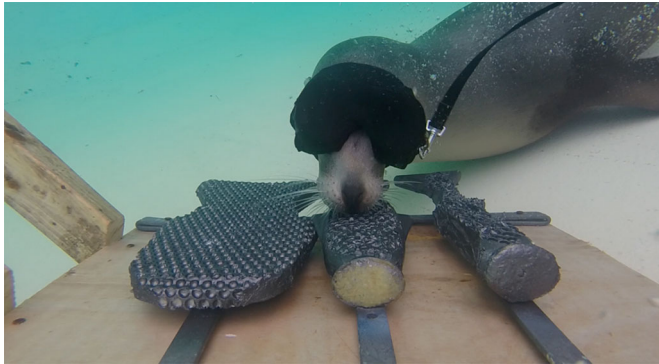


INSIDE JEB

Sea lions switch whisker manoeuvres to sense tactile differences



Lo the sea lion, wearing a quick-release blindfold, investigating fish models of different widths with her tactile whiskers. Photo credit: Alyx Milne.

Alyx Milne really is living her dream. ‘I always wanted to be a marine mammal trainer after my Gran and Grandpa took us to Sea World, USA’, says Milne from Manchester Metropolitan University, UK. Since then, she has spent much of her career working with marine mammals in zoos and aquariums in the UK. ‘Working with sea lions is incredible, but challenging. They all have their own personalities’, she chuckles. But Milne, Llwyd Orton, Matthew Sullivan and Robyn Grant (also from Manchester Metropolitan University) were curious to learn more about how Californian sea lions (*Zalophus californianus*) explore their surroundings with their incredibly tactile whiskers. ‘Scientists in the 70s and 80s found that seal and sea lion whiskers are 10 times more sensitive than whiskers of mammals that live on land’, Milne explains. Would the sea lions sweep their whiskers across objects in specific ways when investigating them, like humans and sea otters stroking and manipulating objects with their fingertips and paws? Intrigued, Milne trained four blindfolded sea lions at Blackpool Zoo, UK, to distinguish a submerged 14 cm wide

fish-shaped model by whisker-touch alone.

Having taught the animals to rest their noses on the fish shape and retract their whiskers along their snouts when they recognised it, Milne, and Charlotte Black and Gary Jones (from Blackpool Zoo), then tested whether the sea lions could distinguish the 14 cm wide fish from a wider and thinner version using their whiskers alone. Impressively, the sea lions were able to pick out the medium-sized fish quickly, by sweeping their whiskers around the edges of the shapes. However, as the tests proceeded, two of the sea lions transferred to another zoo and the third, Rubi, gave birth to her first pup, leaving Lo to continue alone.

Fortunately, though, Lo tuned out to be a star pupil. ‘She used to get all excited and vocal when she knew she was going to do research training’, Milne smiles, recalling how the sea lion was incredibly precise, selecting the correct fish almost 100% of the time, even when her boisterous pup Lolita accompanied her. And when Milne, Black and Jones trained Lo to

select a fish covered in bumps from a smooth fish and another covered in dimples, they realised that the sea lion was using a different strategy to explore the textured fish. This time, Lo positioned her head toward the centre of the fish and swept her whiskers across the different surfaces before resting her nose on the bumpy surface to earn her fish reward.

‘Watching Lo move differently for each task was amazing’, says Milne, adding that the sea lion spent just 0.3 s exploring the textured fish with her whiskers in contrast to the 1 s long sweeps of the head she made when investigating the widest fish; blind-folded humans take more than a minute to distinguish objects by touch. And, when Milne tracked how Lo manoeuvred her whiskers as she explored the different objects, she found the sea lion flexed her whiskers by 47 deg when sweeping the different width fish shapes, but only twitched her whiskers by 34 deg while investigating the textures.

‘Sea lions do active touch sensing’, says Milne, adding, ‘The ability to switch whisker exploration strategies between tactile tasks enabled Lo to not only complete the tasks efficiently but also do so with great success’. And Milne is keen to discover whether other members of the seal and sea lion family adapt their whisker manoeuvres to different tasks to be as tactile as Lo and the other Blackpool sea lions.

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