

Eyes came before limbs in the transition to land

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The transition to land from our fishy ancestors is one of the most iconic, and best documented, transitions in the fossil record. We know that fleshy-limbed fish living in shallows used their limbs to move in the shallows and then up onto land, and became tetrapods (4-legged vertebrates) along the way. What has been less well-studied is the transition to vision in air that also occurred during that evolutionary event. Vision in air is different, and in some ways easier, than seeing in water. According to a new study by Malcolm MacIver of Northwestern University and Lars Schmitz of the Claremont Colleges, early tetrapod ancestors may have been seeing like land-based animals before they were moving like them.

Said Schmitz, "We were surprised to find that large eyes evolved in aquatic tetrapods, preceding the evolution of complete limbs and terrestriality." The eyes moved to the top of the head and nearly tripled in size, millions of years before the animals were fully terrestrial, and would have allowed them to hunt in a new way.

MacIver and Schmitz measured the eye sockets of over 50 fossil taxa near that transition to land as part of the study. The larger eyes at the top of the head and above the water line would have allowed for a far greater visual range, allowing them a greater diversity of behavior.

Invertebrates—insects and other arthropods—had already moved on land, and would have been a rich source of prey. "With eyes above the water surface, fish were able to spot a cornucopia of unexploited invertebrate food on land from distances much further than aquatic

prey," said MacIver.

Eyes are metabolically costly, so their increase in size must have been accompanied by a significant adaptive advantage, and this study is the first to provide a scenario for their evolution. "Animals like Tiktaalik (an early tetrapod) have their eyes on the top of their heads, suggesting that they may have hunted like modern crocodiles: swimming calmly near the surface, the head slightly raised, with eyes above the water, trying to detect prey across the water or even on land," said Schmitz.

Provided by Society of Vertebrate Paleontology

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