

# Microplastics: The emergence of a global conservation concern

A group of orcas (killer whales) swimming in the ocean. The water is dark blue with white foam from the orcas' movements. Several dorsal fins are visible, some with white patches. The orcas are spread out across the frame, with one in the foreground and others in the background.

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VP Research - Ocean Wise Conservation Association

# Plastic represents a visible threat to sea life



- Charismatic species have been visible victims of nets and other debris for decades;
- Packing bands, fishing gear and plastic bags entangle turtles, seabirds and marine mammals;
- Despite litter bylaws and adoption of at-sea disposal rules, ghost gear, litter and a legacy of lost items plague the oceans.

# Today's macroplastic is a reservoir for tomorrow's microplastics



*Plastic does not breakdown chemically, but breaks up physically into smaller and smaller pieces.*

Microplastic particles are < 5 mm.

Two categories:

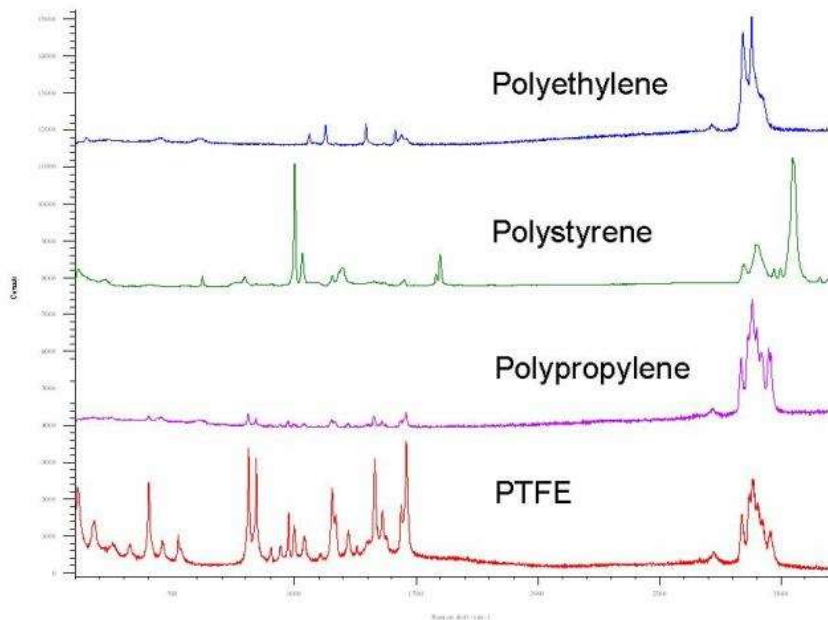
*Primary microplastics* are deliberately manufactured (microbeads and nurdles);

*Secondary microplastics* are the breakdown products of larger items such as plastic bottles, bags, packaging, nets and textiles.

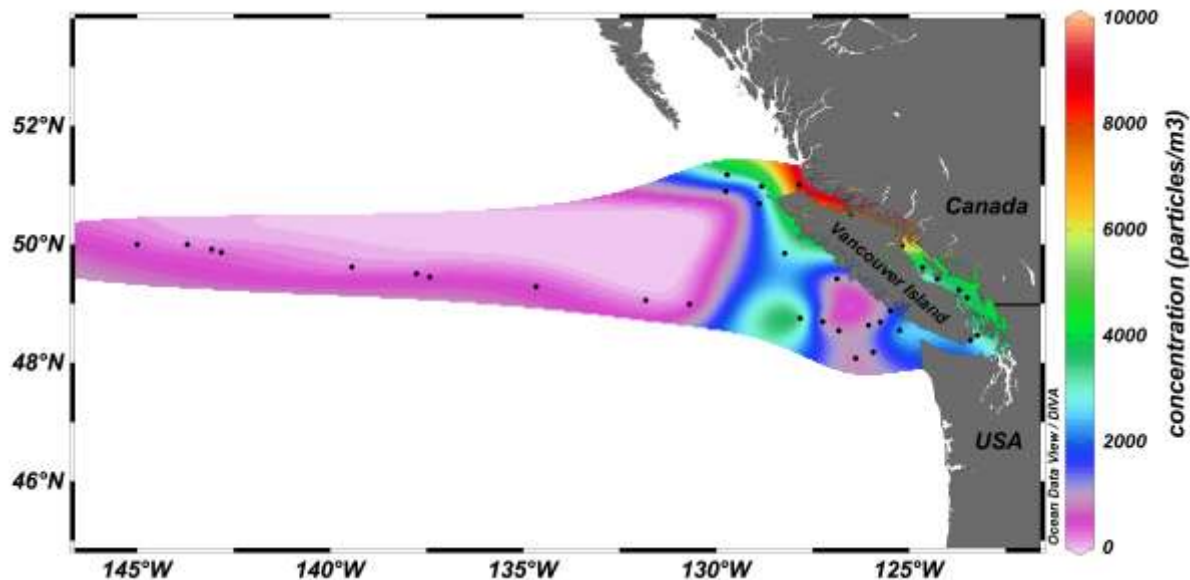


# The Ocean Wise *Environmental Microplastics Facility* ('The Plastics Lab')

1. Sampling in environment
2. Extraction & cleanup in the lab
3. Visual characterization and counting using microscopy
4. Forensic identification using FTIR spectrometry



# Seawater: up to 9,200 particles per cubic meter in the NE Pacific Ocean



(Desforges, Galbraith, Dangerfield & Ross 2014)

*Up to 80% are fibres*



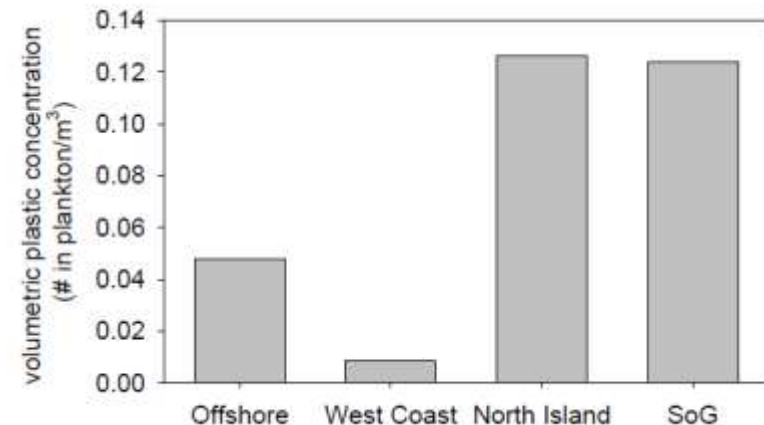
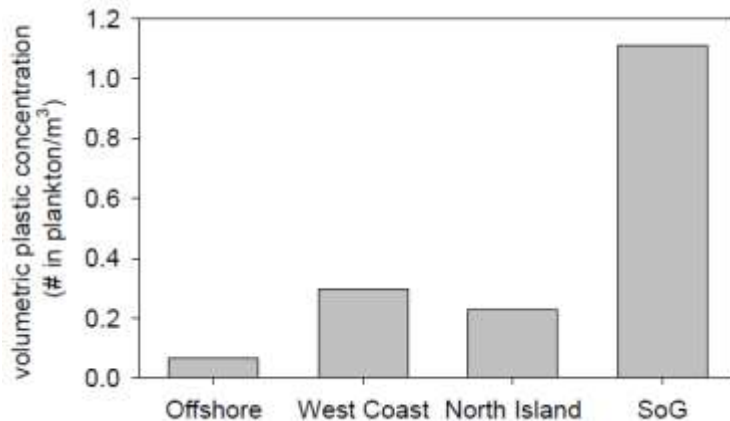
# Threat to ocean productivity?

## Zooplankton are mistaking microplastics for food

*Neocalanus cristata*

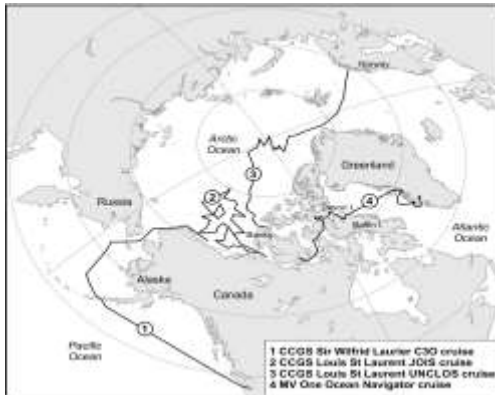


*Euphausia pacifica*

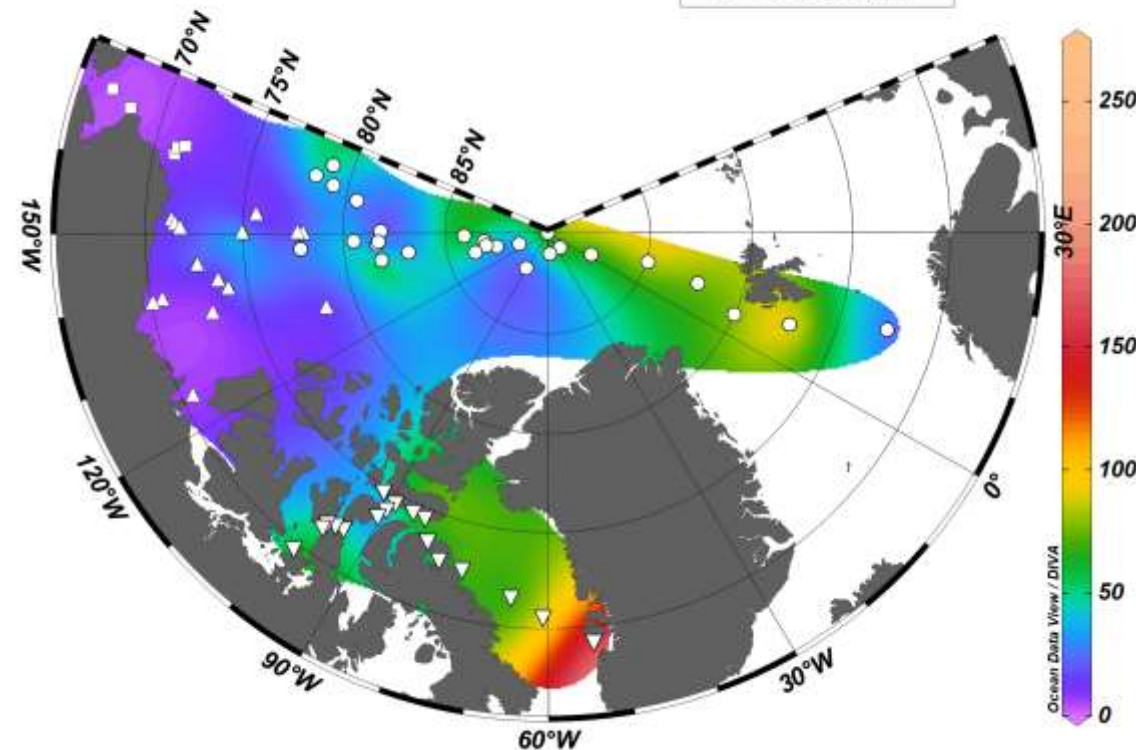


(Desforges, Galbraith, Dangerfield & Ross 2015)

# We find microplastics throughout the Arctic



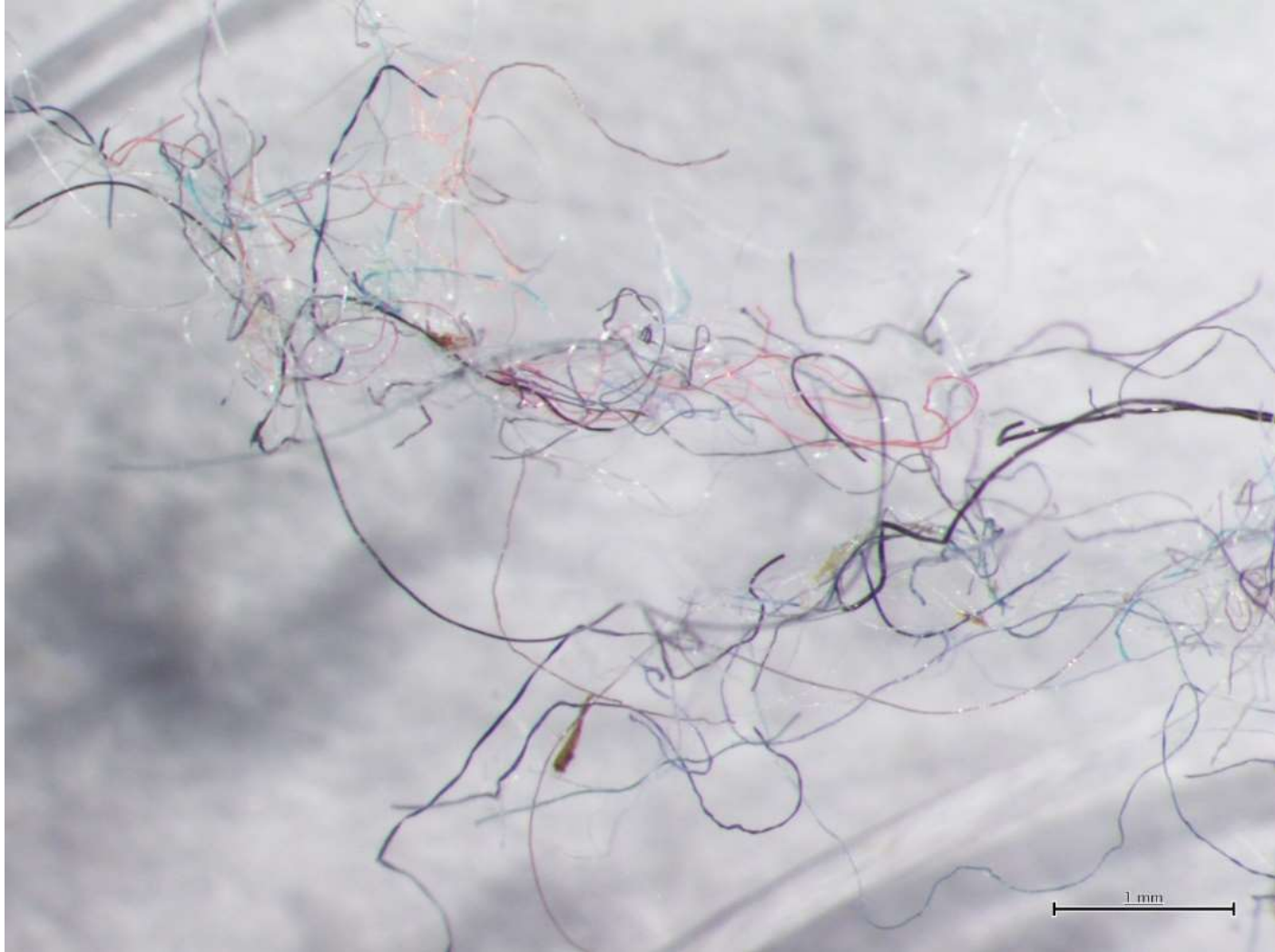
- C30 2016
- △ JOIS 2016
- ▽ One Ocean 2016
- UNCLOS 2016



- Partnership with DFO and One Ocean Expeditions;
- Seawater distribution;
- Ingestion by zooplankton;
- Update in beluga whale food web;
- Community workshops;
- *Dominated by fibers.*

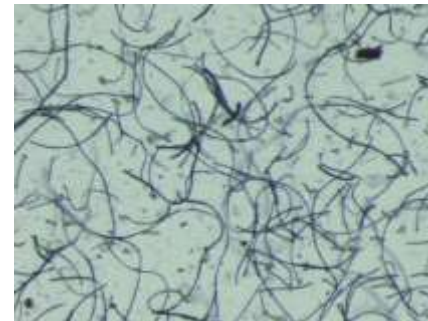
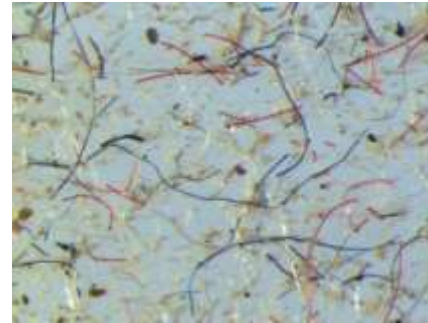
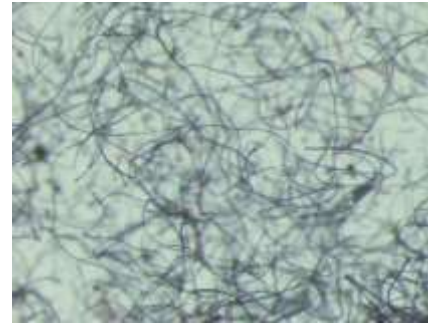


# Where are these microfibers coming from?

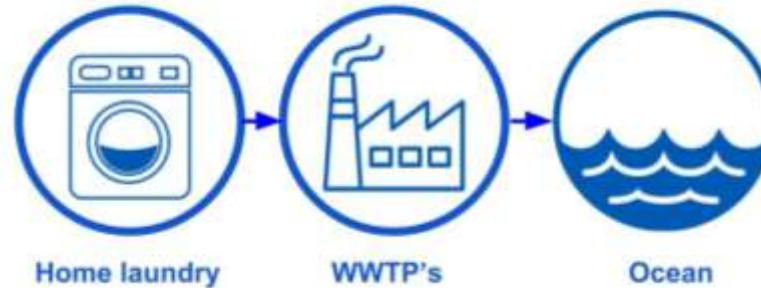




The answer, in part, lies closer to home than one might think. A fleece sweater can lose up to 10 million fibers in a single load of laundry



# Our *Microfiber Partnership* with outdoor retailers and waste management agencies has been studying apparel, home laundry and WWTPs



Environment and  
Climate Change Canada

Environnement et  
Changement climatique Canada



metro vancouver



ocean wise.

# Our washing machine test center samples effluent from laundry to evaluate fiber shedding



- Samples of different textiles (110) are washed.
- Effluent samples are analysed – filters weighed, fibers counted.

# Microfibers in home laundry: loss of fibers documented for 38 fabric types

Our laundry test centre in Vancouver, BC

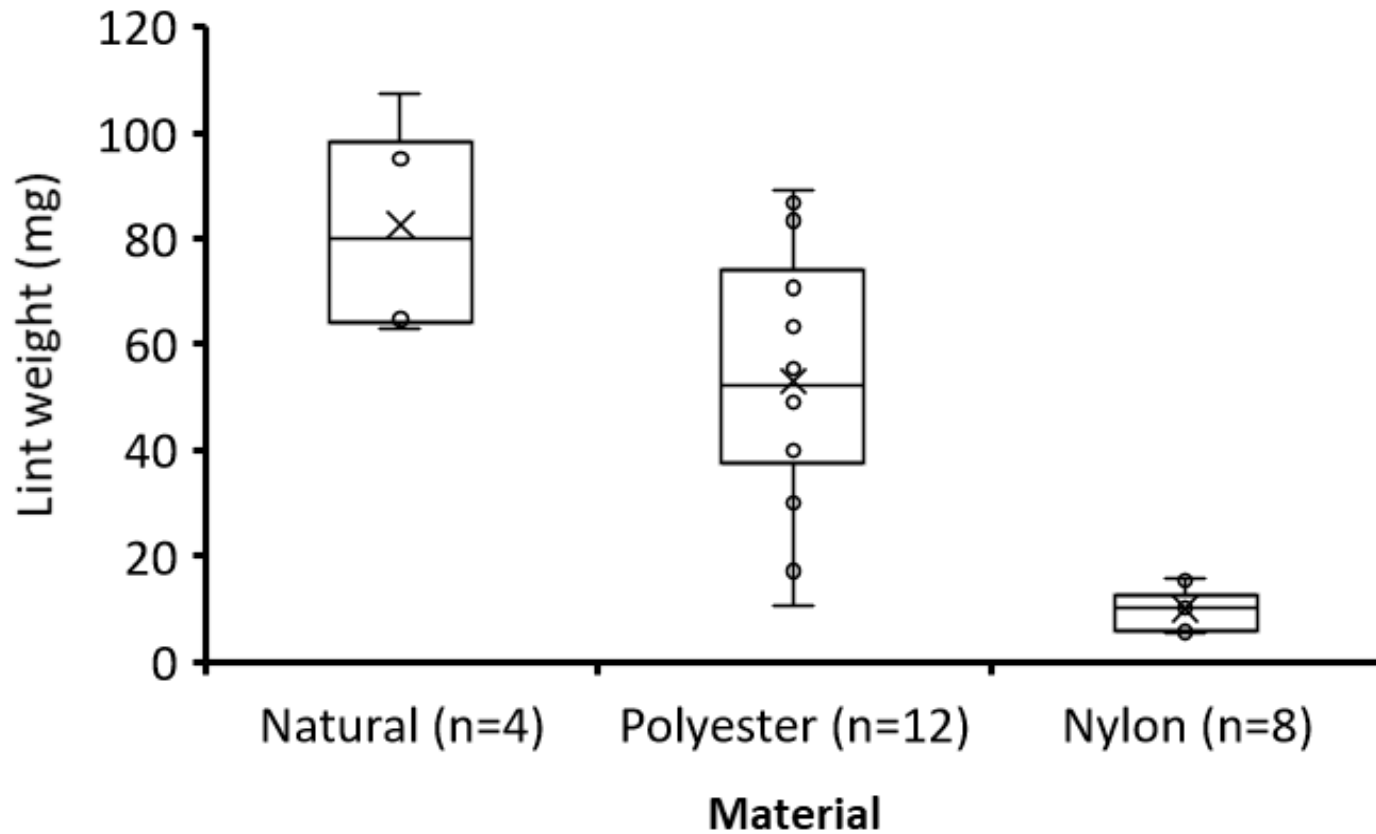


- Standardized fabric samples shed microfibers in washing machines: 3,000 to 3,500,000 microfibers per sample per wash.
- Not all textiles shed equally when laundered.
- Fiber shedding varies over consecutive washes.

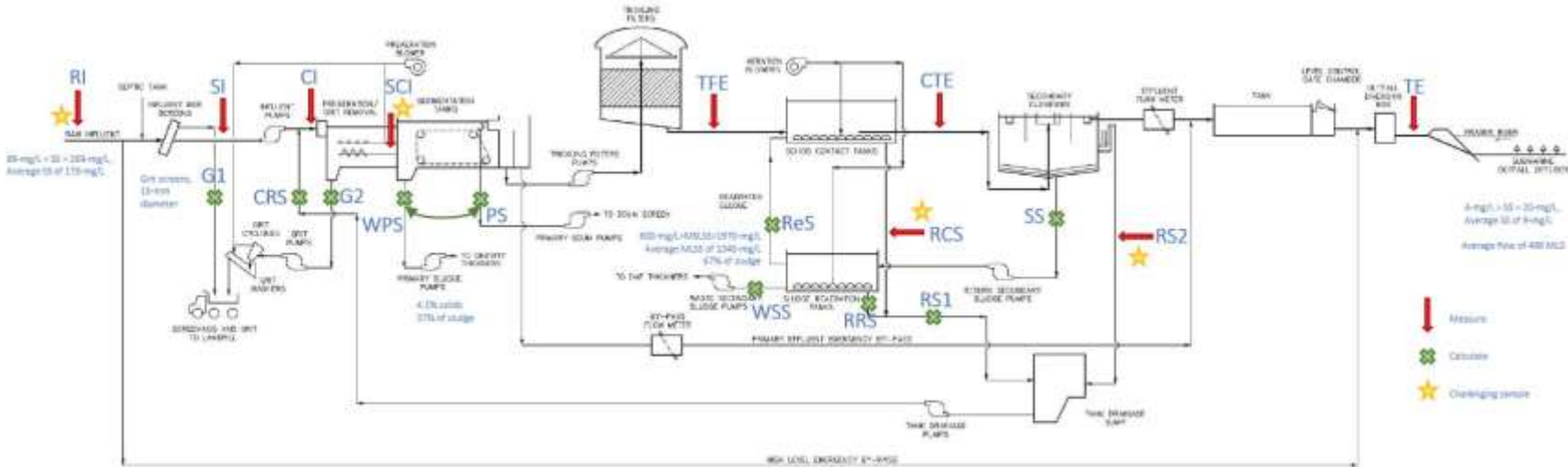


## *Is natural better...?*

Lint loss during laundry was highest for natural textiles, followed by polyester & nylon



# From your laundry to the WWTP: microplastics in wastewater treatment facilities



## 1.8 trillion synthetic microparticles enter the largest WWTP in Vancouver every year

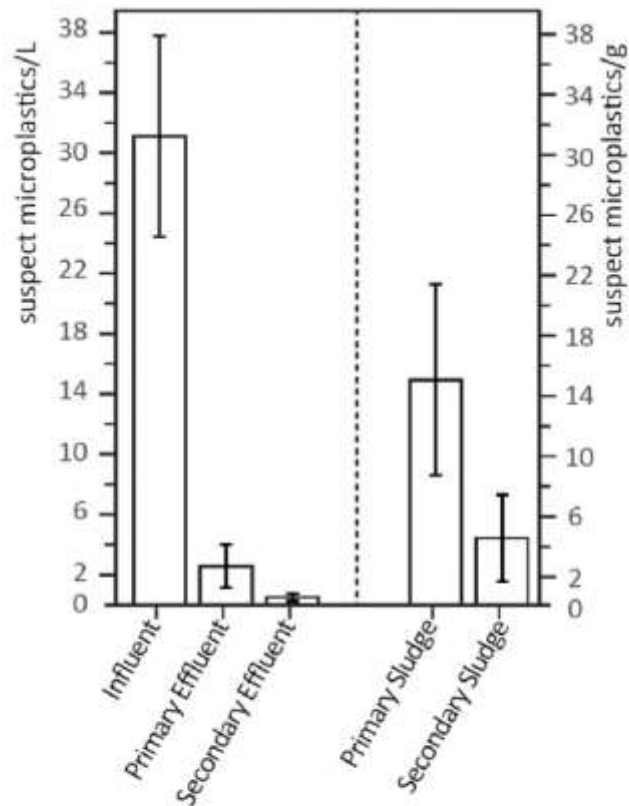


Fig. 3. Average counts for suspected MPs identified by stereomicroscopy in wastewater sample matrices at the wastewater treatment plant. The majority of suspected MPs are retained in the solids stream with  $< 0.5 \pm 0.2$  MP/L exiting the plant in the secondary effluent. Counts are reported as MP/L  $\pm$  SD in liquid matrices and MP/g  $\pm$  SD in solid matrices. Liquid samples were taken from influent ( $n = 5$ ), primary effluent ( $n = 6$ ) and secondary effluent ( $n = 6$ ) and solid samples were taken from primary ( $n = 6$ ) and secondary sludge ( $n = 6$ ).

- 71% are fibers
- Fibers were dominated by polyester and Rayon
- 30 billion enter the ocean
- 99% are retained in WWTP
- These are redistributed as agriculture, forestry & mining fertilizers

# Forensic identification of mystery microfibers in the environment: our FTIR analysis of weathered textile samples under controlled conditions is nearing completion



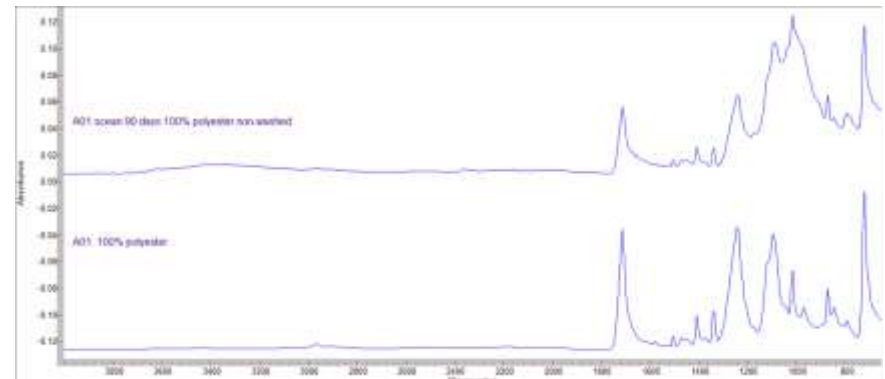
Air



Wastewater



Ocean



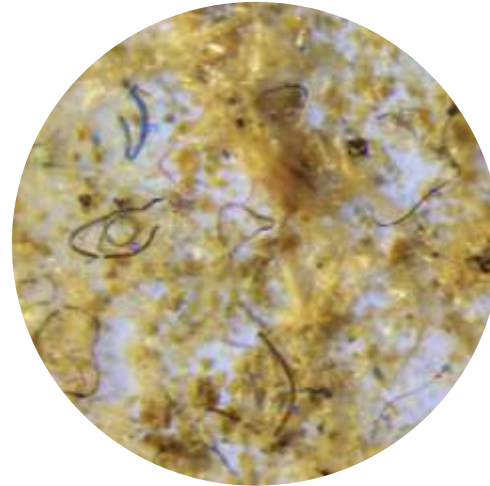


*P.s. It's not just textiles: Microplastics vary by size, shape, colour & origin*

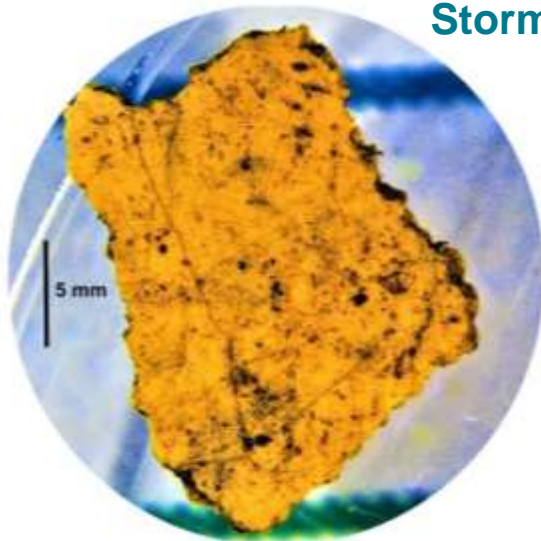
Treated wastewater



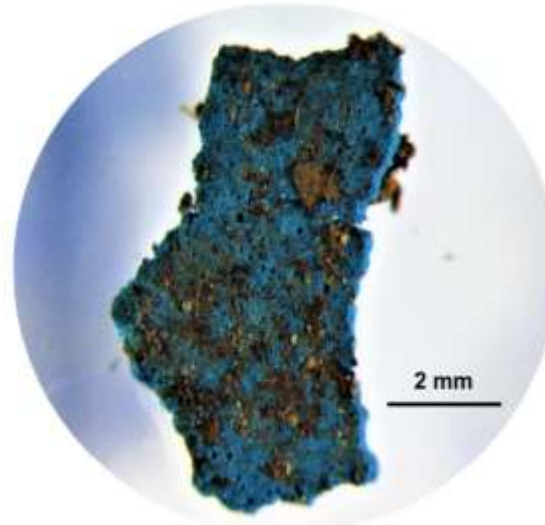
WWTP Biosolid



Storm drain



Storm drain



# A few final thoughts

*This is a global issue:* Plastic is everywhere in the environment and is rapidly increasing.

*This is complicated, and yet simple.* Plastic is used in many products but have a common industry origin and only a few pathways to the ocean.

*All roads lead to microplastics:* Plastic products break up into tiny pieces but never disappear.

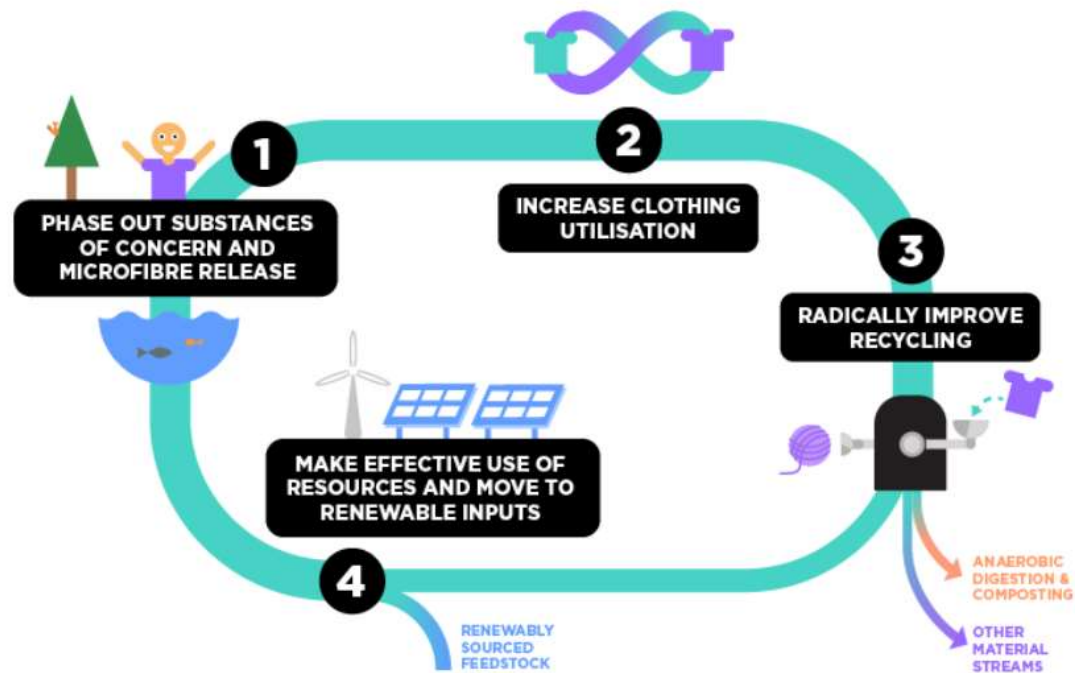
*We are all connected to the ocean:* there appear to be a lot of fibers in the world's oceans coming from clothing, laundry and wastewater.

*You are not alone:* A team effort is required by all sectors of society to solve this crisis.

*The plastic pollution crisis is tractable.* Everyone gets this, and we can do this.

# Thank you

## Creating a new textiles economy



[tiny.cc/fibres](https://tiny.cc/fibres)



# Thank you

*Staff:* Anna Posacka, Katerina Vassilenko, Marie Noel, Anahita Etemadifar;

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