

FOOD HABITS OF THE STONE MARTEN (*MARTES FOINA*) IN THE UPPER AVETO VALLEY (NORTHERN APENNINES, ITALY)

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ABSTRACT – The diet of the stone marten (*Martes foina*) was studied analysing **63** faeces collected from February **1990** to December **1991**. The results were expressed as relative percentage of frequency (Fr%) and as percentage of mean bulk (Vm%) Mammals, mainly rodents, were the staple in the diet (annual Vm% = **62.9**) and reached a maximum peak in winter (Vm% = **79.4**). Vegetables were mostly represented by Rosaceae fruits (annual Vm% = **22.3**) and were consumed during all year round. Insects, mainly Coleoptera and Orthoptera, were fairly frequently eaten, although their volume was not remarkable (annual Vm% = **4.1**). Birds and garbage were scarcely used. The trophic niche breadth of the stone marten, evaluated using the Levin's index (B), varied from **2.49** in winter to **4.8** in summer. In the same study area the diet of the red fox (*Vulpes vulpes*) was studied. The niche overlap between this canid and the stone marten was not extensive (Op = **0.52**; Os = **0.51**).

Key words: Stone marten, *Martes foina*, Trophic niche, Feeding habits, N-Italy.

RIASSUNTO – Indagine sul comportamento trofico della faina (*Martes foina*) in alta Val d'Aveto (Appennino Ligure-Emiliano) – La dieta della Faina (*Martes foina*) è stata studiata analizzando **63** feci raccolte dal febbraio **1990** al dicembre **1991**. I dati ottenuti, espressi come frequenza relativa percentuale (Fr%) e come volume medio percentuale (Vm%), evidenziano che i Mammiferi, in particolare i Roditori, sono la componente alimentare principale (Vm% annuale = **62,9**), con maggior consumo durante il periodo invernale (Vm% = **79,4**). I vegetali, rappresentati per la maggior parte dai frutti delle Rosacee (Vm% annuale = **22,3**), sono la seconda categoria trofica per importanza e compaiono per tutto l'arco dell'anno. Gli Insetti, quasi esclusivamente Coleotteri ed Ortoteri, presentano una discreta percentuale di utilizzo (Fr% annuale = **21,2**) pur non avendo un'incidenza volumetricamente importante (Vm% annuale = **4,1**). Gli Uccelli costituiscono una fonte di cibo poco utilizzata. L'ampiezza di nicchia trofica, valutata mediante l'indice di Levins (B), variava da **2,49** (inverno) a **4,8** (estate). Il confronto dello spettro trofico della faina con quello della volpe (*Vulpes vulpes*), rilevato nella stessa area di studio, evidenzia una limitata sovrapposizione di nicchia (Op = **0,52**; Os = **0,51**)

Parole chiave: Faina, *Martes foina*, Nicchia trofica, Abitudini alimentari, N-Italia.

INTRODUCTION

The present research took place within a multidisciplinary project promoted by "Agoraie Group" of the Italian Society of Natural Sciences. Eco-ethological studies on Italian mustelids are a priority subject of research of this Group, in order to develop a suitable management of these carnivores.

This paper concerns with the feeding habits of the stone marten (*Martes foina*) in an Apennine area of the northern Italy.

STUDY AREA

The study area was part of the Aveto valley and covered approximately 160 Km². It was located in northern Apennines, between Genoa and Piacenza-Parma provinces.

Above 900 m a.s.l., the vegetation was represented by mesophylous broadleaves trees, mainly beeches (*Fagus sylvatica*), and in second order hornbeams (*Carpinus betulus*), mountain ashes (*Sorbus aucuparia*) and ashes (*Fraxinus excelsior*). At higher altitude, Ericaceae moor was widespread, mixed with blackthorns (*Prunus spinosa*), roses (*Rosa* sp.) and raspberries (*Rubus idaeus*). At lower altitude chestnut (*Castanea sativa*) and oak (*Quercus cerris*, *Quercus pubescens*) woods occurred. In addition, wild fruit-trees as pear-tree (*Pyrus* sp.), apple-tree (*Malus* sp.) and cherry-tree (*Prunus avium*) were largely present.

The study area was included in the northern Apennine range of the wolf (*Canis lupus*) and held a population of wild-boars (*Sus scrofa*). On the other hand the roe deer (*Capreolus capreolus*) occasionally occurred. The pine marten (*Martes martes*) was absent.

METHODS

Stone marten food habits were studied by faecal analysis. Scats were collected along transects coinciding with footpaths, regularly distributed within the study area; they were stored in plastic bags and frozen for their analysis. From February 1990 to December 1991, 63 scats of stone martens (17 in spring, 23 in summer, 8 in autumn and 15 in winter) were collected. During the same period 204 scats of the red fox (*Vulpes vulpes*) were gathered too. Each sample was broken and washed through three sieves with decreasing meshes size (0.5, 0.3 and 0.1 mm), in order to separate food remains. Mammals and birds were identified analysing hairs and feathers according to Day (1966) and Debrot et al., (1982); insects and fruit were determined on the basis of chitinous remains and seeds respectively.

According to Kruuk and Parish (1981) and Prigioni (1991) the results were expressed as:

a) percentage frequency of occurrence ($F\%$) = (number of faeces containing a food item on the total of faeces examined) x 100;

b) relative percentage of frequency ($Fr\%$) = (times that the same food item occurs on the total of food items) x 100.

c) percentage of estimated volume ($V\%$) = (rated volume of a food item on the number of faeces containing that item) x 100.

d) mean percentage volume ($Vm\%$) = (rated volume of a food item on the total number of faeces) x 100.

The trophic niche breadth of the stone marten and of the red fox was evaluated by using Levins' index (Levins, 1968), while their overlap was measured through Pianka's index (Op) (1973) and Schoener's index (Os) (1970). The relative frequency of each food item in the whole diet was used for calculating both indices. The components of the diet of the stone marten and of the red fox were grouped into 10 categories (see Appendix).

The Spearman rank correlation coefficient (r_s) was used to test the relationship between the consumption of main food items.

RESULTS AND DISCUSSION

The annual diet of the stone marten is shown in Fig. 1 (see also Appendix). Mammals were the main food item with a dominance of rodents. Vegetables were the second food category in order of importance and were particularly represented by Rosaceae fruits. Insects, mainly Coleoptera and Orthoptera, occurred fairly frequently in the diet, although their volume was not remarkable. Birds and garbage were scarcely used.

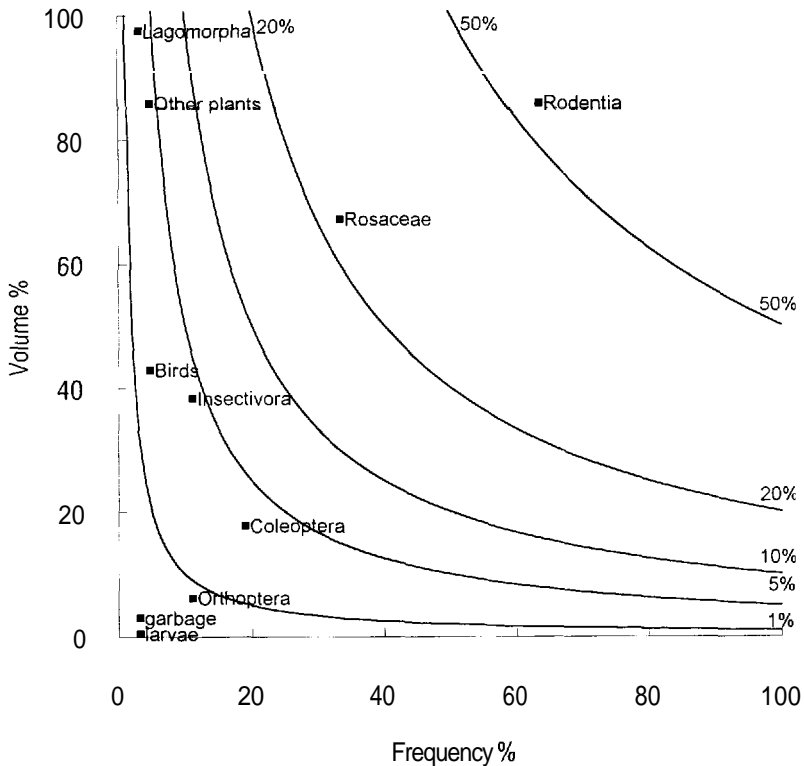


Fig. 1 – Percentage of estimated volume of the main food categories when present versus their percentage of frequency. Isopleths connect points of equal relative volume in the overall diet.

Rodents and Rosaceae fruits were taken during all seasons (Fig. 2) with a major exploitation in winter and in autumn respectively. Orthoptera were mainly consumed in autumn, Coleoptera in spring and summer. Birds, lagomorphs, insectivores and garbage were discontinuously and scarcely used.

Comparing the use of the principal food items, a negative correlation was only recorded between rodents and Rosaceae fruits ($r_s = -0.867$ $N = 8$ $P = 0.005$).

The trophic niche breadth of the stone marten and of the red fox reached the highest value in summer and in spring respectively, and the lowest in winter for both species (Tab. 1). The annual niche breadth of the red fox was lightly wider than that of the stone marten ($B = 5.83$ vs. $B = 4.24$). The niche overlap between the two species was not extensive ($Op = 0.52$; $Os = 0.51$).

Tab. 1 – Seasonal variation of niche breadth (B) in stone martens and red foxes.

	Stone marten	Red fox
Spring	4.25	7.01
Summer	4.80	5.88
Autumn	3.10	4.77
Winter	2.49	3.22
Year	4.24	5.83

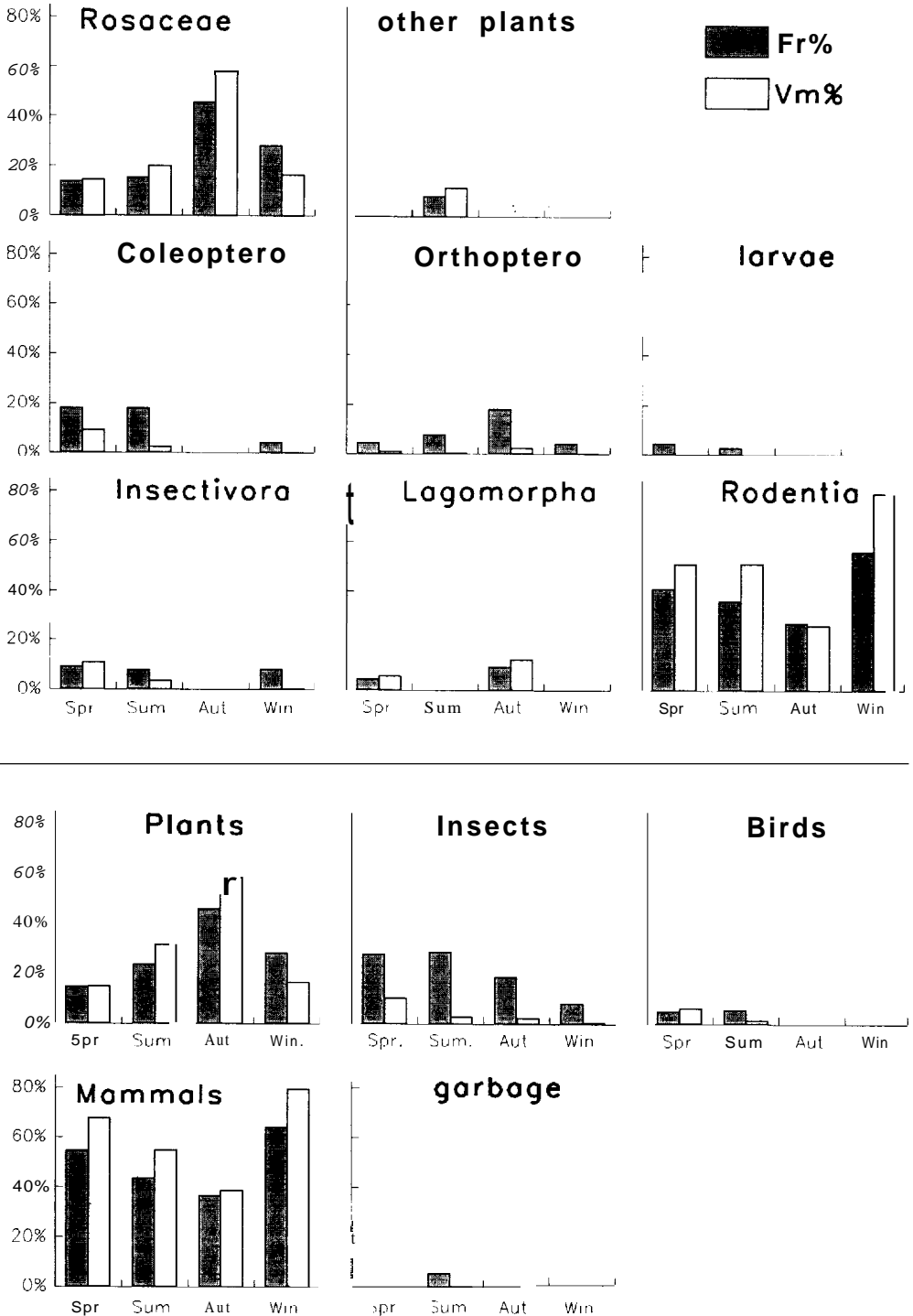


Fig. 2 – Seasonal distribution of the relative percentage of frequency (Fr%) and of the mean bulk percentage (Vm%) of the prey items eaten by the stone marten throughout the year.

The results confirmed that the stone marten is a polyphagous and opportunistic carnivore (Waetcher, 1975; Goszczynsky, 1976). Mammals, mainly rodents, represented an important protein intake throughout the year. They were partially replaced in autumn by fruits which were particularly abundant in this season, Apple and pear orchards were mainly clumped at the edge of pastures and offered a high availability of food because they had been abandoned from several years.

Insects were one of the staple resources as pointed out in several other studies (e.g. Weachter, 1975; Marchesi et al., 1989; Serafini & Lovari, 1993). On the other hand birds were scarcely preyed on. According to Goszczynski (1986) birds are taken when there is a shortage of rodents especially in winter and spring. This evidence did not seem to occur in our study area, where rodents were probably available to a large extent throughout the year.

Lagomorphs were rarely consumed by stone martens, as reported in a research on the feeding habits of red foxes carried out in an Apennine zone very close to our study area (Rosa et al., 1991).

The consumption of garbage only in summer seemed to be linked with food remains abandoned by tourists.

The trophic niche breadth of the stone marten and of the red fox was unexpectedly low, in contrast with their generalist attitude. This result was probably due to the low number of food categories used to rate the niche index (Colwell & Futuyma, 1971; Hanski, 1978; Prigioni, 1991). On the basis of the niche overlap value, competition for food resources does not seem to occur between the two species.

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APPENDIX

Food items detected by analysis of stone marten faeces. The food categories considered for calculating **B**, **Op** and **Os** indexes are in bold, * Ericaccac and undetermined plants were grouped in "other plants" category.

PLANTS

*Ericaceae

Vaccinium sp.**Rosaceae***Malus* sp.*Prunus avium**Prunus domesticu**Prunus spinosa**Pyrus* sp.*Rubus idaea**Rubus* sp.

*Undetermined plants

INSECTS

Coleoptera**Orthoptera****Undetermined larvae****BIRDS**

Passeriformes

Eggs

MAMMALS

Insectivora*Erinaceus europaeus**Sorex araneus**Sorex* sp.

Undetermined Insectivora

Lagomorpha*Lepus europaeus*

Undetermined Lagomorpha

Rodentia*Clethrionomys glareolus**Muscardinus avellanarius**Myoxus glis**Sciurus vulgaris*

Undetermined Rodentia

GARBAGE