



Pollution

Avoiding Collapse

Environmental Contaminants in the Air, Water and Land are at Record Levels and Increasing, Seriously Harming People and Wildlife in Unforeseen Ways



Avoiding Collapse: Grand Challenges for Science and Society to solve by 2050, published by:
Anthony D. Barnosky, Paul Ehrlich, and Elizabeth A. Hadly text



Microplastics Pose an Existential Threat to the Health and Wellbeing of Californians





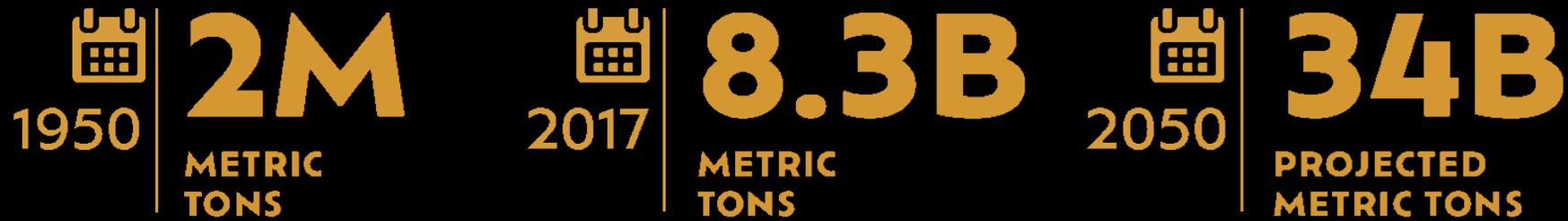
Plastic Pollution is Global and Ubiquitous



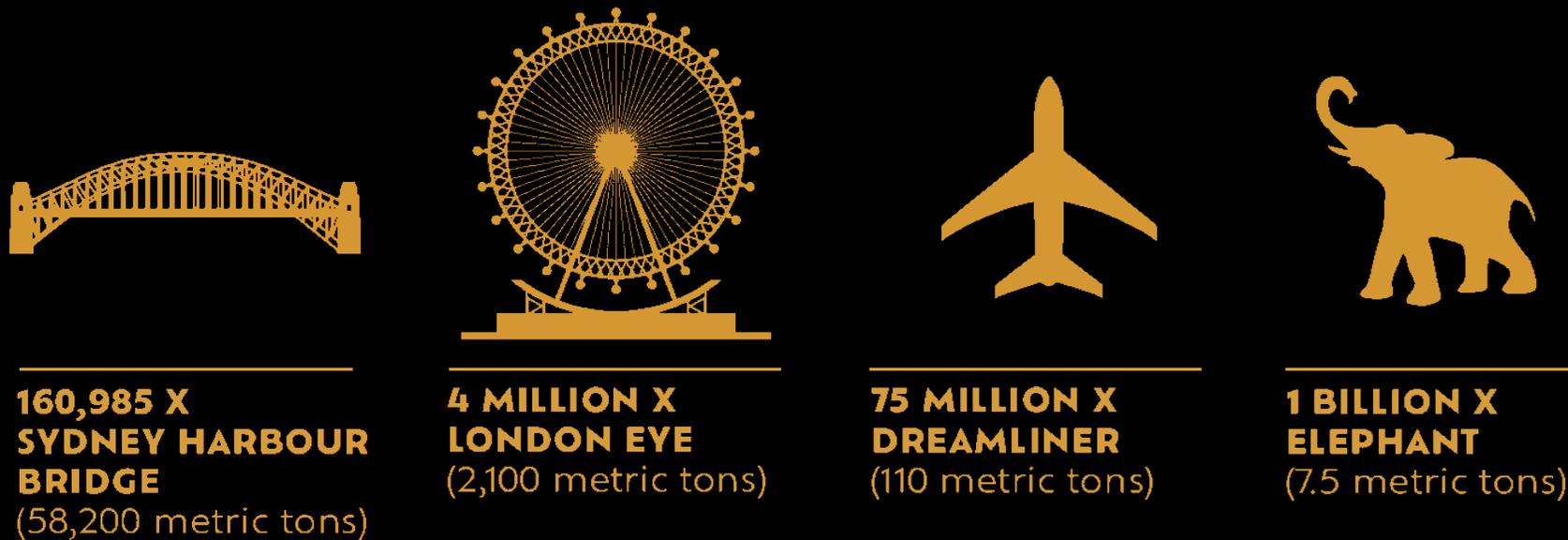


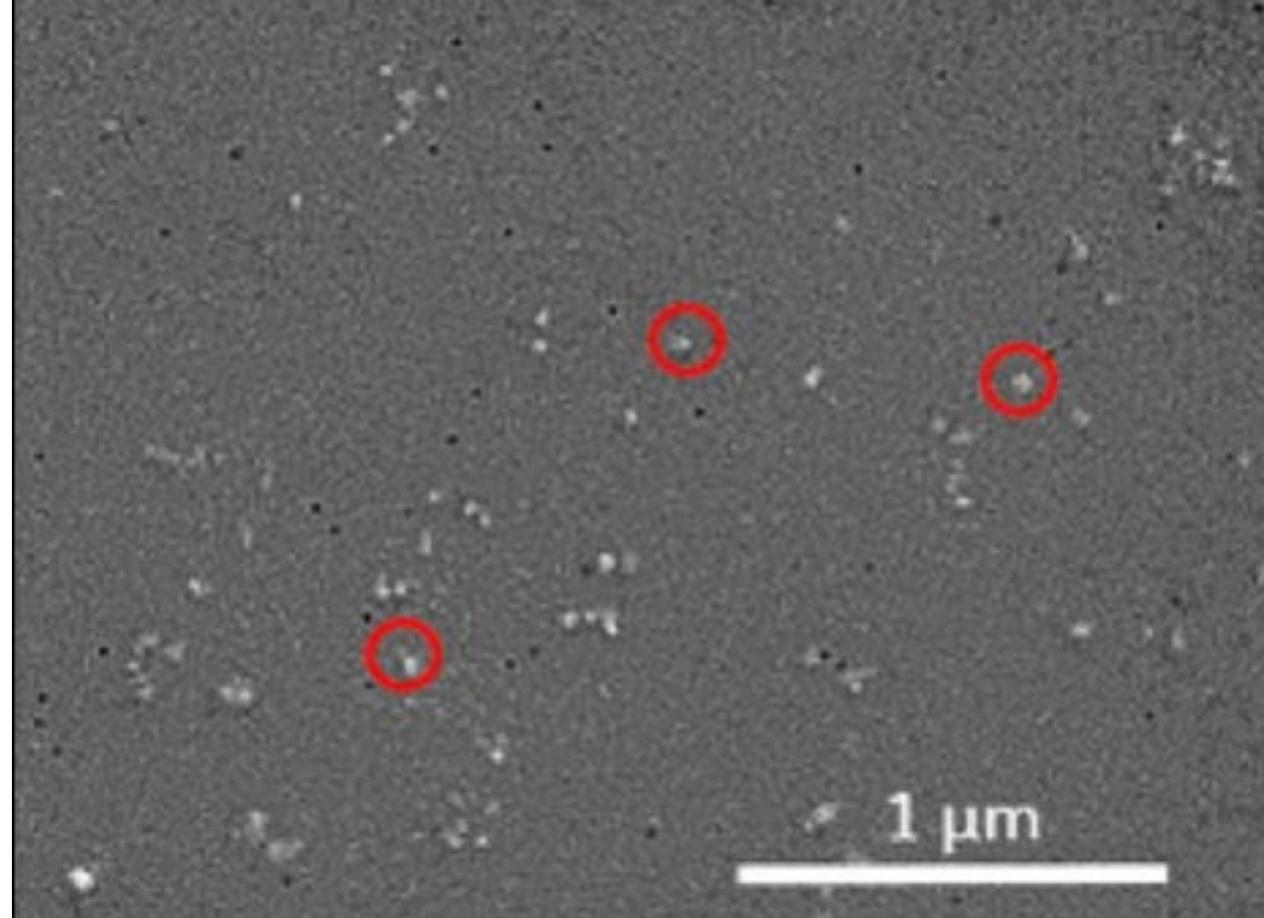
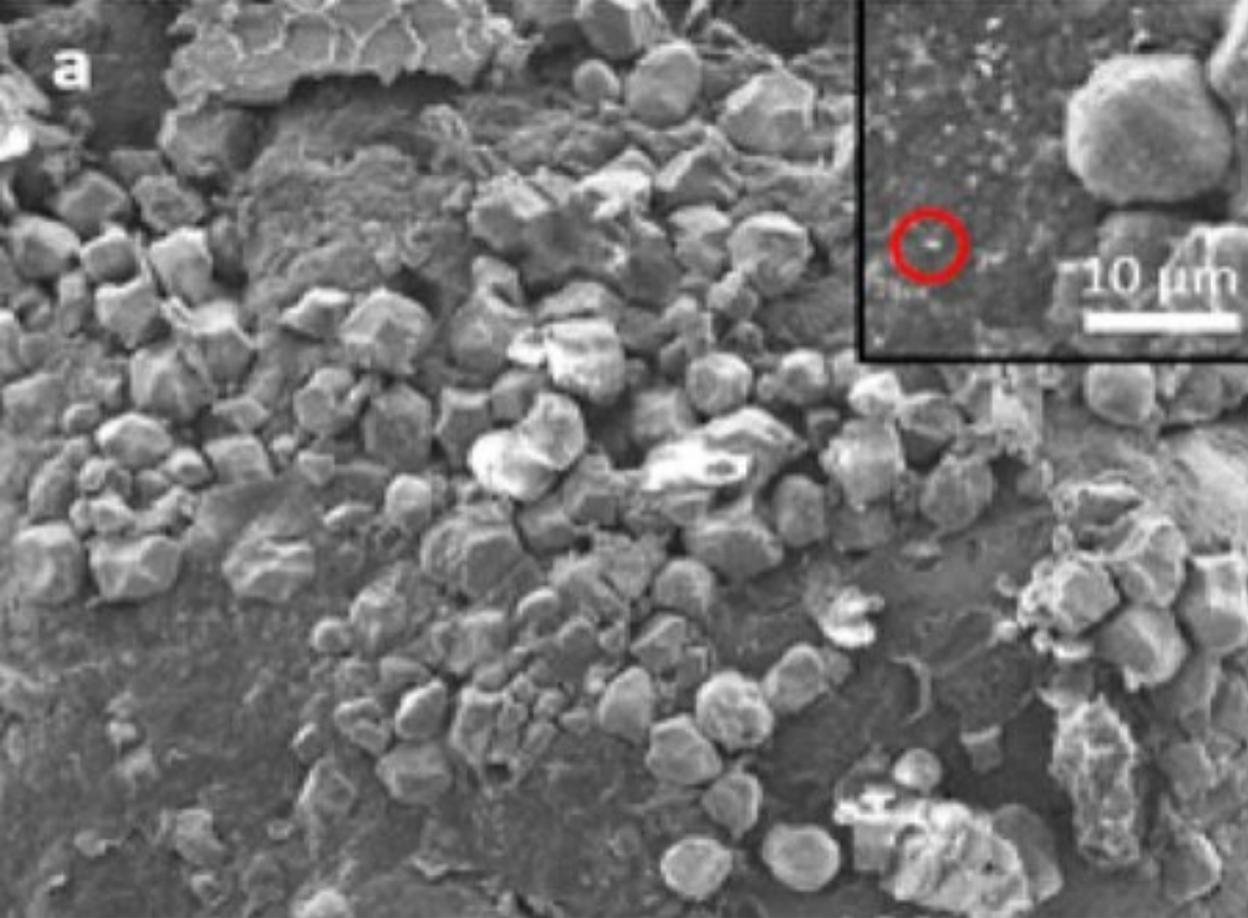
**Every minute,
a garbage
truck of
plastic enters
the ocean**

HOW MUCH PLASTIC HAVE WE PRODUCED?



HOW HEAVY IS 8.3 BILLION METRIC TONS?





Plastic Breaks Down into Microplastics

Scanning electron microscopy image of polyethylene facial scrub



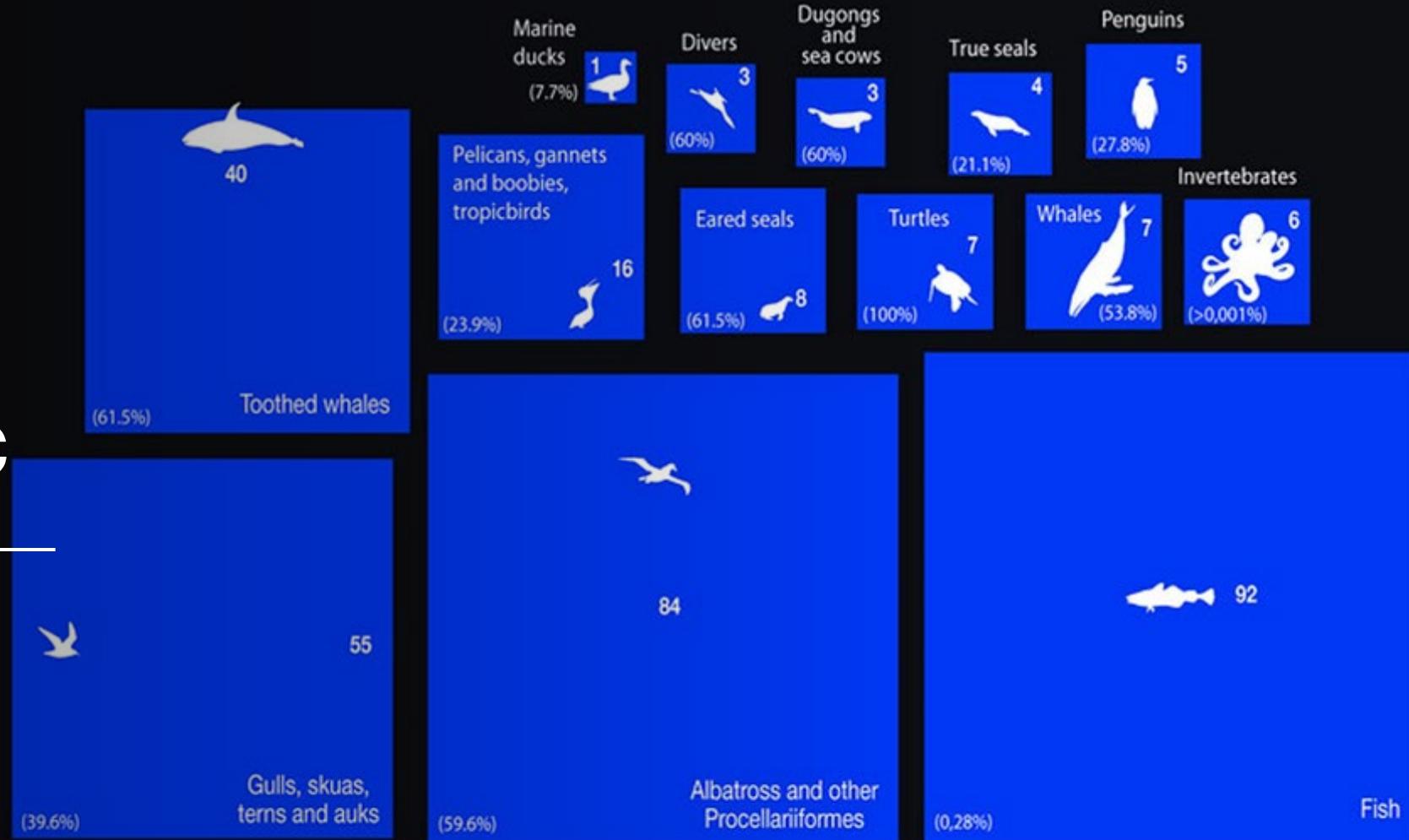
15 % of the species affected by marine debris are vulnerable, endangered or critically endangered (IUCN Red List)¹

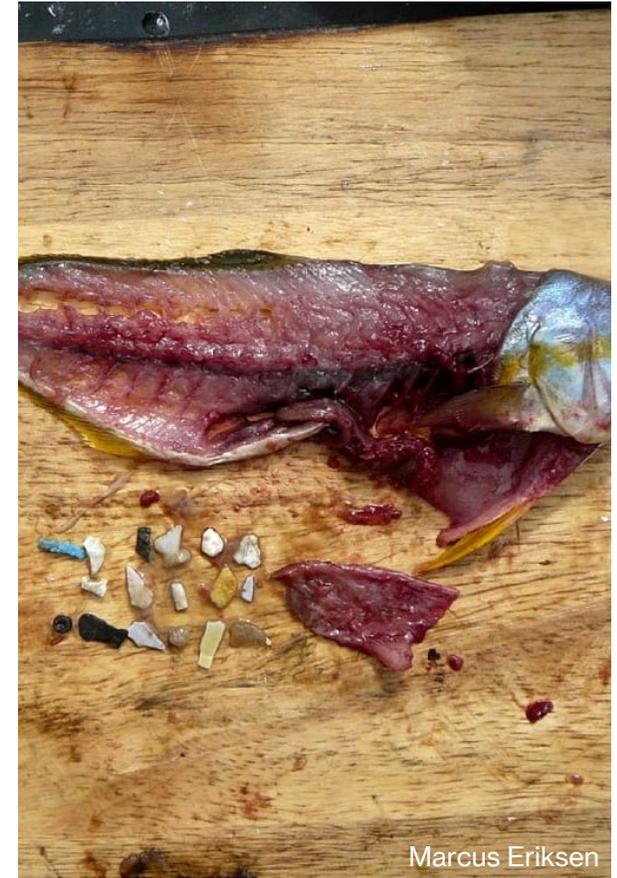
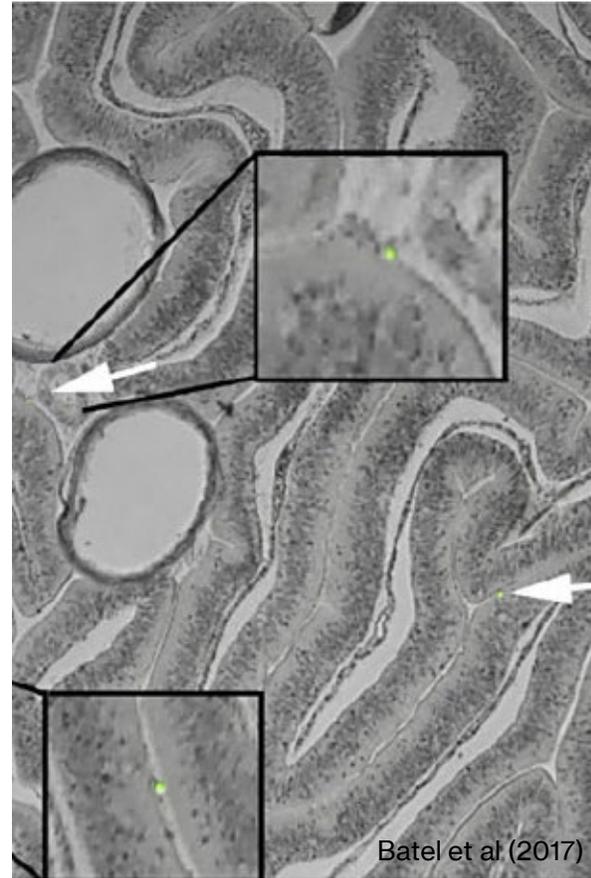
¹Moore et al .M. Pollut. Bull. (2001). ²Cole, et. al Env.. Sci. Tech. (2016). ³Eriksson, C., et. al. Ambio

Plasticized animal species - Ingestion

Number of species with documented records of marine debris ingestion

At least 206
marine
species
ingest plastic



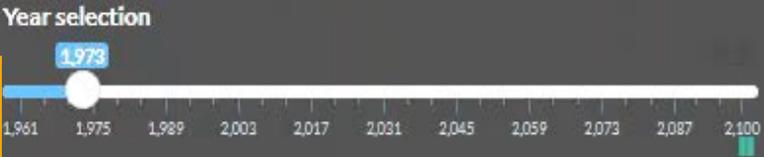


Microplastics Harm Animals in Many Ways

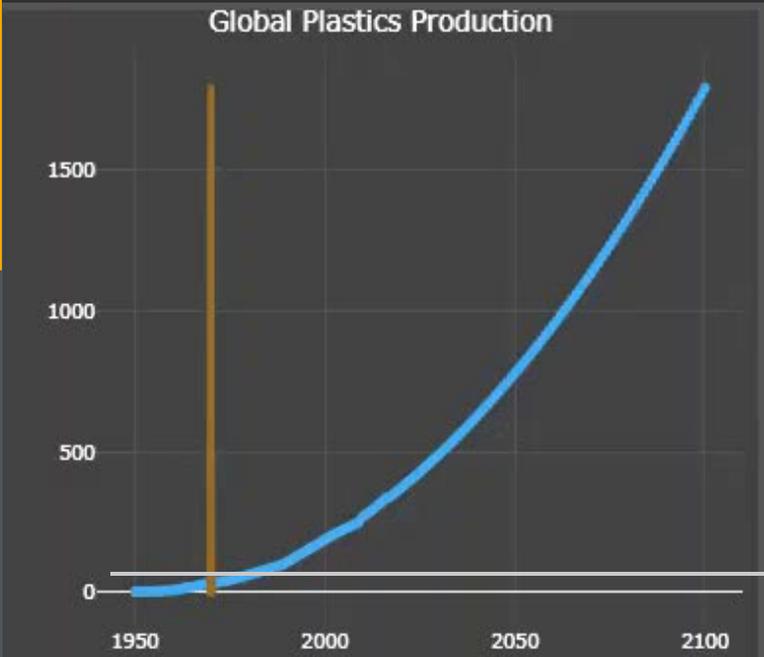
- Food Dilution
- Entanglement
- Cellular Toxicity
- Internal Lacerations

A black-to-yellow color scale is used to indicate plastic concentration:
- black = low concentrations
- yellow = high concentrations
(all concentrations are in microplastics per m²)

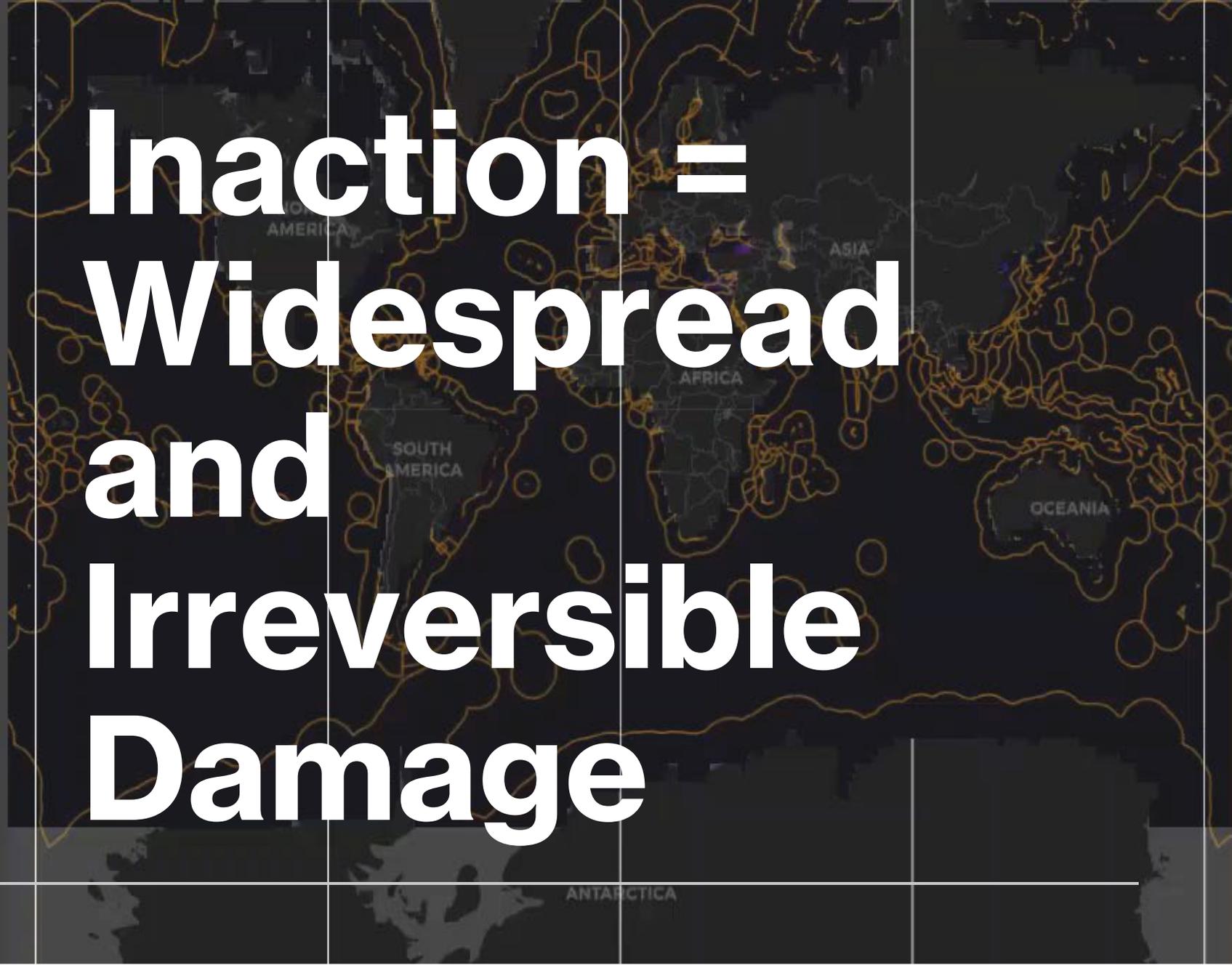
A year can be selected using the slider below.
Pushing the green play button will allow you to progress automatically through the years from 1960 to 2100.
You can also click on the map to see the number of microplastics per m².



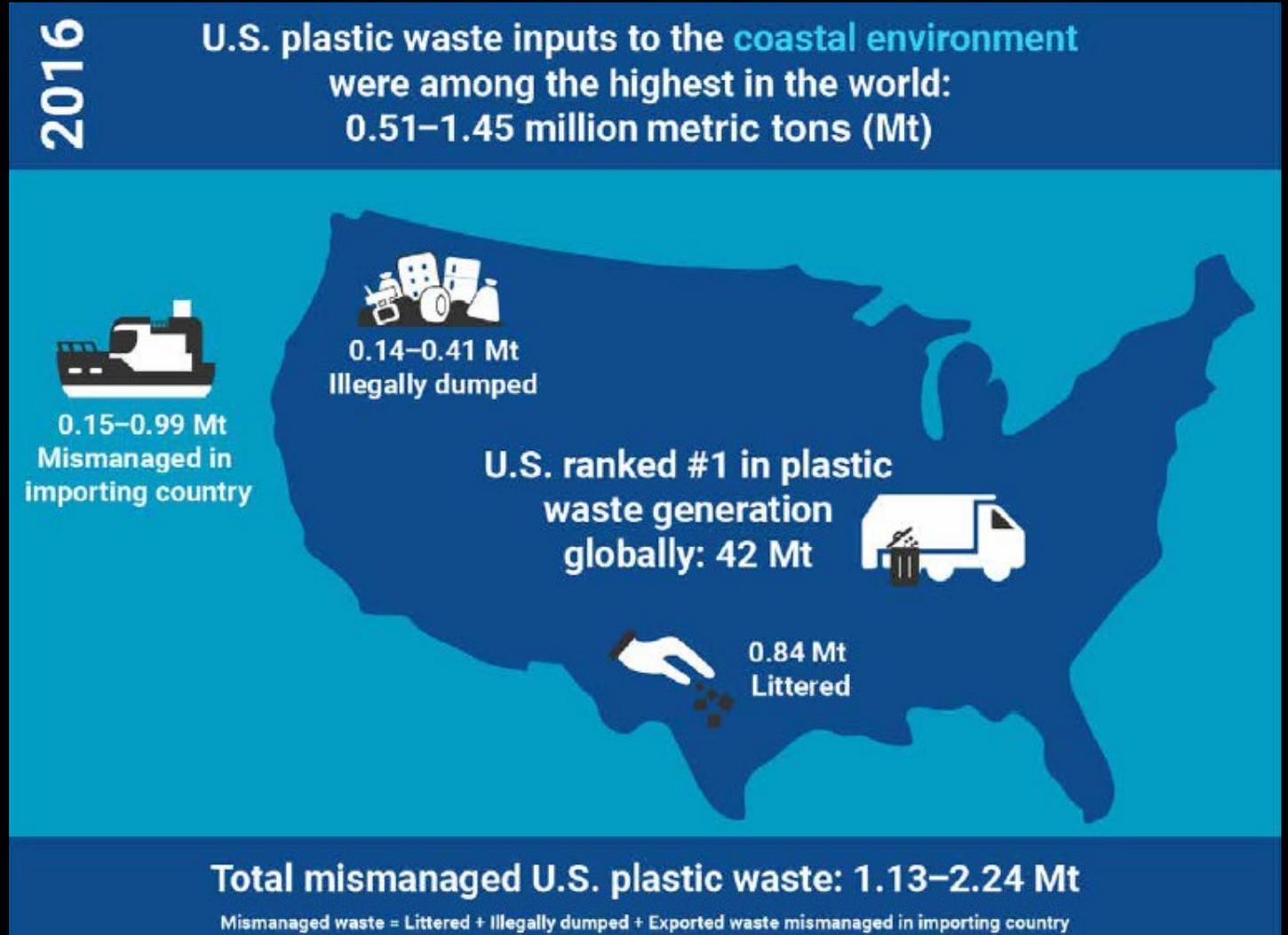
1961 → 2100



Inaction = Widespread and Irreversible Damage



U.S. Highest Contributor of Plastic Into Oceans





Microplastics are a Global and Local Problem

Los Angeles, CA

San Diego, CA

Microplastics are a Global and Local Problem

- 7 Trillion Microplastics Enter San Francisco Bay Annually



Source: San Francisco Estuary Institute (2019)

theguardian

Groundbreaking study finds 13.3 quadrillion plastic fibers in California's environment

Exclusive: report reveals far more microfibers than there are stars in the Milky Way - and they can easily enter oceans and waterways



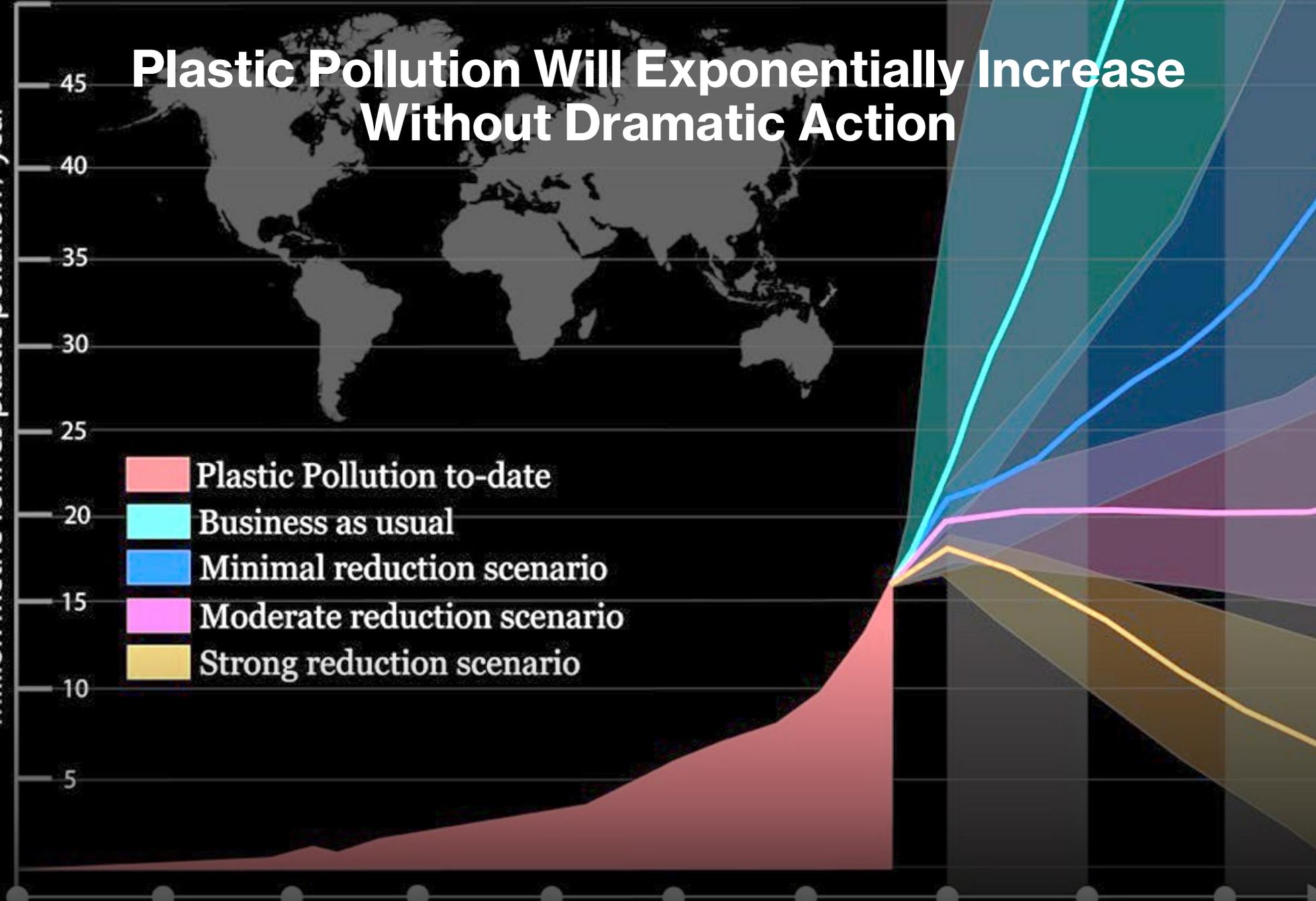
Plastic microfibers are one of the most widespread, yet largely invisible, forms of plastic waste. Photograph: Rachel Ricotta/AP

Plastic Pollution Will Exponentially Increase Without Dramatic Action

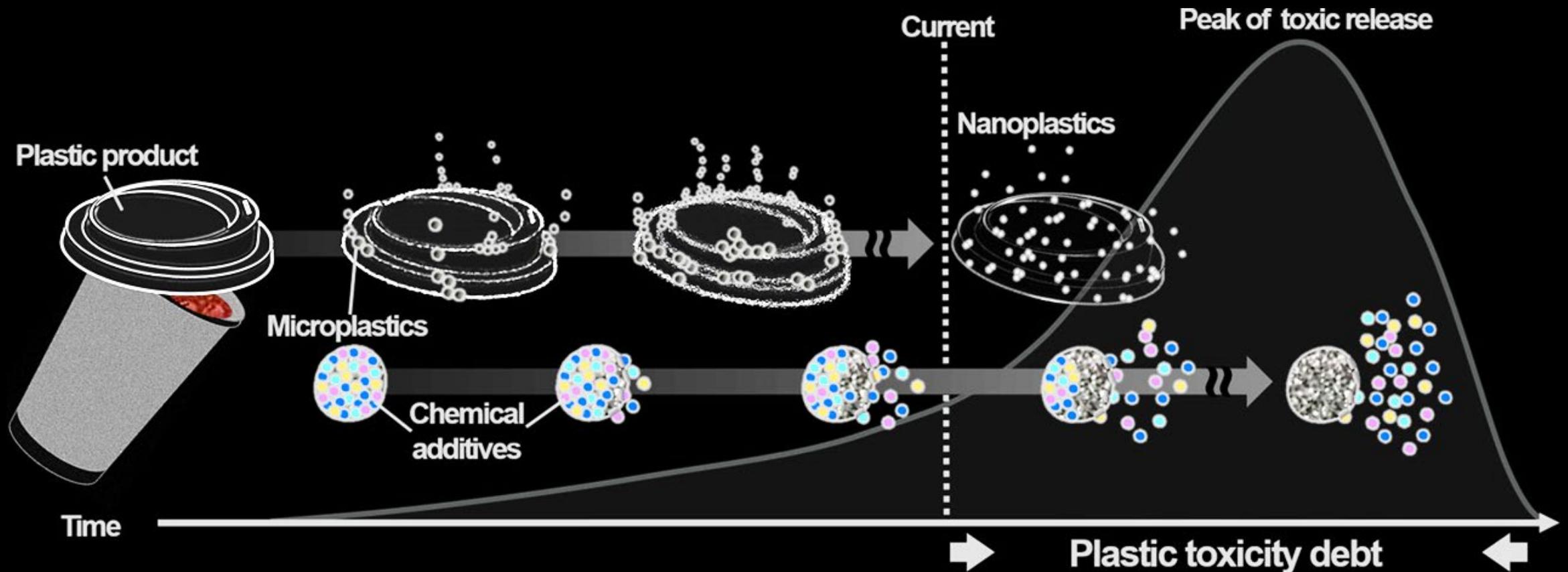
Million Metric Tonnes plastic pollution / year

- Plastic Pollution to-date
- Business as usual
- Minimal reduction scenario
- Moderate reduction scenario
- Strong reduction scenario

1950 1960 1970 1980 1990 2000 2010 2020 2030 2040



Inter-generational Legacy of Pollution

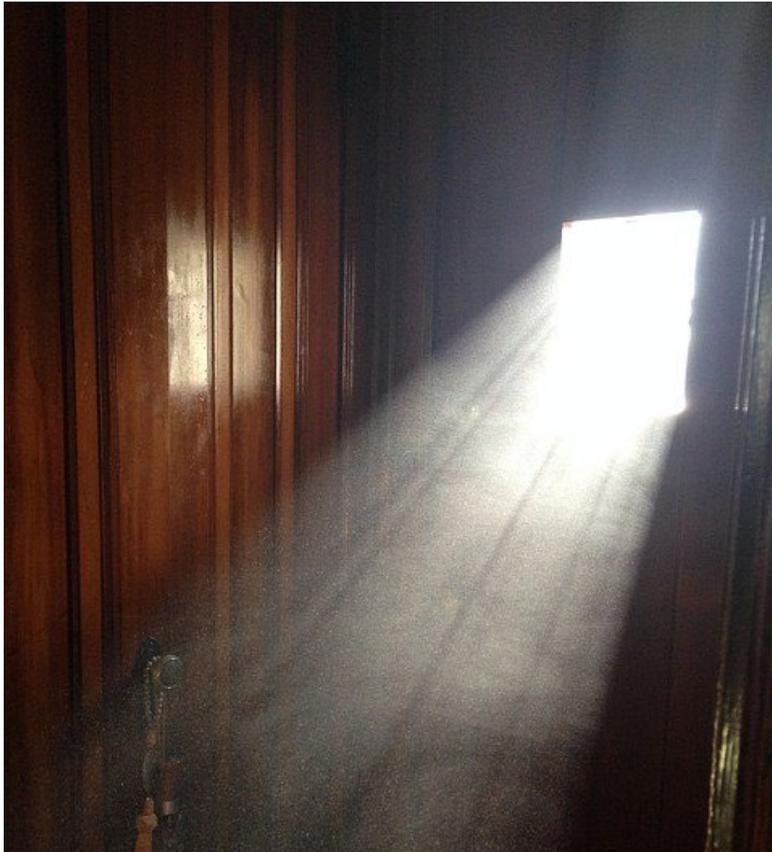


An underwater scene showing a large amount of plastic waste, including a large clear plastic bag filled with various plastic items like cups and lids, floating in the water. Other smaller pieces of plastic are scattered throughout the scene. The water is a deep blue color.

Plastic is Not *Just* an Ocean Issue

Humans Eat, Breathe, and Drink Microplastics

2-13% of indoor dust is plastic



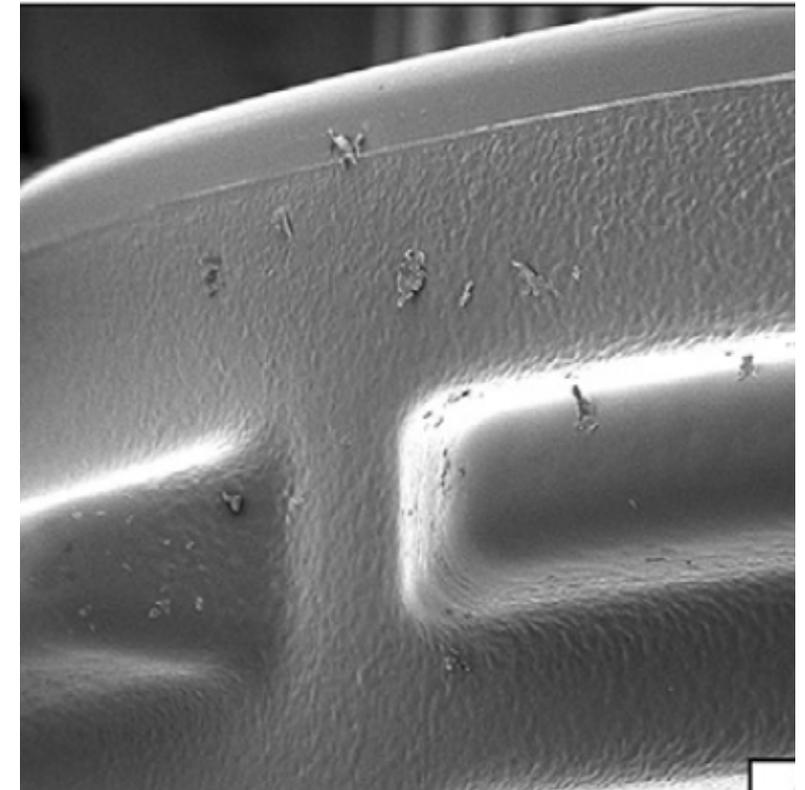
C. Liu et al, Environment International 2019

Babies drink ~1 million microplastics daily from feeding bottles alone



Li et al. (2020). Nature

Plastic water bottles releases **14-2,400** microplastic particles when opening



Winkler, et al. Water Research (2020).

It took
you up to
1 WEEK
to eat this
credit card

Tiny bits of plastic are in our food, water and air.
Find out how much plastic you eat at

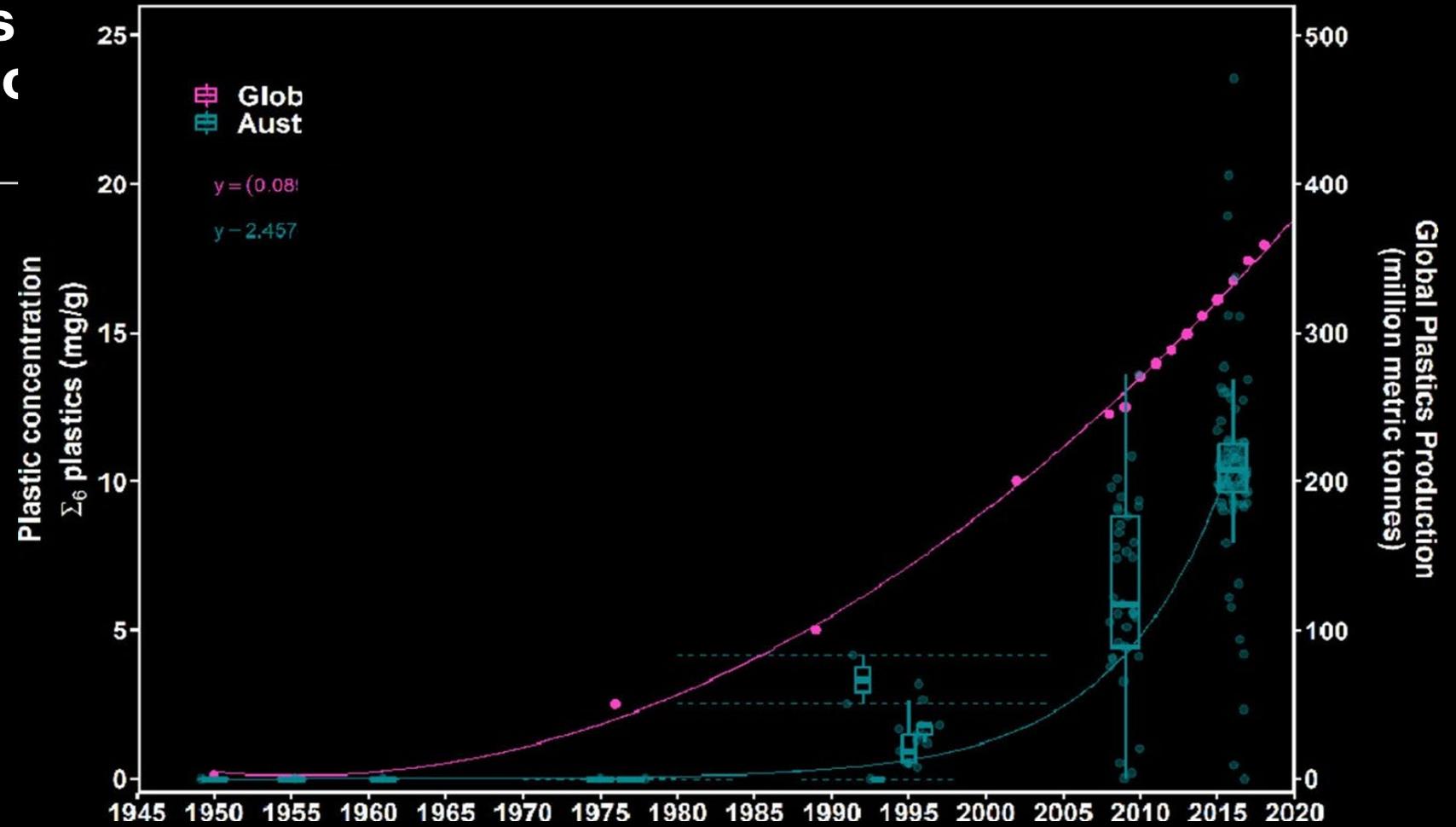
[YOUR PLASTIC DIET . ORG](http://YOURPLASTICDIET.ORG)



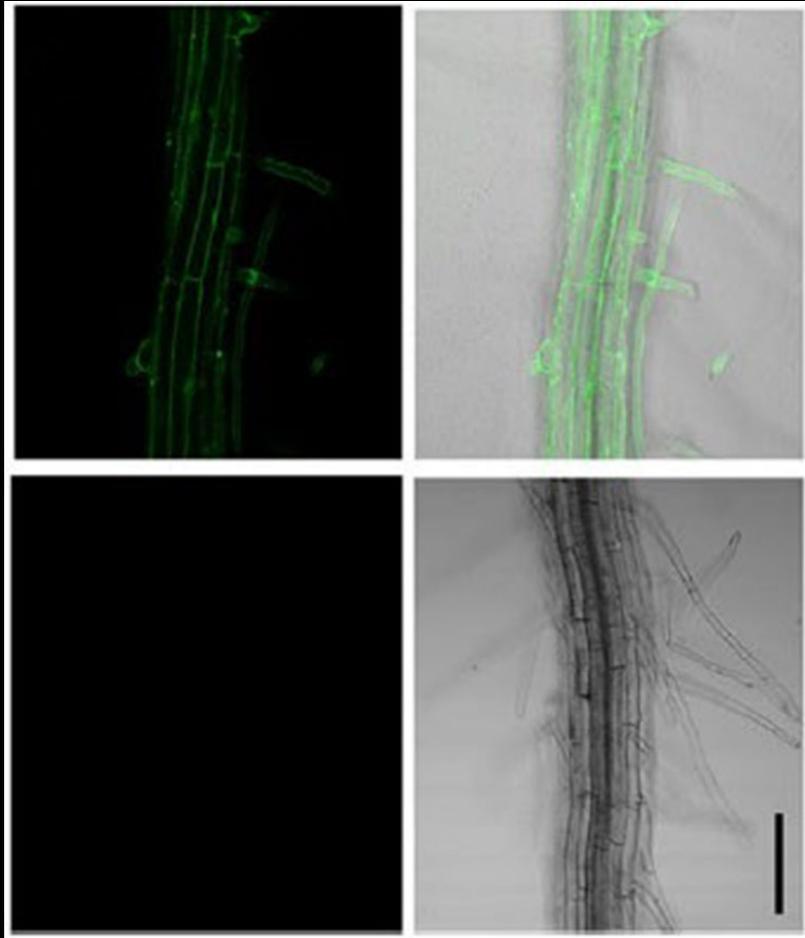
**So how much
does a credit
card a week
add up to?**



Plastics in Biosolids Correlates to Plastic Production

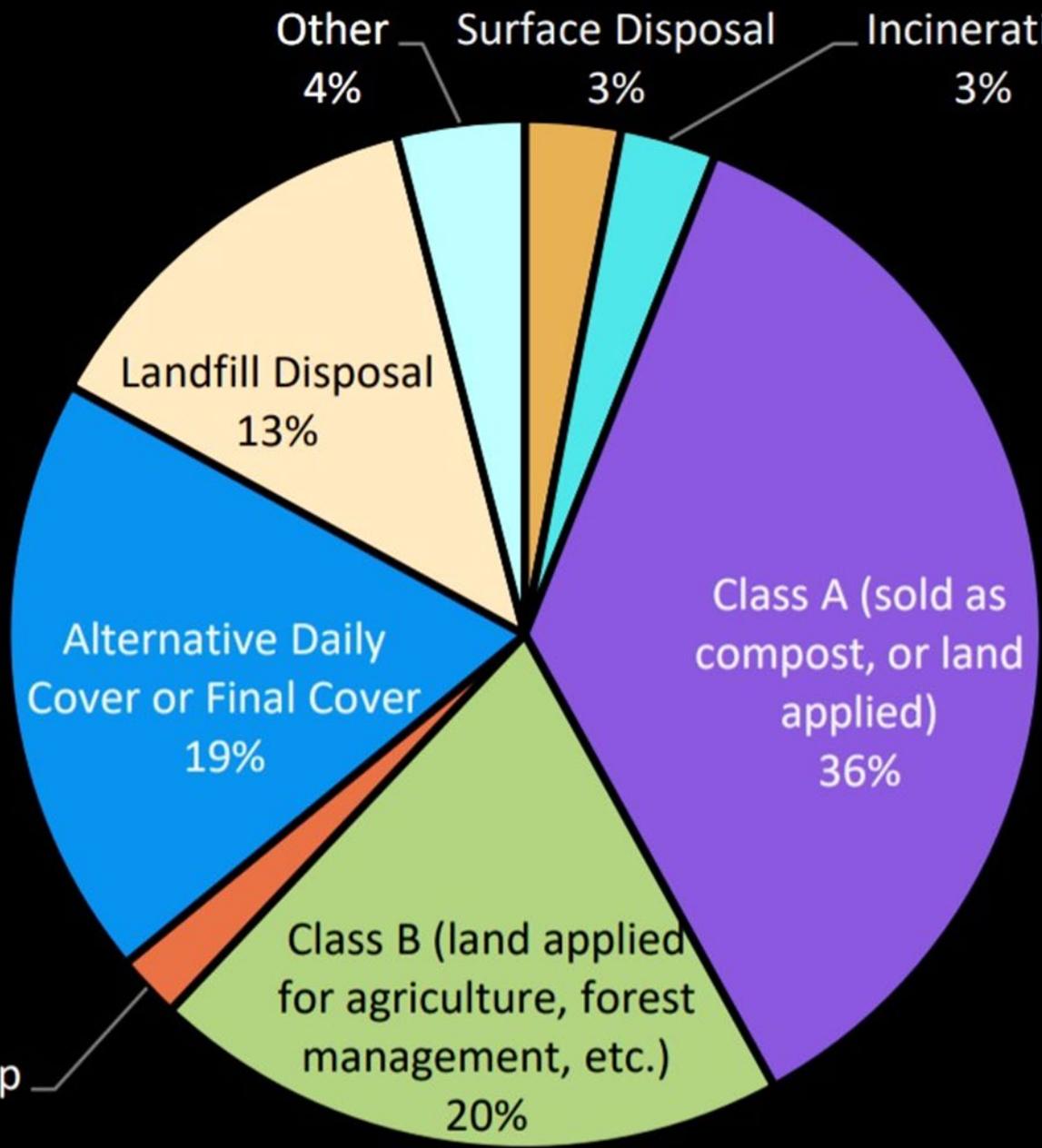


Plants Uptake and Accumulate Microplastics



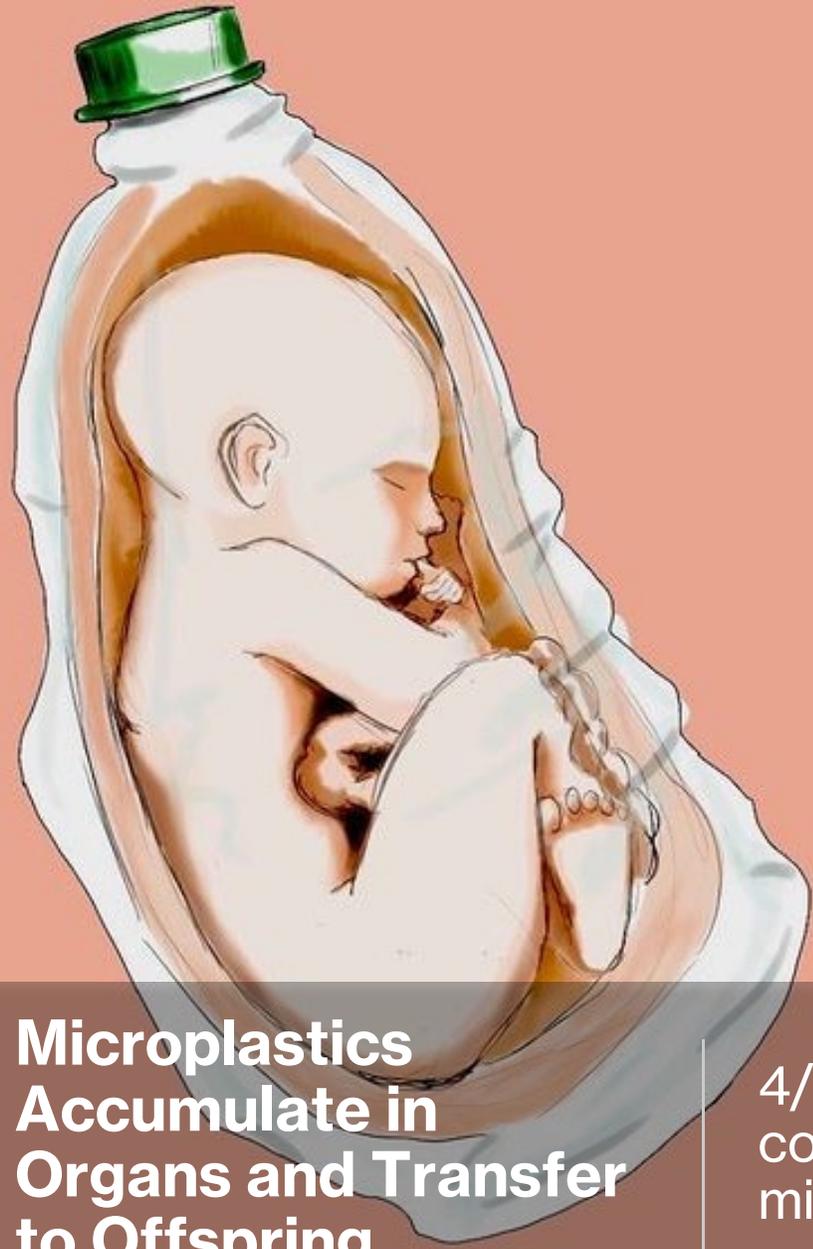
- Microplastics

- Control



~75%
Biosolids in California are Land-Applied

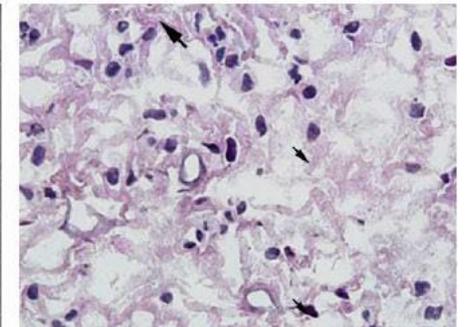
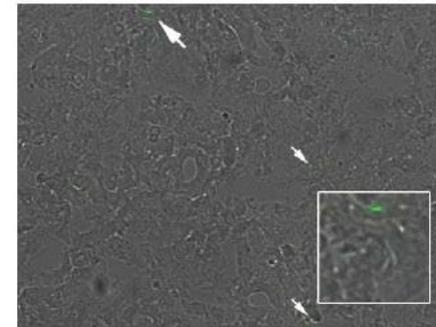
723,000 dry metric tons applied in CA in 2013



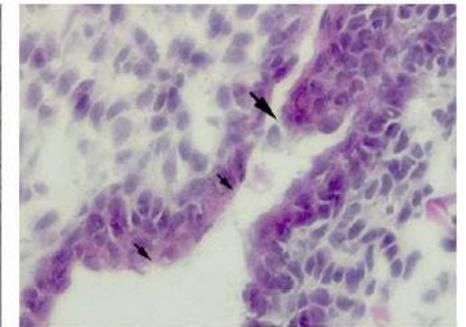
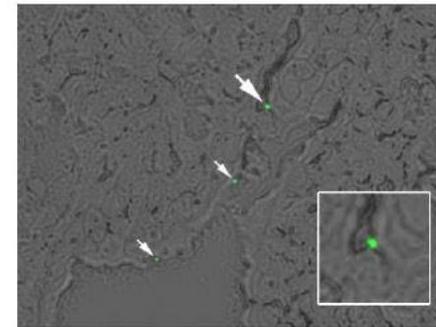
Microplastics Accumulate in Organs and Transfer to Offspring

4/6 placentas contained microplastics

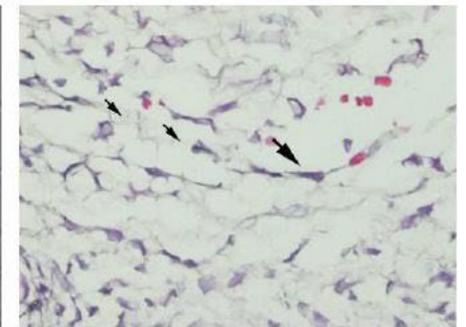
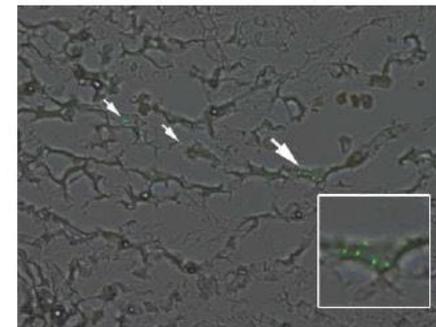
Placenta



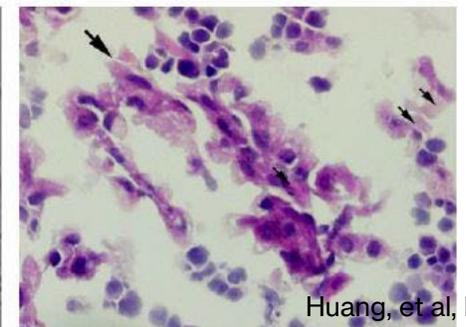
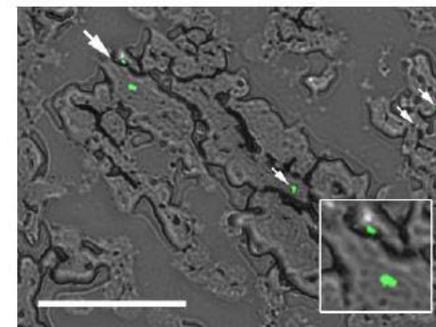
Brain



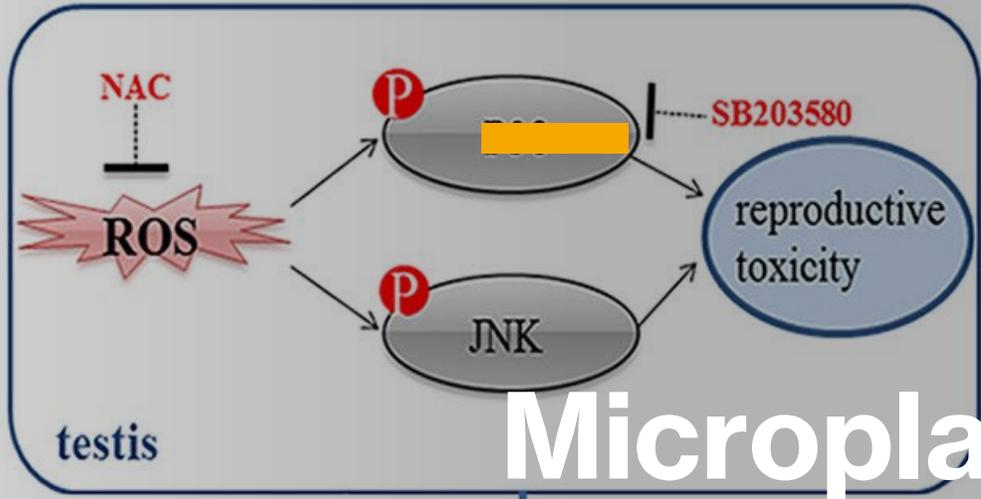
Lung



Liver

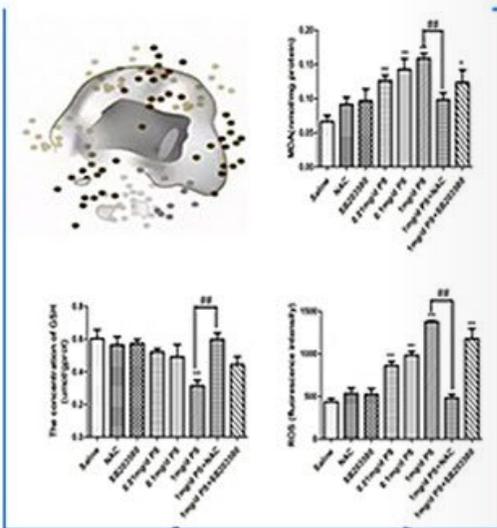


micro-PS
(Oral exposure)

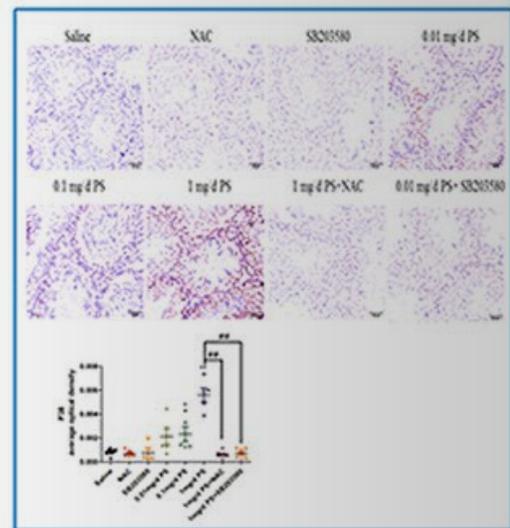


Microplastics Impact Male and Female Reproduction

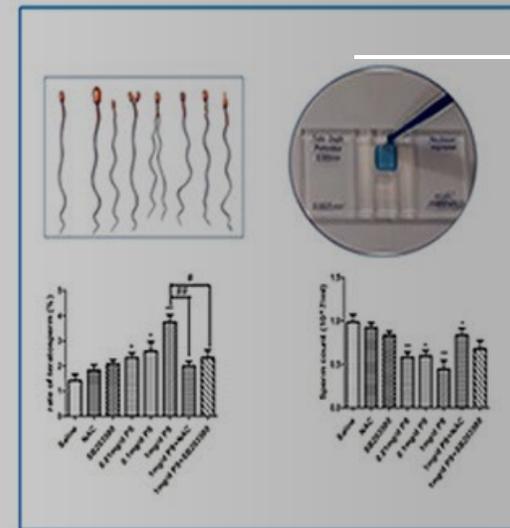
oxidative damage



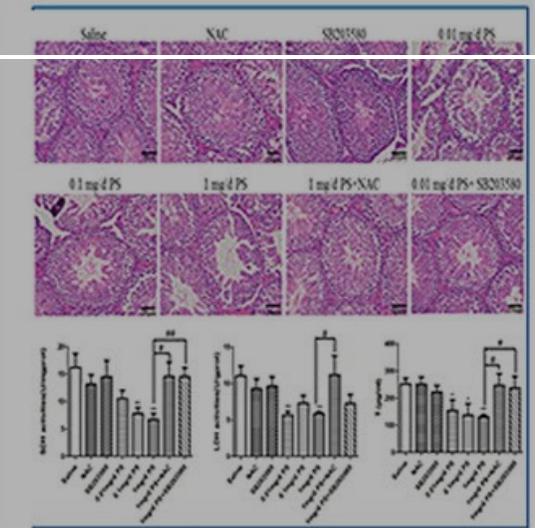
p38 phosphorylation



sperm count deformity rate



enzyme activity testosterone



 Governing Magazine

California Is First to Tackle Microplastics in Drinking Water

Huge gaps exist in scientific knowledge, but California is about to set the world's first health guidelines for microplastics in drinking water.

Mar 17, 2021



California is Global Leader on Microplastics Science and Policy

- CalEPA first government agency to develop monitoring method for microplastics
- California first government to require monitoring in drinking water
- San Francisco Estuary set precedent for microplastics monitoring
- DTSC's Safer Consumer Products one of first government agency worldwide to consider alternatives assessment

CAS REGISTRY

50 Years
> 100
million
organic &
inorganic
substances

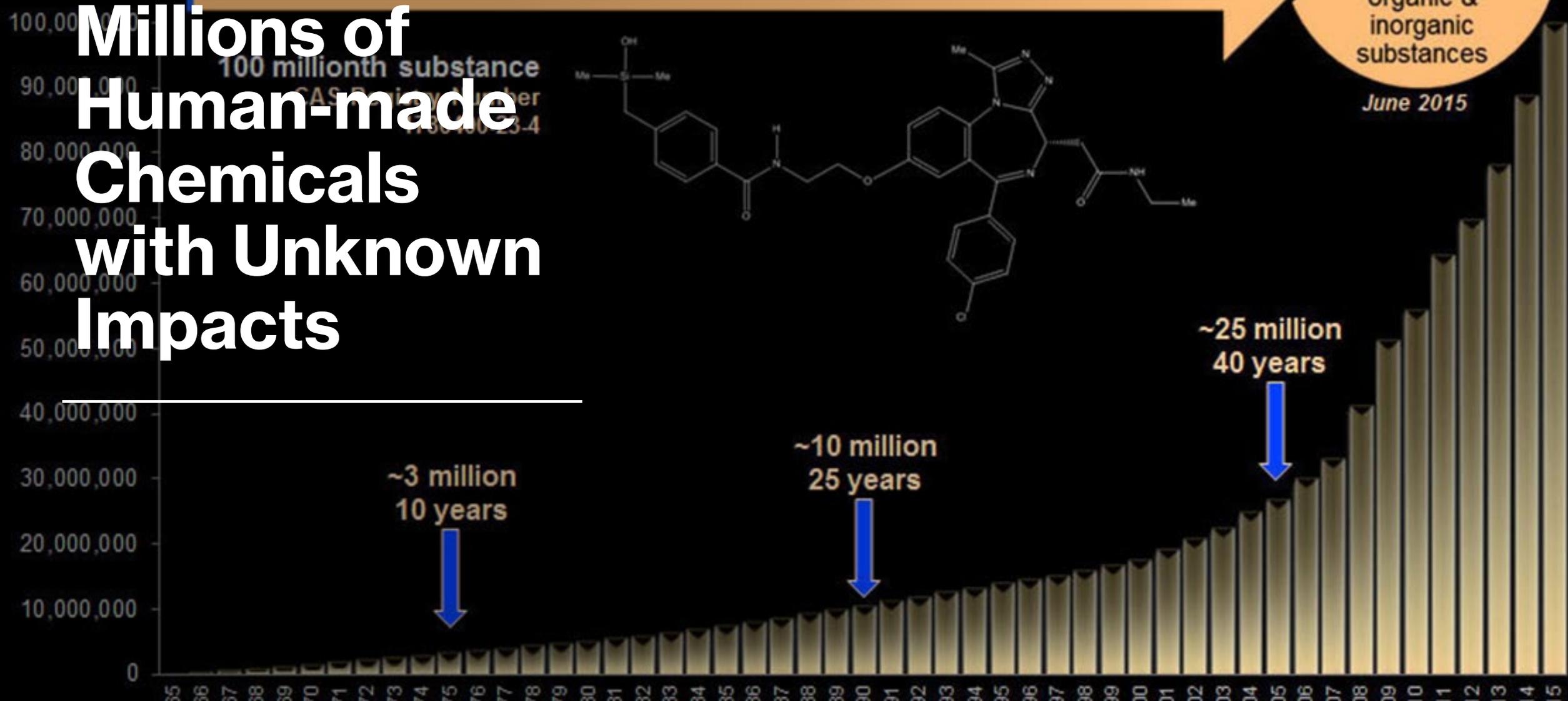
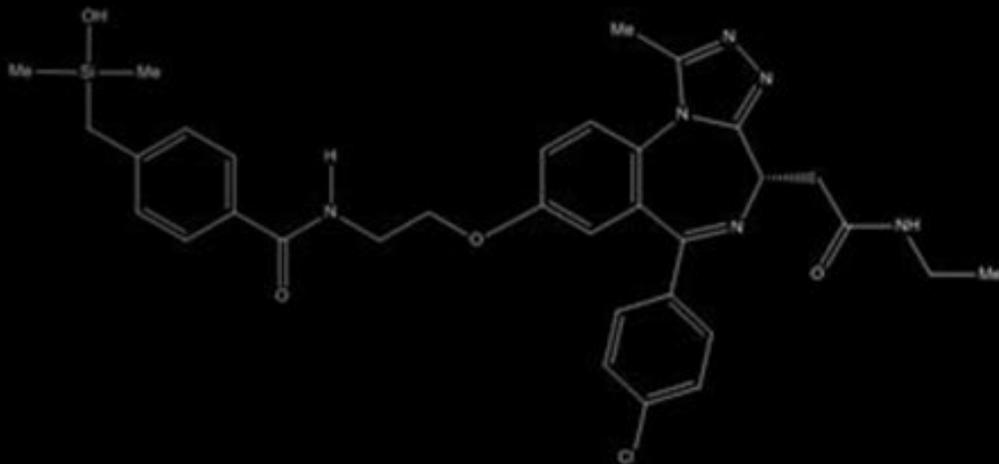
June 2015

Millions of
Human-made
Chemicals
with Unknown
Impacts

100 millionth substance

CAS Registry number

75040-23-4

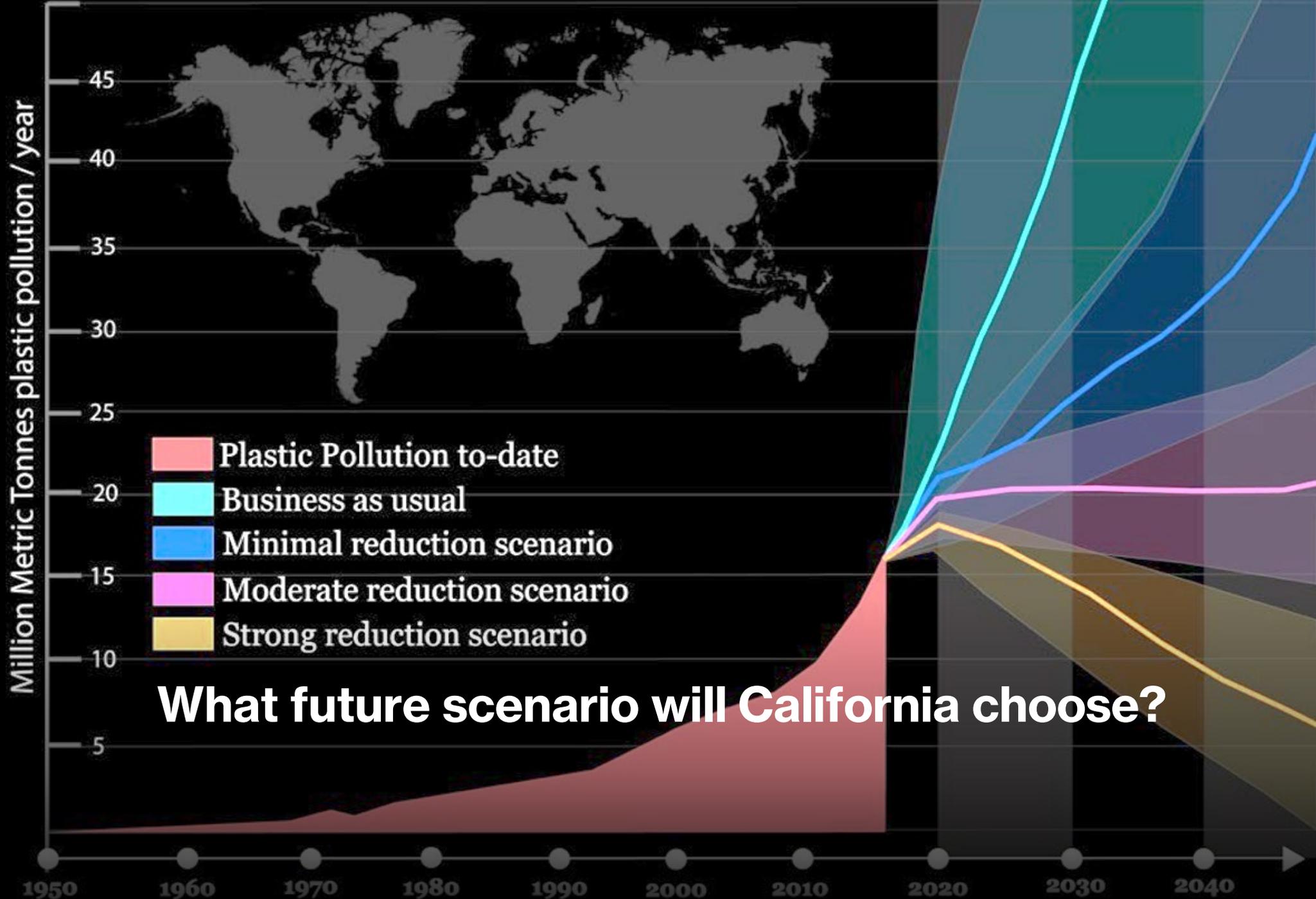


To Recap...

- The U.S. is the global leader in plastic production (43 MT in 2021).
- Worldwide plastic production is projected to increase four-fold to 34 BT by 2050.
- Plastic breaks down into microplastics but does not degrade for thousands of years.
- Microplastics are in 93% of U.S. drinking water.
- Microplastics are ubiquitous and found in food, water and air at increasing rates.
- Microplastics have also been found in human organs, blood, and tissue, including fetuses.
- Humans will consume increasing amounts of plastic indefinitely.

Recap Continued...

- Pollution from a wide variety of sources is overwhelming California and contaminating our air, food and water in addition to ecosystems throughout the state.
- State Scientists in every agency work to reduce pollution or its impacts on public health and the environment.
- Plastic production and its associated pollution will continue to increase making it even more critical for the state to recruit and retain the scientific talent it requires to combat the pollution crisis.



What future scenario will California choose?



Questions?

