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PLENARY 2

Day 2

Solutions for a Plastic Planet

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NATIONAL
ZERO
WASTE
CONFERENCE



PLASTICS 101

NZWC October 2025

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Polymer / waste composition across decades – summary (from [Our Shared Seas](#))

- **1950s–1960s:** plastics were a small but fast-growing share of manufacturing. Early polymers (PE, PVC, PS, nylons) increased. Waste streams were dominated by durable fragments and early packaging.
- **1970s–1990s:** growth of **PE, PP and PET** (packaging and fibres) shifted the waste mix heavily toward short-lived packaging (films, bottles, single-use items). By 2015, **PE (36% of non-fiber production), PP (21%) and PVC (12%)** were the largest polymer groups historically. The “big seven” polymers (PE, PP, PVC, PET, PUR, PS, polyamides) accounted for $\approx 92\%$ of plastics made between 1950–2015.
- **2000s–2020s:** multi-layer films, composites, and complex additives increased (making recycling harder). Packaging dominates waste tonnage; textile fibers (synthetic) are an increasing source of microplastic release. Global recycling of plastics remained low — single digits to low tens of percent (Geyer et al. estimate $\sim 9\%$ recycled cumulatively to 2015; more recent snapshots still show low recycled content in new plastics).

Explosive growth:

- **Explosive growth:** global annual production rose from **~2 Mt (1950)** to **~380–407 Mt (2015)** and to roughly **~400–470 Mt (2025 estimate)** — a **~100–200×** increase in annual production over the postwar period. Cumulative production since 1950 passed **~8 billion tonnes** by **~2015–2018**. (Geyer et al.; Our World in Data).
- **Material concentration:** a small set of polymers (PE, PP, PVC, PET, PS, PUR, polyamides) dominate production and therefore dominate the waste stream — which makes targeted policy (design changes for those polymers, packaging reduction, recycled-content mandates) especially powerful.
- **“Waste” management lagging:** only a small proportion is recycled (Geyer et al. estimated **~9%** of cumulative waste recycled to 2015); the majority has been landfilled, incinerated, or leaked to the environment — producing long-term ecological and health legacies. Our “waste” is not true-costed.
- **Ocean gyres are real and increasing:** field surveys and modelling (Lebreton 2018; Ocean Cleanup work) show that subtropical gyre accumulations such as the Great Pacific Garbage Patch have grown and now contain trillions of pieces (mostly microplastics), with evidence for exponential increase.

Many, many, and more many, plastics

Decade (ending)	Global Production (Mt/yr)	% of Big 7 Polymers	Consumed As (dominant uses)	Wasted As (dominant polymers / forms)
1965	~15 Mt	~85 % (PE, PVC, PS + early PP)	Consumer goods, electrical insulation, basic packaging, pipes	PE & PS packaging, PVC construction offcuts, dumped in open sites or burned
1975	~45 Mt	~88 % (PE, PP, PVC, PS, PET, PUR emerging)	Packaging, construction, household goods, textiles	PE/PP films, PS cups, PVC scrap — mostly landfilled or dumped
1985	~120 Mt	~90 % (Big 7 well-established)	Packaging, textiles (polyester), building, electronics	PE/PP packaging waste, PET textiles, PS foams — little recycling
1995	~180 Mt	~91 %	Packaging (~40 %), textiles (~15 %), construction (~20 %)	Same polymers — packaging dominates; open dumping common in Global South
2005	~240 Mt	~91–92 %	Single-use packaging, consumer goods, automotive, electronics	Multi-layer films, bottles (PE, PP, PET), rising exports of waste plastics
2015	~400 Mt	~92 % (PE 36 %, PP 21 %, PVC 12 %, PET 10 %, PUR 6 %, PS 6 %, PA 1 %)	Packaging (>40 %), textiles (~15 %), building (~16 %), transport (~7 %), electronics (~4 %)	79 % landfilled/leaked, 12 % incinerated, 9 % recycled; waste = same Big 7
2025 (est.)	~430–470 Mt	~92 % (similar shares; minor bio-plastic growth < 2 %)	Packaging still ~40 %, textiles rising, construction stable	Waste dominated by PE, PP, PET films/fibers; ~80 % mismanaged globally

The Big 7 Polymers

Polymer (Abbrev.)	Full Name & Definition	Primary Source (Feedstock)	Key Properties	Main Functions / Applications	Waste & Environmental Issues
1. PE — Polyethylene	Polymer of ethylene (C₂H₄) monomers. Simplest hydrocarbon chain polymer. Exists as LDPE (low-density), HDPE (high-density), LLDPE, UHMWPE.	Derived from ethylene , produced by cracking ethane/naphtha (fossil hydrocarbons). Bio-based ethylene can come from ethanol .	Tough, flexible, chemically inert, water-resistant; adjustable density and strength.	Packaging films & bags, bottles, containers, pipes, toys, geomembranes, cable insulation.	Very persistent; major share of global litter. LDPE films often escape waste collection; difficult to recycle mechanically when thin or contaminated.
2. PP — Polypropylene	Polymer of propylene (C₃H₆) . A polyolefin similar to PE but with methyl side groups giving higher stiffness & melting point.	Derived from propylene , a by-product of oil and gas refining or steam cracking.	Lightweight, rigid, heat-resistant, fatigue-resistant (“living hinge”).	Food packaging, bottle caps, automotive parts, textiles (nonwovens), reusable containers.	Common in single-use packaging and fibers; recycling limited by polymer variety; contributes to microplastics from fibers & woven bags.
3. PVC — Polyvinyl Chloride	Polymer of vinyl chloride monomer (CH₂=CHCl) . Contains ~56 % chlorine by mass.	Ethylene + chlorine (from salt electrolysis).	Rigid or flexible depending on additives; flame-resistant, durable, good insulation.	Pipes, window frames, flooring, cables, synthetic leather, medical tubing.	Additives (phthalates, stabilizers) toxic; releases HCl and dioxins if burned; problematic in recycling.
4. PET — Polyethylene Terephthalate	Condensation polymer of ethylene glycol and terephthalic acid (aromatic polyester).	Ethylene glycol from ethylene; terephthalic acid from para-xylene (oil). Bio-PET can use bio-ethylene glycol.	Clear, strong, lightweight, gas-barrier properties, good dimensional stability.	Beverage bottles, food packaging, textile fibers (polyester), films.	Recyclable (especially bottles); textiles create microfibers; persistence when littered.
5. PS — Polystyrene	Polymer of styrene (C₈H₈) ; can be solid (crystal PS) or foamed (EPS/XPS).	Styrene from ethylbenzene , derived from benzene + ethylene (oil).	Clear, brittle (rigid PS) or insulating (foam PS); easy to mold; low density.	Food trays, cups, packaging foams, insulation panels.	Low recycling rate; breaks into microplastics easily; litter prevalence (especially EPS).
6. PUR — Polyurethane	Formed by reaction of polyols and isocyanates → urethane linkages (–NH–CO–O–).	Derived from fossil-based intermediates (toluene di-isocyanate, MDI, polyols).	Versatile: flexible or rigid foams; excellent cushioning & insulation.	Furniture foams, mattresses, building insulation, coatings, adhesives, footwear.	Complex, cross-linked structure → hard to recycle; burning releases toxic gases.
7. PA — Polyamides (e.g., Nylon-6, Nylon-6,6)	Polymers containing amide (–CONH–) linkages.	Derived from petrochemicals (caprolactam, hexamethylene diamine + adipic acid).	High strength, abrasion-resistant, temperature-resistant; can be spun into fibers.	Textiles (nylon fabric, stockings), engineering plastics (gears, bearings), automotive.	Fiber microplastics in laundry effluent; limited recyclability; energy-intensive production.

Solutions for a Plastic Planet

► 2025 National Zero Waste Conference
October 23, 2025

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Phase 1: Ban New Plastics Production

Stop the bleeding. Stop the harm to future generations.

- ▶ Promote a universal worldwide ban on producing new virgin plastics.
 - ▶ This is being discussed in the Global Plastics Treaty conversations.
- ▶ Classify plastics as a “hazardous waste” pertaining to international trade through the Basel Convention.
 - ▶ The goal of the Basel Convention is “to protect human health and the environment against the adverse effects of hazardous wastes.”



Phase 2: Reduce Plastics Consumption

Reduction is not Recycling: It is a higher priority

- ▶ Reduce the consumption of Plastics
 - ▶ Start with the reduction of the use of Single-Use Plastics
 - ▶ Then reduce unnecessary plastics
 - ▶ Reduce use of all plastics
- ▶ Stop the addiction to plastics
 - ▶ Global plastic waste generation doubled from 2000 to 2019 to 353 million tons.



Phase 3: Reuse of Recovered Plastics

Reuse is not Recycling: Reuse is higher priority

- ▶ Replace SU plastic bags with cloth bags
- ▶ Replace plastic dishware with washables
- ▶ Replace single-use carry-outs with reusables
- ▶ Replace bottled water with refillable containers
- ▶ Replace disposables with repair clinics
- ▶ The CO2 emissions from disposable plastic and polystyrene cups are 3 to 10 times greater than those of reusable ceramic, stainless steel, and glass when compared over their life cycles



Phase 4: Recycle Existing Flows of Plastics

Recycle Existing Plastics – Avoid new production

- ▶ Recycle Ocean Recovered Plastics
 - ▶ Oceans Plastics Recovery Project
 - ▶ Ocean Titans
 - ▶ OceanWorks
- ▶ Avoid the creation of new plastic from oil/gas
- ▶ Earth911 Recycling Database



Phase 5: Introduce Plastic Substitutes



Research and Development for Substitutes

- ▶ Regenerative growth begins with the innovation and use of plastic substitutes that are environmentally safe and nontoxic to human health.
- ▶ We can work toward a future where all plastics are replaced with safe substitutes!
- ▶ Significant business opportunities for expansion into replacement products utilizing materials that substitute for plastics
- ▶ Creativity could be applied with the entrepreneurial spirit!

Phase 6: Phase out all existing production of plastics

Eliminate the production of all plastics

- ▶ An existential threat of climate change drives the need to shut down new proposed plants and existing plastic production plants based on Carbon Dioxide and Methane emissions and human harm.
- ▶ From the moment of creation through the infinite lifespan of each plastic product, continuous environmental impacts are unmitigated and infinitely ongoing.
- ▶ The choice: save the Earth
or continue the use of plastics.



Bridge to Phase out Plastics

Phase 1: Ban New Production of Plastics

Phase 2: Reduce Plastic Consumption

Phase 3: Reuse of Recovered Plastics

Phase 4: Recycle Existing Flows of Plastics

Phase 5: Introduce Plastic Substitutes

Phase 6: Phase out all Existing Production of Plastics



Untangling Plastics: The Missing Link in Mitigating Climate Change

Book Publication date: Nov 14, 2025

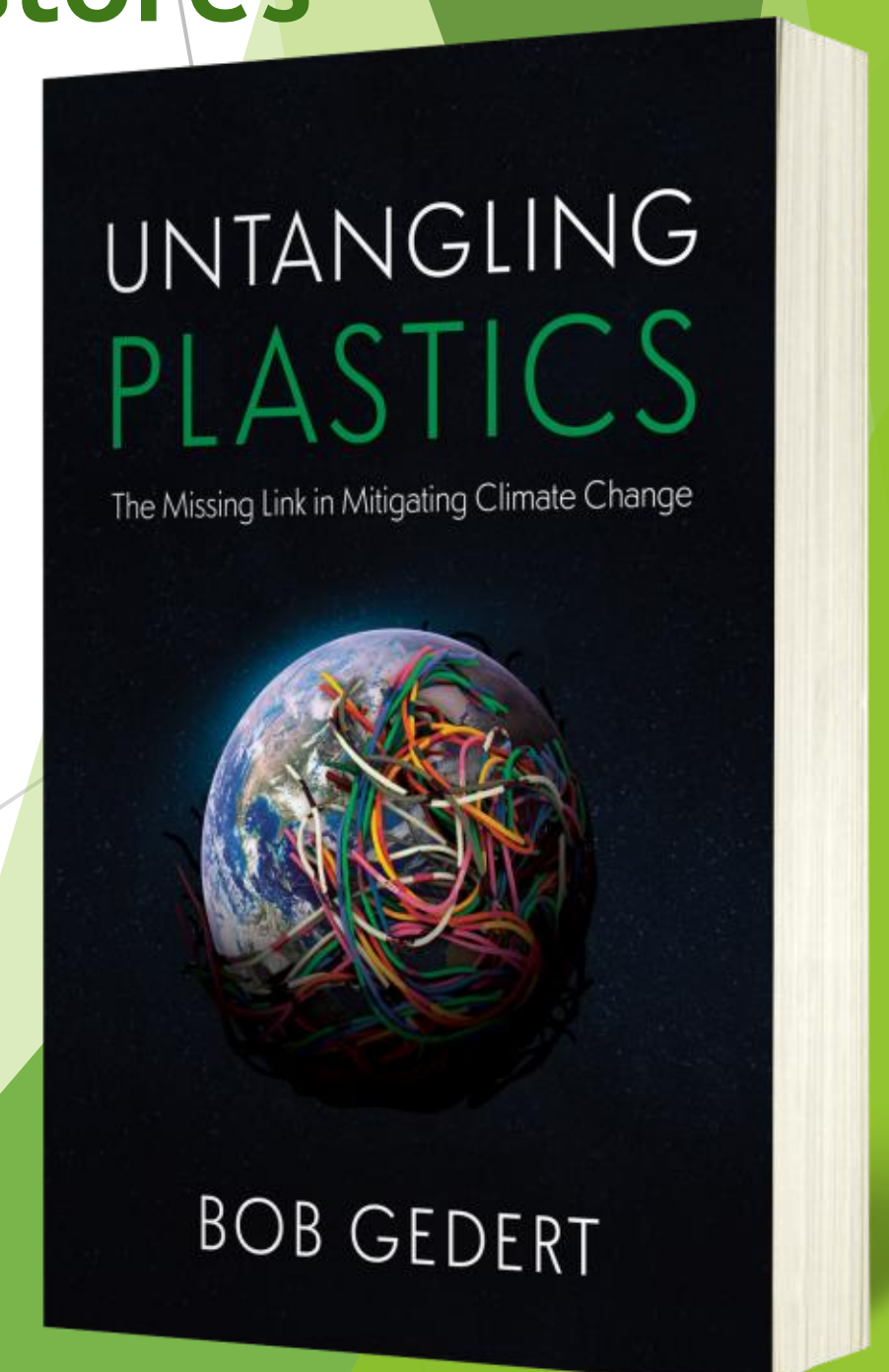
Can be purchased on Amazon, Barnes and Noble, and local bookstores

UntanglingPlastics.com

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The Truth: Plastic Pollutes

During: Fossil Fuel Extraction,
Refining, Shipping, Storage →
Plastics and Petrochemical
Manufacturing → Plastics
Shipping, Storage, Use, and
Disposal

**Plastic causes "disease
and death from infancy
to old age" costing \$1.5
trillion annually. - Lancet
Countdown on Plastics**



To solve plastic pollution, turn off the plastics tap



Plastics Tap installation in Nairobi, Kenya, by Ben Von Wong





Since the 1980s and 90s, laws aimed at eliminating plastic pollution have been cropping up around the world.

Such a piecemeal approach can be helpful locally, with measurable impacts, but these policies only a drop in the ocean in terms of impact on the grand scale of plastic pollution.





The plastic industry loves the narrative that people pollute and cause plastic pollution by littering and failing to recycle.

When really it's the plastic industry's businesses and products that are causing harm.



Solution: Global Plastics Treaty

Cut and cap plastic production, regulate and eliminate toxic chemicals, support and incentivize real solutions, stop creating industrial sacrifice zones.

Earlier this year, parties rejected a weak treaty. Negotiations are still on the table.



What are real solutions?

Plastic-Free
Reuse
Refill
Repair
Share
Regenerate
and REFUSE single-use



Plastic was first mass produced in the 1940s and 50s. That's less than 100 years ago.

THERE WAS LIFE BEFORE PLASTIC! Real solutions exist today.

Individuals can embody the changes they want to see by making lifestyle shifts. But we need systems change to make a serious difference and solve the crisis we face.

Learn more: www.plasticpollutioncoalition.org



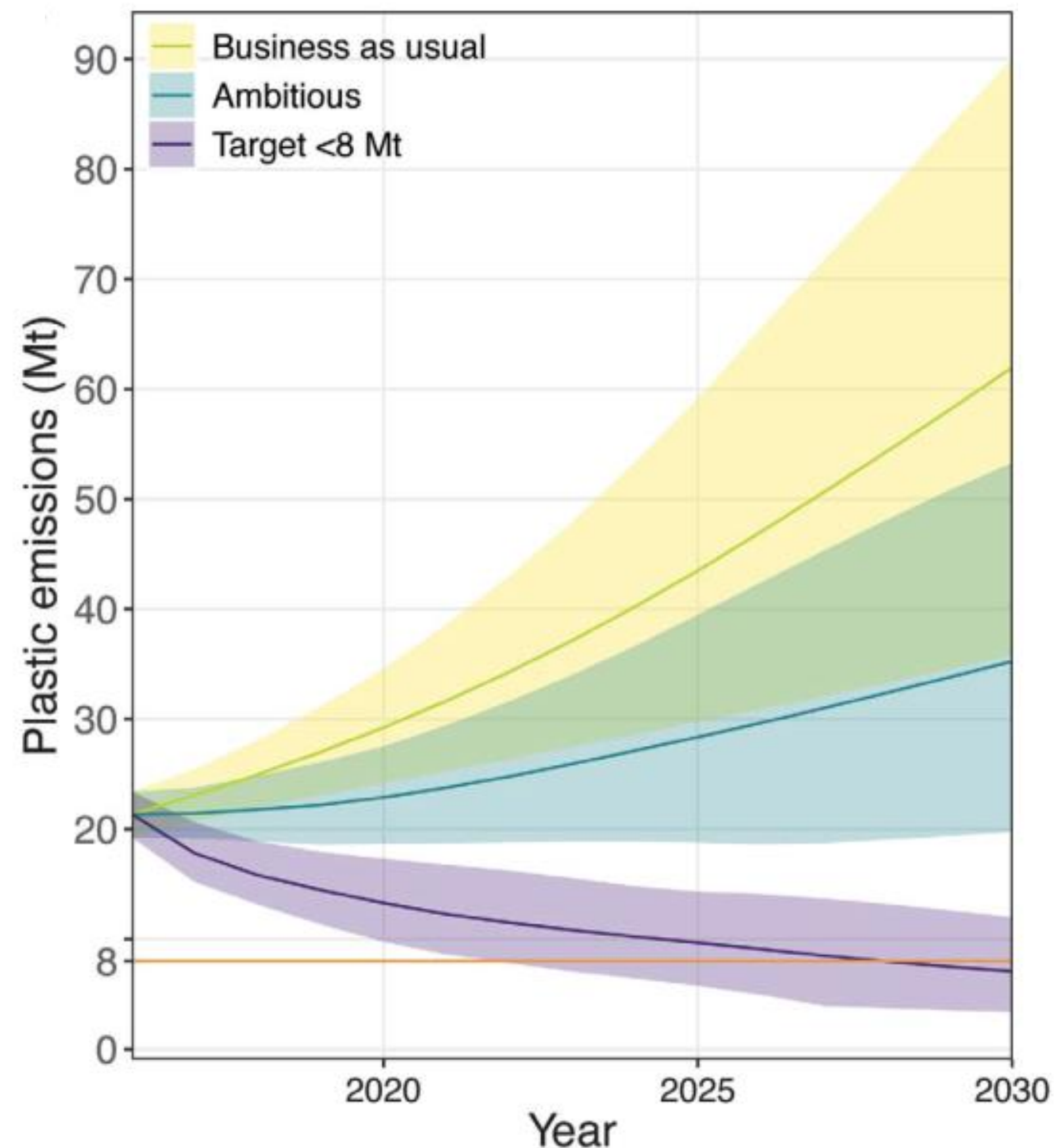
plasticpollutioncoalition

An underwater scene featuring a large school of fish swimming in clear blue water. In the foreground, there are large, yellowish-brown seaweed fronds. The overall atmosphere is serene and natural.

A healthy ocean and a thriving planet, forever and for everyone.

Ocean Conservancy unites science, people and policy to protect our ocean, today and for generations to come.

The need for a comprehensive approach



To reduce plastic emissions into the ocean to 8 Mt / year (2010 levels):

- Make less plastic: 25-40% decrease per capita
- Increase quantity and quality of waste management/recycling: 60-99%
- Continue targeted clean ups: 40%



Ending Ocean Plastics

- Ocean Plastics Science
- Conservation Cleanups
- Plastics Policy

PLASTICS POLICY

Our goal is to prevent plastics from becoming pollution in the first place.

ELIMINATING PROBLEMATIC PLASTICS

We focus on banning and phasing out the most highly polluting plastics to have an immediate impact on the ocean *today*.

HOLDING PRODUCERS ACCOUNTABLE

We focus on holding producers financially accountable for the plastics they're generating to improve how we use and manage plastics to protect the ocean for *tomorrow*.

REDUCING SINGLE-USE PLASTICS

We focus on policies that require a reduction in single-use plastics to achieve our goal of a 50% reduction of single use plastics by 2050 to protect our ocean into the *future*.



Stop Buying Plastic Packaging

If we don't buy it -- they won't make it



Promoting Consumer Campaigns that Change Behavior:
Buy Recycle ♦ Recycle Right ♦ Reduce ♦ Reuse ♦ Refuse ♦ Compost

▶ This approach would have four major components:

- Strategic Consumer boycotts
- Incentive-based public policy
- Support for sustainable businesses and policies
- Consumer campaigns to buy recycled and incentivize reduce, reuse, and refuse

Strategic Consumer Boycotts

- Targeting the top corporate plastic polluter
- Refusing specific types of problematic plastic packaging
- Rejecting unnecessary packaging
- Switch to plastic-free, targeting better alternatives.
- Promoting plastic-free stores and shopping aisles



Incentive-based public policy

- Plastic bag fees
- Pay-as-you-throw (PAYT)
- Deposit-refund systems
- Performance-based rewards



Support for sustainable businesses and policies

- Eco-design incentives
- Reduce single-use plastics
- Implement reuse and refill systems
- Improve waste management



Why will these strategies work?

- Targeted companies fear reputational damage from consumer backlash
- Making alternatives more economically appealing penalizing plastics
- Drives consumer behavior to reject plastics
- Increases market demand for eco-friendly alternatives



Why will these strategies work?

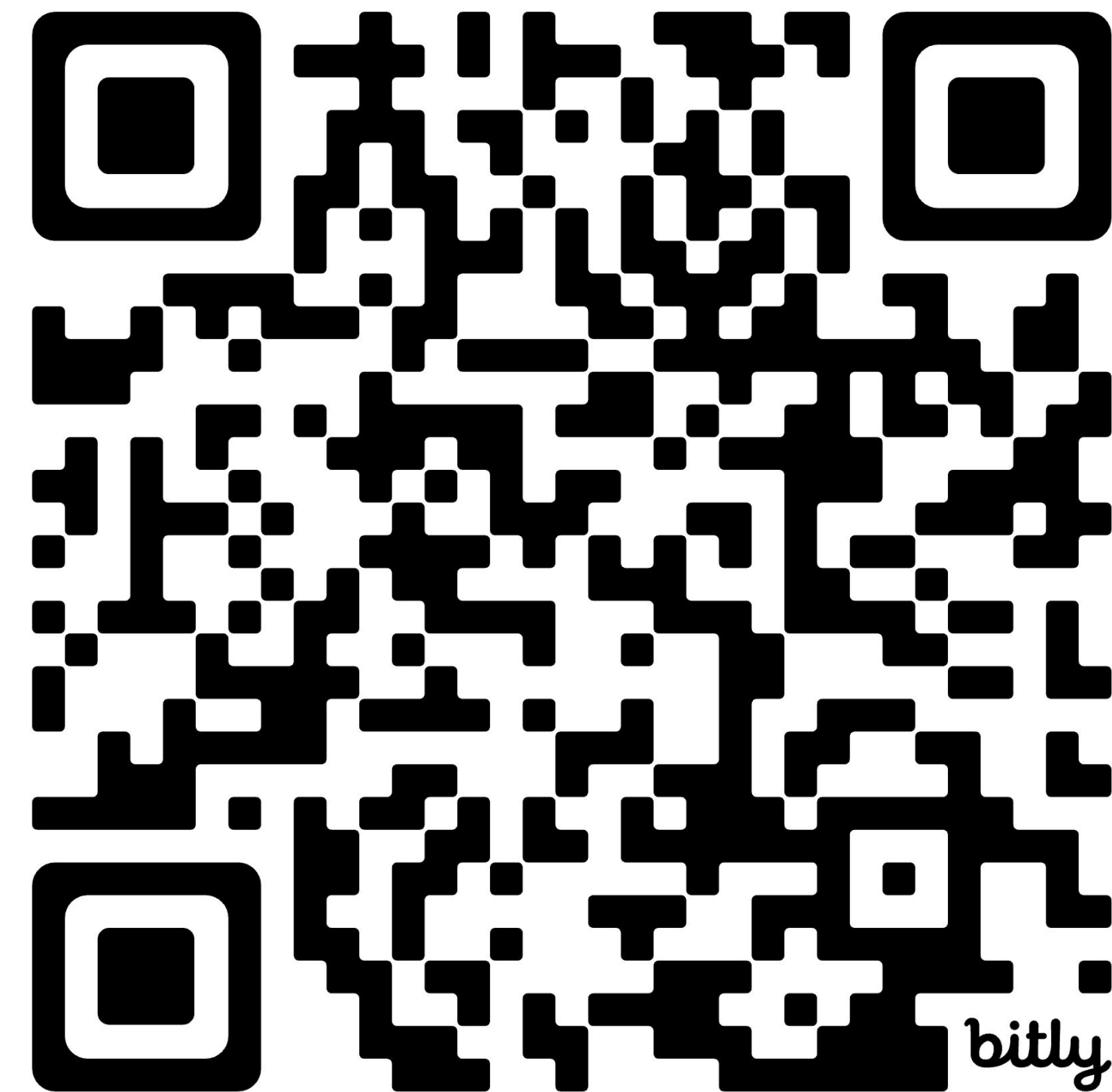
- Companies that respond :
 - Get competitive advantage from sustainable practices
 - Motivates more companies to reduce their reliance on single-use plastics.
- Promotes the use of materials that and supports a circular economy.
- Supports Global Policy Development



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"the world is a pile of shit: if it's going to be moved at all, it's got to be taken by handfuls", From Allen Ginsberg's poem "The Terms In Which I Think Of Reality".