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Rabbits or Refuse? Landfill Use and Relevance as a Food Source for an Increasing Wintering Population of the Red Kite

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Abstract: Household waste landfills represent a huge source of trophic resources for opportunistic and versatile wildlife species. Among them, the red kite (*Milvus milvus*) is one of the most endangered in Europe. Several studies have pointed out the importance of landfills as a source of food for this species during the wintering season, but the information on the frequency, seasonal and daily patterns of use, and age of red kites that exploit this food source is still insufficient to understand their actual role in conservation. In this study, we evaluated the patterns of use of household waste by overwintering red kites in southeastern Madrid, central Spain. The results showed the constant presence of relatively low numbers (<30 on average) and a reduced hourly inflow and outflow of red kites throughout the day and during the whole winter period in the studied landfill. A higher proportion of juveniles was found in the landfill than in the overall wintering population. Pellet analysis clearly shows that the diet of red kites is dominated by the wild rabbit (*Oryctolagus cuniculus*), which is quantitatively very relevant compared to household waste obtained from the landfill. This suggests a relatively low quantitative importance of landfills as foraging grounds for the increasing population of wintering red kites in the study area. Instead, the high regional density of wild rabbits attracts large numbers of red kites that can eventually use landfills as a non-optimal last-resort foraging option, owing to the predictability of household waste, especially for juveniles. The continuous presence of red kites in landfills likely influences an uninformed positive perception about their relevance to the conservation of the wintering population, despite risks there faced, such as collision, electrocution, and intoxication. Future research is needed to assess in depth the influence of wild rabbits in Spain on the habitat use and global population dynamics of red kites.

Keywords: conservation; *Milvus milvus*; *Oryctolagus cuniculus*; rubbish dumps; scavenger raptors; waste management; wildlife

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1. Introduction

The growth of the human population leads to the generation of huge quantities of household waste often deposited in open landfill sites, which represents a management challenge for environmental conservation [1–3]. In Western Europe, current regulations and standards require the progressive reduction of such practices with an ultimate goal of recycling the vast majority of these residues [4,5]. These regulations are difficult to enforce in many regions due to poor planning of urban developments, increasing consumption of waste-generating products, and a lack of practices and policies that allow for recycling [1,6,7]. Due to the expected growth and concentration of the human population in urban areas, it is expected that open landfill sites will remain active for decades to come [8,9]. Waste disposed of in these sites generates pollution that can enter soils, air, and water, negatively affecting the health of human populations living in the surroundings [3,10,11] and the health and population dynamics of wildlife species foraging there [12–14].

Household waste dumps represent a huge source of trophic resources for opportunistic and versatile wildlife species, including gulls, scavenger raptors, storks, and corvids [13–15]. Multiple environmental and population factors have been highlighted in determining the impact of waste as food on population dynamics, especially the sustained growth of populations and species most dependent on this resource. However, important aspects for understanding the patterns of landfill use are largely unknown for rare species. Among these species, the red kite (*Milvus milvus*) is one of the most endangered in Europe [16].

Numerous studies have pointed out the importance of landfills as a source of food for the red kite, especially during the wintering season [17–20]. During the breeding season, these sites are also exploited by the floating population, while breeding individuals are more dependent on wild animals that are preyed upon or scavenged [21]. There is some information on the conservation problems for red kites and other avian scavengers associated with the use of livestock carcass dumps, or "vulture restaurants" [22–26]. However, the available information on the frequency, seasonal and daily patterns of use, and age of red kites that exploit the resources found in landfills [15,27–29] is still insufficient to understand their actual role in the survival of these individuals and their importance as a whole for this species' conservation status. Previous reports often assumed that wintering populations that use landfills are highly dependent on the food there found [15,30–32]. Alternatively, landfills may act as a non-optimal last-resort foraging option owing to the predictability of food resources, albeit costly and dangerous to obtain due to competition with conspecifics and other species, and due to other risks like collision, electrocution, and intoxication [13,14]. Food exploited by red kites in landfills corresponds to small offal fragments, especially cooked or uncooked remains of poultry, lamb, cow, pig, and marine fish [33–36], as has been documented for its sister species, the black kite (*Milvus migrans*), for which there is more specific information on the use of landfills and the food there obtained [37–39].

Food remains in varying degrees of decomposition available in landfills should not provide a large amount of biomass compared to the carcasses of domestic animals disposed of in livestock carcass dumps for use by threatened scavenging birds [24,40]. These food remains are also not comparable in terms of biomass and nutritional quality with the remains of wild animals generally exploited by this species, especially key prey such as voles and rabbits, and road-killed or sick, weak, and young individuals of multiple vertebrate species [22,33,34]. In addition, carcass dumps and landfills are sources of infection by pathogens and parasites from decomposing organic matter mixed with synthetic materials and other contaminants that can affect bird health [13,14,25,26]. Regardless of the quantity and quality of the resources that kites obtain from landfills, it is challenging to determine their relevance for kite populations during wintering. This is due to the continuous nomadic movement of individuals in this season, owing to multiple factors such as weather, landfill features, the number of individuals of this and other species that use these sites, and the abundance and availability of wild prey in the surroundings. These and other important aspects for understanding the patterns of resource use in landfills and the countryside by this species are largely unknown.

In this study, we evaluated the patterns of use of household waste by overwintering red kites in central Spain. Specifically, we recorded the seasonal and hourly abundance of kites exploiting this matter and the dynamic of inflow and outflow of individuals to a particular landfill throughout the day to assess the quantitative importance of these sites for the wintering population. To evaluate the role of resources obtained at the landfill versus those provided by wild or domestic animals obtained elsewhere, the diet of red kites was studied by analyzing pellets collected at a communal roost near the landfills. We also assessed the age of individuals exploiting the resources found at the landfills and compared it with the age distribution in the total population concentrated in communal roosts in the area. The abundance of other bird species was also recorded to characterize the avian community foraging in the landfill. This information is discussed in accordance

with previous knowledge of the importance and risks associated with the use of landfills by wintering red kites.

2. Materials and Methods

2.1. Study Species

The red kite is mostly distributed in Europe. It is listed in Annex I of the wild birds Directive 2009/147/EC due to its negative population trend. From 2005 until 2019, the species was listed as "Near Threatened" by the IUCN. After overcoming this negative trend and maintaining a positive trend for at least 30 years, the species was reclassified in 2020 to "Least Concern" [41], largely due to successful reintroductions in the United Kingdom and recovery partially attributed to supplementary feeding in human settlements [42,43]. The red kite migrates from central and northern Europe to more southern regions to spend the winter. These movements begin in August, reaching the wintering quarters and end in late February, when individuals return to the breeding areas, with variations depending on age and other individual and environmental factors [20,44]. Spain holds one of the most abundant breeding populations and represents its main stronghold as a wintering area, with around 50,000 individuals [32]. A sharp decline in its breeding and wintering ranges during the 1990s and 2000s [21], which continues in most regions, has led to the species being listed as "Endangered" in the Spanish National Catalogue of Threatened Species (RD 139/2011, 4 February). The decline of the red kite is mainly due to increased mortality by shooting, intentional poisoning, and unintentional intoxication through pest control poisons directed at small rodents [12,17,45–47]. Electrocutions and collisions with power lines and wind turbines also represent an increasing threat [48–51].

2.2. Study Area

The study was conducted in the southeast of Madrid, central Spain. This is a peri-urban area, highly degraded by habitat alterations due to urban developments, large infrastructure, former mining operations, and intensive irrigated agriculture [52,53]. In the area, there are two large landfills for domestic waste from the city of Madrid and other surrounding municipalities. The landfill called Mancomunidad Sur is located in the municipality of Pinto (Figure 1). This landfill (hereafter called Pinto) covers an area of 90 ha, where the household waste of a human population of 1,580,619 people is deposited [54], which is equivalent to 288,324 tons per year. This enormous amount of waste represents only 10% less than what is deposited in the other landfill in the area (Valdemingómez), the largest in the province of Madrid [55], where a large solid waste incinerator is located. The area has been noted for its high levels of soil and water contamination [53], and references therein] despite the fact that its surroundings belong to a protected area (Parque Regional del Sureste) with high landscape and biodiversity values [56]. Studies on wild birds inhabiting this area have shown high levels of multiple pollutants of different origins [53,57–59]. The red kites that feed in the aforementioned landfills establish their communal roosts in the riparian forest of the Manzanares River downstream of the city of Madrid (Figure 1).

2.3. Patterns of Use of the Landfill

Censuses were carried out at the Pinto landfill to determine the number of foraging red kites. Observations were carried out from a high and dominant point that offered a wide view of the landfill, which allowed us to count the vast majority of the birds there present. Rainy, snowy, or foggy days were avoided. Surveys were carried out by visual counts of all individuals present at a given time using binoculars. Snapshot counts were taken every 30 min, from 9:00 am to 18:00 on each sampling day, beginning on 6 December 2020 and ending on 14 February 2021. Overall, 191 counts were conducted across 11 full-day surveys; two of the hourly counts in a single day were discarded because of dense fog. Data accounting for variation in the number of kites using the landfill were grouped by weeks and months to simplify the analysis. Hourly counts throughout each sampling day were

grouped into three daylight periods: (1) morning, 9:00–12:00 am; (2) midday, 12:00–15:00; and (3) afternoon, 15:00–18:00.

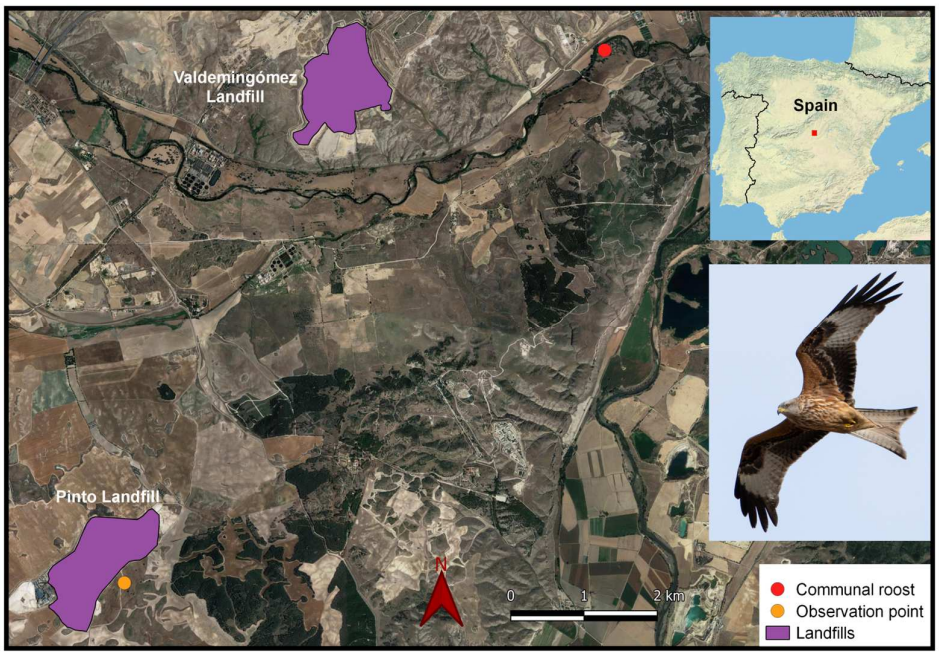

Figure 1. Map showing the location of landfills, observation point, and communal roost of the red kite in southeastern Madrid, central Spain.

Individuals of other bird species present in the landfill were counted using the same methodology. Only medium and large species were considered due to the impossibility of detecting all individuals of species smaller than the spotless starling (*Sturnus unicolor*); the number of individuals of the latter species could be estimated due to the continuous flights over the rubbish.

To assess the flow rate of red kites entering and leaving the landfill, counts of individuals crossing the perimeter of the landfill in the direction of entry and exit were made for 15 min. These surveys were conducted every hour and took place just after each count of the total number of individuals present at the landfill. The data obtained by sampling the flow of individuals were transformed in terms of absolute flow (or turnover rate), calculated as the difference between the number of individuals entering and leaving the landfill in each sampling period.

2.4. Age Determination

The age (juvenile or adult) of red kites foraging at the landfill was assessed by photographs of randomly observed individuals across the study period (n = 218), taken with a digital camera (Sony alpha 6600, with FE 200–600 mm lens). The age of a sample of individuals (n = 179), observed with a telescope in the trees that serve as communal roosts in the area, was determined as an approximation to the age distribution in the population as a whole; two snapshot samplings were conducted in the communal roost on 27 January and 2 February 2021. Individuals were classified as juveniles (born in the previous breeding season) or adults (born in previous years) by plumage characteristics and iris color [60].

2.5. Diet

The diet of the wintering population was evaluated through the analysis of pellets (n = 71) collected in January 2021 in a communal roost located on the riverine forest at the banks of the Manzanares River, about 4 km from the Valdemingómez and 10 km from the Pinto landfills, respectively (Figure 1). Prey remains contained in the pellets were macroscopically identified from reference collections. Food remains were classified

according to their origin in the landfills versus those obtained in the countryside. The food obtained from landfills included any domestic livestock remains, such as poultry, pig, cow, lamb, and marine fish, as this type of food can only be obtained from household waste (hereafter, "organic waste") due to the absence of specific dumps of livestock carcasses in the study area. The presence of anthropogenic debris such as plastics, paper, metal, and glass was also recorded in the pellets, reflecting the use of landfills for foraging, and was categorized as "synthetic litter". The remains from wild animals were classified into four categories, including wild rabbits (*Oryctolagus cuniculus*), other wild mammals, birds, and insects.

To analyze the diet, the percentage of pellets in which each food category appeared was used, as in other studies on the diet of this and other scavenger species [22,61]. The pellets of this species generally consist of the hair or feathers of the consumed animals. This makes it impossible to quantify the minimum number of specimens consumed due to the difficult-to-control variations derived from the consumption of individual animal fragments obtained by scavenging, which also prevents the quantification of the biomass contributed by each type of food, as occurs in other scavenger species [62].

2.6. Data Analysis

We used Generalized Linear Mixed Models (GLMMs) to investigate factors affecting the number of red kites using the landfill in each snapshot count (Poisson error distribution, log-link function) and the flow of individuals entering and leaving the landfill (turnover rate) in each sampling period (Gaussian error distribution, identity link function). Explanatory variables included daylight period (morning, midday, and afternoon), month, and the interaction of both factors. In the analysis of the turnover rate, the number of individuals present in the landfill in the count just before the estimation of the flow of individuals was also included as a covariate. We included the day of the counts as a random term in both models, as the number of kites and the turnover rate could be similar within days due to specific environmental and social conditions. The age distribution (juveniles/adults) of individuals foraging in the landfill was compared with that of the overall population (sampled at communal roosts) using Fisher's exact test. Statistical analyses were performed using SPSS software v. 28 (IBM SPSS Statistics, Armonk, NY, USA). Statistical significance was set at $p < 0.05$ (2-sided).

3. Results

3.1. Abundance of Red Kites and Other Species Foraging in the Landfill

We counted individuals of 16 medium–large bird species in the landfill (Table 1). The red kite was observed feeding at the landfill on all sampling days and was present in the vast majority of daily counts. Other frequent species were the black-backed gull (*Larus fuscus*), black-headed gull (*Chroicocephalus ridibundus*), and the white stork (*Ciconia ciconia*), which also had the highest mean abundances and maximum counts. Comparatively, the red kite showed a low mean abundance, with a maximum of 92 individuals recorded in one of the hourly counts. Other species were observed every day but in a lower proportion of the hourly counts, while the remaining species can be considered infrequent visitors in low abundance, as with the presence of endangered species such as the cinereous vulture (*Aegypius monachus*) or rarities such as the great egret (*Ardea alba*). It is worth noting the very scarce presence of some wintering black kites (Table 1). Several smaller species were recorded feeding at the landfill but could not be adequately counted, including the house sparrow (*Passer domesticus*), the white wagtail (*Motacilla alba*), and the domestic pigeon (*Columba livia*).

3.2. Seasonal and Hourly Abundance and Flow of Red Kites

According to the GLMM, the number of red kites recorded in the landfill was influenced by the daylight period and its interaction with the month (Table 2). This indicates that the number of red kites was lower in the morning, while the number of kites as the

day progressed depended on the month, being highest at midday in December and similar between midday and afternoon in January and February (Figure 2).

Table 1. Bird species foraging at the Pinto landfill, southeastern Madrid, central Spain, during the winter of 2021. Data show the frequency of occurrence on sampling days and counts, their mean and maximum abundances, and the sum of all counts.

Species	% Days n = 11	% of Counts n = 189	Mean ± SD Abundance	Maximum	Sum
Milvus milvus	100	99.5	27 ± 19	92	5164
Larus fuscus	100	94.2	1531 ± 1749	9274	289,330
Chroicocephalus ridibundus	100	91.5	37 ± 43	226	7048
Ciconia ciconia	100	89.9	65 ± 87	620	12,270
Corvus corax	100	32.3	0.8 ± 1.6	9	154
Sturnus unicolor	100	31.7	53 ± 120	800	10,036
Buteo buteo	100	26.5	0.3 ± 0.6	3	59
Falco tinnunculus	81.8	19.6	0.2 ± 0.5	3	45
Pica pica	45.5	10.1	0.4 ± 1.3	7	78
Circus aeruginosus	63.6	6.3	0.06 ± 0.2	1	12
Aegypius monachus	54.5	5.8	0.07 ± 0.3	2	14
Bubulcus ibis	36.4	4.8	0.2 ± 1.3	14	38
Milvus migrans	45.5	4.2	0.04 ± 0.2	1	8
Corvus monedula	27.3	4.2	0.5 ± 3.7	40	97
Accipiter nisus	36.4	2.1	0.2 ± 0.1	1	4
Ardea alba	9.1	0.5	0.005 ± 0.07	1	1

Table 2. Results of the GLMM conducted to evaluate factors affecting the number of red kites in each snapshot count in the Pinto landfill, southeastern Madrid, central Spain. Explanatory variables included daylight period (morning, midday, afternoon), month, and the interaction of both factors.

Predictors	Estimate	SE	t	p	CI (95%)	
					Inf.	Sup.
(intercept)	3.614	0.4393	8.227	<0.001	2.747	4.481
Period = morning	−0.409	0.1006	−4.063	<0.001	−0.607	−0.210
Period = midday	0.119	0.0857	1.393	0.165	−0.050	0.289
Month = December	−0.430	0.4702	−0.914	0.362	−1.358	0.498
Month = January	−0.590	0.5087	−1.160	0.247	−1.594	0.413
[Period = morning] × [month = December]	0.538	0.1097	4.906	<0.001	0.322	0.754
[Period = morning] × [month = January]	−0.040	0.1332	−0.302	0.763	−0.303	0.222
[Period = midday] × [month = December]	0.118	0.0947	1.243	0.216	−0.069	0.305
[Period = midday] × [month = January]	−0.126	0.1123	−1.118	0.265	−0.347	0.096

Analysis of the turnover rate shows no significant influence of the daylight period, month, number of individuals present in the landfill in the count just before the estimation of the turnover rate, and the interaction between these variables (GLMM, all $p > 0.17$). Pooling all data, the mean numbers of individuals entering and leaving the landfill in each sampling period (n = 96) were very similar (9.4, SD = 7.4 and 9.2, SD = 7.2, respectively).

3.3. Age Distribution

The proportion of kites of each age class recorded in the communal roosts was not statistically different between the sampling in January (79.1% of adults, n = 91) and February (84.1% of adults, n = 88) (Fisher's exact test, p = 0.4437). Overall, the proportion of each age class was different between the landfill (63.3% adults, 36.7% juveniles, n = 218) and the total population sampled in the communal roost (81.5% adults, 18.5% juveniles, n = 179, pooling both samplings) (Fisher's exact test, $p < 0.001$).

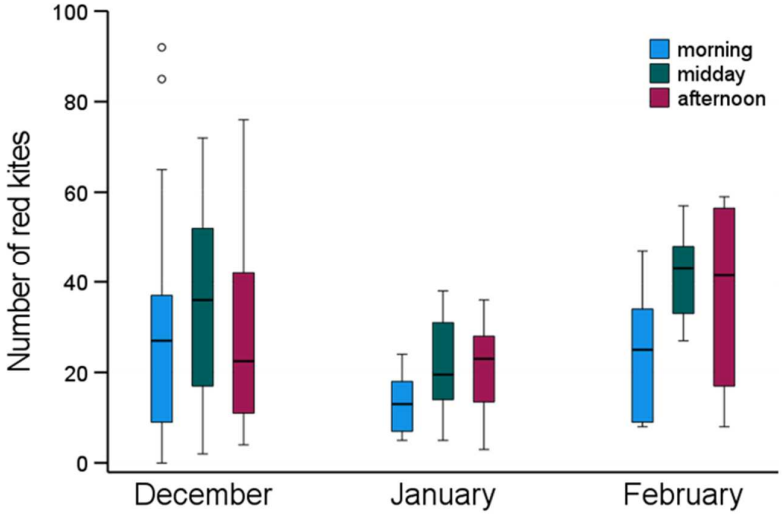

Figure 2. Median, interquartile range, outliers, and extreme cases of the number of red kites recorded in the Pinto landfill in southeastern Madrid, central Spain, according to daylight period (morning, midday, and afternoon) in each study month in the winter of 2020–2021.

3.4. Diet

The quantification of the food remains found in pellets (n = 71) is shown in Figure 3. Most pellets (97.2%) contained remains of wild rabbits. Remains of other wild animals were present in a very low proportion of pellets and correspond to mammals, including wild boar (*Sus scrofa*, 1.4%), house mouse (*Mus musculus*, 2.8%), Mediterranean pine vole (*Microtus duodecimcostatus*, 1.4%), birds (domestic pigeon, 1.4%), and insects (unidentified beetles and ants; 5.6%). The occurrences classified as "carrion obtained from landfill" corresponded to bones and feathers of poultry (*Gallus gallus domesticus*, 4.2%), while pellets with synthetic rubbish included plastic fragments and a small piece of metal from a commercially available sausage remnant (1.4%).

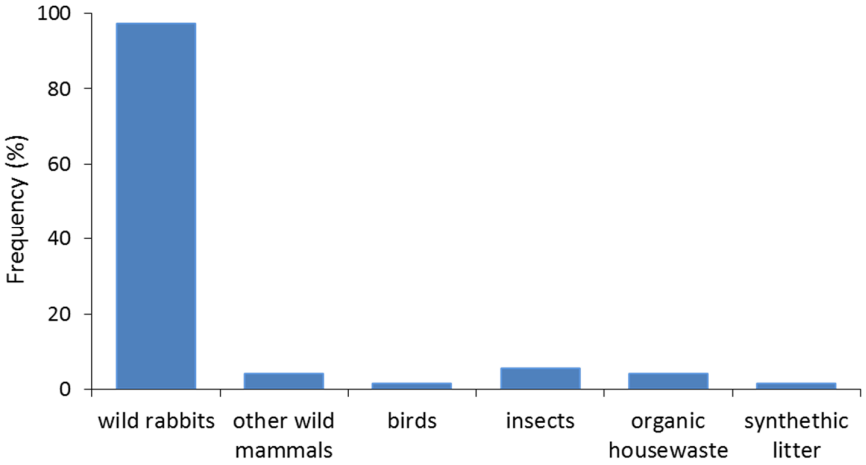

Figure 3. Proportion of occurrence of each food type in pellets (n = 71) of red kite, collected in the communal roost near the landfills of southeastern Madrid, central Spain, during the study period (winter 2020–2021).

Because each pellet may contain remains of different food types, the sum of the proportions of each of the considered food categories can add up to more than 100%. Thus, most of the pellets were composed exclusively of wild rabbit hair and bones (61 of 71, 85.9%), while a large majority of the pellets with other food types also contained rabbit remains (8 of 10, 80.0%). Only two of the analyzed pellets (2.8%) contained no rabbit

remains: one consisted exclusively of poultry feathers and the other of poultry feathers and insect remains. The only pellet with synthetic litter consisted mostly of rabbit remains.

4. Discussion

Around 17% of the world's food production is wasted annually, which translates into a global average of 121 kg of household waste per capita [63]. The dumping of household waste in open landfills is still a common practice in many European regions, and it is expected to last in forthcoming decades [3,55]. In Spain, around 17.5 million tons of food wasted annually are primarily disposed of in open landfills, where red kites forage on a daily or seasonal basis, especially during winter, thus exerting a generally unknown influence on their populations. Our results show the constant presence of red kites throughout the day and during the whole winter period at a landfill in central Spain. Gulls of two species and the white stork also frequently used the landfill and showed much higher abundances than red kites, while several other scavengers and generalist foragers were frequently observed but at much lower abundances. The presence during the winter of red kites in landfills located in southeastern Madrid was not recorded in the past [17,64,65], and the use of the area as wintering grounds, including the establishment of communal roosts, is a recent event.

Nowadays, seasonal migratory movements dictate the variations in the number of red kites foraging in the landfill during the winter, with a slightly higher abundance in December and February than in January. This suggests that individuals moving to more southerly latitudes can spatiotemporally overlap with local and migratory individuals spending the winter in the study area [20,66]. In addition, individuals returning to their breeding areas from southern latitudes can coincide with those that have not yet begun their migration towards the north, thus increasing their abundance in February in central Spain [34,44,67]. These seasonal movements, together with the typical nomadic movements during the wintering season, suggest that the recent use of landfills could play a role in the movements of wandering and migrating red kites, as well as for those established in the area as their wintering and breeding grounds.

The number of red kites in the landfill increased until midday and then decreased as individuals returned to the roost, although with variations depending on the month. This agrees with similarly frequent entries in the morning and in the afternoon, and some accumulation of individuals during the central part of the day. The lack of any clear daylight turnover pattern in the landfill may be influenced by kites' activities that are not related to feeding but to social interactions, including chases, fights, food thefts, and passive gatherings that can be envisioned within the range of interactions with a social function in this species [21,36]. Specifically, it was frequently observed that after obtaining food remains, individual kites quickly left the landfill followed by other individuals attempting to steal the food. The landfill was also used during midday as a resting place after feeding and as a place of concentration before returning to the roost. Therefore, the counts of red kites could overestimate the landfill's importance as foraging grounds, as not all individuals observed necessarily feed there. In addition, kites also predate on wild animals in the landfill (small birds and rodents) and their close surroundings, especially wild rabbits breeding and foraging at a high density in the embankments on the edges of the landfill and surrounding crops and hillsides.

Generalist predators and scavengers may select particular food and foraging places depending on energetic and social constraints [68,69]. Because red kites are opportunistic predators and facultative scavengers, their diet includes a high variety of items, exploited based on abundance, availability, predictability, and preference [21,22,33,35,70]. The results of the pellet analysis make it clear that the diet of red kites in the study area is dominated by the wild rabbit, a key prey species in the Mediterranean [71]. This dependence is favored by the high abundance of this prey in the study area and their surroundings, now and in the past [22,33], which indicates that the natural environment offers a much greater quantity of suitable food than the landfill itself. Food scraps obtained from a landfill may

leave little residue in the pellets, which would lead to underestimating their importance in the diet [33]. While this may be true for meat scraps without integument, it does not apply to household waste and slaughterhouse scraps and items that may result in the presence of small bones, feathers, or scales, as in the case of poultry and fish scraps. In addition, the remains obtained from the landfill are associated with indigestible synthetic debris, such as plastic, paper, small glass, and metal fragments, which should be present in a higher proportion of the pellets if the landfills were an important source of food at the population level. Even then, this would not invalidate the preponderant importance of the wild rabbit in the diet. In any case, the potential underestimation of the importance of the remains obtained from the landfill would have to be associated with the simultaneous consumption of rabbits, suggesting that the role of this prey item is quantitatively very relevant compared to the food obtained from the landfill, as occurred in the black kite in the same area [37].

The wild rabbit represents the ideal prey type for many medium- and large-sized raptors and carnivore mammals in the Mediterranean, especially when this key prey species reached a high density [71]. Other avian species with a much higher abundance in the landfill, such as gulls and the white stork, can compete with red kites for food scraps [15,36], whereas when feeding on wild prey, this competition does not occur. Therefore, the importance of landfills may be greater as predictable feeding sites than as places where food may be available as an abundant, easily accessible, defensible, and nutritionally high-quality resource. In particular, the scraps generally obtained from household waste are small, low energy, and low nutritional value items, compared with the wild prey and carrion exploited in livestock carcass dumps [15,22,25,37,40]. However, due to their predictability, food scraps obtained in landfills can be important in periods of scarce availability of wild prey or bad weather. These resources could be especially valuable for young and inexperienced, migrating or wandering individuals with little knowledge of the study area, and experience and ability to search for and capture more optimal food-animal, both as live prey or carcass, as well as for uncompetitive individuals or those in poor physical condition. This is in agreement with a higher proportion of juveniles in the landfill than in the overall wintering population, estimated by sampling at roosts. In addition, the landfill could act as a place with a social function that could be extended to nearby communal roosts [72].

The wintering population in the study area was established in 2009 and has increased progressively since then, reaching about 3000 individuals estimated through simultaneous counts in communal roosts in the last years (authors' unpubl. data), which represents one of the numerically most important wintering nuclei in Spain. This contrasts with the relatively low abundance of kites observed in the studied landfill, with less than 30 individuals on average across daily snapshot counts throughout the winter and a reduced hourly inflow and outflow. The use of the other landfill in the area (Valdemingómez) could be assumed similar, although the waste management by recycling and incineration there [55] can make food resources less available for scavengers. Moreover, in the last few years, campaigns have been launched for reasons unknown to us to scare away the birds that feed in this landfill (pers. obs.) by those responsible for waste management by the regional governments.

5. Conclusions

Our study suggests relatively low quantitative importance of landfills as foraging grounds on a daily basis for the increasing population of wintering red kites in southeastern Madrid. Instead, the high regional density of wild rabbits, and in the surroundings of the landfills, attracts large numbers of red kites that can eventually use these places, thus likely influencing an uninformed positive perception about its relevance for the conservation of the wintering population. In contrast to predation on wild rabbits, the use of the landfill as a foraging site and of the refuse as food is subject to multiple risks to the health and survival of the kites. These risks include mainly poisoning and contamination through ingestion of toxic products and hazardous synthetic materials, electrocution and collision

with wires and fences, entanglement with ropes and plastics, and unintentional poisoning with anticoagulants used in rat extermination campaigns. More research is needed to evaluate the role of increasing populations of wild rabbits on the habitat use and population dynamics of the red kite in central Spain.

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