Juvenile dispersal of Red Kites *Milvus milvus* in North Africa. Contribution from GPS monitoring of individuals released in Andalusia

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Dispersion de juvéniles de Milans royaux *Milvus milvus* en Afrique du Nord. Apport du suivi GPS des individus relâchés en Andalousie.

Le Milan royal est une espèce qui effectue de grands déplacements lors de sa dispersion juvénile ou pour rejoindre les aires d'hivernage. Généralement, les individus du nord et du centre de l'Europe hivernent dans la péninsule ibérique, tandis que la population ibérienne est principalement sédentaire. Le programme de renforcement de la population de Milan royal en Andalousie (Espagne) a débuté en 2021, plus précisément dans le 'Parc naturel de Cazorla, Segura et Las Villas' situé dans la province de Jaén. 59 Milans royaux juvéniles ont été relâchés en trois groupes, dont la plupart ont été équipés d'émetteurs GPS. Les premiers couples reproducteurs ont été formés en 2023. Cinq individus, appartenant au premier et au troisième groupe, ont traversé la mer vers l'Afrique du Nord de différents endroits en 2021 et 2022. L'un d'eux a traversé depuis Cabo de Palos à Murcie vers l'ouest de l'Algérie, tandis que les autres ont traversé le détroit de Gibraltar vers le Maroc. Tous les individus sont morts. Deux causes de mortalité d'origine anthropique ont été identifiés, l'empoisonnement et la noyade dans les bassins d'irrigation.

Introduction

The red kite is considered a partial migrant. A large part of the northern European population chooses the Iberian Peninsula as its wintering site (García-Macía *et al*. 2021). The species is listed at European level as Least Concern, but in the south of the continent it is considered Endangered, being better distributed in the northwestern quadrant of the Iberian Peninsula (Molina, 2015). In the southern quadrant, it is practically extinct except for a small breeding population in Doñana National Park (Viñuela et al. 2021). In Morocco, there are no recent breeding records, but wandering individuals have been regularly observed (Radi *et al*. 2020; Onrubia *et al*. 2023).

The population decline of the species in southern Spain led the Andalusian Regional Government to entrust GREFA with a project to reinforce the species in 2021. Most of the individuals released until 2023 were equipped with GPS transmitters, which have been used to find areas of juvenile dispersal, causes of mortality or places of settlement for reproduction. To date, four individuals have reach Africa and one died near the Moroccan coast.

Materials and methods

During 2021 and 2022 in the Cazorla, Segura and Las Villas Natural Park (Jaén, Andalusia), 59 red kites were released, mostly juveniles, in three different groups. Previously, a study on the suitability and feasibility of the action had been carried out (Martín, 2021). The origin of the individuals was as follows: rehabilitated at GREFA's Wildlife Hospital; translocated from the area around Madrid-Barajas airport aviation safety reasons; born in captivity at the Alfranca breeding centre belonging to the Government of Aragon; and translocated from wild nests of the Mallorcan population.

The individuals were released by means of a Hacking Cage (Viada & Iglesias, 2018) where they acclimatised to the environment and several months later were released. 56 red kites were fitted with a GPS transmitter using a 0,44-inch teflon pectoral harness (García *et al*. 2021). Forty-eight transmitters of the Ornitela trademark (model OT20) and eight of Interrex (model Lego) were used. Interrex transmitters were used in collaboration with the LIFE EUROKITE project (LIFE18 NAT/AT/000048). All birds that crossed to Africa had been equipped with Ornitela transmitters and a configuration of a position every 300 seconds was set if the battery status was higher than 75%. Data delivery interval was set at 4 hours.

Figure 1. Red Kite released in the 'Parque Natural de las Sierras de Cazorla, Segura y Las Villas', Jaén, Andalusia (Spain). Photo: Rafael Hernández/GREFA.

Figure 2. Red Kite released in Jaén, Andalusia (Spain). Photo: Rafael Hernández/GREFA.

Table 1. Red Kite individuals in Africa.

Ring	Trademark	Model	Sex	Group	Release Date
4AN	Ornitela	OT20	Female	1st	15/9/2021
49J	Ornitela	OT20	Male	1st	15/9/2021
77R	Ornitela	OT20	Female	1st	15/9/2021
PH3	Ornitela	OT20	Female	3rd	22/7/2022
PHU	Ornitela	OT20	Male	3rd	22/7/2022

The information has been processed and analysed with Qgis, R-studio and Google Earth (Yu et Gong, 2012; Kurk Menke *et al*. 2016; Leonard, 2017).

Results

Almost 9 % of the individuals released with GPS transmitter in Jaén district (n=5) attempted to cross to Africa. Three of them were released on 15 September 2021 (first release) and two of them on 11 July 2022 (third release). Two of them came from the Balearic Islands, another two from the area around Madrid-Barajas Airport and one was born in Alfranca breeding centre (Zaragoza). They were 3 females and 2 males.

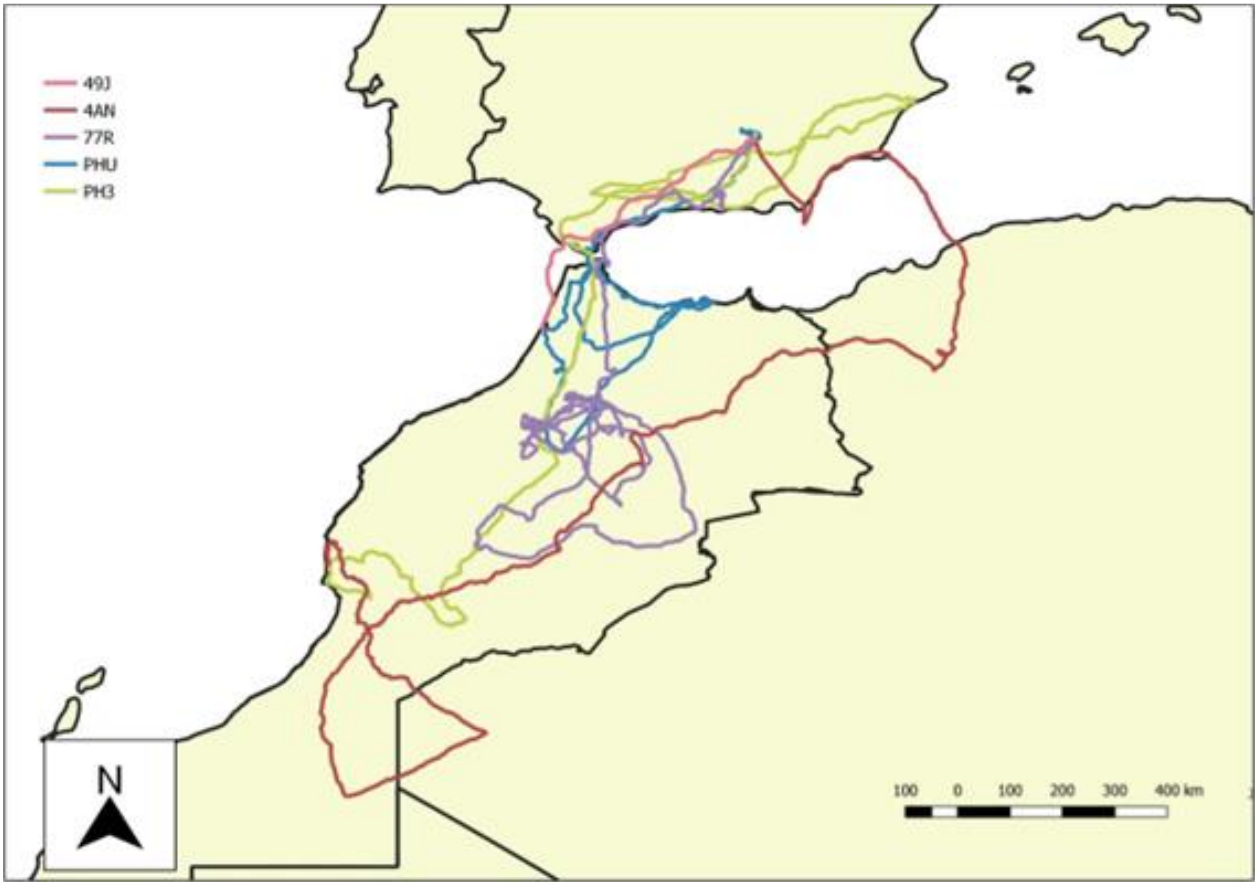

Figure 3. Red Kite´s tracks between southern Andalusia (Spain) and northern Morocco and western Algeria.

All the individuals that attempted to cross to Africa did so between the end of August and the beginning of October. Two of them chose the narrowest part of the Strait of Gibraltar (19.1 km on average) while the other three crossed over 120 km on average. The average crossing time for the individuals that crossed the shortest part was 34.59 minutes, while for the others it was more than 3.5 hours on average. 4AN crossed from Cabo de Palos in Murcia and reached Algeria, 49J from Caños de Meca (Cádiz) and drowned less than 1,500 metres from the coast. 77R crossed from Gibraltar and when it was about reach Ceuta, returned to the sea, taking more than three hours to make the full crossing. PH3 and PHU crossed at the narrowest part without problems.

Table 2: Dates of release and data about the crossing of the Mediterranean of each tracked Red Kite.

Ring	Release date	Crossing date	Distance crossed (Km)	Time at last point in Europe (UTC)	Time at first point in Africa (UTC)	Crossing duration
4AN	15/9/2021	04/10/2021	194,5	6:23:19	10:43:21	4:20:02
49J	15/9/2021	29/09/2021	113,8	12:02:36	15:02:08	2:59:32
77R	15/9/2021	03/10/2021	52,3	8:04:56	11:19:56	3:15:00
PH3	22/7/2022	24/08/2022	18,4	13:51:53	14:26:46	0:34:53
PHU	22/7/2022	21/08/2022	19,8	9:11:54	9:46:59	0:35:05

All individuals were presumed dead, and in four cases the transmitter was recovered. Only one of the known deaths was due to natural causes, being the red kite drowned while crossing the Strait of Gibraltar (49J) less than 1,500 metres from the African coast. 4AN was never found, neither the transmitter nor the carcass, presumably buried by a fox. The transmitter and rings from 77R were recovered in a village but no further information was obtained. PH3 drowned in an irrigation pond and PHU was found vomiting and convulsing, symptoms compatible with poisoning.

Table 3. Dates of release and disappearance and the cause of mortality of the tracked Red Kite individuals.

Ring	Release date	Disappearance date	Days alive	Cause of death
4AN	15/9/2021	30/10/2021	45	Unknown
49J	15/9/2021	29/9/2021	14	Drowned in the sea
77R	15/9/2021	18/1/2022	125	Unknown
PH3	22/7/2022	31/8/2022	40	Drowned in a pond
PHU	22/7/2022	31/8/2022	40	Poison

Discussion

The red kite is a species considered rare in North Africa. Red kites released in Andalusia have reached North African countries such as Morocco or Algeria during their dispersal period. All the individuals crossed on dates coinciding with the migration of other species such as the black kite (*Milvus migrans*), booted eagle (*Aquila pennata*) or European honey buzzard (*Pernis apivorus*). One of the most reasonable hypotheses is that these red kites, belonging to the first and third release groups, have been joined flocks of migratory species on their way to their wintering sites (Panuccio *et al*. 2014; Mellone *et al*. 2013; Scholer *et al*. 2016). None of them released in the second group (April) crossed to Africa, so the release date and the beginning of the dispersal period may be influencing this dynamic of movements to North Africa. As the individuals had three different origins this highlights the fact that this aspect would not be related to a greater or lesser tendency to cross to Africa. Onrubia (2015) reported an average of 25.17 red kites crossing the Strait of Gibraltar annually in three different periods between the 1970s and the 2010s. The fact that almost 10% of the specimens released in Andalusia have crossed to Africa may be a reflection of a greater GPS tagging effort in Andalusia, where the species is in a critical situation. This number seem to have increased during the period 2012-2021 (Onrubia *et al*. 2023).

The fact that three of the five individuals made cross at apparently unsuitable sites or making long duration trips could indicate several things. It could be that, being young individuals, inexperience led them to take such a risk. And other option might be that individuals joined groups of other species capable of travelling long distances over large bodies of water without problem, such as European honey-buzzard (*Pernis apivorus*) (Agostini *et al.* 2005; Vansteelant, 2016). Two of the birds, 49J and 77R, had a lot of trouble crossing the sea, very close to the coast. 49J died barely 1,500 metres from the coast and 77R returned to the sea after having been coasting for a couple of hours. This could be explained by the fact that these birds were being pursued or harassed by gulls. This has been observed with other species such as short-toed eagles (*Circaetus gallicus*) or griffon vultures (*Gyps fulvus*) (González, pers. comm.). Another reason for this could be the strength of the wind at the time of crossing (Nourani & Yamaguchi, 2017; Miller et al. 2016).

None of the five individuals that tried to cross to Africa returned to Europe, all of them died in Morocco. Only one of them managed to spend more than a month in Morocco. This fact would indicate that the natural recolonisation of this species as a breeder in this region could be complicated. This information can also be compared with the continued tagging of more red kites with GPS transmitters in the future.

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