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ROADSIDE RAPTOR SURVEYS IN CENTRAL ARGENTINA

ALEJANDRO TRAVAINI*[1], ALEJANDRO RODRIGUEZ[1], OLGA CEBALLOS[2], JOSÉ A. DONAZAR[1] AND FERNANDO HIRALDO[1]

RESUMEN.- Recuento de aves rapaces por carretera en Argentina central. Durante oct 1992 se realizaron conteos en carretera de rapaces a lo largo de 2230 km, en una región central de la Argentina. Fueron detectadas 16 (80%) de las 20 especies presentes (incluyendo jotes). La especie más común fué el Chimango *Milvago chimango* (n=1397), seguida del Gavilán Caracolero *Rostrhamus sociabilis* (n=191), y del Carancho *Polyborus plancus* (n=66). La abundancia del Chimango parece estar relacionada positivamente con el nivel de alteración humana del ambiente, alcanzando valores máximos en las afueras de la ciudad de Buenos Aires. La diversidad de rapaces fue máxima en zonas arbustivas y estepas de la Pampa Seca y el N de la Patagonia.

INTRODUCTION

Roadside surveys can be useful to examine relative abundance, density, habitat use and perch preference (Diesel 1984, Fuller and Mosher 1987) and have been widely employed to describe species composition and relative abundance of raptors in poorly known areas (see review in Ellis *et al.* 1990, Donazar *et al.* in press). Surveys also permit monitoring changes in raptor numbers over time (Mathisen and Mathisen 1968, Wotzkow and Wiley 1988). However, these comparisons require similar routes of travel and observation methods in each survey.

Here we report the results obtained in raptor roadside surveys carried out in 3 provinces of central Argentina: Buenos Aires, La Pampa and Neuquén. Although the avifauna of these Argentinian provinces is relatively well known, little information is actually available on diurnal raptor relative abundances. Olrog (1980) and Ellis *et al.* (1990) presented results on roadside raptor surveys in the same region but considered only a single habitat (Olrog 1980) or provided no habitat references (Ellis *et al.* 1990). Our goal was to conduct a survey that could be repeated in the future to detect relative abundance trends. Our habitat descriptions (habitats) were as simple and clear as possible in order to permit comparisons with future evaluations.

STUDY AREA AND METHODS

Roadside surveys were performed into a 2230 km journey from Buenos Aires city to Zapala city (i.e. Pampas to Patagonia). A total of seven different habitats were identified (Figure 1). Habitats in the "Pampa" region (habitats I to IV) were delimited on the basis of human alteration and main land use criterions. Habitat V corresponds with the "Espinal" (*Prosopis* woodland) area while habitats VI-VII was typical of the "Monte" (*Larrea scrub*). For details on the vegetation see Cabrera (1976).

Habitat I: open fields with scattered houses near Buenos Aires.

Habitat II: flat and open landscape with marshy areas devoted to cattle raising.

Habitat III: flat and open landscape with fewer marshes. Agriculture is more important than cattle raising.

Habitat IV: natural grasslands and short-grass prairies on an undulating landscape, croplands are also present.

Habitat V: patchy area of natural grasslands and algarrobo (*Prosopis sp*) forests, "Espinal" in Cabrera (1976).

Habitat VI: Very flat and dry area with dense scrubland of Creosote bushes (*Larrea sp.*), the "Monte" of Cabrera (1976).

Habitat VII: Ondulating extensive plains covered by a mixed steppe of bunch-grasses and spiny shrubs.

All habitats were in flat or slightly ondulated landscapes with open vegetation.

The surveys were conducted in Oct 1992, on days 24 (1305-1934 hours): habitats I,II and III (215 km); 25 (0924-1746 hours): habitats III an IV (291 km); 26 (0817-1705 hours): habitats IV, V and VI (263 km), and 27 (0903-1150 hours): habitat VII (116 km), totalling 885 km surveyed.

Counts were conducted by 3 experienced observers: the driver, another person sitting on the front and a third one on the back. A fourth person recorded information. The surveys were carried in fair weather, without clouds and with maximum wind 20 km/h, except for habitat VII where winds reached 40-50 km/h. Average driving speed was 40-60 km/h. Binoculars and a 20-45X spotting scope were used for identification of raptors. Raptors were recorded only while in transit, although occasional stops were made to identify individuals. Following Marion and Ryder (1975) we also recorded if raptors were flying or perched.

Relative abundance of raptors was estimated as the number of kilometers traveled per individual observed (Enderson 1965, Johnson and Enderson 1972). A Shannon index (H') was used to calculate diversity (Zar 1984), and a t-test was used to test for differences in diversity indices between adjacent habitats (Magurran 1988). Confidence levels were corrected by the Bonferroni procedure in multiple comparisons (Zar 1984).

RESULTS

We observed 1891 diurnal raptors, comprising 16 species, in the 885 km of the roadside surveys or 1 individual/ 0.47 km (table 1). The Chimango Caracara (*Milvago chimango*) was the species detected most frequently (n=1397), followed by the Snail Kite (*Rostrhamus sociabilis*) (n=191), the Crested Caracara (*Polyborus plancus*) (n=66), and the American kestrel (*Falco sparverius*) (n=50). Raptor diversity and abundance varied among habitats surveyed (Table 1). Diversity index reached its highest value in habitat VI, the only one in which Chimango Caracaras were not the most numerous (Table 1). Diversity was lower in habitat I,

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1Estación Biológica de Doñana, CSIC, Apartado 1056, 41080 Sevilla, Spain
2 Grupo de Estudios Biológicos Ugarra, Carlos III 19, 31002 Pamplona, Spain

Table 1. Results of roadside raptor counts in Central Argentina, during October 1992. Roman numbers correspond to habitats, followed by the number of kilometers travelled needed for detecting one individual, as a relative abundance index. Number of birds in brackets.

	HABITAT						
Species	I {19 km}	II {151 km}	III {182 km}	IV {217 km}	V1 {60 km}	VI {40 km}	VII {116 km}
Cathartes aura					9.41(17)	3.64(11)	14.50(8)
Coragyps atratus					160.00(1)		19.33(6)
Circus cinereus			54.25(4)				
Circus buffoni		75.50(2)	7.00(26)				
Geranoaetus melanoleucus				217.00(1)	53.33(3)		
Elanus leucurus		50.33(3)	36.40(5)	217.00(1)	26.67(6)		
Rostrhamus sociabilis		0.80(190)	182.00(1)				
Buteo polyosoma					9.41(17)	13.33(3)	58.00(2)
Buteo swainsoni						13.33(3)	
Buteo magnirostris		18.88(8)					116.00(1)
Buteo albicaudatus		151.00(1)			53.33(3)	10.00(4)	116.00(1)
Buteo sp.						13.33(3)	
Polyborus plancus	9.5(2)	11.62(13)	30.33(6)	27.13(8)	4.44(36)	40.00(1)	
Milvago chimango	0.17(112)	0.33(465)	0.53(346)	0.80(273)	0.99(162)	4.00(10)	4.00(29)
Falco sparverius	9.5(2)	15.10(10)	91.00(2)	14.47(15)	8.00(20)	40.00(1)	
Falco femoralis			182.00(1)				
Spiziapteryx circumcinctus					160.00(1)		
Falco sp.		151.00(1)	91.00(2)				
Unidentified raptor		50.33(3)	182.00(1)	108.50(2)	5.71(28)	5.00(8)	
Total individuals	0.16(116)	0.22(696)	0.47(390)	0.71(304)	0.54(294)	0.91(44)	2.47(47)
Total species	3	8	7	6	10	7	6
Diversity (Shannon index)	0.174	0.859	0.460	0.432	1.347	1.632	1.160

in a very disturbed area with only 3 species detected and an extreme predominance of Chimango Caracaras. Diversity was significantly different between all pairs of adjacent surveys ($p<0.05$) except between habitat III and IV ($p>0.50$). Only one species, the Chimango Caracara was observed in all habitats. Its abundance, however, varied markedly, being more frequent in the more human alterated habitat near Buenos Aires and decreasing progresively as we approached the Patagonia. Crested Caracaras and American Kestrels were detected everywhere except in the steppe. Turkey vultures (*Cathartes aura*) and Black Vultures (*Coragyps atratus*), Red-backed Hawks (*Buteo polyosoma*) and White-tailed Hawks (*Buteo albicaudatus*) were observed almost exclusively in scrubland and steppe areas. The remaining species were observed in the "Pampa" zone where humid zones, grassland and cultures intergradate. Snail Kites were observed only in the first surveys in this area.

Majority of raptors were flying when first observed. More birds were observed on fence posts than other perches, largely because of the tendency for Chimango Caracaras to use them. Most Turkey Vultures (n=36) and Long-Winged harriers (*Circus buffoni*) (n=28) were observed flying, (94%) and (96%), respectively. Snail Kite (n=191) and American Kestrel (n=50) were detected mainly perched, (82%) and 78(%), respectively.

Red-backed Hawk (n=22), Crested Caracara (n=66) and Chimango Caracara (n=1397) were detected flying in similar proportion as perched. For the other species there were not enough observations available for a confident description of their preferences.

DISCUSION

Our results suggest that the diversity of raptors in Argentina may be linked to habitat features and human influences. Maximum diversity was reached in the dry Pampas and Patagonia where habitats were relatively pristine. In the humid "Pampa", the high humanization could determine the absence of some species (see below) and the overrepresentation of those that benefit from human transformation (Chimango and Crested Caracaras). These species benefit from food provided by refuse dumps and livestock carcasses. The relationship between human alteration of habitats and abundance was very clear in the Chimango Caracara: its numbers decreased progressively from Buenos Aires to the Patagonia Steppe. A similar phenomenum was noted in Patagonia (Donázar *et al.* 1993).

Snail Kites, Cinereous (*Circus cinereus*) and Long-winged Harriers appeared only in the "Pampa", where wetlands (ponds, small rivers) were abundant. Snail Kites were confined to the eastern sections of the Pampas. Perhaps because of the distribution of Pomacea snails.

Vultures were present in dry zones of the western Pampas and Patagonia, but were not found in the eastern humid Pampas, an area of great food resources. This could be related to the absence of nesting sites in the flat landscapes of the humid Pampas, without cliffs or large and old trees with big holes. *Buteo* species were also more abundant in dry areas with scrubland and steppe vegetation. A similar preference was noted in Patagonia (Donázar *et al.* 1993) and may be linked to food availability (small mammals). American

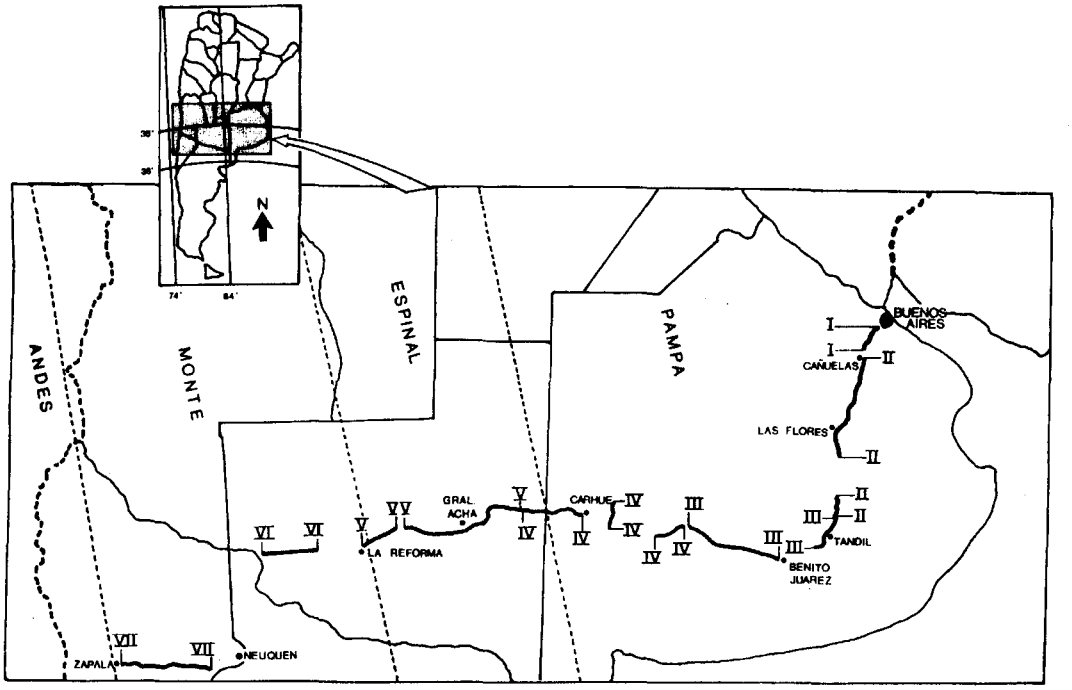

Figure 1. Roadside raptor survey carried out in Central Argentina. ROman numbers correspond to Habitats, see methods for their description. Main vegetation forms delimited following Cabrera (1976).

Kestrels, however, were rare or absent in dry habitats, as was noted by Donazar *et al.* (1993).

Results of our surveys were probably biased by the road itself (Míllsap and LeFranc 1988). First, roads atracted scavenger species (mainly Chimango and Crested Caracaras) in search of road-killed animals. Second, artificial perches, such as fences and power poles ran parallell to roads, favouring the detection of birds utilizing them. In our study these species are Snail Kites, Crested Caracaras and American Kestrels. Raptors that prefer ground for perching (Chimangos) are comparatively more difficult to spot (Marion and Ryder 1975) and may have been under estimated.

Chimango abundance in the Patagonic steppe (4.0 km-/bird) is quite similar to that found by Donázar *et al.* (in press) in a similar habitat about 500 km to the south (4.2 km/bird). Olrog (1980), for a survey that overlap with our in habitat V, reported relative abundances of 4.8 km/individual for Chimango Caracaras, 12 km/individual for American Kestrels (*Falco sparverius*), 26,7 km/individual for Red-backed Buzzard and 80 km/individual for Grey Eagle-Buzzards (*Geranoaetus melanoleucus*). All these relative abundances are lower than those presented by us (table 1). A similar trend could be noted for Chimango and Crested Caracaras in our habitat III when compared with a similar survey (Ellis *et al.* 1990: road count 13) (Table 1).

The higher abundance that we found may be due to methodological constraints. In our study, three observers worked at time, whereas in the other studies only two obervers counted birds. It can not be discarded, however, that raptor abundance had increased in the Pampas as Donazar *et al.* (1993) suggested for northern Patagonia.

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