Sea snakes can sense objects at a distance by feeling movements in the water

June 8 2016, by Robyn Mills

The head of a Beaked sea snake (Hydrophis schistosus) and a close up of a single scale on head. Credit: Jenna Crowe-Riddell

The move from life on land to life in the sea has led to the evolution of a new sense for sea snakes, a University of Adelaide-led study suggests.

The international team, led by researchers in the University's School of Biological Sciences, studied tiny and poorly understood structures on the heads of snakes called 'scale sensilla'. The research has been published in the Royal Society journal *Open Biology*.

"Land snakes and many lizards have small raised structures on the scales on their heads – called scale sensilla – that they use to sense objects by direct touch," says lead author Jenna Crowe-Riddell, University of Adelaide PhD student.

"We found that the scale sensilla of sea snakes were much more dome-shaped than the sensilla of land snakes, with the organs protruded further from the animals' scales, potentially making them more likely to be able to sense vibrations from all directions. We also found that scale sensilla on some of the fully aquatic snakes covered a much higher proportion of the scales' surface.

"We believe sea snakes use these organs to sense objects at a distance by 'feeling' movements in the water. This hydrodynamic sense is not an option for land animals. In water, a new way of sensing the environment becomes possible."

Lead author Jenna Crowe-Riddell observes a juvenile Stokes sea snake (Hydrophis stokesii). Credit: Ruchira Somaweera

Sea snakes evolved from land-living snakes, taking to life in the sea between 9 and 20 million years ago. They spend the majority of their lives at sea: hunting fish, swimming and diving using a paddle-shaped tail, and coming up to the water's surface to breathe air. Although they can also see, little is known about the underwater sensory perception of the snakes.

"Every movement of a fin or flipper generates vibrations underwater, like when you drop a stone into a pond and the surrounding ripples spread to every corner of the pond," says Ms Crowe-Riddell.

The researchers, including from the University of Witwatersrand in South Africa and from the University of Western Australia, looked at 19 species of snakes, including fully-aquatic, semi-aquatic and land species, and measured the coverage of sensilla over single scales on their heads.

They used DNA sequencing to reconstruct the evolutionary relationships between the snakes; and used microscope imaging and specially developed software to automatically detect the small organs from silicone casts of snake heads. They also examined the shape of the sensilla using scanning electron microscopy.

An olive sea snake (Aipysurus laevis) dives after taking a breath at the water's surface. Credit: Chris Malam

"What we now need to do", says lead scientist Dr Kate Sanders, "is to investigate the physiology of these scale sensilla and demonstrate exactly what they can sense. If they are hydrodynamic tactile sense organs, as we suspect, then by comparing them to the scale sensilla of closely related land-snakes we can start to understand how evolution has changed these organs from direct-touch sensors to distance vibration-sensors that work underwater."

The researchers believe being able to sense vibrations underwater would

mean potential impacts on sea snake populations from man-derived disturbances such as motor boats and seismic surveys.

More information: The evolution of scale sensilla in the transition from land to sea in elapid snakes DOI: 10.1098/rsob.160054

Provided by University of Adelaide