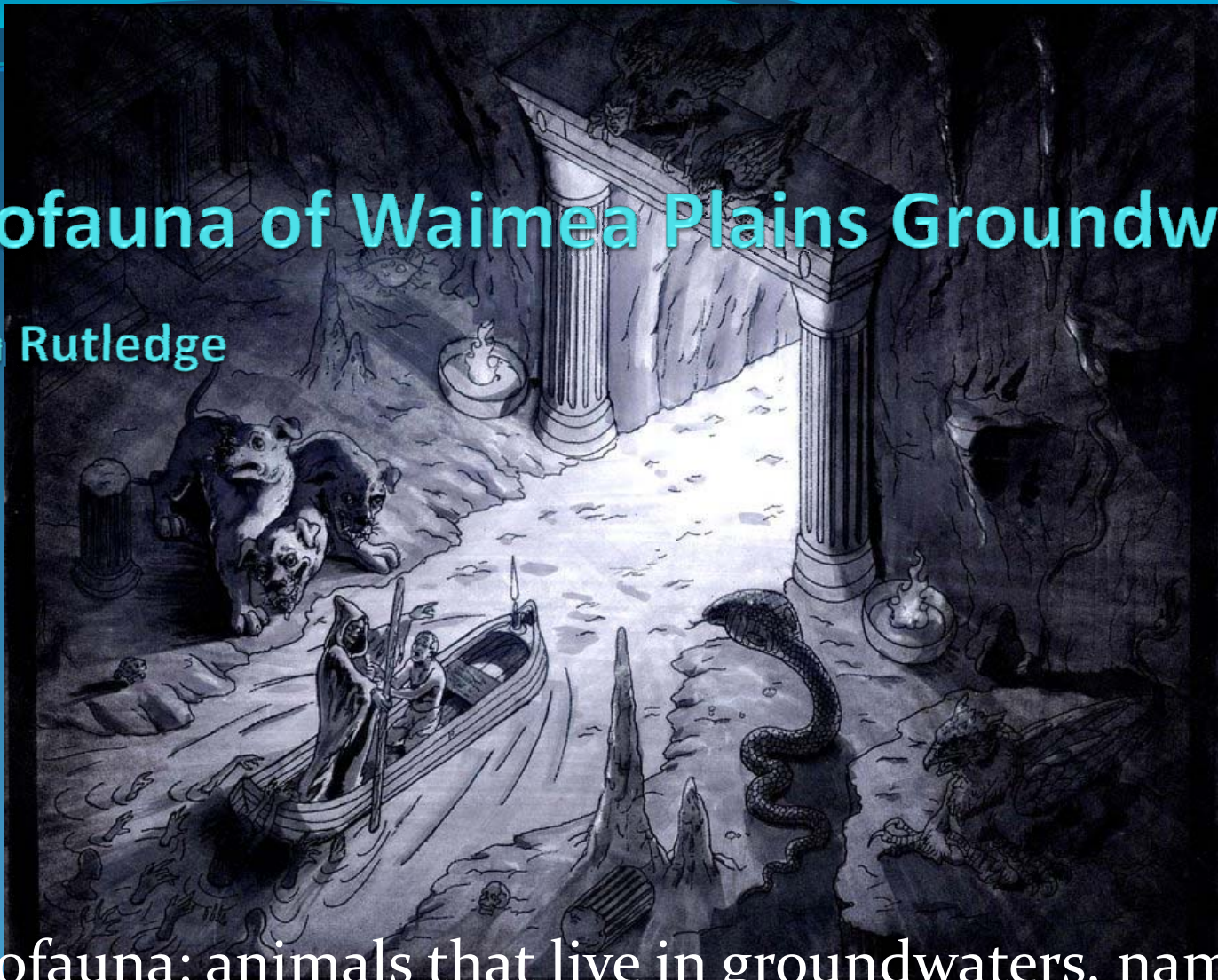


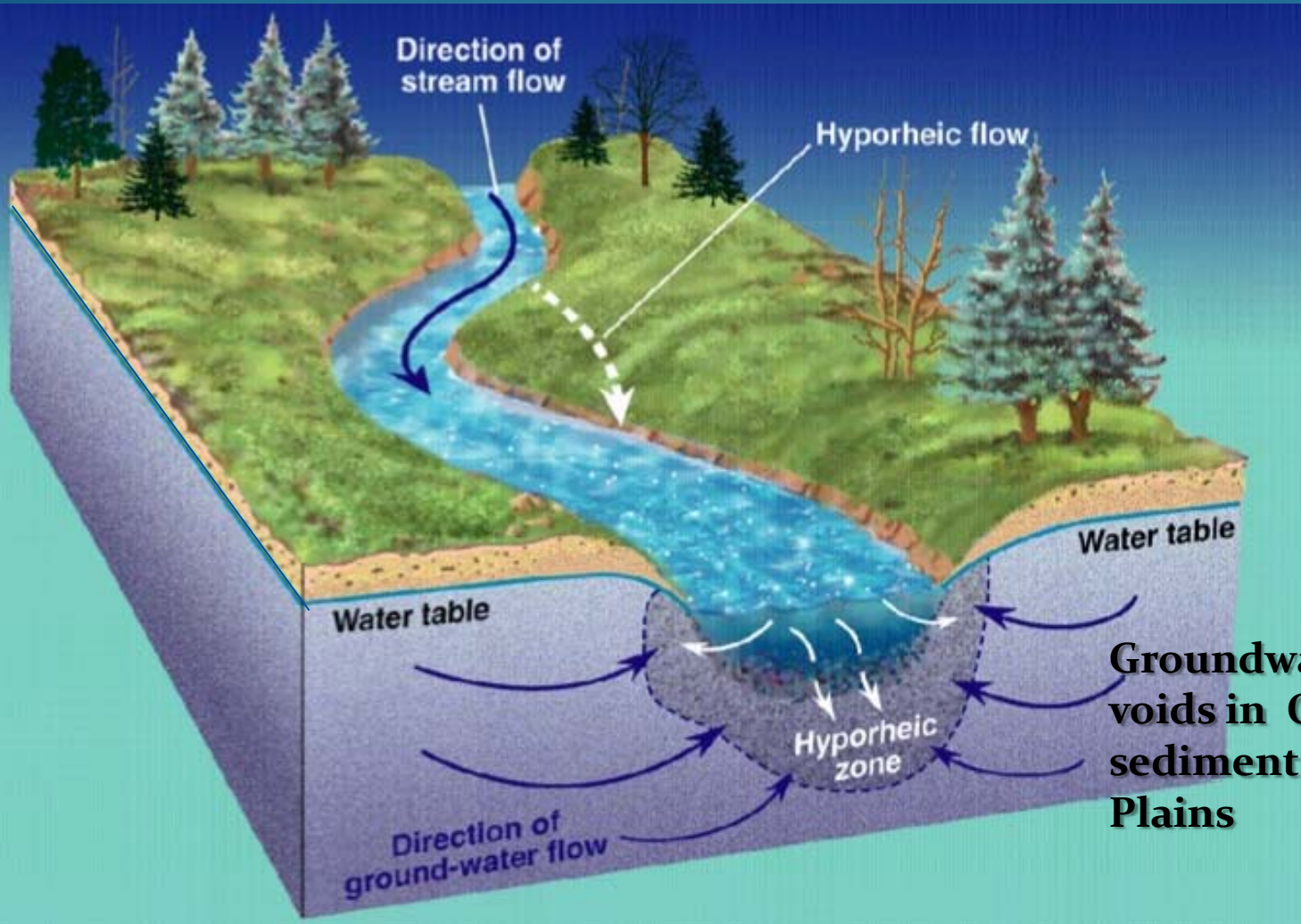
Stygofauna of Waimea Plains Groundwater

Martin Rutledge



Stygofauna: animals that live in groundwaters, named after the river in Greek mythology, the Styx, which separated the Earth from the Underworld and the living from the world of the dead..

Groundwater contains about 90% of earth's liquid freshwater resources so is a huge underground ecosystem – habitat for the Stygofauna



Groundwater occupies the voids in Quaternary sediments of the Waimea Plains

. **stygophiles**-may move in or out of interstitial habitat e.g Olinga



In sedimentary material Stygofauna live in the water filled voids in groundwater between the particles

- Knowledge of the fauna poor – not surprising given its obscurity and difficulty to sample

stygobites- specialised to live entirely in interstitial spaces

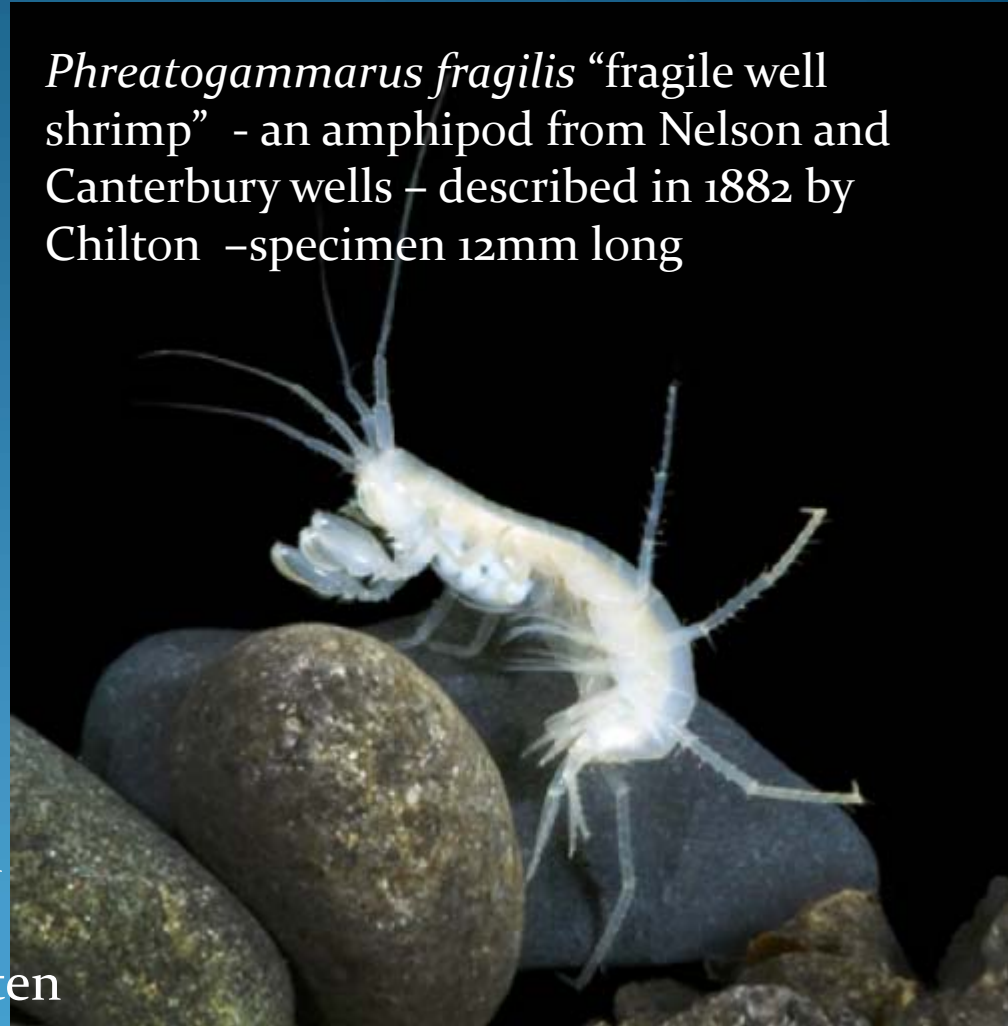


Where groundwater emerges as springs some stygofauna may emerge- Pearl Creek?

Typical features of stygofauna

- Small size-to fit voids
- Unpigmented
- Eyeless
- Elongate appendages- to detect whats happening
- Low metabolic rate
- Often high level of endemism
- Dominated by crustaceans often

Phreatogammarus fragilis “fragile well shrimp” - an amphipod from Nelson and Canterbury wells – described in 1882 by Chilton –specimen 12mm long



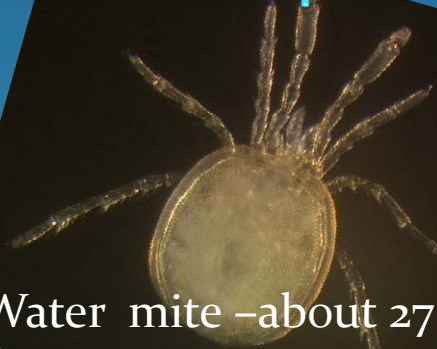
Stygofauna of the Waimea Plains

mostly collected by Kuschel in 1972 in shallow wells near
Brightwater about 4 metres deep - "Livingstones well"

Kuschelita mica
(snail)



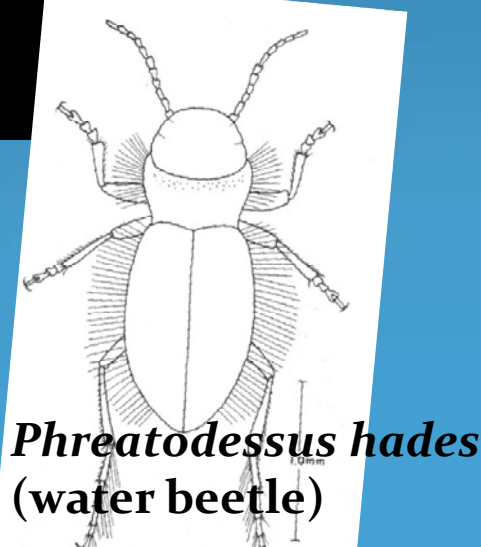
Water mite - about 27
species - many in
family Notoaturinae



Paracrangonyx compactus (amphipoda)



Atopobathynella
(syncarida)



Phreatodessus hades
(water beetle)

Worm



Ostracod

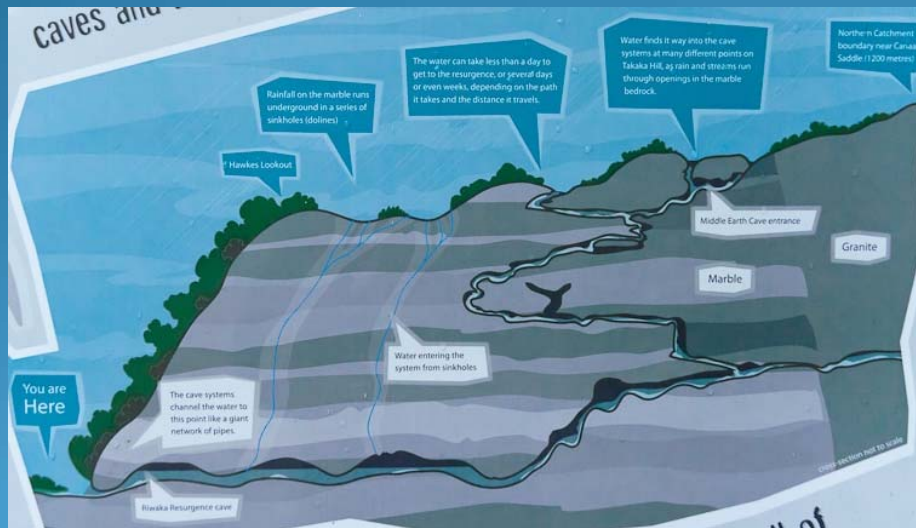
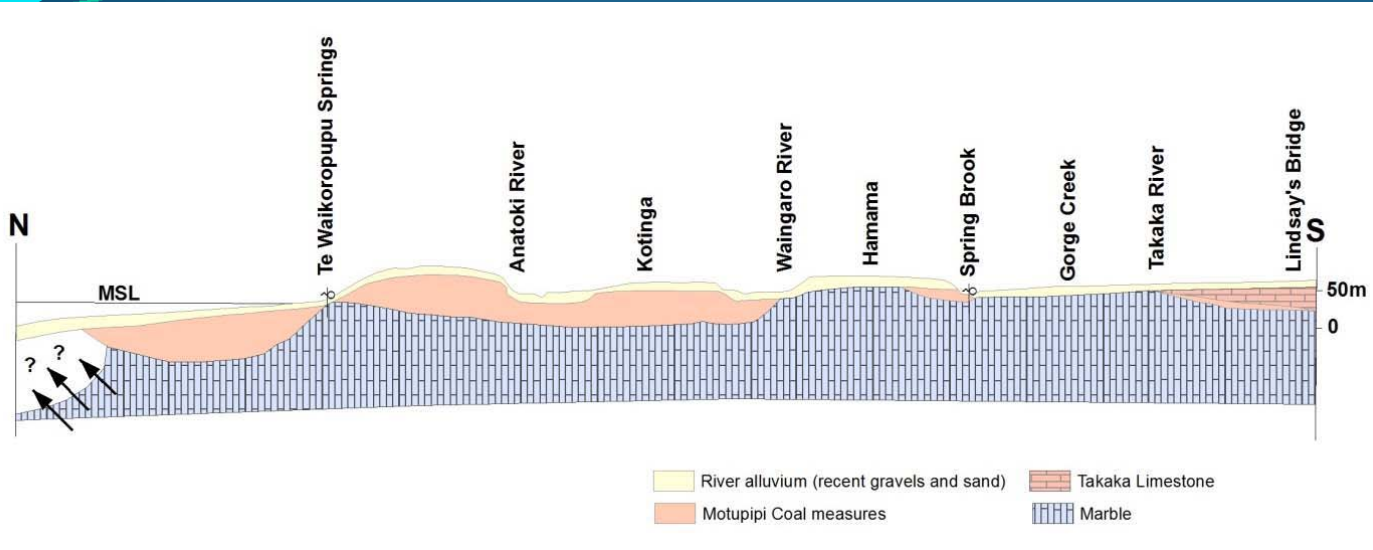


copepod



Many other new
species likely to be
added as Kuschels
samples are
processed worms,
ostracods, copepods
etc

Arthur Marble Aquifer Golden Bay –large and complex mix of linked groundwater –karst and alluvial



Riwaka resurgence-

Where spaces are large enough in groundwater systems larger forms may occur such as fish- none recorded in New Zealand

Recent discoveries by diving expedition of three new endemic species from the Pearse Resurgence



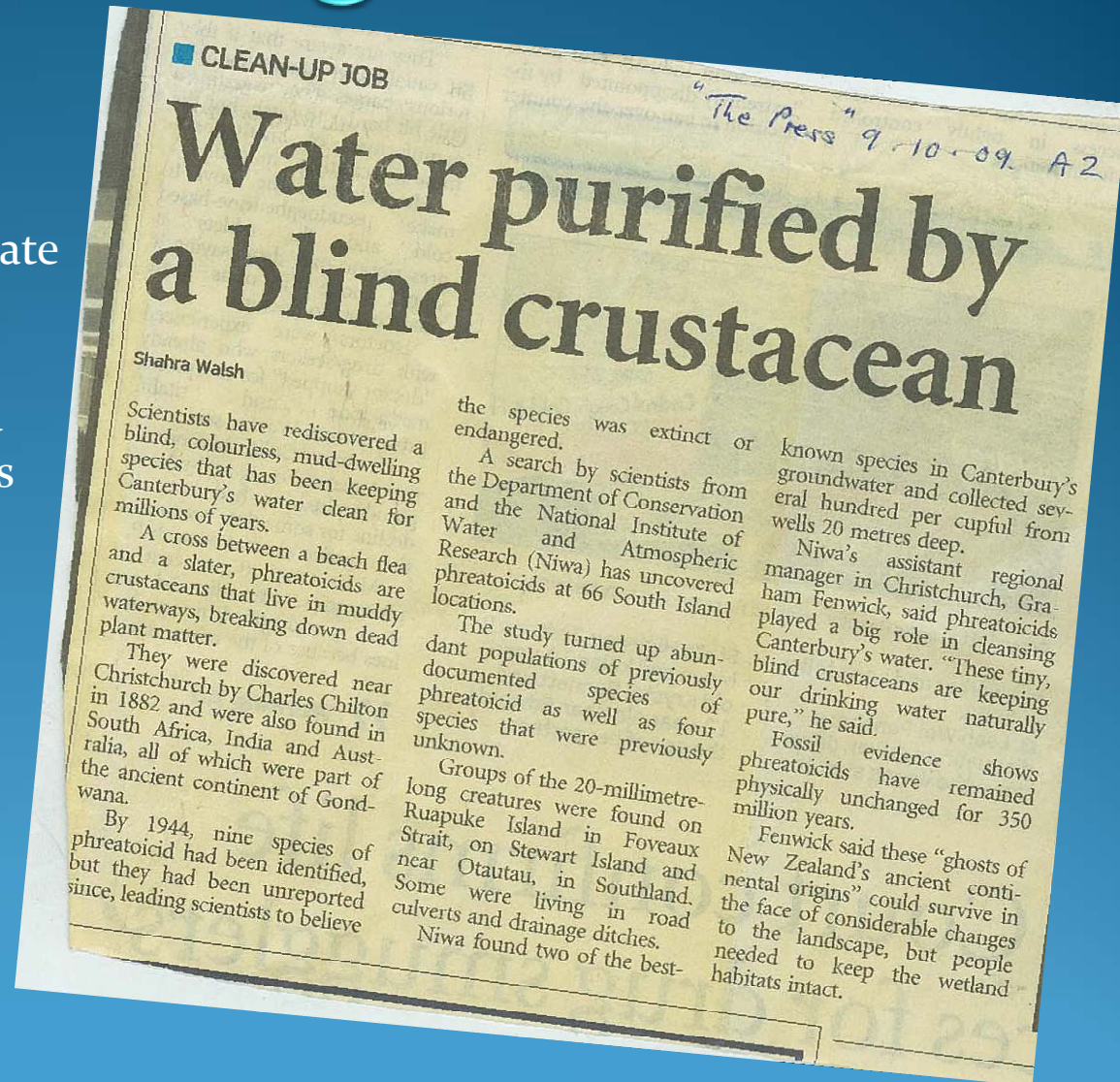
Undescribed *Paraleptamphopus*
from 40 metres depth +
a new worm
a new snail

What is the ecological role of stygofauna?

- percolating dissolved and particulate organic material base of food chain
- These nourish films of bacteria and fungi growing on sediment particles which the stygofauna graze on
- Predators then feed on smaller elements of the fauna

Stygofauna purify the water of organic contaminants

Stygofauna maintain the void spaces in a clean condition to maintain porosity and oxygen circulation to deeper levels



What are the sensitivities of Stygofauna?

- **Water quality changes** : like other freshwater invertebrates Stygofauna are sensitive to contaminants
- Crustacean groups that make up a lot of the fauna are very sensitive to common pollutants -mites, isopods, amphipods, ostracods
- recovery takes a long time- especially the confined aquifers
- Nutrient enrichment by fertilizers, leakage of septic tanks, piggery wastes-elevated nitrate levels for example
- Contamination by toxic substances- pesticides, weedicides, heavy metals in stormwater runoff
- Chronic effects likely as well as acute effects-but poorly studied – Hickey 2013 recommended research to get better understanding on effects-use amphipods as interim indicators
- **Sedimentation**- changes the exchange rate of surface water and oxygen exchange to deeper layers – groundwater and sediment adds nutrients
- **Water abstraction changes**—changed connections between surface and sub surface reduced groundwater levels, saltwater intrusion

• What stygofauna can tell us:

The presence or changes to stygofauna can be used to determine:

- levels of protection of surface water connectivity
- water quality
- the biodiversity, health and function of groundwater dependent ecosystems
- Consider how we might establish a baseline condition for Waimea stygofauna to measure health over time:
 - E.g look at the diversity and abundance of key indicator species at selected wells