

## Conspecific tolerance and sexual segregation in the use of space and habitats in the European polecat

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Radiotracking of three couples of polecats *Mustela putorius* Linnaeus, 1758 in wetlands of western France showed that the monthly home ranges of male averaged  $0.426 \text{ km}^2$  and overlapped the females' ranges which were smaller ( $0.125 \text{ km}^2$ ). Although the distribution of polecat's localizations in the three main habitats differed significantly between the male and the female, the seasonal overlap of habitat niches ( $C_{jk}$ ) was considerable and varied from 0.727 to 0.894. The proportion of simultaneous localizations on the same square averaged 4% of monthly localizations while 96% of the localizations indicated solitary activity. Also, the duration of time occurring together was short: only 1.8 days per month on average. The observations suggested that the social organization of *M. putorius* was characterized by periodic variations of intra-specific tolerance between males and females which were probably influenced by hormonal factors during spring and by food availability during summer and autumn. A strong spatio-temporal segregation, however, determined a particularly individual exploitation of the space.

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### Introduction

The social organization of mustelids generally seems to be based on a system of a rather strict intrasexual territoriality (Powell 1979); the male defends an almost exclusive territory against other males and the female against other females. On the other hand, a male covers a larger area which most frequently overlaps that of one or several females (Lockie 1966, Erlinge 1977).

Nevertheless, most mustelids live a rather solitary life and direct interactions often remain antagonistic (Poole 1973, 1974). Social phases of life cycle, like reproduction or rearing the young, require an inhibition of the intraspecific intolerance through changes of behaviour (Peters 1984, Lode 1989, 1990).

Thus, it seemed interesting to check whether the home range overlap between males and females results from a real tolerance or whether there is a strategy of

avoidance behaviour. Radiotracking of three couples of *Mustela putorius* Linnaeus, 1758 in the marshes of western France provided information on this aspect. The aim of the study was to specify the level of tolerance and to examine the possibility of a sexual segregation in *M. putorius*.

### Material and methods

Radiotracking was done on two wetlands and on adjoining small woods in western France, Grand-lieu (47°05'N, 1°39'W) and Bribe (47°20'N, 2°10'W) (see Lode 1993, 1994). The climate is mild and humid (mean temperature between 6°C in winter and 17°C in summer, precipitation averaging 800 mm per year) influenced by the nearby ocean.

Each of three couples of polecats *Mustela putorius* (Table 1) were fitted with radio-transmitters, and tracked simultaneously. The surveys concern couples, and evidently not a female with its cubs. Localizations were obtained through triangulation with at least one localization an hour plus a localization during diurnal den using a portable receiver and a yagi antenna. Data were transferred to a square of 50 m a side to take into account the impreciseness of the technique. The area occupied by each individual was evaluated on a monthly basis by the convex polygon method (Mohr 1947) and the proportion of the space overlap was calculated. The proportion of different habitats was measured for each polecat. A description of the main characteristics of the landscape allows us to define a brief typology in three distinct habitats, ie deciduous woods, marshes, and dry meadows. No localization was found in marginal habitats such as cereal field, road, and housing, for each surveyed animal. The overlap index of the habitat niche was calculated following the Schoener (1968, 1974) formula  $C_{jk} = 1 - 0.5 \sum |P_{ij} - P_{ik}|$  in which  $P_{ij}$  was the relative proportion of each habitat in the area occupied by the animal  $j$ . The index varies from 0 (avoidance) to 1 (complete overlap). When the presence of these individual polecats was simultaneously recorded on the same 50 meters a side quadrat, it was considered that the two animals were together. The number of localizations common refers only to the animals being on the same site. The minimal duration in days, during which individuals presented at least one localization in common, was measured to give an account of occurrence together. Finally the temporal distribution of 19 observations was used to test the simultaneous presence of several individuals at the same place. These observations were made by naturalists and game-keepers, and concerned a total of 48 individuals observed. Comparisons were tested with the  $\chi^2$ , the  $U$  of Mann-Whitney or the  $H$  of Kruskal-Wallis (Siegel 1956).

Table 1. Characteristics of the 6 radiotracked polecats *Mustela putorius* in western France.

No	Males			Females				
	Body mass (g)	Number of localizations	Surveyed period (days)	Home range (km <sup>2</sup> )	Body mass (g)	Number of localizations	Surveyed period (days)	Home range (km <sup>2</sup> )
1	1250	224	83	0.824	605	276	131	0.392
2	1580	235	129	1.608	820	132	98	0.441
3	1500	306	130	1.482	680	98	49	0.338
Average				1.305				0.390
SD				0.344				0.042

## Results and discussion

### Overlap in activity areas

The home range of the males averaged **1.305 km<sup>2</sup>** (SD = 0.344) and that of females  $0.390 \pm 0.042 \text{ km}^2$ . The monthly area of activity was on average  $0.426 \pm 0.201 \text{ km}^2$  for males while the females used a significantly smaller area reaching  $0.125 \pm 0.047 \text{ km}^2$  (Table 2). These figures roughly coincided with Nilsson's evaluations (0.2-0.9 km<sup>2</sup>; 1978) or Blandford's (1.1 km<sup>2</sup>; 1987). The polecat's preference for rivers or wet areas (Danilov and Rusakov 1969, Blandford 1987, Lode 1991, 1993, Jedrzejewski *et al.* 1993) could also lead to a linear shape of the home ranges expending 3 km along the banks (Brzezinski *et al.* 1992). Under more severe climatic conditions like in the Karely or in the Swiss Alps, the home range could cover an extensive area (more than 11 km<sup>2</sup>), suggesting a kind of nomadism (Danilov and Rusakov 1969, Weber 1989). In western France the polecats tended to exploit a larger area during autumn and winter than during spring and summer ( $H = 7.16, p = 0.06$ ; see Table 2).

Range overlap between males and females reached 30.7% on average without any significant difference among the couples (males:  $H = 1.41, ns$ , females:  $H = 2.95, ns$ ). The overlap seemed more significant in spring (43%) and autumn (29.5%) than in summer (17%) or in winter (25%). An overlap of a female's range by a male has been observed in often studies in polecats (Weber 1989, Lode 1991, 1993, Brzezinski *et al.* 1992). This overlap of the areas frequented by the male and the female seems characteristic for several mustelids (Erlinge 1974, Powell 1979, Zalewski *et al.* 1995). The differences in the number of localizations show that marshes were significantly more exploited in spring (55.7) and in summer (52.6) while woods were more frequented in winter (59.4) and in autumn (48.2,  $\chi^2 = 64.7, p < 0.0001$ ). In fact, the exploitation of woody and wet areas was associated with consumption of small rodents and anurans respectively (Weber 1989, Lode 1991, Jedrzejewski *et al.* 1993, Lode 1994). In western France, the distribution of localizations in the frequented habitats significantly differed between male and female polecats ( $\chi^2 = 29.6, df = 2, p < 0.001$ ; Fig. 1) whatever the considered couple

Table 2. Seasonal variations of the monthly home ranges (km<sup>2</sup>) used by 6 radiotracked polecats in western France (number of localizations are given in brackets).

	Winter	Spring	Summer	Autumn	Mean	Mann-Whitney U-test
Males	0.629	0.261	0.300	0.494	0.426	
SD	0.177 (268)	0.141 (253)	0.114 (138)	0.018 (107)	0.201 (765)	
Females	0.124	0.110	0.100	0.125	0.125	$U = 7, p < 0.002$
SD	0.028 (71)	0.012 (110)	0.010 (87)	0.035 (238)	0.047 (506)	

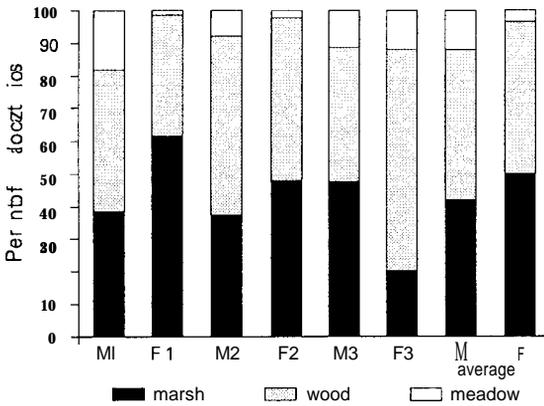


Fig. 1. Distribution of polecats' localizations considering the main habitats: marsh, wood, and meadow. M - male, F - female.

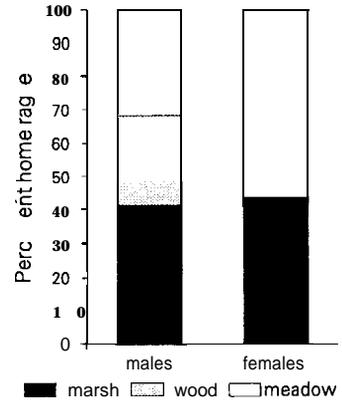


Fig. 2. Proportions of the area utilized by polecats considering the three main habitats.

(couple 1:  $\chi^2 = 51.6$ ,  $p < 0.0001$ , couple 2:  $\chi^2 = 7.52$ ,  $p < 0.02$ , couple 3:  $\chi^2 = 24.5$ ,  $p < 0.0001$ ). Nevertheless, the overlap index concerning the different habitats varied:  $C_{jk} = 0.779$  for marshes,  $C_{jk} = 0.894$  for woods and  $C_{jk} = 0.727$  for meadows, depending on the considered couple. Moreover, the proportion of habitats in the activity area did not really differ between males and females (Fig. 2;  $U = 48.5$ , ns for marshes,  $U = 41.5$ , ns for woods,  $U = 37$ , ns for meadows). Thus, it seemed that the female avoided making use of the sectors most frequented by the males. Erlinge (1974) also noticed the existence of a temporal segregation in the stoat *Mustela erminea*.

#### Common space utilization

Males and females were rarely located simultaneously in the same square (5%, 24 observations out of 453 localizations) and the average proportion of localizations with animals together represented only 4.6% (SD = 5.7) of the monthly localizations without any significant difference among the couples ( $H = 0.45$ , ns; Fig. 3). In fact, the duration of the period in which the activity took place on the same areas did not exceed 1.8 days a month (SD = 1.9) on average without a significant difference among the couples ( $H = 1.85$ , ns). The longest duration observed in summer corresponded to the communal use of the same diurnal den. This intraspecific tolerance was particularly obvious during March in western France and corresponded to the breeding period (Saint-Girons 1973, Audy 1976, Lode 1990). Nonetheless, in May and June, females once again displayed a certain cautiousness towards their conspecific polecats and did not simultaneously use the same area as the males. Such a behaviour seemed to favour the protection of the litter after the parturition. Moreover, the observation of an agonistic interaction suggests social dominance change in favour to females. In summer and the

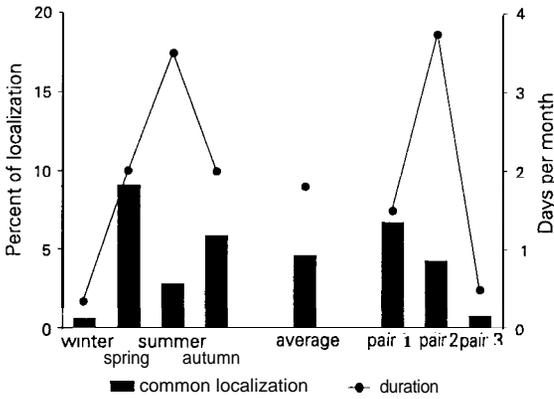


Fig. 3. Monthly proportions of localizations when polecats were simultaneously in the same square, (histogram) and mean duration in days of the common use of an area (curve line).

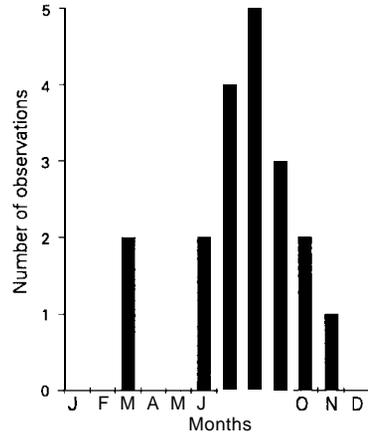


Fig. 4. Monthly variations in number of observations ( $n = 19$ ) of several polecats seen together in western France.

beginning of autumn, there was an increase of tolerance, the number of observations of several polecats together was significantly more frequent ( $H = 8.2$   $p < 0.042$ ,  $n = 19$ ). The young could live together, until autumn, with an adult female and this relationship let suppose that familial links remained during this period (Lode 1993). Pulliainen (1984) made the same observation on *Martes martes*.

In fact the increase of food resources during this period could also constitute a decisive factor. In western France summer and autumn coincided with an increase in the abundance of voles and of rabbits for the most part (Lode 1991, 1994). Thus, these periods of intraspecific tolerance were still limited in time and seemed to be linked to the influence of reproductive hormonal factors or to the increasing of trophic availabilities. Nonetheless, animals regularly showed a strategy of spatio-temporal avoidance, even between male and female. Habitat use remained very selective and the predation centered on zones of strong trophic potentialities (Weber 1989, Jedrzejewski *et al.* 1993, Lode 1994). The polecat's individualism, thus, constituted a response particularly adapted to the regular exploitation of inequally distributed out resources. It seems reasonable to conclude that this segregation of the space frequentation leads to a social organization characterized by a very individualistic strategy of environment use.

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