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Livestock exclusion: consequences on nocturnal rodents in Baja California Sur

Alfredo Ortega-Rubio, Heidi Romero-Schmidt, Cerafina Argüelles-Méndez, Rocio Coria-Benet and Francisco Solis-Marín
Centro de Investigaciones Biológicas de Baja California Sur A.C. Apdo. Postal No. 128. La Paz 23000, BCS. México.

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Resumen: Se trabajó en un área de 9 600 m^2, y dos años de antigüedad cerrada al ganado en una "isla de vegetación", de la Sierra de La Laguna de Baja California Sur. Se compararon dos conjuntos de transectos (1 000 m^2 en total): uno dentro y otro fuera del área cerrada. En seis noches consecutivas se capturó roedores usando trampas Sherman. *Perognathus spinatus* es más abundante dentro del encierro, donde la cobertura de pastos y hierbas, así como su altura son mayores. Posiblemente allí obtiene mayor cantidad de semillas (su alimento principal). Sin embargo, no existen diferencias significativas entre el número de capturas de *Peromyscus eva* adentro y afuera de la exclusión.

Key words: Baja California Sur, livestock exclusion, rodent abundance.

The absence of livestock grazing is often associated with changes on vegetation diversity and structure (Milchunas *et al.* 1988) and alterations in animal abundance including reptiles (Bock *et al.* 1990), birds (Bock *et al.* 1984), rodents and lagomorphs (Heske and Campbell 1991) and invertebrates such as ants (Heske and Campbell 1991). Livestock exclusion promotes an increase or decrease of the rodent population depending on the species (Heske and Campbell 1991).

Most work has been done at grasslands of desert and semidesert habitats (Brown and Heske 1990), and there is no previous work on two endemic rodents of Baja California Sur: *Perognathus spinatus* (Heterouridae) and *Peromyscus eva* (Cricetidae).

Most of the few works regarding these species, are concerned with their taxonomical status, their general biology and geographical distribution (Woloszyn and Woloszyn 1982).

The study was performed at Sierra de La Laguna, a mountainous complex that reaches altitudes of 2100 m. Sampling was done on a tropical deciduous forest subject to overgrazing during the last 200 years (Arriaga and León de la Luz 1989, Arriaga 1990). The livestock profoundly changed the vegetation structure and composition of a biogeographic unity: the Cape Region (Arriaga 1990).

An exclosure area comprising 9600 m^2 was established by Arriaga in 1989 at the Casas viejas study site (Fig. 1). In September of 1991 we established within the exclosure five transects 25 m long and separated 10 m from each other (total area 1000 m^2). Transects were replicated outside the exclosure 35 m away from the fences but matching the vegetation and substrate inside the exclosure.

Every 5 meters two Sherman traps baited with oats were positioned (2 m from each other). For the six consecutive nights (last week of September 1991) all transects were sampled simultaneously and individuals marked by toe-clipping.

Around each trap station characteristics listed in Table 2 were visually estimated for an area of 1 m^2. A total of 78 captures of 53 nocturnal rodents of three species were done.

Some trends are apparent (Table 1). Inside the exclosure the population density, body weight and length are greater for *Perognathus*

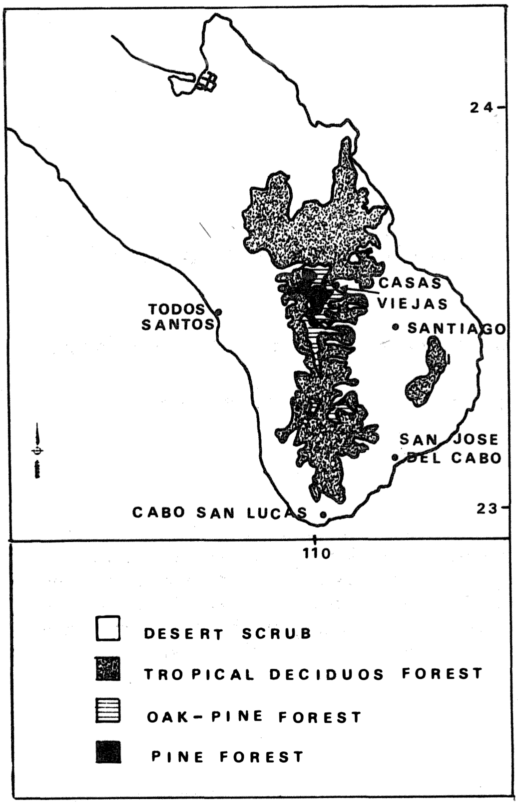

Fig.1. Localization of the study site at La Sierra de la Laguna, Baja California Sur, México.

TABLE 1

Average number and body measures of the nocturnal rodents captured inside and outside the exclosure

Species, etc.	N	Outside	N	Inside
Perognathus spinatus	11	2.250 (1.075)	26	6.500 (2.834)
Length		7.617 (0.465)		8.150 (0.135)
Weight		15.349 (2.826)		19.944 (1.803)
Peromyscus eva	9	2.250 (1.500)	3	0.750 (0.957)
Length		7.775 (0.695)		7.776 (0.177)
Weight		18.333 (4.041)		17.000 (0.724)
Neotoma lepida	2	0.500 (0.577)	2	0.500 (0.577)
Length		13.001 (4.243)		15.500 (0.364)
Weight		62.317 (6.569)		58.524 (4.242)

The number in parenthesis is the standard deviation; N, the total number of captures and t is the student test value; the first variable is the only case for which the difference is significant (t-student, $p < 0.05$).

spinatus peninsulae Merrriam. Inversely, outside the exclosure individual numbers tend to be greater for *Peromyscus eva eva* Thomas, as was body weight for *Neotoma lepida notia* Nelson and Goldman. However, only the greater abundance of *P. spinatus* inside the exclosure is statistically significant (Table 1).

There are important differences in vegetation structure and substrate availability at both sides of the fence (Table 2). Only grass and herb cover and average height (higher inside) and the proportion of nude soil cover (higher outside) are statistically significant. Previous studies have shown dissimilar results regarding nocturnal rodent's responses to livestock impact. Reynolds (1950) found *Dipodomys merriami* to be more numerous in grazed zones, while Heske and Campbell (1991) captured more individuals of several nocturnal rodents, such as *Dipodomys merriami D. ordii, Onychomys* sp and *Sigmodon hispidus*, inside exclosures.

Similarly, we found more *P. eva* outside and more *P. spinatus* inside the exclosure.

Livestock may impact rodent density indirectly by altering the species composition of the vegetation. This can reduce the protective cover for rodents and the food for insects, affecting insectivorous rodents (Heske and Campbell 1991).

On the other hand, the cattle may affect them directly by harvesting seed heads and other plant parts while grazing, thus depleting the nourishment resources of an area and competing by food directly with the rodents. Cattle could destroy rodent burrows and heavily compact the soil.

Why only one rodent population shows a significant response to livestock impact ? Answering will require a study of the rodents' food and shelter, possibly with experiments

We offer a working hypothesis: *P. spinatus* individuals are specialized in the consumption

TABLE 2

Average microhabitat characteristics inside and outside the exclosure

	Outside	Inside
Nude soil cover %	59.182 (24.408)	21.827 (18.777)
Grass and herb cover %	10.364 (8.535)	53.077 (23.588)
Grass and herb height cm	6.450 (2.773)	36.154 (21.031)
Stone cover %	24.091 (21.543)	21.250 (20.424)
Stone diameter < 20 cm	5.750 (14.930)	4.846 (3.614)
> 20 < 50 cm	2.250 (0.957)	2.692 (3.738)
> 50 cm	1.167 (3.601)	1.231 (1.922)
Fallen trunk cover %	6.361 (14.334)	3.846 (11.209)
Tree density	1.846 (0.801)	2.091 (1.424)
Number of tree species	7	8
Tree height (m)	2.919 (2.20)	3.025 (1.840)
Tree cover %	57.500 (33.961)	69.000 (38.715)

In parentheses: standard deviation, first three variables were statistically different (Chi-square, $p < 0.001$).

of seeds (Woloszyn and Woloszyn 1982), while those of *P. eva* and *N. lepida* are omnivorous (Woloszyn and Woloszyn 1982). The abundance and height of grasses and annual herbs are significantly higher inside the exclosure, probably favouring *P. spinatus*.

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