

## INSIDE JEB

# Decisive sea otters distinguish differences by touch



Selka the sea otter eating a sea urchin. Photo credit: Ari Friedlander (permit no. USFWS MA186914-2).

When dinner is encased in a robust shell, brute force is often the only solution, but sea otters (*Enhydra lutris*) have been more ingenious. Some pound clams and snails on a rock balanced on their chests, while others skilfully crack open shells to satisfy their voracious appetites. Describing sea otters as eating machines, Sarah McKay Strobel from the University of California Santa Cruz (UCSC), USA, explains that they devour 25% of their own body weight each day just to remain warm. Yet little was known about their hunting tactics because the shy mammals stop seeking food when human divers are near. Suspecting that the enigmatic animals do not rely on smell or vision to locate dinner in the cloudy Monterey Bay waters, Strobel and PI Colleen Reichmuth wondered whether the dextrous creatures might depend instead on the sensitivity of their whiskers and paws to hunt by touch.

‘Sea otters can sometimes be viewed as the “problem child” when it comes to training’, says Strobel, recalling the months of effort that went into preparing a wild sea otter named Selka at the Long Marine Laboratory at UCSC for her starring role. Working with a large

team of volunteer helpers, Strobel, Reichmuth and Jillian Sills trained Selka to approach a cabinet perched on the side of her pool, in which they concealed a pair of side-by-side vertically ridged boards: one with 2 mm wide grooves and another with 5 mm wide grooves. Inserting her paw through a narrow slot into the cabinet, Selka touched both and Strobel rewarded her whenever she pressed hard on the 2 mm board to produce a ‘click’, indicating that she had identified the correct one. Once Selka had mastered the first comparison, the team trained her to identify the 2 mm grooves when offered a choice between it and a 4 mm grid, before completing seven more comparisons. They also taught the sea otter to interrogate the grids with her whiskers, although Strobel admits that training her to wear a blindfold while nuzzling the boards was tricky. ‘I knew that if I tried to do anything Selka wasn’t ready for, I would very likely get bit ... I had to make wearing the blindfold fun’, Strobel smiles. Having completed the training process in the air, the team then raised the water level in Selka’s pool to inundate the cabinet and trained her to differentiate between the submerged grids.

After months of dedicated patience, the team tested Selka’s ability to distinguish the 2 mm grooved board from boards with grooves ranging from 2.1 to 3 mm wide. Tapping the pairs of boards with her paw, Selka seemed to recognise the 2 mm wide grooves almost instantly if she encountered them first, depressing it swiftly to make a click, but moved on quickly to the second board if the grooves were the wrong width. Strobel admits that she was amazed by Selka’s decisiveness – taking less than 0.2 s when using her paw and 0.4 s when exploring with her whiskers – in contrast to the human volunteers, which explored the boards with their fingertips and were 30 times slower. And it made no difference to Selka whether the boards were submerged or in the air. Tim Tinker also used a novel method to compare the change in Selka’s accuracy as the difference between the grooves became narrower, and found that she could distinguish grooves that were 0.28 mm wider than the 2 mm groove with her paw, although her accuracy declined slightly when using her whiskers (0.48 mm wider than the 2 mm grooves).

‘Selka used her memory to solve the trial as quickly as possible’, says Strobel, who suspects that sea otters’ ability to make rapid decisions based on touch is essential for their survival. ‘Their dives tend to be 1–2 minutes or shorter, which means they have to be very efficient’, she says, adding ‘our results ... suggest that sea otters are capable of using touch in this short amount of time to detect prey’.

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**Strobel, S. M., Sills, J. M., Tinker, M. T. and Reichmuth, C. J.** (2018). Active touch in sea otters: in-air and underwater texture discrimination thresholds and behavioral strategies for paws and vibrissae. *J. Exp. Biol.* **220**, jeb181347.

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