

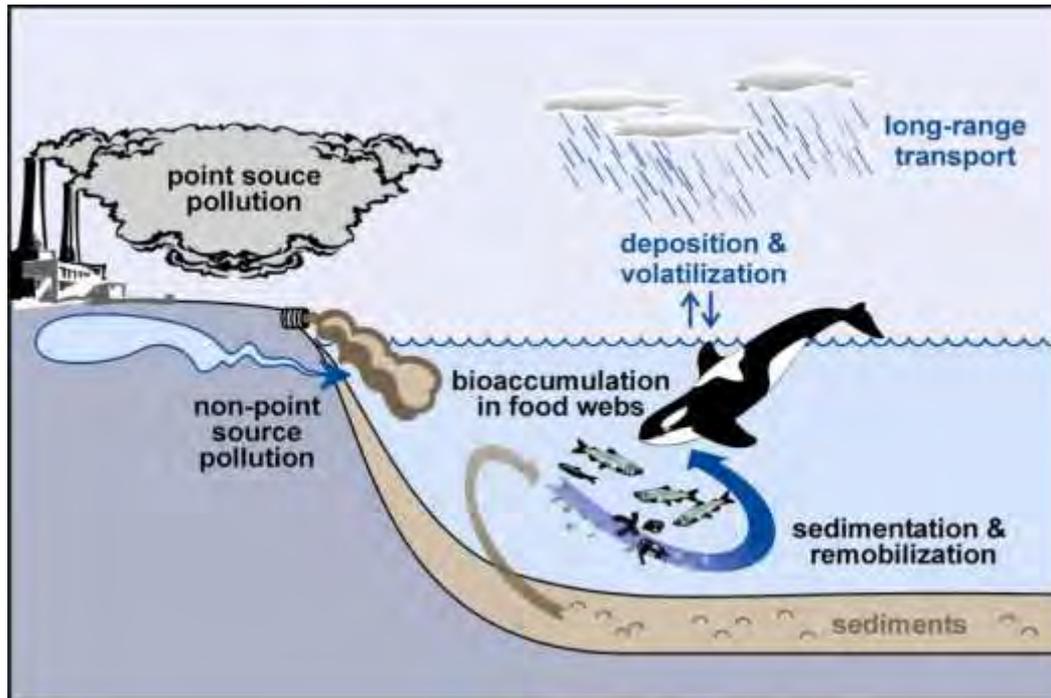
Plastics as an emerging threat to the world's oceans



(Kate Le Souef, Great Canadian Shoreline Cleanup)

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The ocean is a sink for pollutants, where the food web is vulnerable to contamination



Properties of the chemical in question explain its fate in the environment;

Many chemicals attach to particles (sediments) or get into the food web (biomagnification);

Fish-eating birds and marine mammals prone to high levels of persistent contaminants.

Ocean Pollution Research Priorities at Ocean Wise

- Marine mammals as sentinels of ocean pollution (PBT chemicals)
- Safe traditional foods for aboriginal populations
- Oil spill science
- *PollutionTracker* (sediment and mussel monitoring)
- Microplastics in the ocean



Plastics represent an emerging threat to ocean life

- 25,000 formulations;
- Used in a wide variety of consumer and industrial products;
- Sometimes possesses endocrine-disrupting properties;
- can cause acute or chronic toxicity;
- Documented in hundreds of species of fish, seabirds and marine mammals around the world;
- Is a pollutant class like no other...

Plastic is everywhere



The *Great Canadian Shoreline Cleanup*: A national conversation on visible litter

- Program was launched 25 years ago;
- 2016:
 - 2,016 cleanup sites
 - 3,211 km shoreline cleaned
 - 11,910 garbage bags filled
 - 175,932 kg garbage collected
 - 59,136 volunteers participated



Top 10 shoreline cleanup items in Canada: A story of abundance, physical properties and environment processes

Rank in 2015	Item	Number collected
1	Cigarette filters (cellulose acetate)	409,417
2	Food Wrappers	93,129
3	Plastic Bottle Caps	50,904
4	Plastic Beverage Bottles	37,769
5	Beverage Cans	27,814
6	Other Plastic & Foam	27,110
7	Straws & Stirrers	27,047
8	Other Plastic Bags	25,047
9	Metal Bottle Caps	22,093
10	Plastic Grocery Bags	20,492

Where do they come from?

Labels help on large items, but are not found on most plastics found in the ocean

Type of Plastic	It starts as...	It gets made into...
 PET Polyethylene Terephthalate	Peanut Butter Jars Water Bottles Soda Bottles	Carpeting Tennis Balls Paint Brushes
 HDPE High-Density Polyethylene	Juice Bottles Liquid Detergent Bottles Plastic Grocery Bags	Plastic Lumber Trash Cans Toys
 PVC Polyvinyl Chloride	Shampoo Bottles Cooking Oil Bottles Salad Dressing Bottles	Floor Mats Hoses Computer Cords
 LDPE Low-Density Polyethylene	Food Storage Containers Dairy Container Lids Dry Cleaning Bags	Frisbees™ Lawn Furniture Toys
 PP Polypropylene	Medicine Bottles Yogurt Containers Flower Pots	Brooms Toothbrushes Sleeping Bags
 PS Polystyrene	Dairy Containers Vitamin Bottles Flower Pots	Building Insulation Rulers Food Service Trays
 Other Other Plastics	Ketchup Bottles Window Cleaner Bottles Water Coolers	Street Signs Pens Concrete Supports



Plastic represents a visible threat to sea life



- Charismatic species have been visible victims of nets and other debris for decades;
- Packing bands and fishing gear entangle turtles, seabirds and marine mammals everywhere;
- A slow, painful death often results;
- Costly and dangerous rescues are not the answer.

Plastic products break down: sharp fragments found in salmon



- Shards of plastic found in the stomach of a steelhead salmon returning to the Fraser River near Vancouver;
- Healed and open wounds in the gastrointestinal tract;
- How common is this?



Microplastics emerge as a new conservation concern



Microplastic particles are < 5 mm (variable minimum sizes, depending on the reporting lab);

Two basic categories:

- ❧ *Primary* microplastics are deliberately manufactured (microbeads and nurdles) – now largely regulated.
- ❧ *Secondary* microplastics are break-down products of larger items.

Microplastic particles come in all shapes and sizes, but basic categories provide guidance

Fragments

Sheets

Fibres

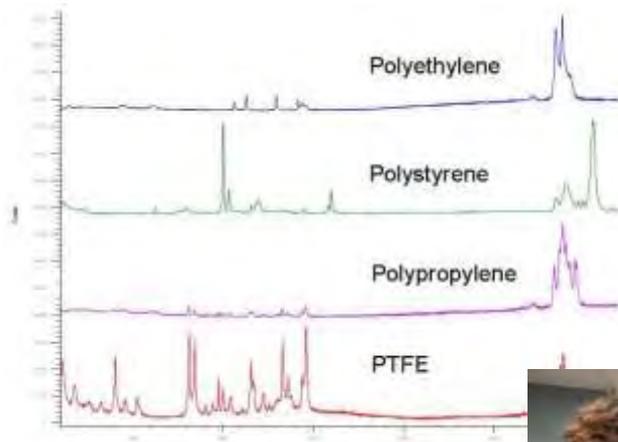
Microbeads

Nurdles

Styrofoam beads

How do we measure microplastics in environmental samples?

1. Sampling (< 5 mm)
2. Lab extraction & cleanup
3. Counting with microscopes
4. Polymer identification using FTIR

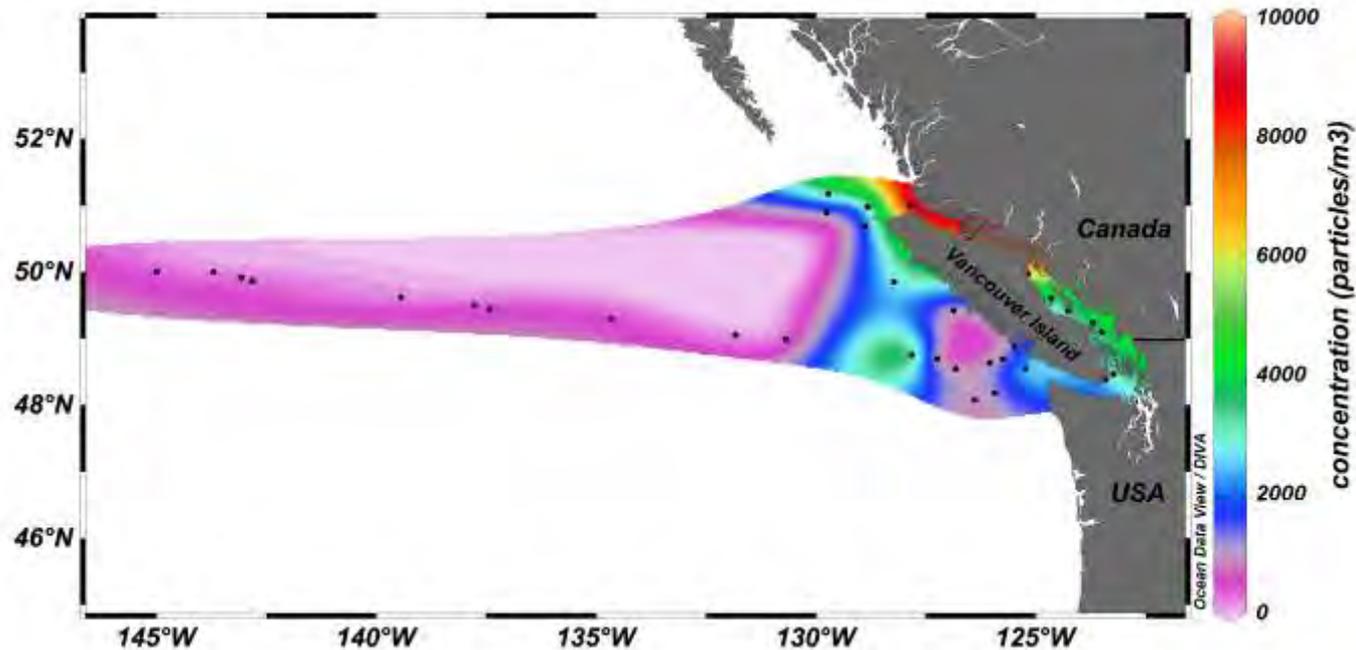


The Salish Sea under a microscope



1000 μm

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



(Desforges, Galbraith, Dangerfield & Ross 2014)

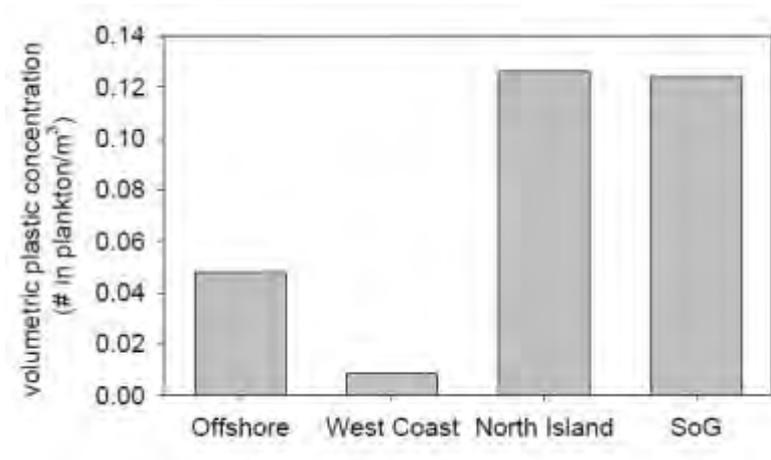
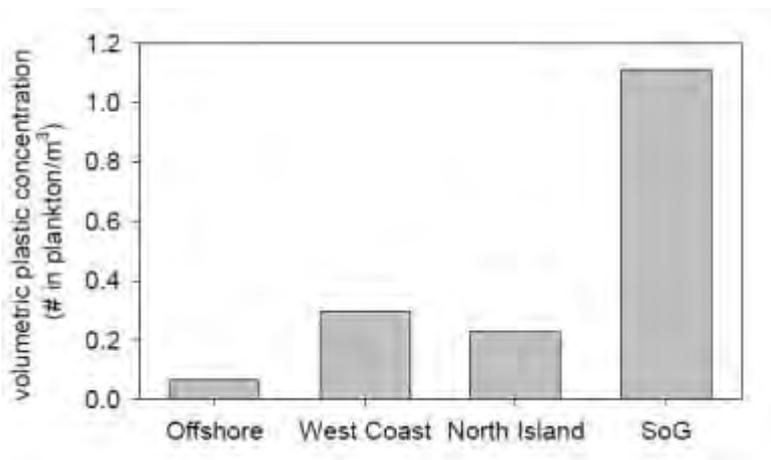


Zooplankton are mistaking microplastics for food: Highest levels near the coast

Neocalanus cristata



Euphausia pacifica



(Desforges, Galbraith, Dangerfield & Ross 2015)

Estimated trophic transfer of microplastics through salmon predation on zooplankton in the Strait of Georgia

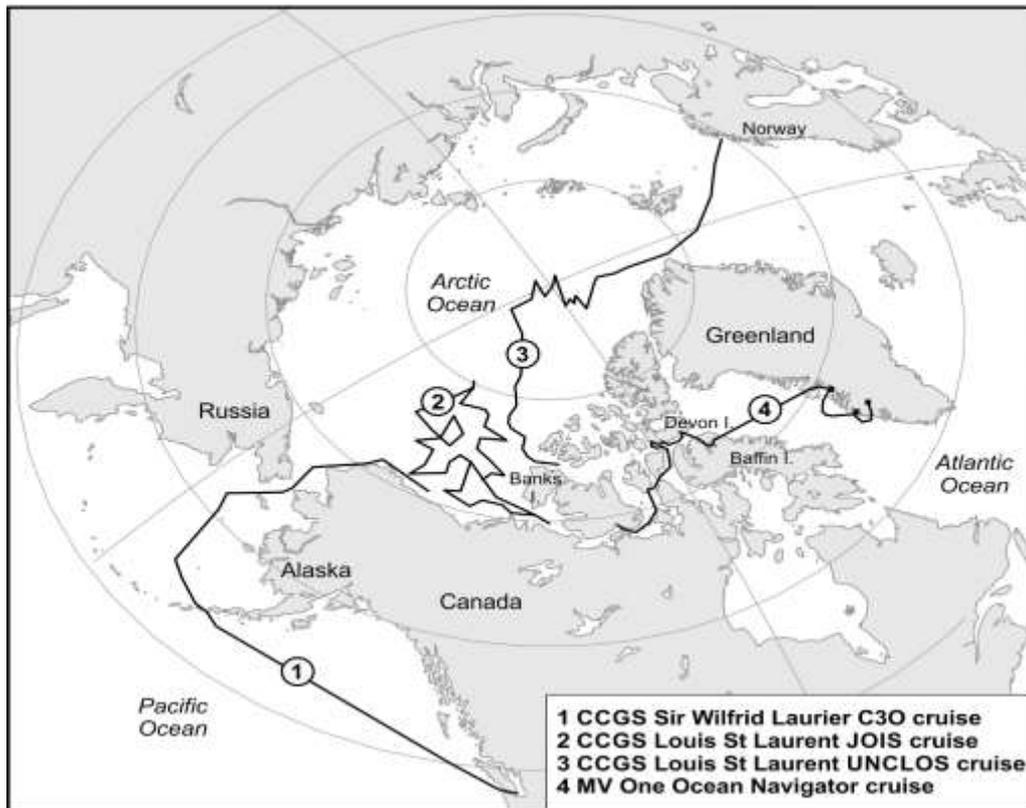
Juvenile salmon	Pink, chum, coho, sockeye & chinook	1.8 – 6.6 particles per day
Adult salmon	Pink, chum, coho, sockeye & chinook	39 – 91 particles per day

(Desforges, Galbraith, Dangerfield & Ross 2015)

Humpback whale: 300,000 microplastic particles per day



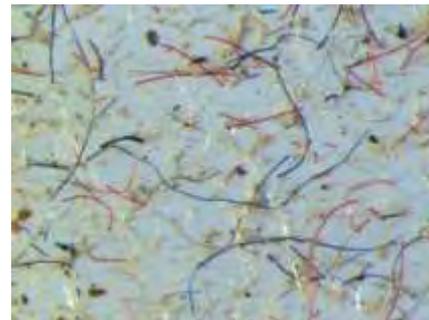
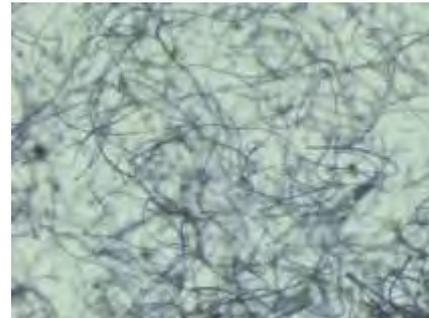
Microplastics in the Arctic



Partnering with Fisheries & Oceans Canada and One Ocean Expeditions on several cruises;
Collecting seawater, sediment and zooplankton samples;
Extracting, counting and characterizing microplastics.

Where are these microplastics particles
coming from?

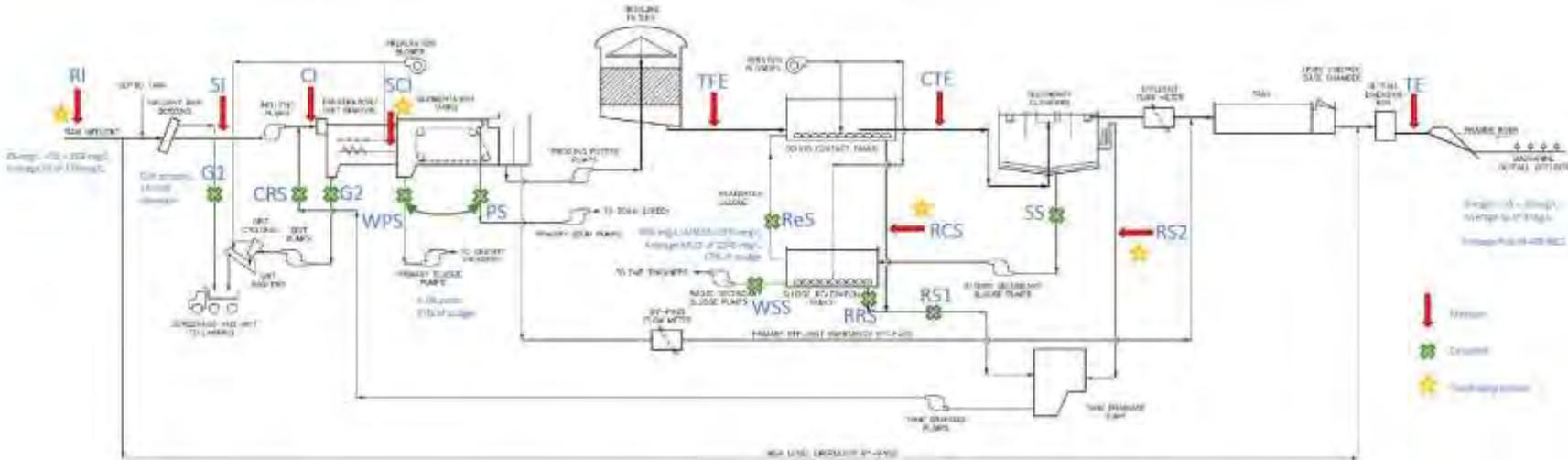
A single polyester sweater can lose a million fibers during laundry



A novel partnership to bridge the 'science to solutions' conversation



Collaboration with *Metro Vancouver* to look at microplastics in wastewater treatment facilities



The solution is tractable: best practices, green design, regulations, consumer choices or beach clean up



URBAN



HOME & GARDEN



SHIPPING

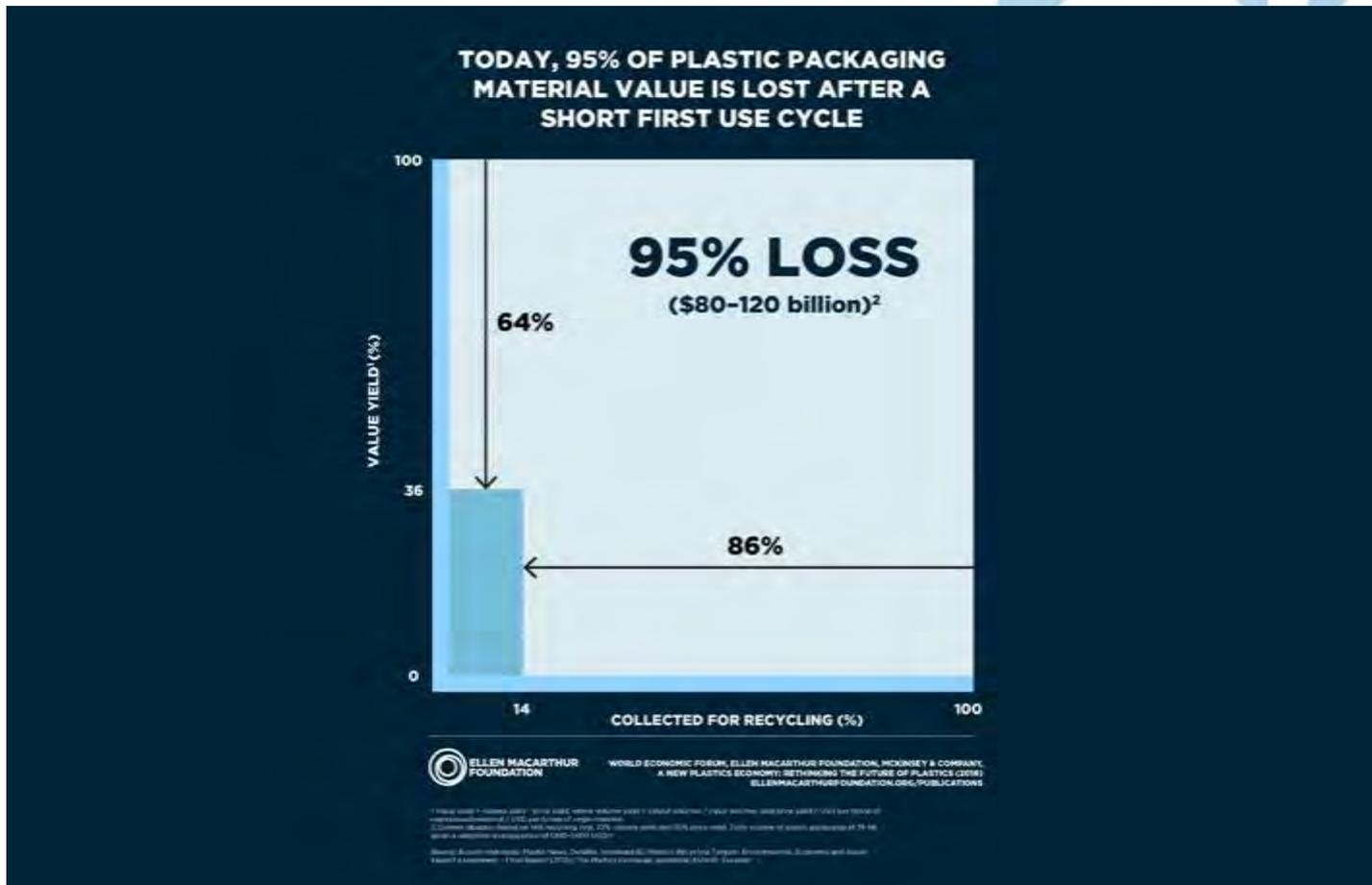


INDUSTRY



AGRICULTURE & FORESTRY

Plastic as a commodity: Canada prepares to shine as it aims to close the loop on the plastic economy



(MacArthur Foundation, Davos Economic Forum, McKinsey & Co., 2016)

Thank you

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