

Biodiversity and A New Species of Gastrotrich in Strathcona Provincial Park?

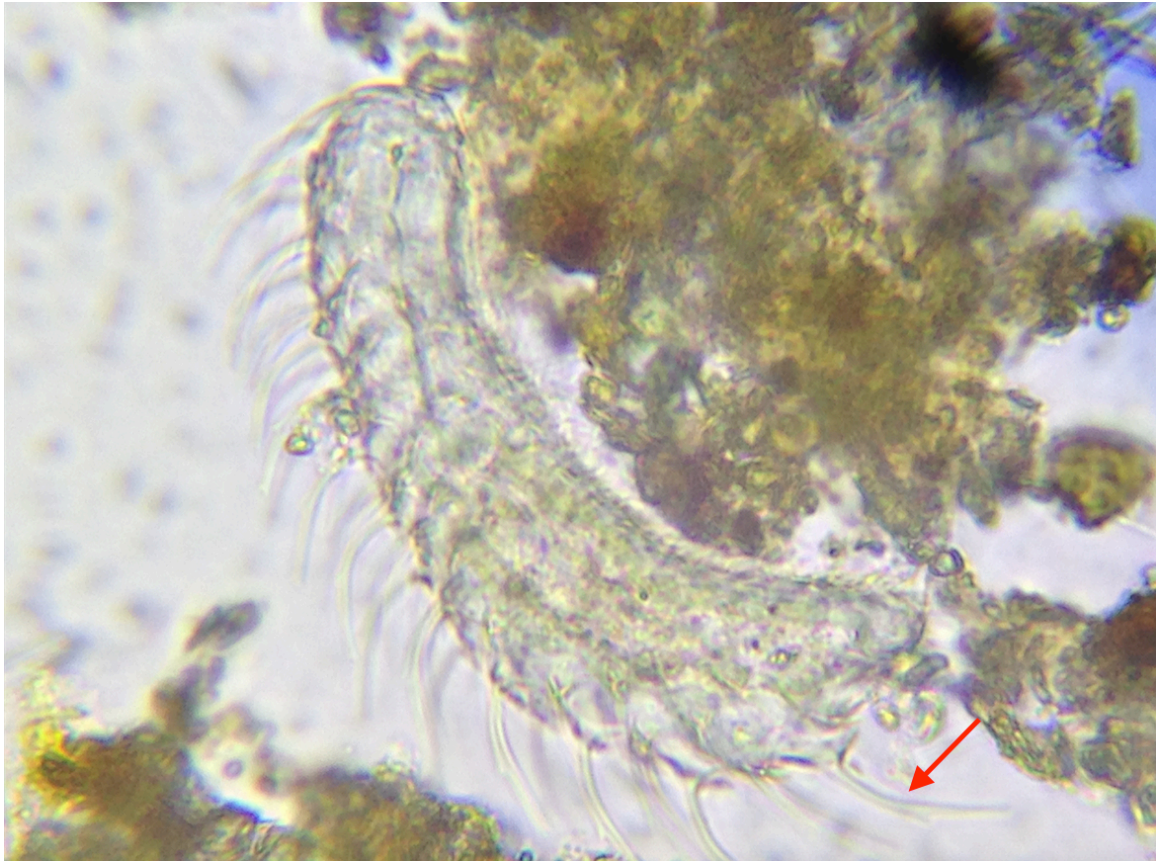


Figure 1: “*Chaetonotus X*” a species of gastrotrich apparently new to science found in Paradise Creek in Paradise Meadows Strathcona Provincial Park (September 2023.) Red arrow points to the unusual forking on auxiliary spikes . (magnification ~ 1000x)

At a time when conservation scientists report that a human-driven sixth mass-extinction is well underway at rates 354 times higher than expected, it may be comforting to consider that the waters of Strathcona Provincial Park seem to be home to species yet unrecorded by science.¹ It may also be a bit disconcerting that these rare species are likely regularly killed every time hikers collect drinking water and treat it with ultraviolet lights and water filtration systems! While clear water is taken for granted to be “clean,” we frequently overlook the fact that natural “untreated waters” are actually a product of biogeochemical processes. Natural waters are a biologically-conditioned chemical solution which carries, and is also a suspension of, organic debris and micro-organisms.

¹ <https://www.theguardian.com/environment/2023/sep/19/mutilating-the-tree-of-life-wildlife-loss-accelerating-scientists-warn>

Even a cursory exploration reveals that natural waters are miniature ecosystems of a flora and fauna with familiar-sounding names such as “trachelomonas,” “closterium,” “amoeba” and “cryptomonas.” These are names frequently associated with adverse human gastro-intestinal reactions. Some are benign, some we have a genetic and cultural resistance to, and some are downright dangerous to humans. While drinking natural untreated water used to be commonplace, as it was with “whole unpasteurized milk,” the combination of increased risk of pollution and a lowered immunity in human populations has made the ingestion of these substances hazardous to one’s health. Water treatment by filtration or UV before consumption therefore remains strongly-recommended, when drinking natural water.

That does not mean however that these micro-organisms are unimportant or undesirable. Quite the contrary! In a counter-intuitive way these organisms are extremely important and much to be desired by human beings. Gastrotrichs are indicators of “unpolluted waters.” They are sensitive to anthropogenic contaminants. They feed on bacteria and micro-algae and appear to be responsible for controlling bacterial and algal blooms that can de-oxygenate waters and result in eutrophic conditions. In that sense, they are part of the clean-up crew in biological processing chains that control nutrient cycling across entire watersheds. As research has demonstrated, the complexity of intact natural ecosystems provides a multitude of ecological niches. The higher the number of niches, the greater the biodiversity of ecosystems. The greater the biodiversity of a system is, the greater is its ability to control nutrient flows, and maintain high water quality.²

That most people overlook the presence of these microorganisms should come as no surprise since even the scientific world and the arcane world of “zoobenthology,” the study of micro-organisms that inhabit aquatic environments, willingly admit that we know relatively little about these poorly-studied organisms. Most of what is known about gastrotrichs can be found in a publicly available chapter of James Thorp’s and Alan Covich’s 2010 third edition of *Ecology and Classification of North American Freshwater Invertebrates*.³

Although they are some of the most abundant microorganisms in freshwater ecosystems reaching densities between 100,000 to 1,000,000 per square metre, all we really know is that gastrotrichs feed on bacteria, and therefore probably control bacterial populations in water. Furthermore, given their densities they are likely to be important in freshwater food chains. Exactly how remains unclear.

² Bradley J. Cardinale (2011). “Biodiversity improves water quality through niche partitioning.” *Nature* 472:86. (<https://www.nature.com/articles/nature09904>)

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https://www.caryinstitute.org/sites/default/files/public/reprints/thorp_covich_gastrotrichs_2010.pdf

As with other non-economically important organisms, their general life cycle has only been worked out recently. They are hermaphroditic, and until recently they were thought to reproduce only parthenogenetically (i.e. by cloning). Their life cycle is in fact much more interesting, because it is unique among invertebrates and admirably well-suited to their ecology. The newly-hatched juvenile is born with 4 parthenogenic eggs which are laid within 4 days once water temperatures reach 20C. The fourth egg is a “resting egg” which is resistant to freezing and drying. The fourth egg serves as a long-term investment in the bank. It assures continuity from year to year through winters and drought. The first three eggs are a population explosion. Once the parthenogenic cycle is over the adult develops an “X-shaped body” (which to this day is not well understood). The X-body is associated with sexual reproduction (which has yet to be witnessed.) How sexual reproduction takes place is not known. This reproductive cycle enables gastrotrichs to survive environmental extremes, increase populations exponentially in a matter of days, and maintain genetic and species diversity.

Where they fit taxonomically, also still remains a matter of debate. They are neither nematodes nor rotifers, so recent work places them in their own phylum. There are two orders: Macrotrichida, which with two exceptions are marine species, and Chaetonotida which can be found in both marine and freshwater environments.

Gastrotrichs are quite elegant ghostly silvery transparent organisms between 50 to 100 microns. They are covered with fine scales and can be observed gliding effortlessly through water and sliding in and out of the debris and detritus they feed on. They are easily recognized by their rounded heads, terminal circular mouth, and a plump elastic abdomen that ends with a distinct two-pronged fork that houses two adhesive tubules with which gastrotrichs can attach themselves to substrates.

Although they are microscopic they have well-developed organs, including a proportionately large brain. They are “acoelomate” – they have no “coelom” – no body cavity with tissues that line and contain the organs, such as is found in evolutionary lineages that lead to vertebrate evolution.

Currently 100 species of gastrotrich are accounted for in North America. As noted by Strayer, Hummon and Hochberg : *“In North America perhaps 75-90% of the probable diversity of freshwater gastrotrichs species are undescribed.”*⁴ That means that between 400-1000 species have yet to be discovered! It is therefore not too surprising to discover as yet undescribed species in the lakes and streams of Strathcona Provincial Park. All it takes is the will to look and consider the importance of species that seem as unimportant to most humans as is biodiversity, because their link to water quality and watershed processes is as under-esteemed as is biodiversity’s to climate change.

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https://www.caryinstitute.org/sites/default/files/public/reprints/thorp_covich_gastrotrichs_2010.pdf

This new species is easily identified to genus as a *Chaetonotus*, because members of that genus have scales with long spikes. This species has very long and very abundant spikes. It was further identified as a yet undescribed species by Michael Muller, a researcher specializing in gastrotrichs, who lives in Ratisbon, Germany. Muller notes that: “... *the form of the spikes is very uncommon: they have an auxiliary point far away from the tip and a doubled tip. I don't know any species with this kind of spikes.... I would be very surprised, if this species is already described!*”⁵

There is no point talking about biodiversity and ongoing extinction rates if the actual importance of biodiversity, not just for humans, but for the functioning of ecosystems and the well-being of the planet continues to be ignored. The discovery of a new species in one of the most intensely trodden corners of Strathcona Provincial Park should make us pause. It may well have been discovered prior to imminent extinction. The last time that the Strathcona Wilderness Institute was able to get reliable official numbers on the annual number of visitors to Paradise Meadows was for 2019 when 37,564 people used that trailhead. Since Covid in 2020 those numbers are known to have doubled or tripled, as has user impact on the trail system, which is now in dire need of repair.

The now fourteen year old Centennial boardwalk is in many places nearing collapse. Ironically, it was developed in a sensitive wetland, without an intensive prior assessment of biological values. *As intense traffic grows, at what point will pollution overwhelm pollution-sensitive species in a watershed's water quality processing chain?*

As E.O. Wilson famously quipped: “*It is the little things that run the world.*” This new species is a minimal subsample of a world that remains largely unexplored, poorly understood and whose complexity remains largely unknown at a time when it may be more important than ever for humanity's future. The importance of biodiversity remains largely ignored and taken for granted by both the public and the politicians they elect. When politicians and public refer to biodiversity it is with reference to megafauna, big mammals, big salmon, big birds etc. The micro-system that sustains them isn't even on the radar. Resulting conservation efforts are therefore often reactive and ad hoc exercises in public theatre, as has been Canada's forty-year strategy to save spotted owls (*Strix occidentalis*), now abandoned by an ineffective *Species at Risk Act*.

In keeping with the *BC Parks Act* most visitors take for granted that the park exists mainly for their right to recreation. They are oblivious to their impact on the park. The rights of other species, their importance to life on this planet and how they make recreation possible need to be given greater public prominence.

⁵ <https://www.inaturalist.org/observations/182501912>

That a new species was found in a highly-managed area speaks volumes to the heroic success of present management practices and efforts. However, these practices are not meant for the growing numbers and impacts we are witnessing, no more than the boardwalk was. This is at best a stop-gap reactive strategy, if it is not complemented with a much needed public education campaign on the importance of biodiversity conservation.

BC Parks, because it manages the greatest area of conservation lands in the province is in a unique position to deliver that education. However to do so it needs to reactivate its naturalist service, and seriously engage with the naturalist community in order support research and citizen science programmes from a local bottom-up approach, not the current colonial top-down practice which excludes the public and treats scientific research as a secondary consideration in the management of the park. That approach has only guaranteed that rare species have gone unrecorded since the inception of the park. The big question remains: *How many undescribed species have yet to be identified in BC's parks before we lose them?* That consideration is no longer acceptable in a biodiversity crisis.

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