World Journal of Environmental Biosciences
All Rights Reserved WJES © 2014
Available Online at: **www.environmentaljournals.org**

Volume 7, Issue 3: 85-90

ISSN 2277- 8047

First Recorded Reproduction of Lesser Kestrel (Falco Naumanni) in Algeria

Bendahmane Lotfi[1], Nouidjem Yassine[2*], Saheb Menouar[1]

[1]Department of Natural and Life Sciences, University of Oum El-Bouaghi, Algeria,
[2]Department of Natural and Life Sciences, University of M'Sila, Algeria.

ABSTRACT

This study was conducted during the breeding period of the Lesser kestrel Falco naumanni during the 2016 & 2017 years, in the southwestern part of the city of Constantine (36°20'09,10'' N, 6°34'41,51'' E). Its principal aim was developing a monitoring technic, to collect data on the biology and ecology of the species during the breeding season, and determine the exploited habitats by the lesser kestrel during the nestling season. For that, binoculars were used to observe the parents' behavior outside the nest. On the other hand, the video surveillance method was opted to monitor the parent's activities during the nestling period. In addition to the parameters directly related to the reproductive monitoring, such as nest location, nesting size, number of breeding pairs, reproductive success and productivity, this study allowed us to identify and monitor over 1650 preys in the three nests.

Keywords: *Urban Birds, Falco Naumanni, Lesser Kestrel, Breeding, Reproduction, Prey, Habitat, Ecology, Environment, Inventory, Constantine.*

Corresponding author: Nouidjem Yassine
e-mail✉ yacinenouidjem@gmail.com
Received: 17 January 2018
Accepted: 28 April 2018

1. INTRODUCTION

The lesser kestrel *Falco naumanni* is a rare small raptor, slightly smaller than the common kestrel *Falco tinnunculus*. Its status in Algeria is unknown, a little investigation and research has been conducted on this species. As a result, there is very little information on the biology and ecology of the lesser kestrel in Algeria.

Currently, the city of Constantine has been considered as a nesting area for this species, and since its discovery in 2014 (Bendahmane L., 2014) several breeding pairs of this species has been registered. Although the reproduction of this falcon has been documented in the literature (Cramp & Simmons, 1980; Nichols et al., 1994; Serrano et al., 2001; Calabuig et al., 2008), the young Constantine population has never been the subject of a scientific study on this species, before.

Monitoring of lesser kestrel reproduction in urban areas (city of Constantine) has been carried out for two successive years of 2016 & 2017.

The objectives of this study were determining a monitoring technique without disturbing the species, collecting data on the behavior of the species during the breeding season, identifying the diet brought by breeding pairs of the lesser kestrel to their offspring, and thus determining the habitats exploited by this falcon during this period.

2. MATERIALS AND METHODS

Study Area

The present study took place near the city of 154 dwellings of CNEP BoussoufAbdelhafid, which is located in the southwest part of the city of Constantine, at an estimated distance of 10 km of downtown area (Figure 1).

The city of Constantine is characterized by a continental climate, and records a temperature varying between 25°C to 40°C in summer, and from 0°C to 12°C in winter; the average rainfall varies from 500 mm to 700 mm during 20 days per year.

The establishment of new urban housing areas (ZHUN) in Constantine during the 70's and 80's allowed the creation of several districts including the BoussoufAbdelhafid city; this land base covers an area of 148.75 ha and is very uneven, particularly in the north-western part where the site of this study is located (36°20'09.10'' N, 6°34'41.51'' E), which was developed on vacant land, and is currently marked by landslide traces, which prevented the inhabitants from occupying these dwellings for fear of a collapse (Boukous S, 2015).

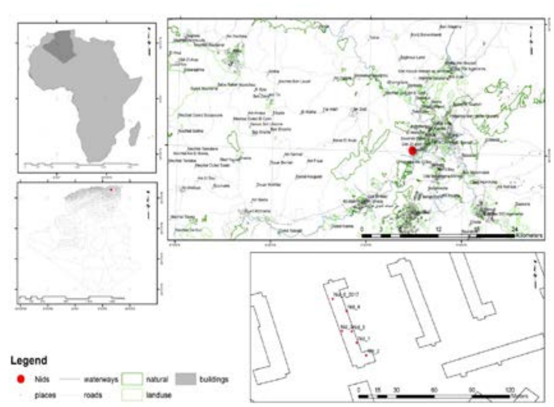

Figure 1. Map of the study area

Monitoring the activities of Lesser kestrel breeding pairs

A conservation approach was carried for the monitoring of breeding pair activities during two consecutive years (2016 & 2017) at a distance and as far away from the disturbance factor as possible; in this way,10 x 60 binoculars were used to observe the parents' behavior outside the nest. On the other hand, the video surveillance method was opted by putting camcorders with a recording capacity, which exceeded the 20 hours closest to the nests as of the hatching of the first egg.

Before that and after the nest survey, periodic visits were made to each nest; and for each nest, the laying date, brood size and incubation period were recorded, then, the installation of the camcorders was proceeded with the arrival of the first chick.

To avoid battery problems, 30-meter single-phase extension cords were used, which were necessary to connect the camcorders directly to the power source; the camcorders had a built-in memory of 80 GB, which allows the researchers to make a continuous recording of more than 20 hours.

The recording was started from dawn until dusk during 03 weeks. The nests were visited twice a day throughout the recording period, the first around 5 a.m. for the installation of the camcorder, the second at 8 p.m. for the transfer of the video to an external hard drive using a laptop computer. This video surveillance allowed the researchers to note for each nest filmed by the diet of the lesser kestrel's young (Table 2).

3. RESULTS AND DISCUSSION

Discovered in 2015, southwest of the city of Constantine with a breeding population of seven pairs, the colony was formed in 2017 by 20 breeding pairs and is now the largest in Constantine.

From the first moments of the discovery of this colony, the researchers proceeded to locate the nests and the breeding pairs, but the inaccessibility to the site in this period prevented them from working properly, in spite of that, they were able to locate seven pairs. Indeed, the site which is constituted of a series of several buildings and presenting a risk of collapse, was placed under surveillance, which prohibited any access or taking photographs. Nevertheless, the researchers tried to contact during the year 2015 with the persons in charge territorially competent to authorize them to reach it, and after having explained to them the context of the present study, they granted us the access to the first building only without official character!

In 2016, the number of the breeding pairs was estimated at 13; 5 of which were installed in the first building, 2 of which were subject to video surveillance (nest number 02 and nest number 03) (Figure 1, Table 1), the others had periodic visits.

In 2017, only one nest installed in the first building was recorded and its location was different from the previous five recorded in 2016, it (nest number 06) was subject to video surveillance, too (Figure 1, Table 1).

The number of breeding pairs in 2017 was estimated at 20 pairs, this escape from former nesting sites was possibly related to the disturbance factor that was caused at the time of the study during the breeding period of 2016.

The arrival of the first individuals

If the kestrel*Falco tinnunculus* was common throughout Algeria, the lesser kestrel*Falco naumanni* on the other hand had an unknown status. In Constantine, the two species were considered as one species. However, the first identification of the lesser kestrel in Constantine was made in 2014 (Bendahmane L, 2014).

The lesser kestrel settles in Constantine in early March with the recording of two colonies with about ten pairs each, the first in the northern part of the Rhumel gorges (36° 22' 22'' N, 6° 36' 41'' E) were also discovered in 2014 (Bendahmane L, 2014), the second discovery was made in 2015 as the subject of this study. The falcons reproduced at the rate of one brood for each couple, and left again at the end of August. Therefore, we it could be concluded that the lesser kestrel was a breeding species present only during the breeding season.

Monitoring the activities of Lesser kestrel breeding pairs

The nests were installed at a height that varied between 9 and 12 m (11.45 ± 1.18) in concrete containers embedded in the building intended for planting (Figure 2). The nests did not contain much, just some rubble and pigeon droppings. During the two years of follow-up, the set of nests studied numbered nine, and contained a total of 35 eggs. The average egg laying size was 3.89 eggs per nest; for comparison, it was 4.11 in southern Spain (Negro et al., 1993). The laying frequency was less than 24 hours, 24 hours and 48 hours for respectively 5.17%, 42.86% and 51.43% of all eggs (Dejonghe, 1989). A total of nine missing eggs for the nine nests studied during the two years of follow-up was noted, about 80% of these missing eggs belonged to the pairs that were video monitored, this disappearance of eggs was observed after the thirty-first day (31 days) of nesting for all the concerned nests, and it was believed that this disappearance was due to the failure of the hatching caused by the researchers' disturbing presence.

The incubation period averaged 29.89 ± 1.17 days. The total number of hatched eggs was 26 with an estimated hatching success of 74.29% for the two years of follow-up.

The sex ratio, which is a very important element of population dynamics, was equal to 1 in lesser kestrel hatches (Tella et al., 1996). For the colony of this study in 2017, a rate of 0.514 for males and 0.486 for females was discerned in the sub-adult and adult population, which was a sex ratio close to equilibrium (1). The slight difference might be due to the higher philopatria in males than in females (LPO Mission Rapaces).

The average number of young at flight per successful breeding pair was estimated to be 2.67. To compare with the region of Caceres in Spain, the reproductive success was 2.88 in 1998 and 3.78 in 1999 (Núñez, 2001). This reproductive success was certainly due to the quantity and quality of food available in the habitats around the nesting site (LPO Mission Rapaces). For example, in Spain in some lesser kestrel colonies, the mortality rate among chicks has reached 35%, this rate was attributed to a lack of food (Donazar, 1993). This phenomenon has not been observed in the colony of this study where food availability seemed to be high.

Table 1. Breeding parameter of Lesser Kestrel in the city of Constantine – Algeria

Year	Nest	The height of the nests' location	Number of eggs	the average incubation period	Lost eggs	Hatched eggs	Number of fledglings ready to fly	Female
2016	N1	11,45 meter (9 - 12)	2	29,89 Days (28 - 31)	0	2	2	1
	N2		5		3	2	2	2
	N3		5		2	3	3	2
	N4		3		0	3	3	2
	N5		3		0	3	3	1
2017	N6		5		2	3	3	2
	N7		4		1	3	2	1
	N8		3		0	3	3	2
	N9		5		1	4	3	1
Total			35		9	26	24	14

Figure 2. Photos taken at the study site (Haddad, 2016)

Determination of prey brought to the offspring

Thus, within the constraints defined above, only three different pairs (two in 2016 and one in 2017) were monitored by video surveillance on all breeding pairs in the colony of the present study between 2016 and 2017. These three pairs were all followed with the technique previously described, namely the installation of the camcorders in each nest as soon as the first egg hatched; this follow-up was done for 24 days for each nest, with an average of 14 h 48 min of video recording per day and per nest. As described before, two visits per day for each nest was made. The first was done in the morning to turn on the camera, the second in the evening to move the recording to an external hard disk. The camcorders could not be put in these three nests beyond the third week for fear of scaring the chicks that might escape from their nests.

Using this video surveillance method, it was possible to determine the diet of the chicks of these three pairs. However, in the majority of cases, it was not possible to identify the type of prey brought by the parents, but it was possible to establish a classification by order and family (Table 2).

The food diversity of these chicks consisted of a minimum of 10 different families of prey brought to the chicks over a three-week nest-rearing period.

The analysis of all the prey brought to the nest during the nestlings rearing period showed the importance of the orthopterans which constituted more than half of this diet with a majority share equal to 65.62% of the prey (n = 1694). Within this order, it was possible to notice the superiority of acridids (66.15% of orthopterans, n = 1117) followed by gryllids (31.51% of orthopterans, n = 1117) and far behind and not negligible came tettigonids (2.33% of orthopterans n = 1117) (Figure 3). The species in these three families occupied a variety of habitats, both upland and wet, and their presence was largely dominant in the lesser kestrel hunting area. The reduced rate of tettigonids in the diet of young birds was explained by the affinity of parents to hunt larger prey (Figure 4).

Far behind the orthoptera, two orders were found which were represented by homoptera and more exactly the family of Cicadidae (100% of homoptera) with a percentage of 13.45% (n=1694), and lepidoptera represented by the family of Sphingidae with a percentage of 10.84% (n = 1694).The presence of chilopodids (100% of Myriapods) reached to 4.33% of prey (n=1694), thus illustrating the flexibility and nutritional opportunism of these couples during periods of high density of orthoptera, homoptera and lepidoptera. But, the particularity of this category of prey, was more than half (57.89% of chilopodidae, n= 76) which was hunted in the first week of nestling.

Finally, beetles, lizards, mantidae and rarely small passerines had all contributed to the diversification of the diet brought to the nest during the nestling period (Figure 5).

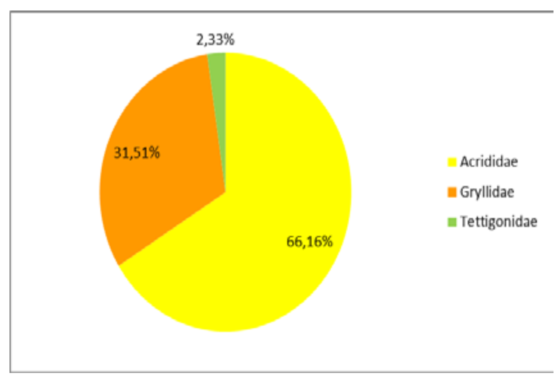

Figure 3. Percentage of prey belonging to the order Orthoptera brought to nests during the nestling period

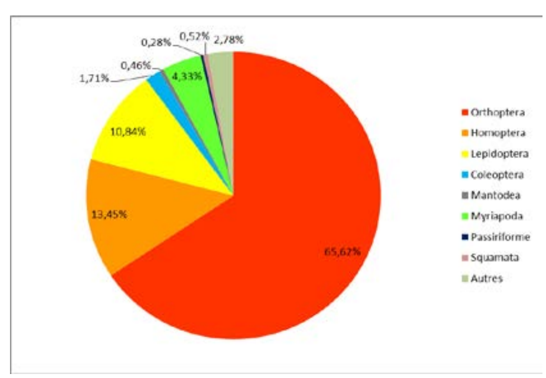

Figure 4. Percentage of different prey brought to nests during the nestling period

Table 2. Variety and quantity of prey provided to nests during the nestling season

Prey		Nest 2								Nest 3								Nest 6							
Order	Family	Week 1	%	Week 2	%	Week 3	%	Total	%	Week 1	%	Week 2	%	Week 3	%	Total	%	Week 1	%	Week 2	%	Week 3	%	Total	%
Coleoptera	-	0	0	2	1,02	6	3,43	8	1,57	3	1,51	1	0,55	2	0,91	6	1	5	2,79	3	1,52	7	3,43	15	2,58
Homoptera	Cicadidae	13	9,29	37	18,88	47	26,86	97	18,98	33	16,58	27	14,75	21	9,55	81	13,46	13	7,26	12	6,06	21	10,29	46	7,92
Lepidoptera	Sphyngidae	17	12,14	32	16,33	37	21,14	86	16,83	19	9,55	15	8,20	18	8,18	52	8,64	14	7,82	6	3,03	21	10,29	41	7,06
Mantodea	Mantidae	0	0	1	0,51	0	0	1	0,20	0	0	1	0,55	1	0,45	2	0,33	0	0,00	3	1,52	2	0,98	5	0,86
Myriapoda	Chilopodidae	4	2,86	0	0	0	0	4	0,78	17	8,54	12	6,56	2	0,91	31	5,15	23	12,85	11	5,56	7	3,43	41	7,06
Orthoptera	Acrididae	63	45	51	26,02	51	29,14	165	32,29	77	38,69	99	54,10	106	48,18	282	46,84	73	40,78	117	59,09	102	50	292	50,26
	Gryllidae	39	27,86	64	32,65	29	16,57	132	25,83	43	21,61	17	9,29	51	23,18	111	18,44	39	21,79	36	18,18	34	16,67	109	18,76
	Tettigonidae	0	0	0	0	1	0,57	1	0,20	3	1,51	1	0,55	6	2,73	10	1,66	8	4,47	2	1,01	5	2,45	15	2,58
Passiriforme	Passiridae	0	0	0	0	0	0	0	0	1	0,50	1	0,55	0	0	2	0,33	2	1,12	0	0	1	0,49	3	0,52
Squamata	Lacertidae	0	0	1	0,51	0	0	1	0,20	1	0,50	2	1,09	1	0,45	4	0,66	1	0,56	2	1,01	1	0,49	4	0,69
Autres	-	4	2,86	8	4,08	4	2,29	16	3,13	2	1,01	7	3,83	12	5,45	21	3,49	1	0,56	6	3,03	3	1,47	10	1,72

Total	8	10	140	100	196	100	175	100	511	100	199	100	183	100	220	100	602	100	179	100	198	100	204	100	581	100	1694

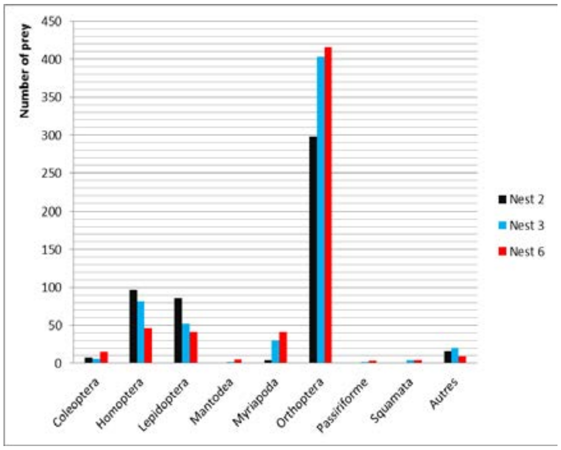

Figure 5: Abundance of nest prey during the nestling season

Exploitation of the hunting area by breeding pairs during the nestling season

The determination of the prey brought by the parents' lesser kestrel to the young made it possible to identify the orthopterans and more particularly the acridids and the gryllids as the primordial prey hunted by these couples, and a little less preponderant for the cicadids and the sphingids. These types of prey are characteristic of xeric lawns and fallows; they are also species from warm environments that adapt very well to cultivated land.

From this diet represented by these different preys, it was possible to determine the hunting zone of lesser kestrel pairs as a mosaic of more or less arid open biotopes. In addition, during the observation throughout the breeding season, it was possible to observe that breeding pairs flew northwestward and found habitats similar to those previously mentioned.

4. CONCLUSION

The initial results of this study seemed to justify the effectiveness of the video surveillance system in terms of the number of images per second, particularly in monitoring certain behavioral characteristics of breeding pairs with respect to their offspring; the image quality was directly related to the cost of the material used. In this case, given the image quality, it was not possible to identify the genus of prey brought to the nest during the nestling period.

This study made it possible to monitor the breeding ecology of nine lesser kestrel pairs, five breeding pairs in 2016 and four breeding pairs in 2017, three of which were video monitored. The initial results from this monitoring showed that nest locations were at an average height of 11.45 m. Thirty-five eggs were counted in the nine studied nests, twenty-six of which hatched after an average incubation period of 29.89 days, giving 26 chicks. Twenty-four chicks took flight; eight of them were falcons and were marked with plastic rings in order to check the fidelity of this species to its birth site (Figure 2). As a result, 80% of the missing eggs (n=9) belonged to the nests that were video monitored.

Although the analysis of all the prey brought to the nest by lesser kestrel parents during the nest-rearing period did not allow the identification of the genus and species of these preys, the results seemed to highlight the remarkable presence of two large families, namely acridids and gryllids.

From the diet of the chicks during the rearing period, represented by the different preys hunted and brought by the breeding pairs lesser Kestrel, it was possible to distinguish more or less arid open environments as a hunting zone for these breeding pairs and thus delimit it on the map.

Finally, the results that were obtained during this work need to be clarified by more in-depth and broader studies. It is also necessary to make this video surveillance system more autonomous from the energy point of view by combining it with a photovoltaic recharging system on one hand, and on the other hand by combining it with a direct recording device on an external hard disk which would make it possible to limit the disturbance factor caused by the researchers' presence on the behavior of these birds as much as possible.

5. ACKNOWLEDGEMENTS

The authors would like to thank Dr HADDAD Karim (Association Environnemental of Constantine Aquacirta) for helping us with the field follow-up. Mr Samy Charaf Eddine AIDAOUI for his help in writing this article. My father Mr Med Cherif BENDAHMANE, Pr Noureddine SIDI MANSOUR and Mr Med Cherif BOULEBIER for the corrections they made on this material.

REFERENCES

1. Bendahmane L (2014). Inventory and ecology of birds subservient to the waters of Rhumel (The gorges of Constantine). Memory of Magister. University of Oum el Bouaghi. Algeria.
2. Boukous S (2015). https://prezi.com/q-01ujax3h_0/risques-lies-aux-glissements-de-terrain-a-constantine-cas-d/?webgl=0
3. Calabuig G, Ortego J, Cordero PJ, Aparicio JM (2008). Causes, consequences and mechanisms of breeding dispersal in the colonial lesserkestrel, Falco naumanni. Animal Behaviour, 76: 1989-1996.
4. Cramp S, Simmons KEL (1980). Handbook of the birds of Europe, the Middle West and NorthAfrica, vol. 2. Oxford UniversityPress, 695 p.
5. Dejonghe JF (1989). Importance, Structure, Origins, Biometrics, Population Dynamics of Kestrelsduringspring migration in the Cap Bon (Tunisia). Alauda 57: 17–45.
6. Donazar JA, Negro JJ, Hiraldo F (1993). Foraging habitat selection, land-use changes and population

decline in the lesserkestrel Falco naumanni. Journal of AppliedEcology, 30: 515-522.
7. LPO Mission Rapaces (26 boulevard Jourdan, 75014 PARIS, rapaces@lpo.fr) http://rapaces.lpo.fr/faucon-crecerellette/suivi-des-populations.
8. Nichols JD, Hines JE, Pollock KH, Hinz RL, Link WA (1994). EstimatingBreeding Proportions and TestingHypotheses about Costs of Reproduction with Capture- Recapture Data. - Ecology 75: 2052-2065.
9. Núñez M (2001). Most frequent pathological processes in captive breeding programs with lesser kestrel, unpublished report, Faculty of Veterinary Medicine of Cáceres, Cáceres.
10. Serrano D, Tella JL, Forero MG, Donazar JA (2001). Factorsaffectingbreeding dispersal in the facultatively colonial lesserkestrel: individualexperience vs. conspecificcues. Journal of Animal. Ecology, 70, 568–578.
11. Tella JL (1996). Ecologicalconstraints, costs and benefits of coloniality in the lesserkestrel. PhDThesis. University of Barcelona, Spain.