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POPULATION BIOLOGY OF THE BARN OWL (Tyto alba) IN GUARICO STATE, VENEZUELA

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ABSTRACT

A demographic study of Barn Owls *(Tyto alba)* was conducted in the central prairies of Calabozo, Venezuela, from 1987 to 1989. Observations were made weekly at 30 natural and 13 artificial nest sites. Breeding occurs during the dry season, between October and March. Clutch size, mortality and breeding success were recorded. 261 chicks were banded.

Experiments were conducted to assess the degree and effect of secondary poisoning on Barn Owls through the application of anticoagulant rodenticides in the rice fields.

INTRODUCTION

In the tropics very little study has been made of birds of prey. Among these the Barn Owl *(Tyto alba)*, being a cosmopolitan species, is generally well known, but its history in the Neotropics has never been researched.

The presence of Barn owls in the rice fields, where rodent pest species are numerous, afforded an opportunity to study their biology in this region and also the effect on their population of the installation of artificial nests. We also studied the effects on them of secondary poisoning by anticoagulant rodenticides.

Artificial nests have been used in North America for reinforcing the species in many places (Marti *et al.* 1979), and Barn Owls have also been known to adopt artificial nests made for other bird species (Van Camp & Henry 1975).

As a population-limiting factor, secondary poisoning through

consumption of poisoned rodents has been studied in many raptor species. The effect of anticoagulants on warm-blooded vertebrates is to block prothrombin, producing the opposite effect of Vitamin K. This leads to consequent haemorrhaging of the organs and finally death.

In Venezuela the most commonly used commercial anti-coagulant rodenticides are Brodifacoum and Coumachlor, labelled at 0.005% and 1% active compound respectively.

STUDY AREA

The study area comprises approximately 2000 hectares at the Guarico Experimental Station near Calabozo, Guarico, Venezuela. Here there are several buildings used as laboratories, grain stores and for cattle research, together with experimental rice fields and an area of natural forest.

The region is topographically flat and the native vegetation is characteristic of tropical savannah. It lies in the irrigation system of the Guarico River, situated at 8o50' N and 67o15' W, at roughly 100m above sea level. This irrigation system is in part of the hydrographic basin of the Central Plains, where the climate is sub-humid, with an extreme shortage of water in the dry season, corresponding in Venezuela to the northern winter, whilst for the rest of the year it is excessively wet.

METHODS

The study began in 1987. Research sites were selected where the owls could be observed constantly at resting places and nest sites.

Visits were made systematically over two consecutive years, based on the fixed dates system for the 52 weeks of the year. Data were collected on the number and sex of adults, their weight, clutch size, hatching rate, weight of young etc. The adults were trapped and banded on the left foot, the young on the right foot at four weeks of age.

Thirteen artificial nests were erected, made of wood and measuring 0.5 x 0.5 x 0.5m with an entrance of 0.2 x 0.2m. These were placed on trees and buildings and were kept under observation simultaneously with 30 natural nests. In 1988 four of the wooden nests were replaced by plastic ones.

In December 1988 18 owlets were collected from a rice farm near the study area and taken to the Central University Laboratories at the Agricultural Zoology Institute at Maracay. The birds were permitted to stabilize and adapt to the new conditions – a maximum temperature of 35oC and a minimum of 20oC – and fed on mice *(Mus musculus)*.

The bioessay consisted of feeding each owlet with one mouse per day.

These mice had been poisoned for 1, 2, 3, 4 or 5 consecutive days with Brodifacoum or Coumachlor, with a dosage of 0.005% for the former and 0.082% for the latter. There were two groups of five owls each, one for each rodenticide. The reckoning of survival time began after consumption of the first mouse. If after 15 days an owl had not died, it was offered an additional mouse which had been poisoned to the same degree as the first one, with a view to proving the cumulative effect. The weight of the poison consumed, the weight of the mice, the initial and final weights of the owls plus the number of days before they died were documented and subsequently autopsies were performed.

RESULTS

We found that the Barn Owl breeding season in Calabozo, Venezuela, is from late October to early March, corresponding with the dry season, at which time the population is at its peak.

In the two years' study we recorded (Table 1) a total of 427 eggs in all nests, with 267 in the first season (1987-88) and 160 in the second (1988-89), of which 177 and 120 hatched respectively. We recorded an average of 31 + 0.76 days of incubation and the young left the nest after 61.7 + 6.9 days. Thus the owlets remain in the nest for a rather long time, retaining their juvenile feathers for between eight and ten weeks.

Out of the total number of chicks hatched, 30 died before being of age to be banded (four weeks) in the first season, and 11 died in the second, giving rates of survival beyond four weeks of 83% and 90.8% respectively.

Nestlings attained adult weight of *ca.* 550 grams between 25 and 35 days after hatching.

The maximum population observed for each season was 157 owls in 31 nests during the fourth week of 1988 and 129 in 20 nests during the fifth week of 1989. The minimum population in the region during the rainy season – April to October – was 12 pairs in both years.

Based on an observed sex-ratio of four females to one male, we found a replacement rate of 3.81 female young per brood in the first year and 3.83 in the second.

During the first season of this study, eight females produced double clutches, but only one in the second season. One banded female born in 1988 bred already in 1989, laying two eggs, showing that females can reproduce one year after birth. We found the average clutch size to be 7.8 eggs in natural nests and 6.3 in artificial nests.

Throughout the study period, 45 natural and 12 artificial nests were used

out of a potential 60 and 20 respectively. The number of eggs laid in natural nests was higher than in artificial nests; also the number of broken eggs was higher in natural nests, indicating that artificial nests provided better protection for the eggs.

The number of eggs hatched and young banded were similar in both cases. Mortality after banding (i.e. after four weeks) was greater in natural than in artificial nests, but the number of owlets that died before banding was greater in artificial nests. This may not be significant, however, since competition from bees at that time caused the deaths of eight chicks. (In California, artificial nests on trees have had a high level of occupation but low success rate due to human disturbance and competition from bees Apis *melliphica* (Marti *et al.* 1979)).

The major causes of mortality in eggs and chicks were predation and accidental falls from perches. We deduced a further factor, however, from the large number of dessicated corpses found in the fields. This led us to consider poisoning by anti-coagulant rodenticides, so we accordingly sought to test the effects on Barn Owls taking mice which had ingested poisoned bait. Tables 2 to 5 give the results of our tests with Brodifacoum and Coumachlor. The mice were fed on poisoned bait *ad libitum,* resulting in an aleatory amount of poison consumed. The owls lost weight after consumption of these mice. The time they took to die did not depend on their initial body weight, nor on the amount of Brodifacoum ingested over 1 ppm (mg/kg) per body weight, nor on the amount of Coumachlor ingested over 10 ppm per body weight.

Whereas the total amount of rodenticide ingested was similar for both products, this was not true of the total amount of active compound, where Brodifacoum is ten times stronger on average than Coumachlor and halved the length of survival time.

Post mortem studies showed different degrees of haemorrhaging in the owls:-

1. Gradual, slow haemorrhaging, with deep organic congestion but skin and muscles little affected.

2. More severe haemorrhaging with, slight organic congestion, except for the heart, with skin and muscles more affected.

3. Very severe haemorrhaging, with slight organic congestion except for the heart (destroyed), and with skin and muscles badly effected. There were hematomas in the areas of high blood irrigation.

Of the 18 owlets collected in December 1988, three died a few days after arrival at the laboratories, the autopsies showing Type 2 above of haemorrhaging and damage.

Townsend *et al.* (1981) reported that Coumachlor, when administered directly to the Short-eared Owl *(Asio flammeus)* and Galapagos Hawk *(Buteo galapagoensis)*, was toxic, inducing death, but there was no evidence of secondary poisoning when rats infected with Coumachlor were fed to these two species.

CONCLUSION

We conclude that, at least in the high-temprature weather conditions in Venezuela, these results point to a strong risk of secondary poisoning and mortality caused by anticoagulant rodenticides and that further research is needed.

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TABLE 1: Total reproductive effort and mortality rates of Barn Owls during a two-year study in Calabozo, Venezuela.

	SEASONS	
	FIRST	SECOND
Eggs Laid	267	169
Hatched	177	120
Eggs Failed	90	40
Nestlings Died	41	14
Egg Mortality	33.33%	25.00%
Nestling Mortality	23.16%	11.67%

TABLE 2: Brodifacoum anticoagulant rodenticide (at 0.005%) consumption by mice (Mus musculus) fed to Barn Owls.

NUMBER OF DAYS CONSUMING POISONED BAIT	WEIGHT OF MOUSE (grams)	TOTAL AMOUNT OF COMMERCIAL PRODUCT INGEST (grams)	TOTAL AMOUNT OF ACTIVE POISON CONSUMED (mg)
1	28.50	5.00	0.25
1	24.00	4.50	0.22
2	28.50	9.50	0.47
3	33.00	12.00	0.60
4	25.00	11.00	0.55
5	25.00	11.00	0.55

TABLE 3: Effect of Brodifacoum anticoagulant rodenticide (0.005%) on Barn Owls fed poisoned mice.

OWL WEIGHT		MICE POISONING TIME (days)	WEIGHT (ppm) OF POISON INGESTED BY OWL	OWLS' SURVIVAL TIME (days)
INITIAL	FINAL			
298.00		1	0.83	
308.00	254.00	1	0.77	22
343.00	325.50	2	1.38	6
268.00	256.00	3	2.23	6
377.50	366.00	4	1.45	5
333.00	252.00	5	3.75	4

TABLE 4: Coumachlor anticoagulant rodenticide (0.082.%) consumption by mice (Mus musculus) fed to Barn Owls.

NUMBER OF DAYS CONSUMING POISON	MOUSE WEIGHT (grams)	TOTAL AMOUNT OF MIXED COMMERCIAL PRODUCT INGESTED (g)	TOTAL AMOUNT OF ACTIVE POISON CONSUMED (mg)
1	30.00	5.50	4.51
2	24.00	4.50	3.69
2	37.00	3.50	2.87
3	24.00	7.00	5.74
4	37.00	13.00	10.66
4	37.00	13.50	11.07
5	37.00	14.00	11.48
5	42.00	13.00	10.66

TABLE 5: Effect of Coumachlor anticoagulant rodenticide (0.082%) on Barn Owls fed poisoned mice.

BARN OWLS WEIGHT (grams)		MICE POISONING TIME (days)	INGESTED POISON TO BARN OWL BODY WEIGHT (ppm)	OWLS' SURVIVAL TIME (days)
INITIAL	FINAL			
271.00	259.00	1	16.64	5
371.00		2	9.94	
293.00	228.00	2	9.79	29
337.00	330.00	3	17.03	12
308.00		4	34.61	
284.00	233.00	4	38.97	23
314.00		5	36.56	
279.00	249.00	5	38.30	21

European Black or Cinereous Vulture soaring. Photo: B.-U. Meyburg