The effects of capture and recapture on space use in large grey mongooses

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Susceptibility to capture and possible space-use shifts resulting from capture stress were assessed in wild large grey mongooses. Mongooses were captured with or without a reward (baited or unbaited trap). For up to 50 days after capture, mongooses avoided the area delimited by a ring of 100 m in radius centred on the trap location when captured without a reward, but no significant space-use differences were observed after capture with baited traps. We found no significant differences between capture on the periphery or in the central part of the home range. Despite the small influence that capture produced on the pattern of space use by mongooses in our study, it should be considered when radio-tracking carnivores.

Waarnemings is gemaak op die vatbaarheid om gevang te word en veranderinge in ruimtegebruik na vangs in die groot grysmuishond. Muishonde is gevang met of sonder 'n beloning (d.w.s. aas). In muishonde wat gevang is sonder 'n beloning, is 'n gebied van minstens 100 m van die vanghok of slagyster vermy vir tot 50 dae na vangs. Geen veranderinge in ruimtegebruik is opgemerk in gevalle waar aas gebruik is. Geen betekenisvolle veranderinge in ruimtegebruik is opgemerk in diere wat of op die rand of in die middel van hul loopgebied gevang is. Alhoewel die veranderinge in ruimtegebruik nie groot is nie, behoort hulle in aanmerking geneem te word wanneer radio-opsporing van karnivore gedoen word.

Keywords: Capture, *Herpestes ichneumon*, mongooses, space use, Spain

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Introduction

Home range is defined as the area traversed by one individual during the course of its normal activities of food gathering, mating and caring for young (Burt 1943). Thus, by definition, the place where an animal is captured belongs to its home range. However, the home range comprises areas of different intensity of use. These can be defined as a core area, where the resident spends most of its time, and a peripheral area (edge), where its presence is occasional (Adam & Davis 1967). We can assume that resident animals have a good knowledge of their core areas and, consequently, recognize and behave neophobically when they find a new stimulus there (for instance, the bait in a trap) (Johnson & Balph 1990; Windberg & Knowlton 1990). On the other hand, they will investigate more confidently when the stimulus is found in less familiar environments, like the periphery of the home range.

In this context, Laundré & Keller (1983) suggested that coyotes *Canis latrans* were captured more easily on the edges than in the centres of their home ranges. Also, Hibler (1977) and Woodruff & Keller (1982) reported that most radio-collared coyotes were captured near the edge of, or outside, their normal ranges and postulated that they might be more vulnerable to capture in less familiar areas. Windberg & Knowlton (1990) demonstrated a decreased vulnerability to traps for both territorial and transient coyote females inside their respective ranges. Nevertheless, in all these studies the pattern of home range use before the capture was unknown and recently, Travaini, Aldama & Delibes (1993), working with red foxes *Vulpes vulpes*, have suggested that shifts in home range use (e.g. the avoidance of the trap area) could result from stress following capture.

This possible change in the pattern of home range use must be taken into account when using radio-tracking in field studies of carnivores, as this technique usually requires capturing and immobilizing the animal before fitting the transmitter on it. The only possibility of proving the existence of such a shift is to analyse the spatial behaviour of recaptured animals for which the home range size and shape before the stress of the second capture is known.

We wanted to know if large grey mongooses *Herpestes ichneumon* are more easily captured on the periphery than in the core area of their home ranges. Moreover, we will evaluate the existence of shifts caused by capture stress. To do this, we will use only recaptured mongooses for which the capture place and the home ranges before and after the capture are known. We will also consider two different situations when analysing capture effects on behaviour: if the recapture was done with, or without, a reward (traps baited or not baited).

Study area and Methods

We used field data from a two-year study on the ecology and social organization of large grey mongooses in the Parque Nacional de Doñana of southwest Spain (Palomares & Delibes 1993). Animals were captured using padded leg-hold traps or cage traps (Palomares & Delibes 1992a) either baited with live doves or not baited. After immobilization with a combination of xylazine-hydrochloride and ketamine-hydrochloride (Palomares & Delibes 1992b), mongooses were equipped with a radio collar.

To evaluate the existence of shifts caused by capture stress, from a total of 24 radio-monitored animals, we used only those that had been recaptured at least once after a certain period (usually three weeks). We assumed that this was long enough to enable a reliable evaluation of the space use by the animal.

We compared the total number of radio fixes with reference to concentric 100-m radius circles centred at the trap point ten days before recapture, and successive groups at ten-day intervals after recapture (i.e. first ten days, then 10 – 20 days, 20 – 30 days, etc.) (Figure 1). Initially, we used the whole data set but later, we divided our sample into two groups, considering whether bait (reward) was or was not used to trap the animals. A test for comparing two proportions (Z; Zar 1984: pp. 395 – 400) was used to assess whether mongooses made similar use of each circle before and after recapture.

To evaluate the existence of variable trap susceptibility in the central part or on the periphery of the home range, we considered a core area within the 90% isopleth defined by the harmonic mean method (Dixon & Chapman 1980), and a peripheral area, the remaining 10%. We compared the expected and the actual number of captures in each zone by the Exact Test of Wells & King (1980) for contingency tables. This is a multi-tailed statistic where no minimum expected matrix cell values are required and which is based on the Fisher-Yates Exact Test and the chi-square statistic. Differences were considered as significant if $p < 0{,}05$. The expected number was calculated using the trapping effort and the time spent by the animal in each area. Trapping effort was computed by dividing the total number of working traps by the trapping area of each home range area (core and peripheral area). The time spent by the animal in each area was derived from the harmonic mean method employed to limit each area: 90% of the total time was spent within the central area and 10% on the periphery.

Results and Discussion

When analysing the whole data set, we found differences in the use of the first circle (100 m) around the trap, before (ten days) and after (up to 50 days) the recapture (Table 1). This suggests that the mongooses tended to avoid the immediate neighbourhood of the trapping point where they suffered the stress of capture. However, this is not the case for mongooses captured with a reward (baited traps) as there are no significant differences in any combination of groups of circle radius and days before and after the recapture (Table 1). We think this is conclusive, in spite of the fact that we have data for only twenty days. For the second group (mongooses captured without a reward), we found that the first 100-m radius circle was used statistically less often after the capture, the effect being detected at least for 40 days and up to 400 m (Table 1). Although there is the possibility that mongooses shift their space use for reasons other than those analysed (e.g. Doncaster & Macdonald 1991, for the red fox *Vulpes vulpes*), we think that potential aversion of the trap locality must be considered. Surprisingly, this aversion could be reduced by giving the mongooses a reward (food) for the capture.

To analyse the susceptibility to getting trapped in different portions of the range, we have considered the avoided area within a circle of 100 – 300-m long radius (12,6 – 28,3 ha) as insignificant when compared with the size of the total home range (average: 664 ha, n = 18), the central area (296 ha) and the peripheral area (368 ha). We could then evaluate the existence of a greater susceptibility to being captured on the periphery of the home range using all the recaptures as a unique sample. When doing this, we found

Table 1 Radio-fixes obtained for each concentric circle, 10 days before recapture and during successive ten-day periods. For both the complete data set and the rewardless group five ten-day periods are considered while for the group with a reward only two ten-day groups are considered

	Radius of circle (m)			
	100	200	300	400
Complete data set				
10 days before (n = 65)	19	24	28	30
10-day periods after (n)				
First 10 days (39)	5*	14	17	21
10 – 20 days (46)	5*	8	11	11
20 – 30 days (26)	0*	2	5	5
30 – 40 days (20)	0*	2	3	3
40 – 50 days (21)	4*	5	8	9
With reward				
10 days before (n = 30)	12	14	17	18
Ten-day periods after (n)				
First 10 days (17)	4	11	13	13
10 – 20 days (22)	15	16	19	19
Without reward				
10 days before (n = 35)	7	10	11	12
10-day periods after (n)				
First 10 days (22)	1*	3	4	8
10 – 20 days (24)	1*	3	3	3
20 – 30 days (26)	0*	2*	4	4
30 – 40 days (20)	0*	1*	2*	2*
40 – 50 days (21)	3	6	7	8

(n) Total radio-fixes within ten-day periods before or after capture, including those outside the 400-m radius circle
* $p < 0{,}05$

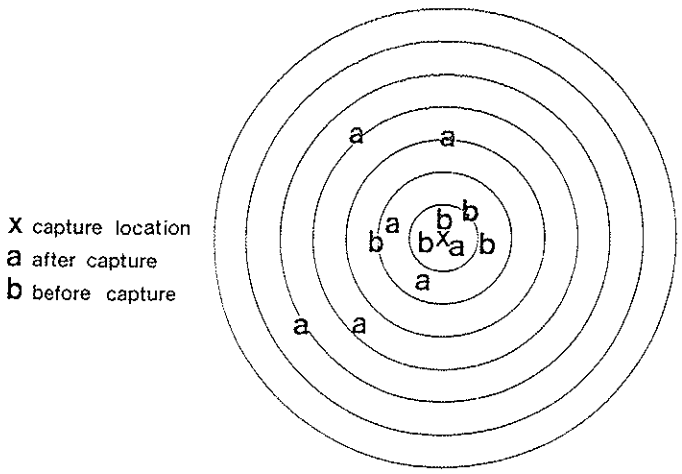

Figure 1 Concentric circles of an increasing radius of 100 m up to 700 m centred on the trap location with five radio-fixes 10 days before recapture and seven radio-fixes 10 days after it. The data set corresponds with one large grey mongoose, chosen as an example.

no statistical significance in favour of a greater susceptibility to be captured on the edges (n = 3 individuals) or core areas (n = 13 individuals) of the home range (Exact Test of Wells & King, χ^2 = 1, 11 428; p = 0,5966; n = 16).

In spite of the small influence that capture produced on the pattern of home range use by mongooses in our study, it should be considered when radio-tracking carnivores. It is possible that for other species, or even for the same species under different situations, this influence could bias the initial results of radio-tracking studies. On the other hand, our findings on susceptibility to being captured could indicate that there is no differential susceptibility to being captured in areas within a home range, as was found by Roy & Dorrance (1985).

Johnson & Balph (1990) found that social rank plays an important role in the vulnerability to novel conditions and objects (e.g. traps) in coyotes, especially when living in a group. Mongooses, like coyotes, live in social groups with social ranks (Palomares & Delibes 1993). Some individuals could be more vulnerable to traps when they are in the central area of their home range as a consequence of their low social ranking, thus masking possible differences in susceptibility to being captured. The control of resources by dominant animals appears to force subordinates to be less conservative in acquiring resources (Johnson & Balph 1990). Transient animals could engage in more exploratory behaviour than do residents, as Metzgar (1967) found for white-footed mice. We think that further detailed and controlled experiments should be performed before definite conclusions are reached.

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