

'4-eyed' spookfish, first vertebrate to use mirrors for seeing

A startling new discovery has found that the four-eyed spookfish uses mirrors, rather than lenses, to focus light in its eyes.

'In nearly 500 million years of vertebrate evolution, and many thousands of vertebrate species living and dead, this is the only vertebrate discovered that uses mirrors to form image by the eyes,' said Julian Partridge of Bristol University.

This finding is to be published this month in Current Biology.

Spookfish's two eyes, seeming to be four, are split into two connected parts. One half points upwards helping to view the ocean and potential food. The other half points downwards into the abyss below. These 'diverticular' eyes are unique, since unlike other vertebrates, they use mirror to make images.

Like other deep-sea fishes, spookfish also makes the most of the little light that reaches 1,000 metres beneath. The spookfish looks for the bioluminescent light reflected by other animals. Its diverticular eyes catches this light and helps it to get careful of the presence of other active animals which otherwise are unseen.

Discovered 120 years ago, spookfish's reflective eyes were not known until now because a live animal had never been caught.

It was only when Hans-Joachim Wagner, a professor at Tuebingen University caught a live specimen off the Pacific island of Tonga, and his research team used flash photography to confirm the fish's upward and downward gazes.

Photographs taken by Tammy Frank from above the live fish produced eye-shine in the main tubular eyes that point upwards, but not in the diverticular eyes that point downward. Instead, these reflect light when seen from below.

After microscopic analysis of the sections of the eye Professor Partridge realised that the diverticular mirrors were something excitingly new.

The mirror has tiny plates, probably of guanine crystals, arranged into a multi-layer stack. On scanning it was found that the precise orientation of the plates within the mirror's curved surface is perfect for focusing reflected light onto the fish's retina, said a Bristol release.

The use of a single mirror has a distinct advantage over a lens for forming bright, high-contrast images. That provides the advantage of spotting even the dimmest and briefest of lights in the deep sea to the fish and thereby saving it from being eaten.

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