

## PRELIMINARY DATA ON THE SOCIAL ECOLOGY OF THE STONE MARTEN (*MARTES FOINA* ERXLEBEN 1777) IN TUSCANY (CENTRAL ITALY)

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**ABSTRACT** – A research study on the spacing patterns and territoriality of the stone marten (*Martes foina*) was carried out in Central Italy from 1990 to 1992. Twelve individuals were intensively radio-tracked in a wooded and rural area of Tuscany region. Our data seem to confirm a model of intrasexual territoriality for the species. In addition, social organization does not appear to change between different habitat conditions.

**Key words:** Stone marten, *Martes foina*, Radio-telemetry, Social organization.

**RIASSUNTO** – *Dati preliminari sull'ecologia sociale della faina (Martes foina Erxleben 1777) in Toscana (Italia centrale)* – Dal 1990 al 1992 è stata condotta una ricerca sull'uso dello spazio e la territorialità della faina (*Martes foina*) in Italia centrale. 12 individui sono stati intensamente monitorati con tecniche radio-telemetriche in un'area forestale e rurale della Toscana. Dai nostri dati appare confermato per la specie il modello di territorialità intrasessuale. Inoltre, l'organizzazione sociale non sembra cambiare in differenti condizioni ambientali.

**Parole chiave:** Faina, *Martes foina*, Radio-telemetria, Organizzazione sociale.

### INTRODUCTION

The stone marten (*Martes foina*) has always been described as solitary and non co-operative (Herrmann, 1991; Skirnisson, 1986). Available data on the species' territoriality patterns (Herrmann, 1989 and 1991; Kruger, 1990; Müskens et al., 1989; Skirnisson, 1986) show that home ranges of males can overlap with those of one or more females, but that range overlap within the same sex is limited. It has been proposed that the social organization of the species is based on an intrasexual territoriality (i.e. exclusive ranges for adults of the same sex; overlap between adults of the two sexes; sub-adults tolerated in the parents' home ranges; sensu Powell, 1979), similar to that already shown for most species of mustelids and all species of genus *Martes* (Balharry, 1993). It is still unclear whether such organization can vary in different resource conditions. Assuming that, in species showing intrasexual territoriality, intolerance (within sexes) is determined by defence of resources (food or mating partners), it is predictable that the social organization could vary between areas with different food resource availability or dispersion. In a study on pine marten (*Martes martes*) organization in different habitat and density conditions, Balharry (1993) showed that intrasexual organization appears to be

inflexible for the species, thus hypothesizing a phylogenetic rather than an adaptive origin for this social pattern.

Aims of the present study were to assess: i) if the intrasexual territoriality model is also validated by the studied population and ii) whether there is any significant difference in territoriality patterns between mating units living in different habitats and resource conditions.

As concerns the latter objective, two distinct habitats could be identified in the study area: a forested habitat, without human settlements, in which resources were mainly wild prey and berries and a rural habitat, with many potential food sources of human origin (orchards, poultry, garbage etc.) that provide abundant resources throughout the year (Genovesi, 1993).

In the present paper, we compare the social organization of martens living in the two different resource conditions, assuming that resources in the rural area are more clumped and stable, while those in the forested habitat are more dispersed and variable.

#### STUDY AREA

The study was conducted in a mainly wooded and rural hilly area (180-500 m a.s.l.) of central Italy (Tuscany region, 43°14'N, 11°11'E). Forests are mixed deciduous, Mediterranean maquis and pine plantations. Woods cover about 70% of the area and clearings about 20%. Human presence is limited to farm houses and a few small villages, located mainly in the north eastern part. The monitored animals used three adjacent but distinct portions of the area: the first is mainly forested, without any habitations; the second is mostly wooded, with the presence of a few isolated farmhouses and little agriculture (olive groves, vineyards, orchards), and the third is more rural, with several farmhouses, poultry, olive groves, vineyards, kitchen gardens, and extensive farmland (cereals, sunflowers etc.).

#### MATERIAL AND METHODS

Twelve stone martens (3 females and 9 males) were captured (Tab. 1) in self-designed cage-traps (125 X 25 X 25 cm) baited with eggs, anesthetized with Ketamine (Ketalar, Parke Davis) and fitted with radio collars (Telonics, MOD 080). Individuals were classified as adults (> 1 year old) and sub-adults ( $\leq$  1 year old) by teeth wear. As M9 and M2 were found dead during the radio-tracking period, their age was determined more accurately by cementum annuli count. Signals were monitored by means of a receiver (mod. La 12 Custom) and H hand-held and yagi four element antennas, either hand-held or set on a car.

Radio locations (fixes) were collected by triangulation from 3 or more points, and accuracy was initially tested by locating hidden collars (accepted error < 125 m). Fixes were sampled daily for each individual at various times, with intervals of 12-24 hr. Continuous observations were also conducted during which animals were located at 15 min intervals for an activity period of at least one night.

Spacing patterns were defined using 100% Minimum Convex Polygon (MCP) (5 fixes were eliminated from M11 for space use analysis because the animal was located for a few days after release in an area to which it never again returned). All locations were stored by a Geographic Information System (GIS) (ARC-INFO; Esri, Ca.). Software was implemented to define MCP and to link it with ARC-INFO. ARC-INFO was also used to map and analyze MCP sizes and overlaps.

Tab. I – Animals radio-tracked, periods of radio-tracking and samples of radio locations (fixes); M = male, F = female.

ANIMALS	AGE	RADIO-TRACKING PERIODS	DAY Tot.	FIX	FIXES FROM CONTINUOUS OBSERVATIONS	Fix Tot
M1	adult	12/21/90 - 03/15/91	85	64	363	427
M2	sub-adult	12/29/90 - 04/28/91				
		01/30/92 - 05/20/92	213	154	519	673
M4	adult	03/27/91 - 03/28/91	2	3		3
F5	adult	04/15/91 - 12/01/91				
		01/06/92 - 06/30/92	405	526	1581	2107
M7	adult	05/17/91 - 11/29/91				
		02/22/92 - 05/30/92	324	379	1312	1691
F8	adult	06/18/91 - 06/21/91	3	6		6
M9	adult	02/20/92 - 06/03/92	103	126	251	377
M11	adult	06/21/92 - 12/15/92	177	306	599	905
M12	sub-adult	08/02/92 - 09/10/92	39	66	91	157
F13	adult	09/15/92 - 10/06/92	21	171	146	317
M14	sub-adult	10/08/92 - 10/12/92	2	4		4
M15	sub-adult	09/08/92 - 11/27/92	80	94	168	262
F19	adult	06/03/93 - 08/14/93	72	118		118
TOTAL			1526	2017	5030	7047

## RESULTS

Between December 21, 1990 and October 31, 1992, 1899 fixes and 86 continuous observations were collected in 1454 radio-tracking days, for a total sample of 7353 radio locations. For all space use analysis, only those fixes with an estimated error  $\leq 125$  m were considered ( $n=6588$ ). Average MCP size, calculated only for animals ( $n=9$ ) with an adequate sample of locations ( $>150$ ), was 352.52 ha (S.D. = 224.75,  $x$  max = 778.91 ha,  $x$  min = 16.50). All MCP are shown in Fig.1.

Animal F19 was trapped and radio-tracked in 1993 (that is, in a period not included in the present analysis), but its MCP is also shown as it was considered preliminary in defining the overlap ( $> 90\%$ ) between M11 and the two females (F19 and F13) in the rural area. Extensive overlap (85.57%) was also found between male M7 and female F5 which lived in a forested area. Adult females seem to have exclusive ranges (F5 - F13; F13 - F19). Also adult males had exclusive ranges (M7 - M11), and the border between their territories seemed to be extremely well defined (MCP overlap  $<8\%$ ). Extensive overlap (95.5%) was found between M1 and M2 in 1991 (Fig.2), when the latter was a sub-adult, but with the absence of any association between the two males. When retrapped in

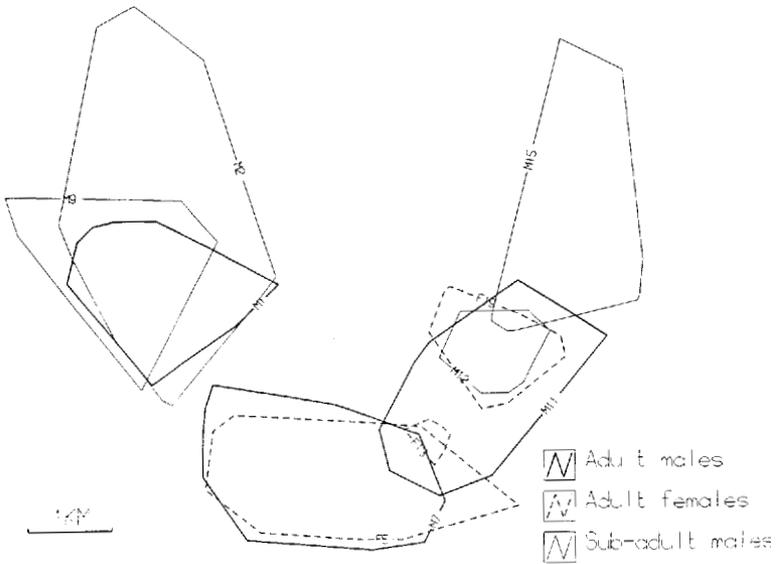


Fig. 1 – Home ranges (100% Minimum Convex Polygon) calculated for individuals with a sample of radio location > 150.

1992, M2, which could then be considered an adult, had shifted its range to the exclusive portion of the 1991 MCP. In this period we trapped another male (M9), about 1 year old, that had a range adjacent to that of M2 (Fig. 2). When M2 died (May 15 1992), M9 shifted its range to include a part of M2's, and started to use a resting site located in M2's original range.

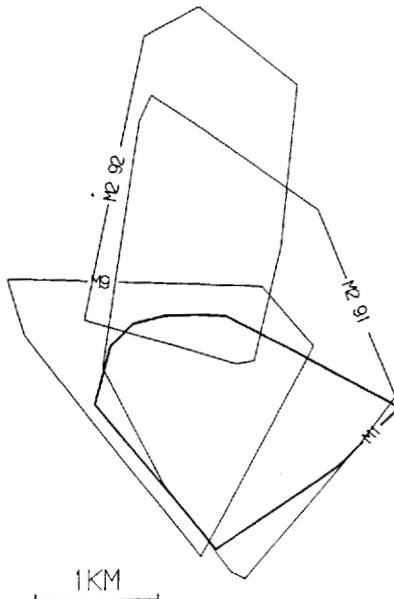


Fig. 2 – Home ranges of three males radio-tracked in two distinct periods: 1991 (M1 and M2 92) and 1992 (M9 and M2 92).

## DISCUSSION

Analysis of the territoriality patterns of low density species (as are almost all carnivores), presents a variety of problems, as it is very difficult to test parameters such as exclusiveness of ranges between individuals. In addition, it is difficult to measure resources dispersion and availability for an opportunistic species such as the stone marten, which feeds on many different items (see Clevenger, 1993 for a review). Indirect data, such as environmental characteristics, were used to identify different resource conditions, assuming that resources in a forested habitat are more dispersed than in a rural area, where food sources are more stable and clumped.

Our data show that: 1) adults of the same sex tend to occupy adjacent ranges, with limited overlap (while there is extensive overlap of home ranges between parents and their offspring up to an age of 12-18 months), 2) in one case, the death of an individual was followed by the occupation of part of its range by an adjacent animal of the same sex, 3) male ranges overlap with those of one or more females and 4) the above pattern of territoriality has been found in two mating units (1 adult male/1-2 adult females), one living in a forested area, and one living in a more rural area.

These results: i) confirm that the intrasexual territoriality model holds for the stone marten population studied, and ii) give some indications that no (or limited) variation in the territoriality pattern occurs between groups living in different resources conditions.

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