SENATE COMMITTEE ON ENVIRONMENTAL QUALITY
SENATE COMMITTEE ON NATURAL RESOURCES AND WATER

CLOGGING CALIFORNIA'S OCEAN WITH PLASTICS

Wednesday, March 20, 2019

Dr. CLARE STEELE
California State University, Channel Islands

Microplastic types

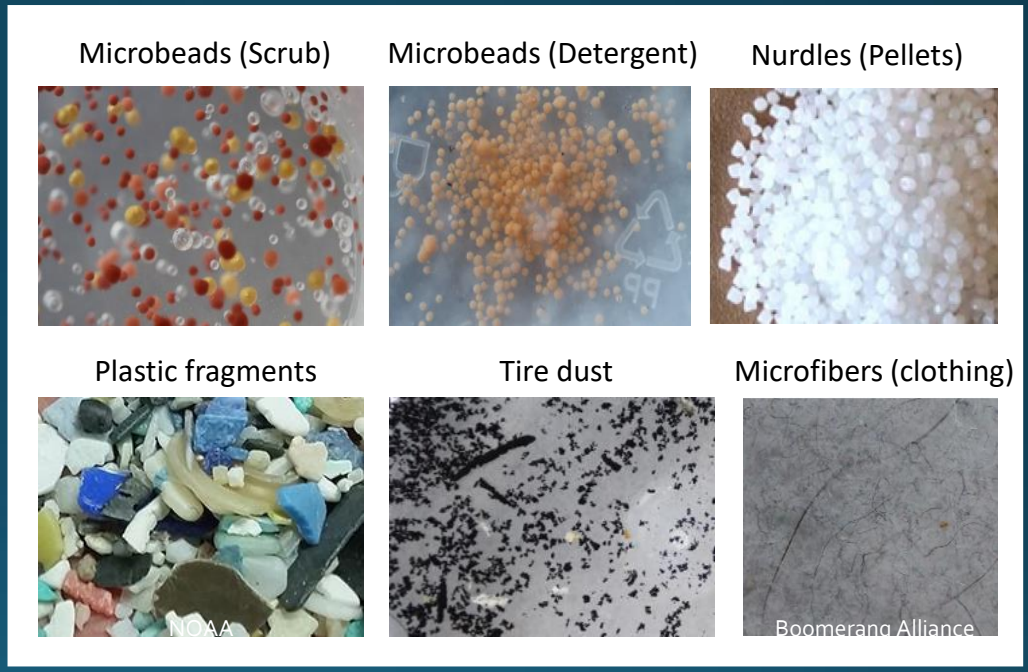
Plastic particles and fibers less than 5 mm – 0.001 mm

Primary microplastics

- Manufactured microbeads, nurdles

Secondary microplastics

- Fragments of larger items

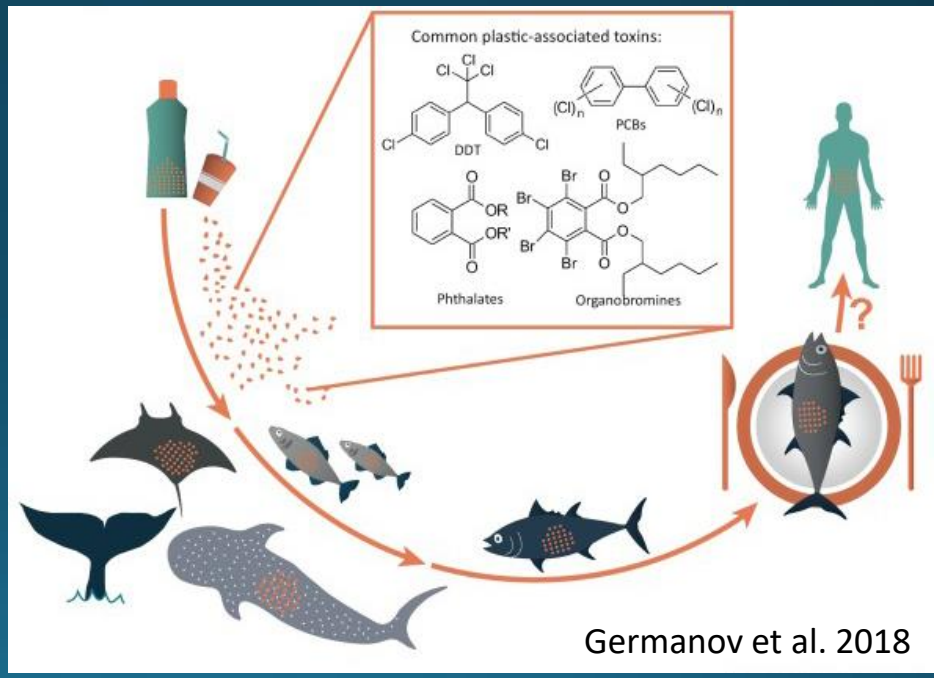


Characterizing ocean microplastics

Polypropylene (24%), low-density polyethylene (21%), polyvinyl chloride (19%) and high-density polyethylene (17%) - Andrady 2011

Additives:
Plasticizers, phthalates, antioxidants, anti-static agents and flame retardants

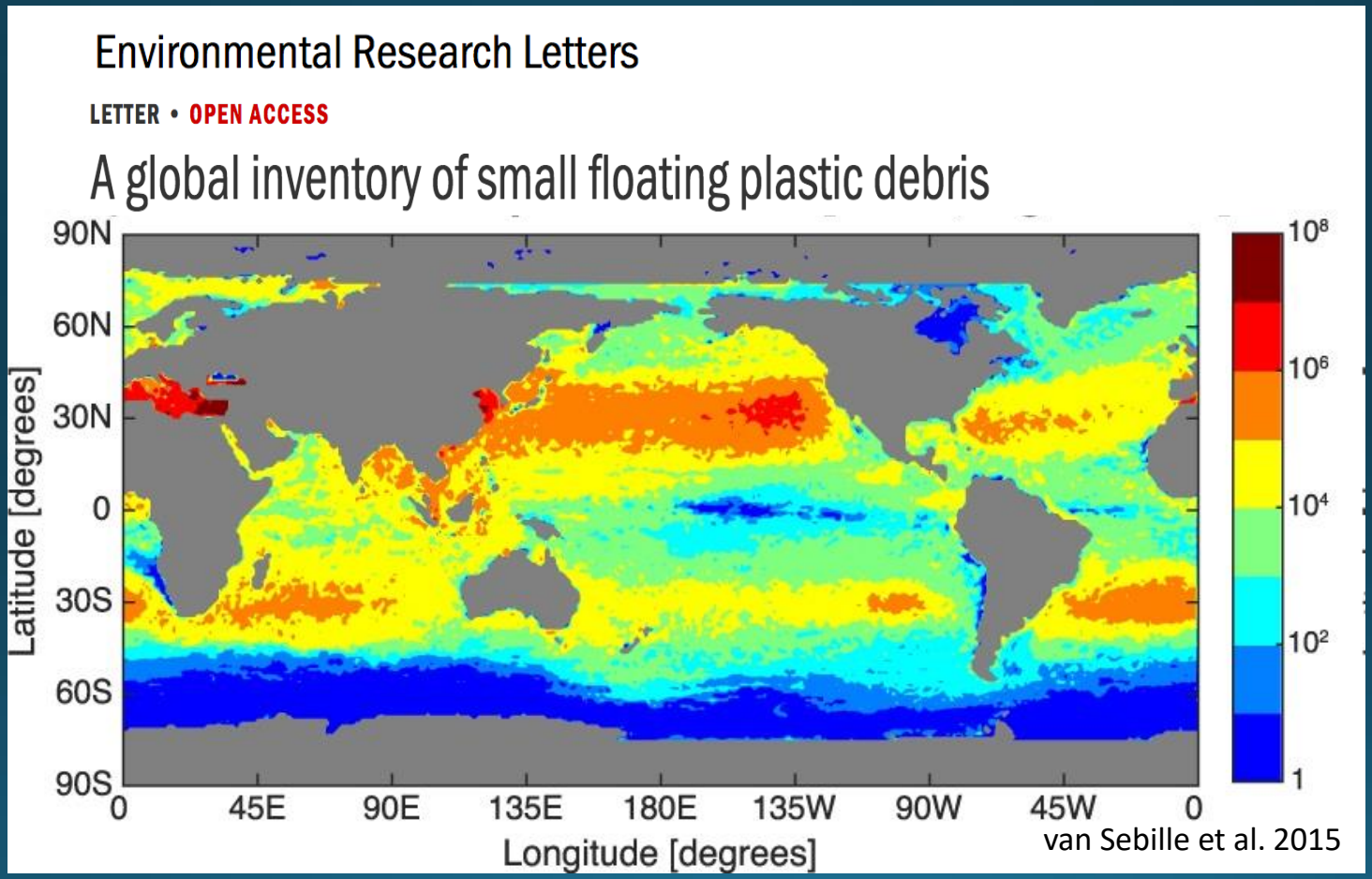
Adsorbed chemicals:
PCBs, DDT, brominated flame-retardants



Germanov et al. 2018

Floating microplastics estimated at 15 - 51 trillion particles

- van Sebille et al. 2015



Ocean microplastics present even in remote regions

Surface waters

Deep waters

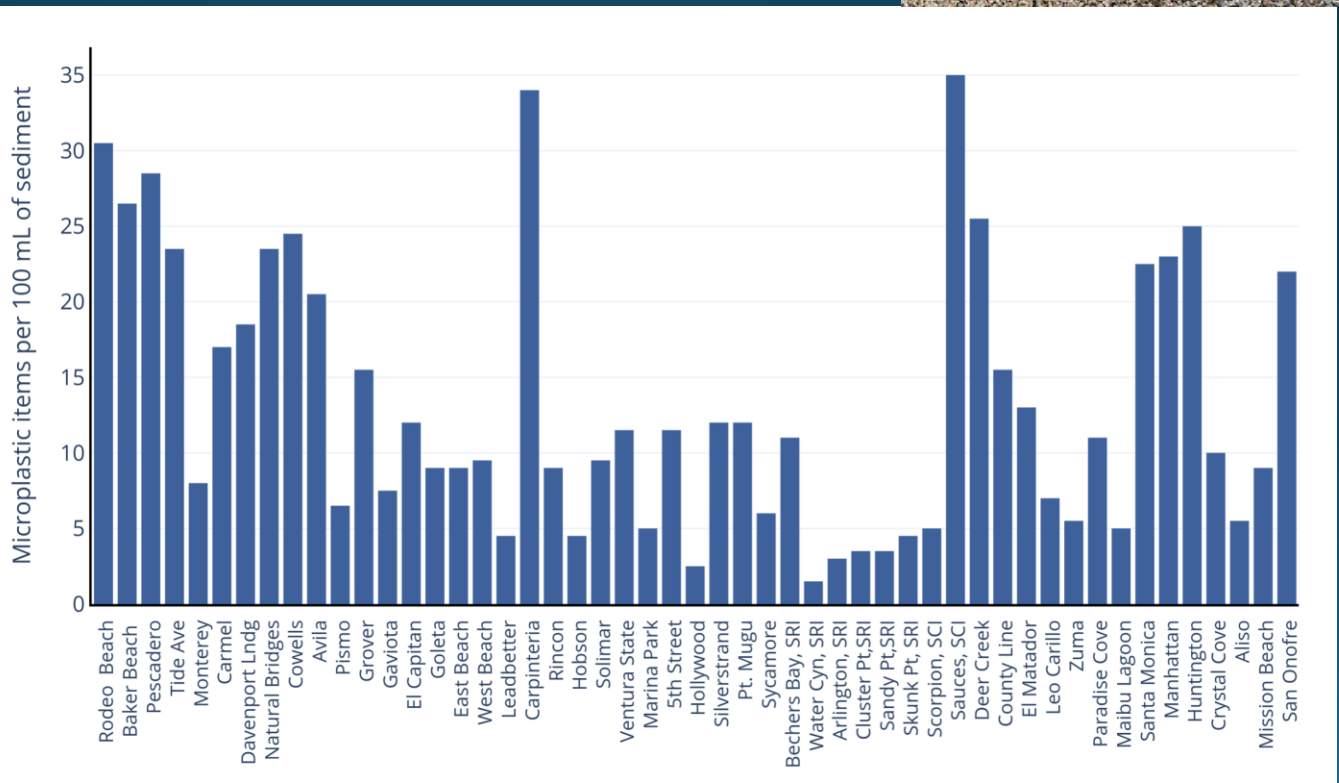
Woodall et al. 2014

Beach sediments

Deep ocean sediments

Microplastics ubiquitous on CA beaches

- Present in beach sands at 51 beaches including Channel Islands
- Ingested by Pacific mole crabs (35%) and enter coastal foodwebs



Surface deposition on biological communities

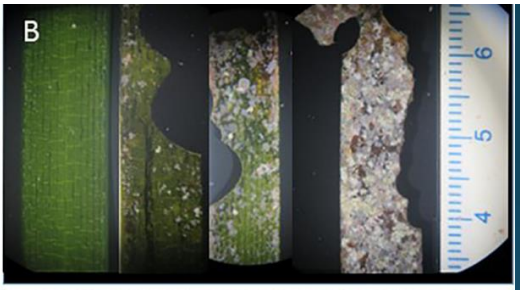
Plastic waste associated with disease on coral reefs

Joleah B. Lamb[1,2,3,*], Bette L. Willis[2,3], Evan A. Fiorenza[1,4], Courtney S. Couch[1,5,6], Robert Howard[7], Douglas N. Rader[8], ...
+ See all authors and affiliations

Science 26 Jan 2018:
Vol. 359, Issue 6374, pp. 460-462
DOI: 10.1126/science.aar3320

Thalassia testudinum as a potential vector for incorporating microplastics into benthic marine food webs

Marine Pollution Bulletin
Volume 135, October 2018, Pages 1085-1089



Goss et al. 2018

Interactions between microplastics and phytoplankton aggregates: Impact on their respective fates

Marine Chemistry
Volume 175, 20 October 2015, Pages 39-46

Zhao et al. 2018

Lamb et al. 2018

Ingestion of microplastics

- Over 220 different species have been found to consume microplastic
- Small size makes microplastics indistinguishable from natural prey
- May be accidentally ingested when filter feeding


Cole et al. 2013


UC Irvine


Ellevog

Ingestion of microplastics

Microplastics directly consumed by:

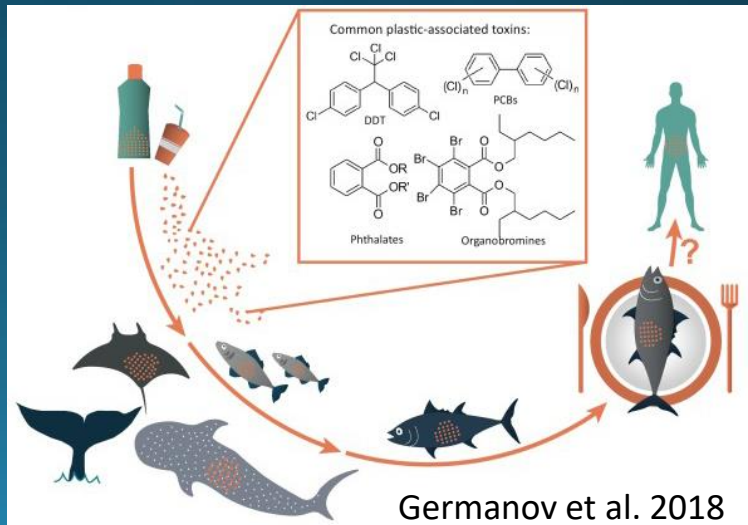
- ocean trench amphipods (7000 – 10,000 m depth)
- endangered tidewater gobies in California
- 63 species of seabird

Effects of microplastic ingestion

- Physical – false satiation, altered feeding behavior, gut perforation, tissue damage
- Chemical – toxicity, inflammation, impacts to reproduction and growth
- Demonstrated impacts at the sub-lethal / individual mortality rather than population-level

Ongoing concerns

- Microplastics are ubiquitous in marine environments and increasing
- Evidence regarding microplastic toxicity is emerging
- Seafood consumption is one pathway for human microplastics exposure
  - Present in mussels, oysters, fishes sold for human consumption
  - 50-100 particles per mussel
  - Up to 11,000 particles consumed per year
- Bioaccumulation and food chain effects are not yet well understood



Germanov et al. 2018

Dr. Clare Steele
California State University, Channel Islands
clare.steele@csuci.edu

microplastics.xyz

California State University
CHANNEL ISLANDS