

To survive, some freshwater fish breathe air, 'walk' over land

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Environment Correspondent

Freshwater fish give new meaning to the phrase "survival of the fittest", with some developing the ability to breathe air and others to move across land in search of new freshwater bodies.

They might look duller compared with their flashy cousins from the marine realm, but even that is a survival trait – they often take on the colours of their surroundings as this helps them to avoid being eaten by predators above water.

The unique environments they live in have made freshwater fish

develop traits that are less commonly found in marine fish.

South-east Asia, with mountains and valleys where freshwater pools abound, is likely host to many species of freshwater fish that have yet to be discovered, or to fish that have been wrongly identified.

In Singapore, researchers recently clarified the identity of native freshwater fish *Barbodes sellifer* after it was labelled as something else for decades.

Mr Tea Yi-Kai, a fish expert and a PhD candidate at the University of Sydney, said freshwater fish are a very diverse group because of the nature of their habitats.

"Lakes, rivers and streams are often very discontinuous, which

means that fishes are often isolated from one another," he said.

"This is one reason why you find a lot of endemic species, which are species found nowhere else, that are restricted to particular river basins."

But freshwater fish taxonomy (or categorisation) is muddled, which means new species are often hidden under old names, and relationships between freshwater fishes are not as well known.

"The immense diversity complicates things and makes the work difficult, which is why new species are regularly being discovered," said Mr Tea.

Take it from Dr Tan Heok Hui, curator of fish at the National Univer-



Dr Tan Heok Hui recently published papers on four new species of freshwater fish from the region, including a cave barb in the Philippines and riparian loaches from Kalimantan. ST PHOTO: GIN TAY

sity of Singapore's (NUS) Lee Kong Chian Natural History Museum.

Over the past five months, he has published papers detailing four new species of freshwater fish from the region, including a cave barb in the Philippines and riparian loaches from Indonesian Borneo.

"Where there are elevated areas, there will be riparian systems," Dr Tan said, referring to ecosystems found on the banks of a freshwater body, such as a river or stream. "A closer look at such habitats could yield more diversity."

For his doctoral thesis at NUS, which he completed in 2003, Dr Tan had examined a group of freshwater fishes known as suckers that are endemic to Borneo.

"From that work which mainly covered Sarawak, Brunei, Sabah and a small part of Kalimantan, I discovered more than 20 new species," he said. "The coverage was not complete as Kalimantan has not been well surveyed and I expect more new species."

Kalimantan is the Indonesian portion of Borneo, where Sabah, Sarawak and Brunei are located.

Apart from salinity, riparian freshwater ecosystems and the ocean are different in several ways.

Here are some of them, and how freshwater fish have evolved to deal with them:

1 FAST WATER FLOW

Most freshwater bodies have a uni-directional flow of water, with water flowing from upstream to downstream, said Dr Tan.

Sometimes, such as during periods of heavy rain, the water flow can be rapid, with a sudden rise in water depth and murkiness.

Freshwater fishes have developed adaptations to avoid being washed away by the currents.

These include having enlarged pectoral and pelvic fins, which, together with the fish's belly, form an adhesive apparatus along its underside that enables the fish to "suction" itself to the riverbed in

fast-flowing waters.

This can be seen, for example, in *Engkaria eubranchus* – a new genus (or group of species) identified by Dr Tan.

2 LOW-OXYGEN ENVIRONMENTS

Freshwater fish like betta are often found in oxygen-poor stands of water. As a result, they have developed labyrinth organs that act as a pseudo-lung, said Mr Tea.

"Air breathing is a characteristic that is almost exclusive to freshwater fishes," he said.

While some marine fish have structures that are adapted to air breathing, whether they do so is unclear, he added.

3 COLOUR

Many freshwater fish have colours similar to the riverbeds or other habitats they are found in, said Dr Tan.

They are often brown or grey, similar to the colours found in the substrata of many freshwater bodies.

This helps them avoid being eaten by predators above water.

The pale-fleshed barb (*Barbodes pyrrholeos*) that Dr Tan and his Filipino colleague, Dr Daniel Edison Husana, recently discovered in the Philippines was found in a cave, where it is pitch black.

4 DEALING WITH DROUGHT

Drought is a very common problem faced largely by freshwater fishes, said Mr Tea.

"Many rivers and streams are ephemeral," he said. "To overcome this, many freshwater fishes have evolved... and are able to 'walk' across land in search of new freshwater bodies."

Dr Tan said the climbing perch, for instance, has gill covers that allow it to stay on land for short periods. To "walk", the fish extends its gill cover into the ground.

"This enables it to sort of wriggle along," he said.

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The *Engkaria eubranchus* is a genus that has developed an adaptation to avoid being swept away by currents. Enlarged pectoral and pelvic fins, together with its belly, form an adhesive apparatus along its underside that enables it to "suction" itself to the riverbed. PHOTO: TAN HEOK HUI



Freshwater fish like the *Betta ibanorum* (left) are often found in oxygen-poor stands of water. As a result, they have developed labyrinth organs that act as a pseudo-lung, said Mr Tea Yi-Kai, a fish expert and a PhD candidate at the University of Sydney. PHOTO: NUS



The pale-fleshed barb (*Barbodes pyrrholeos*) that Dr Tan Heok Hui and his Filipino colleague, Dr Daniel Edison Husana, recently discovered in the Philippines was found in a cave, where it is pitch black. PHOTO: DANIEL EDISON HUSANA