MICROPLASTICS

Origins, Global Impact, and Key Contributors

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Did you know that every piece of plastic ever made still exists in some form today?

Who are the major contributors to this global issue, and how are their actions impacting ecosystems and communities?

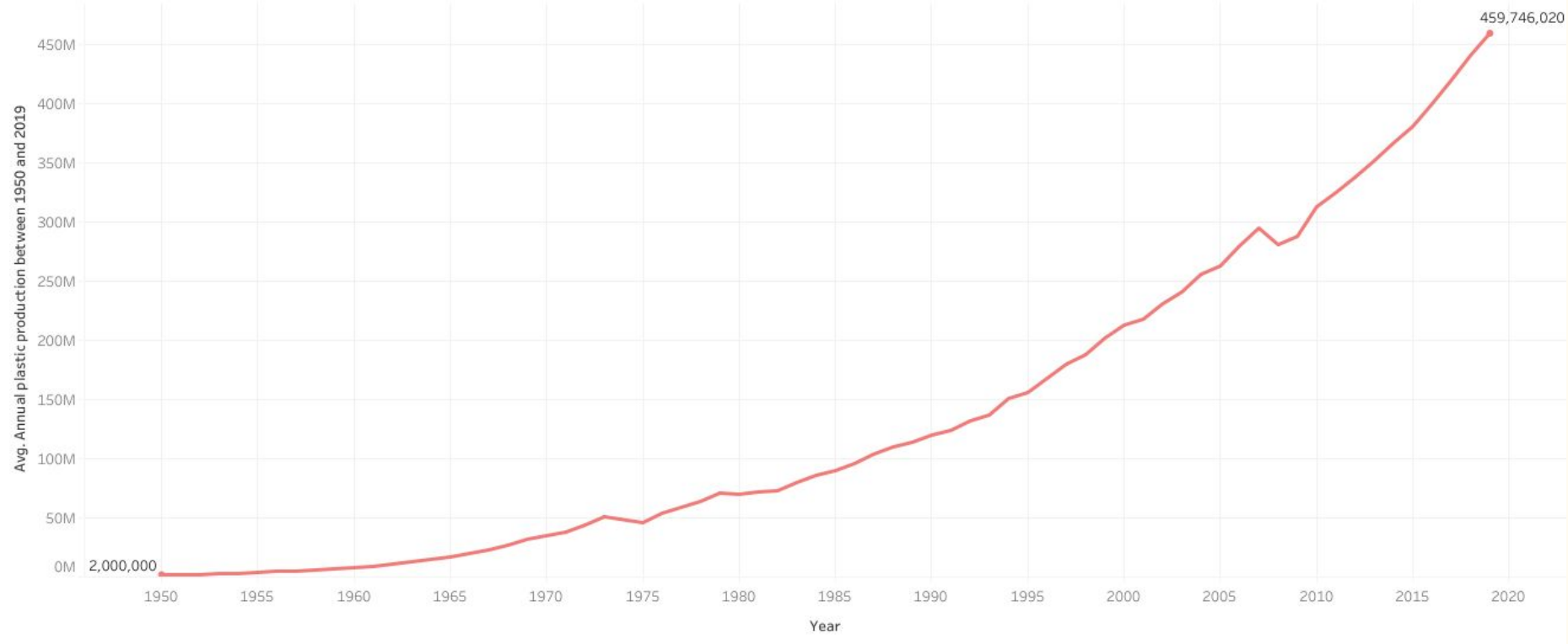

Microplastics are tiny plastic particles smaller than 5 millimeters, originating from the breakdown of larger plastics and small plastic fragments in consumer products.
MOMMYPOTAMUS.COM

Evolution and Impact of Plastic Pollution

- The late 20th century saw a **significant increase** in single-use plastics, dramatically altering consumption patterns.
- A large proportion of **microplastics end up** in the oceans, accumulating in marine environments and affecting aquatic life.
- Since the 1950s, plastic pollution has been a **growing concern**, with its impact becoming more evident over the decades.
- Microplastics, are now found in **every ocean**, impacting marine ecosystems and wildlife.

https://www.istockphoto.com/it/immagine/microplastic-ocean

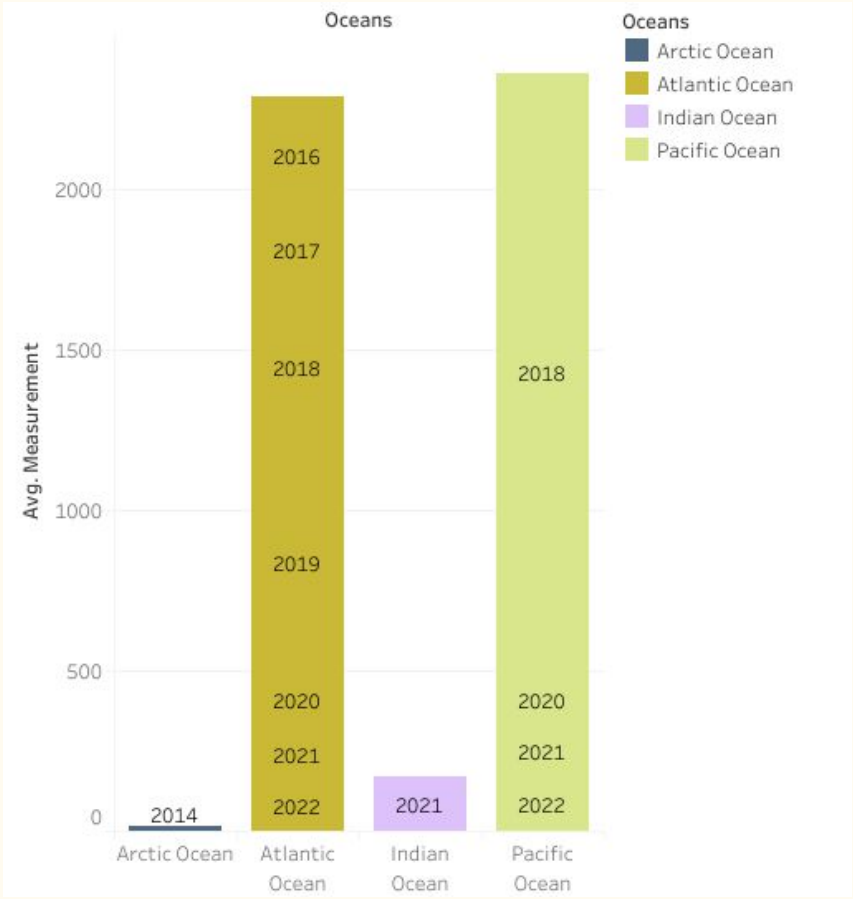
Annual Plastic Production Over Time



Microplastic Measurements for different oceans

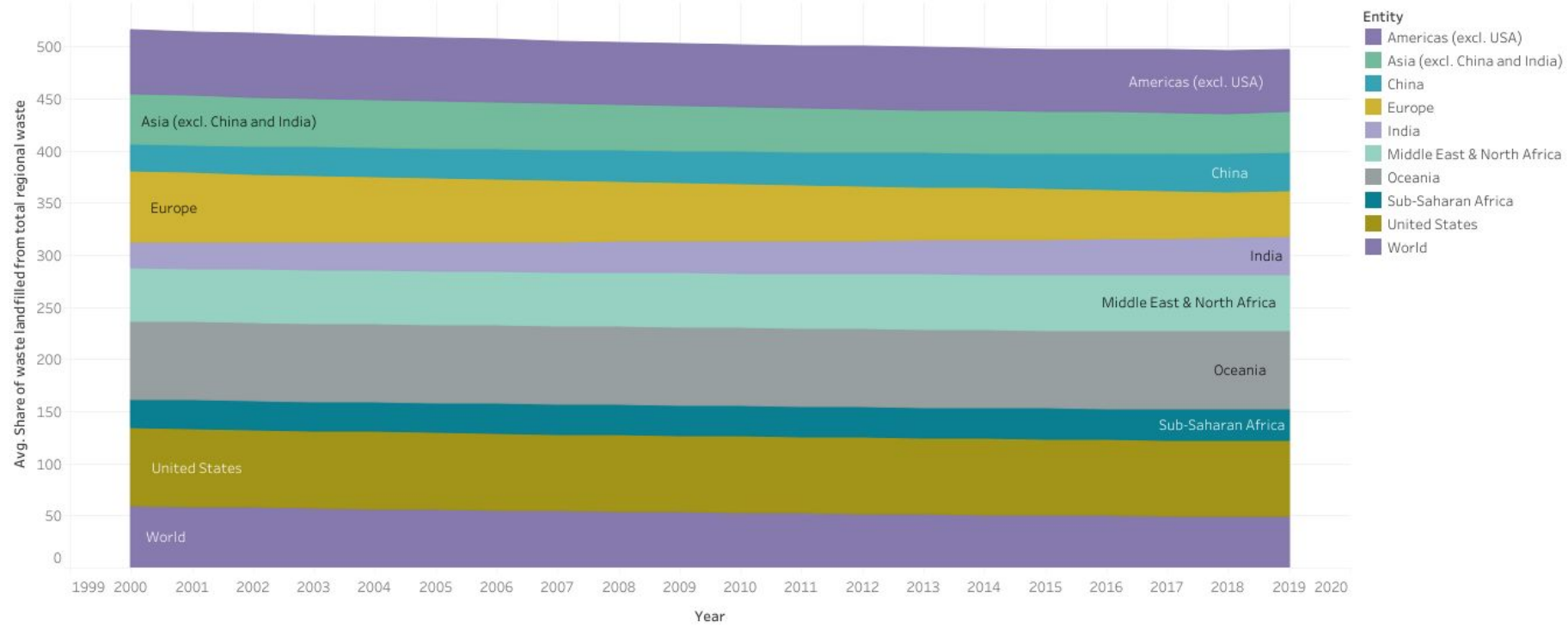
- Arctic Ocean: 9.2 microplastics per unit
- Atlantic Ocean: 178.5 microplastics per unit
- Indian Ocean: 26.6 microplastics per unit
- Pacific Ocean: 114.0 microplastics per unit

The Atlantic Ocean has the highest average microplastic measurement, indicating significant plastic pollution levels compared to other oceans.



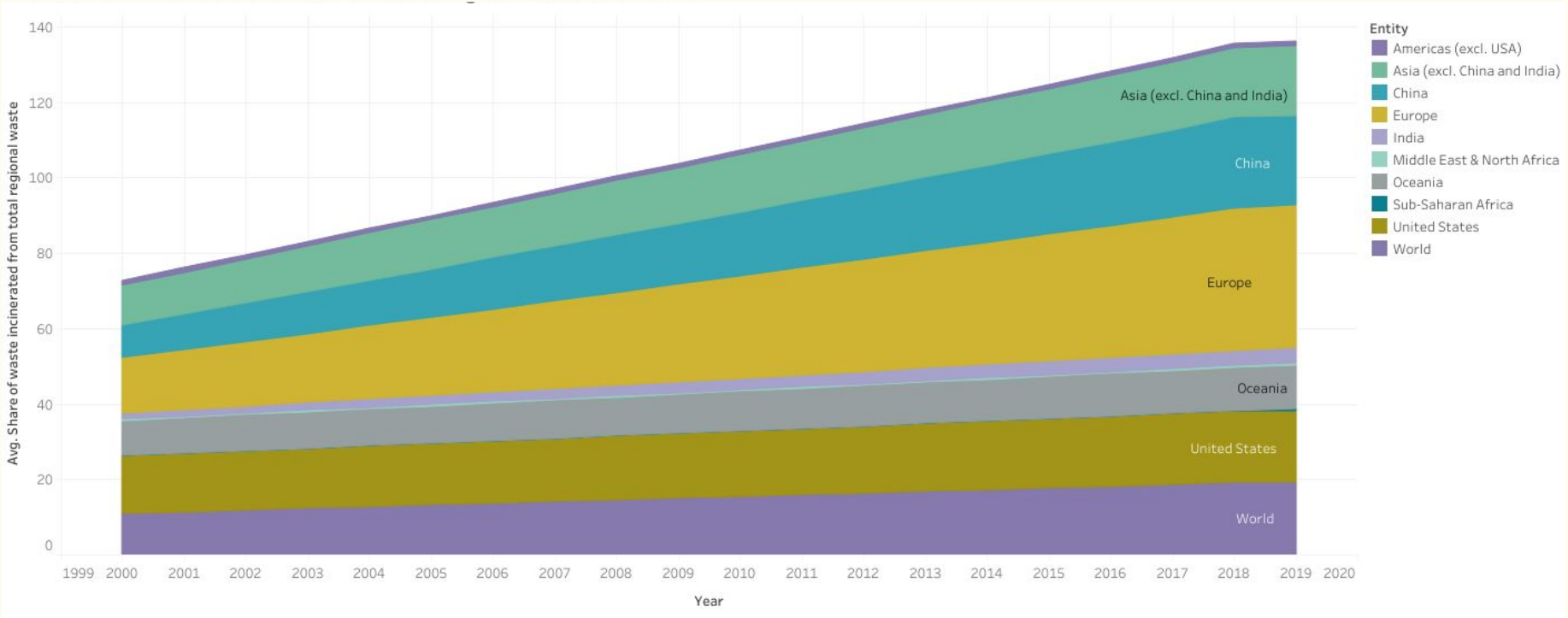
Global Waste Management Practices by Country

Waste Landfilled



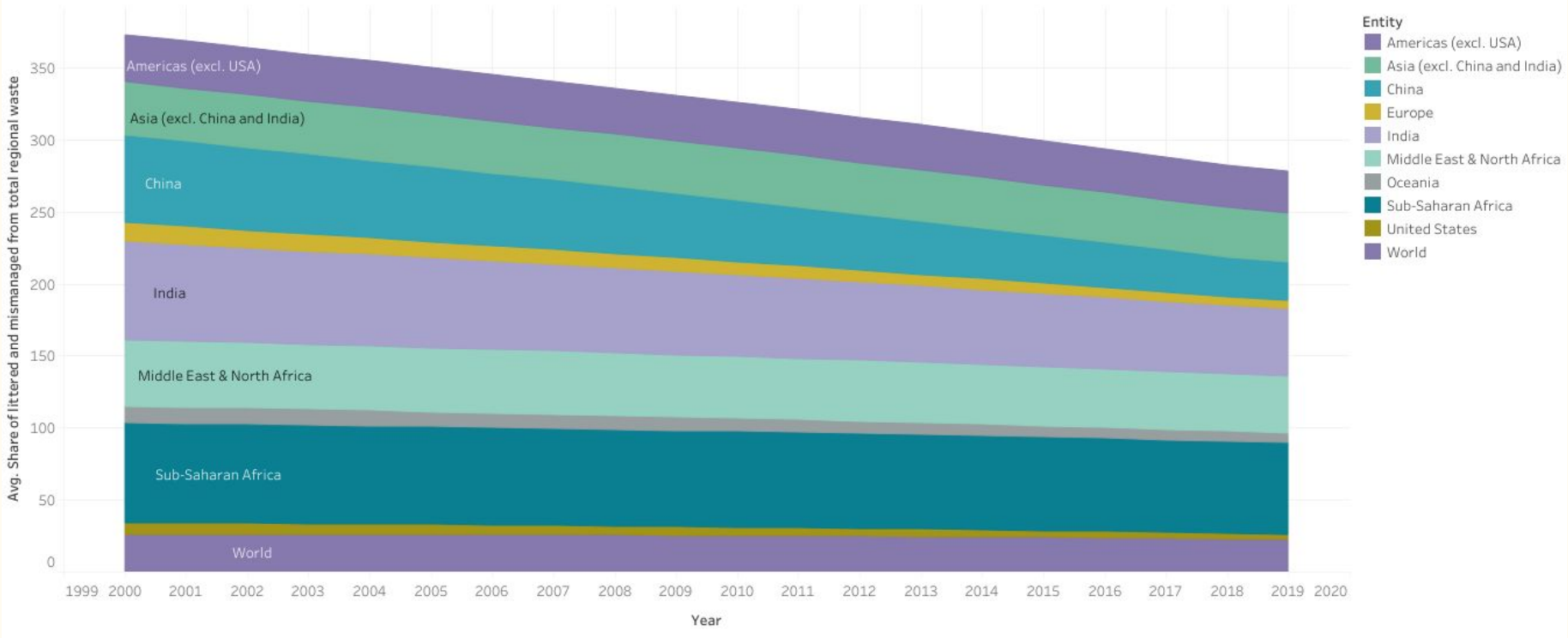
Global Waste Management Practices by Country

Waste incinerated



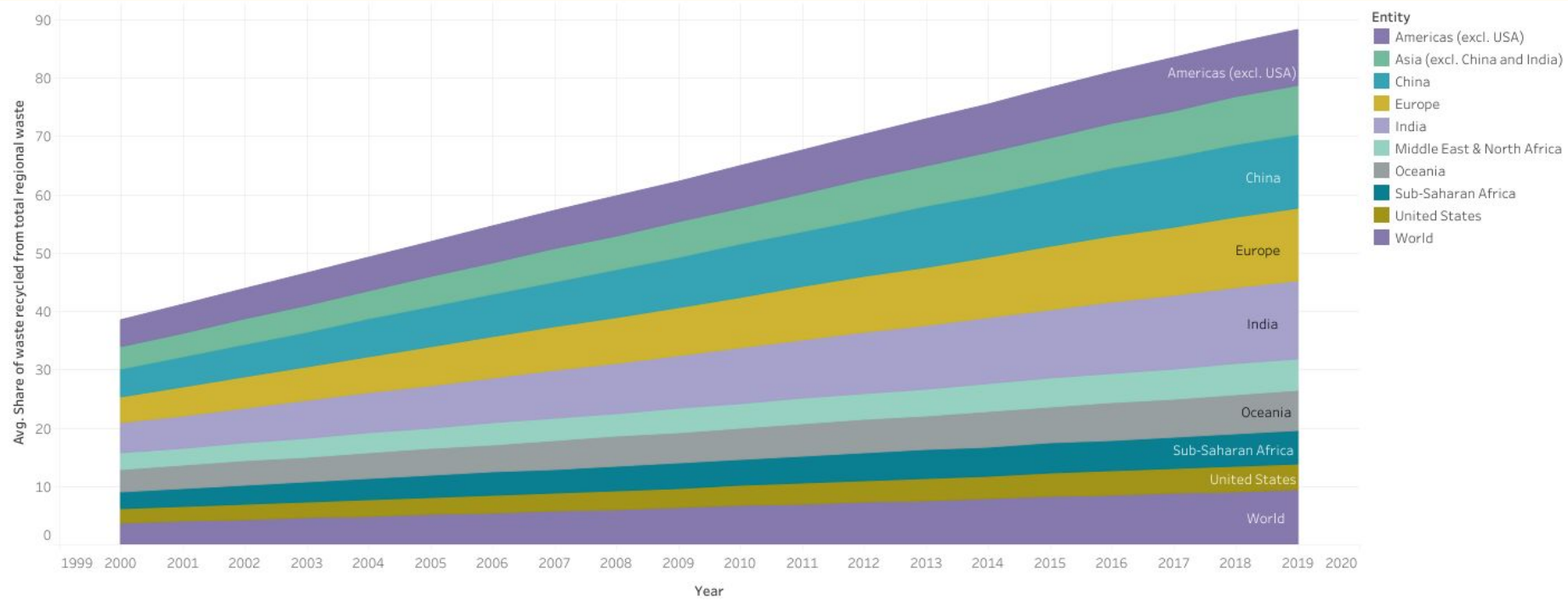
Global Waste Management Practices by Country

Waste littered and mismanaged



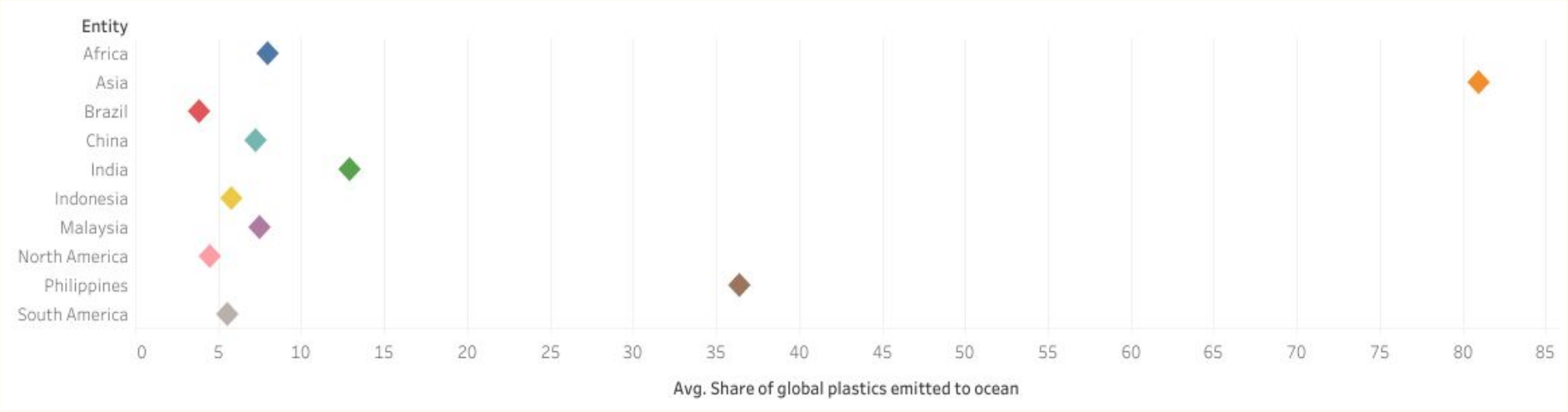
Global Waste Management Practices by Country

Waste recycled

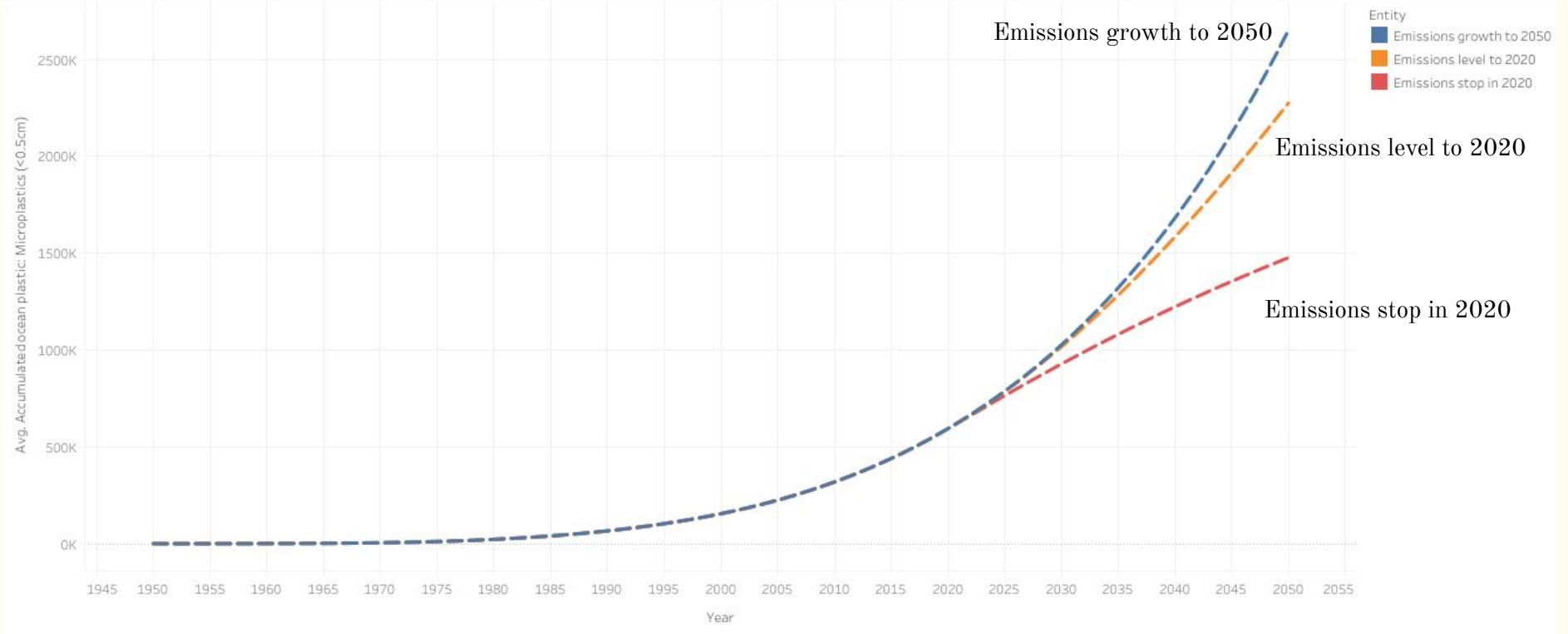


Top 10 Contributors to Global Plastics Emitted to Oceans in 2019

- Asia is the largest contributor, emitting 80.99% of global plastics to the oceans: The Philippines (36.38%), India (12.92%) are significant contributors to ocean plastic pollution.
- Africa and Malaysia also have substantial emissions, with 7.99% and 7.46% respectively.
- Other notable contributors include China (7.22%), Indonesia (5.75%), South America (5.51%), North America (4.50%), and Brazil (3.86%).



How much plastic will stay in the surface oceans in the future?



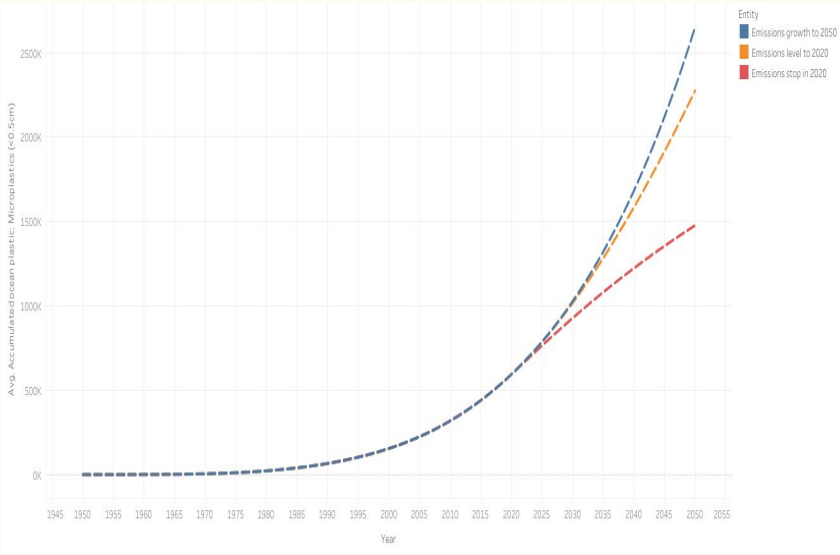
How much plastic will stay in the surface oceans in the future?

The study by Lebreton, Egger, and Slat challenges the old idea that plastics in the surface ocean break down quickly into microplastics and sink. Their findings suggest that large plastic pieces (macroplastics) can **last for decades.** These plastics can get **buried and reappear** on shorelines or **end up in the ocean far from where they started**, even years later.

https://ourworldindata.org/where-does-plastic-accumulate

This is important because it affects **how much plastic we might see in the surface oceans in the coming years.** The study looked at three possible scenarios for the future:

1. We stop adding any plastic to the oceans by 2020.
2. Plastic pollution keeps increasing until 2020, then stays the same.
3. Plastic pollution continues to grow until 2050, following past trends.



Why does this matter?

What is the impact of microplastics?

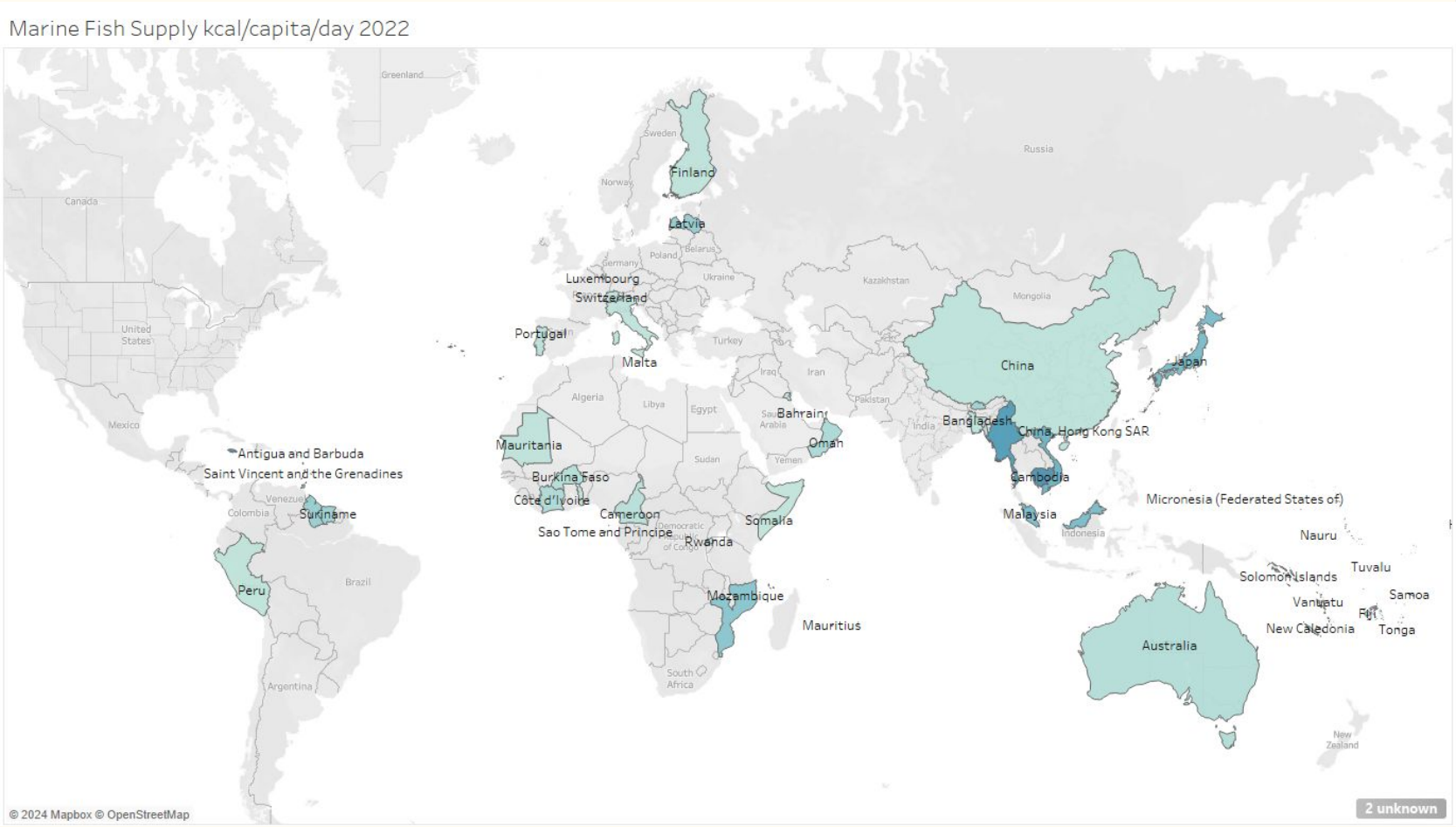
Where are microplastics in the environment? And how do they enter the human body?

- Microplastics 80% are produced on land but most end up in the sea
- They are light, indestructible & float which allows them to travel far
- Humans can take on microplastics via ingestion, inhalation or skin contact

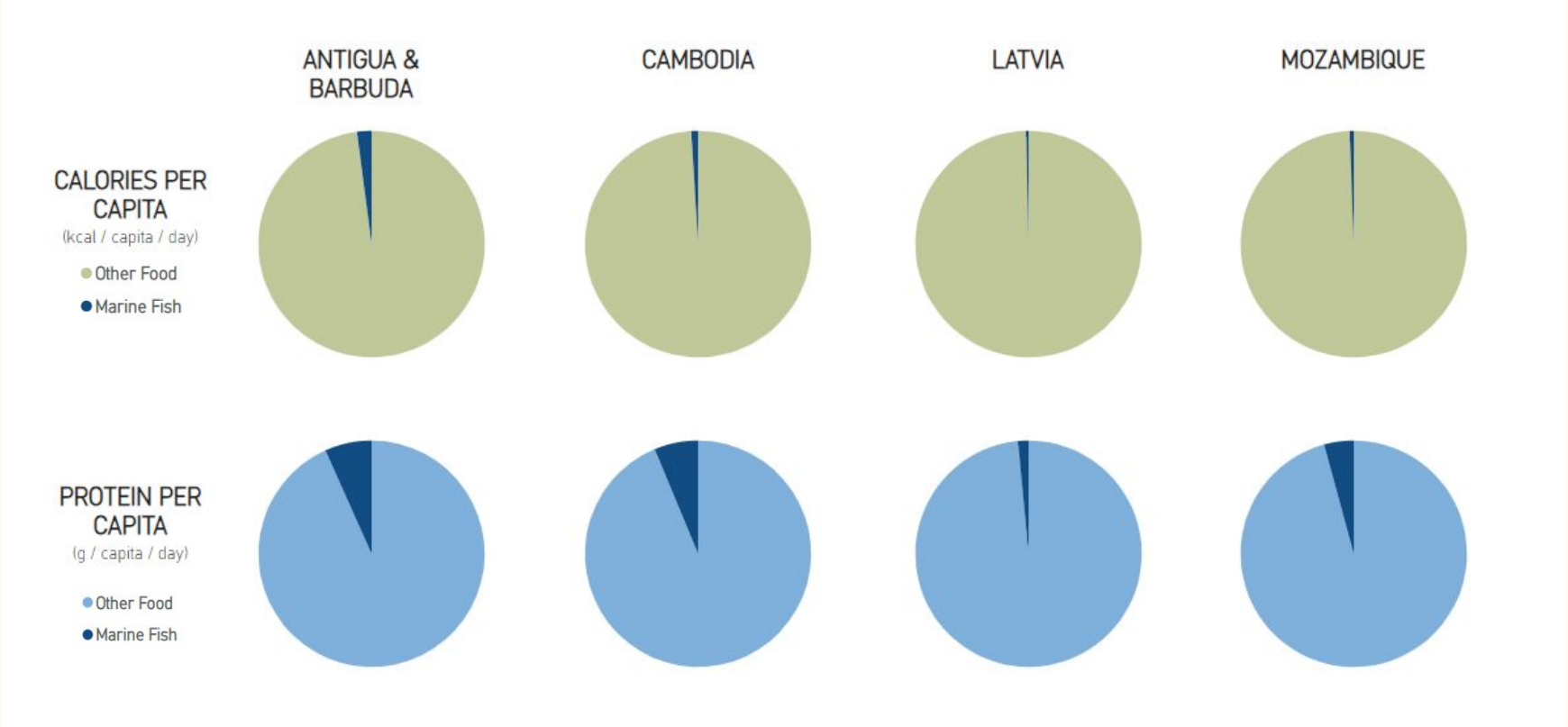
https://femina.wwmindia.com/content/2022/jun/fertility-thumb1654247101.jpg

HOWEVER, the greatest risk for exposure is from particles in seafood and the environment [1]

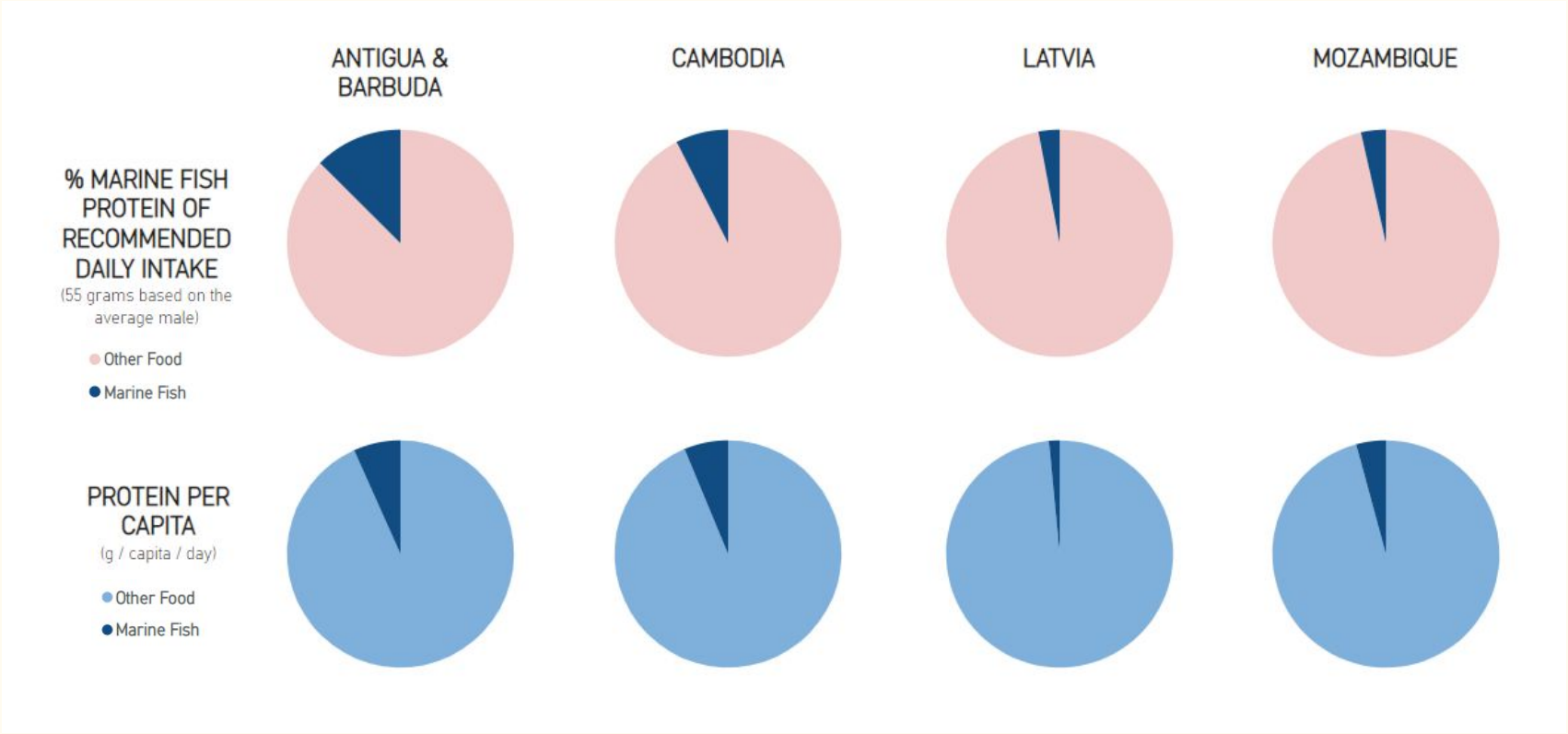
Who are at risk?



Reliance on Marine Fish in the National Diet



Are these countries more at risk for microplastic related disease?



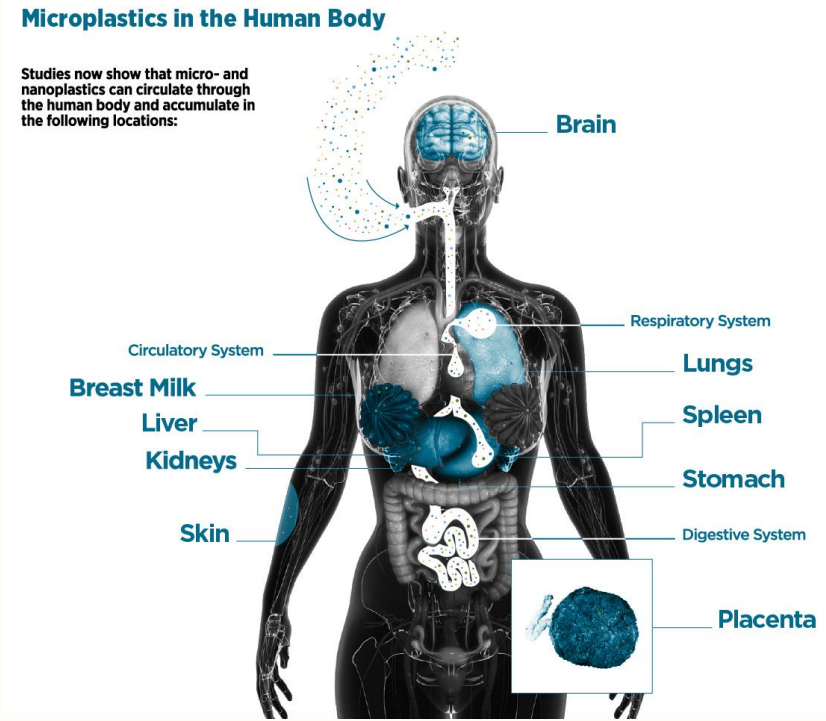
Human health impacts of microplastics

How?

- Particle toxicity
- Chemical toxicity
- Pathogen & parasite vectors

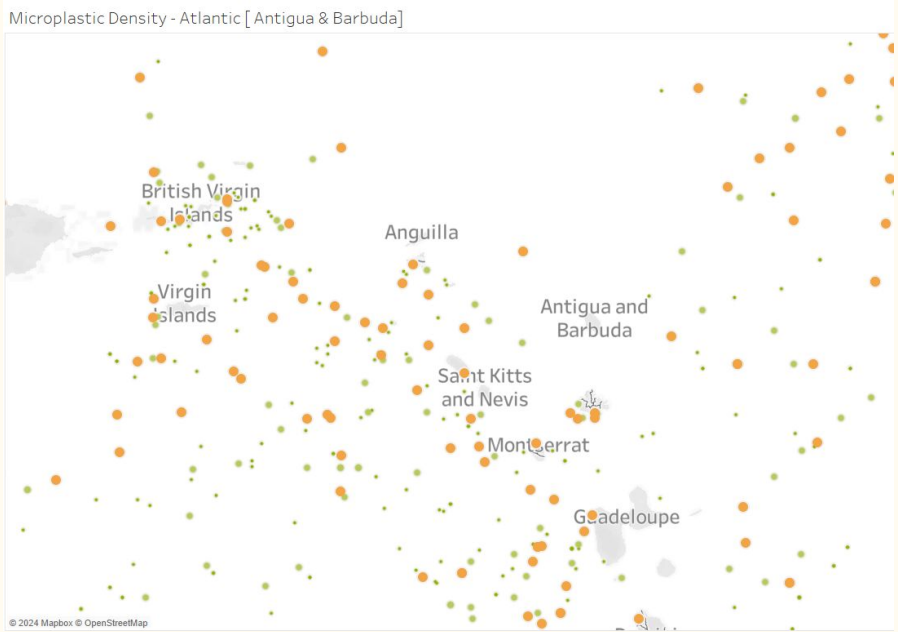
Which Causes?

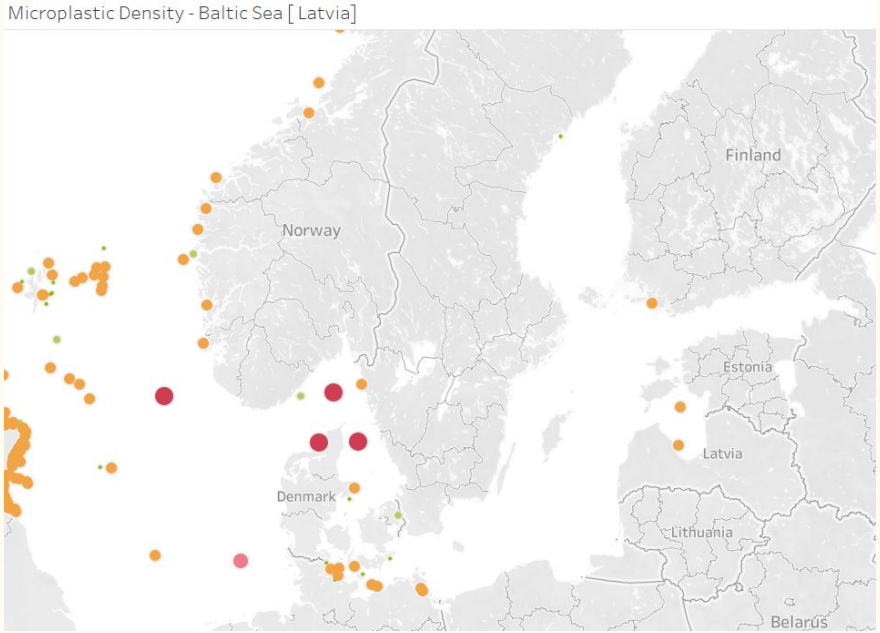
Inflammation, cancer, alterations to gut physiology (microbiota, ion transport, mucin production), toxicity related changes - foetal development, liver damage, higher risk of cardiovascular disease etc. etc... [1]

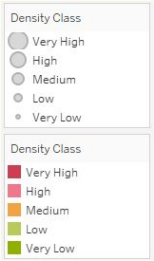


https://www.ciel.org/wp-content/uploads/2023/03/SoloInfographics_Mar16-03.jpg

Microplastic density in these regions







What is the risk?

High quantities measured in the ocean - from the microplastic data set we can see high levels of microplastics in the ocean. **Medium level = 0.005-1 particles per m2**

Higher reliance on fish - in some regions there is a high reliance of fish in the diet. Accumulation is therefore more likely

Low quantities for an effect - When humans are exposed to BPA at **0.2-20 ng/L** they are more likely to develop obesity and cardiovascular disease.

SUP consumption isn't reducing as much as we'd hope

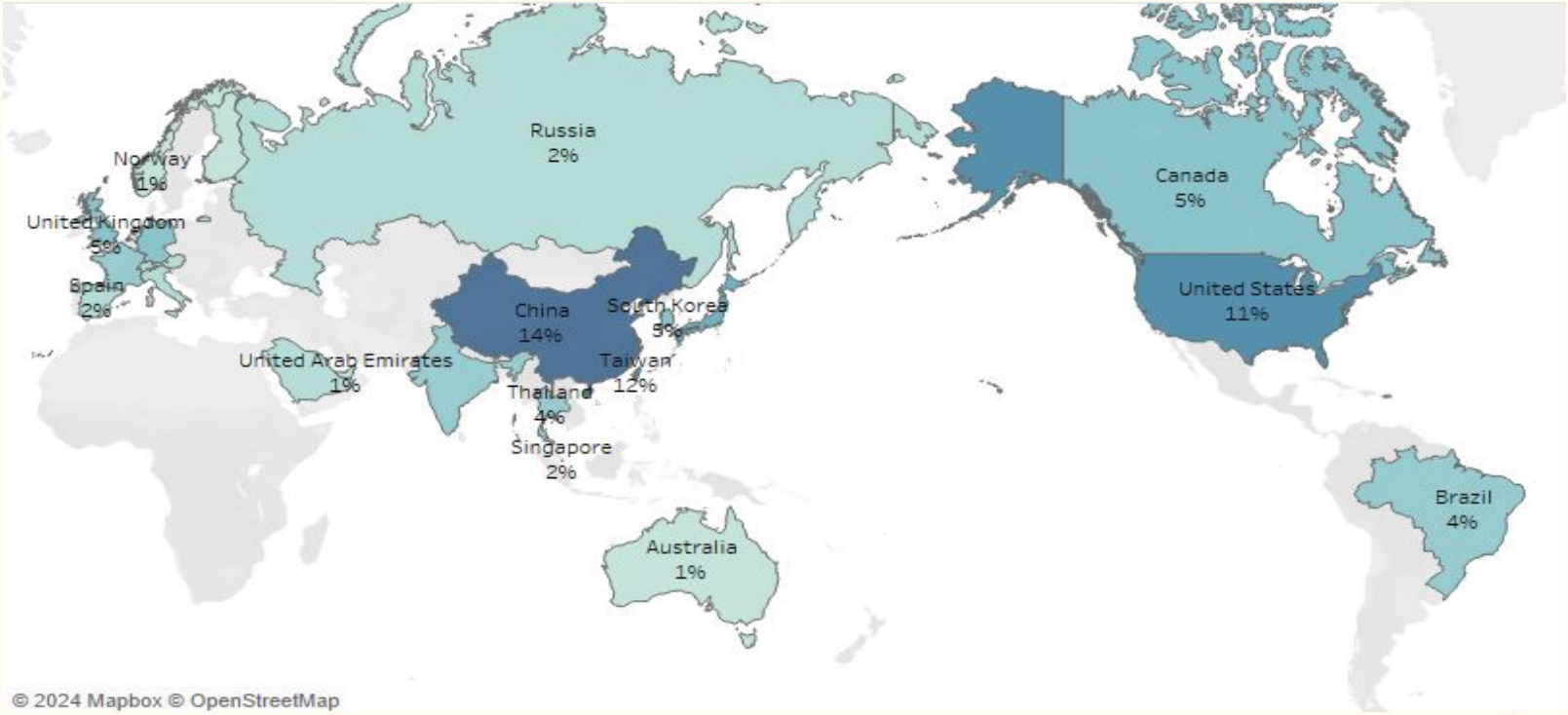
More research is still required to validate the effects of human exposure to micro- and nano-plastics.

SUP is on the rise around the world and who are responsible?

Who invests in its production? Which banks are involved? Who makes all this plastic?

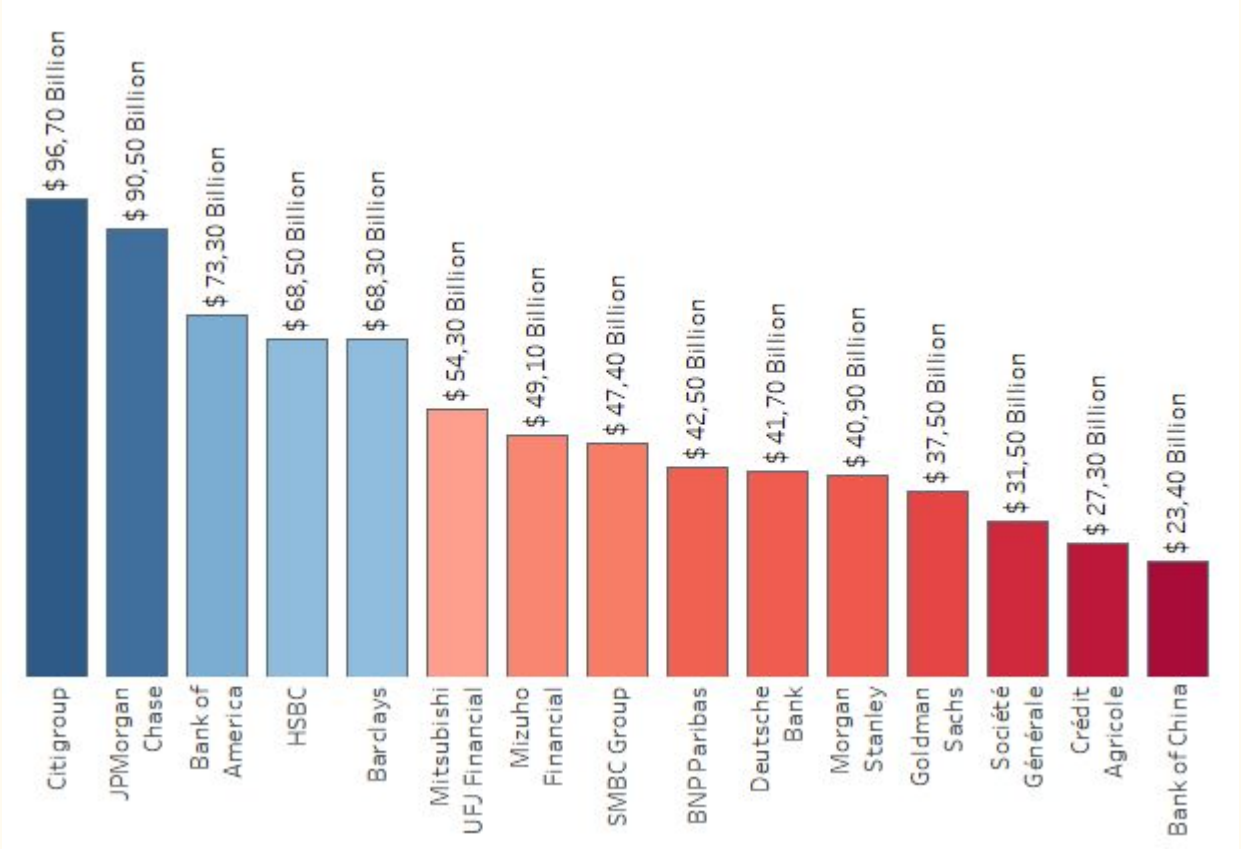
- A small number of large companies, giant investors and banks are behind much of the global industry.
- Some of the best-known names, such as Vanguard and BlackRock. And the world's biggest banks, such as Citigroup and JPMorgan Chase, finance production.
- Governments are also big stakeholders in this industry. The largest SUP manufacturers are partly owned by governments, such as China and Saudi Arabia.

Where is the headquarters of the banks that finance plastic production?



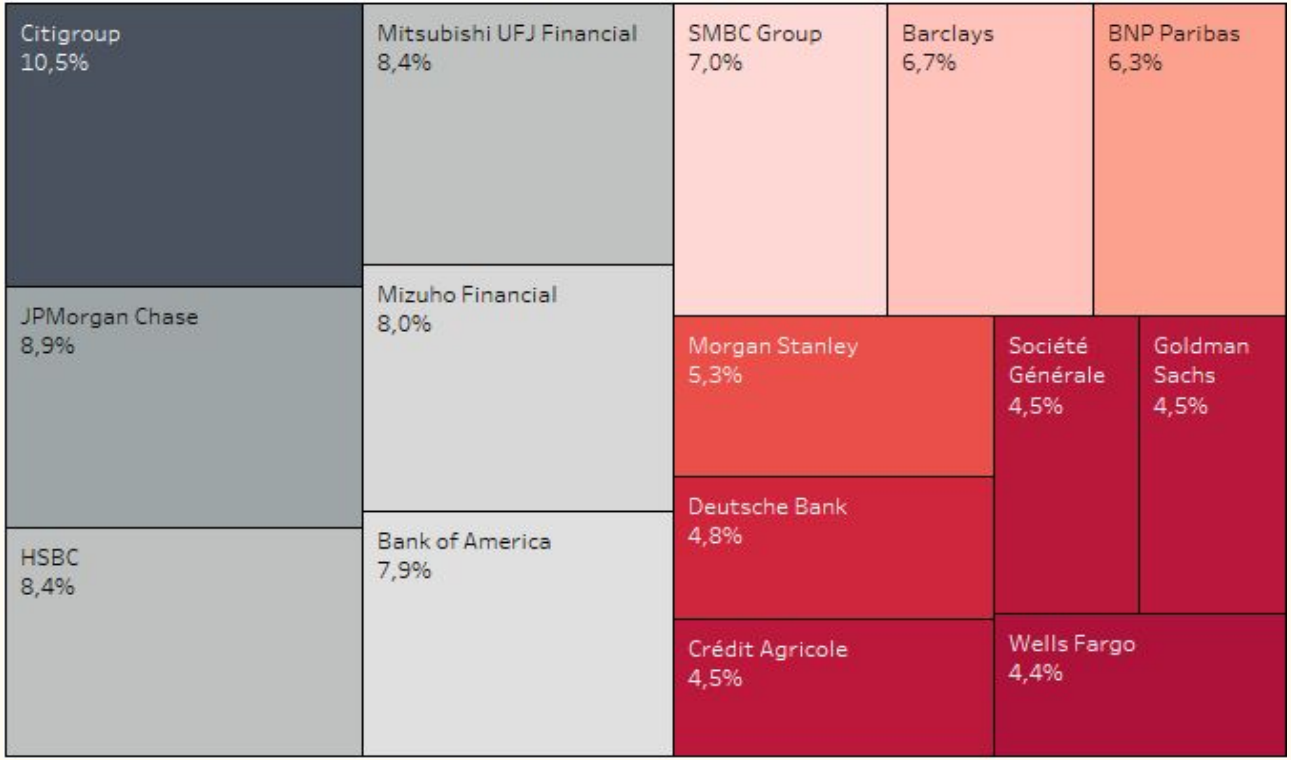
Total value of loans and underwriting in billions of dollars

15 of the world's largest banks, topped by Citigroup, JPMorgan Chase and Bank of America, are estimated to have lent almost US$30 billion to single-use plastic polymer production since 2011.



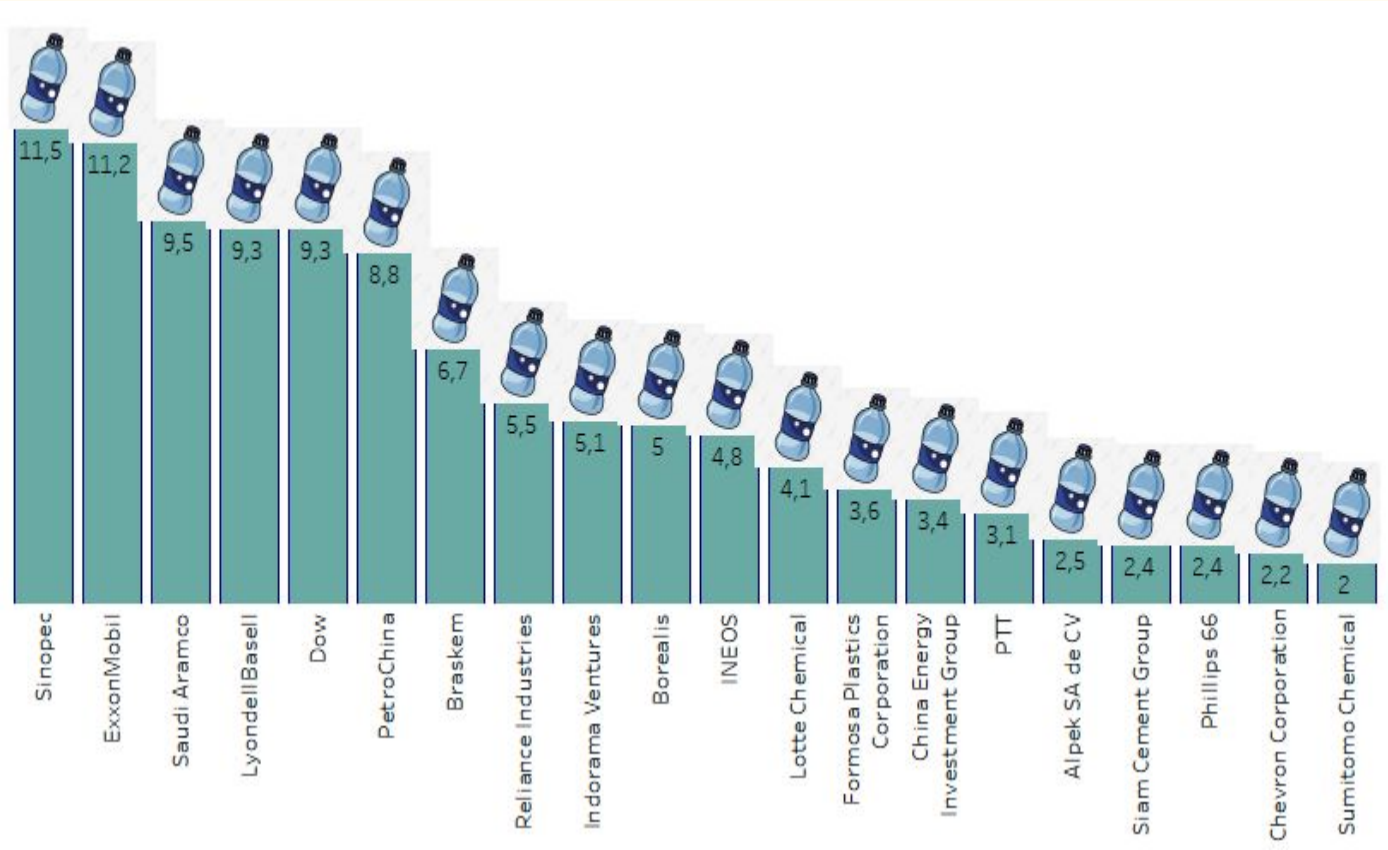
Number of deals per bank between 2010 and 2019

The largest polymer producers are supported by global financial institutions, which are either investors in these companies or provide banking services such as loans to fund working capital and expansion plans.



Polymer production per producer in millions of metric tons

Single-use plastic (SUP) is considered one of the world's greatest environmental dangers. Half of all SUP production worldwide is produced by 20 companies.



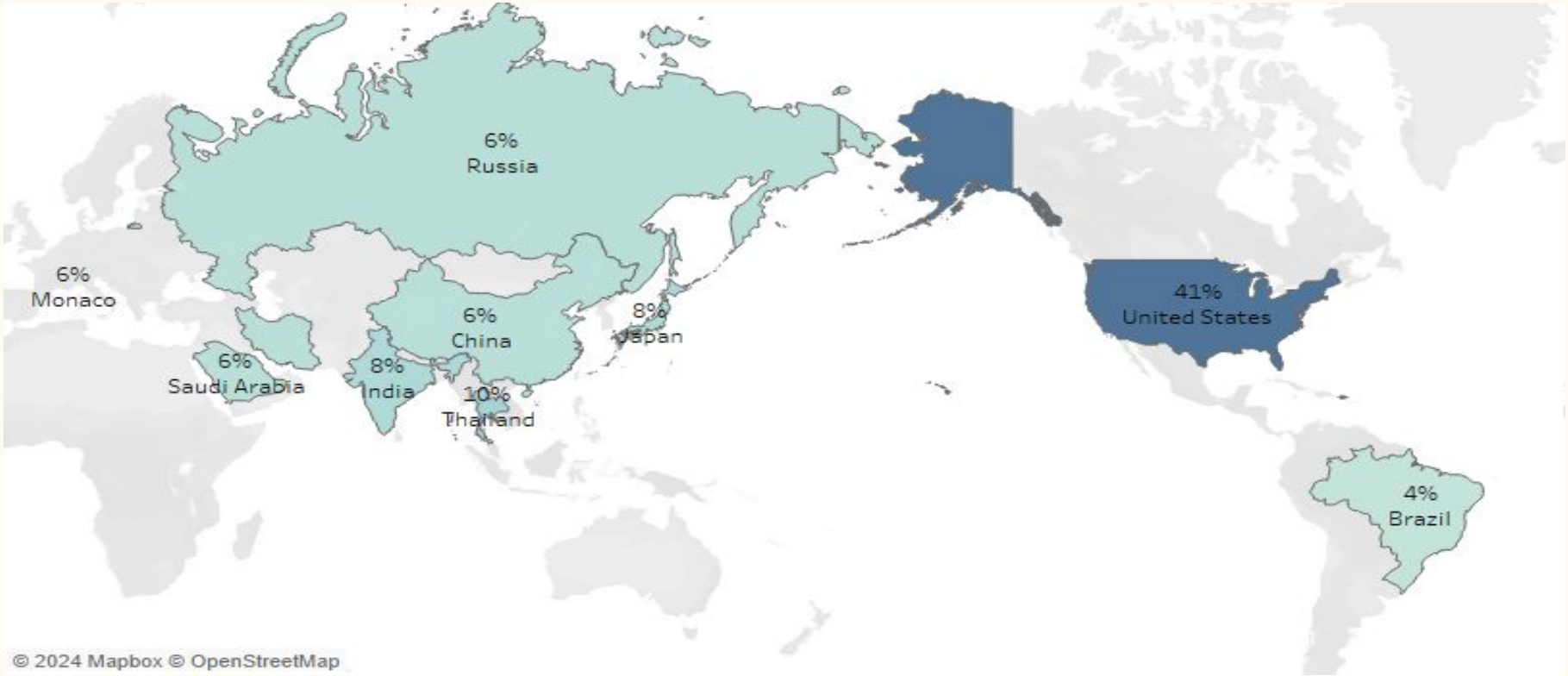
Companies that produce most SUP waste in million metric tonne

Polymer Producer	Flexible format contribution to SUP waste	Rigid format contribution to SUP waste	Total contribution to SUP waste
ExxonMobil	4,70	1,20	5,90
Sinopec	4,30	1,30	5,60
Dow	4,70	0,90	5,60
Indorama Ventures	0,20	4,50	4,60
Saudi Aramco	3,20	1,10	4,30
PetroChina	3,30	0,80	4,00
LyondellBasell	2,10	1,80	3,90
Reliance Industries	1,80	1,30	3,10
Braskem	1,90	1,10	3,00
Alpek SA de CV	0,00	2,30	2,30
Borealis	1,50	0,70	2,20
Lotte Chemical	1,10	1,00	2,10
INEOS	1,00	1,00	2,00
Total	1,00	0,90	1,90
Jiangsu Hailun Petrochemical	0,00	1,60	1,60
Formosa Plastics Corporation	1,00	0,60	1,60
Far Eastern New Century	0,00	1,60	1,60
PTT	1,10	0,30	1,50
China Energy Investment Gro..	1,20	0,30	1,50
China Resources	0,00	1,30	1,30

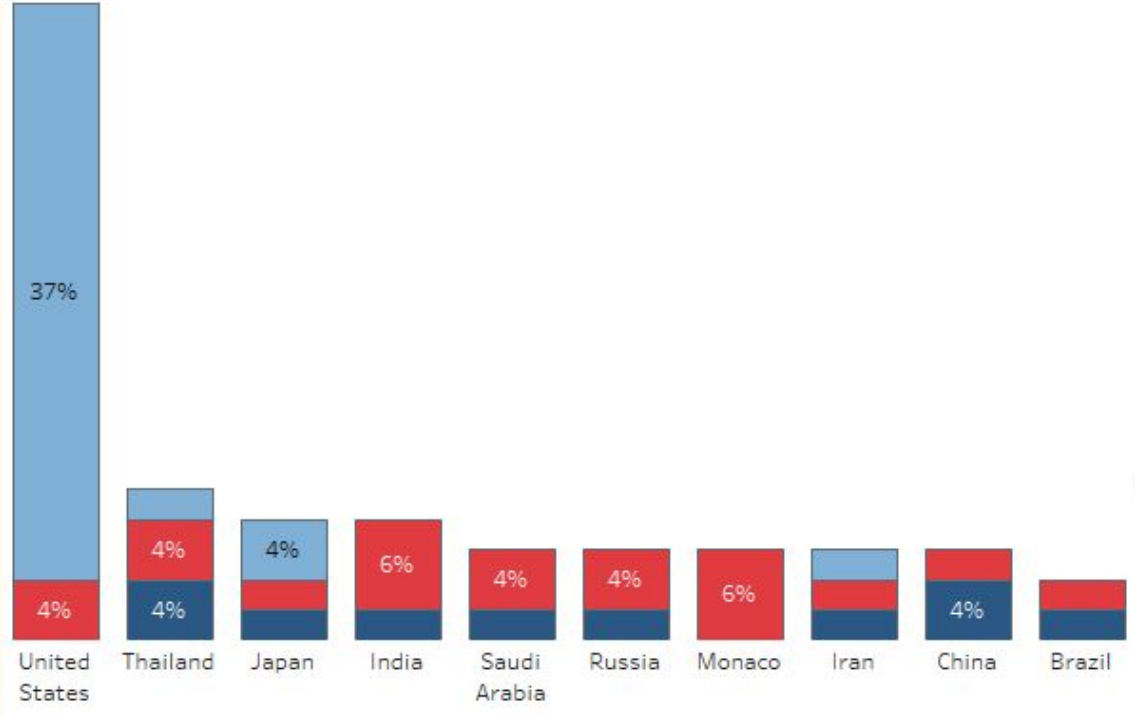
Contribution of polymers and investors to SUP production

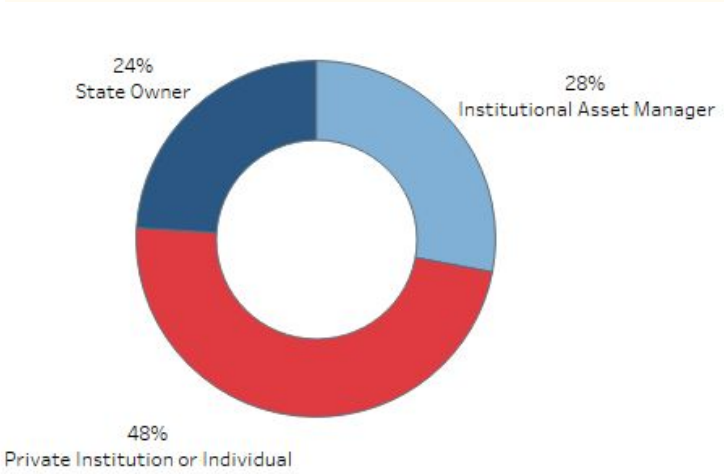
- The producers that contribute the most to SUP waste are ExxonMobil, Sinopec and Dow, and this contribution is in a flexible and rigid form.
- Flexible: Any product or packaging made primarily from non-molded plastic, such as plastic bags, films, wraps, pouches, or laminates. They have lower collection rates, are more difficult to sort and recycle, and have higher leakage rates.
- Rigid: Any item that has a relatively inflexible fixed shape or form and is capable of maintaining its shape or form, whether empty or full, under normal usage.
- The largest number of investors are in the US, with smaller numbers also in Thailand, Japan, India and Saudi Arabia. Half of the investors, 48%, are private institutions or individuals.

Where are the world's largest SUP investors located?



What kind of SUP investors are there and where are they located?





CONCLUSION

So, what is the current scenario and what could be the solution?

The Situation:

- Currently millions of plastic waste is being placed in landfill and ending up in the ocean via rivers and waterways in the form of micro- and nanoplastics.
- Via inhalation and ingestion these plastic particles are being take into the human body with potentially huge impacts on non-communicable diseases such as cancer & cardiovascular disease

The Solution - Supporters:

- Institutional asset managers and global banks are providing billions of dollars to companies producing polymers from fossil fuels, and only a fraction to companies trying to move to a circular plastic economy. There is an urgent need to reverse this asymmetry.
- Banks should align their loan portfolios with public policy on reducing, reusing and recycling plastics, and ceasing financing for new plants that use virgin raw material to produce SUP packaging.

CONCLUSIONS cont.

The Solution - Nations:

- Implement stricter regulations on plastic production and waste management to reduce plastic emissions.
- Invest in research and development of biodegradable and eco-friendly alternatives to traditional plastics.
- Enforce penalties for companies that do not comply with environmental standards regarding plastic waste.

The Solution - Consumers:

- Reduce single-use plastic consumption by educating the community on opting for reusable items.
- Properly sort and recycle waste to minimize plastic pollution, alongside local clean up initiatives.

References

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7920297/pdf/nanomaterials-11-00496.pdf

Datasets

- Microplastic dataset from Kaggle - https://www.kaggle.com/datasets/william2020/marine-microplastics/data
- FAOSTAT was used for all food balances for 2022 - https://www.fao.org/faostat/en/#data/FBS
- Plastic waste makers index from Kaggle: https://www.kaggle.com/datasets/pranav941/the-plastic-makers-index?select=Who+Produce+the+most.csv

Thank you!