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Eradication of the Brown Rat from the Toro Islets (Corsica): remarks about an unwanted colonizer

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Abstract — Between 1986 and 1988 the Brown Rat *(Rattus rattus)* was introduced onto the Toro Islets, an important place for breeding birds (Cory's Shearwater *Calonectris diomedea*, Storm Petrel *Hydrobates pelagicus*, Pallid Swift *Apus pallidus*, and other birds). The aims of this paper are: (i) to describe and discuss the method used to eliminate the rats from these islets in 1991-1992, (ii) to show the consequences of the Brown Rat's introduction on seabirds on Corsican islets. Keeping islands free from rats appears to be a major target for the conservation of seabirds in the Mediterranean.

Introduction

The Brown Rat *Rattus rattus* is known on 34 of the 125 vegetation-covered islets off Corsica (Guyot 1989, Guyot *et al.* 1992). On the Toro islets it was previously absent, at least in 1979 (Papacotsia and Soreau 1980) and 1986 (Delaugerre and Brunstein 1987), but in July 1989 rats were located on Toro Grande and Toro Piccolo (Bretagnolle and Thibault 1990). Arriving between 1986 and 1988, they were either introduced by man or they landed from a boat anchored near the islets. In 1989 their number was estimated at several tens. In 1990 a first attempt at eradication carried out from the 1st to the 9th of July, succeeded in catching 79 individuals and their density was estimated at 50 individuals per hectare (Granjon et al. 1992).

On account of the originality and great fragility of the Toro islets' flora and fauna (Lanza 1972, Papacotsia and Soreau 1980, Lanza and Poggesi 1986 and Table 1) it was decided to eradicate the rats from them. The aims of this paper are to describe the method used and to show the consequences of the presence of the Brown Rat on the composition of the fauna of flying vertebrates breeding on the islets off Corsica.

Study area and Methods

The eradication of Brown Rats was carried on on the Toros (9°23'E, 41°30'N), a group of 5 islets covering 2.6 hectares, situated in the Cerbicale Archipelago, south-east of Corsica (Figure 1). We followed Lanza and Poggesi (1986) for the toponymy. Toro Grande is separated from the mainland by 6.3 km and from the nearest islet of the archipelago by 3.9 km. Its maximum height is 34 meters. Table 2 presents some characteristics of the Cerbicale Islands. Due to its small surface area, the absence of fresh water and a limited vegetation cover, they have never been exploited by man for agriculture or pasture. As the property of the National Navy, the Toro islets have never been incorporated in the Cerbicale Natural Reserve, despite their great biological interest.

We used PVC tubes sited on the islets for the rat eradication. Each contained a solid poison bait (Coumatetralyl), held in the center by wire. The tubes were placed on December 10th 1991, and were checked during 5 visits; baits were replaced if they had been gnawed.

Results and Discussion

Tables 3 and 4 show the number of poison stations left on the islets and the percentage of baits gnawed on each visit. On the last visit, none of the baits had been gnawed and during visits in May 1992 no rat was seen at night.

Why exterminate the rat on the Toro islets?

Two species of rats *(Rattus rattus* and *R. norvegicus)* may occupy European islands. The Brown Rat inhabits numerous islands and islets in the Mediterranean (Cheylan 1984). Its diet is mainly vegetarian (Cheylan 1988), but its predation on birds has been largely underestimated. On the Toro islets, two kinds of disturbance have been noticed: (i) high

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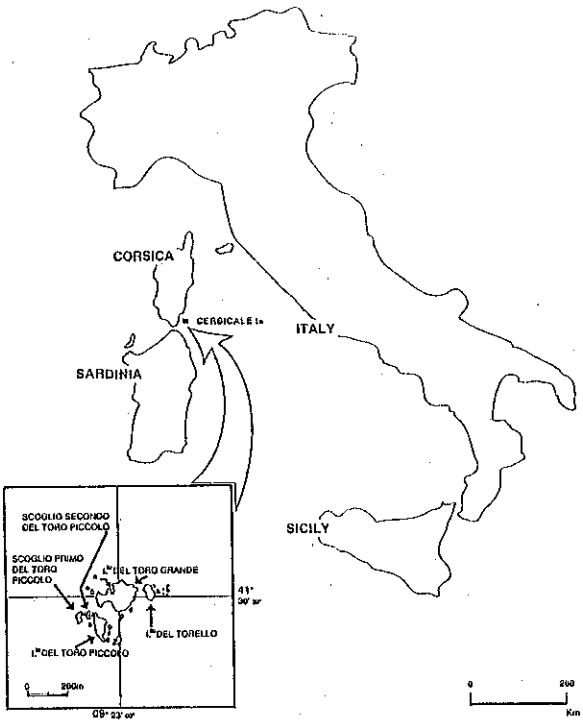

Figure 1 - The Cerbicale Islands (From Lanza and Poggesi 1986)

predation of Cory's Shearwater *Calonectris diomedea* chicks since 1988, (ii) over-grazing, especially on Toro Piccolo whose vegetation was nearly destroyed in 1991. For example, a rare plant *(Silene velutina* Pourret) which was recorded on a small number of islets (Lanza *et al.* 1983) was relatively abundant in 1988 (i.e. some tens), but in 1989 only 8 could be found on Toro Grande and none on Toro Piccolo.

A study of petrel predation by rats suggested that the birds are endangered when their weight is equal or inferior to that of rats (Imber 1975, Moors and Atkinson 1984). The mean weight of rats on Toro was 187.8g ($\pm$23.6, n = 16) for males and 164.3g ($\pm$12.9, n = 13) for females (Granjon *et al.* 1992). We may thus conclude that the rat constitutes a threat to several vertebrates on the islets, such as the Storm Petrel *Hydrobates pelagicus,* the Pallid Swift *Apus pallidus* and the European Free-tailed Bat *Tadarida teniotis,* Table 5.

Examination of the flying vertebrates list for the 125 islets off Corsica (Guyot 1989, Guyot *et al.* 1992) shows the influence of the presence of the rat (Table 5). We may notice that:

(i) the Storm Petrel and the European Free-tailed bat are significantly absent when the Brown Rat is present; Hydrobatidae are very sensitive to

Table 1 - Information on Cerbicale islands, (1) Guyot 1989, (2) Gamisans 1992, (3) after Cheylan 1988.

Islet	Presence of Brown Rat	Surface area (1) (ha)	Distance from coast (m)	Distance from rat dispersal source (m)	Number of vascular plants (2)	Number of plants eaten by brown rat (3)
Vacca	No	0.48	3.215	1.000	6	4
Forana	Yes	15.48	1.780	1.780	76	10
Maestro maria	Yes	3.2	1.600	1.600	68	12
Piana	Yes	18.49	1.600	1.600	71	7
Pietricaggiosa	Yes	4.58	2.125	2.125	46	6
Toro	No	2.6	6.300	3.9	10	4

Reference: (1) Guyot 1989, (2) Gamisans 1992, (3) after Cheylan 1988.

Table 2 - Number of flying vertebrates on Toro.

Species	Number	Reference
Hydrobates pelagicus	20-30 pairs	Bretagnolle and Thibault (1990)
Calonectris diomedea	39-55 pairs	Linard, Linard and Thibault, unpub. (1988)
Larus cachinnans	90-110 pairs in 1986, but probably increasing recently	Guyot (1987)
Larus audouinii	no breeding after 1980	Delaugerre and Thibault, in prep.
Apus pallidus	<250 pairs	Brunstein, unpub. (1986)
Tadarida teniotis	5-10 individuals	Bretagnolle and Thibault, unpub. (1989)

Table 3 - Percentage of baits gnawed et each visit.

Date	% of baits gnawed (n = 150)
16 Dec. 1991 (installation)	0
31 Dec. 1991	72
14 Jan. 1992	34
09 Feb. 1992	7.3
25 Feb. 1992	2.6
28 Apr. 1992	0

Table 4 - Number of poison stations on the Toro Islets

Locality	Number of tubes
Toro Grande	100
Toro Piccolo	42
Torello	5
Scoglio secondo del Toro Piccolo	8
Scoglio primo del Toro Piccolo	4

rats because of predation on chicks and the disturbance of adults (Moors and Atkinson 1984),

(ii) Cory's Shearwater, the Pallid Swift and the Rock Pigeon *Columbà livia* are present with a significantly higher density where the Brown Rat is absent,

(iii) there is no such relation for the Shag *Phalacrocorax aristotelis*, Audouin's Gull *Larus audouinii,* the Yellow-legged Gull *Larus cachinnans* and the Alpine Swift *Apus melba*; we may notice that (i) the period of emancipation of the chick after hatching is longer for Shags and gulls than for Storm Petrels and Cory's Shearwaters and (ii) that the Alpine Swift nests in crags which are of difficult access for rats.

Method used

Trapping with two-door boxes was carried out in 1990; the catch rate remained high after six consecutive nights (Granjon *et al.* 1992). This method proved inefficient and logistically heavy. The use of a rodenticide appears easier and more efficient (Moors *et al.* 1989), as shown by previous experience on another Mediterranean island (Daycard and Thibault 1990). Although no experiment on the resistance and effect of Coumatetralyl on the Brown Rat has been carried out in the Mediterranean, it seems to be the most efficient poison against *R. norvegicus* (Kaukeinen and Rampaud 1986), and problems of resistance mainly appear with Warfarin. The use of a solid cube inserted in the tube limits the risks of poisoning other animals. The Toro islets are too small to have a resident population of birds of prey. Although some Yellow-legged Gulls might have eaten poisoned rats, we did not find any carcasses. Edwards *et al.* (1988) discuss the risks for the fauna when anticoagulant poison is used.

Occasional presence of the Brown Rat on islets

The Brown rat has been present in Corsica since at least the 6th century (Vigne and Marinval-Vigne 1985). On Lavezzi island, it has been present since at least the 14th century (Vigne and Cheylan, in prep.), but its colonization was probably more ancient on account of the island economic importance leading to regular turnrounds of boats. The Cerbicale islands have seen limited human activity, but this was important enough to have led to the introduction of Brown Rats on all the islands except for two, Toro and Vacca. The Toro islets have never been exploited by man, but fishermen used to stop alongside them to disentangle their nets, thus occasionally allowing Brown Rats to land by swimming.

For a sample of 24 islands off Corsica, significant differences between islets with rats and those without do not appear either in relation to remoteness (Kolmogorov-Smirnov test, D = 0.30, N.S.), nor to the surface area of the island (D = 0.22, N.S.). This suggests that other factors are responsible for their arrival, such as human activities, and that the island's surface area is not the main factor leading to a successful colonization. Floristic diversity and vegetation productivity may be the main key-factors determining their success or extinction (Cheylan 1988). On Toro and Vacca, where the number of vascular plants eaten by rats is smaller than on other islands of the archipelago (Table 1), two hypotheses may be made. First, the rats have never colonized Toro islets before, but they will be able to stay after behavioural and physiological modifications (Granjon and Cheylan 1990, Granjon *et al.* 1992) and ecological adaptations (Cheylan 1988), eating for example some plants rarely used elsewhere, like *Silene velutina* (Caryophyllaceae generally not eaten, Cheylan 1988). Secondly, in the absence of good conditions for population maintainance on the islets, extinction will rapidly follow the rats' introduction; on 3 islets off the West Coast of Corsica, rats became extinct a few years after their discovery (Guyot 1989). On Toro the presence of several vertebrates sensitive to rats suggests that if colonization has previously been achieved, it was ancient and rapidly followed by extinction.

Table 5 - Comparison of density or presence of flying vertebrates between islands with rat and rat-free islands around Corsica (1) Cramp and Simmons (1977, 1983), H (2) Cramp (1985), (3) Schoeber and Grimmberger (1991). For tests we used Fisher's Exact test and Chi^2 test; N.S. = not significant, * = P<0.05, *** = P<0.001.

Species	Weight (g) (1), (2)	Test	Number of stations (3)	Remarks
Tadarida teniotis	25-50	***	9	Significantly rare or absent where rat present
Hydrobates pelagicus	28.6	**	3	Significantly absent where rat present
Calonectris diomedea	560-730	***	11	Significant lower density where rat present
Phalacrocorax aristotelis	1,760-2,154	N.S.	33	No significant relation
Larus audouinii	500-600	N.S.	9	No significant relation
Larus cachinnans	800-1,500	N.S.	29	No significant relation
Apus pallidus	41.3	***	21	Significant lower density where rat present
Apus melba	104	N.S.	6	No significant relation
Columbia livia	200-355	***	17	Significant lower density where rat present

Perspective

It was not possible to wait for a hypothetical extinction of rats on the Toro islets. The eradication of Brown Rats seemed important to ensure the conservation of several species of vertebrates, but a new colonization will always be possible, because no law forbids landing on Toro. Risks might be lessened by prohibiting landing and anchoring at less than 300 meters around the islets (see Moors *et al.* 1989).

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