

Turning off the Tap on California's Trash

Sherry Lippiatt, PhD
California Regional Coordinator
NOAA Marine Debris Program
I.M. Systems Group



Marine Debris Definition



“Any persistent solid material that is manufactured or processed and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment or the Great Lakes.”

Marine Debris Sources



Ocean-Based

- Commercial & recreational fishing
- Offshore oil and gas
- Cargo ships
- Abandoned and derelict vessels
- Research equipment



Land-Based

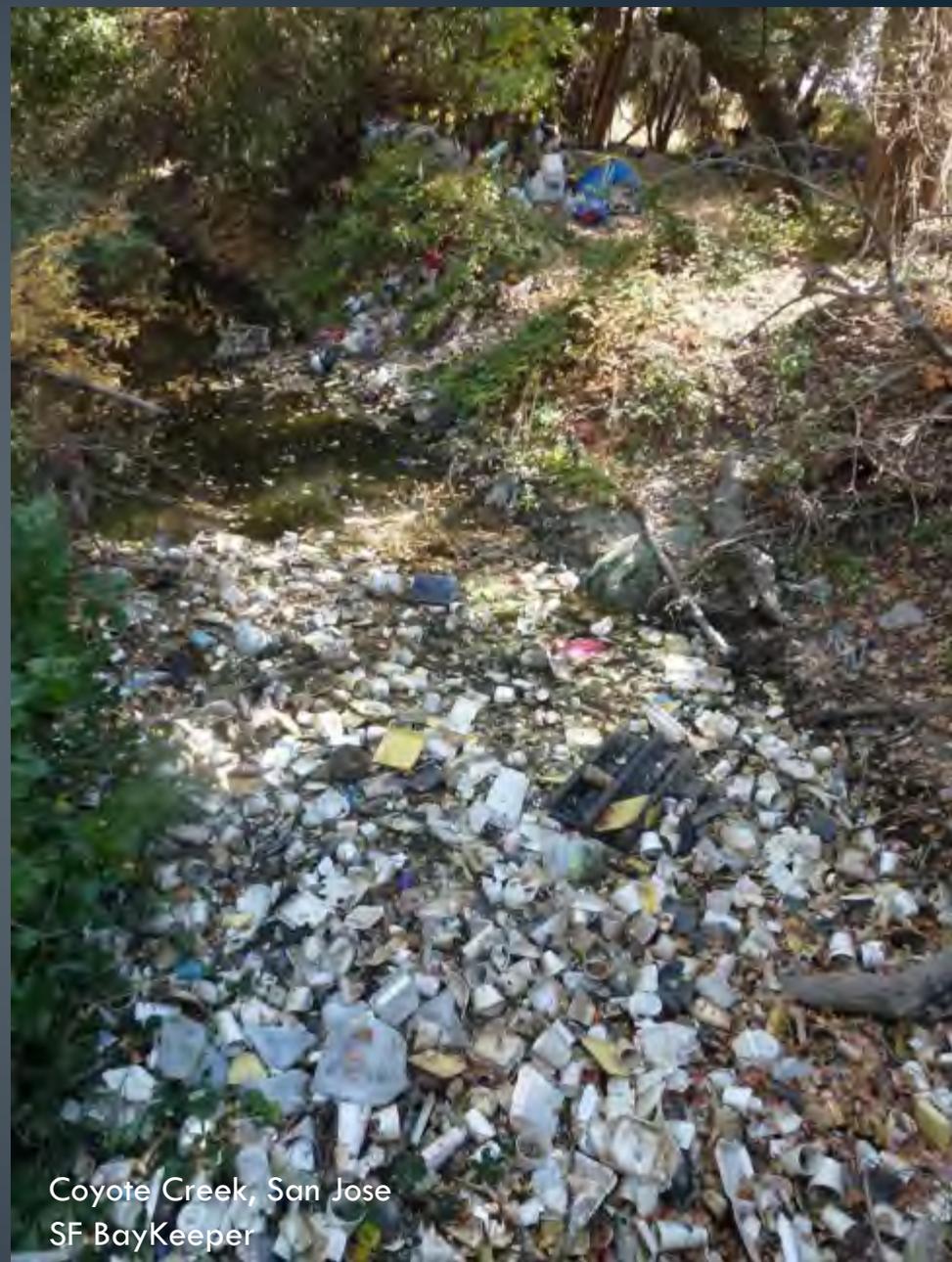
- Littering
- Illegal Dumping
- Improper waste management
- Storm water discharge
- Extreme weather events

Marine Debris is Ubiquitous





Ballona Creek, Los Angeles
Bill MacDonald (Algalita)



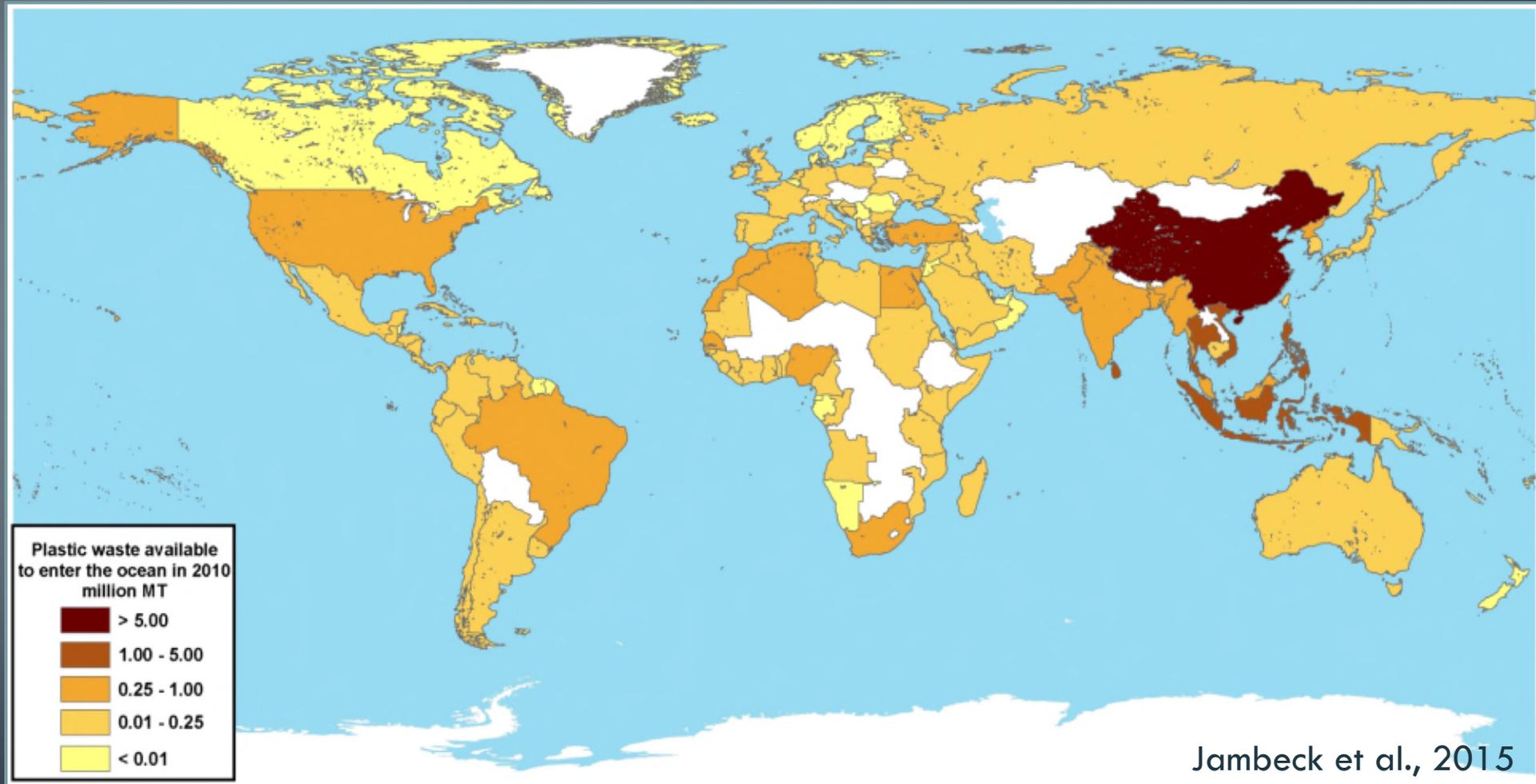
Coyote Creek, San Jose
SF BayKeeper

How Trash Gets Into Creeks



Plastic

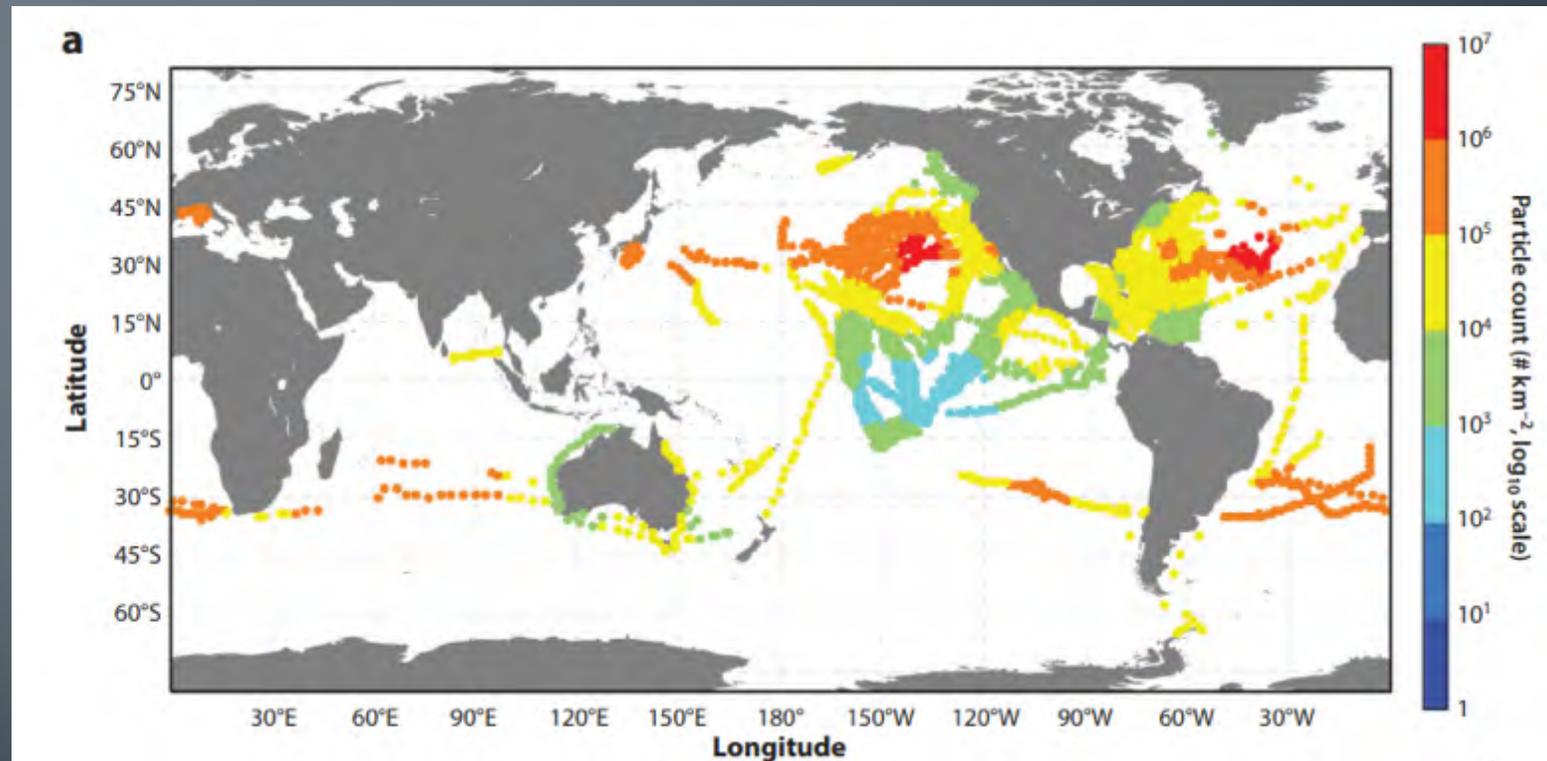
~ 8 million tons of plastic debris ENTER the ocean every year



Jambeck et al., 2015

Fate of Plastic in the Sea

- Oceans are undersampled
- Surface waters account for $\sim 1\%$ of the 8 million metric tons / year going in (E.g. *Van Sebille et al., 2015*: 93,000 to 236,000 metric tons of plastic float on the sea surface)



Fate of Plastic in the Sea

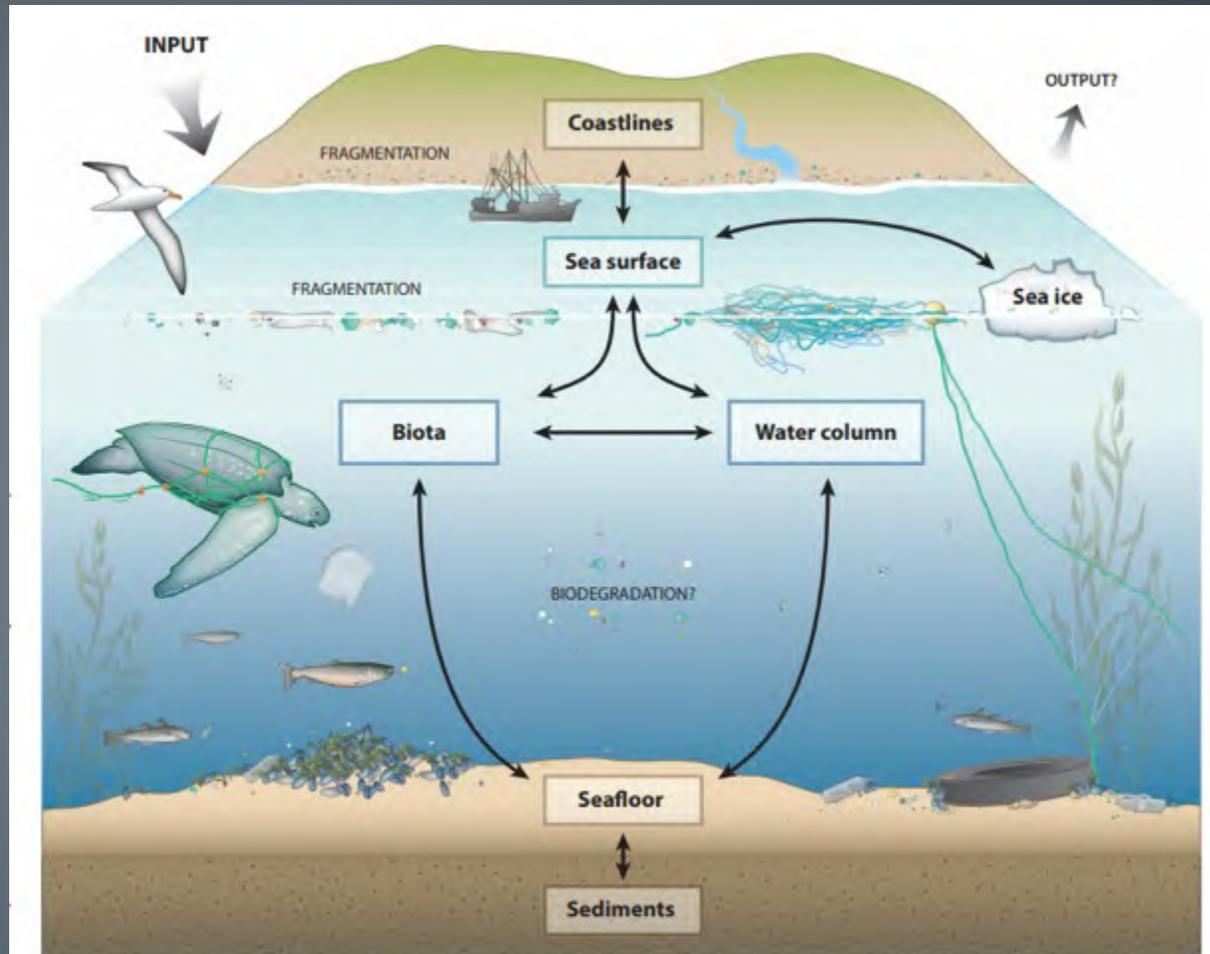


Figure 1

The mass balance of plastics in the marine environment. The large gray arrows indicate fluxes into and out of the marine environment, including potential biodegradation of plastics. The boxes indicate reservoirs of plastic debris, and the black arrows indicate potential pathways of plastics between reservoirs. Fragmentation of plastics caused by weathering and biological processes can occur in all reservoirs, especially when exposed to sunlight (at the sea surface and along coastlines).

Impacts

Physical



Chemical



Socioeconomic



Microfibers

- Most abundant debris type in whole water samples, wastewater effluent
- Sources:
 - Clothing (synthetics can shed >1900 fibers per wash, Browne et al., 2011)
 - Fishing line
 - Wet wipes
 - Upholstery
 - Carpet
 - Cigarette filters
- Tap water, bottled water, soil, beer
- ?? Atmospheric transport (Dris et al., 2016)





NOAA Marine Debris Program

Established in **2006** by U.S. Congress as the federal lead for marine debris

Mission: to investigate and prevent the adverse impacts of marine debris



Program Pillars

- Prevention
- Removal
- Research
- Regional Coordination
- Emergency Response



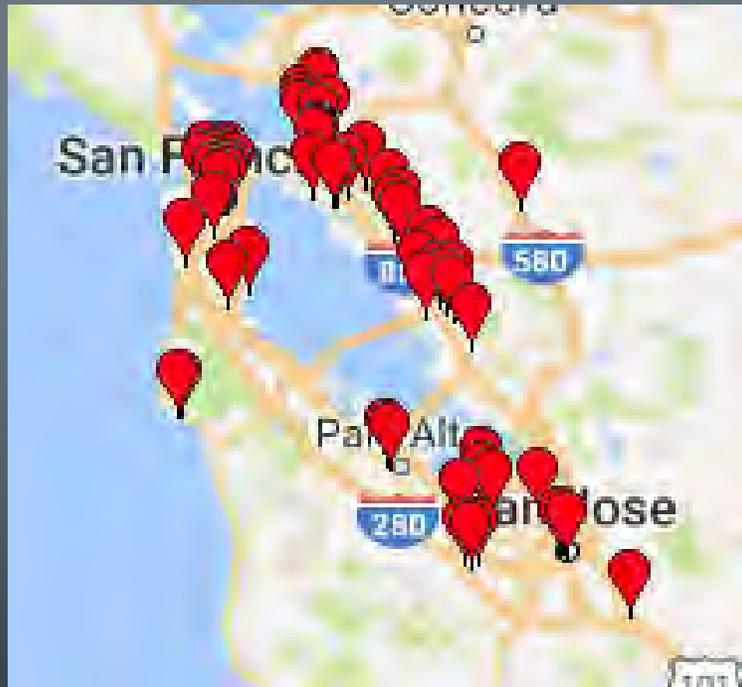
Prevention

- NOAA Marine Debris Prevention Grants
- One Cool Earth: *Salinas River to the Sea*



Prevention

- Clean Water Fund's ReThink Disposable Program
- 67% of litter on Bay Area streets is disposable food / beverage packaging
- Participating food businesses save average \$6k per year



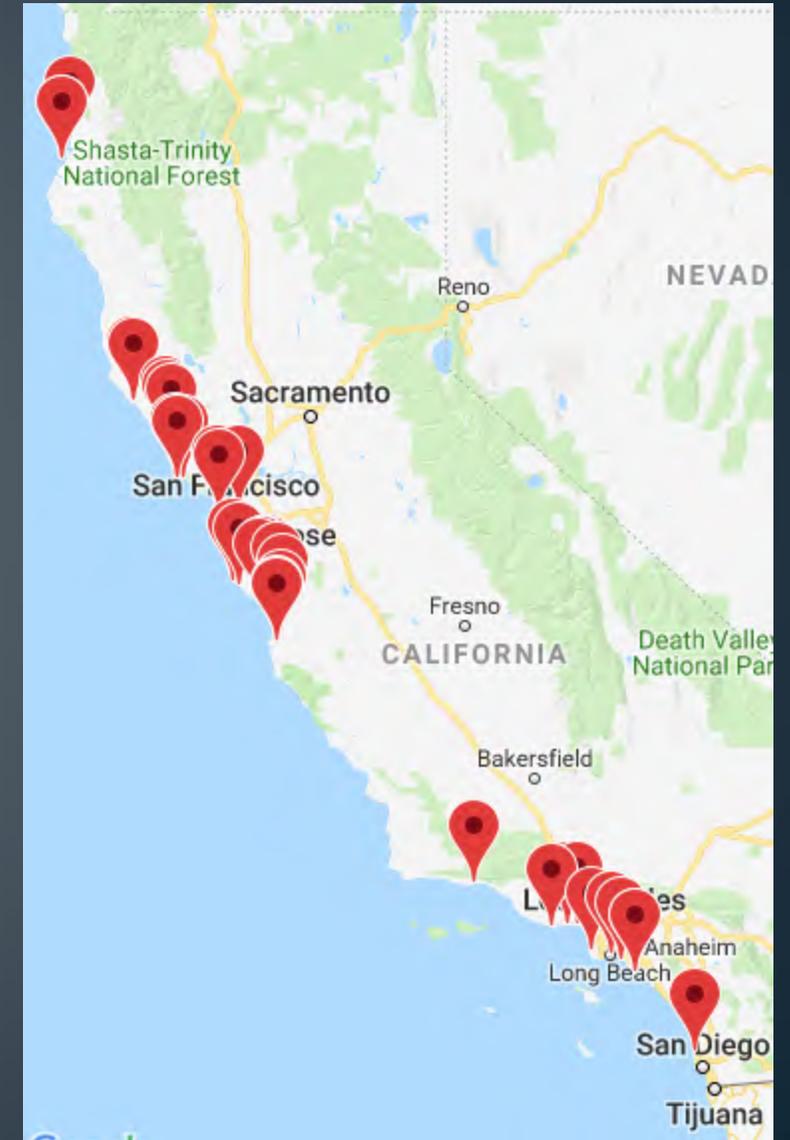
Removal

- NOAA Marine Debris Removal Grant Program (FY19 FFO announced in August)
- Save Our Shores: *Hotspot Large-scale Debris Removal from the Monterey Bay National Marine Sanctuary*



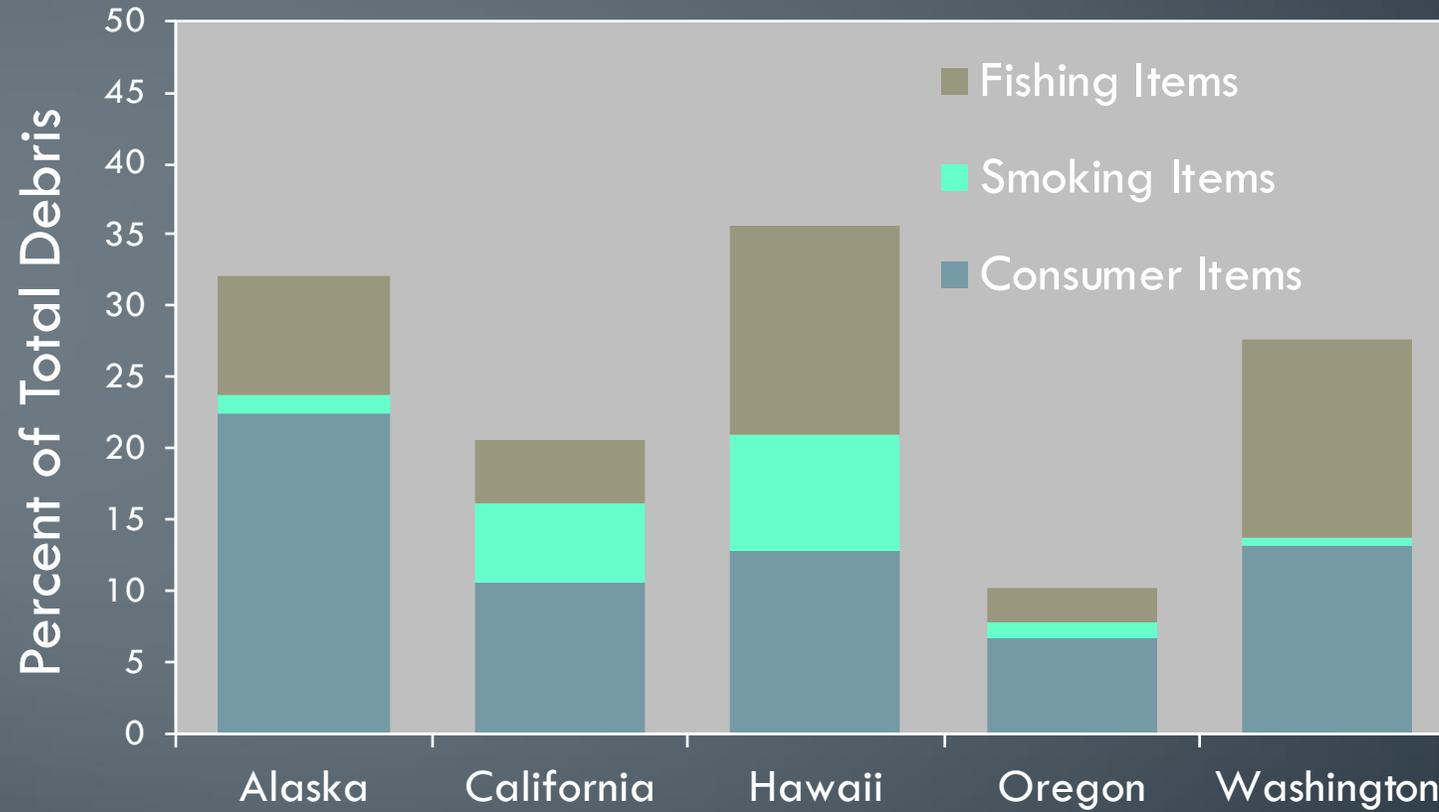
Research

Marine Debris Monitoring and Assessment Project



Research

Plastic Debris by User Groups



* Does not include cigarette butts < 2.5 cm

Research

- NOAA Marine Debris Research Grant (FY19 FFO announced in Sept)
 - Risk assessment or exposure of populations to debris
 - Debris fate and transport (surface waters – water column – benthos)
 - Gains in ecosystem services after debris removal
- Ongoing projects:
 - MicroP in seafood in American Samoa (ASU)
 - Selective ingestion of microP by oysters (UConn)
 - MicroP ingestion by the black sea bass (UNCW)
 - Plastic export mechanisms and risk to sea scallop (WHOI)



Coordination

California Ocean Litter Prevention Strategy

50+ participating organizations

1. Source reduction – mandates and incentives
2. Source reduction – EPR and product design
3. Waste management / interception on land
4. Research
5. Behavior change
6. Ocean-based debris prevention and cleanup



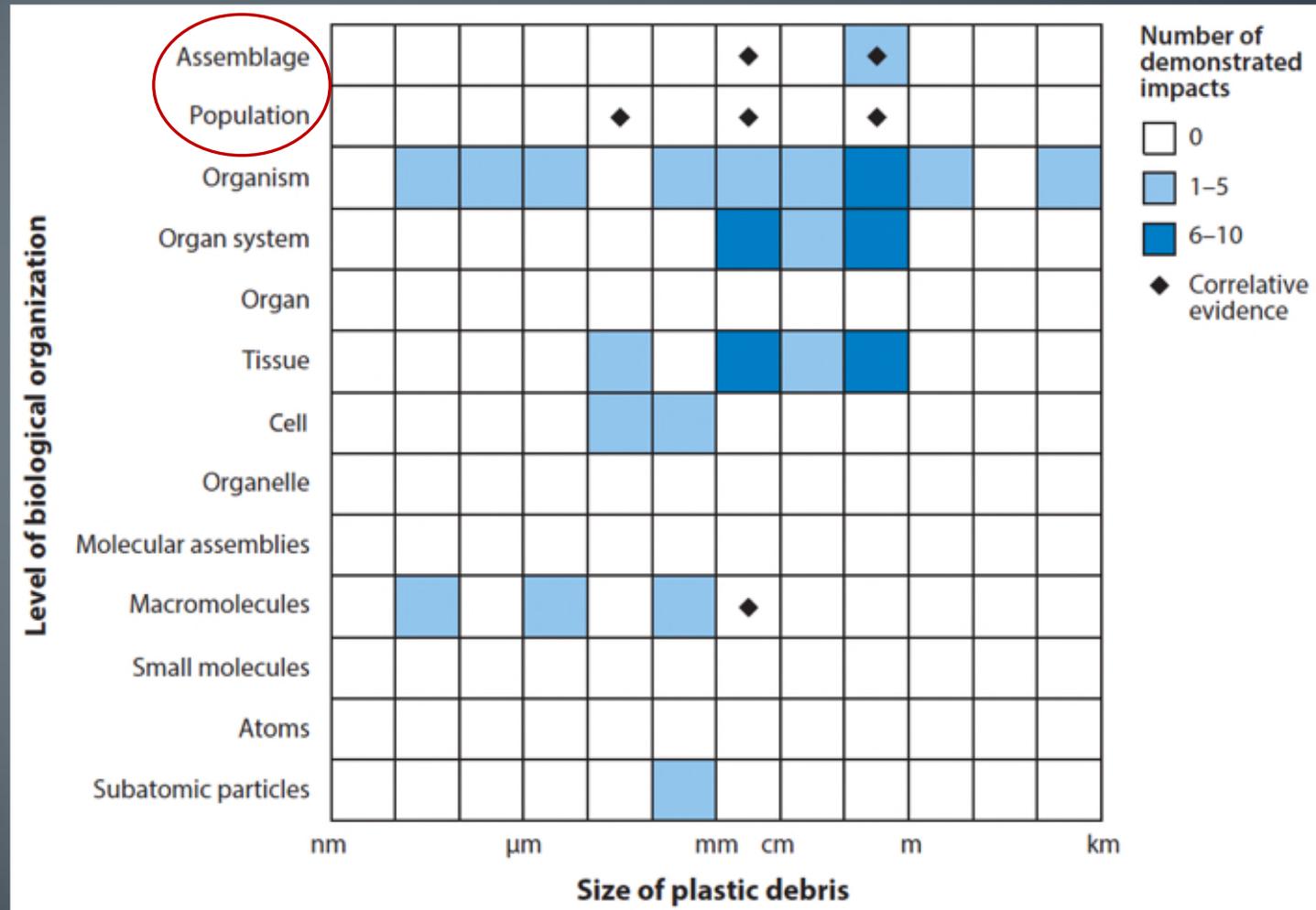
Thank You!

Sherry.Lippiatt@noaa.gov

CSUCI Marine Debris Bootcamp
Santa Rosa Island, CA



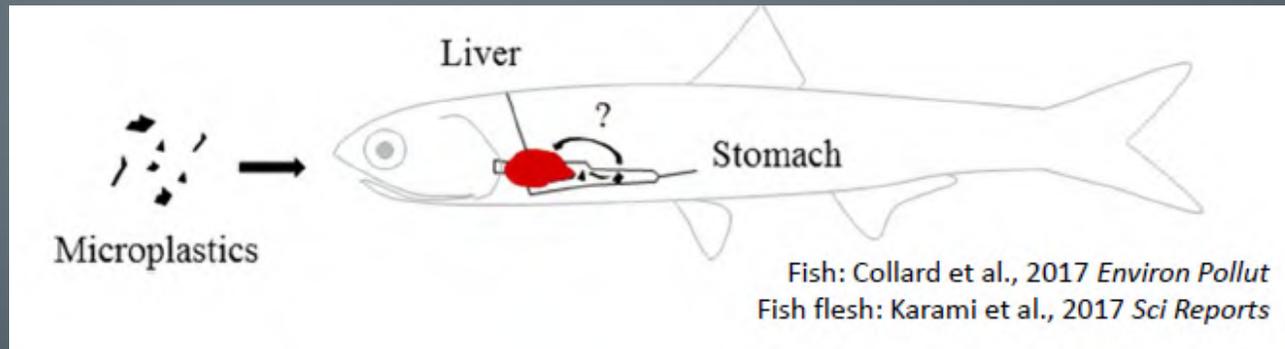
Evidence for Impacts is Growing



Law et al. 2017

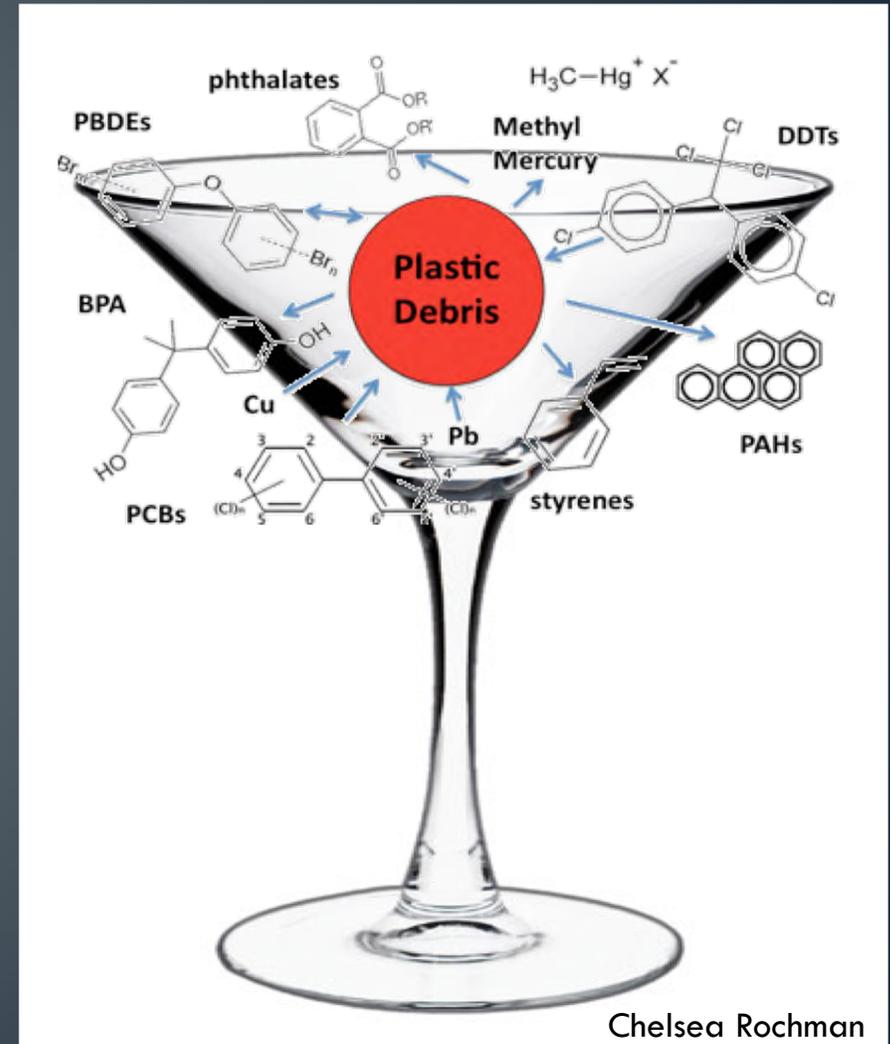
Chemical Impacts

- Plastics absorb and leach chemicals
- Plastics can translocate from gut into fish tissue, organs, blood cells



- Exposure and concentration gradients?
- Polymer type? PS, PE > PET, PVC
(Rochman et al. 2017)

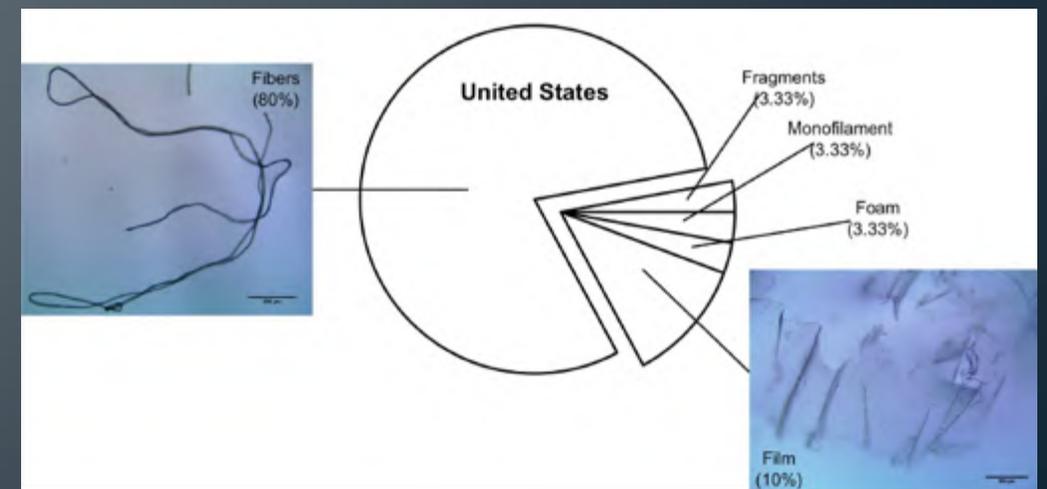
“Cocktail of Contaminants”



Physical Impacts

Ingestion

- > 600 species ingest plastic debris
marine mammals, fish, seabirds, turtles
- Human ingestion?
- Seafood purchased in Half Moon Bay
25% of fish guts had plastic, 0-10 pieces / fish
33% of oysters, 0-2 pieces / oyster
Mostly fibers



(CBD, 2012; Rochman et al., 2015)

Socioeconomic Impacts

- Safety and navigation
- **Tourism:** Reducing marine debris by 25% at OC beaches would save residents roughly \$32M (NOAA)
- **Fishing industry – competition from ghost fishing**

Chesapeake Bay: removal of 34K pots over a 6-year period increased crab harvests by \$21 Million (VIMS)



Bob Pagliuco

Removal: Trash Capture

- 2015: California Water Resources Control Board “Trash Amendments”
- Requires permitted storm water dischargers to prevent and intercept street litter before it enters waterways
- Inline netting, screens, “Continuous Deflection Systems”

