Animal Conservation (2004) **7**, 313–320 © 2004 The Zoological Society of London. Printed in the United Kingdom DOI:10.1017/S1367943004001490

Behavioural trait assessment as a release criterion: boldness predicts early death in a reintroduction programme of captive-bred swift fox (*Vulpes velox*)

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(Received 7 August 2003; accepted 12 February 2004)

Abstract

Reintroduction of captive-bred animals is a key approach in conservation attempts for many endangered species, however, post-release survival is often low. Rearing conditions may be unlike those encountered upon release and the animals may not have had experiences necessary for survival in the wild. Animals may also habituate in captivity to stimuli that may pose a danger after release and/or there may be selection for behavioural traits, in particular reduced fearfulness, that may not be suited for the wild. Here, variation in boldness was assessed in captive-bred swift fox (*Vulpes velox*) and tested for influence on survival after release. Radio-tracked individuals that died in the 6 months following release were those judged previously as bold. In the presence of novel stimuli in captivity, they had left their dens more quickly, approached more closely to the stimuli and shown more activities indicating low fear than did those that survived. These individuals were less suited for release. Future selection of release-candidates on the basis of behavioural variation should enhance the success of reintroduction programmes.

INTRODUCTION

The effects of behavioural variation on the welfare and management of animals have been studied in both farms (Spoolder *et al*., 1996; Ruis *et al*., 2000) and zoos (Gold & Maple, 1994; Carlstead, 1999; Carlstead, Mellon & Kleiman, 1999), as a means of assessing the suitability of individual animals for the particular requirement, whether for food production, captive breeding, or exhibition. Nevertheless, in many reintroduction programmes the selection of release candidates is often based solely on fulfilment of age, sex and health criteria (Yalden, 1993; Sarrazin & Legendre, 2000). However, there may be many other factors affecting the success of reintroduction. Previous recommendations for candidate selection for reintroduction have discussed the behavioural skills required, such as locomotion and food acquisition (Kleiman, 1989, International Academy of Animal Welfare Sciences, 1992). One aspect of behavioural variation that may be important in terms of survival and adaptation to the wild is boldness. Variation in levels of boldness, or fearlessness, is considered a key element in human personality (Coleman & Wilson, 1998) and recent studies have shown that similar variation exists in non-human species such as cats (Lowe & Bradshaw, 2001), ungulates (Lyons, Price & Moberg, 1988), fish (Coleman & Wilson, 1998) and octopus (Mather & Anderson, 1993). Levels of boldness are subject to natural selection (Huntingford & Giles, 1987); therefore, released individuals with inappropriate levels of boldness may suffer reduced fitness in the wild. Here, we examine boldness and survival in a release programme of swift fox (*Vulpes velox*).

Swift fox were once common to the eastern plains of Montana (Johnson, 1969) with many sightings in the area of the Blackfeet Reservation (Bailey & Bailey, 1918). Following a reduction in numbers, swift fox were declared extirpated in Montana in 1969 (Hoffman, Wright & Newby,1969). Recently sightings have increased (Knowles, 1998; Knowles *et al*., 1998), with foxes in the northern portion of the state thought to be dispersers from the Canadian Reintroduction Programme (Carbyn & Killaby,1989).

A reintroduction agreement was reached between the Blackfeet Fish & Game Dept of the Blackfeet Indian Tribe, the US conservation charity Defenders of Wildlife and the Cochrane Ecological Institute (CEI), a swift fox breeding facility (Johnson, 2000), to establish a population of swift fox on an area of the Blackfeet Reservation in northern Montana. The first release of swift fox onto Blackfeet land took place in 1998 and continued over a 5 year period. There is evidence that foxes are surviving and reproducing both on the release site and in surrounding areas (Johnson, 2000).

Released foxes are juveniles bred from foxes held in the captive breeding colony. When animals are maintained

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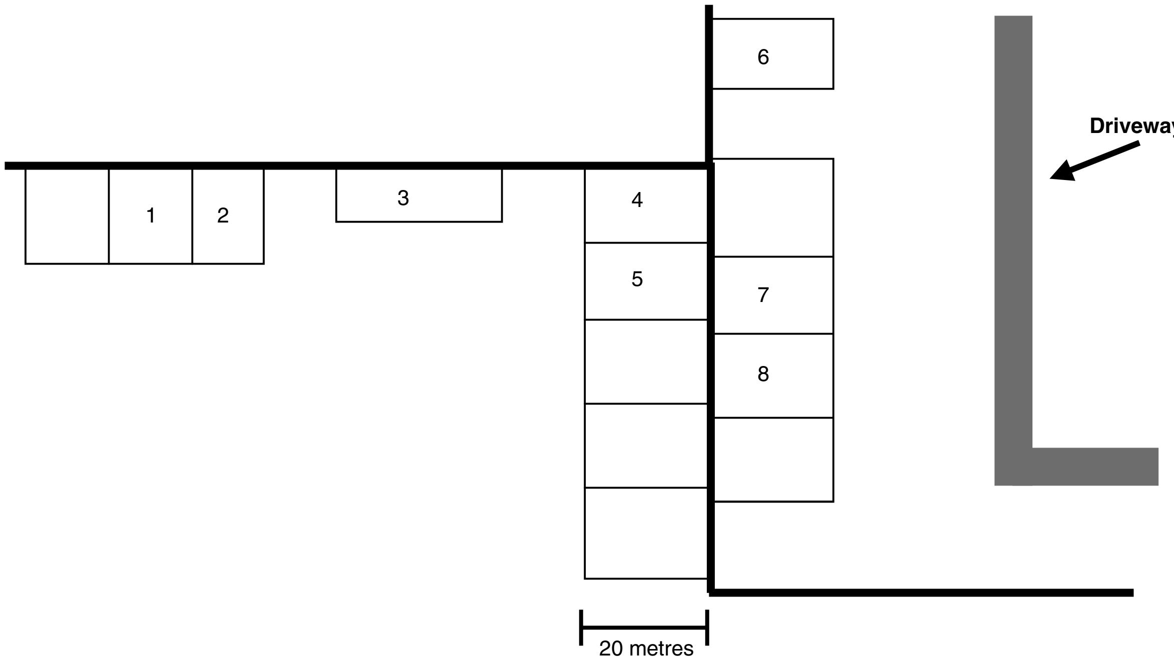

Fig. 1. Layout of enclosures. The experimental enclosures holding family groups are numbered.

in captivity over a long period of time it is likely that they will show signs of behavioural selection to suit their environment (Sutherland, 1998; McPhee, 2003) resulting in behavioural deficiencies (Kleiman, 1989; Biggins *et al.*, 1999). Inappropriate responses to potentially dangerous stimuli may result in reduced survival following release. Accordingly, we developed a test to assess boldness in captive-bred swift fox. These foxes were monitored after release to assess whether boldness was related to survival.

MATERIALS AND METHODS

The responses of eight family groups, comprising a total of 15 adults and 34 young, to novel stimuli were assessed, with a focus on behaviour that may distinguish bold and shy individuals. Family groups were maintained in separate enclosures with limited visual contact between groups (Fig. 1). Following a habituation period to the presence of the observer, four novel stimuli (1, grey plastic box approximately 75 × 50 × 50 cm; 2, multicoloured beach ball 30 cm diameter; 3, grey feed sack, stuffed with paper, approximately 90 × 50 cm; 4, unknown adult human) were separately presented in each enclosure for 50 min. Each test was on a separate day and the same four stimuli were repeated 6–8 weeks after the first presentations (Trial 1 and Trial 2). All stimuli were presented between 1600 and 2200 h, i.e. within the normal hours of swift fox activity (Teeling, 1996) to ensure that all individuals were in sight when the stimuli were presented. The order of presentation was random. Observations were recorded from outside the enclosure and each session was video-recorded.

The behaviour of all individuals within the family group was recorded according to a previously compiled ethogram (Table 1: Teeling, 1996; Bremner, 2002), using instantaneous scan sampling (Martin & Bateson, 1993) at 30s intervals. In addition, latency to emerge (Fox, 1972), i.e. time of first appearance following insertion of the novel stimulus, and the estimated closest distance of approach to the stimulus was recorded for each individual.

Activities thought to represent ‘boldness’ and ‘caution’ were identified (Table 2) and the number of occurrences counted for each fox. Bold activities were given a value of 2, while cautious activities had a value of 1.

Boldness scores were calculated per individual as a score for each presentation of a novel stimulus, a total score (all stimulus scores combined) for each trial and an overall total boldness score (all stimulus scores for both trials combined), with a high score indicating high levels of boldness.

Of the 34 juveniles observed, 31 were selected by the breeding centre for release and, prior to release, 16 were radio-collared (Biotrack, nylon collar TW-3 1/2AA). The original intention had been to collar all 31 of the juveniles, however, changes in management policy at the CEI resulted in collaring being restricted to 16 individuals. Therefore, a minimum of two juveniles was collared from Families 1–7, selecting juveniles with scores that were representative of the range of levels of boldness (Table 3). No foxes from Family 8 were collared since these were the youngest litter and it was felt that the offspring were not yet of adequate size.

Within the reintroduction programme, releases occurred on a yearly basis, at the end of the summer when there are high levels of abundance of prey. All 31 foxes were conveyed in transportation kennels to the Blackfeet Tribal Reservation and placed at an assigned Portable Protective Shelter (PPS) in sibling groups. The PPS’s function was to provide initial shelter, protection

Table 1. Behavioural ethogram with definitions

Behaviour	Behaviour definition
1. Out of sight	Not visible in enclosure
2. Resting relaxed	Lying or sitting in a relaxed, or asleep, posture, ears lowered, eyes may be closed
3. Resting alert	Lying, sitting or standing with ears erect and eyes open
4. Stretching	Elongating limbs with a bout of yawning
5. Rolling	Rubbing face and flank on ground or object
6. Walking	Slowest gait of locomotion
7. Trotting	Steady pace faster than walk, lift diagonal pairs of legs
8. Loping	Slow bouncy run
9. Running	Fastest pace of locomotion
10. Jumping	Leaping either into the air or on to an object (e.g.den box)
11. Climbing	Prolonged effort to climb up an object
12. Sniffing	Sniffing at the air
13. Investigating	Walking, running or standing whilst sniffing at ground or object in enclosure
14. Bold approach (object)	Direct approach towards novel stimulus/object, ears and body erect
15. Bold approach (conspecific)	Direct approach towards conspecific, ears erect
16. Hesitant approach (object)	Slow approach towards novel stimuli/object with frequent retreats and advances, ears and body usually lowered
17. Hesitant approach (conspecific)	Slow nervous approach towards conspecific with frequent retreats and advances, ears and body usually lowered
18. Chasing conspecific	Chasing a conspecific not in play, often away from a novel stimulus or food item
19. Fleeing	Run towards den or away from object, often in response to a warning bark
20. Fleeing conspecific	Moving quickly away from conspecific
21. Following conspecific	Moving slowly behind a conspecific, not chasing
22. Stalking	Approaching an object/prey item in a crouched position
23. Pouncing on object	Leaping onto an object using fore-legs to land, often occurs following stalking
24. Pouncing on conspecific	Leaping onto conspecific, often occurs during an existing play bout, or as an invitation to play
25. Fighting	Aggressive interaction between conspecifics
26. Fighting over object	Aggressive interaction as a result of competition over object
27. Discipline	Snapping or growling at a conspecific, may knock them to the ground and stand over them. Usually performed by an adult, directed towards kits
28. Submission	Directed towards conspecific, lowered posture, ears flattened, often wagging tail
29. Play chase	Running, chasing alone or with other conspecifics, often alternate role of pursuer
30. Play flee	Running away from a conspecific or object, ears more erect than when ‘Fleeing’. When with another conspecific, often alternate who is chasing and fleeing
31. Play fight	Wrestling, tumbling, biting and jumping with a conspecific
32. Play stalk	Slow approach to conspecific with body held low to ground
33. Playing with object	Biting, tossing in the air, or jumping with an object
34. Digging	Using front paws to make holes
35. Eating	All masticatory behaviours associated with food
36. Drinking	Intake of liquid
37. Food gathering	Collecting and carrying items of food in the mouth
38. Food offering	Presenting a food item to a conspecific
39. Food beg	Position of mouth and nose close to mouth of conspecific whilst wagging tail
40. Caching	Storing food item, usually in a small hole, and covering with debris
41. Unearthing food	Retrieving a previously cached food item
42. Hunting	Predatory behaviour towards prey item, including stalking and jumping on/catching prey
43. Defecating	Discharge faeces or urine from body
44. Marking	Scent marking, either by depositing minimal amount of urine or rubbing body on a prominent object in enclosure
45. Grooming (self)	Biting, licking, nibbling or scratching at own body
46. Grooming (conspecific)	Biting, licking, nibbling or scratching at a conspecific
47. Greeting conspecific	Ears back, head low, tail wagging
48. Watching conspecific	Observing another fox within the enclosure
49. Watching observer	Looking at the observer who is collecting data
50. Kit carrying	Adult moving kit to another area by scruff of the neck
51. Warning bark	Short loud bark, usually emitted by an adult at potential danger
52. Suckling	Kit feeding by sucking at mother’s teat
53. Entering den	Moving out of sight into either A-frame or den hole
54. Leaving den	Coming into view from either an A-frame or den hole
55. Following person	Moving at a distance behind a person within the enclosure (Stimulus D)
56. Watching person	Watching person within the enclosure, usually in an alert posture (Stimulus D)
57. Vomiting	Regurgitation of food

Table 2. Behavioural activities reflecting personality types

Bold	Cautious
2. Resting relaxed	3. Resting alert
13. Investigating	16. Hesitant approach (object)
14. Bold approach (object)	17. Hesitant approach (conspecific)
15. Bold approach (conspecific)	19. Fleeing
18. Chasing conspecific	20. Fleeing conspecific
21. Following conspecific	28. Submission
23. Pouncing on object	48. Watching conspecific
24. Pouncing on conspecific	51. Warning bark
27. Discipline	56. Watching person
29. Play chase	
30. Play flee	
31. Play fight	
32. Play stalk	
33. Playing with object	
55. Following person	

from predators (Smeeton & Weagle, 2000) and a point of reference for the fox to return to whilst making dispersal forays. The eight sibling release groups were spaced throughout the reintroduction site. Foxes were maintained in their kennels overnight and released early the following morning. Post-release monitoring was conducted by radio-tracking using a 2-Element H Antennae with R2000 scanner (ATS Ltd). Intensive monitoring was conducted for 6 weeks immediately after the release and comprised searching of the reintroduction site from 18:00–06:00 h to obtain fixes for as many foxes as possible, as well as scanning of dens at 2-h intervals from 06:00–18:00 h. PPS usage was also recorded during the intensive monitoring period. To determine survival status 6 months after release, further monitoring was conducted as a 4-week follow-up survey by radio-tracking over pre-determined routes from 18:00–00:00 h and 06:00–12:00 h to give maximum coverage of the release site.

Survival status of the foxes was classed as alive (A), or dead (D). Foxes were defined as alive if they were seen by eye and identified with the telemetry equipment, or if a succession of fixes were obtained from different locations during the relevant period of activity for swift fox. Foxes were classed as dead if the body/remains of body and radio-collar were obtained ($n = 4$), or if a below-ground fix was consistently obtained at an exact location for several days during the normal activity period ($n = 1$).

Table 3. Total boldness scores for individual foxes

Family 1	Sex	Boldness score	Family 2	Sex	Boldness score
Adult Male	M	126	Adult Male	M	1068
Adult Female	F	168	Adult Female	F	646
Kit 1*	M	713	Kit 1*	M	974
Kit 2	F	536	Kit 2*	F	729
Kit 3*	F	370	Kit 3*	M	480
Family 3	**Sex**	**Boldness score**	**Family 4**	**Sex**	**Boldness score**
Adult Male	M	512			
Adult Female	F	557	Adult Female	F	33
Kit 1	F	328	Kit 1*	F	346
Kit 2*	F	280	Kit 2	M	284
Kit 3*	F	130	Kit 3	F	364
Kit 4	F	247	Kit 4	F	18
Kit 5	M	357	Kit 5*	F	102
Kit 6	F	202			
Family 5	**Sex**	**Boldness score**	**Family 6**	**Sex**	**Boldness score**
Adult Male	M	408	Adult Male	M	583
Adult Female	F	13	Adult Female	F	764
Kit 1*	F	231	Kit 1*	F	478
Kit 2	F	229	Kit 2	M	417
Kit 3	M	116	Kit 3	F	285
Kit 4*	F	50	Kit 4	M	106
			Kit 5*	M	25
Family 7	**Sex**	**Boldness score**	**Family 8**	**Sex**	**Boldness score**
Adult Male	M	920	Adult Male	M	642
Adult Female	F	530	Adult Female	F	78
Kit 1*	M	220	Kit 1	F	224
Kit 2	M	226	Kit 2	M	96
Kit 3*	M	201	Kit 3	M	48
Kit 4*	M	277	Kit 4	F	35

*, radio-collared foxes.

RESULTS

Foxes were ranked from highest to lowest boldness, separately for adults and juveniles, for each of the eight stimulus tests (two groups of four, i.e. Trial 1 and 2), with analysis corrected for tied ranks. A high level of concordance (Kendall coefficient (Siegel, 1956)) was found for both adults ($W = 0.607$, $\chi^2_{14} = 67.98$, $P < 0.001$) and juveniles ($W = 0.375$, $\chi^2_{33} = 99$, $P < 0.001$), indicating that individuals judged as bold when exposed to one stimulus were judged as bold when exposed to other stimuli.

Analysis of variance showed that fewer bold activities were performed in the presence of an unknown person than for the remaining three stimuli ($F_{3,132} = 16.66$, $P < 0.0001$). Sex, however, had no effect on boldness scores, but adults were less fearful than juveniles ($F_{1,44} = 6.11$, $P < 0.01$). There was no interaction effect between sex and age. Trial number had no effect on the score and there was no interaction effect between trial number and sex. There was, however, a significant interaction between trial number and age ($F_{1,44} = 3.9$, $P < 0.05$), indicating that the boldness score of juveniles was greater in the second trial than in the first, but that there was no difference in the boldness of adults between the two trials.

Boldness scores for each of the stimuli and trials were summed to give an overall boldness score for each individual (see Table 3). These were significantly correlated with the mean latency to emerge (Adults: $r_{13} = -0.843$, $P < 0.001$; Juveniles: $r_{32} = -0.781$, $P < 0.001$), and mean closest distance to the novel stimuli (Adults: $r_{13} = -0.922$, $P < 0.001$; Juveniles: $r_{32} = -0.779$, $P < 0.001$).

The survival data of the 16 radio-collared foxes were analysed to test for a relationship between survival and the individual's boldness score. Those that died ($n = 5$) had achieved higher boldness scores (Fig. 2(a): unpaired *t*-test, $t_{14} = 2.942$, $P < 0.01$), had left the dens more quickly (Fig. 2(b): unpaired *t*-test, $t_{14} = -2.223$, $P < 0.05$), and approached more closely (Fig. 2(c): unpaired *t*-test, $t_{14} = -2.291$, $P < 0.04$), in the presence of novel stimuli, than did those that survived ($n = 11$). Of those that died, two were located by a road and had clearly been killed by motor vehicles; the other three were located more than 100 m from a road and the precise cause of death was not established. One animal appeared to have died within an underground den but it is possible that the collar could have been removed and the animal was not dead. Analysis without this individual, however, showed similar differences in boldness between those that survived and those that did not (unpaired *t*-test, $t_{13} = 2.944$, $P < 0.01$).

In addition, survival and boldness data were analysed in relation to the distance data obtained from radio-tracking. Boldness scores showed a positive correlation with both the total distance ($r_{14} = 0.588$, $P < 0.02$) and the mean distance per fix ($r_{14} = 0.574$, $P < 0.02$) moved by an individual. Mann–Whitney *U*-tests revealed no significant difference between alive and dead foxes for the total distances moved ($n^1 = 11$, $n^2 = 5$), however, the mean distance moved between fixes was significantly greater for those individuals that had died ($U = 6$, $P < 0.02$).

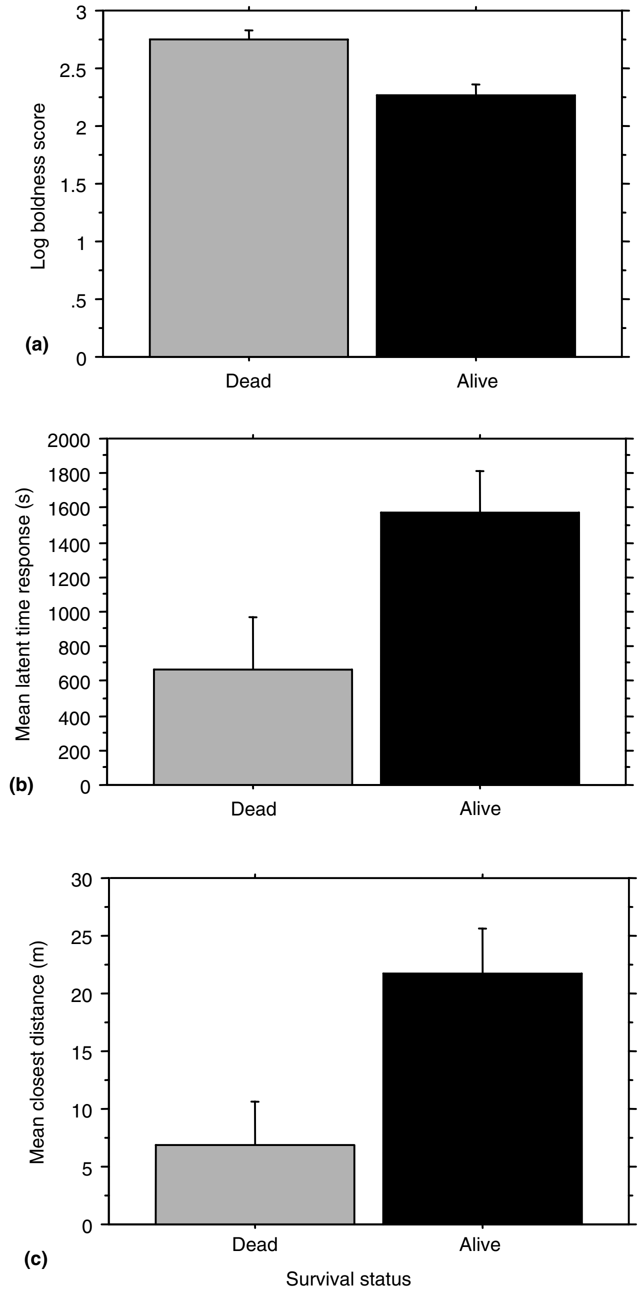

Fig. 2. (a) Log boldness score of 16 radio-collared kits and their survival status 6 months following release. Standard error bars are shown. (b) Mean latency to emergence (in s) following the insertion of a novel stimulus into the enclosure and survival status. Standard error bars are shown. (c) Mean closest distance of approach to a novel stimulus during a observation period and survival status. Standard error bars are shown.

There was no correlation between boldness scores and the use of the PPSs ($r_{14} = 0.121$, NS) and PPS use did not differ between those that died or those that remained alive at the end of the study ($t_{14} = -0.746$, NS).

Offspring at the CEI are born to either a pair of captive-born parents, or to a pair containing at least one wild-born parent. Parental boldness score did not differ between those that were captive-born or wild-born ($t_{12} = 0.109$, NS). Furthermore, no significant correlation was found between the mean parental boldness score and the mean juvenile boldness score within family groups ($r_6 = -0.173$, NS). There was no significant relationship between parent's origin and survival rates of released juveniles (Fisher's Exact Probability Test, $P = 0.23366$).

DISCUSSION

In this study, behavioural variation was investigated in the context of boldness/cautiousness and the response of individuals to novel stimuli. Examination of boldness levels for four stimuli over two trials showed consistent responses for individuals, which ranged between the extremes of boldness and cautiousness. Both adults and juveniles were consistent in their response to novel stimuli in terms of activities performed (boldness score), the distance of approach and latency to emerge. Correlations between boldness score, latency to emerge and distance to novel stimuli clearly indicate that a fox with high levels of boldness is more likely to leave its den more quickly and approach more closely to a novel stimulus. The combination of these three measures, taken over a 2-month period, affords a means of assessing levels of boldness in an individual that reflect a long lasting 'personality trait', thus providing a method for predicting behavioural responses to novel stimuli or situations after release. That is, bold individuals should be less likely to avoid potential predators, conspecifics or anthropogenic stimuli that may pose a risk.

Bolder foxes were found to move greater distances from the release site, both overall and between each fix. In addition, individuals that showed a lower mean distance moved per fix were those that survived. These findings reflect those previously found for released red fox (*Vulpes vulpes*) and swift fox. Released rehabilitated red foxes showed high levels of erratic movement and travelled widely, foxes that survived where those that reduced travelling to limit their movements to a much smaller area (Robertson & Harris, 1995). Moehrenschlager & Macdonald (2003) found that translocated swift fox with smaller dispersal distances had greater survival and reproductive success rates and they suggested a period of acclimatisation. However, Robertson & Harris (1995) found that this delayed but did not eliminate the high movement phase.

Released swift fox do not have a period of site acclimation prior to release, but are provided with Portable Protective Shelters (PPSs). Whilst several foxes were found to use these shelters for long periods of time and to repeatedly return to the release site, no relationship was found to exist between shelter use and levels of boldness or between shelter use and survival, thus suggesting that prolonged use of the shelters did not influence swift fox site acclimation.

Within a family group, foxes are more likely to be exposed to similar stimuli, therefore, variation in levels of external stimuli can not be the only means of causing differences in behavioural response. Whilst sex was not found to be significant, age did have a significant effect on boldness scores, with adults showing higher levels of boldness than juveniles. This may be a result of adults having spent greater periods of time in the captive environment and becoming habituated to the absence of predation and to the random occurrence of stimuli such as unknown people. If these individuals have not been subjected to predation attempts and are provisioned with food by humans, then they are likely to become less cautious in the presence of novel stimuli. It is also likely that very young foxes are prone to be warier of novel stimuli, with strong selection pressure for cautious reactions. As the foxes mature this natural reaction may lessen in some individuals. Indeed, an interaction effect was found to exist between boldness score and trial number for juvenile foxes, whereby individual boldness scores increased during the second trial. The first trial was performed within a very short time period of the juvenile's first emergence from the natal den, whilst the juveniles were very naïve. They are also strongly influenced by parental control during this period. It was common during this first trial for adult foxes to perform bold-type behaviour in the presence of the stimuli, having first given off warning barks to ensure that juveniles remained in the natal den. During the second trial, the frequency of warning barks decreased overall and in the remaining cases appeared to be more frequently ignored by juveniles. It is also possible that individuals had habituated to the stimuli during the first trial, although exposure to the stimuli during each trial lasted for only 50 min and each exposure was a minimum of 4 weeks apart. Nevertheless, the high level of concordance between the rankings of most to least bold among the juveniles indicate that the boldness trait becomes established at an early age.

It was clear from the overall boldness scores of the juveniles that there was considerable variation both within and between families (Table 3). From the survival data gained from radio-tracking, those that died in the 6 months following release had been judged as being bolder than those that survived. Thus, being overtly bold seems to be disadvantageous to survival in these captive-bred, released animals. The precise cause of death could only be ascertained for two individuals, both having being hit by vehicles on a highway. These animals had seen vehicles at the breeding centre and they may have habituated to the sight and sound of such dangerous stimuli. The cause of death for another two was not determined and the bodies were located at least 100 m from the highway. It is possible that they too were hit by vehicles but survived long enough to move away from the road. There were no obvious external wounds. The fifth individual seemed to have died within an underground den and the body could not be retrieved. On the basis of local Fish & Wildlife reports, we believe that it is unlikely that the collar became detached and that the fox was alive. However, removing this individual from the analysis did not alter the main finding, i.e. animals that died had significantly higher boldness scores than those that survived.

High levels of fearlessness may be a result of habituation and could also be due to selection during captive breeding, since a high reproductive success rate is more likely to be achieved by those that are least stressed by their captive environment (Carlstead *et al*., 1999). Thus, animals produced after several generations of captivity may be at a disadvantage when released, since selection for optimal boldness in captivity is likely to vary considerably from optimal levels of boldness in a wild environment. Natural selection for optimal levels of boldness in different natural environments has been shown to vary in fish according to the predation risk (Giles & Huntingford, 1984) and animals that frequently perform bold behaviour may be 'pathologically fearless' when released (Archer, 1973).

Overt boldness might be reduced after training, in an attempt to reduce the high mortality of bold individuals. Training has been used in other reintroduction programmes with some measure of success, such as improving locomotion (Kleiman *et al*., 1986) and prey-recognition (Biggins *et al*., 1999). However, it should be noted that attempts at successful pre-release training do not always result in a post-release survival advantage, for example, increased predatory abilities in a group of trained black-footed ferrets did not result in higher survival rates than their untrained counterparts (Biggins *et al*., 1999). In addition, attempting to teach bold foxes to become generally wary would be incredibly difficult, therefore training in this instance should aim to result in aversion to specific threats, such as vehicles, humans and common predators, e.g. coyotes and birds of prey.

Bold individuals should not be released if they are likely to die without contributing to a viable population. However, even if released animals manage to reproduce, their offspring may inherit a higher boldness than is optimum for the natural environment, if boldness has been subject to artificial selection. Thus, the average fitness within a small population may be reduced. However, bold individuals may not be suitable as captive breeders if they pass on undesired traits to their offspring. The aim should be to screen individuals both for breeding stock and for release, so as to maximise success in a variety of release programmes. Further studies of boldness in the context of survival, social learning and genetic influences are important to determine what to do with captive-bred animals that demonstrate high boldness.

The grouping of these three measures (boldness score, mean closest distance and latency to emerge) has not been used in previous studies; however, it appears to be suited for investigations of levels of individual boldness. The methods employed were easy to use and could be applied to other species with adaptations according to the particular species' behaviour and environment. The results show a significant correlation between boldness scores, latency to emerge and distance to novel stimuli and show that individual levels of boldness may influence the likelihood of an individual surviving following release. This relationship between consistency of behavioural reaction and survival of released foxes demonstrates the importance of behavioural trait, or 'personality' assessment for reintroduction. Thus, we propose that behavioural trait assessment should be recognised as a potential predictor of survival rates in released animals and used as a tool for animal selection and preparation.

Acknowledgments

This study was supported by the Department of Education for Northern Ireland, Defenders of Wildlife, the Blackfeet Tribe Fish and Wildlife Department and the Montana Department of Fish, Wildlife and Parks. Thanks to the Cochrane Ecological Institute for allowing behavioural observations of the captive-breeding colony. The authors would like to thank Ira Newbreast and Minette Johnson for assisting, encouraging and supporting this research. Special thanks are due to all the volunteers who assisted with various aspects of this study. Thanks are also due to Devra Kleiman and Axel Moehrenschlager for their helpful comments on an earlier edition of this paper.

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