Project for the Study and Conservation of the Sand Dune Lizard

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INTRODUCTION

The Sand Dune Lizard -SDL- (*Liolaemus multimaculatus*) is a small, diurnal, sand-dwelling liolaemid lizard, endemic to the Pampean coasts of Buenos Aires and Río Negro provinces in Argentina (Cei 1993). Due to their restricted distribution, its hypothetic low abundance and the high man-made disturbance undergone by its habitat, this lizard has been categorized as vulnerable species (Lavilla et al. 2000). Currently there are few remnants of natural dune areas that support populations of SDL. Nevertheless, only one of these areas, namely Mar Chiquita Provincial Reserve, efficiently protects one population of this lizard as a result of conservation actions (Kacoliris et al., 2006). Previous researches had demonstrated that anthropogenic factors such as habitat fragmentation and loss of native plant species in coastal dunes could be reduce the natural abundance of this lizard species, promoting local extinctions (Vega, 2001). However at the present time, available information about these lizard populations are scarce.

SDL must confront all risks associated to "small populations", "very specialized species", "species with a restricted distribution" and probably also must confront risks related to "isolated populations". There is a lack of coastal Reserves, and coastal dunes are suffering a higher human impact, principally due to coastal cities growth, summer tourism (transit of vehicles) and expansion of exotic forests. In this framework, there are some common questions: is the protection of SDL populations possible? Which are the risks that need to be reduced? How can we help SDL?

Several reasons justify the urgent necessity of increase information about SDL wild population and promote a monitoring and conservation strategy. The causes of dunes habitat loss and fragmentation are identified. Local people do not know the problematic associated with this lizard and their habitat. Finally, suitable habitats for SDL are still available. Because of that, we decided to initiate conservation actions.

Since 2006 a "Sand Dune Lizard Study and Conservation Project" is carried out. This project includes several actions like educational campaigns, researches about this species and their habitat, the promotion of management strategies for the coastal dunes habitats and the promotion of new Reserves. However, our efforts were focused on research and educational activities. Our work included field researches, educational campaigns and the making of diffusion material. Our aim is to promote the conservation of SDL and coastal habitats.

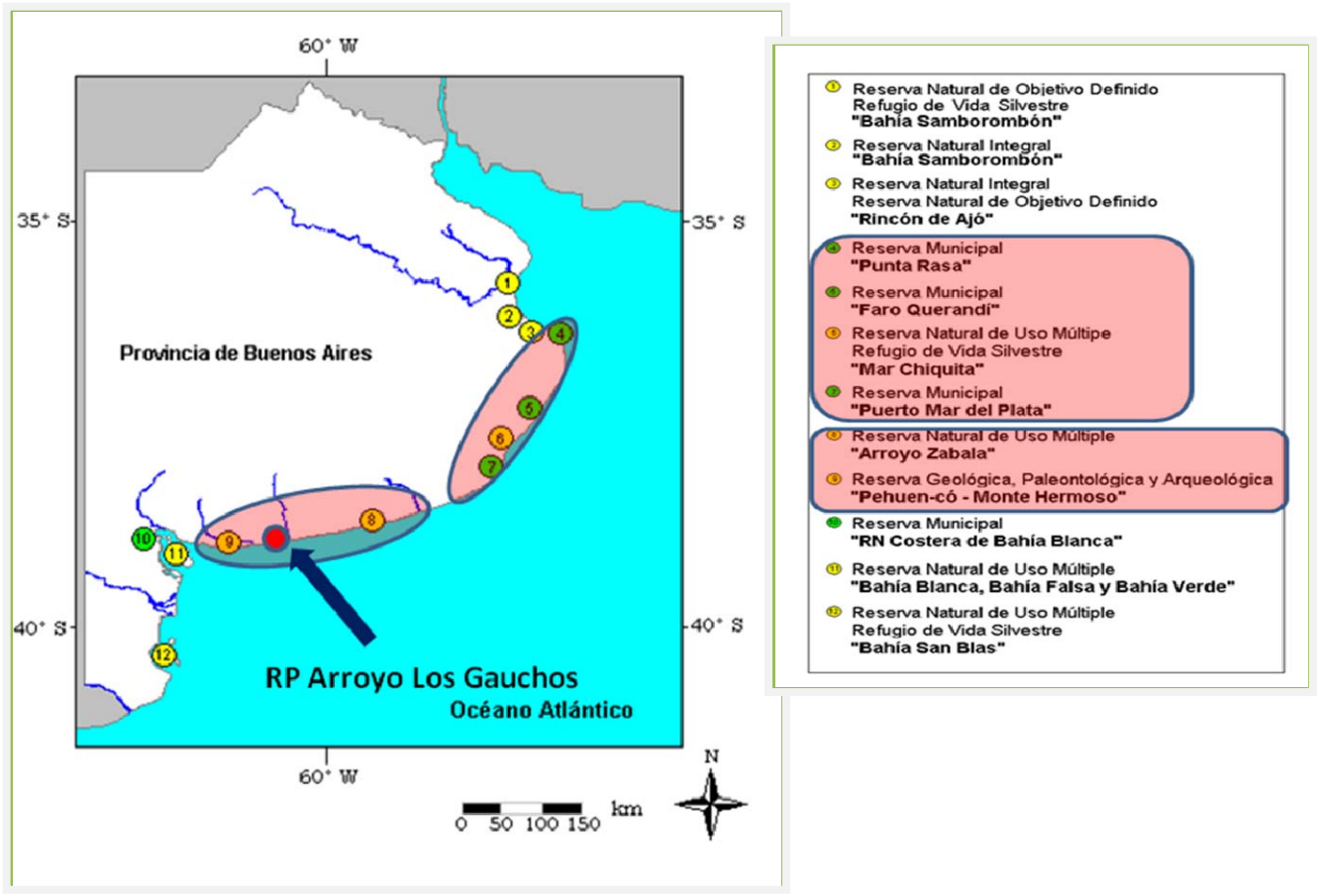
During the 2007-2008 seasons we generated new information about SDL ecology. This information is important as tool, for the management of SDL in each particular dunes site. We also made educational actions oriented to inform childrens, local people and tourists, about SDL and dunes problematic. In this report we present work, techniques and results of the SDL Study and Conservation Project between August 2007 and May 2008 in the Coastal Dunes, Buenos Aires Province, Argentina.

WORK SITES

We visited several sites placed in two large dunes sectors: (1) North-East dunes sector and, (2) South-West dunes sectors (Figure 1). These sectors are divided by a natural barrier (a hill) at the Mar del Plata city. Several sites placed on these sectors are considered as "Grassland Valuable Areas" for South America (Bilenca and Miñarro, 2004). Grassland Valuable Areas are important for Pampean biodiversity, where it is still possible to develop conservation efforts. We work principally at Buenos Aires Province because represent at least 80% of SDL distribution. Several sites had categories of Reserve, but SDL only inhabit sites 4 to 10.

Lizards also inhabit others sites, placed at both sectors, but they don't have category. Only in one of these sites, namely the Mar Chiquita Natural Reserve (site 6), conservation management actions are conducting in order to protect an important population of SDL (Kacoliris, et al. 2006). Both sectors also have other natural and human barriers like rivers, towns and cities. Mar del Plata hills clearly divide SDL populations in two isolated groups without interbreeding possibilities, and the other small barriers could be also impede the interbreeding between populations. Nevertheless more studies are necessary in order to assess the degree of isolation between wild populations of this lizard.

Figure 1. Coastal Reserves located at Buenos Aires Province. Red ellipses represent the two great dunes sectors. Small circles represent coastal Reserves whereas colors of circles represent the category of the area (give in by Celsi Cintia).



Monitoring of SDL populations were carried out in three sites placed at both large dunes sectors: Faro Querandí Municipal Reserve; Mar Chiquita Provincial Reserve (sites 5 and 6 respectively, North-East dune sector); and Marisol, located between the Arroyo Zabala and the Pehuen Có-Monte Hermoso Reserves (red circle, South-West dune sector) (Fig. 1). Nowadays Marisol could be categorized like Natural Reserve. We are working in this objective with other conservation groups, and authorities are very enthusiastic with our proposal. For this reason we decide to evaluate population status of SDL in this sector. Educational activities were made in Marisol, San Bernardo city, Mar del Tuyú city and in Monte Hermoso-Pehuen Có Reserve.

RESEARCH ACTIVITIES

SDL population size

We estimate the population size of SDL in three dunes sectors: 1) Mar Chiquita Provincial Reserve, 2) Faro Querandí Municipal Reserve and 3) Marisol. Although sectors 1 and 2 are Natural Reserves, sector 2 has human impact due to the unregulated transit of vehicles in dunes, whereas in sector 1 park rangers regulate this activity. Sector 3 has human impact due to the vehicles transit, but in less quantity than in Faro Querandí. Density was estimated using Distance Sampling techniques. We tested this method and concluded that is adequate for this species in this habitat (allowing all model assumptions). We worked with a systematic line transect design.

Transects (of 1km length) were walked by three observers until obtain a number of detections of at least 60 lizards (in order to generate robust models). However, we only obtain this number of detections in Mar Chiquita (the core area of our researches). For this reason, the Faro Querandí and Marisol results must be considered only in a preliminary way. We work in summer of 2008 under similar weather conditions. We proved several models to fit our data and selected the best (Hazard rate cosine model) based on Akaike´s Criterion (Table 1).

Table 1. Density estimations for three SDL populations. D=individuals/ha. LCI=Lower Confidence interval; UCI=Upper Confidence Interval.

	D	LCI	UCI
Mar Chiquita	3.6	2.5	5.1
Faro Querandí	4.1	2.8	6.0
Marisol	3.4	2.2	4.5

Results do not show important differences in SDL density between sectors. However, in all cases, densities were low (following Zug et al. 2001, which consider low densities those lower than 10 individuals per hectare). Population size was estimated on the basis of total dunes hectares in each site multiplied by the density of lizard (Table 2).

Table 2. Population size of SDL in each dunes sector. Ha= total dunes hectares; LCI= lower Confidence Interval; UCI=Upper confidence interval.

	Ha	LCI	UCI
Mar Chiquita	3050	7625	15555
Faro Querandí	5757	16120	34542
Marisol	5200	11440	23400

Although the three sectors have different human impact, we don't find important differences in lizard's density. These results could be indicating that: a) lizards are not highly affected by these disturbs, b) disturbs are not high enough, or c) the disturb effects are not reflected in lizard's density. More studies in dunes sectors with higher disturbs are necessary to corroborate the possible existence of any effect.

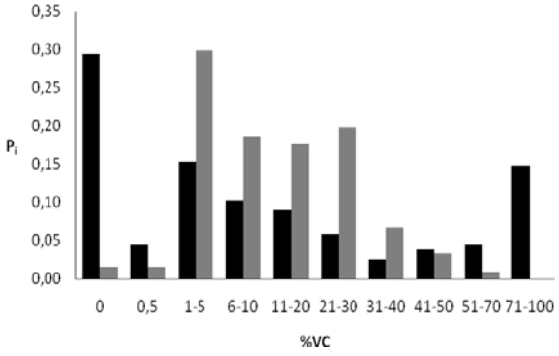
Our results showed that SDL densities are low in the three studied sites. Distance method is adequate for monitor this lizard.

SDL Habitat Use

We assess SDL preferences of some microhabitat variables like plant types, vegetation cover, and vegetation structure (shrubs size). For this aim we use a design that compares use vs availability with a chi square test and the Bonferroni confidence intervals were used in order to known how categories of each variables were used more or less than expected.

Our results showed that SDL does not use microhabitats in a random way (Figure 2). This lizard selects microhabitats with low to medium vegetation cover (between 5 to 50% VC), composed principally by herbs species. This could be related with the escape and thermoregulatory behavior. Microhabitats with high vegetation cover (>50%) impede sand bury behavior due to the sand compaction, whereas in microhabitats with lack of vegetation lizards are very exposed to predators.

Figure 2. Microhabitat availability (black columns) and microhabitat used by Sand dune lizard (gray columns). Pi= proportion; %VC= categories of vegetation cover percentages.



About vegetation structure, we find that lizards prefer shrubs higher than 1 m^3 like refuges, probably due that smaller shrub size don't be useful like refuges. However density of these refuges is lower than lizard densities and not all lizards can access to one shrub. We observed that only adults were found using shrubs, and we think that it is probable that juveniles are rejected by adults.

We also visited the Pehuen-Có and Monte Hermoso Reserve, but activities only included exhaustive searches of lizards with the aim to observe relations between SDL and *Neospartom darwini* (an endemic shrub of this dunes sector). We found lot of SDL (n=83) using this shrub species like refuges. This dunes sector is important to conserve together, the SDL and the *N. darwini* shrubs, both endemic dunes species.

Our results showed that SDL prefer microhabitats dominated by herbs species, with low to medium vegetation cover and shrubs with medium to large size.

SDL Habitat suitability

We assess the amount of suitable habitat for this lizard in a preliminary way. We categorized habitats in four categories using the ENVI software: 1) Grasslands; 2) Exotic forests; 3) Live dunes, and; 4) Interdunes. On the basis of the habitat use results, we had known that lizards only use grasslands. For this reason we evaluated the amount of grasslands in each studied site (Table 3).

Table 3. Grasslands amount in each dunes site. Ha= total dunes hectares; %Am = % amount of grasslands; TAm=total hectares of grasslands.

	Ha	%Am	Tam
Mar Chiquita	3050	19	580
Faro Querandí	5757	36	2073
Marisol	5200	23	1196

The preliminary results showed that only 3849 ha of suitable habitat exist in these three dunes sites. These sites represent the 27% of total dunes area at Buenos Aires Province. However, more analysis are need, with more accurate habitat categories, to known the total amount of suitable habitats for SDL at Buenos Aires and Río Negro provinces.

Results showed that only a 30% of the dunes represents suitable habitat for SDL.

EDUCATIONAL ACTIVITIES

Educational campaigns

We made 5 educational campaigns since July of 2007 and May of 2008.

1. San Bernardo: August of 2007. We made a meeting in a School, about SDL and dunes problematic.
2. Mar del Tuyu: November of 2007. We made a meeting in a School, about SDL and dunes problematic.
3. Marisol: December of 2007. We made a meeting with local people about the importance to designate Natural Reserve the area placed near to Arroyo los Gauchos.
4. Pehuen-Có: December of 2007. We made a meeting with local people about the need of actions oriented to protect dunes habitats.
5. Mar del Tuyu: March of 2008 We made a meeting in a School, about SDL and dunes problematic.

Scientific meetings

We made one presentation titled: "*About the actual distribution and the conservation status of Sand dune lizard in Buenos Aires province*". This presentation was exposed in the "VII Congreso Argentino de Herpetología" that was carried out in Córdoba Province (Argentina) during November of 2007.

Diffusion material

We edit diffusion posters about the problematic of SDL. These posters were distributed in several coastal cities and towns, principally in schools and communal buildings.

Scientific material

We made 4 scientific articles about SDL ecology, using previous data, and data recorded during the 2007-2008 field season. These articles were sent for publication and yet are in revision. We are working on a new paper but it will send for publication in a few weeks.

1. **Kacolirs, F. P.**; J. D. Williams; G. Sánchez Véliz and A. Rafael. Uso de cavidades en la arena por parte de la lagartija de los médanos (*Liolaemus multimaculatus*). Sending to Cuadernos de Herpetología.

2. **Kacoliris, F. P.**; I. Berkunsky and J. D. Williams. Population size of the threatened sand dune lizard (*Liolaemus multimaculatus*) in pampean coasts habitats. Sending to Amphibia-Reptilia

3. **Kacoliris, F. P.**; C. Celsi and A. L. Moserrat. Microhabitat use patterns of the Sand dune lizard (*Liolaemus multimaculatus*: Liolaemidae) in pampean coasts, Argentina. Sending to the Herpetological Journal.

4. **Kacoliris, F. P.** and J. D. Williams. Key Features of Vegetation in Microhabitats Used by Sand dune lizard (*Liolaemus multimaculatus*) from Argentina. In progress.

Sand dune lizard is an endemic and vulnerable species that inhabits coastal dunes in Argentina. Their habitats are in critical status due to human impact. Although suitable habitats are still available, populations are isolated by natural and human barriers that could be impeding lizards interbreeding. A conservation strategy is necessary to promote the protection of SDL and coastal habitats.

ACTUAL SITUATION

SDL status

Lizard densities are low, microhabitat requirements are restricted and human disturbs are increasing every year. Previous studies demonstrated that human disturb (like a road construction) on sand dunes can promote the reduction and loss of native plant species which are essential for SDL. These disturbs could promote decreasing of abundance and local extinctions of lizards by the loss and fragmentation of suitable habitats. Considering these reasons, we think that the SDL status is critical.

Needs in each study area

Mar Chiquita Reserve

Mar Chiquita Reserve is the unique site in which SDL are protected. Human disturbs are low, because park rangers work hard for regulate them. However, a lot of exotic forest exists in this area and they are in expansion. In these exotic forests, the main features of microhabitat preferred by SDL were changed. For this reason, SDL avoid these forests.

In Mar Chiquita, the main needs are to develop control strategies to reduce the expansion of exotic forests.

Faro Querandí Municipal Reserve

Faro Querandí is the larger dunes area at North-East dune sector in which SDL exist. Although this area was named Reserve, they do not have park rangers, management plans and neither conservation actions were made in this area. Disturbs are increasing year to year.

In Faro Querandí is necessary to make a strong educational campaign and to promote local authorities to regulate indiscriminate transit of vehicles in dunes.

Marisol (Arroyo Los Gauchos Reserve)

Marisol is a large dunes area in which SDL could be protected. Although that disturbs exist in this area, they are still low. Authorities are enthusiastic in making a Natural Reserve in this area, but local people do not agree yet.

In Marisol, educational activities are necessary to show local people the benefits on declaring a Natural Reserve.

Advances

During the 2007-2008 season new information was generated (about population size and microhabitat use), one method was tested to monitor SDL populations (Distance sampling method), lots of local people participated in educational activities, diffusion material was generated, new links were formed (with other conservation groups and authorities related to coastal dunes) and needs in three dunes sites were identified (one of them considered like possible place to make a new Reserve). Although a lot of work is still necessary, we think that results are goods and that SDL and coastal dunes conservation is still possible.

Future Work

We need to continue both, the research and the educational activities. SDL density monitoring must be continued and new dunes sites must be incorporated. Future researches will assess the degree of isolation of each SDL population, effect of disturbs and isolation (with a bioindicator like the fluctuating asymmetry) and evaluate differences in some behavior features (like escape behavior, closed point of approximation, etc.) between disturbed and not disturbed populations. Educational activities must be continuing with the making of diffusion material, scientific material and meetings oriented to schools and local people. We need to work hardly with authorities, in order to promote actions oriented to the regulation of some disturb activities like the transit of vehicles. We also need to evaluate the possibility of carry out a plan of reduction of exotic forests and restoration of native grasslands in some dunes sectors like the Mar Chiquita Natural Reserve. We need to explore other dunes areas in order to evaluate, in a similar way, the SDL status and the main needs to promote their protection. This information is critical to generate an integral management plan considering the needs in each sector.

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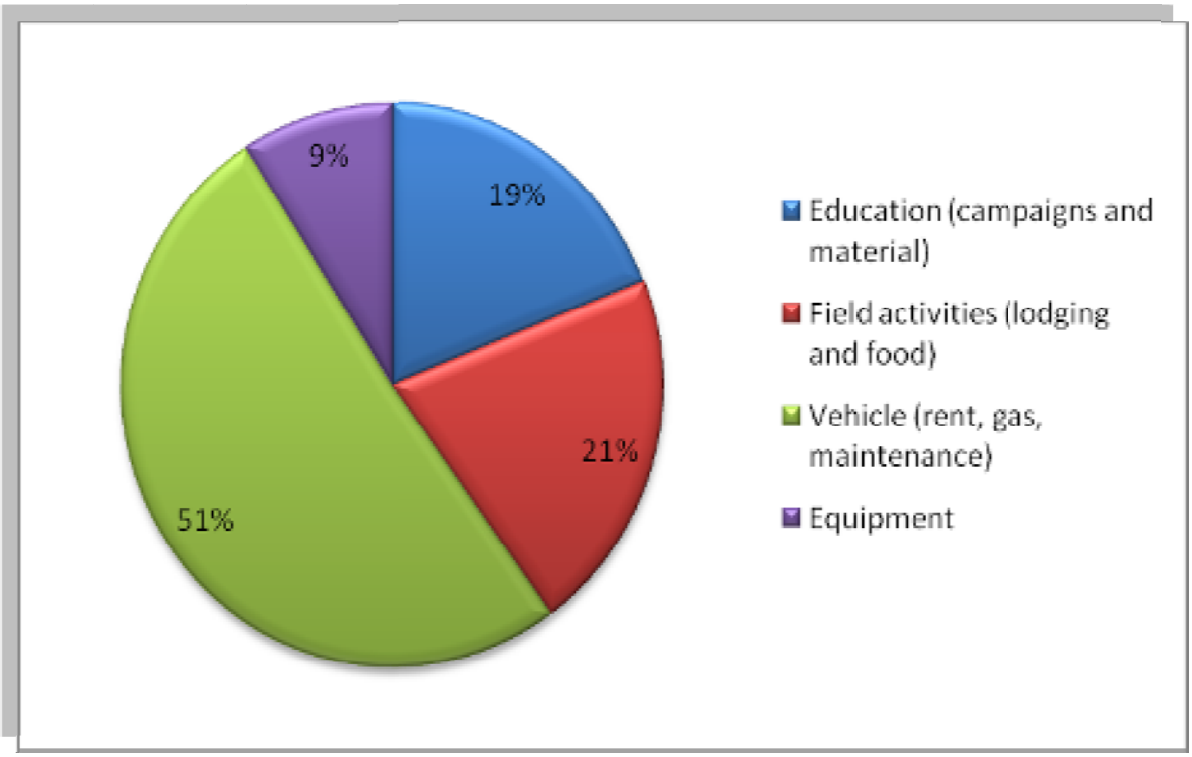
Appendix 1 – Budget (£ 2,150)



Appendix 2 – Field Crew

Responsible

- Federico P. Kacoliris

Coordinators of field activities

- Alejandro Molinari
- Alberto Rafael

Field assistants

- Gianluca Guaitoli
- Gala Sanchez Véliz

Volunteers

- Emiliano Guerrero
- Celeste Ruiz De Arcaute
- Brent Barret
- Francesca Cunninghame
- Carla Cassino
- Erika Kubish
- Cintia Celsi
- Ana Laura Monserrat