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INFLUENCE OF SOME ENVIRONMENTAL PARAMETERS ON SMALL MAMMALS (RODENTIA, INSECTIVORA) IN THE CENTRAL ALPS

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ABSTRACT - This paper points out the relationships occurring bctwccn small mammal populations studied in some areas of the central-Western italian Alpine Arch. and some environmental parameters that characterize the Alpine habitat. The faunal data were collecterd with traps randomly placed except for Alpe Devero, where a trapping grid has been utilized.

Key words: Small Mammals, Trapping, Alpinc habitat.

Since 1986 a lot of research on small mammal populations has been carried out in certain areas of the Central-Western Alps. The examined area is very large and the data, collected so far, arc not homogeneous. For this reason a standard mapping scheme has been set up to help give a clearer picture of relationships between small mammal populations and some environmental parameters which characterize the Alpine habitat.

The study areas are:

1. Upper Scnagra Valley (CO) - Area of Environmental Importance (Chiarenzi. 1993): situated in the centre of the Lepontine Alps with a surface area of nearly 1320 ha. Its vegetation profile is alpine. The cacuminal part is exploited by sheep farmers while the lower parts are largely wooded.
2. Alpc Devero Natural Park (VB) (Erra, 1994): in the Upper Ossola Valley, between 1650 and 3200 m a.s.l. It is a typical alpine habitat with several humid areas.
3. Bregaglia Valley - Area of Environmental Importance (SO): with a harsh orography and a low anthropic impact. Its altitude varies between 450 and 1900 m a.s.l.
4. Val Masino - Val Codera (Disgrazia - Bernina System - Regional Natural Park) (Forenzi, 1994): this group lies between 730 and 2170 m a.s.l.; a typical alpine habitat.
5. Montecchi di Colico (CO) (Osio, 1994): this area includes four hills of glacial origin and is situated on the north-eastern side of Lake Como. Its particular climate allows the growth of a thermophilous, as well as hygrophilous, vegetation.
6. Mount Legnone (Cantini, 1991): the western portion of the Orobie Alps includes Mount Legnone (2610 m) arid Mount Legnoncino (1714 m): the altitude is between 700 and 2610 m a.s.l.

Faunal data were collected by trapping methods. For each study area a different technique was used. Except for Alpe Devero. where a trapping grid has been utilized, traps were randomly placed. In the Senagra Valley live-traps and snap-traps were used for 17 sites. Each trapping period lasted 1-2-nights. On Alpc Devero live-traps only were used. Twenty-five sites were monitored. 70 traps were placed in each site for a 3 night period. In Bregaglia valley both snap and live-traps were employed. They were placed for 2 nights in each of the 15 sites.

In the remaining study areas only snap-traps were used. In the Disgrazia-Bernina Group 11 sites were monitored for two consecutive trapping nights. 8 stations located at Montecchi di Colico were investigated during 2 trapping nights. Finally traps were placed on Mount Legnone in 15 sites for one night only. The Trappability Index (T.I.; Pucek, 1981) was used to compare the presence data. It was calculated as follows:

total number of captured individuals X 100/(nights during which trap operated **X** number of traps)

This formula was applied to each species and each site. The resulting percentage expresses the relationship between the number

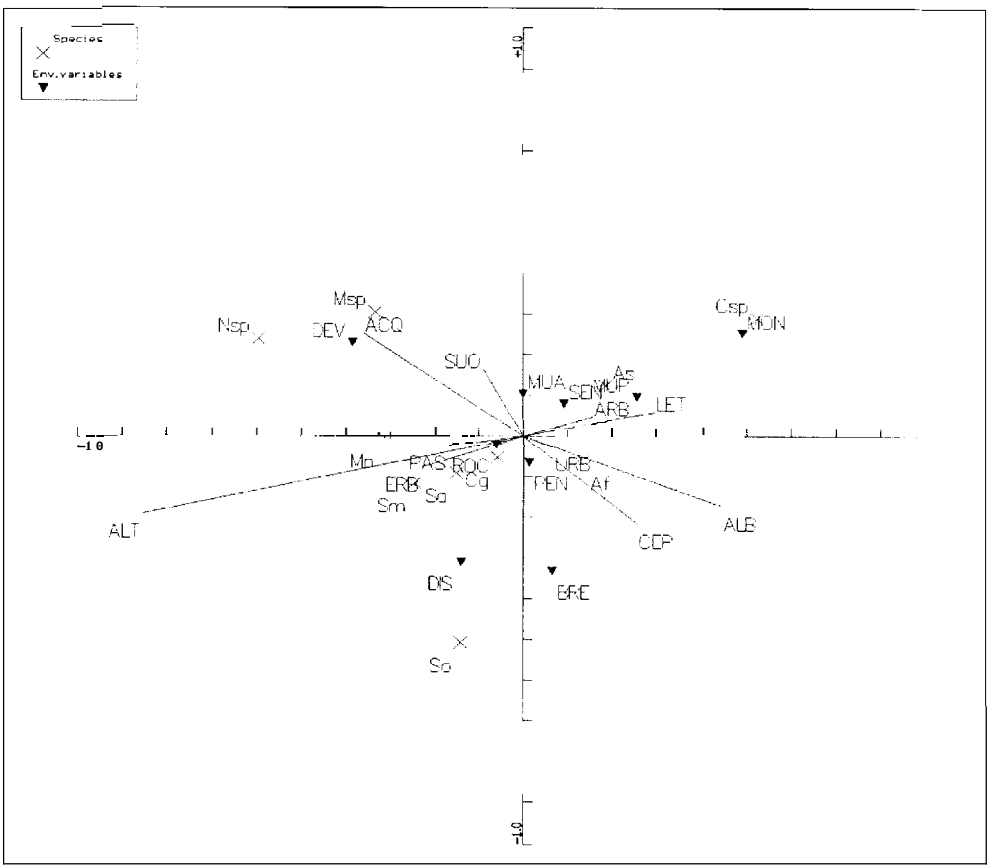

Figure 1 - CCA triplot (Smilauer 1992) which shows scores on the first an second axis. ***Species key:*** **As:** ***A.*** *sylvaticus*, **Af**: ***A.*** *flavicollis*, **Cg: C.** *glareolus*, **Mn:** *Chionomys nivalis*, **Msp:** *Microtus multiplex-arvalis-subterraneus*, **Sa**: *S. araneus*, **So:** *S. alpinus*, **Sm:** *S. minutus*, **Nsp:** *Neomys sp.*, **Csp:** *Crocidura spp.* ***Environmental variables key:*** **ALT:** Altitude; **PEN:** Slope; **ROC:** Rock cover (%); **CEP:** Stumps cover (%); **LET**: Litter coverage (%); **PAS:** Grazing; **ALB:** Tree coverage (%); **ARB:** Shrub coverage (%); **ERB:** Erbaceous coverage (%); **IJRB:** Human presence; **SUO:** Soil moisture level; **ACQ:** Water presence; **MUA:** Absence of dry stone walls; **MUP:** Presence of dry stone walls; **SEN**: Senagra Valley; **DEV:** Alpe Devero; **BRE:** Bregaglia Valley: **DIS:** Disgrazia-Bernina; **MON:** Montecchi di Colico; **LEG:** Mount Legnone.

of nights and the number of traps used and evaluates the 'sampling effort' invested for each station.

Environmental parameters were measured in the same way for each study area. Data was analysed by a multivariate method: the Canonical Correlation Analysis (Gauch 1982, Ter Braak 1988, Ter Braak 1990).

The present analysis considers 5 Insectivore taxa, 3 Arvicolidae, 2 Muridae, for a total of 809 catches (Table 1).

Ninety-nine sites and 28 environmental parameters were considered. Fig. 1 shows the ordination diagram. This diagram points out the relationship between environmental variables and species abundance data (cumulative percentage variance 49.3%). For a better understanding of species distribution, one should focus one's attention on the environmental variables that influence distribution. The first axis is mainly influenced by the altitude variable (ALT), arboreal coverage (ALB), stumps (CEP) and rock (ROC) percentages. Therefore it describes an assumptive arboreal gradient which is related to altitude. From the right to the left hand side the arboreal gradient develops from woodland surroundings -presence of shrubs (ARB) and stumps (CEP)- to zones characterized by high grass coverage (ERB and PAS). The presence of water (ACQ) and soil dampness (SUO), contrasted to the varying steepness of the slope (PEN), influences the second axis so it can be considered to be a water prcscncc gradient.

Below the relationship between species and environmental parameters are discussed.

Apodemus flavicollis (Af), being on the right of the vertical axes, shows a preference for woodland surroundings. Its position in the diagram is due to correlation to intermediate values of arboreal coverage and stumps percentage. The position of *Apodemus sylvaticus* (As), retlects different ecological preferences from those of *A. flavicollis*. In fact it is linked to high values of shrub coverage and litter presence. The fact that both species are near the origin of the axes means that all those variables do not drastically influence their ecological distribution.

As far as *Crocidura spp.* (Csp) are concerned, no theory is possible because their position reveals a strong correlation with Montecchi di Colico (MON) whcrc the greatest number of catches for this species were counted. Anyway, it is important to bear in mind that this study area has the

Table 1 - Summary of catches relative to each species and to each study area.

	Senagra Valley	Alpe Devero	Bregaglia Valley	Disgrazia Bernina	Montecchi di Colico	Mount Legnone	Total
Apodemus sylvaticus	16	19	9	5	22	60	122
Apodemus flavicollis	10	1	45	21	89	50	222
Clethrionomys glareolus	17	77	62	31	3	60	260
Microtus nivalis		26		3		10	40
Microtus sp.	6	22		1			31
Sorex araneus	3	5	7	17		6	38
Sorex alpinus			2	5			1
Sorex minutus	1	2	4	1			8
Neomys sp.		3		5			9
Crocidura suaveolens	1				13		14
	54	153	129	102	127	186	751

lowest altitude and some distinct thermoxerophilous characteristics.

The other species can be found in the left hand quadrants, and show a preference for clearings. *Sorex araneus* (Sa) and *S. minutus* (Sm) have similar environmental needs. The presence of mostly grassy areas seems to be the most important aspect.

The position of *S. alpinus (So)* demonstrates a lower ecological tolerance than that of *S. araneus* and *S. minutus*, from which it is clearly separated. Its position seems to depend chiefly on water shortage and slope steepness. Probably other unknown factors which were not considered in the present study, were important.

Neomys fodiens/anomalus (Nsp), are positioned beyond the highest value of the (ACQ) variable and are far from any other species and from the origin of the axes. This situation confirms the peculiar ecological needs of both species as well as their faunal value.

Chionomys nivalis (Mn) is strongly influenced by the gradients that are highlighted by the first axis. Its position is connected to the high value of rocks (ROC) and an intermediate value of altitude (ALT), in accordance with existing literature about this species.

Results show that *Clethrionomys glareolus* (Cg), a commonly wood-linked species, is indipendent from the variables which are typical of these environments (the arboreal coverage and the stumps percentage). This suggests that the species has a considerable ecological flexibility.

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