A behavioral assessment of active touch in sea otters: paw and whisker texture discrimination in air and under water

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The establishment of healthy predator populations can be essential for balanced ecosystem functioning. Through natural dispersal patterns and facilitated reintroductions, sea otters (*Enhydra lutris*) are expanding along the coastline of western North America into nearshore habitat unoccupied by this top predator for the past 200 years. Sea otters consume a variety of cryptic benthic invertebrates and can have large-scale effects on community structure due to their trophic position and high daily metabolic demands. However, the proximate mechanisms (*i.e.*, sensory and cognitive abilities) that enable sea otters to identify and select potential prey items are virtually unknown. While their fine-scale underwater behavior has not been documented, sea otters are assumed to rely on an enhanced sense of touch to forage. To explore this possibility, we used behavioral psychophysical methods to investigate sea otter tactile abilities in air and under water for both paws and whiskers. We used a two-alternative choice procedure to measure the ability of a trained sea otter to discriminate between pairs of stimuli that differed in texture. For each tactile structure in each medium, we measured the subject's discrimination threshold, corresponding decision time, and behavioral strategy. Our subject maintained similar sensitivity in air and under water, and the sensitivities of both tactile structures were comparable to those of other tactile specialists. However, the subject's paw discrimination threshold was lower than her whisker discrimination threshold, indicating that paws are the more sensitive tactile structures in sea otters. The results from these controlled experiments support that sea otters have sensitive and quick active touch with their paws and whiskers, which corresponds to our observations of their surface behavior. This research informs our interpretation of underwater foraging behavior, providing a basis to understand how sea otters may use active touch to efficiently detect, discriminate, and manipulate hard-shelled invertebrate prey.