

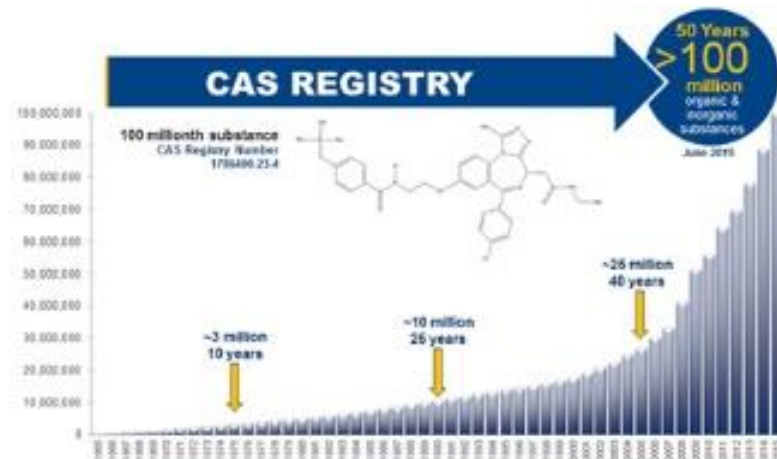
Ocean pollution priorities: where do we start?

Peter S. Ross

VP Research - Ocean Wise Conservation Association



Our world of pollutants – Where do we start?



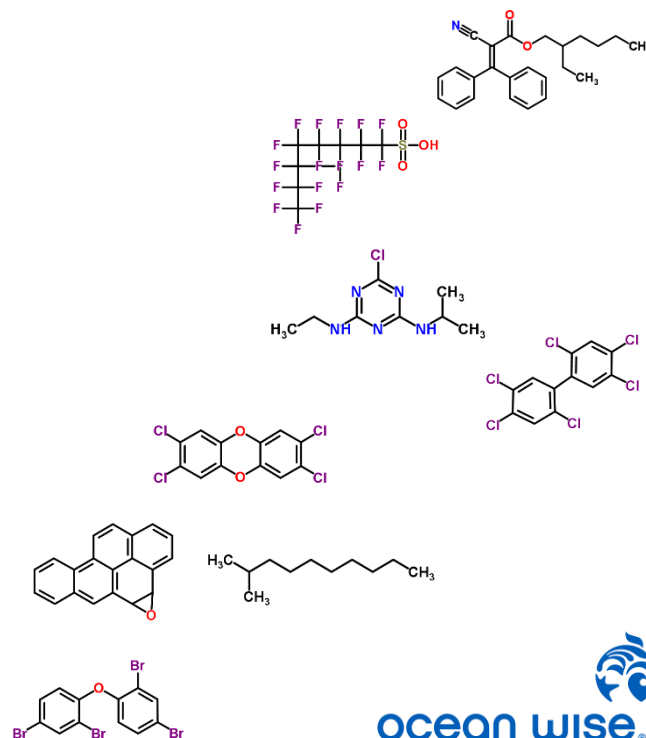
100 million chemicals registered
(CAS, 2015);

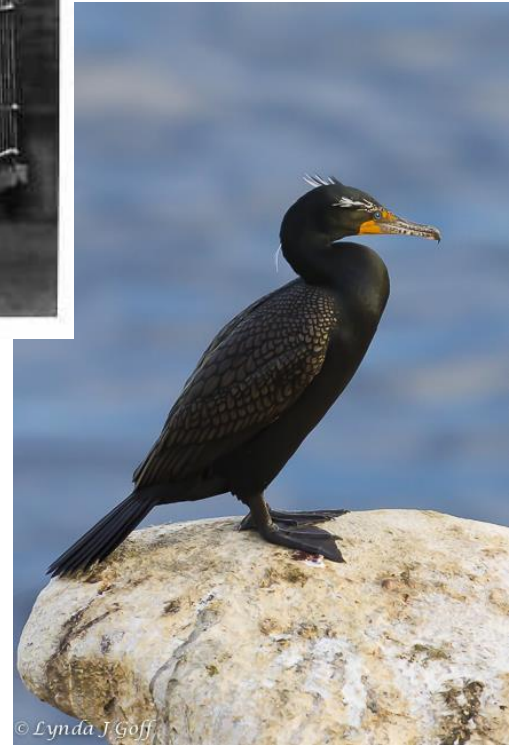
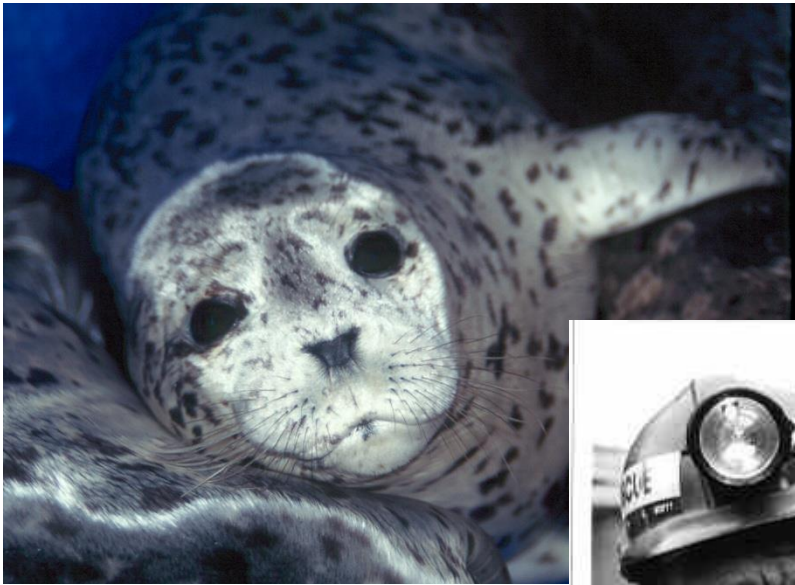
Over 250,000 chemicals on the
global marketplace, with 1,000 new
chemicals every year;

Wide variety of properties;

Different species at risk;

Range of emission histories.





© Lynda J Goff

Some canaries are vulnerable to environmental pollutants



NE Pacific killer whales are the most PCB-contaminated marine mammals in the world



Marine Pollution Bulletin
Volume 40, Issue 6, June 2000, Pages 504-515



High PCB Concentrations in Free-Ranging Pacific Killer Whales, *Orcinus orca*: Effects of Age, Sex and Dietary Preference

P.S Ross ^{a, *}, G.M Ellis ^b, M.G Ikonoumou ^a, L.G Barrett-Lennard ^c, R.F Addison ^a

Show more

[https://doi.org/10.1016/S0025-326X\(99\)00233-7](https://doi.org/10.1016/S0025-326X(99)00233-7)



SHARE REPORT

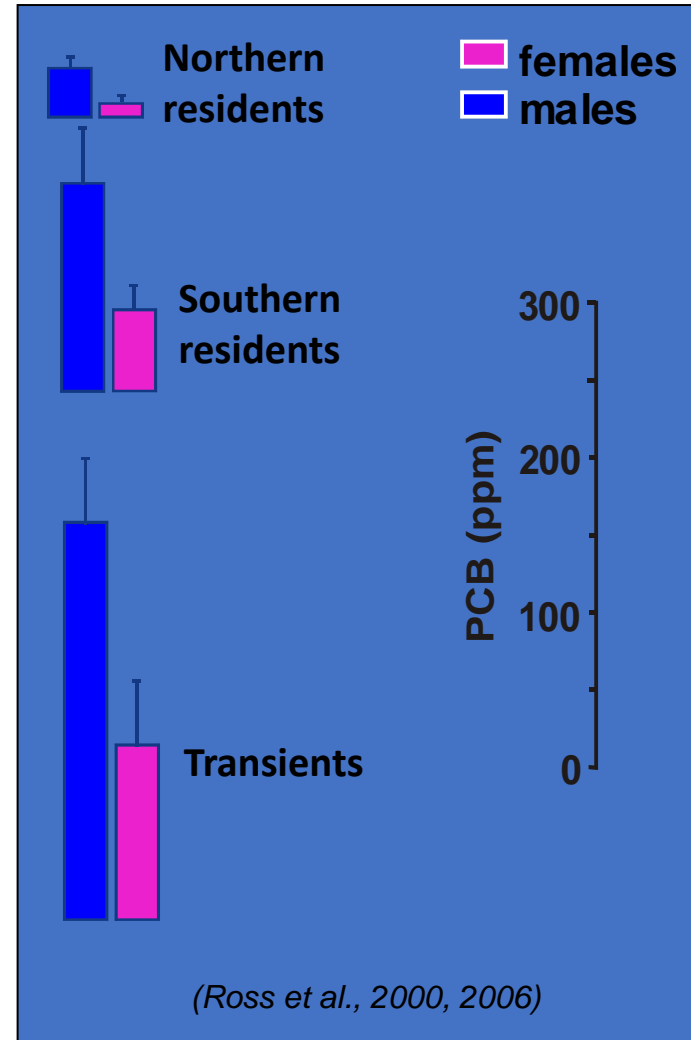


Predicting global killer whale population collapse from PCB pollution

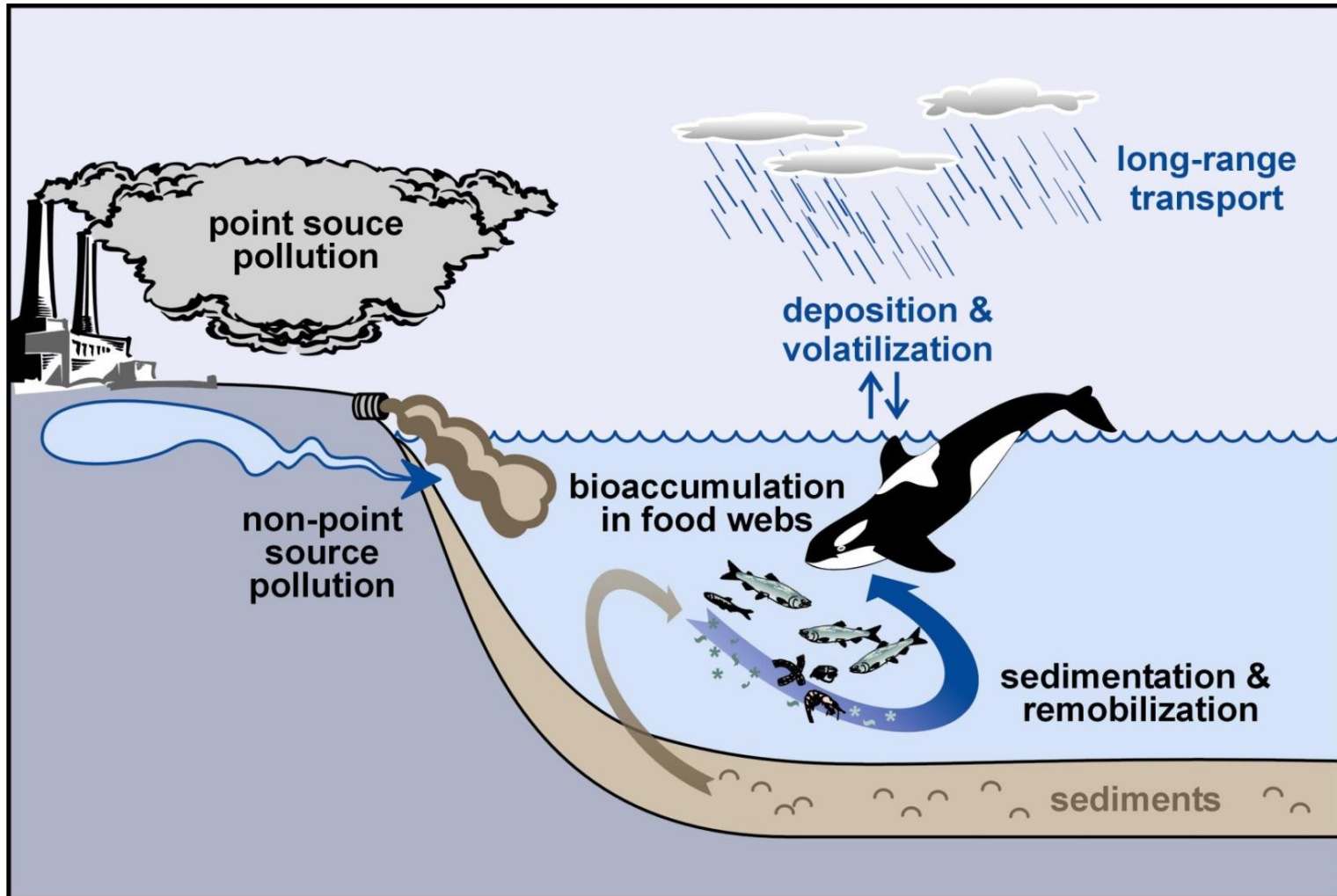
Jean-Pierre Desforges^{1, *}, Ailsa Hall^{2, *}, Bernie McConnell³, Aqalu Resing-Asvid⁴, Jonathan L. Barber⁵, Andrew Brownlow⁶, Sylvain De Guise⁷, Igor Eulaers⁸, Paul D. Jepson⁹, Robert J. Letcher¹⁰, Milton Levin¹¹, Peter S. Ross¹², Filipa Samarra¹³, Gisl Vikingson¹⁴, Christian Sonne¹⁵, Rune Dietz¹⁶

¹Department of Bioscience, Arctic Research Centre, Aarhus University, Frederiksborgvej 399, P.O. Box 358, 4000 Roskilde, Denmark.
²Sea Mammal Research Unit, Scottish Oceans Institute, University of St Andrews, St Andrews, KY16 8LB, UK.
³Greenland Institute of Natural Resources, P.O. Box 570, 3900 Nuuk, Greenland.
⁴Centre for Environment, Fisheries and Aquaculture Science, Pakefield Road, Lowestoft NR33 0HT, UK.
⁵Scottish Marine Animal Stranding Scheme, SRUC Veterinary Services Drummondhill, Stratherrick Road, Inverness IV2 4JZ, UK.
⁶Department of Pathobiology and Veterinary Science, University of Connecticut, 67 North Eagleville Road, Storrs, CT 06269-3089, USA.
⁷Connecticut Sea Grant, 1080 Shennecossett Road, Groton, CT 06340-6088, USA.
⁸Institute of Zoology, Zoological Society of London, Regent's Park, London NW1 4RY, UK.
⁹Ecotoxicology and Wildlife Health Division, Environment and Climate Change Canada, National Wildlife Research Centre, Carleton University, Ottawa, Ontario K1A 0H3, Canada.
¹⁰Ocean Wise Conservation Association, P.O. Box 3232, Vancouver, British Columbia V6B 3X8, Canada.
¹¹Marine and Freshwater Research Institute, Skjalagata 4, 101 Reykjavik, Iceland.
¹²Corresponding author. Email: pdj@bios.au.dk (J.-P.D.); rd@bios.au.dk (R.D.); ajh7@st-andrews.ac.uk (A.H.)
 - Hide authors and affiliations

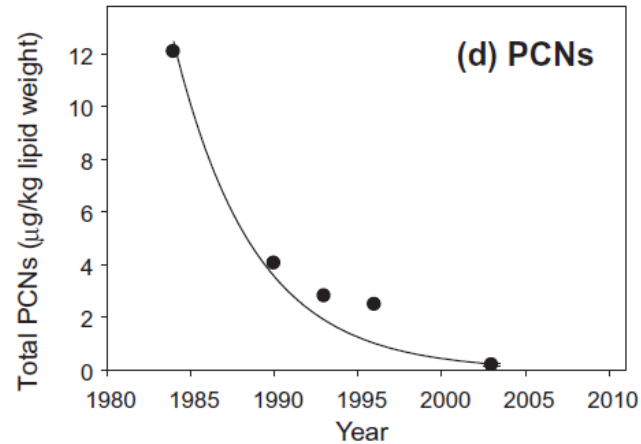
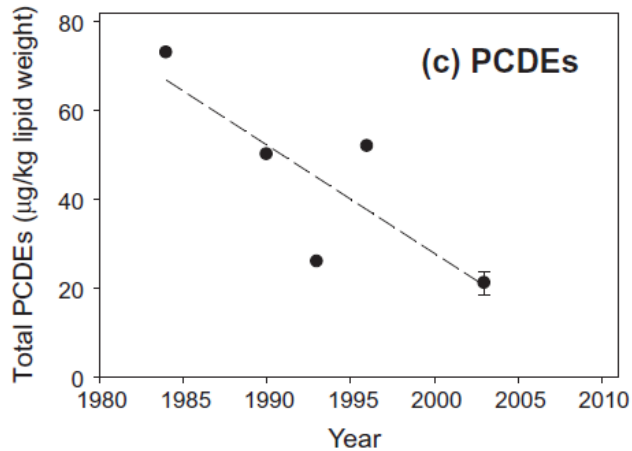
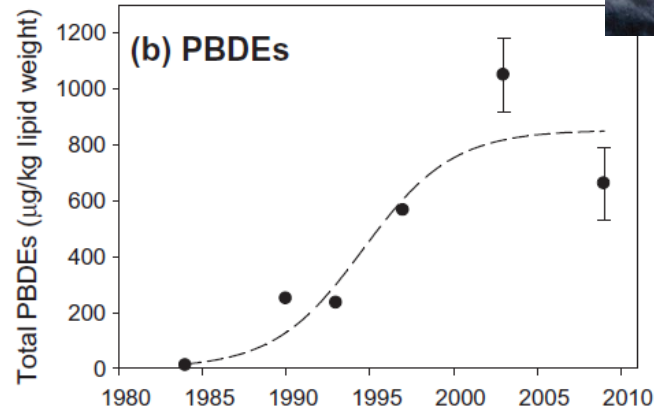
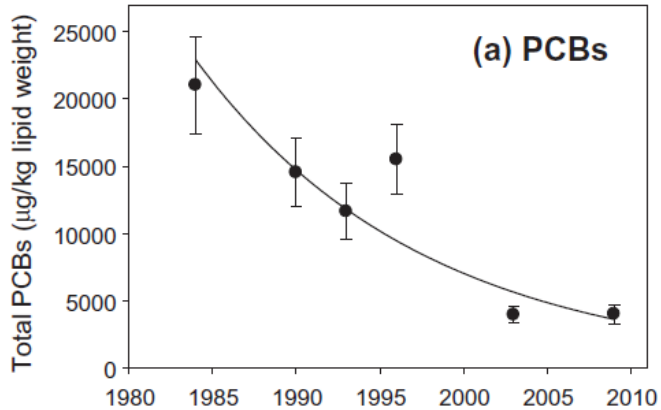
Science 28 Sep 2018:
Vol. 361, Issue 6409, pp. 1373-1376
DOI: 10.1126/science.121953



High trophic level species are vulnerable to the bioaccumulation of high concentrations of persistent contaminants



Progress revealed: Harbour seals reveal lower PCBs and PBDEs following regulations

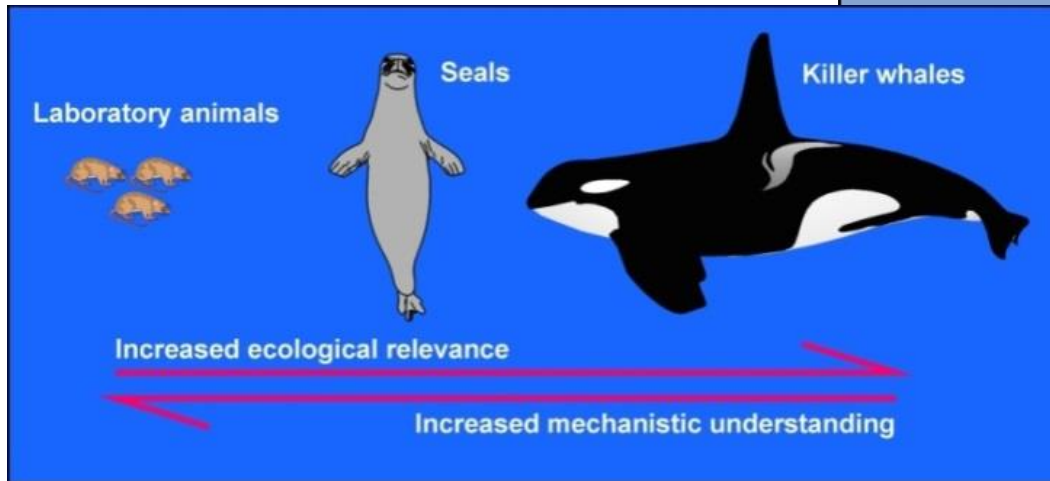
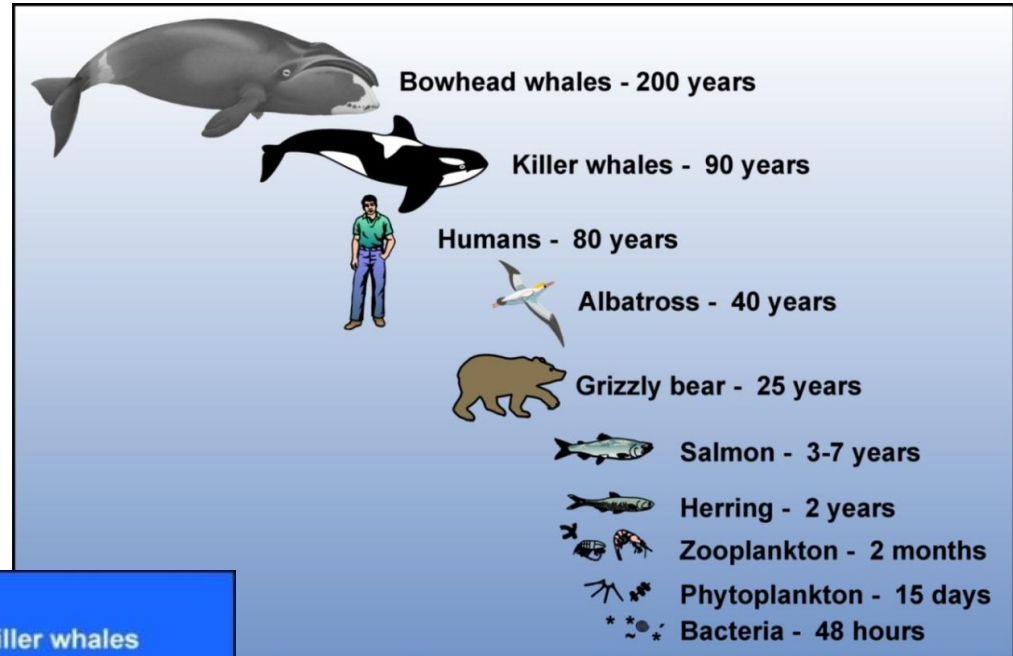


(Ross et al., 2013)

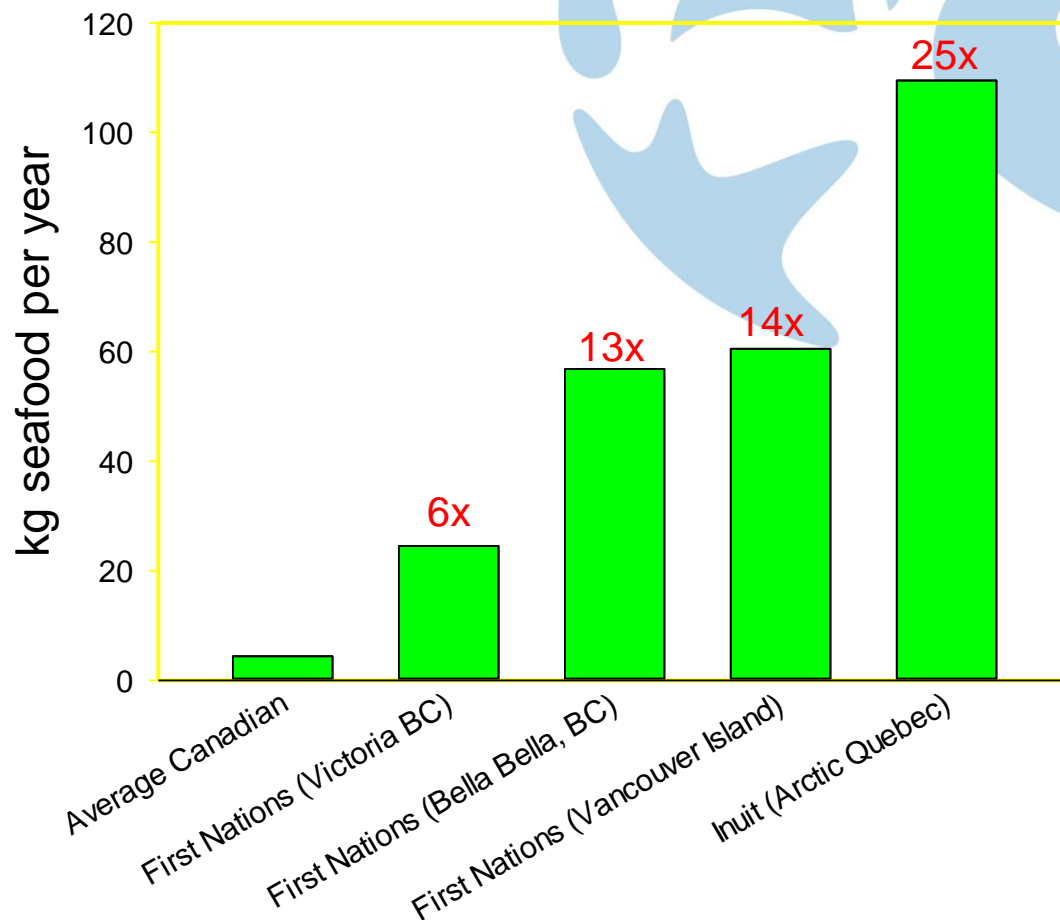
Do EQ Guidelines protect high trophic level wildlife?

Most regulations are based on toxicity testing in the lab with single chemicals

Long-lived (up to 100 years)
Mobile or migratory
Large habitat needs
Top predators



Ocean resources are more important to many indigenous communities: contaminants in seafoods via traditional foods

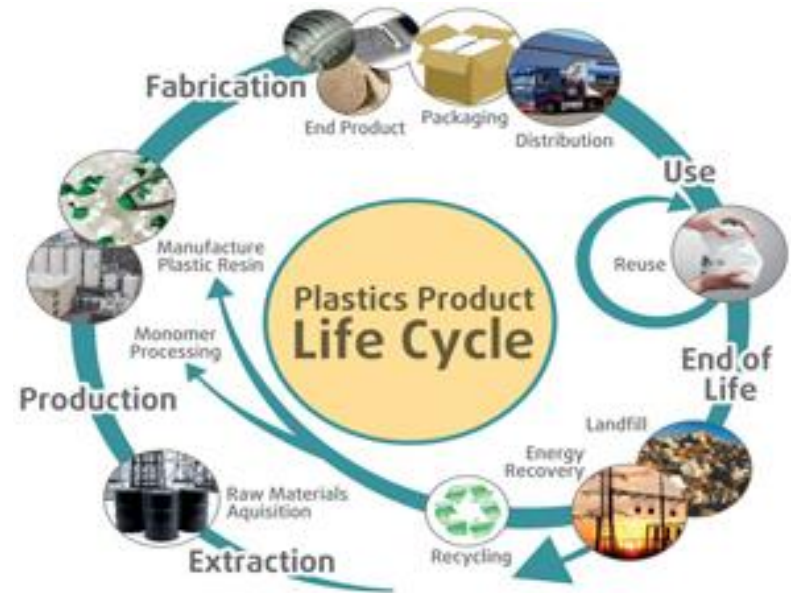


(Connacher 1993; Mos et al 2004; P.S. Ross unpublished; Dewailly et al 1994)

... but we now face another pollutant class that represents an emerging threat to ocean life

- Thousands of formulations;
- Used in a wide variety of consumer and industrial products;
- Can cause acute or chronic toxicity;
- Documented in hundreds of species of fish, seabirds and marine mammals around the world;
- Does not break down chemically;
- Is a pollutant class like no other...

Plastic



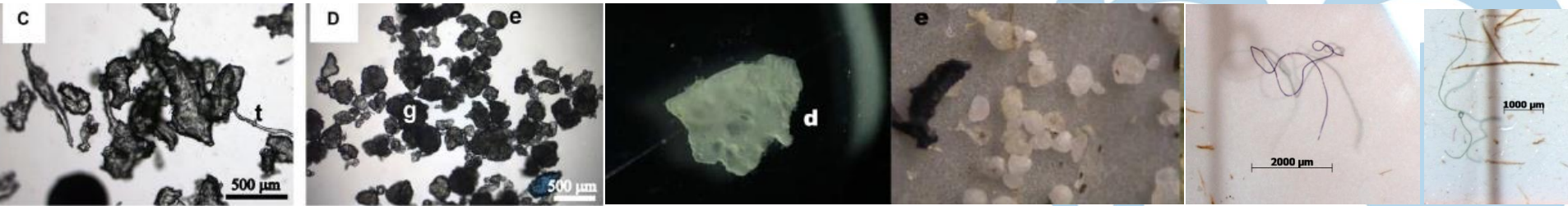
(Kate Le Souef, Great Canadian Shoreline Cleanup)

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;
- 1 million+ marine mammals and seabirds die every year;
- Plastic represents a conservation threat to many seabird species.

Microplastics emerge as a new conservation concern



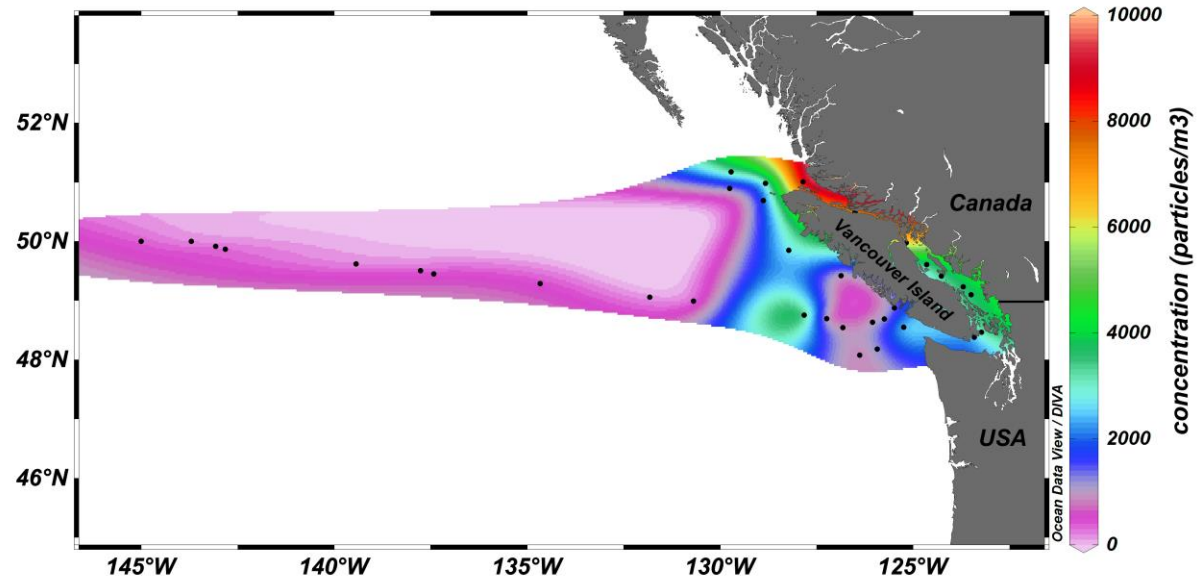
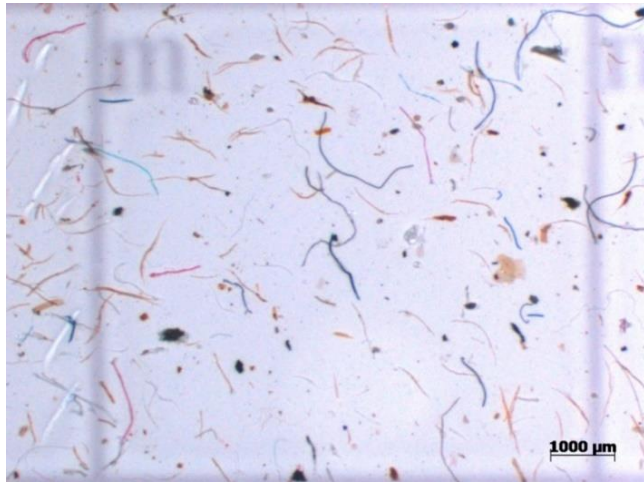
Microplastic particles are < 5 mm (variable minimum sizes, depending on the reporting lab);

Two basic categories:

Primary microplastics are deliberately manufactured (microbeads and nurdles);

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

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



(Desforges, Galbraith, Dangerfield & Ross 2014)

Up to 80% are fibres

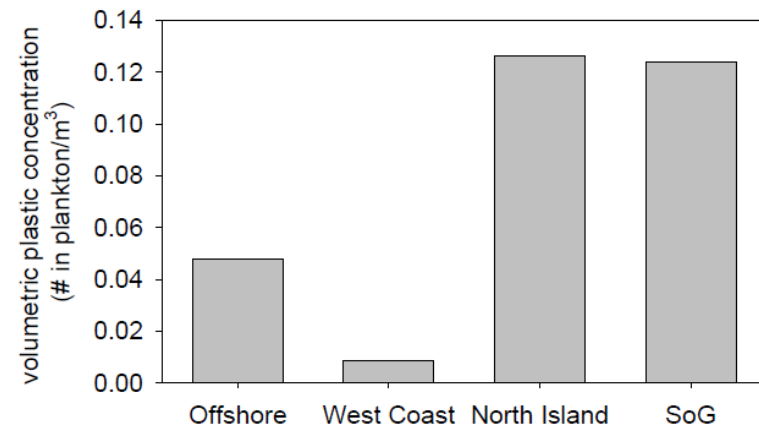
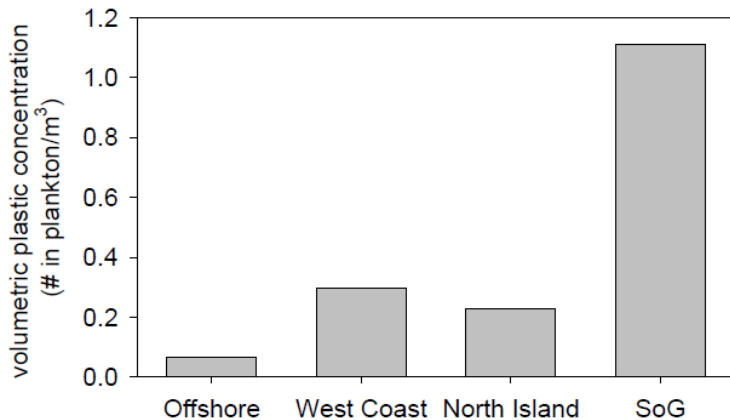


Zooplankton are mistaking microplastics for food

Neocalanus cristata

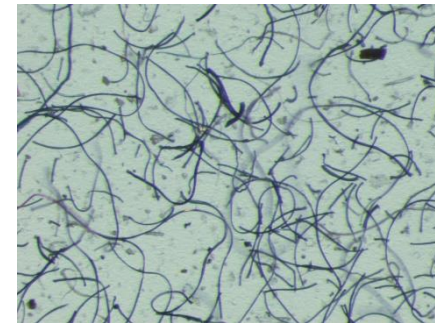
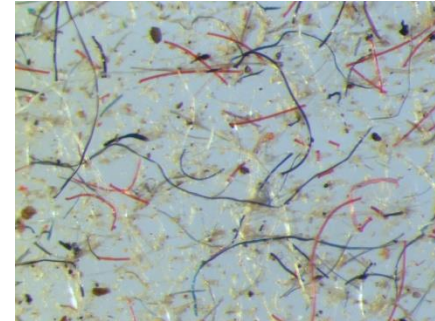
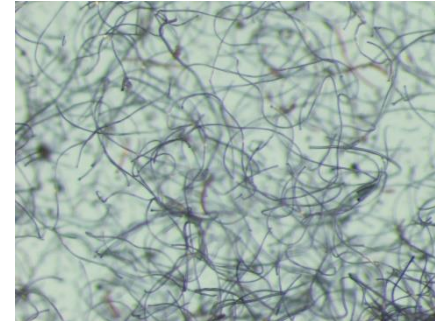


Euphausia pacifica

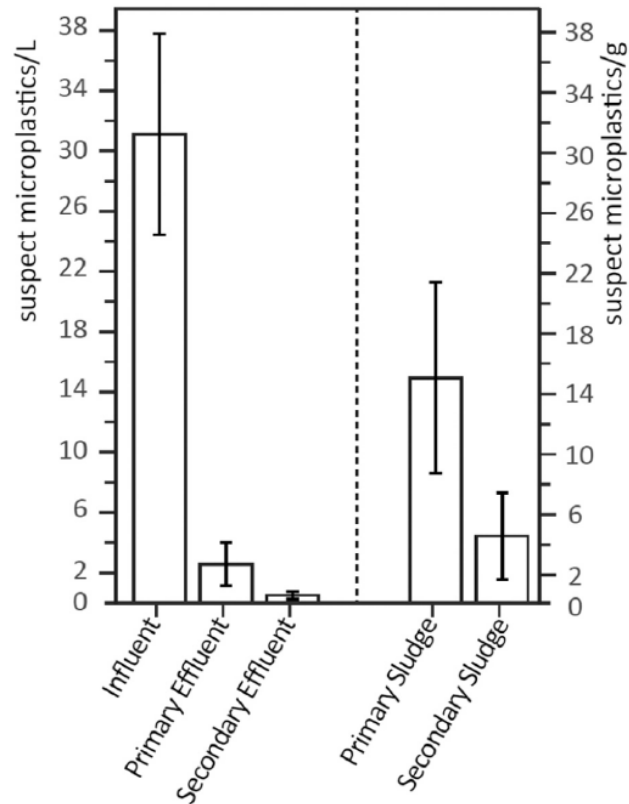


(Desforges, Galbraith, Dangerfield & Ross 2015)

Microplastics: A single polyester fleece sweater can lose up to 10 million fibres in a laundry load



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



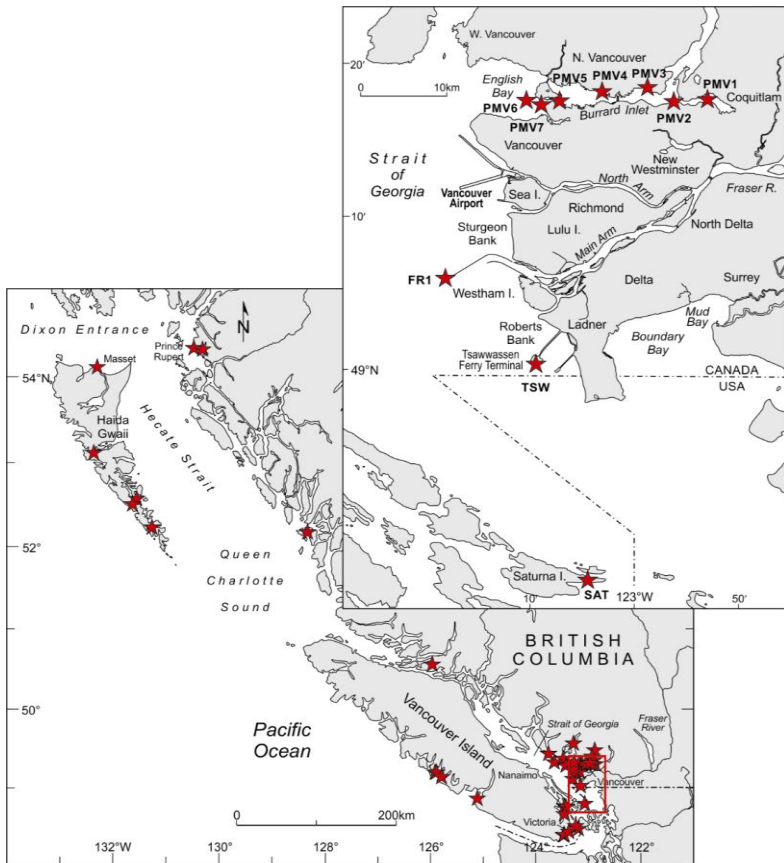
- 71% are fibers
- Fibres were dominated by polyester and Rayon
- 30 billion enter the ocean
- 99% are retained in WWTP
- These are redistributed as agriculture, forestry & mining fertilizers

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).



PollutionTracker.org –
a high resolution, open-access
contaminant monitoring initiative

A coast-wide, mid-field pollution monitoring program (*PollutionTracker.org*)



- 13 partners from industry, government and First Nations
- 55 sites established coast-wide
- sediment and mussels analyzed
- Over 400 priority contaminants analyzed

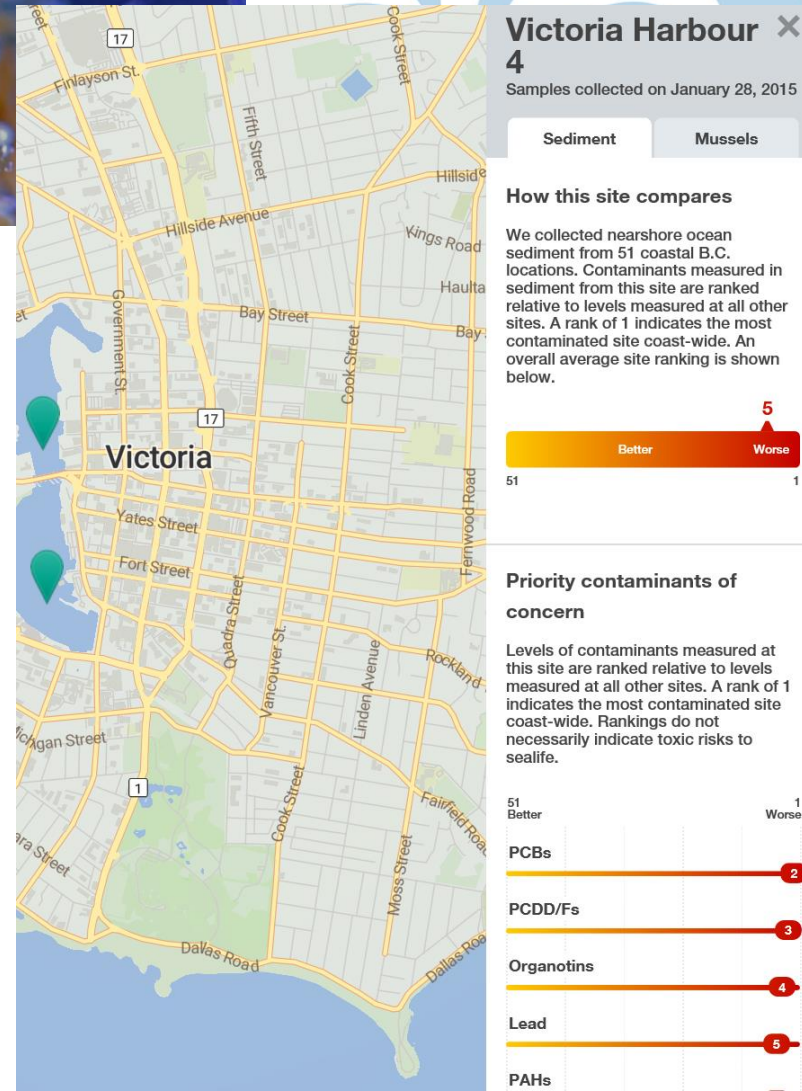
How polluted is our ocean?

PollutionTracker, a new monitoring program for coastal British Columbia, Canada, is helping us answer this question. We are documenting the levels and trends of hundreds of contaminants of concern in mussels and nearshore ocean sediments.

Explore *PollutionTracker*

PollutionTracker monitoring helps to identify:

- *New pollutants*
- *Hotspots*
- *Responses to source control*
 - *Trends over time*
 - *Fisheries closures*
- *Species at Risk & Critical habitat*
- *Dredge & disposal practices*



Thank you

Staff: Anna Posacka, Katerina Vassilenko, Marie Noel, Anahita Etemadifar, Kelsey Delisle, Esther Gies, Jessica LeNoble, Stephen Chastain, Mathew Watkins, Stephanie Wang;

Graduate students: Lauren Howell, Julie Dimitrijevic, Rhiannon Moore.



NORTH GROWTH
FOUNDATION



THE W. GARFIELD WESTON
FOUNDATION



The
McLean
Foundation

