INSIDE JEB

# Dinosaur eels build up their fin bones for life on land

A dinosaur eel (*Polypterus senegalus*) walking. Photo credit: Antoine Morin.

The name ‘dinosaur eel’ – otherwise known as *Polypterus senegalus* – sounds impressive, but these fish are not actually dinosaurs or eels, although they are genuinely extraordinary. Equipped with a pair of lungs in addition to gills, tough armour-plated scales and a stegosaurus-like dorsal fin, dinosaur eels look rather prehistoric propelling themselves slowly through water with their front fins. And the exotic creature’s idiosyncrasies don’t end there. ‘*Polypterus* can survive on land for long periods and use their front pectoral fins to move around’, says Trina Du from the University of Ottawa, Canada; which makes them extremely intriguing for scientists wanting to understand how the first animals dragged themselves out of the primordial swamp onto land. ‘Water and land are drastically different environments requiring different strategies for animals to breathe, eat and move’, says Du. As dinosaur eels still face many of the challenges that the first land pioneers must have encountered, Trina Du and Emily Standen, also from the University of Ottawa, decided to investigate how the pectoral fins of dinosaur eels stand up to the forces of gravity when they resettle on land.

After purchasing some of the fascinating creatures from a local pet supplier, the duo placed one group in a tank while the rest got to try out their land fins under two different scenarios. In one situation, the fish were provided with a small dry area, so they could clamber out of the water when they wished, in addition to being encouraged once a day to propel themselves with their fins 30 cm along a smooth surface to return to the water. In the other, the fish were provided with a gravel surface in a shallow pool (3 mm) of water, and spent 5 weeks carrying their weight on their fins. Then, Du and Standen took a close look at the effect that gravity had on the bones in the fish’s fins.

Comparing the fish that had spent 5 weeks residing on gravel with the fish that had no access to land, the duo could see that the front fin bone (the propterygium, which attaches to the shoulder) of the landlocked fish was longer and stronger than that of fish that never left the water. This bone-strengthening response was also a reversal of that of birds and mammals – which strengthen bone by exercising – although the duo suspects that this difference could be down to the distinctive structures of fish and mammal bones. In addition, two of the bones (metapterygia and propterygia) were thicker after the fish lived out of water and the fine bones that fan out the fin (medial radials) had also grown longer.

However, practising a 30 cm stroll each day had a different effect on the fins from 5 weeks of standing out of the water. The fish that took daily exercise only built up the medial radial fin bones, making them longer and stronger. ‘This localised response may be due to the position of the pectoral fins contacting the ground while walking’, says Standen, describing how the fin splays out as the fish presses down to propel itself forward.

Dinosaur eels are able to build up their fin bones when they move from a weightless existence to life on land, although taking exercise has a different effect from simply standing around. And Du and Standen suspect that this adaptability could have been a key factor in the success of the first explorers that dragged themselves out onto the shore 380 million years ago.

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**Du, T. Y. and Standen, E. M.** (2020). Terrestrial acclimation and exercise lead to bone functional response in *Polypterus senegalus* pectoral fins. *J. Exp. Biol.* **223**, jeb217554. doi:10.1242/jeb.217554

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