

## **Structural enrichment and enclosure use in an opportunistic carnivore: the red fox (*Vulpes vulpes*)**

C Kistler<sup>\*†</sup>, D Hegglin<sup>‡</sup>, H Würbel<sup>§</sup> and B König<sup>†</sup>

<sup>†</sup> Institute of Evolutionary Biology and Environmental Studies, University of Zürich, Winterthurerstrasse 190, CH 8057 Zürich, Switzerland

<sup>‡</sup> SWILD, Urban Ecology & Wildlife Research, Wuhrstrasse 12, CH 8003 Zürich, Switzerland

<sup>§</sup> Division of Animal Welfare and Ethology, Clinical Veterinary Sciences, University of Giessen, D 35392 Giessen, Germany

\* Contact for correspondence and requests for reprints: claudia.kistler@ieu.uzh.ch

### **Abstract**

An increasing number of zoos keep their animals in natural-looking enclosures, but it is often unclear whether or not the species' behavioural and ecological needs are being adequately met. For species that suffer predation in the wild, structural enrichment in captivity can play a crucial role in connection with enclosure use. Firstly, we examined the effectiveness of structural enrichment in modifying enclosure use in an opportunistic carnivore, the red fox (*Vulpes vulpes*). In a test enclosure, we placed both long wooden and cover structures that simulated natural habitat in predetermined sectors. A group of four foxes were exposed to four treatments: (i) structural enrichment in location 1 (LOC1s); (ii) structural enrichment in location 2 (LOC2); (iii) structural enrichment removed (REM) and; (iv) structural enrichment again in location 1 (LOC1e). Sectors containing long wooden structures were preferred significantly compared the rest of the enclosure. Sector use was selectively shifted to those in which cover structures were present. Structural enrichment had no significant effect on activity. Secondly, in a new outdoor enclosure, we compared the use of sectors with cover or elongated structures with that of corresponding sectors without structures. All individuals showed a significant preference for sectors containing structures. In the course of the three-week observation period, there was a significant decline in preference for structures and a significant increase in activity (week 1 < week 2 = week 3). These results suggest that in medium-sized carnivores, structural enrichment is beneficial when natural features with a net-like distribution over the habitat are simulated.

**Keywords:** animal welfare, environmental enrichment, red fox, structural preference, *Vulpes vulpes*, zoo