Microplastics In Our Lungs, Blood, And Heart:
A ticking Time Bomb?

by
Dr. Goetz Schuerholz, Chair CERCA

The tiny particles created by the decay of plastic have now reached every corner of the earth and infiltrated the human body. They have been documented in all parts of us, our lungs, maternal and placental tissues, human breast milk, and our blood. Although little is known yet about their damage and danger to humans and other organisms, microplastics are widely recognized to be an increasing hazard, posing a threat to human health and the planet.

The focus of CERCA's Microplastics Project Phase I conducted in 2020/21 in collaboration with scientists from the University of BC, Simon Fraser, and the Canadian Wildlife Service, was on the identification of microplastics concentration and distribution in sediments of the Cowichan Estuary. Phase II, implemented in collaboration with "Project Watershed" from Comox and scientists from the same Universities, aimed at a comparison of the Comox and Cowichan Estuaries in terms of microplastics concentrations and distribution in sediments of the inter-tidal area and on the analysis of bio-samples (i.e. varnish clams).

The peer-reviewed article on the Phase I outcome was published in a scientific Journal as reported on C ERCA's Website:

https://www.cowichanestuary.com/news/microplastics-in-mudflat-sediments-of-the-cowichan-koksilah-estuary

The results of Phase II are in the process of being published as a peer-reviewed article elaborated by Dr. Zeinab Zoveidadianpour as lead author. CERCA's Board Director Dr. Bernhard Juurlink summarized the results of the paper published on CERCA's website:

https://www.cowichanestuary.com/news/phase-ii-of-cercas-microplastic-study-in-the-cowichan-estuary

In addition to Dr. Juurlink's summary report it is noteworthy that the Cowichan River sediment samples taken above and below the Duncan sewage outfall did not show significant differences in microplastics composition and/or load. This appears to indicate that most microplastic particles entering the sewage lagoon are being filtered out by the first and second treatment before the treated water is discharged into the River.

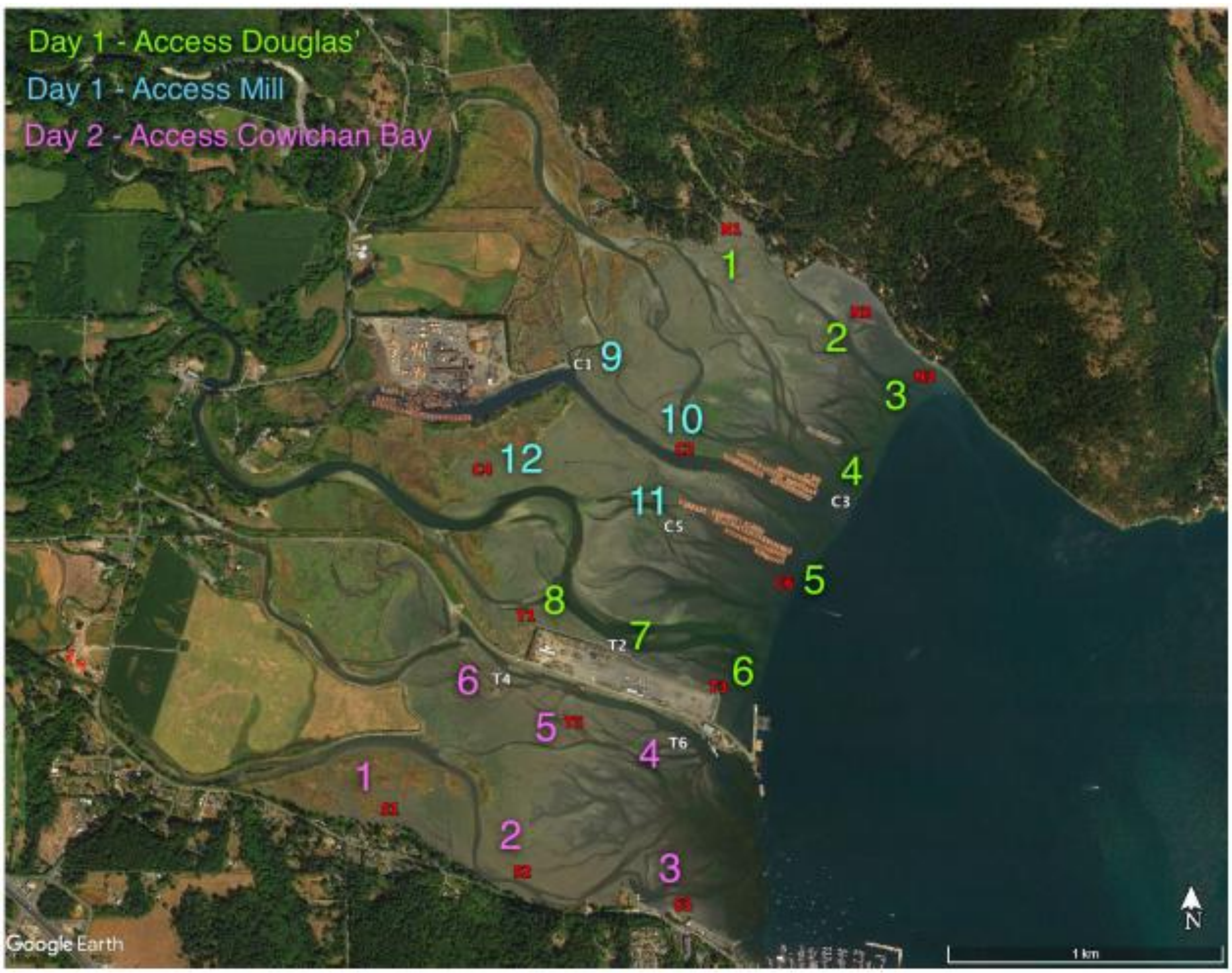
The following report compares the northern and southern sections of the Cowichan Estuary which are artificially divided by the man-made Causeway leading to the Westcan Terminal. The report was produced by Dr. Zeinab Zoveidadianpour at a special request by CERCA. She was the lead scientist of Phase II working under a Mitacs Postdoc fellowship for the past two years.

Microplastics: A Comparison of the Northern and Southern Section of the Cowichan Estuary

by

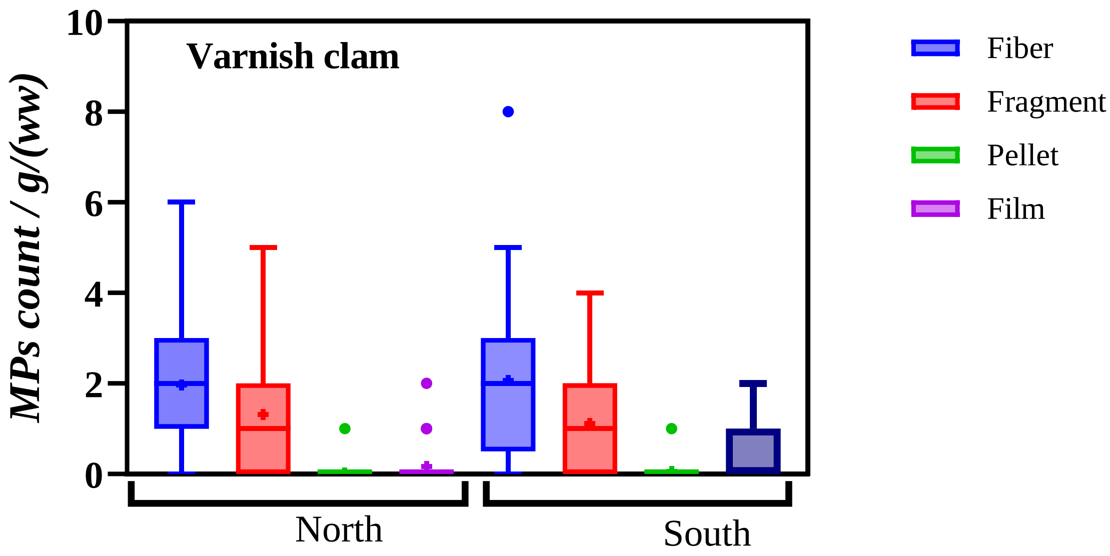
Dr. Zeinab Zoveidadianpour

This summary report compares microplastics (MPs) characteristics such as type, color, size, and polymer composition between sediment and bio-samples from the Northern and Southern Sections of the Cowichan Estuary. Samples of the Northern Section include locations 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 (colors green and blue on the map below) and of the Southern Section 1, 2, 3, 4, 5 6 (color purple on the map).

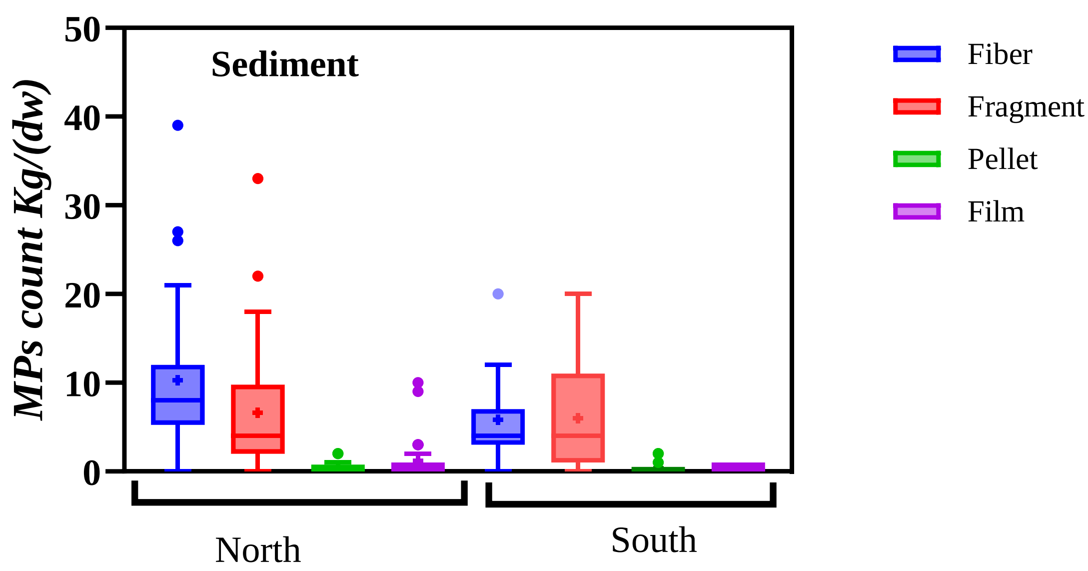


Microplastic Types:

Varnish Clams: The North region shows higher amounts of fibers and fragments, while the South has fewer Microplastics (MPs) overall (see Figure below).

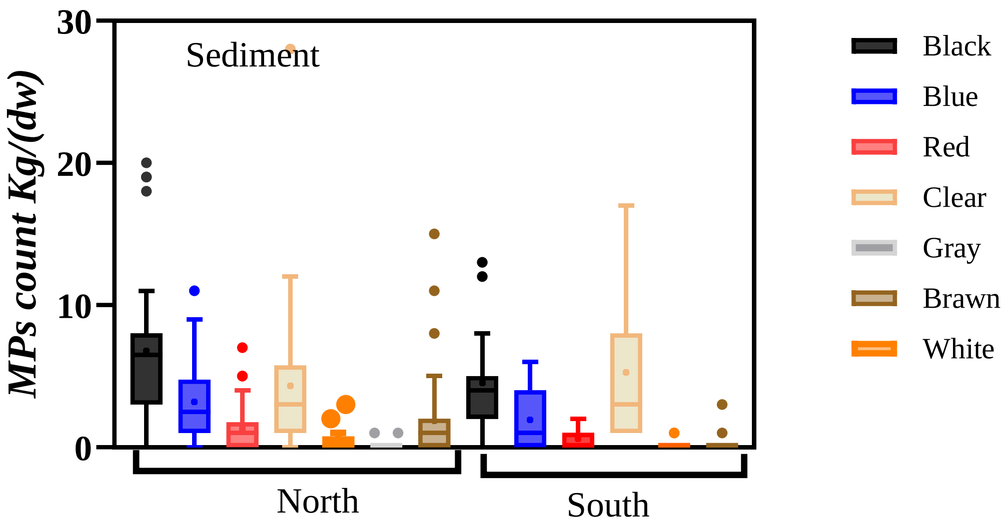


Sediment: The North region has a high concentration of fibers, with more fragments and pellets compared to the South (see Figure below).



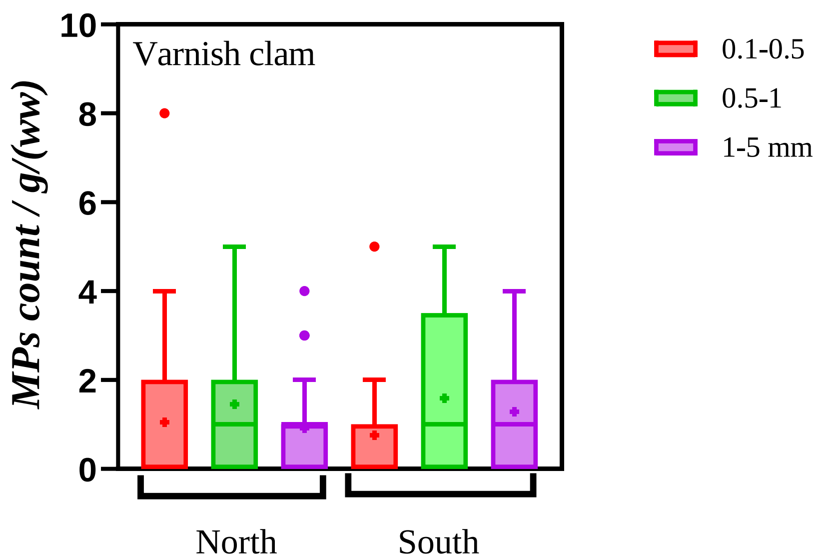
Color Distribution:

Varnish Clams and Sediment**:** Black microplastics dominate in both regions, but the North shows greater variability and higher counts of blue and red MPs (see Figures below).

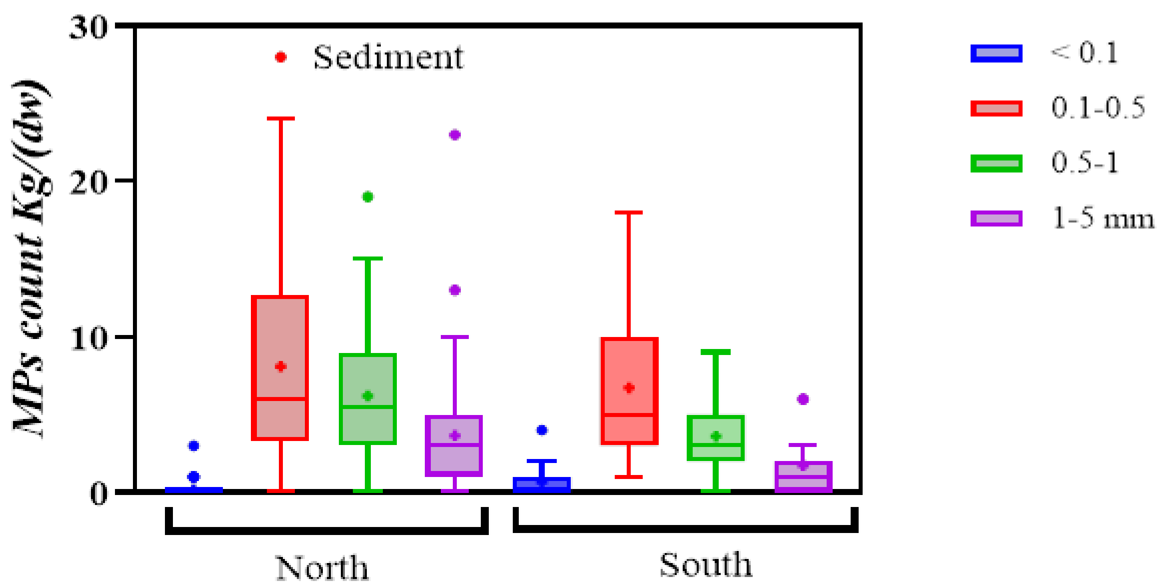


Size Distribution:

Varnish Clams**:** The North and South regions contain more MPs in the 0.5-1 mm and 1-5 mm size ranges, indicating higher pollution exposure (see Figure below)

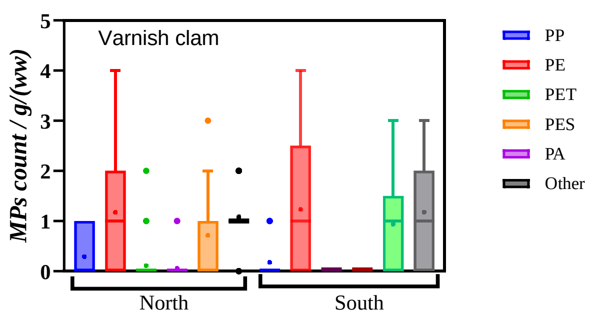


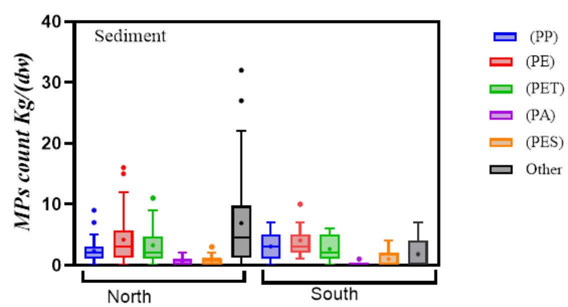
Sediment: The North shows more variability in MP size, particularly in the 0.1-0.5 mm range (see Figure below).



Polymer Composition:

Varnish Clams and Sediment: The North region is dominated by polyethylene (PE), with more variability and higher counts, while the South has a more balanced and lower concentration (see Figures below).





Conclusions:

The North region exhibits higher microplastic contamination across all categories, suggesting localized pollution sources. In addition, varnish clams and sediment in the North show more significant MP accumulation, indicating a need for targeted pollution management.

The higher levels and variety of microplastics found in the northern part of the estuary suggest that local pollution plays a significant role. This pollution might be coming from nearby industrial sites, urban runoff, or specific water currents that gather and hold debris. Because of this, more microplastics end up in both the sediment and the varnish clams in this area.

The way water flows, how sediment settles, and the effect of tides differ between the northern and southern parts of the estuary. These factors can impact where microplastics end up. For instance, if the water moves more slowly in the North, it could lead to more microplastics settling into the sediment, where varnish clams might eventually ingest them.

The fact that polyethylene (PE) is more prevalent in the northern part of the estuary suggests they're likely coming from everyday items like packaging materials, fishing gear, and household products. The mixture of microplastics found there, degraded pieces, and more recent debris.

In contrast, the southern region shows a more balanced and generally lower presence of these plastics, which could indicate fewer pollution sources or possibly better waste management practices in the areas that influence this part of the estuary.

The large number of fibers found in the sediment and varnish clams, especially in the North, points to textile pollution as a major concern. This likely comes from washing synthetic clothes, which releases microfibers into the water. These tiny fibers are easily transported by currents, settling in sediments, or being ingested by marine organisms.

Fishing activities may also play a role in fiber and fragment pollution. Discarded fishing lines, nets, and ropes made from synthetic materials can break down into smaller particles, contributing to the higher levels of microplastics in the North.

Effects on Marine Life and the Environment:

The higher levels of microplastics in varnish clams from the North suggest these organisms are being more heavily exposed, which could mean these plastics are making their way up the food chain. This is concerning both for marine life and for people who consume seafood from this region.

The buildup of microplastics in the sediment, particularly in the North, could be damaging the quality of the sediment and harming the organisms living there. Microplastics can alter the physical and chemical properties of the sediment, which could, in turn, affect its ability to support various marine species.

Recommendations for Pollution Management:

The results suggest that pollution management efforts should be concentrated in the northern part of the estuary. This could involve identifying and reducing specific sources of pollution, improving waste management practices, and setting up regular monitoring to keep an eye on microplastic levels.

Raising awareness and educating the public about the sources and impacts of microplastic pollution, combined with stricter regulations on plastic waste disposal and reduction, could help reduce the amount of microplastics entering the estuary, particularly in the more affected northern region.

Additional Comments by Goetz Schuerholz:

One reason for the significantly higher concentration of microplastics in the Northern section of the Estuary could be the absence of eelgrass fields, destroyed by decades of log boom storage, log transport, and log handling in the inter-tidal area. For more detail on the history and current status of eelgrass in the estuary follow the link below to an article by Dr. Goetz Schuerholz published on the CERCA website:

https://www.cowichanestuary.com/news/the-story-of-eelgrass-in-the-cowichan-estuary

Source: Google image modified by Goetz Schuerholz, CERCA

Optimum eelgrass habitat, formerly covered by dense eelgrass meadows; all eelgrass has disappeared.

Cowichan River North- and South Fork tributary channels which used to support eelgrass until the late 1970s; no more eelgrass found today.

The areas marked by the two dotted boxes cover the only eelgrass meadows left in the estuary. The area North of the Westcan Terminal supports less than 2 acres set aside in the 1970s as conservation area by the Cowichan Estuary Environmental Management Plan. The eelgrass meadow South of the Terminal has successfully been rehabilitated after the inter-tidal Crown Lease 103103 allocated to log booming was abandoned by MacMillan Bloedell in the early 1990s.

The ecotone between the sub-tidal and intertidal ecosystems in the estuary overlaps with traditional log boom storage areas (see area circled by the blue line on the map above), commonly believed to be primarily responsible for the disappearance of eelgrass.

One of the many goods and services provided by eelgrass is its role as an efficient filter and of water, possibly absorbing microplastic particles transported by tidal waves before they enter the intertidal mudflats. Such particles will settle in the eelgrass fields to be buried by sediments over time.

It is hypothesized that in the absence of eelgrass north of the Terminal tidal waves are entering the mudflats barrier-free depositing microplastics along the way which would account for higher loads in the Northern section compared to the Southern section. The eelgrass fields south of the Terminal extend from the Terminal to the Southern shoreline of the estuary, effectively acting as a formidable barrier breaking the wave action and possibly filtering out most of the microplastic particles before they enter the intertidal flats. This, however, is a hypothesis which still needs to be substantiated by researched.