SMALL MAMMALS ASSEMBLAGES ON THE MONTE DESERT, ARGENTINA:

Relationships with habitat complexity and assemblages rules

Lic. Daniela Rodríguez
GIB-IADIZA-CONICET-CCT MENDOZA
mdrodrig@mendoza-conicet.gov.ar

INTRODUCTION

The Monte Desert Biome is the most diverse arid land in South America, mainly because of its endemic mammal species. Biotic (heterogeneity, complexity, productivity, etc.) and abiotic (temperature, precipitation, etc.) factors are likely to regulate mammal assemblage processes, and therefore the latitudinal pattern of diversity. According to current conservation and management goals, there is a big necessity to relate the scale of ecological patterns and processes to the scale at which they are described and measured.

According to habitat-heterogeneity hypothesis, high spatial heterogeneity promotes the persistence of high species richness because the limiting resources can be more readily subdivided in complex habitat. Previous studies at local scale, carried out at the Ñacuñán MaB Reserve (Monte Desert Biome, Argentina) have yielded opposite results, either positive for small mammal-heterogeneity patterns in different habitats inside the protected area, or negative (for some species) between protected and unprotected surrounding areas. Nevertheless at regional level there is no information on this pattern along a productivity-heterogeneity gradient.

Assemblage rules were proposed by Fox in 1989, and states that there is a high probability that each species entering a community will be drawn from a different genus, guild or taxonomically related group of species with similar diets, until each group is represented. These rules are now homologated to functional diversity theory, which involves the understanding of communities and ecosystems based on what organisms do, rather than on their evolutionary history. Despite its importance on structuring communities, any functional study was performed on small mammal's assemblages of Monte Desert.

Ctenomys mendocinus

OBJETIVES

The main goal of this project is to answer the question: **How does small mammal assemblage diversity change along a geographical gradient in the Monte Desert, Argentina?**

Particular objectives are: 1) to describe geographical pattern of small mammal's diversity, 2) to relate this pattern with habitat-heterogeneity and assemblage rules at different spatial scales.

This study will contribute to the understanding of the spatial distribution and assemblage of small mammals, by using a multiscale approach.

Salinomys delicatus

RESEARCH ACTIVITIES

During 2008 I completed the final phase of my PhD. project. Along this period I sampled five new localities and included them on an integrative analysis of small mammal's community of Monte Desert. Eighteen localities were sampled along a latitudinal range of 5º in Mendoza Province, Argentine (from 32º to 37º) (Fig. 1). The study area is characterized by an arid and semiarid climate, with a markedly habitat heterogeneity and patchiness.

Figure 1. Mendoza Province and sampling localities

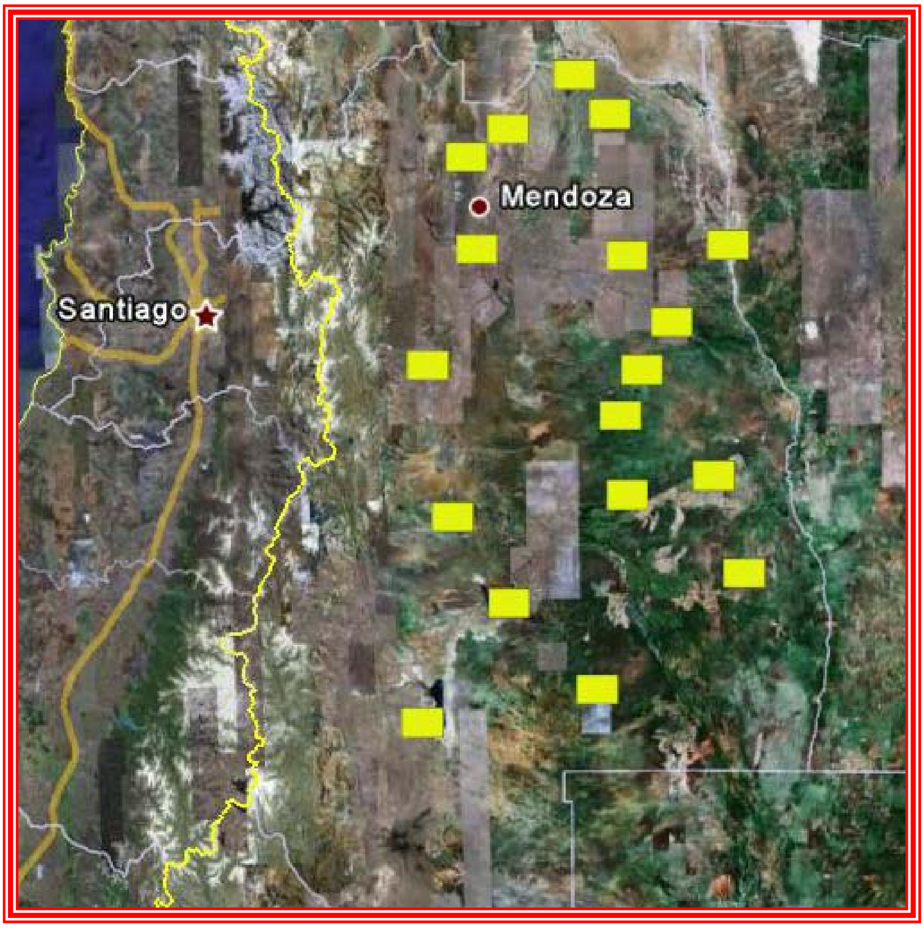


Figure 2. Habitat types of Monte desert

Sand dunes

Salt flats

Perennial river grasses

Shrub community

Creosote bush

Mesquite forest

On each locality I checked for habitats with different vegetation structure and selected six study sites, 500 m apart, inside each patch. Small mammals sampling was conducted with live capture Sherman traps. I placed 25 traps (10 m apart) along a line transect on each study site, and kept it active during 3 consecutives nights. Captured animals were marked for individual identification with picric acid, identified to species level and then released. .

For habitat description I used the modified point quadrat method, with 100 sample points along a 30-m long transect. I estimated: tree cover, shrub cover, sub-shrub cover, grass cover, herb cover, bare soil and litter cover. I placed One vegetation transect in each study site.

Graomys griseoflavus

RESULTS

A total of 411 individuals from 12 species were captured during this study. Species were: *Eligmodontia typus, Eligmodontia moreni, Graomys griseoflavus, Thylamys pallidior, Calomys musculinus, Phyllotis xanthopygus, Akodon molinae, Akodon sp., Abrotrix andinus, Salinomys delicatus, Tympanoctomys barrerae* and *Microcavia australis* (offspring). These species represent 65% of the Monte Desert small mammal richness. Total sampling effort was 23 000 night/traps and capture success was 2.6%.

A) Habitat complexity

The heterogeneity was different among habitat types, being the most complex the mesquite forest (H=1.62), followed by sand dunes (H=1.56) and shrub communities (H=1.53). Salt basins (H=1.40) and creosote bush (H=1.33) followed heterogeneity, but they had higher levels of standard deviation. Cortadera was the habitat with the lowest heterogeneity (H=0.92).

Eligmodontia moreni

B) Species diversity across a gradient of habitat heterogeneity

I structured small mammal's assemblages according to the habitat types they inhabit. The rank-abundance curves were similar throughout the gradient, showing a dominant species and a gradual proportional decrease in the rest of the species of the assemblage (Fig. 3). The richest habitat was the shrub community with 9 different species, followed by the mesquite forest (7 species). The poorest habitat was the salt basin with only three species.

Phyllotis xanthopygus was exclusive to the shrub community, whereas *Tympanoctomys barrerae* was typical of salt basins. *Graomys griseoflavus* was dominant in the mesquite forest and Cortadera, whereas *Eligmodontia typus* abundance was high at sand dunes, creosote bush, salt basins and shrub community. *Calomys musculinus* was present in mesquite forest, salt basins, shrub community and creosote bush. In all four habitats this species showed the lowest abundance, so it couldn't be analyzed comparatively. The genus *Eligmodontia* was one of the first two dominant species in five habitats, but it was absent in Cortadera.

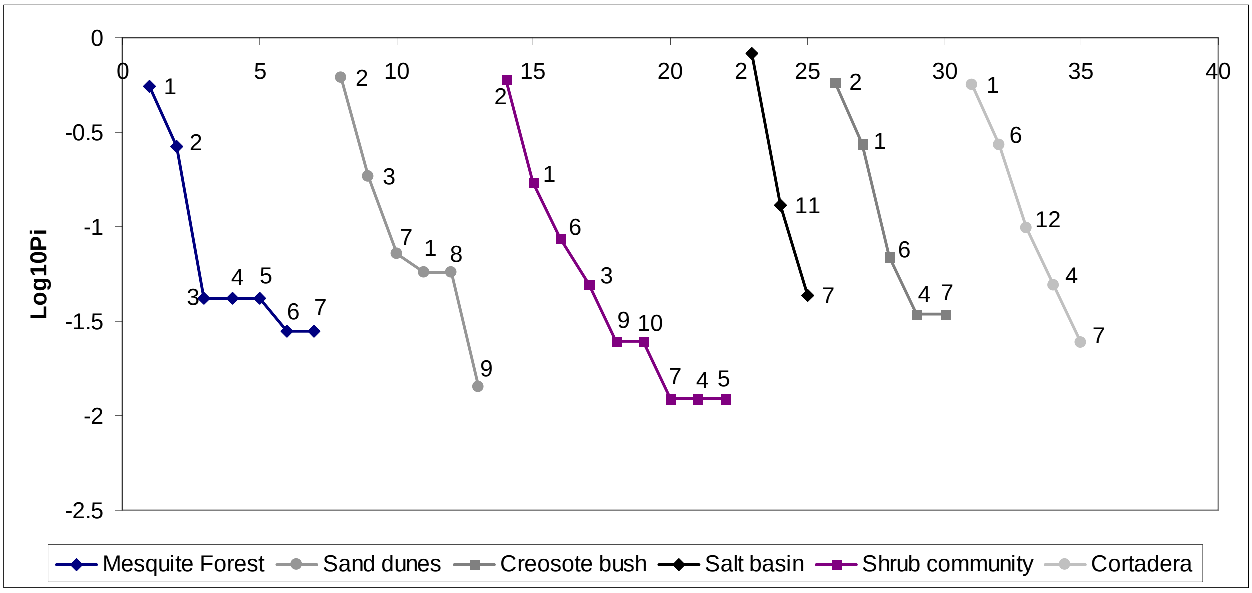


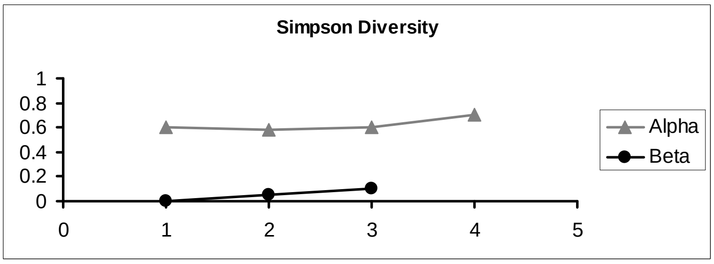
Figure 3: Rank-abundance curves for six habitat types. 1-*Graomys griseoflavus*; 2-*Eligmodontia typus*; 3-*Eligmodontia moreni*; 4-*Thylamys pallidior*; 5-*Salinomys delicatus*; 6-*Akodon molinae*; 7-*Calomys musculinus*; 8-*Abrotrix andinus*; 9-*Microcavia australis*; 10-*Phyllotis xanthopygus*; 11-*Tympanoctomys barrerae*; 12-*Akodon sp.*

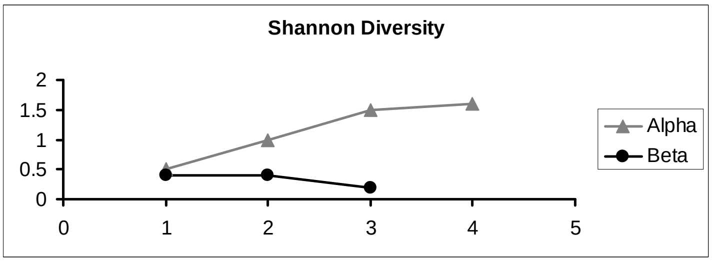
C) Changes in diversity across spatial scales

Comparing beta diversity (as total diversity between different sampling levels) with alpha diversity (within-habitat diversity) we found differents results for the first two sampling levels (habitat and locality level) depending on the index used. At habitat level, alpha and beta diversities were similar for Species Richness and Shannon-Weaver indices, whereas alpha diversity was significantly higher than beta diversity for the Simpson index. At locality level alpha diversity was higher than beta for the Simpson and Shannon-Weaver indices, but smaller for Species richness. When comparing protected with unprotected areas (3rd sampling level) alpha diversity was always significantly more important than beta (Fig. 4)

Eligmodontia typus

Figure 4. Alfa and beta diversity based on different community descriptors. 1) habitat level, 2) locality level, 3) protection level, 4) regional level





D) Test of habitat-heterogeneity hypothesis with small mammals of Monte Desert.

We test the hypothesis using four different community descriptors (species richness, abundance, diversity and evenness) and four different habitat descriptors (vertical complexity, horizontal heterogeneity, % cover by plant form, and % cover by vertical stratum) at two different spatial scales (regional and patch).

1) Regional scale

Diversity (Shannon-Weaver index) was mainly explained (60%) by habitat complexity, particularly by grasses and litter cover (91%) (Fig. 5).

Evenness (Simpson index) was also explained by complexity (80%), and particularly by % shrubs, % litter and % grasses (96%) (Fig. 6). On the other hand, abundance was explained by habitat heterogeneity (89%), and particularly by % cover of the lower stratum, % trees, and % bare soil (97%) (Fig. 7). Richness was the only community descriptor which wasn't explained by any structural variable.

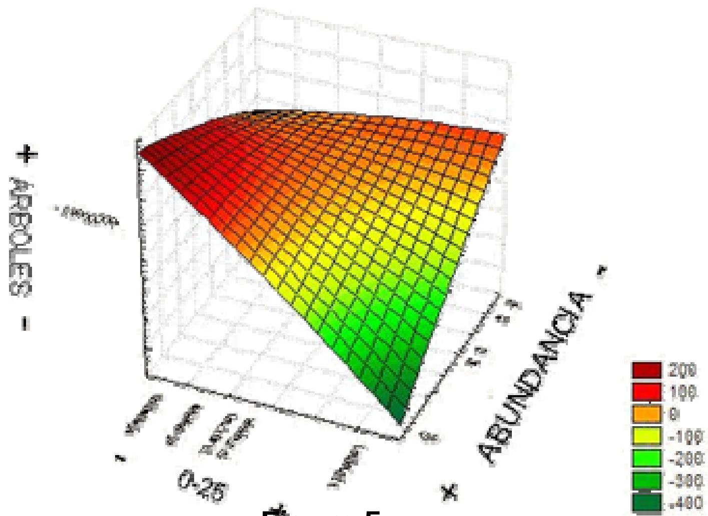


Figure 5.

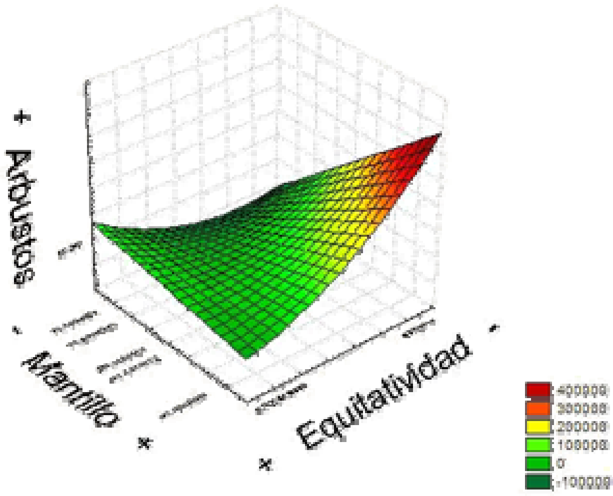


Figure 6.

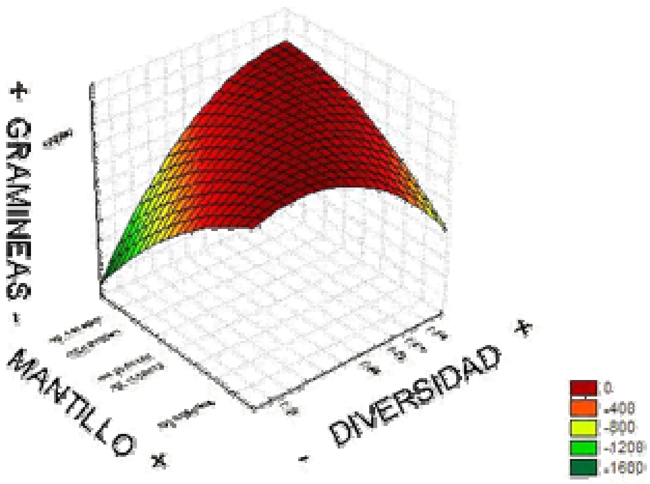


Figure 7.

2) <u>Patch scale</u>

The Observed pattern couldn't be explained by any habitat descriptor. Interspecific interactions, as well as diet or habitat selection, and particular adaptations to extreme habitats of the species involved, could control community assemblages at this spatial scale.

Tympanoctomys barrerae

E) Assemblage rules and functional diversity of small mammals of Monte Desert.

For assemblage rules, we categorized all species present in the community according to diet, habitat selection, fosorial activity, tail length, daily activity, social system, body mass, torpor and renal index. We analysed the assemblages either at regional and patch scale.

1) <u>Regional scale</u>

We compared assemblages depending on their habitat type at regional level. The most functionally diverse assemblage was salt basin, mainly because of the presence of rare species (e.i. *Salinomys delicates, Tympanoctomys barrerae*), which are specialist of this type of habitats. Follow in decreasing order mesquite forest, creosote bush, sand dunes and shrub community. The less functionally diverse habitat was “cortaderas”, the only one dominated by a perennial grass (99% of present plants).

	Mesquite forest	Shrub com.	Cortadera	Creosote bush	San dunes	Salt flat
Eveness	0.61	0.54	0.52	0.62	0.58	0.44
diet	0.21	0.19	0.26	0.18	0.22	0.27
tail lenght	0.25	0.25	0.45	0.26	0.45	0.31
fossorial	0.00	0.04	0.00	0.00	0.02	0.20
diary activity	0.00	0.03	0.00	0.00	0.02	0.20
social system	0.00	0.03	0.00	0.00	0.02	0.20
habitat	0.37	0.32	0.16	0.38	0.27	0.29
body mass	0.53	0.40	0.15	0.49	0.26	0.42
torpor	0.13	0.15	0.15	0.11	0.19	0.14
renal index	0.55	0.47	0.15	0.55	0.44	0.33
FUNCTIONAL DIVERSITY INDEX	**0.23**	**0.21**	**0.15**	**0.22**	**0.21**	**0.26**

2) <u>Patch scale</u>

At patch scale, shrub community of El Tapón and Huanacache localities were the most functionally diverse. The less diverse patches were shrub community of R153 and sand dunes of La Paz localities. Patches with only 1 species recorded were not functionally diverse.

Locality	ÑACUÑÁN		TELTECA	LLANCANELO			LUJÁN	DIVISADERO		LA PAZ		VILLAVICENCIO	SAN CARLOS	AGUA DEL TORO
habitat	SD	CB	MF	SF	SC	SD	SC	MF	CB	SD	MF	SC	SC	CB
Eveness	0.44	0.56	0.50	0.25	0.30	0.54	0.22	0.22	0.23	0.09	0.56	0.50	0.22	0.50
diet	0.15	0.21	0.27	0.25	0.18	0.29	0.05	0.06	0.06	0.02	0.14	0.22	0.05	0.26
tail lenght	0.44	0.32	0.50	0.25	0.10	0.47	0.00	0.22	0.23	0.00	0.17	0.50	0.22	0.00
fossorial	0.00	0.00	0.00	0.25	0.21	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
diary activity	0.00	0.00	0.00	0.25	0.21	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
social system	0.00	0.00	0.00	0.25	0.21	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
habitat	0.12	0.31	0.24	0.21	0.13	0.35	0.16	0.19	0.20	0.07	0.39	0.35	0.14	0.24
body mass	0.44	0.56	0.50	0.25	0.21	0.15	0.22	0.22	0.23	0.09	0.50	0.50	0.22	0.00
torpor	0.44	0.32	0.50	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.50
renal index	0.00	0.48	0.50	0.25	0.30	0.32	0.22	0.22	0.23	0.09	0.50	0.50	0.22	0.50
FUNCTIONAL DIVERSITY INDEX	**0.18**	**0.24**	**0.28**	**0.22**	**0.18**	**0.23**	**0.07**	**0.10**	**0.11**	**0.03**	**0.19**	**0.23**	**0.12**	**0.17**

Locality	R206		JOCOLÍ	PUNTA DEL AGUA		HUANACACHE			R153		San José		La Cienaguita	El tapón	
habitat	MF	SD	MF	SC	C	SD	SC	MF	SC	SC	SD	SC	CB	SB	SC
Eveness	0.66	0.44	0.75	0.64	0.54	0.48	0.64	0.31	0.07	0.46	0.53	0.67	0.64	0.44	0.63
diet	0.24	0.09	0.31	0.23	0.26	0.14	0.28	0.16	0.01	0.19	0.24	0.31	0.21	0.24	0.29
tail lenght	0.18	0.00	0.38	0.35	0.49	0.44	0.64	0.31	0.00	0.13	0.13	0.20	0.48	0.44	0.63
fossorial	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
diary activity	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
social system	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
habitat	0.35	0.32	0.38	0.48	0.17	0.21	0.44	0.21	0.05	0.21	0.24	0.29	0.39	0.21	0.43
body mass	0.58	0.44	0.38	0.49	0.14	0.10	0.64	0.31	0.07	0.26	0.26	0.37	0.48	0.44	0.63
torpor	0.32	0.00	0.38	0.00	0.14	0.00	0.00	0.00	0.00	0.34	0.41	0.49	0.00	0.44	0.00
renal index	0.58	0.44	0.75	0.49	0.14	0.48	0.64	0.31	0.07	0.36	0.44	0.57	0.64	0.44	0.63
FUNCTIONAL DIVERSITY INDEX	**0.25**	**0.14**	**0.28**	**0.25**	**0.15**	**0.15**	**0.29**	**0.14**	**0.02**	**0.17**	**0.19**	**0.25**	**0.25**	**0.25**	**0.29**

Microcavia australis “baby”

EDUCATIONAL ACTIVITIES

Scientific meetings

I’d presented two studies at the XXII Jornadas Argentinas de Mastozoología, Villa Giardino, Córdoba, in November 2008:

1) **Rodríguez D.**, V. Chillo, S. Albanese, P. Cuello, C. Lanzone, A. Ojeda y R. Ojeda. 2008. **Nuevos registros y uso de recursos de *Salinomys delicatus* en el desierto del Monte, Argentina**.
2) **Rodríguez D.** y R. Ojeda. 2008. **Estructura de hábitat y diversidad de micromamíferos del Monte a distintas escalas espaciales.**

Scientific papers

I'm writing two papers:

1) Rodríguez Daniela and Ojeda Ricardo. (in preparation). Additive partitioning as a conservation tool for protecting biodiversity at multiple spatial scales.

2) Rodríguez Daniela and Ricardo Ojeda. (in preparation). Can habitat structure address small mammal's assemblages? A multiscale approach.

Educational activities

I conducted different activities:

1) Radio diffusion on local FM stations about biodiversity loss and the importance of conservation.

2) School workshops about native and exotic fauna, and the usefulness of protected areas.

3) I organized the first Provincial Biodiversity workshop, where participated people with different social activities, as school teachers, fauna managements, scientist, university students, oil dealers, and foresters. It was promoted by Provincial Government, Biodiversity research Group, and IADIZA (Argentinian Research Institute on Arid Zones).

4) I conduct a post-graduated course titled: "Diseño de estudios de campo en biología y campos afines" (Design of field studies on biology and related areas), promoted by the University of Cuyo and its PhD. Program, and the CCT-Mendoza-CONICET.

FIELD ASSISTANTS, COLABORATORS AND VOLUNTEERS

Responsible and collaborators

- María Daniela Rodríguez (responsible)
- Verónica Chillo (collaborator)
- Pablo Cuello (collaborator)
- Agustina Ojeda (collaborator)

Field assistants and volunteers

- Rosa Perelli (Universidad Nacional de Luján, Bs.As)
- Sigrid Nielsen (UBA, Bs.As.)
- Leandro Álvarez (Universidad Champañat, Mendoza)
- Verónica Soñez (Universidad Nacional del Litoral, Santa Fe)
- Ma. Eugenia Arias (Universidad Nacinal de Santiag del Estero)
- Andrea Donello (Universidad Nacional del Litoral)
- Daniel Hernández (Universidad de La República, Uruguay)