# There's Life in Groundwater

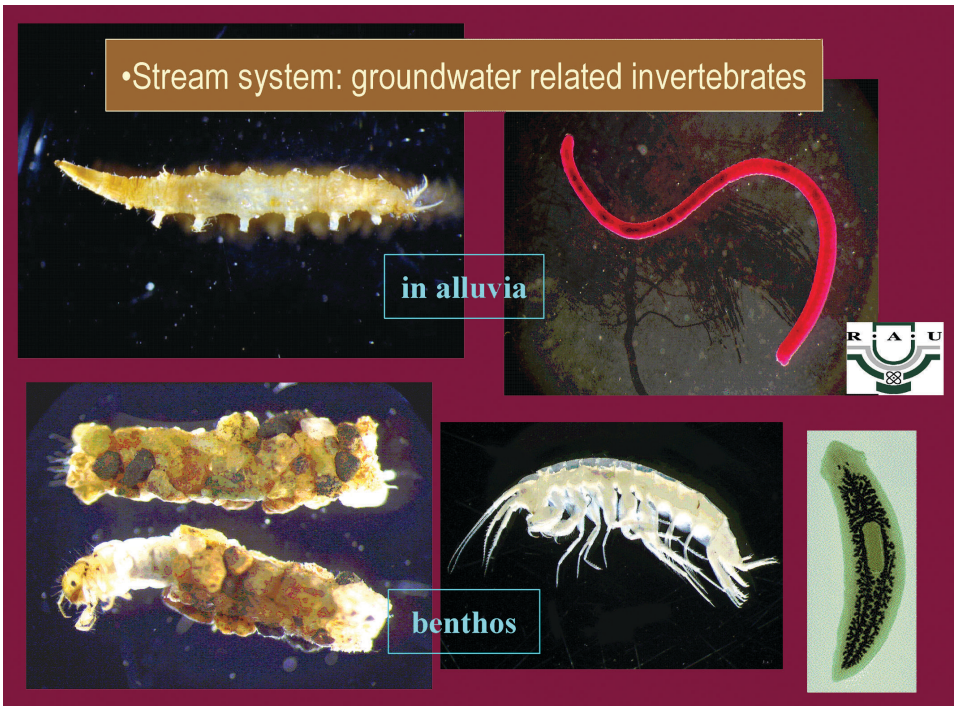
***In bodies of water beneath the surface of the Earth, are living organisms that need to be protected. It has taken dedicated scientific research and state-of-the-art technology to shed light on these organisms. Edith Webster reports.***

*Sayomi Tasaki, a freshwater invertebrate zoologist-research scientist based at the Rand Afrikaans University (RAU) and focusing on groundwater ecology, working with the Water Research Commission and affiliated to the Department of Water Affairs & Forestry, abseils into a cave to investigate groundwater fauna.*

Modern technology has enabled scientists to discover thriving communities of tiny living organisms in groundwater beneath the surface of the Earth, including aquifers in parts of southern Africa. And, as subterranean karst wetlands are defined as groundwater-dependent systems (Ramsar Convention, Iran 1971), these ecosystems should be protected.

*Blind amphipod (a 4 to13 mm stygobite) found in the Koelenhof Cave - Kromdraai Conservancy. Stereodigital Photograph: Sayomi Tasaki. Courtesy: RAU, Department Of Zoology*

Dr Heather MacKay, research manager at the Water Research Commission (WRC), says scientists, already armed with knowledge of the unusual animals in aquatic habitats, are focusing on the small fauna (micro-organisms and invertebrates) living in aquifers. Sometimes these organisms occur in small fractures within rock strata or in the interstitial spaces within shallow, unconsolidated rock just beneath the streambed – the hyporheic zone.




*Pictures of groundwater-related invertebrates found in Gauteng stream systems*

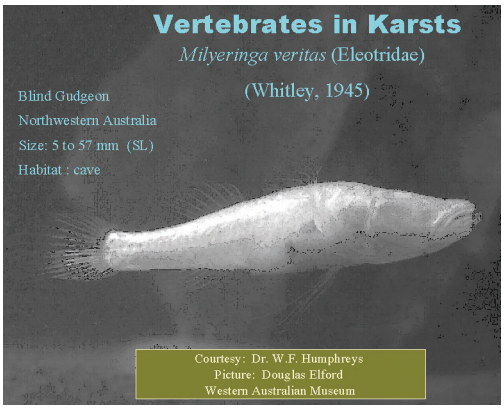
"Amphipods, for instance, are sometimes found when a borehole is drilled. They appear at various depths within the borehole water – there are usually greater concentrations at the bottom of the borehole – having migrated there via fractures or spaces in the rock," she says.

"Drillers have often noted this as a curiosity: occasionally small animals would be found in water brought up from the borehole."

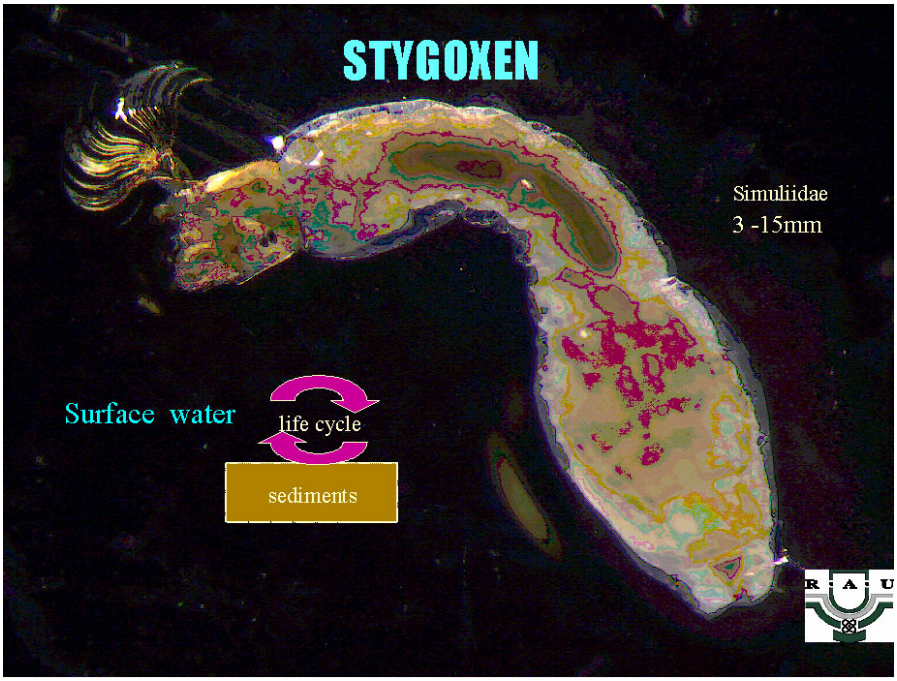
But, as they are living organisms, they are not merely a "curiosity", even though their linkages with and importance to other aquatic and terrestrial ecosystems are not yet well understood at all.

According to Dr MacKay many of these underground aquatic habitats are very sensitive to impacts such as pollution seeping down from the land surface as a result of, for example, agriculture, urban development or over-abstraction of groundwater.

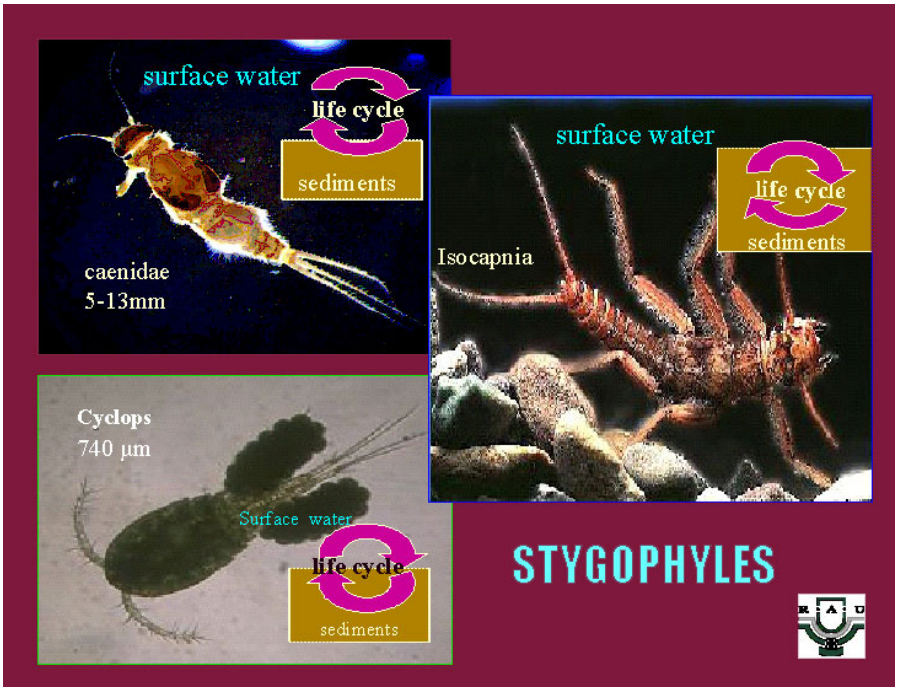
Now, using sophisticated technology, such as a video camera that can be dropped down a




*The Blind Gudgeon found in caves in Northwestern Australia*




*STYGOXEN - a group of animals occurring accidentally in groundwaters*




*STYGOPHILE - a group of animals living within surface water-groundwater interfaces (benthos, alluvia, interstitial)*

borehole, organisms are being closely monitored in underground ecosystems – they simply couldn't be reached before scientists were availed of state-of-the-art equipment.

Sayomi Tasaki, a freshwater invertebrate zoologist-research scientist based at RAU, focusing on groundwater ecology and working with the WRC and the Department of Water Affairs & Forestry, has found various groundwater-related invertebrates (scientifically referred to as stygoxen, stygophyle and stygobite), including the blind *Sternophysinx* amphipod group, in the area around The Cradle of Humankind (the Kromdraai Conservancy region).

The *Sternophysinx calceola*, which does not have eyes, senses movement by detecting sound waves via phonoreceptor appendages on its antennae. It has thus evolved to survive in groundwater habitats devoid of light.

"In South Africa, these eyeless crustaceans can be found in water up to 170 m below ground," says Tasaki.

"These stygobites are aquatic animals totally adapted to live their entire life cycles in absolute darkness, below ground," she explains.

"Because of the fine nature of their evolutionary development, they are extremely well tuned to their environments, becoming a sort of natural indicator of system integrity."

Tasaki says studies of such fauna can, at least, reveal the composition of aquifers and, thereby, provide important information that can guide efforts to protect aquifers from pollution and over-utilisation.

Ongoing studies of stygofauna continue throughout the world. In northwestern Australia, scientists have found blind fish (completely devoid of skin pigment) in the Cape Range and Barrow Island. Some European countries are using meiofauna (minute stygal invertebrates) in their studies of the

hyporheos – the transactional zone, or interstitial waters, between streambed sediments and groundwater.

"Stygal communities actively participate in the food chain; consuming and being consumed; they reproduce, interact and react in accordance to fluctuations in the composition of the system," Tasaki points out.

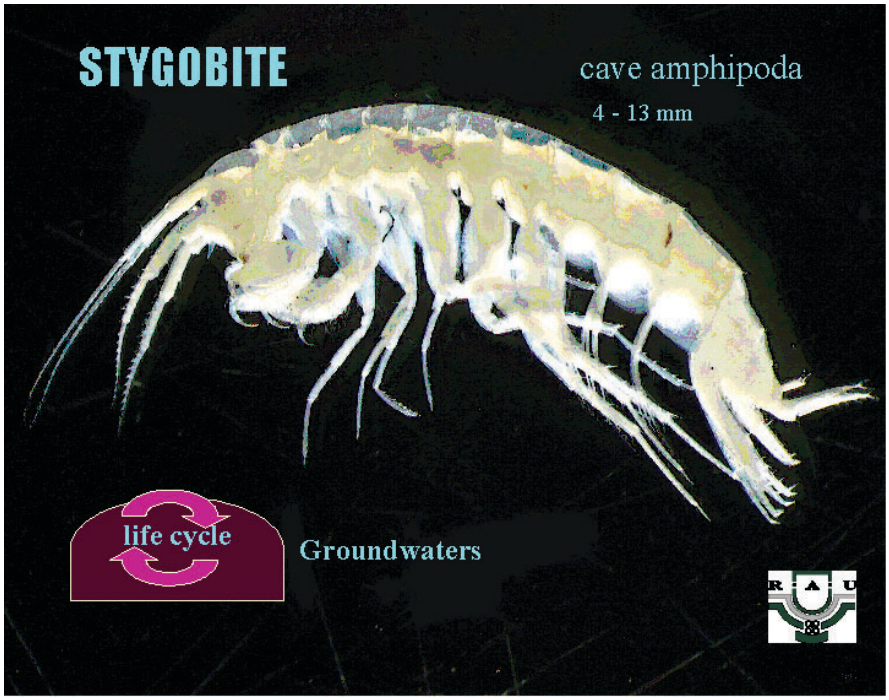
"All subterranean fauna, therefore, deserve consideration as each group has a different role in terms of its interrelationship with the broader environmental system."

Tasaki is studying groundwater-related invertebrates in order to provide a better understanding of catchments and, thereby, make a valuable contribution to water management in South Africa.

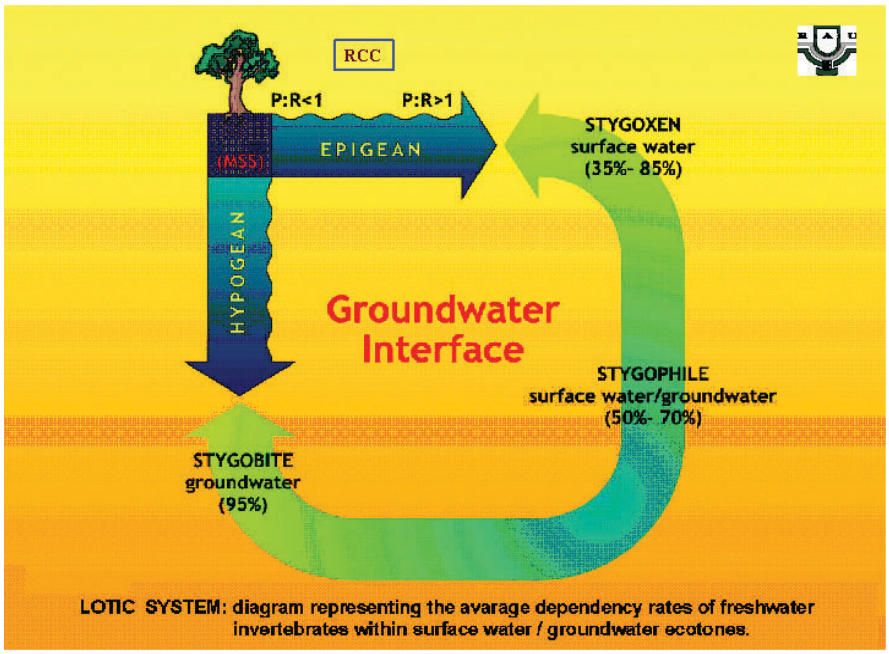
Her research is

- identifying links and pathways for ecological processes between surface water and groundwater systems,
- refining the understanding of these systems in order to support conservation and protection of groundwater-dependent ecosystems,
- potentially providing a water quality assessment model using groundwater invertebrates,
- assessing the quality of groundwater discharge, and
- detecting the occurrence and transmission of organic pollution in aquifers.

For more information, contact Sayomi Tasaki at RAU's Zoology department, (011) 489-2441.




*STYGOBITE - group of animals entirely adapted to live in subterranean aquatic systems*




*LOTIC SYSTEM - representation of fauna classification and average groundwater dependency rates in a lotic system*

**Seterodigital pictures: S. Tasaki**
**Design of slides: H. Hoets and S. Tasaki**
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