

A CONSERVATION PROPOSAL FOR MOST ENDANGERED INSULAR LIZARDS IN THE BALEARICS

MAYOL, J.¹

Abstract: Available data regarding conservation status of lizard populations from Balearic Islands, as well as threat factors affecting them are presented. Some populations are highly threatened, due to their intrinsic limitation of island surface occupied and, in addition, there are cases of viable artificial populations. Hence, we propose the translocation of a fraction of most threatened populations to islets today unoccupied by lizards. We show the criteria under which such operation could be performed.

Key words: Conservation, insular populations, lacertids, Balearic Islands.

Resumen: Una propuesta de conservación para las poblaciones insulares de lagartijas más amenazadas de las Baleares.- Se presentan los datos disponibles sobre la situación de conservación de las distintas poblaciones de lacértidos de las Baleares, y los factores de amenaza que las afectan. Considerando que existen poblaciones muy amenazadas, por una limitación intrínseca de la superficie de los islotes ocupados, y que existen casos de poblaciones artificiales viables, se propone traslocar parte de las poblaciones más amenazadas a islotes actualmente desocupados por la especie respectiva, y los criterios bajo los cuales tal operación podría ser considerada.

Palabras clave: Conservación, poblaciones insulares, lacértidos, islas Baleares.

Resum: Una proposta de conservació per les poblacions de sargantanes més amenaçades de les Balears.- Es presenten les dades disponibles sobre la situació de conservació de les distintes poblacions insulars de lacèrtids de les Balears, i els factors d'amenaça que les afecten. Atès que existeixen poblacions molt amenaçades, per una limitació intrínseca de la superfície dels illots ocupats, i que hi ha casos de poblacions artificials viables, es proposa translocar part de les poblacions més amenaçades a illots actualment desocupats per l'espècie, i els criteris sota els quals una tal operació podria ser considerada.

Paraules clau: Conservació, poblacions insulars, lacèrtids, illes Balears.

INTRODUCTION

Podarcis lilfordi is considered as EN, endangered, and *Podarcis pityusensis*, as NT, near threatened (MEJIAS & AMENGUAL, 2000; PÉREZ-MELLADO, 2002a,b), but the situation is very different if we consider the status of each

¹ Servei de Protecció d'Espècies. Conselleria de Medi Ambient Govern de les Illes Balears. Avda. G. Alomar i Villalonga, 33. Palma, 07006. e-mail: jmayol@dgmambie.caib.es

island population. For example, the last species has two abundant populations at Ibiza and Formentera islands, while the populations of *P. lilfordi* of Cabrera, Sa Dragonera and Colom islands cannot be considered as really threatened, independently of UICN criteria. Those populations have thousand of individuals and demonstrated a clear capacity to resist the presence of foreign predators (cats, rats and even genets). The legal protection of these localities assures a permanent vigilance and, in the case of negative variation in their population status, it would be detected and corrected.

We cannot forget that the largest populations of main islands of Mallorca and Menorca were extinct after human arrival to the islands. Modern extinction of insular populations is not uncommon, even if within lacertid lizards we have only few examples. During the XX century the cases of known extinct Balearic populations are:

(1) Ses Rates island in the port of Maó (Menorca Island), due to the explosion of the islet in 1935. (2) Also the population of Frares Island close to Colonia Sant Jordi (Mallorca Island) was extinct during the enlargement of the port that joined the islet with the main island, in the 1960s. (3) The same process affected the population of *P. pityusensis sabinae* (from Sabina Island, joined to the port of Formentera in the 1960s).

More doubtful is the extinction of *P. p. subformenterae*, described in 1954 from an islet between Trocadors and Formentera. The whole area is today, and probably was historically, a

peninsula, even if some years it is isolated from Formentera Island (as it could be the case when the sample of the described subspecies was collected). Thus, it is a natural and recurrent phenomenon.

Even if extinction can be a "natural" event, it is positive to try to avoid it, independently of the cause, natural or anthropogenic. As we can see below, the threat factors to lacertid lizards are related, directly or indirectly, with human activities.

The conservation of insular populations of lacertid lizards is constrained in some cases by a key factor: the surface of the island where they live. Even if, due to environmental reasons, large demographic variations can exist, some populations will be always within the category of highly endangered, on IUCN criteria. The reason is that population size, as well as the distribution range, cannot increase. In theory, it would be impossible to manage the taxon *in situ* to obtain a guarantee for its conservation.

Known risk factors for the survival of *Podarcis* at Balearic Islands

From literature, own data, and observations from other authors, we extracted the factors working against the survival of insular populations of lacertid lizards included in Table 1. Some of these factors disappeared or have a small influence in recent years. Hence, the factors that, from our viewpoint, could be important in present day at Balearic Islands are: (1) Small Carnivora: cats and genets are

Human factors	Terrariophilia and trade Scientific collection Introduction of different subspecies in islands (hybridisation) Bombing of islets during military exercises Employment of venoms
Introduced predators	False Smooth Snake, <i>Macropododon cucullatus</i> Ship rat (<i>Rattus rattus</i>) Small Carnivora (<i>Felis catus</i> , <i>Mustela nivalis</i> , <i>Genetta genetta</i> ,...)
Natural predator	Yellow-footed seagull, <i>Larus cachinnans</i> Kestrel, <i>Falco tinnunculus</i>

Table 1. Threat factors on insular populations of *Podarcis* at Balearic Islands

present in Cabrera, and sometimes cats are living in some islets. We recommend the elimination of small carnivorous mammals introduced in islands, not only for the conservation of lizards, but also for the preservation of other interesting vertebrates as Procellariiformes. (2) Rats, present in much of the major islets. Even if the Ship rat is an herbivorous species, its predation on sea birds is well documented and, at least, it can be a competitor for trophic resources. Thus, we must consider as probable the consumption of lizards or their clutches. Works of rat control or eradication are carried out to preserve breeding birds in several of the islets. Even if the anticoagulant substances employed are not dangerous for reptiles, the operations are done with traps especially designed to avoid lizard access. Obviously, *Podarcis* species are benefited from these operations.

Increase of the breeding population of the yellow-footed seagull (*Larus cachinnans*) in the Balearic archipelago is particularly serious. Its capacity of

predation over lacertid lizards is well established and, for example, we recorded five individuals of *Podarcis pityusensis* regurgitated by a chick of this species during a ringing survey in Formentera Island. This seagull, a scarce species 50 years ago in Balearics, increased its whole population at an annual rate of 13% during the eighties. From ten years ago, the population is severely controlled by means of a culling programme that maintains a Balearic population of 13.000-15.000 breeding pairs. Many years ago, this species had less trophic resources (rubbish dumps, discarded seafood from fishing boats) and the eggs were collected by fisherman. The ever-known maximum of the species was probably reached during the eighties, with 17.000 breeding pairs. Today, it is the most increasing factor against lizard populations, at least as a potential threat.

Fortunately, the worst risk factors disappeared, thanks to the strict protection of islets that includes the prohibition of joining islets and main

islands with bridges, as well as any residential or constructive employment. The bombing by the Army also disappeared, as well as their general use for shepherding, that can affect the conservation of the vegetal cover and the raise of predation by some birds of prey, as was described by Pérez-Mellado (*in litt*) at Sa Nitja islet (Menorca) by the kestrel, *Falco tinnunculus*, where, unfortunately, the presence of some goats continues. In general, there is a clear decrease in the human use of these coastal islets, except tourist presence. An important element to take into account is the automation of lighthouses. This fact affected lizard populations in two different ways. From one side, a potential danger disappeared: MARTÍNEZ-RICA & CIRER (1982) recorded the attempt of lighthouse keepers at Ses Bledes islet to eradicate the lizard population with venom. In some cases, these keepers were also

collectors, involved in the business of lizard trade (Aire Island, Menorca). Also they introduced cats and other species in islets. But from another side, the lizards from islets are very anthropophyllous and, without doubt, human occupation gave additional trophic resources to reptiles (rubbish, etc.). It is interesting that MARTÍNEZ-RICA & CIRER (1982) detected a population decrease at Bleda Plana and Porcs (Ibiza), inhabited by lighthouse keepers during the sixties and empty from the eighties.

Threatened insular populations

In any case, some populations merit a special attention. All populations with a size below 1000 individuals would be the object of conservation measures, especially if any threat factor increases their extinction risk. We resume the situation in Tables 2 and 3 (MARTÍNEZ

Island	Surface	subspecies	Treaths
El Toro	6250m ²	<i>Pl. toronis</i>	Increase of <i>L. cachinnans</i>
Margrats	97.500m ²	<i>P. l. hartmanni</i>	Increase of <i>L. cachinnans</i> and <i>R. rattus</i>
Pelada	12.500m ²	<i>Pl. jordansi?</i>	Very small islet and very poor in resources. The same subspecies lives in other islets
Esponja	3.750m ²	<i>Pl. espongicola</i>	Small population size
Bledes (Cabrera)	5.900 m ²	<i>Pl. nigerrima</i>	Very small population size
Estells de fora (2)	4.300m ²	<i>Pl. estelicola</i>	Scarce. Two populations.
Illa de l'Aire	34 Has	<i>Pl. lilfordi</i>	Uncontrolled visits. Vulnerable.
Binicodrell	5.000 m ²	<i>Pl. codrellensis</i>	Very small population size
Bledes (Menorca)	37.500 m ²		Very small population size. Breeding colony of <i>L. cachinnans</i>
Porros de Fornells	1.600 m ²	<i>Pl. porrosicola</i>	Scarce due to the small surface of the islet

Table 2. Insular populations of *Podarcis lilfordi* with less than 1000 individuals. Insular surfaces according to Bennasar *et al.* (1979)

Insular populations	43
Common populations	10
Populations threatened by hybridisation	19
Population under high human pressure	14
Population highly threatened or extinct	18

Table 3. Evaluation of conservation status of *Podarcis pityusensis* according to Martínez Rica & Cirer (1982)

RICA & CIRER, 1982). From data of these authors, and discarding those populations of erroneous descriptions or that, and according to our data, we consider the situation of this species as summarized in Table 4.

The conservation *ex situ* is a possibility: both species of lizards are well adaptable to captivity and it would be possible the dissemination of individuals from most endangered populations at zoological collections or terraria to assure their conservation. But the difficulties are important: few sites can maintain for a long period of time large populations to guarantee a suitable

genetic diversity and to act in this way on several populations is highly expensive in terms of time and money.

However, there is another possibility that merits our attention: the use of islands without present-day lizard population, where there is no risk to endanger the existence of other natural values and in similar ecological conditions as the original populations. At these islands (Table 5) it would be possible the introduction of a fraction of the original population for those more endangered. In the cases in which it would be convenient, it would be possible a previous program of captive

Island	Surface	subspecies	Validity	Threats
Alga o Puet (Formentera)	11.250 m ²	<i>P.p.algae</i>	Doubtful	Hybridisation with <i>P.p.formenterae</i> due to the change in the coastal line
Caragolé	2500 m ²	<i>P.p.caragolensis</i>	Doubtful	Scarce population
Frare d'Espartar	1000 m ²	<i>P.p.frailensis</i>	Doubtful	Very scarce population
Gastabí	12.500 m ²	<i>P.p.gastabiensis</i> (1)	Valid	Very poor habitat
Punta de Trucadors	-no island-	<i>P.p.grueni</i>	Valid	Formentera peninsula. Hybridisation
Escull Vermell	350 m ²	<i>P.p.maluquerorum</i> (1)	Valid	Very scarce population
Porcs o Pou	12.500 m ²	<i>P.p.puercosensis</i>	Doubtful	Very scarce population
Illetes de Purroig	6200 m ²	<i>P.p.purroigensis</i>	Doubtful	Very scarce population
Escull d'Espartar	2000 m ²	<i>P.p.zenonis</i>	Valid	Very scarce population

Table 4. Threatened populations of *Podarcis pityusensis*. (1): subspecies living in more than one islet

Island	Surface	Terrestrial animals present at the islet
MALLORCA COAST:		
Illa d'enmig(Illetes)	3.100m ²	Endemic Tenebrionid beetles and helicids (Gastropoda)
Salas	8.750m ²	Endemic Tenebrionids
Sec	5.000m ²	Very poor soil and vegetation
Dos pans	8.000m ²	Without endemisms. A breeding colony of <i>L.audouinii</i> in the past
Pantaleu	25.000m ²	Breeding colony of <i>Calonectris diomedea</i> and <i>Hidrobates pelagicus</i>
Sóller	31.250m ²	Breeding colony of <i>Larus cachinnans</i>
Formentor	12 has	Breeding colony of <i>Larus cachinnans</i> , and the presence of other bird species. Very large surface.
La Victòria	2.500m ²	Well protected from storms. Dense shrubland
Aucanada	22.500m ²	Well protected from storms and dense shrubland. Lighthouse. Occasionally, domestic animals.
Porros	3.125 m ²	Presence of a fossil dune. An endemic helicid from Balearics.
Aubarca	2.500m ²	Very rocky. Some breeding bird species.
Faralló des Fred	1.250 m ²	Scarce halophyllous vegetation. Small available surface.
Pontàs	1.250m ²	Very high. Difficult access
Gavina	3.750m ²	Scarce vegetation. Presence of Tenebrionid beetles from Balearics.
Galera (Palma)		Good plant cover. Without species of interest.
MENORCA COAST		
Quarentena	10.000 m ²	Presence of <i>Podarcis sicula</i> .
Cudía	12.000 m ²	Without information. Plant cover relatively good.
Fontanelles	2.500 m ²	Scarce vegetation (coastal camefits)
Binisafua	16.250m ²	Scarce halophyllous vegetation
PITIUSIC COAST		
Escull Ses Punxes (Bosc)	<500 m ²	Small rocky island with very scarce vegetation.
Vaixell(Bledes)	< 500 m ²	Islet of scarce vegetation
Pta.de ses Portes	2500 m ²	Tabular surface, soil and herbaceous vegetation
Negra sud	8750 m ²	Tabular surface, soil and herbaceous vegetation
I.Punta Grossa N	6250 m ²	Good elevation and with vegetation. Poor available information
I Punta Grossa S	3750 m ²	Good elevation and with vegetation. Poor available information
Entrepenyes	1650 m ²	No available information
Carall Bernay	1250 m ²	No available information
Escull de Llibrell	2500 m ²	No available information

Table 5. Coastal islets of Balearics without *Podarcis lilfordi* or *P.pityusensis*

breeding to diminish the extinction risk of the endangered population.

This idea raised after knowing the existence of deliberated introductions, made in some cases by scientists. We show these introductions in the Table 6.

None of the invertebrate species above mentioned are exclusive of islets devoiding lacertid lizards. Thus, the conservation of invertebrates and lacertid lizards is compatible at the same locality.

The proposal here presented would be the division of most endangered populations in two localities, to avoid the risk of collapse. The present day information is too limited to envisage a global action that, in any case, would be performed according to the following criteria: (1) Selection of most endangered populations. Detailed censuses and, in the case of a population size lower than 20 individuals, start of a captive breeding program to create a secondary population from individuals produced in captivity before translocation. (2) For each population, to choose an island destination with similar characteristics as the original

island and, preferably, in the same geographical area. (3) Prior the introduction of lacertid, to make a complete survey of fauna and flora of selected island for translocation. If we detect any species not present in the original island, such locality will be discarded for translocation. (4) Maximum number to extract from the original population will be the 25% of the population size. Preferably, all individuals will be juveniles and the sample will have a sex-ratio of 1:1 or, if biased, similar to the observed sex-ratio. (5) Starting from demographical data of original and new populations, design an artificial exchange of individuals to maintain an unique gene pool. (6) All works will be published to obtain a wide scientific audience. (7) The project will be accompanied by an informative campaign about the interest of these species to increase the knowledge of their legal protection and to avoid uncontrolled captures or introductions.

The proposal suffers from the inevitable interference with natural processes, including the spontaneous extinction of some populations that we

ISLAND	Introduction year	Origin	Presence in 2000	Reference
Illetes (Calvià)	Unknown	Ibiza	Yes	Several references
Dau gros	1930	Bledes x Ibiza	Yes	Böhme & Eisentraut (1981)
Galera	1930	Ibiza	Yes (1980)	Martínez-Rica & Cirer (1982)
Negra de Vila	1930	Ibiza	Yes	Idem
Vaixell de Bledes	1930	Ibiza	No (1980)	Martínez-Rica & Cirer (1982)
Sa Porrassa	1975?	Foradada	Yes	Unpublished

Table 6. Known introductions of *Podarcis pityusensis* and *P. lilfordi*, and their results

have to accept. It is difficult to verify if that extinction is natural, due to the indirect influence of human activities or the result of the interference with natural selection processes and genetic changes, that we consider minimized with the proposed criteria. Anyway, we think that the cautionary principle implies the assumption of risks, at least in the case of populations where a demographic decline is detected, increasing their extinction risks. As conservation professionals, we have the ethical obligation to avoid such risk.

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