OCEANS, MICROFIBERS AND THE OUTDOOR INDUSTRY: A LEADERSHIP OPPORTUNITY

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OUR BLUE PLANET
THE OCEAN HEALTH EQUATION

Taking Too Much Out + Putting Too Much In = Uncertain Future for Our Ocean
PUTTING TOO MUCH IN: MARINE DEBRIS

A PREVENTABLE PROBLEM
30 YEARS: INTERNATIONAL COASTAL CLEANUP

- 11 Million volunteers
- 190 Million pounds of trash
- 360,000 miles

- 30 YEARS
- 153 COUNTRIES
- 215 Million ITEMS COLLECTED
215 MILLION ITEMS COLLECTED
GROWTH IN GLOBAL PLASTIC PRODUCTION

Global plastic production by year, Million tons

18,194% INCREASE

SOURCE: PlasticsEurope Market Research Group (PEMRG) / Consultic Marketing & Industrieberatung GmbH

1 Includes Thermoplastics, Polyurethanes, Thermosets, Elastomers, Adhesives, Coatings and Sealants and PP-Fibers.
8 MILLION TONNES ENTER THE OCEAN ANNUALLY

SOURCE: Jambeck et al. 2015, Science
By 2025, there could be 1 ton of plastic for every 3 tons of fish.

1 Model conservatively assumes 2% of plastic produced is leaked into ocean, although some scientists estimate higher levels.

SOURCE: Jang et al., 2014; Plastics Europe; Jambeck et al., 2015; Jennings et al. 2008; Jennings and Blanchard, 2004; OC Analysis
WHY DOES THIS MATTER?
PLASTIC POLLUTION IMPACTS WILDLIFE

SOURCE: Ocean Conservancy; Rochman et al., 2013; Davison and Asch, 2011; Jacobsen et al., 2011; Raum-Suryan et al., 2009; Hanni and Pyle, 2000; NOAA; EIA
BUT WHAT ABOUT THE SMALL STUFF?

- Microplastics (<5mm)
  - Degraded consumer packaging
  - Microbeads and nurdles
  - Plastic microfibers:
    - Frayed fishing net and line
    - Fibers from synthetic apparel

Source: Doyle et al., 2011; Fischer et al., 2015; Brown et al., 2010
Microfibers are dispersed throughout the entire water column.

Microfiber Dist Conceptual model of microplastic transport through the marine environment.
Source: Zalasiewicz et al., 2016
MICROPLASTICS MOST ABUNDANT PLASTIC AT SEA SURFACE

Source: Eriksen et al, 2014; van Sebille et al., 2015; Plastic Free Seas
AND PLASTICS ARE EVERYWHERE
MICROFIBERS TOO ARE WIDELY DISTRIBUTED

- 85% of man-made debris on shorelines is microfibers
- Polyester/acrylic fiber proportions similar to those in apparel

Source: O’Connor, 2014; Brown et al., 2010
BUT WHERE DO MICROFIBERS END UP?
MAYBE THE DEEP SEA

- 4 billion fibers/km² in Indian Ocean
  - 10-40 fibers/50 ml sediment
  - Four orders of magnitude greater than surface
  - Rayon and polyester most prominent (>70%)
- Extrapolated:
  - May be 1.4 million trillion microfibers on seafloor
  - 10,000,000,000,000,000,000 – a BIG number

SOURCE: Woodall et al 2014
WASTE WATER AS A SOURCE OF MICROFIBERS
SAN FRANCISCO BAY

Wastewater Effluent

Fibers 80%
Films Foams 1%
Fragments 17%
Pellets 0%

Surface Waters

Fibers 27%
Films 8%
Foams 8%
Pellets 2%
Fragments 55%

> 1900 fibers per wash per garment is rule of thumb

SOURCE: Sutton et al. 2015
## WASTE WATER AS A SOURCE OF MICROFIBERS

<table>
<thead>
<tr>
<th>Site</th>
<th>Influent (fibers/m³)</th>
<th>Effluent (fibers/m³)</th>
<th>Removal (%)</th>
<th>Daily Volume (m³/day)</th>
<th>Release Rates (fibers/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>290,000</td>
<td>32,000</td>
<td>88.97%</td>
<td>240,000</td>
<td>7.68E+09</td>
</tr>
<tr>
<td>Finland</td>
<td>180,000</td>
<td>13,800</td>
<td>92.33%</td>
<td>270,000</td>
<td>3.73E+09</td>
</tr>
<tr>
<td>Sweden</td>
<td>10,700</td>
<td>4</td>
<td>99.96%</td>
<td>5160</td>
<td>2.06E+04</td>
</tr>
<tr>
<td>Russia</td>
<td>467,000</td>
<td>160,000</td>
<td>65.74%</td>
<td>950,000</td>
<td>1.52E+11</td>
</tr>
</tbody>
</table>

Reported average microfiber concentrations (fibers/m³) in wastewater treatment plant effluent.
Sources: Talvitie & Heinonen, 2014; Gasperi et al., 2015; Talvitie et al., 2015
THE ROLE OF LAUNDERING

SOURCE: Bruce et al. 2016
LAUNDERING MATTERS ALOT

- Top vs. front loader: 430% increase
- Aged vs. new: 80% increase
- Machine type x Age: 10 fold increase
- Fabric loss (new front to aged top):
  - 0.05% to 0.75%
  - 250 mg to 3,000 mg
- 100,000 jackets = 27-199 x106 fibers/day in 92-65% recovery wastewater treatment facilities
- Future Research:
  - Water volume, detergent, temperature, spin rate, size of load, garment style

SOURCE: Bruce et al. 2016
CONCERN: CHEMICAL CONTAMINATION

Pathways of chemical release from textiles.

Chemical release pattern from textiles.
Source: Luongo, 2015
CONCERN: IMPACTS TO MARINE ORGANISMS

• Microfibers can translocate and accumulate w/in animals
  – Substantiated by studies in wild
  – Fish in laboratory experiments
• Reduced food consumption, reduced energy for growth

Source: Murray and Cowie, 2011; Cole et al., 2011; Lusher et al., 2013; Wright et al., 2013; Mathalon and Hill, 2014; Rochman et al., 2013; Watts et al., 2015
EXPERIMENTS DEMONSTRATE IMPACT OF TOXIN TRANSFER

SOURCE: Rochman et al. 2013
CONTAMINANTS CAN BIOACCUMULATE IN THE FOOD CHAIN

SOURCE: Rochman et al. 2013
SO, ARE WE EATING PLASTIC WITH OUR SEAFOOD?

Indonesia:
- 28% of all fish
- 55% of all species

United States:
- 25% of all fish & 33% of shellfish
- 67% of all species

SOURCE: Rochman et al. 2015; Photo Credit: Dr. Chelsea Rochman
PRESENCE OF MICROFIBERS VARIED BY REGION

Indonesia
60% Plastic Fragments
0% Fibers

USA
3% Plastic Fragments
80% Fibers

SOURCE: Rochman et al. 2015
ARE WE PLASTICIZING THE OCEAN FOOD CHAIN?

WHAT GOES IN THE OCEAN GOES IN YOU.

A recent study found that 35% of fish sampled off the west coast had ingested plastic. Find out how you can help. Visit www.surfrider.org/rap

MAKE THE PLEDGE. BAN THE BAG.
SOLUTIONS LIE WITH INDUSTRY LEADERSHIP

- Opportunity to get out ahead of the issue
- Outdoor Industry Association has expressed concern
- Companies are stepping up: e.g. Patagonia

- Areas for cross-sector engagement
  - Research on sources, fates and impacts in the ocean
  - Innovation around garment design (biomimicry?)
  - Identification and communication of best practices for washing synthetic apparel
  - Technology to capture microfibers post-wash
ADVANCING SOLUTIONS: TRASH FREE SEAS ALLIANCE™
GOAL: BUILD AND ADVANCE COLLECTIVE ACTION

- Direct access to leading scientists and emerging science
- Build bridges among NGOs, scientists, and other industry leaders
- Develop impactful Work Streams, from the ground up
- TFS Alliance is a vehicle to move from dialogue to solution identification to results
TRASH FREE SEAS ALLIANCE®: IMPACT AT SCALE

Stemming the Tide: Land-based strategies for a plastic-free ocean

Raising collection rates across priority countries to an average of 78% would lead to a 23% reduction of plastic leakage into the ocean.

Improved collection infrastructure and plugging collection gaps can reduce annual leakage by nearly 50% by 2020.

Improving waste management in China, Indonesia, Vietnam, Thailand and the Philippines can reduce global ocean plastic leakage by approximately 45% over the next 10 years. Total leakage could be reduced by 45% by 2025 if a concrete set of action is implemented in these five countries.
OCEAN CONSERVANCY’S INTEGRATED APPROACH

- Advance the Science
- Empower Citizen Action
- Lead Industry Action
- Smart Public and Private Policy
THANK YOU...LET’S CONTINUE THE CONVERSATION

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SOURCES


