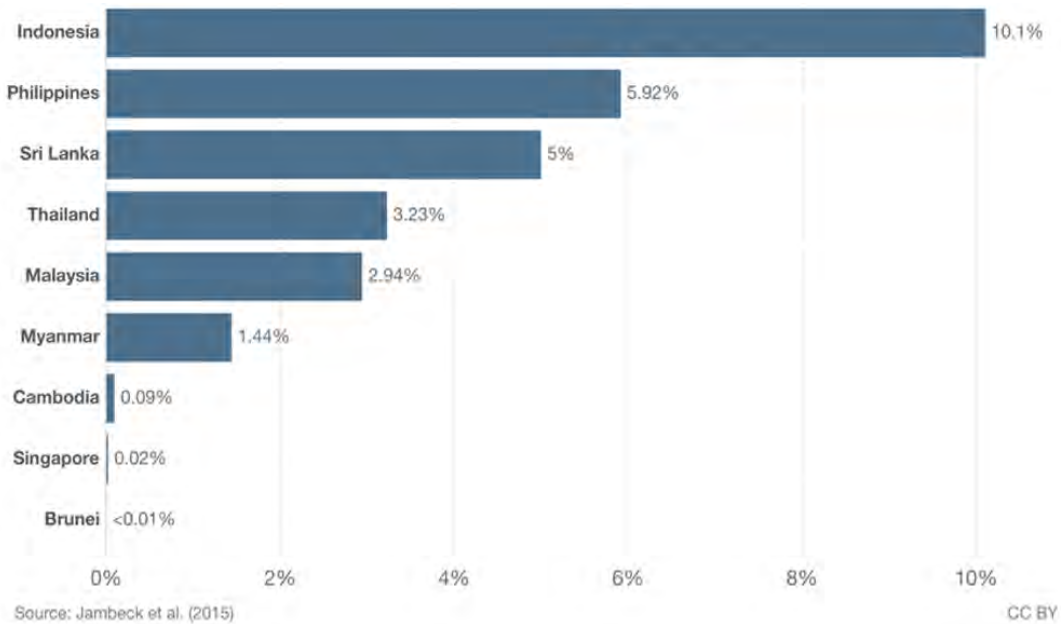
## Global Distribution of Coral, Mangrove and Seagrass Diversity



Source : UNEP-WCMC, 2001.

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# Plastic Pollution and Consequences

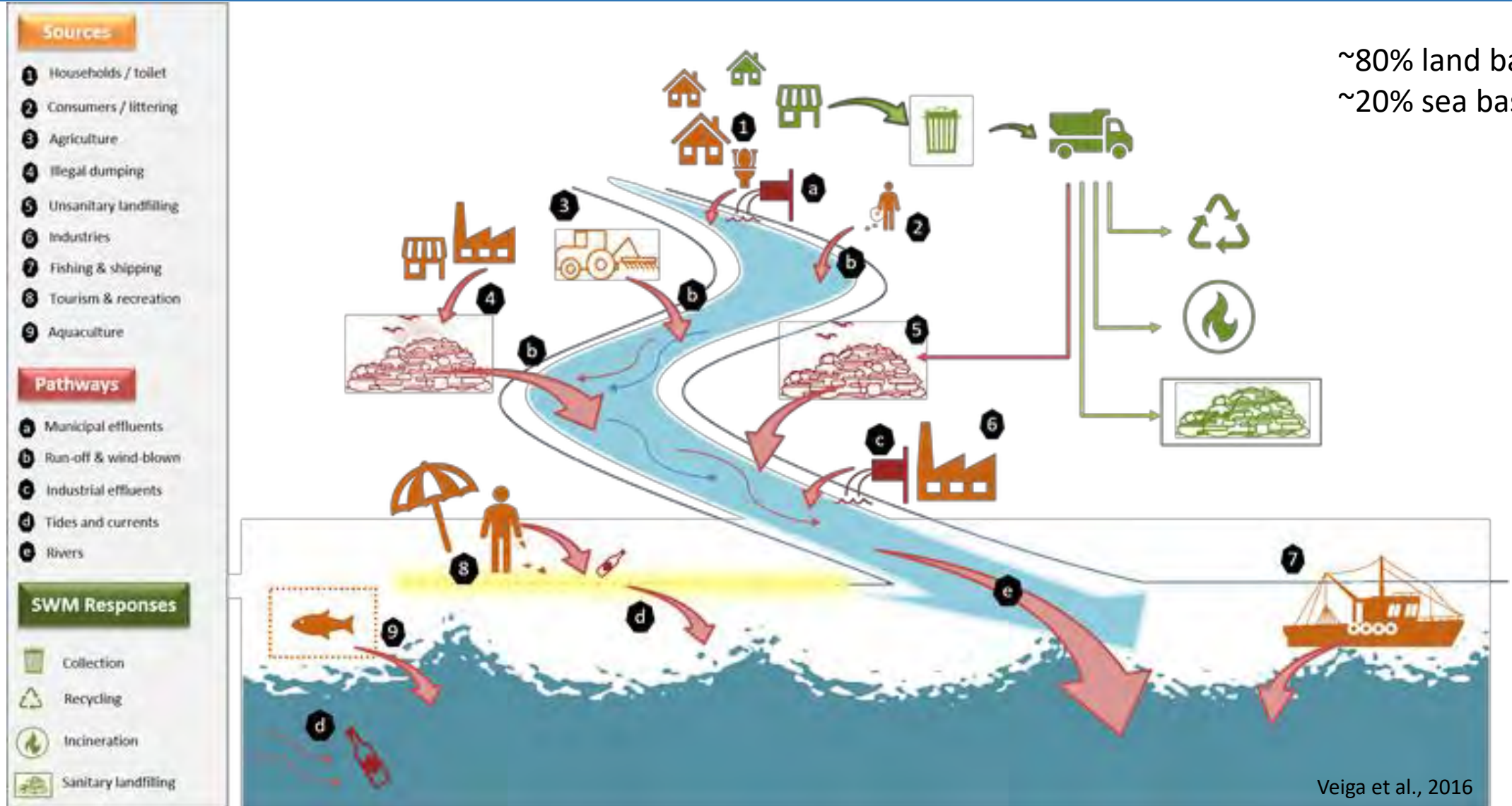


<https://theoceancleanup.com/sources/>

# Plastic Pollution and Consequences

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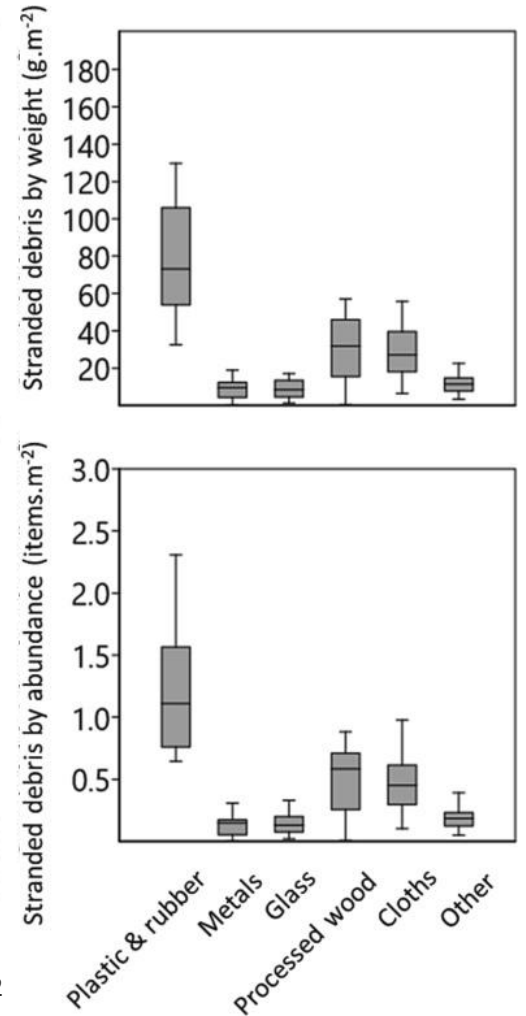
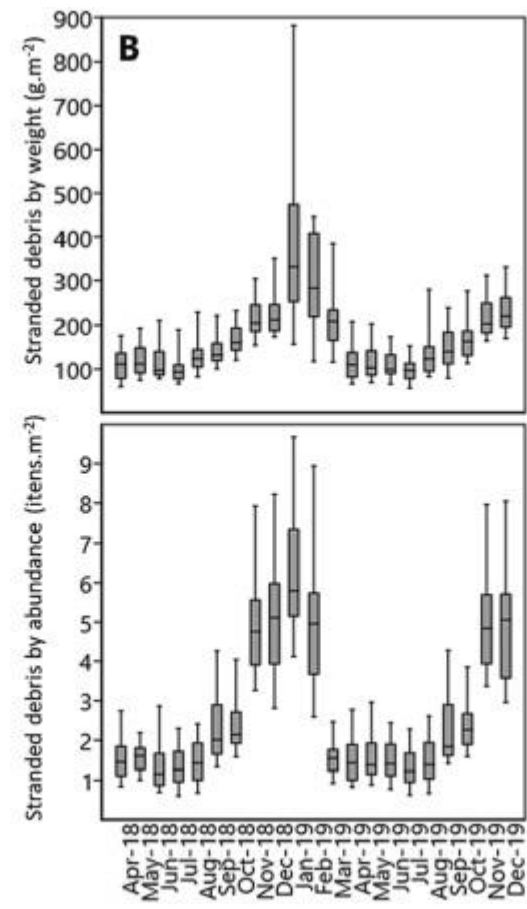
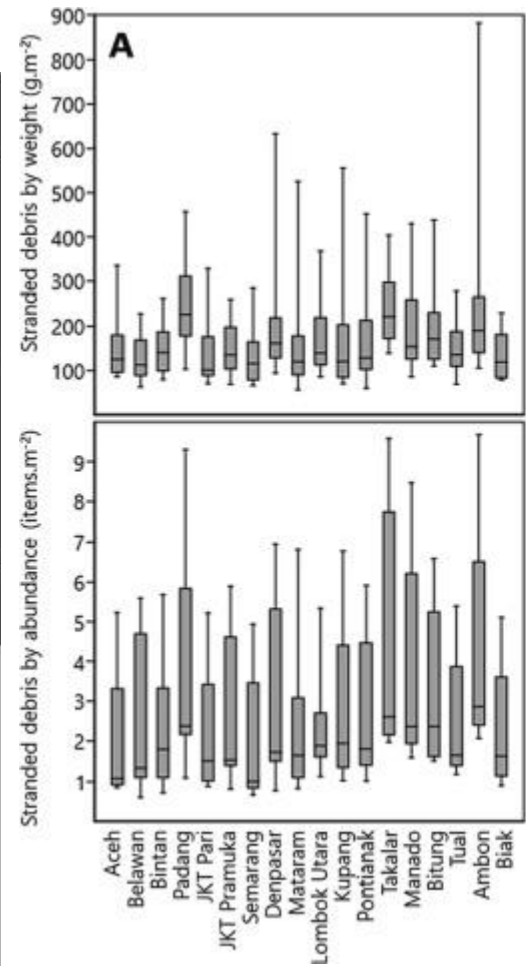
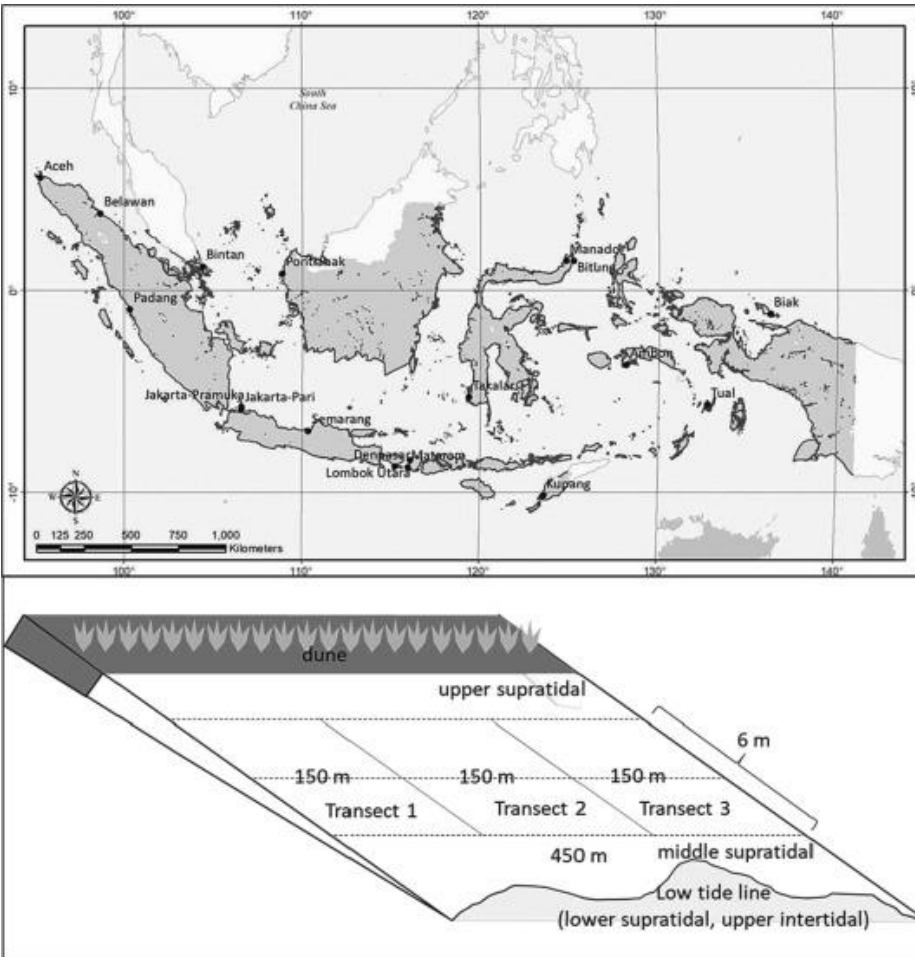
# Plastic Pollution and Consequences



Key sources (orange) and pathways (red) of marine litter, as well as solid waste management (SWM) responses (green).

Credits: Joana Mira Veiga, Deltares. (<https://water.europa.eu/marine/state-of-europe-seas/pressures-impacts/marine-litter>)

# Stranded beach litter



Average:  $166.09 \pm 75.55 \text{ g m}^{-2}$  and  $2.69 \pm 1.31 \text{ items m}^{-2}$

Cordova et al (2022)  
<https://www.sciencedirect.com/science/article/pii/S0025326X22007172>

# Stranded beach litter

Top-10 stranded macroplastic debris in general and in each location.

Area	Top-10 plastic debris category									
	1	2	3	4	5	6	7	8	9	10
All beaches	Plastic sachet/multilayer	Thin plastic wrap/bag	Plastic bottles	Straw, cotton buds, pieces	Plastic cup	Styrofoam packaging	Thick plastic wrap, sack	Cigarettes filter butts	Rope, fishing line, fishing rod, plastic rope/small net pieces	Shoes, sandals, gloves
% share Aceh	12.15 Plastic bottles	11.96 Plastic cup	11.42 Cigarettes filter butts	8.05 Plastic sachet/multilayer	7.64 Styrofoam packaging	6.99 Straw, cotton buds, pieces	6.81 Rope, fishing line, fishing rod, plastic rope/small net pieces	6.47 Diapers, sanitary and period products	4.78 Food boxes, plastic utensil	3.15 Wrap cosmetics, toiletries, etc.
% share Belawan	13.59 Plastic sachet/multilayer	13.22 Thin plastic wrap/bag	12.30 Plastic bottles	9.87 Styrofoam packaging	8.29 Shoes, sandals, gloves	7.01 Plastic cup	6.15 Straw, cotton buds, pieces	5.86 Rope, fishing line, fishing rod, plastic rope/small net pieces	4.15 Plastic cable, Pipe, hoses, pieces	2.57 Diapers, sanitary and period products
% share Bintan	20.77 Thin plastic wrap/bag	15.02 Plastic sachet/multilayer	13.09 Plastic bottles	9.26 Thick plastic wrap, sack	5.88 Straw, cotton buds, pieces	5.13 Plastic cup	4.88 Shoes, sandals, gloves	3.88 Diapers, sanitary and period products	3.38 Food boxes, plastic utensil	2.51 Cigarettes filter butts
% share Padang	14.60 Plastic bottles	14.43 Thin plastic wrap/bag	12.68 Plastic sachet/multilayer	12.43 Cigarettes filter butts	10.63 Plastic cup	9.26 Rope, fishing line, fishing rod, plastic rope/small net pieces	5.74 Thick plastic wrap, sack	3.04 Straw, cotton buds, pieces	2.65 Styrofoam packaging	2.40 Plastic cable, Pipe, hoses, pieces
% share JKT Pari	12.54 Plastic sachet/multilayer	12.35 Styrofoam packaging	10.65 Thin plastic wrap/bag	9.87 Plastic cup	7.66 Plastic bottles	7.64 Straw, cotton buds, pieces	7.55 Shoes, sandals, gloves	7.53 Cigarettes filter butts	7.33 Thick plastic wrap, sac	2.25 Rope, fishing line, fishing rod, plastic rope/small net pieces
% share JKT Pramuka	14.24 Styrofoam packaging	14.00 Plastic sachet/multilayer	13.09 Thin plastic wrap/bag	13.04 Straw, cotton buds, pieces	7.64 Plastic cup	6.17 Shoes, sandals, gloves	5.46 Thick plastic wrap, sack			

## Most frequently reported items of litter

1. Plastic sachet/multilayer
2. Thin plastic wrap/bag
3. Plastic bottles
4. Straw, cotton buds, pieces
5. Plastic cup
6. Styrofoam packaging
7. Thick plastic wrap, sack
8. Cigarettes filter butts
9. Rope, fishing line, fishing rod, plastic rope/small net pieces
10. Shoes, sandals, gloves

## Single-use plastic!!

Cordova et al (2022)

<https://www.sciencedirect.com/science/article/pii/S0025326X22007172>

# Stranded beach litter: sources?

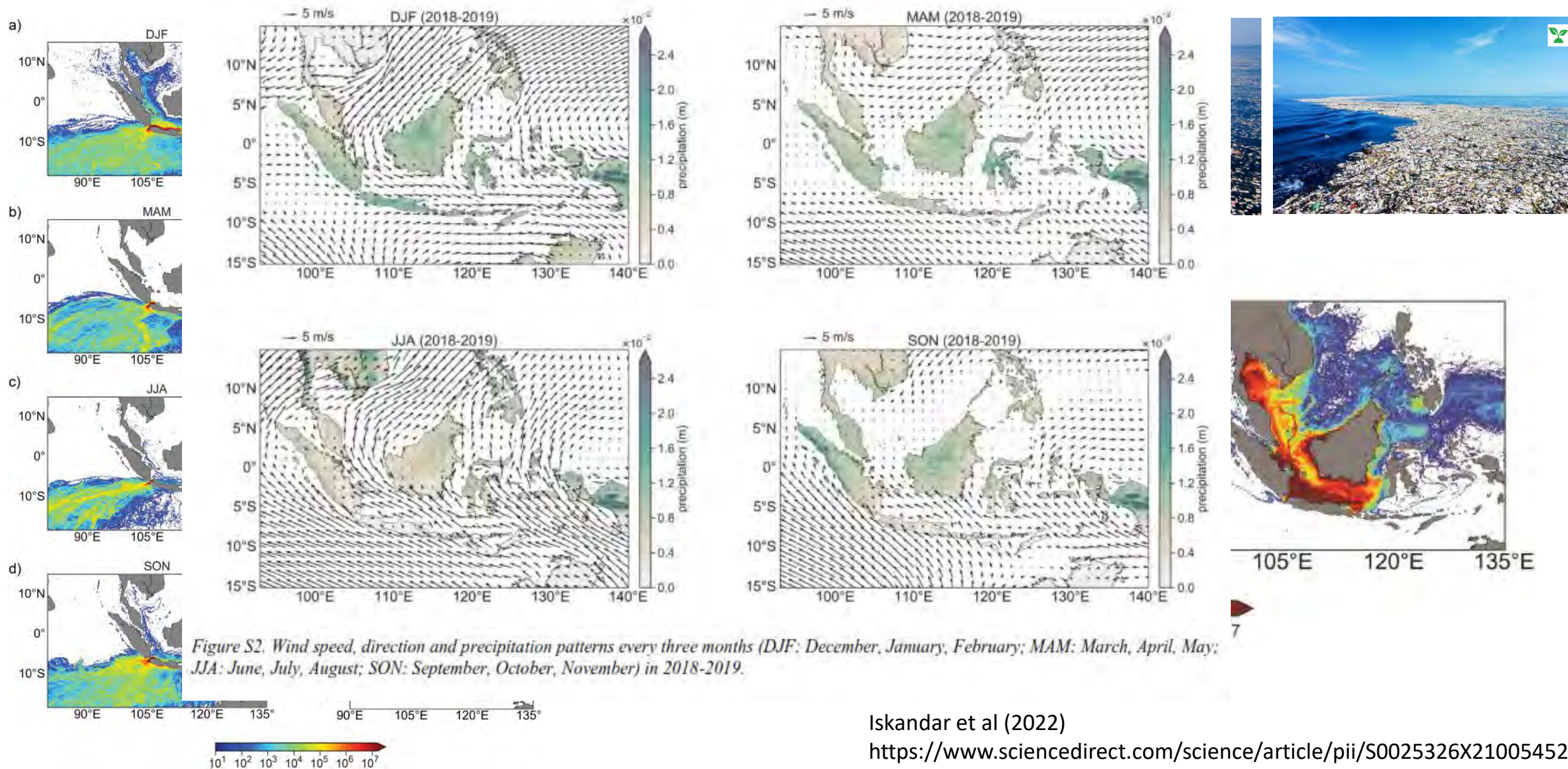


Figure S2. Wind speed, direction and precipitation patterns every three months (DJF: December, January, February; MAM: March, April, May; JJA: June, July, August; SON: September, October, November) in 2018-2019.

Iskandar et al (2022)

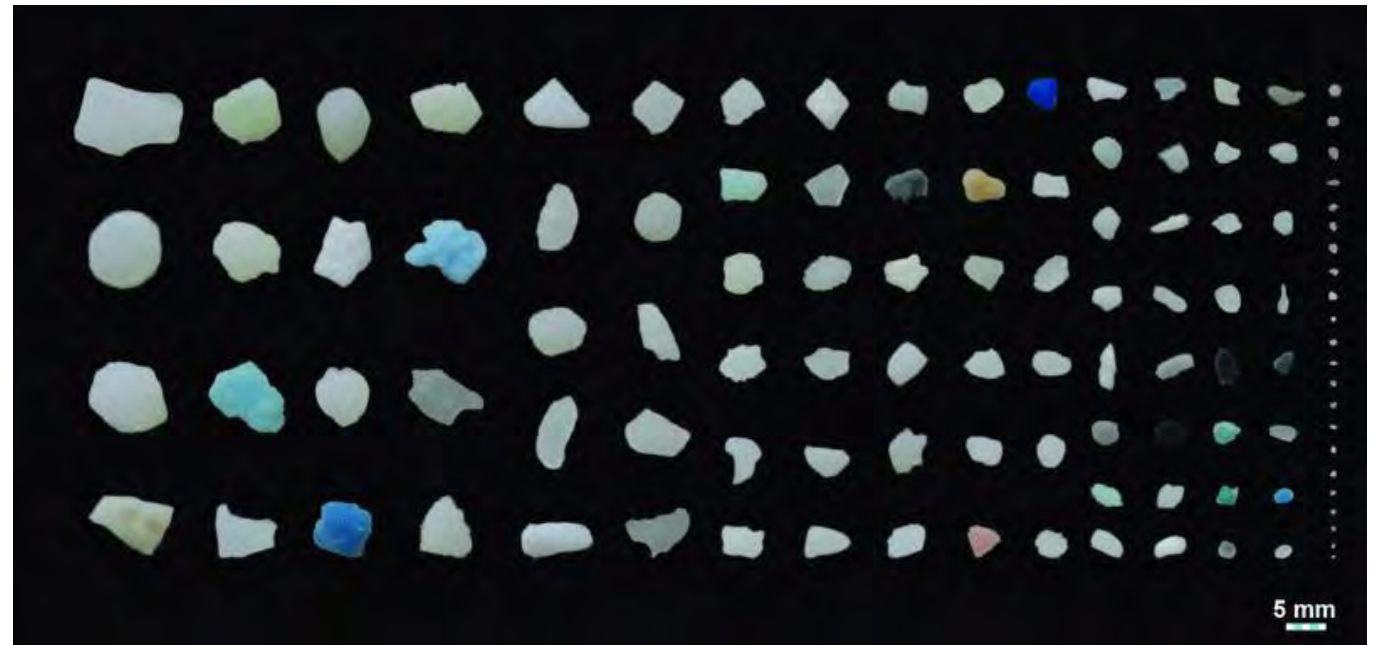
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# Plastic fragmentation

**Plastic don't break down, they break apart !**

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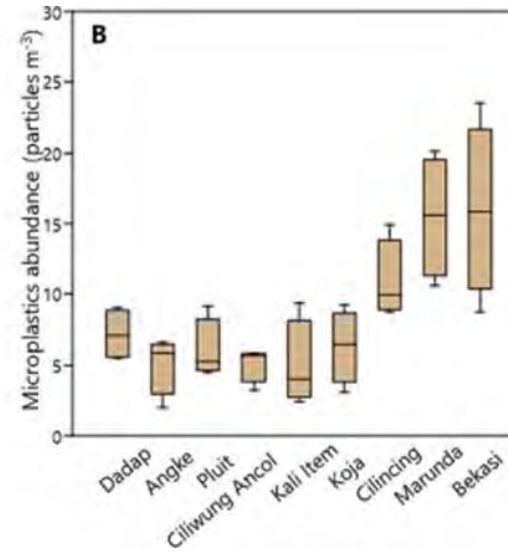
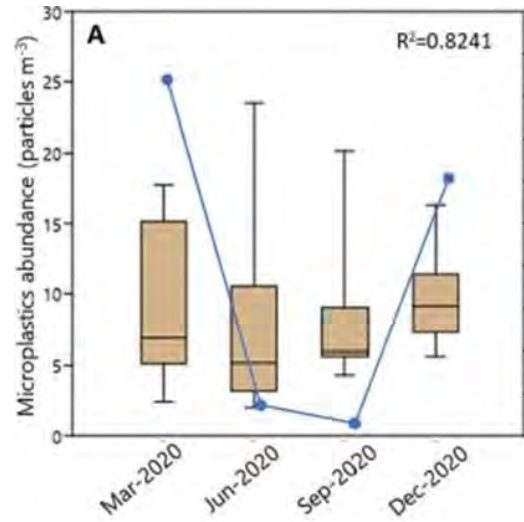
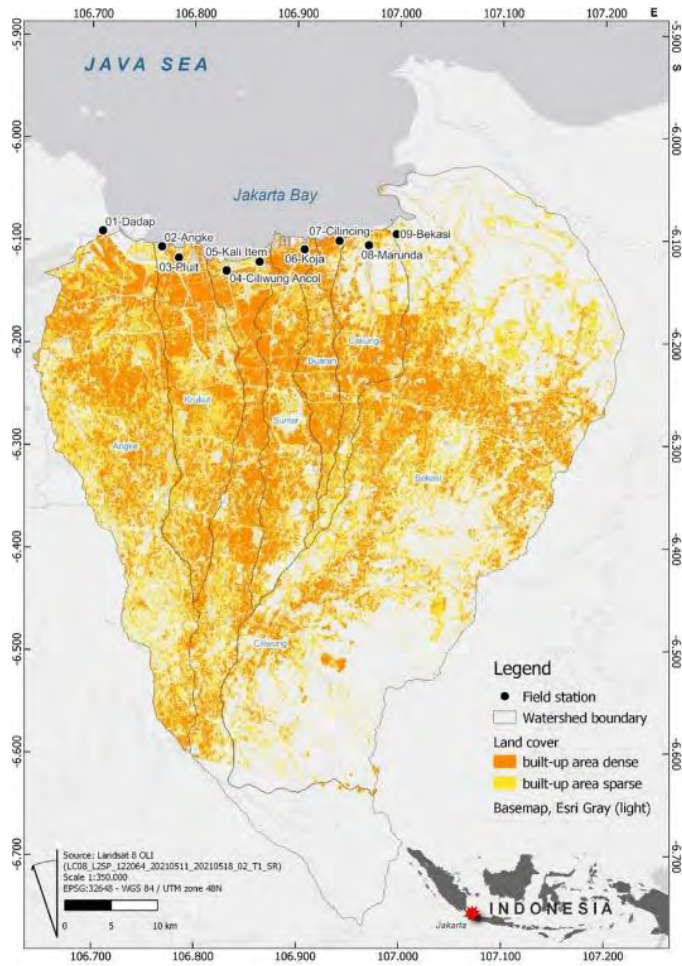


Cozar et al (2014)

<https://www.pnas.org/doi/full/10.1073/pnas.1314705111>

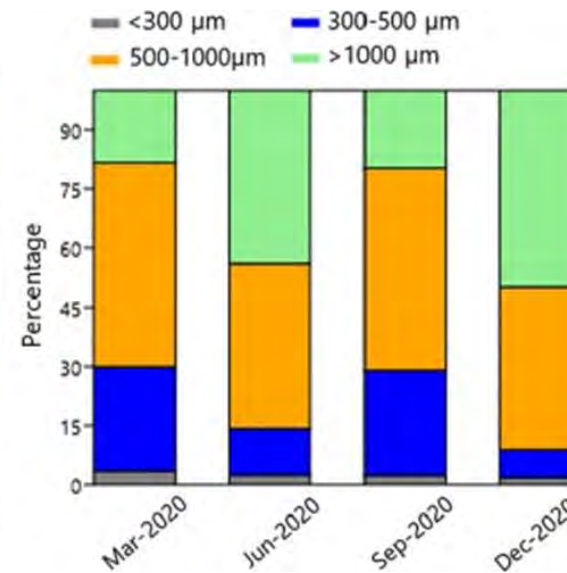
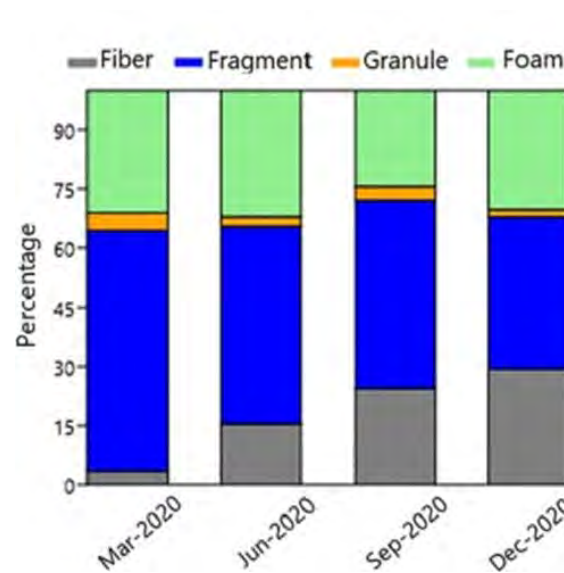
## Microplastics

# Plastic fragmentation: pandemic case study

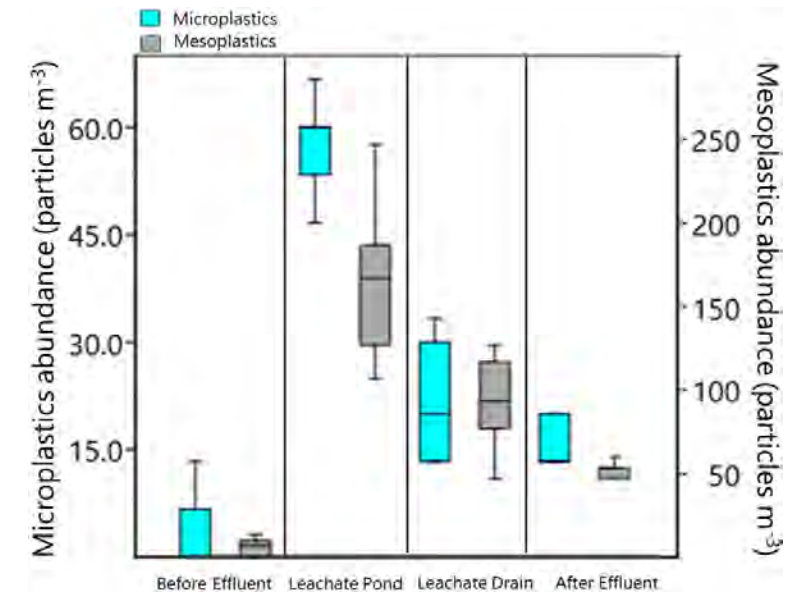


Cordova et al (2022)

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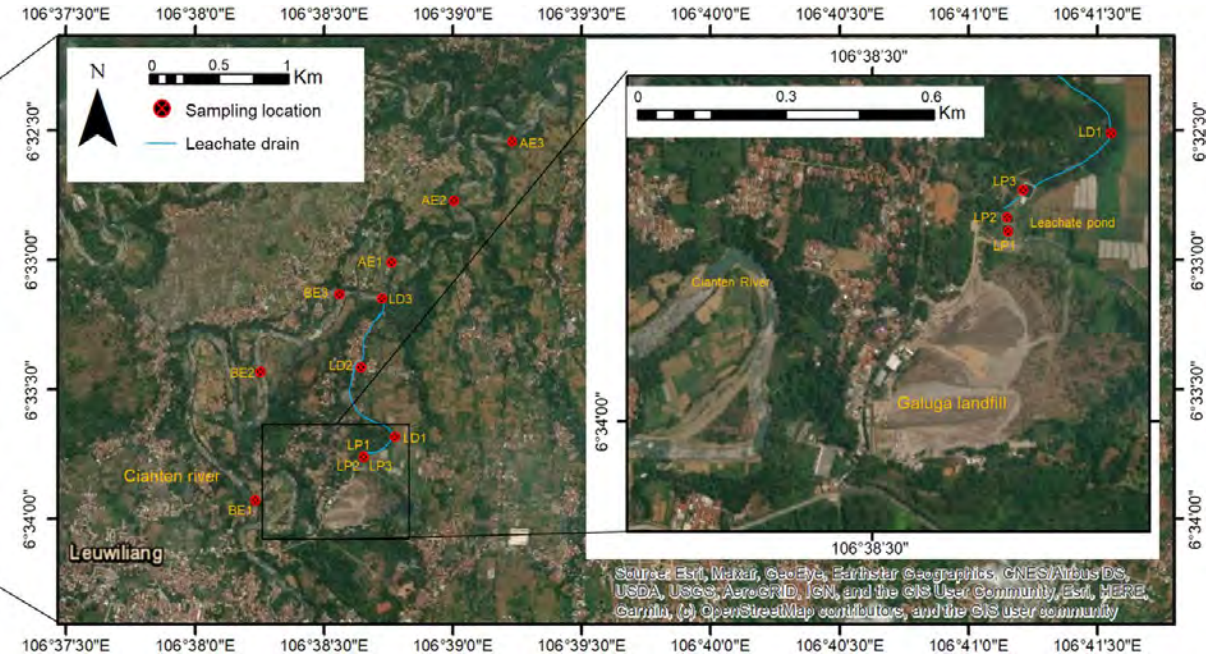


# Lesson Learn: Microplastic Pollution from Landfill Area



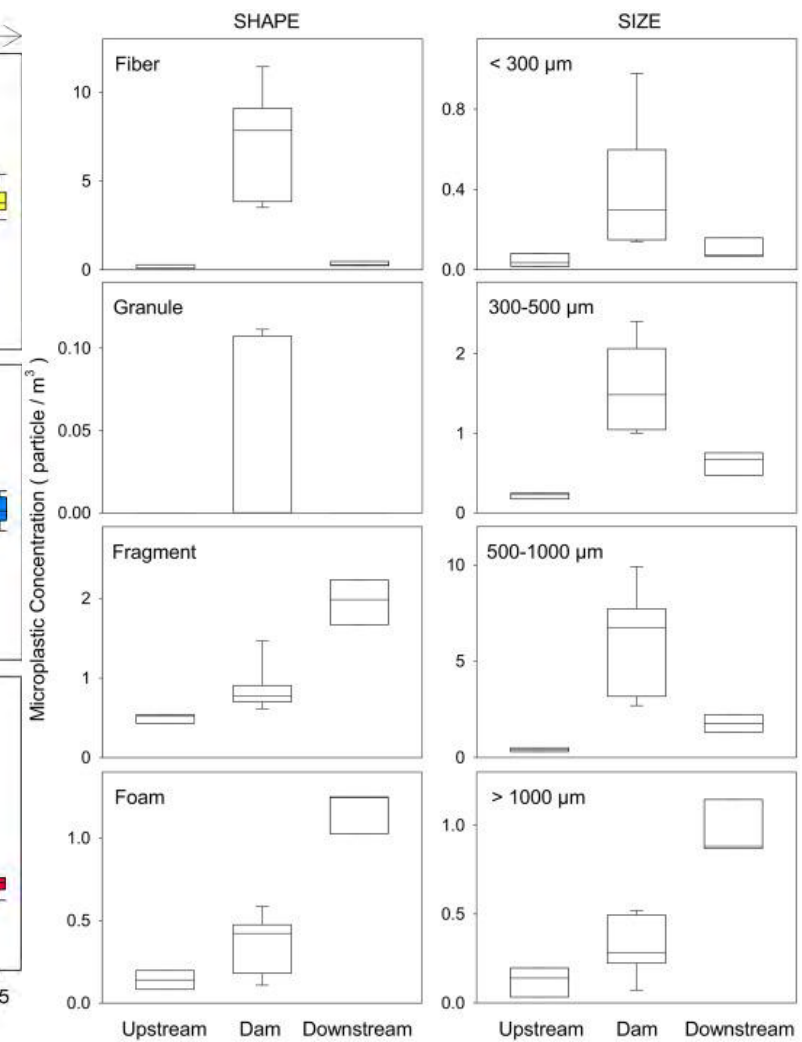
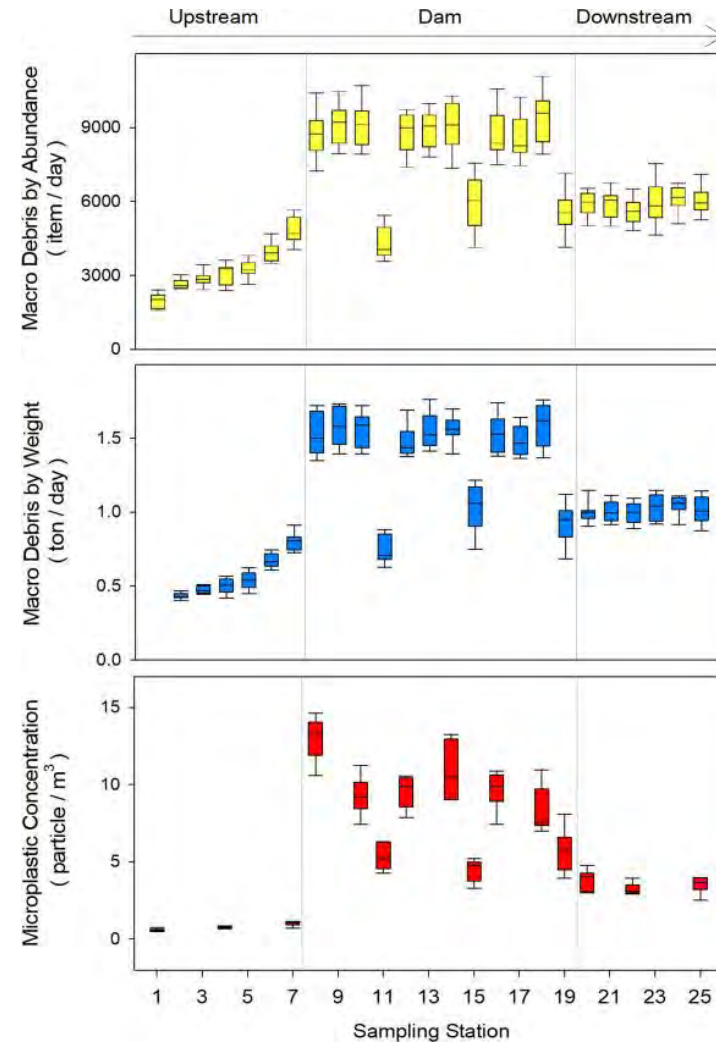
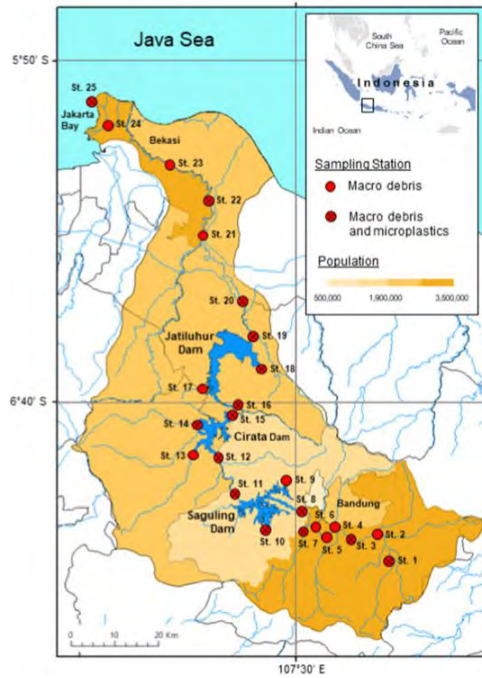
Nurhasanah et al (2021)

<https://www.sciencedirect.com/science/article/pii/S0025326X21000205>



- Micro- and mesoplastics were identified in all water samples.
- An estimated average daily release of microplastic from leachate drain at  $80640 \pm 604.80$  particles
- Daily mesoplastic release from leachate drain to the aquatic environment was estimated  $618240 \pm 1905.45$  particles
- After input from the leachate drain, the microplastic number increased threefold and nine times higher for mesoplastics
- Polyethylene, polypropylene, polystyrene was the most abundant microplastics found

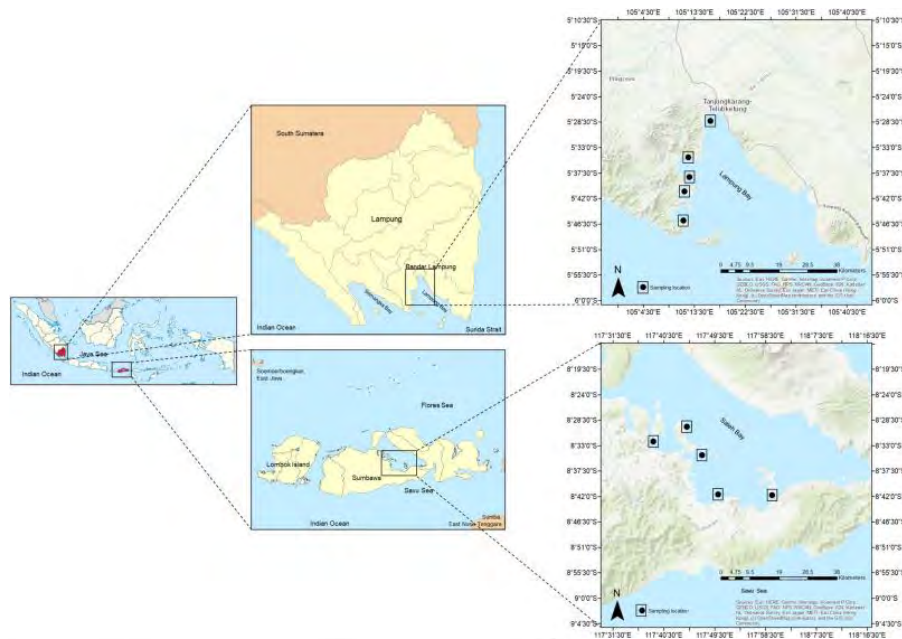
# Plastic pollution in the river



Cordova et al (2022)

<https://www.sciencedirect.com/science/article/pii/S0025326X22000200>

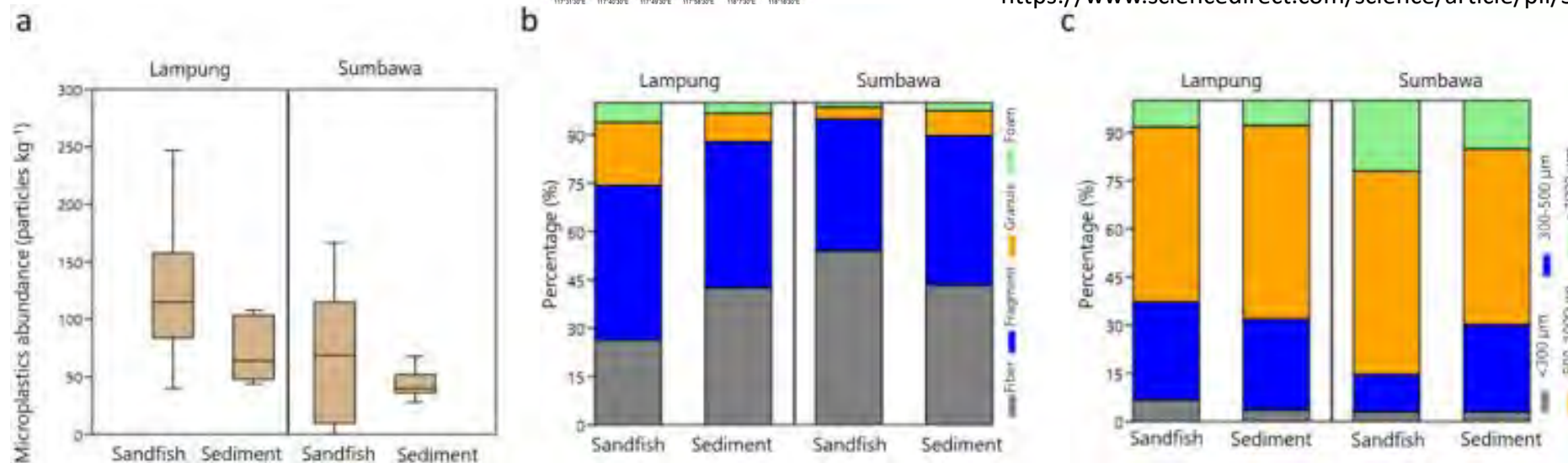
# Microplastic in sediment/soil and macrobenthic organism



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Riani and Cordova (2022)

<https://www.sciencedirect.com/science/article/pii/S0025326X21011681>



# Plastic ingested by marine organism

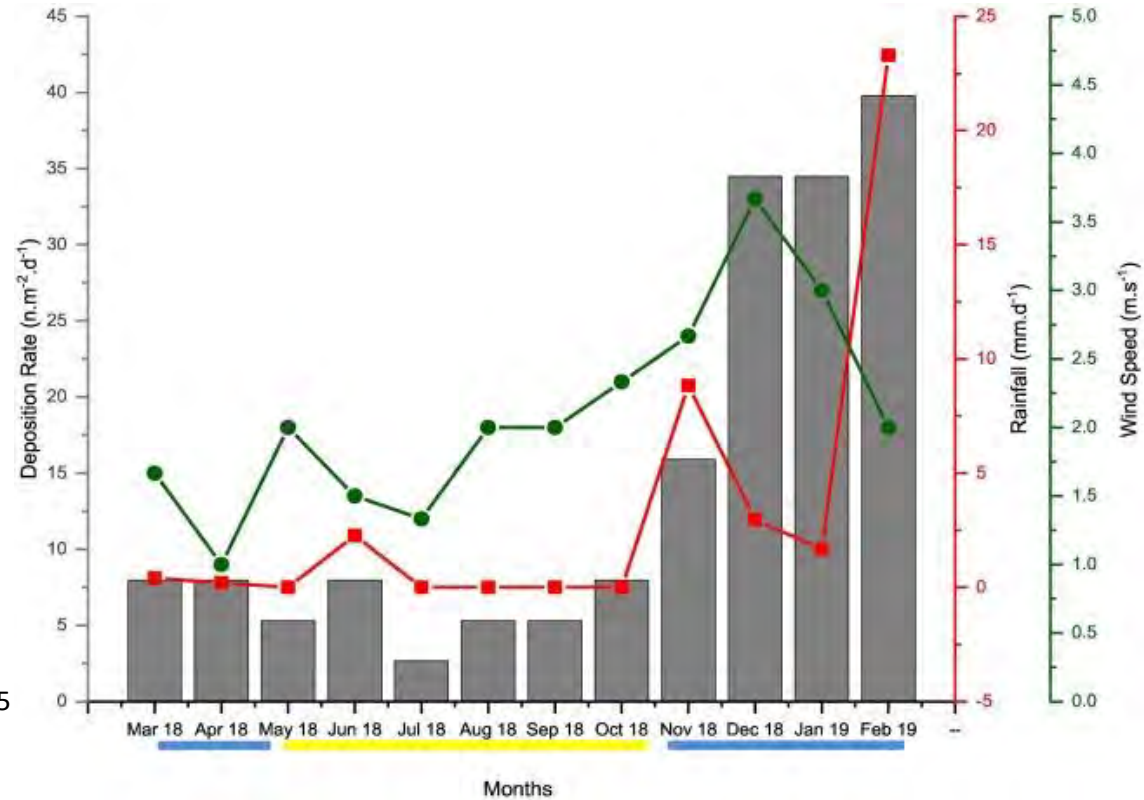


Gazelle : The Palestinian Biological Bulletin – Number 172 – April 2019



<https://news.mongabay.com/2019/11/in-indonesian-waters-filter-feeders-ingest-dozens-to-hundreds-of-microplastic-particles-every-hour/>

# Lesson Learn: Microplastic in the air

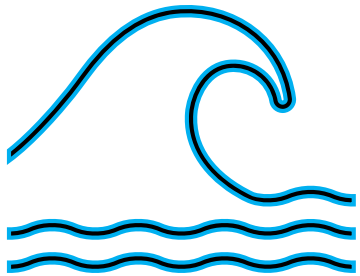


Purwiyanto (2022)  
<https://www.sciencedirect.com/science/article/pii/S0025326X21012297>

- The deposition rate of atmospheric microplastic in the rainy season 4 times fold than the dry season.
- The meteorological factors (rainfall and wind speed) significantly influenced the deposition rate.
- The atmospheric microplastic size significantly affected the deposition.
- The atmospheric microplastics in Jakarta are derived from local activity emissions.

# Plastic in all environmental matrices

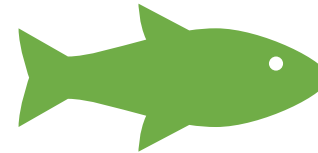
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**Water**



**Sediment/soil**



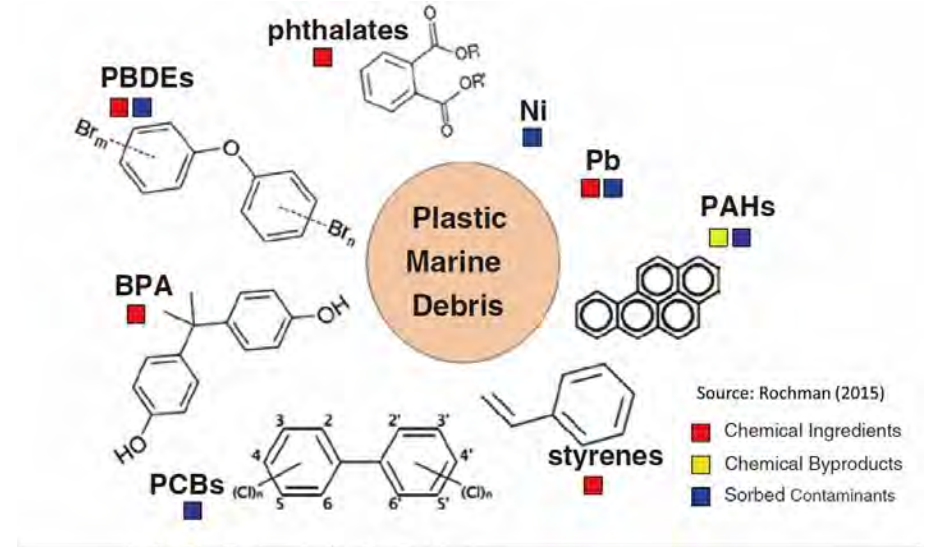
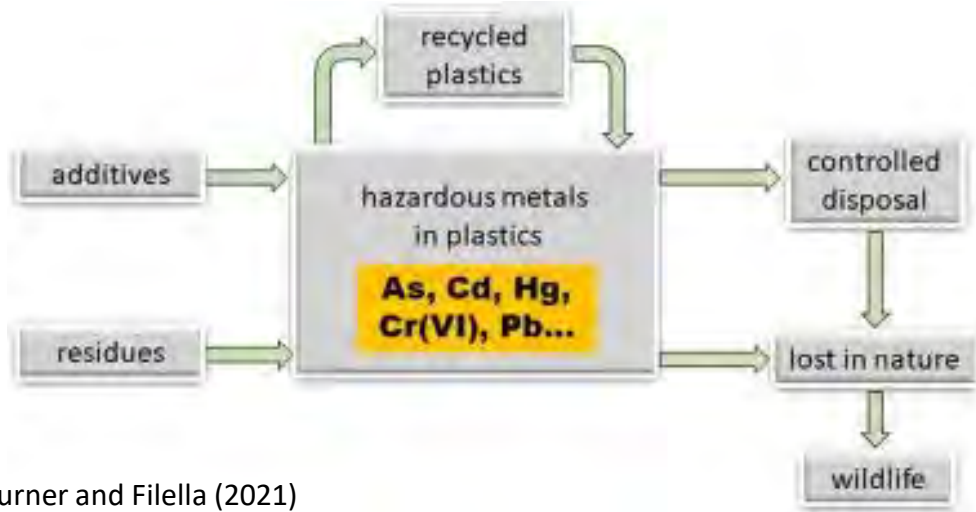
**Biological**



**Airbourne**



# Plastic ingested by marine organism



Turner and Filella (2021)

<https://www.sciencedirect.com/science/article/pii/S0160412021002476>



photo by M.R.Cordova

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# Links climate change and plastic pollution

## The fundamental links between climate change and marine plastic pollution

Ford et al., 2021

<https://www.sciencedirect.com/science/article/pii/S0048969721054693>

We have collated evidence that marine plastic pollution and climate change are linked in at least three ways:



Plastic contributes to greenhouse gas emissions throughout its life cycle



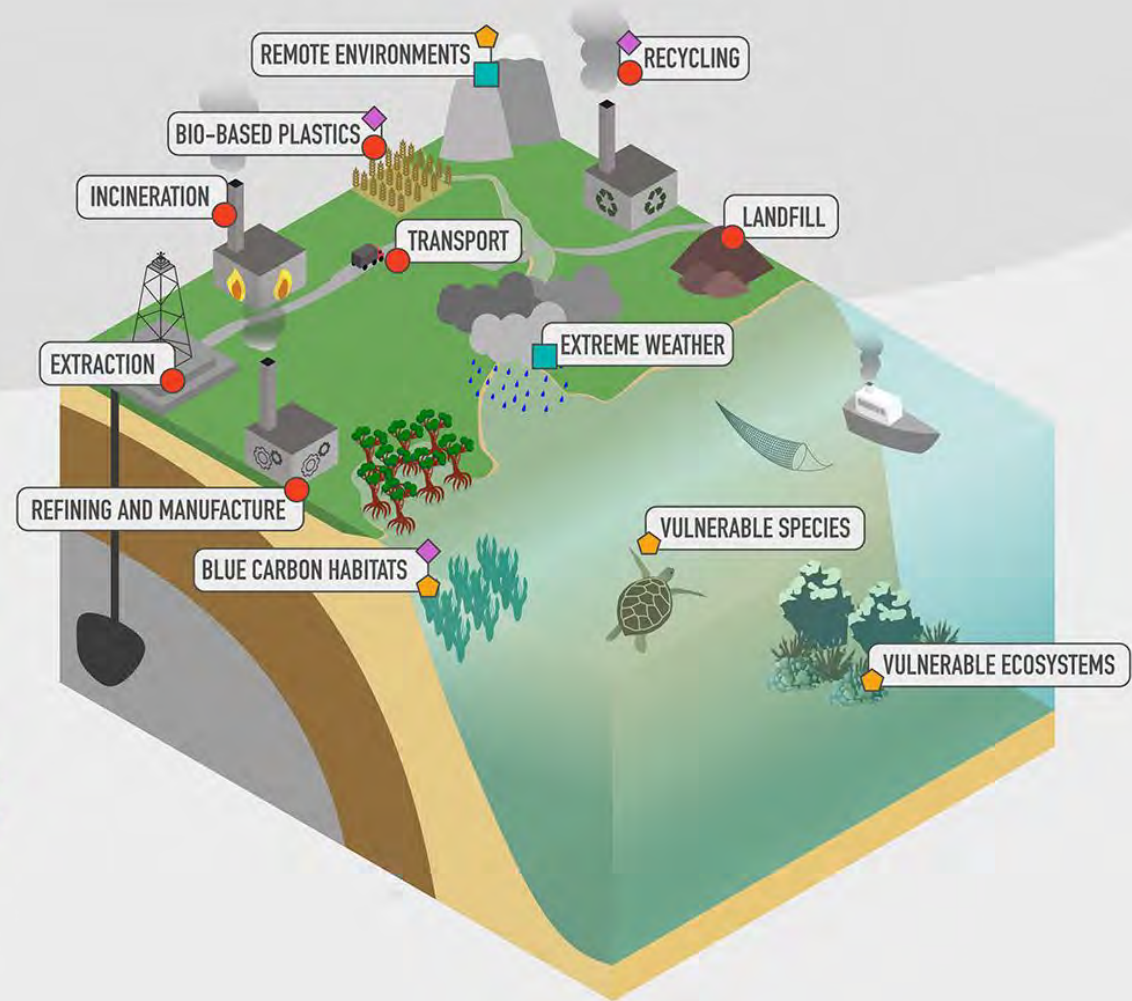
Climate change and plastic pollution co-occur throughout the environment



Climate change will exacerbate the spread of plastic pollution



There are solutions which mitigate against both climate change and plastic pollution



# Concluding remark: The future?

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## The future of food from the sea

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photo by Chandra P.Hadi

**Terima kasih – Thank you – မာနုဏဂျဉ်း –**

**ありがとうございます – شكرا لك – Danke –**

**谢谢 – धन्यवाद – ຂອບໃຈ –**

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