

Evidence-based practice

When a habitat becomes a home: Housing and husbandry of spotted hyenas *Crocuta crocuta* at Disney's Animal Kingdom®

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Abstract

When animals are moved between facilities, as is commonly done in zoos, it may take them time to acclimate to their new surroundings. One way that zoos can increase animals' comfort in their new habitat is through training and enrichment programmes. In 2014, Disney's Animal Kingdom® received two spotted hyenas *Crocuta crocuta* that had not been previously housed in a zoo environment. To acclimate the hyenas to zoo life, a training and enrichment programme was designed, implemented and evaluated. During this time, formal behavioural observations were conducted on the frequency of behaviours such as resting, traveling, pacing and feeding. From these data, behavioural time-budgets were created to track changes in the frequency of behaviours over time. The study found that the hyenas spent the majority of their day resting, followed by traveling, and overall, revealed a decrease in pacing throughout the data collection period. From these observations and experiences with the training and enrichment programmes, it is recommended that facilities housing hyenas be prepared to evaluate their programmes often, as the hyenas were found to be capable and fast learners, benefitting from a routine and feeding strategies that included different types of food in varying presentation formats.

Background

When does a habitat become a home? When zoo animals are moved between facilities, as is common practice in cooperatively managed breeding programmes (e.g., Species Survival Plans®), zoos make special efforts to ensure animals are comfortable in their new habitat. Such was the case when Disney's Animal Kingdom® (DAK) acquired two spotted hyenas *Crocuta crocuta* from a now-closed hyena research colony (Pedersen et al. 1990; Orenstein 2014). Established in 1985, this colony was used to study a variety of topics including reproduction and behaviour (Pedersen et al. 1990; Dloniak et al. 2004; Orenstein

2014). The colony was closed to the public and consequently, the hyenas were unfamiliar with common aspects of being zoo-housed, such as the presence of other animal species, being consistently visible to the public, and participating in a formal behavioural husbandry programme. Additionally, the hyenas' previous living conditions involved significant interaction with care staff resulting in the hyenas being people-oriented, which altered their behaviour from typical zoo-housed hyenas. This unique history of management provided a novel opportunity to train and enrich adult animals that had never been housed at a zoo, with the additional challenge of having to do so using a hands-off approach.

When preparing to house and care for hyenas, it is important to consider multiple aspects of their natural history, including social structure, cognition and ecology. Clans of hyenas are comprised of a mix of related and unrelated individuals (Holekamp et al. 2012). Their cognitive capabilities include being able to solve puzzles through trial and error (Kubina 2014) and social learning (Benson-Amram et al. 2014). As carnivores, spotted hyenas are active, hunt at night (Holekamp et al. 1997), and show no preference for any specific prey (Hayward 2006). Their primarily nocturnal nature (Calderone et al. 2003) made hyenas ideal to house in a newly designed habitat for the night time experience of DAK's Kilimanjaro Safaris, a large African savannah-themed exhibit that guests experience from an open-air safari vehicle. The hyenas are viewable from approximately sunset until the close of operations.

To acclimate the hyenas to their new habitat, animal staff and the behavioural husbandry team developed training and enrichment goals using the S.P.I.D.E.R. framework (Mellen and MacPhee 2001) to set goals, plan, implement, document, evaluate and readjust methods and approaches. Behavioural goals were based on the natural and individual history of the hyenas. In addition, the science and husbandry teams partnered to initiate behavioural observation methods to evaluate hyena behaviour as they transitioned to their new management and shifting routine. This paper reviews the housing, husbandry and acclimation of two spotted hyenas from arrival in 2014 through their first 2 years at DAK.

Action

Housing and husbandry

The two hyenas, Scooter (female) and Zawadi (male), arrived on 20 September 2014 and were housed in a holding enclosure while construction was completed on their permanent habitat (Figure 1). This new enclosure was designed as a rotational exhibit to be occupied by a pack of six African painted dogs *Lycaon pictus* during the day and the hyenas in the evening for the safari night experience. The hyenas were moved to the indoor part of their permanent enclosure on 28 October 2015 and introduced to the outdoor part on 4 November 2015, allowing time for acclimation and training before the night safari experience began in May 2016.

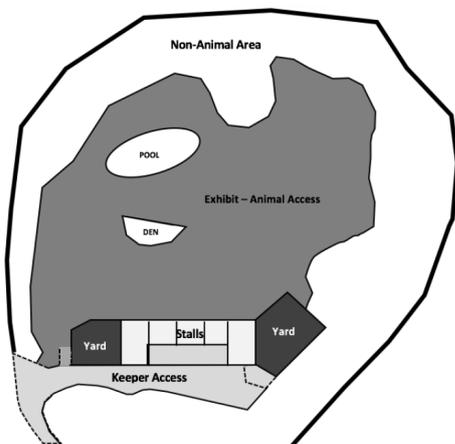


Figure 1. Map of hyena and painted dog enclosure. Note: Not to scale.

Acclimation through training and enrichment

Upon the hyenas' arrival at DAK, a specialised training programme was designed and implemented to support their acclimation to zoo life (Laule 2003). Initially, the goal was to train the hyenas foundational behaviours, such as body positions (sit, stand, lay down), touch a target, enter a crate, and shift between yard, stall and exhibit spaces. Considered factors were husbandry (e.g., needing the hyenas to come indoors easily), health (e.g., training them to present different body parts for inspection), nutrition (e.g., having hyenas stand on a scale to obtain weights), and guest experience (e.g., getting them comfortable being on exhibit).

The hyenas were trained using positive reinforcement techniques using a whistle as the bridge; primary reinforcers included foods from their diet such as chicken, pork and flank steak. After moving to their permanent enclosure in October 2015, the hyenas learned to shift into and out of the exhibit area on cue. To support acclimation to their new exhibit (including visual access to other species, guests and safari ride vehicles), keepers reinforced the hyenas for entering, exploring and gradually spending longer periods of time on exhibit in the presence of guests and safari ride vehicles. During the training process and the initial launch of the safari night experience in Spring 2016, husbandry staff also worked with safari ride operators to ensure that novel stimuli, such as vehicles, guest presence, stopping vehicles near the exhibit, and presence of guest and driver voices were added slowly while the hyenas were on exhibit. In August 2016, an exit cue was introduced to put the behaviour of entering the exhibit under stimulus control. This was phased out by February 2017 as both hyenas were successfully shifting from the holding area onto exhibit. Overall, the experience revealed that the hyenas learned quickly, which is unsurprising given this species has been shown to be capable problem-solvers (Kubina 2014). Thus, when designing hyena training programmes founded on natural and individual history, their robust cognitive abilities and experience with training must be considered (Mellen and MacPhee 2001).

An enrichment programme was also developed to promote expression of goal behaviours, specifically activity, locomotion, exploration, self-maintenance and foraging. Natural behaviours were encouraged through design elements (e.g., grass, dirt and rockwork areas for locomotion, exploration and rest) and enclosure features (e.g., a pool to cool down and hide bones and a den for shelter). In addition, hyenas were encouraged to utilise areas of the enclosure through a variety of enrichment initiatives, including presenting various scents and substrates, plants, browse and additional tubs and pools. Food was offered in a variety of formats based on their natural history and the following feeding strategies were found to be beneficial: dispersed from automatic feeders hung from a tree, whole items hidden in exhibit spaces and submerged in water or frozen in ice.

During the acclimation phase, informal observations were performed of the hyenas shifting between holding and exhibit to track training progress for this behaviour. Video monitoring was used for these observations due to the difficulty of observing the hyenas while on exhibit. Additionally, hyenas were monitored with night-vision motion-sensitive cameras (Bushnell Trophy Cam Aggressor Model 119774) strategically placed around the enclosure to assess space use and anecdotally note behaviours such as pacing, social interactions and effectiveness of enrichment. Both of these options allowed an evaluation of the success of the training programme without having a keeper present during these periods. The information collected from this monitoring was summarised, evaluated and discussed on a weekly basis with animal care and behavioural husbandry teams. Training and enrichment plans were adjusted based on this information. For example, it was noted that the female interacted with objects in the pool and, in response, enrichment such as toys, plants and ice

blocks were added to the pool area to encourage its use. Cameras allowed keepers to remotely monitor progress of exhibit shifting and acclimation without impacting behaviour. Thus, cameras were instrumental for monitoring the progress of exhibit shifting and acclimation from a distance, without keeper presence impacting the hyenas' behavior.

Behavioural observations

To objectively quantify hyena behaviour as they acclimated to their new habitat, the night safari experience (which began in May 2016), and the training and enrichment programme, observational data were collected from 26 January 2016 to 2 December 2016. Over this period, the keepers performed 177 observations. Four observations were removed from the analysis as they included two observations from one day in January, a single observation in November, and a single observation in December, which did not give an accurate visualisation of hyena behaviour across those months. This resulted in 173 observations across 9 months (mean of 19.2 observations/month) used for analysis. Observations were conducted around the keepers' husbandry schedules, between the hours of 0815 and 1720. Overall, 96.5% of observations occurred between 0900 and 1200 (67.6% of observations) or between 1400 and 1700 (28.9% of observations). Hyenas were observed for 30-min periods and behaviour was recorded every 2 min using scan sampling (Altmann 1974). The following state behaviours were recorded: rest, travel, feed, pace, not visible and other (see operational definitions in Table 1). All statistics and plots were completed in R version 4.0.3 (R Core Team 2020).

Consequences

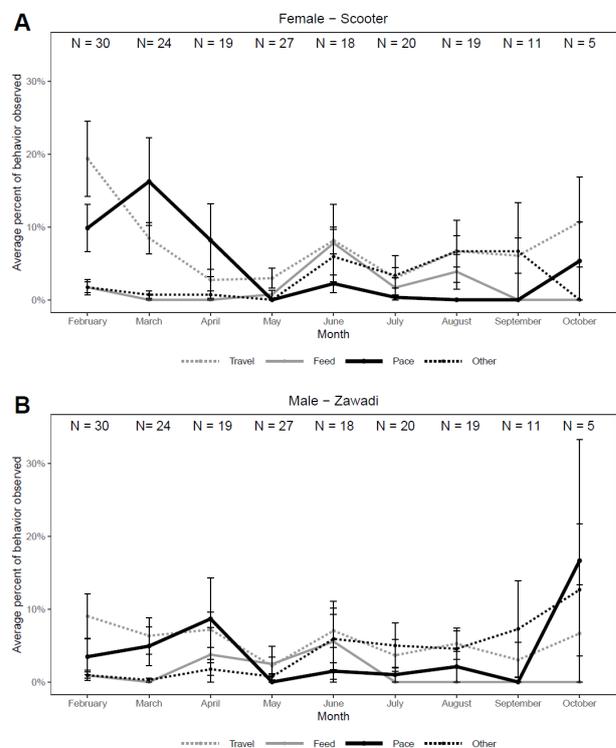
Hyena activity was fairly consistent over the course of observations, with the majority of time spent resting (median per month \pm SE: female 84 \pm 7% and male 88 \pm 5% of behaviour). Besides resting, travel was the most commonly observed behaviour (Figure 2, dashed grey lines). This is similar to research on wild spotted hyenas showing they spend the majority of time resting (reported at 70.7%), followed by traveling (Kolowski et al. 2007), and suggests the hyenas at DAK are performing appropriate levels of these behaviours.

Over the observation period, changes were observed in the amount of time the hyenas spent pacing. Both hyenas initially exhibited increased pacing from February to March (female: 6.4% increase) or April (male: 5.2% increase), decreased pacing through May (female: 16.2% decrease; male: 8.7% decrease), and fairly consistent pacing through the summer months (Figure 2; solid black lines). Subsequently, there was an increase in pacing frequency in October (female: 5.3% increase; male: 16.7% increase; Figure 2; solid black lines); however, only five observations were conducted during the month of October, and this spike was driven by high amounts of pacing that occurred during one observation only. After formal behavioural observations ended in October, keepers initiated informal observations on pacing throughout the evening. They reported that the amount of observed pacing declined and has remained low. Overall, pacing was reduced and observed infrequently from May 2016 onward. Interestingly, this corresponds with the time frame when the park hours were extended for the safari night experience, and thus, when the hyenas began spending longer periods of time on exhibit. These results may suggest that the training and enrichment programme aided acclimation to these new experiences. However, it is important to note that the majority of observations (89%) were conducted when the hyenas were off-exhibit and residing in the stalls or yards, due to the keepers' limited visual access to the exhibit. Thus, these data do not give a thorough depiction of hyena behaviour while on exhibit, but they do support that overall

Table 1. Ethogram of observed state behaviours

Behaviour	Definition
Rest	Lying, sitting or standing without cursorial locomotion
Travel	Quadrupedal movement from one point to another
Feed	Ingesting or chewing on food items
Pace	Walking back and forth repetitively along a route; this route may be a straight line, circle, or figure of eight pattern.
Other	Visible but not resting, traveling, feeding or pacing
Not visible	Animal not visible to the observer

pacing decreased and remained low amid a significant change in the husbandry routine that corresponded with the launch of the safari night experience.



In addition to evaluating pacing over time, it was also determined that the overall amount of pacing was statistically different when hyenas were given access to different areas of the enclosure (Scooter: $\chi^2=350.33$, $df=3$, $P<0.001$; Zawadi: $\chi^2=79.2$, $df=3$, $P<0.001$; Figure 3). The majority of pacing occurred when the hyenas had access to the exhibit only (average of 25.5% of scans; $n=5$ observations) or all areas of the enclosure (average of 20.0% of scans; $n=14$ observations), with low rates of pacing observed when the hyenas had access to stalls only (average of 1.7% of scans; $n=24$ observations) or stalls and yard only (average of 2.2% of scans; $n=130$ observations). It may be that the hyenas paced the least in the stalls, and stalls and yard combined, because these areas resembled their previous enclosure in the research colony and also provided the closest proximity to keepers. However, it is again emphasised that most observations were conducted while the animals had access to the stalls or side yards only. This is a limitation in the observations, as the time budgets and amount of pacing that occurred while the hyenas were on exhibit cannot be accurately determined.

Conclusions

When the hyenas arrived at DAK, it was known that special efforts were necessary to ensure they were comfortable in their new habitat—particularly because of the stark differences between DAK and their previous home at the hyena research colony (Orenstein 2014). To support and monitor their acclimation to a new habitat, a specialised training and enrichment programme was designed and implemented and their behaviour was monitored over time through formal behavioural observations. Data from the behavioural observations suggest that by the time formal data collection began (within 4 months of moving to their permanent enclosure), the hyenas were performing appropriate

levels of resting and traveling behaviour (Kolowski et al. 2007). In addition, while pacing was observed at higher rates from February to April 2016, pacing declined by May 2016 and remained low through the end of data collection and beyond (Figure 2), despite the launch of the safari night experience in May 2016. While data are not available to show a causal link between the training and enrichment programme and reduced pacing or overall appropriate levels of species-specific behaviours, the outcomes from informal observations and regular meetings with animal keepers strongly suggest that the training and enrichment programme was instrumental to the hyenas' acclimation to their new home at DAK.

It is recommended that those who want to study a causal link between training and enrichment effectiveness and behaviour, perform behavioural observations before, during and after training and enrichment efforts. For those with small sample sizes, single-subject methodology is specifically designed to examine changes in behaviour of individuals (Alligood et al. 2017). In addition to this, a formal documentation and evaluation process related to the implementation of enrichment and training, and subsequent changes in behaviour, are components of a longer-term welfare monitoring strategy. Many zoos and aquaria globally are beginning to implement these processes across all taxa, and within the Association of Zoos and Aquariums (AZA) a formalised process for assessing animal welfare is now a required part of the accreditation application (AZA 2019). Given the limited research on hyena welfare and behaviour in zoos, there are likely to be many questions left unanswered and more reports of training and enrichment successes are required, as well as results from more formal quantitative studies that can be used to provide hyenas and similar species with optimal welfare. Such efforts can be used to provide animals with more than a space to live but instead, a home to enjoy.

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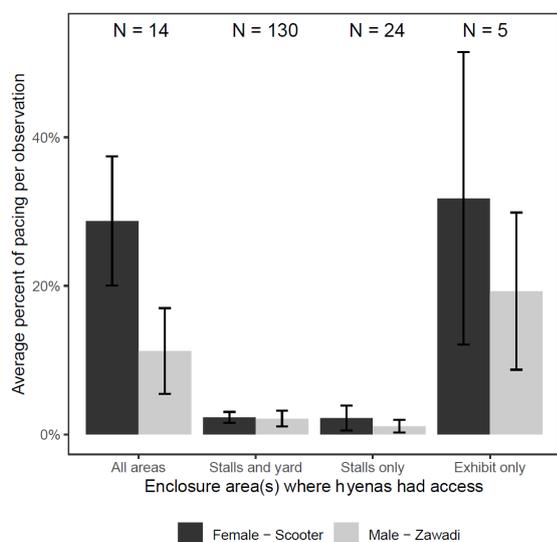


Figure 3. Mean \pm SE percentage of pacing seen per observation by area. Sample sizes are listed at the top of the plot.

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