

Size of Rabbits consumed by Black Kites increased after a Rabbit epizootic

R. VILLAFUERTE¹ and J. VIÑUELA²

¹Unidad de Biología de las Especies Cinegéticas, Estación Biológica de Doñana, C.S.I.C., Apdo. 1056, Seville, Spain, ²Departamento de Ecología Evolutiva, Museo Nacional de Ciencias Naturales, C.S.I.C., José Gutiérrez Abascal 2, 28006 Madrid, Spain.

ABSTRACT

Rabbits are the staple prey for Black Kites in Matagordas, south-western Spain. Because of their poor predatory skills, it has been considered that most of the Rabbits consumed by Kites were young and affected by myxomatosis. After rabbit haemorrhagic disease (RHD) arrived in Spain, and since most of the Rabbits affected were adults, it was expected that the raptor would benefit with the incorporation of larger Rabbits in its diet. In concordance with that prediction, during the immediate three years before the arrival of RHD (1987–89), average size of Rabbits consumed by nestling Black Kites were similar and corresponded to the size of those Rabbits affected by myxomatosis. However, after RHD arrival in 1990, sizes of Rabbits consumed by Kites increased, corresponding to the age more frequently affected by RHD.

Keywords: Black Kite, Doñana National Park, prey, Rabbit, RHD, Spain

INTRODUCTION

Black Kites (*Milvus migrans*) are considered generalist predators and scavengers (Cramp & Simmons, 1980), but in south-western Spain Rabbits (*Oryctolagus cuniculus*) may constitute their staple prey (Viñuela & Veiga, 1992). In Doñana National Park, Black Kites sustain high breeding densities in open areas with dense Rabbit populations (Viñuela, Villafuerte & de le Court, 1994), and their reproductive success is highly correlated with the rate of Rabbit consumption (Viñuela & Veiga, 1992). However, Black Kites exhibit poor predatory skills, so it has been concluded that they can only catch young or ill Rabbits (Valverde, 1967; Cramp & Simmons, 1980; Villafuerte, 1994). Therefore, after the outbreak of myxomatosis in Spain, Black Kites probably increased their rate of consumption of Rabbits (Valverde, 1967), and current consumption rates are apparently dependent on the incidence of myxomatosis (Viñuela & Veiga, 1992; Villafuerte, 1994). In 1988, rabbit haemorrhagic disease (RHD) arrived in Spain, and reached Doñana in 1990 (Villafuerte *et al.*, 1994, 1995). Initial outbreaks of RHD caused massive mortalities, mainly of adult Rabbits (Villafuerte *et al.*, 1994). This resulted in substantial reductions of Rabbit populations and some local extinctions (Villafuerte *et al.*, 1995). The reproductive success and survival of some predators declined (Fernández, 1993; Villafuerte *et al.*, 1996). Conversely, we could expect that RHD and myxomatosis may have been favourable for scavengers such as Black Kites, because these diseases may have given them access to otherwise unavailable prey, such as large Rabbits.

MATERIALS AND METHODS

The study was conducted in Matagordas, within Doñana National Park (37° N, 6° 5' W, see

Correspondence: Rafael Villafuerte, Instituto de Investigación en Recursos Cinegéticos (CSIC, UCLM, JCCLM), Apdo. 535, 13080 Ciudad Real, Spain. E-mail: rafael@irec.uclm.es

Viñuela & Veiga, 1992). There, Black Kites occupy nesting territories from mid-March to mid-April, chicks hatch between late April and early June, and fledglings leave the nests mainly in July (Viñuela, 1991). Thus, the nesting period of Black Kites (May–July) coincides with the greatest abundance of juvenile Rabbits at the end of the breeding season (Villafuerte, 1994). Prey items were collected from a random sample of Black Kite nests, which were visited every 4–7 days (mainly every 5 days) during the nestling period, in the course of a study of their breeding ecology (1987–89, Viñuela & Veiga, 1992), and approximately every two weeks in 1990, the year of the first detected outbreak of RHD in the area on January 14 (Villafuerte *et al.*, 1994).

The size of Rabbits captured by Black Kites was estimated by measuring tarsus length of Rabbit remains, pooling the data gathered during each year. This measure was selected because it is not affected by the condition of the remains, and because they are frequently found in the nests. Rabbit ages and masses were estimated from growth curves obtained in the same population ($R^2 = 96.02$, $F_{1,267} = 6444$, $P < 0.0001$; Villafuerte, 1994), by following the expression:

$$\text{Weight (g)} = \exp\{1.907 + [0.085 \times \text{Tarsus length (mm)}]\}.$$

RESULTS AND DISCUSSION

Confirming our predictions, the tarsus length of Rabbits consumed by Black Kites during 1990 was significantly larger than during 1987–89 (ANOVA and Schaeffe test; $F_{3,239} = 57.7$, $P < 0.001$; Fig. 1), whereas there were no significant differences among the three years pre-RHD. The estimated average mass of Rabbits taken during the years previous to the RHD outbreak was below 500 g, a mass characteristic of juvenile Rabbits (under three month old). In contrast, the average size of Rabbits taken during the same months of 1990 was above 1000 g. This weight is only attained by adult Rabbits.

Myxomatosis no longer has the effect that it did during the 1960s (Trout, Tittensor & Fox, 1992), when mortality bias in relation to age was presumably low. Currently, the virus is affecting mainly young Rabbits (e.g. in Doñana: 350–500 g; Villafuerte, 1994), and many of them would naturally survive the disease, gaining immunity. However, while affected by myxomatosis, they are an easy prey due to their low mobility, poor physical condition, and bad vision (Villafuerte, 1994). So, during 1987–89, Black Kites had easier access to those Rabbits affected by myxomatosis, and this could explain the small average size of Rabbits consumed, and the year-to-year consistency in the average size of Rabbits found in their nests (Fig. 1).

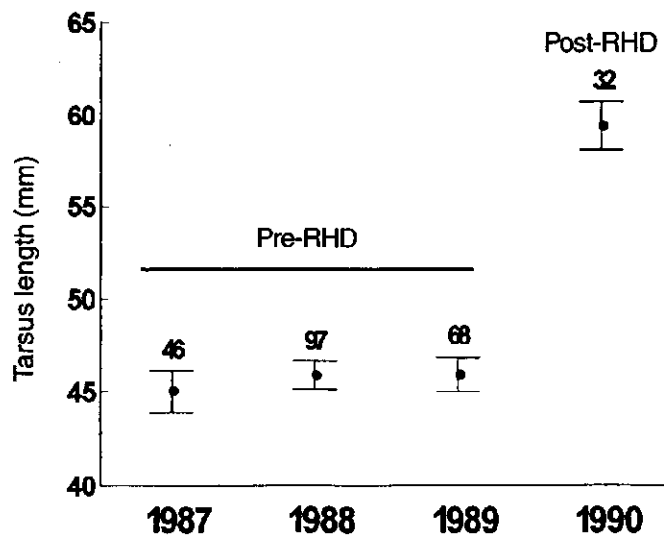


Fig. 1 Tarsus length (mean \pm SD) of Rabbits found in Black Kite nests during 1987–89 (previous to the arrival of rabbit haemorrhagic disease) and on the year of the first outbreak in the study area (1990). Sample sizes above bars.

During 1990, there were high numbers of Rabbits killed by RHD available to scavengers, so probably most of the larger-than-usual Rabbits taken by Kites that year, were obtained as carrion. This is supported by the fact that first outbreaks of RHD were characterized by a sudden death of Rabbits affected by the virus, usually occurring within 24 h after infection (Villafuerte *et al.*, 1994). The existence of a dense population of Black Kites removing many Rabbit carcasses could explain the low number of Rabbits found dead during the first outbreaks, despite the high morbidity of the disease (Villafuerte, 1994).

Therefore, Black Kites have opportunistically taken advantage of two diseases of the most profitable prey in Spain over the last three decades. Something similar was reported in Britain with Red Kites (*Milvus milvus*), that had one of the highest breeding success records of the country on the year of the first outbreak of myxomatosis (Lovegrove *et al.*, 1990).

Many predators in Spain were negatively affected after myxomatosis decimated Rabbit populations, including the most endangered raptor in Europe (Spanish Imperial Eagle *Aquila adalberti*, Ferrer, 1994), and the most endangered cat in the World (Iberian Lynx, *Lynx pardinus*, Rodríguez & Delibes, 1990). Probably the irruption of RHD is having an added effect on the decline of Rabbits and their predators (Fernández, 1993; Calvete *et al.*, 1997; Villafuerte *et al.*, 1996). Our results, however, suggest that both diseases may have been favourable for the Black Kite, that is currently one of the raptors with the healthiest and largest populations in Spain (Heath & Grimmet, 1994). This result may be explained because Black Kite's nesting period coincides with the period of highest availability of juvenile Rabbits, while the population is more vulnerable to myxomatosis (Rogers, Arthur & Soriguer, 1994), at the same time that RHD is killing a high proportion of adult Rabbits (Villafuerte *et al.*, 1995). Although the wave of diseases (especially those of RHD) may be relatively short in a given area, one or both members of each Black Kite nesting pair may have access for a long period to ill or dead Rabbits: while Black Kite females defend a nesting territory around the nesting tree of about 3 ha, gaining access to the Rabbits around the tree (Viñuela *et al.*, 1994), males may be searching for food far away, for instance following the wave of the disease.

Because most of the rabbits consumed by Black Kites were those dead or severely diseased, they are probably not causing a sustained decline in Rabbit numbers, as generally thought by Spanish hunters (Villafuerte *et al.*, 1998). However, if the decline of Rabbits continues, in the long term even Black Kites may suffer a negative impact through prey reduction. This could happen either directly or indirectly from increased illegal persecution of predators by some hunters and gamekeepers who blame them for the Rabbit decline (Villafuerte *et al.*, 1998).

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