

Testimony on Vermont H.105

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April 6, 2017



**THAYER SCHOOL OF
ENGINEERING
AT DARTMOUTH**

Our **PLASTISPHERE**

- About 330 million tons of plastic were produced in 2016, of which about 37% was disposable packaging.
- Plastics accumulate in the environment and are found in
 - air
 - soil
 - fresh water
 - seawater
 - deep-sea sediments
 - sea ice
- Plastics make up 60-80% of marine litter.
- Polyethylene (PE), polypropylene (PP), and polystyrene (PS) are the major components of microplastic debris in the ocean.
- Single use carryout bags are most commonly PE.
- PE can take more than 100 years to break down.

THE GREAT ESCAPE

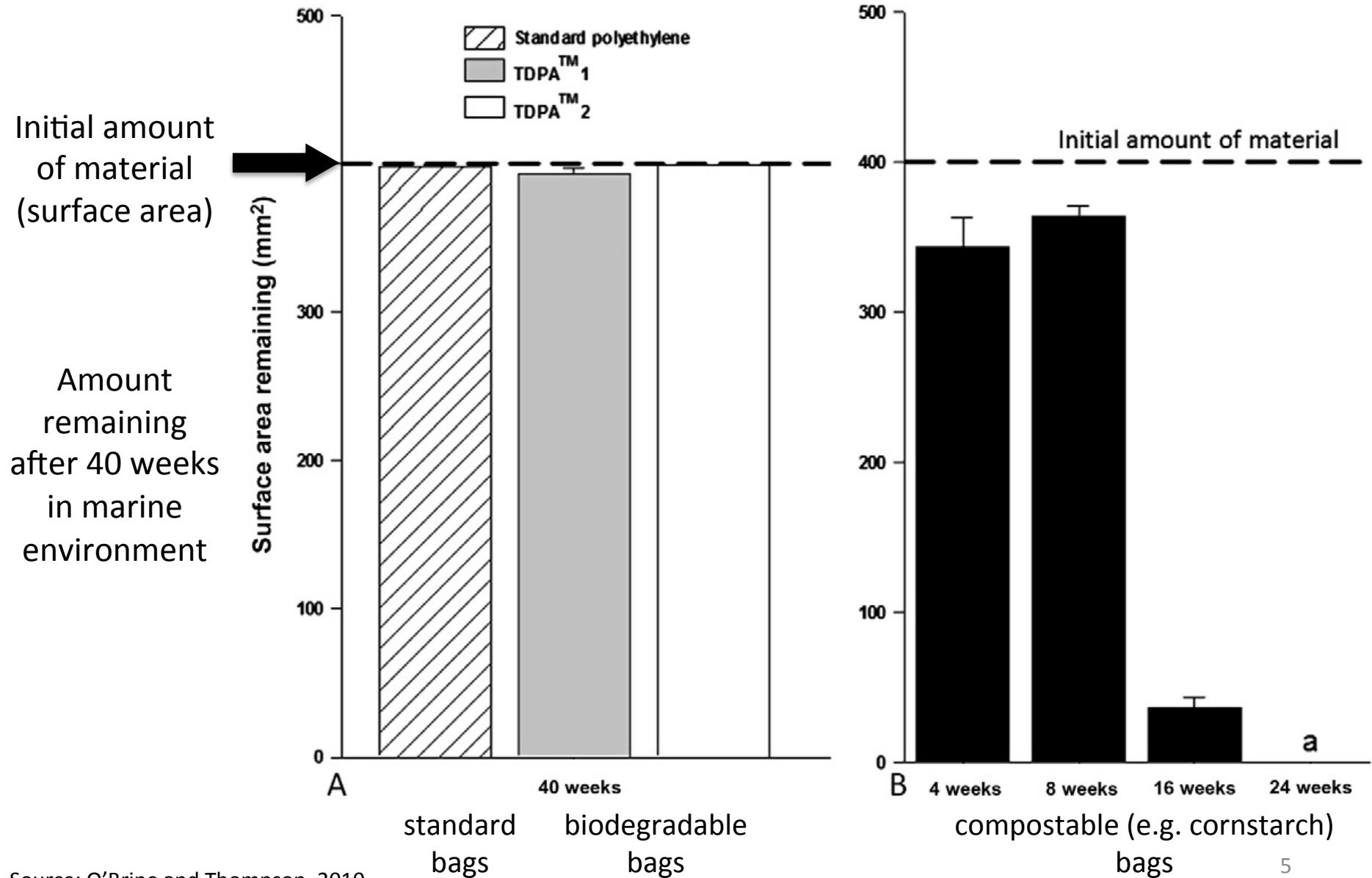
Plastics bags in the environment



Degradation ???

- Abiotic oxidation by exposure to ultraviolet radiation is the initial and rate-determining step for PE degradation in the environment.
- Biodegradable plastic bags contain additives intended to hasten their chemical degradation in the presence of UV light.
- Biofilms form on the surface of bags in the environment within weeks, and biofilms block as much as 90% of the transmitted UV light, drastically slowing degradation.

Plastic bags persist in the environment



Source: O'Brine and Thompson, 2010

~~Degradation~~ Fragmentation

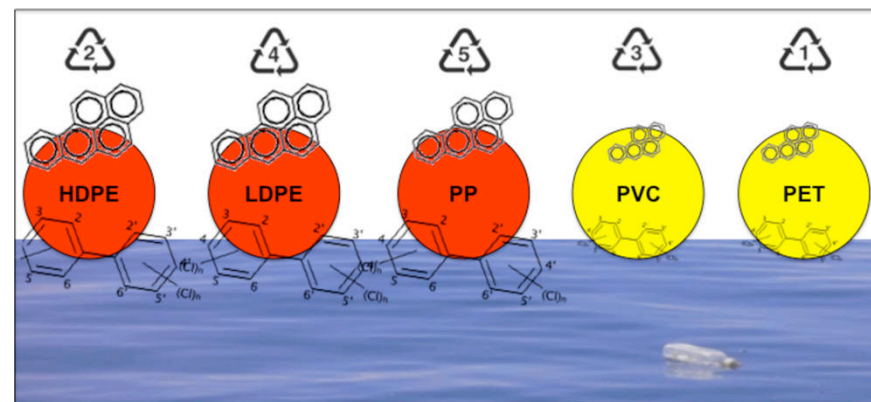
- Large plastic items fragment over time into smaller pieces, which are more readily transported.
- Microplastics are defined as plastic debris <5 millimeters in size.
- Microplastic particles come from the breakdown of larger plastic items, as well as from abrasives, exfoliants, cosmetics, and pre-production plastic pellets.



A toxicological hazard

- Chemicals used in manufacturing, or present in the environment, are sorbed by microplastics and released to organisms

- phthalates
- polychlorinated biphenyls (PCBs)
- polycyclic aromatic hydrocarbons (PAH)
- organochloride pesticides



- PE sorbs an order of magnitude more phenanthrene (a PAH) than either polypropylene or PVC
- PCBs are sorbed in far greater concentrations by PE and PP than by PET and PVC.

Marine animals ingest plastic

- Plastic debris presents a hazard to a variety of animals.
- More than 260 species including fish, seabirds, turtles, and marine mammals have been documented to become entangled in plastics or ingest them.
- Ingestion can result in ulceration or starvation.
- In one study, PE and PP accounted for 97% of the total plastic present in fur seal scat.
- Turtles mistake plastic bags for jellyfish.
- Microplastics have been found in many commercial species of fish, mollusks, and crustaceans
- Effects on human health are being examined



Transport and release of chemicals from plastics to the environment and to wildlife

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Morton A. Barlaz³, Susanne Jonsson⁴, Annika Björn⁴, Steven J. Rowland⁵,
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Water Research

journal homepage: www.elsevier.com/locate/watres

Leachate from microplastics impairs larval development in brown mussels

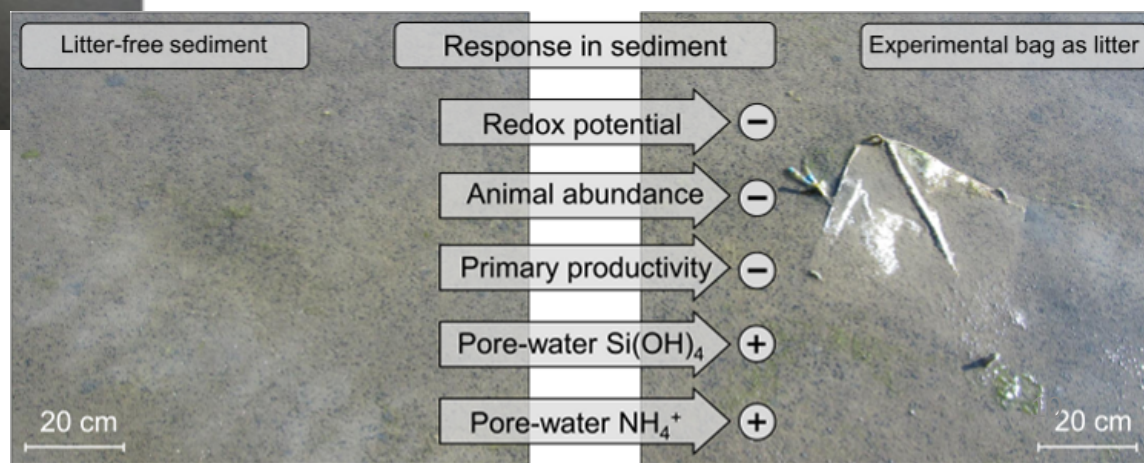
Pablo Pena Gandara e Silva^a, Caio Rodrigues Nobre^b, Priscila Resaffe^c,
Camilo Dias Seabra Pereira^{b,c}, Felipe Gusmão^{a,c,*}

Impacts of Discarded Plastic Bags on Marine Assemblages and Ecosystem Functioning

Dannielle Senga Green,^{*,†,‡} Bas Boots,[§] David James Blockley,^{||} Carlos Rocha,[†] and Richard Thompson[⊥]



Plastic bags on beaches produce anoxic (oxygen poor) microhabitats



Microplastics also found in freshwater ecosystems

Less is known about the effects of plastics on freshwater systems, but research in this area is increasing.

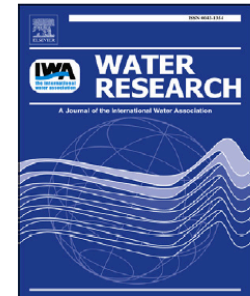


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Review

Microplastics in freshwater systems: A review of the emerging threats, identification of knowledge gaps and prioritisation of research needs



Dafne Eerkes-Medrano ^{a,*}, Richard C. Thompson ^b, David C. Aldridge ^a

Our problem, our solution !

- Goods are already very well packaged, do we really need a further disposable item of packaging to take them home in?
- The single use plastic carrier bag is a symbol of our throwaway society, and an unnecessary and avoidable use of plastics.
- We need to retrain ourselves so that if we go out shopping it becomes as automatic to take out a reusable bag with us as it would be to take a rain coat or an umbrella if it were raining.