

AVIFAUNISTIC DIVERSITY OF MERINE FOREST, NORTH-WEST ALGERIA

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Abstract

This study is an avifaunistic diversity assessment was carried out in the Merine forest, Sidi Bel Abbes (Northwest Algeria). During three years (2019-2021). The major objective of our investigation is to inventory avian species and to define their phenological categories. Among the important results is a record of 71 species of bird, belonging to 17 orders and 28 families. The Passeriformes are the most noted with 43 species, distributed across 15 families, of which the Muscicapidae is the most represented with 10 species. The phenological categories indicates that the majority of this species are resident breeders (65 %), 21% are migrant breeders and 14% are passing visitors. Depending on trophic status, 32% are polyphagous, 27% insectivorous, 17% carnivorous, 15% granivorous and 8% omnivorous. In addition, we noted that, 31 species are protected by Flat 12-235 in Algeria, with one species (Falco naumanni) protected by the Ordinance 06-05. Internationally and one species protected according of the IUCN red list (Streptopelia turtur). The Merine forest is shelter to five species endemic to North Africa: Barbary Partridge (Alectoris barbara), Levaillant's Woodpecker (Picus vaillantii), Moussier's Redstart (Phoenicurus moussieri), Tristram's Warbler (Sylvia deserticola), African Blue Tit (Cyanistes teneriffae).

Keywords: Avifauna, North-west Algeria, phenological categories, protection categories, trophic categories.

1. INTRODUCTION

Algeria has a great diversity of climates such as subtropical, Mediterranean, semi-arid and arid climat. It belongs to the Western Palearctic; it borders to the in the north by the Mediterranean Sea and in the south by the Sahel countries (Stevenson et al., 1988; Samraoui and De Belair, 1998; Sadine, 2018). This geographical location, with all its characteristics that allow it to play an important role in biological diversity (faunistic and floristic), ecological, genetic, landscape and also cultural (Chedad et al., 2020a). Birds are one of the most popular life forms on the planet, widespread and present almost all over the world (Joshi and Shrivastava, 2013).

Artificial ecosystems have a great importance in the reception and refuge of various forms of life (Cereghino et al., 2008), including-birds, especially in habitats of hot and arid regions (Roshier et al. 2001; Mwaura, 2010; Chenchouni, 2010 and Chedad et al. 2020a).

The Algerian avifauna has been extensively studied in various environments where studies devoted to landbirds and waterbirds. Even publications or books rely on occasional observations (Heim de Balsac and Mayaud, 1962; Etchecopar and Hue, 1964; Dupuy, 1969; Ledant et al., 1981; Isenmann and Moali, 2000). However, huge gaps exist in the knowledge of this avifauna in northwest Algeria, particularly in forest of Merine (Sidi Bel Abbes). From this point of view, this work aims to inventory avian species in this forest, showing the importance of the latter in the reception and the refuge of the avifauna and to define their phenological and protection status.

2. MATERIALS AND METHODS

This study was carried out in Merine forest, Sidi Bel Abbes ($34^{\circ}40' 44.10''\text{N}$; $0^{\circ}22'43.61''\text{W}$) (Fig. 1), extends over an area of 56671 ha, with an average altitude equal to 1100 m, for a slope between 3 and 25%. It is bounded to the north by the plain of Zegla; to the South-west by the valleys of the Wadis of Messoulehne, Taouzizine and Djorf-TRAb, occupied by agricultural land and steppe formations of Alfa (*Stipa tenacissima* L.); to the southeast by the forest of Béni-Methar and the high plain of Marhoum; to the west by the forests of Saïda. The general bioclimate is semi-arid with a cool variation. The annual average of rain precipitation is about 250-350 mm (Benabdeli, 1976). Aleppo pine (*Pinus halepensis*) is the main dominant species of this Forest and secondary species are: *Tetraclinis articulata* (Vahl) Mast., *Quercus ilex* L., *Quercus coccifera* L., *Pistacia lentiscus* L., *Phillyrea angustifolia* L. etc. (Fig. 2).

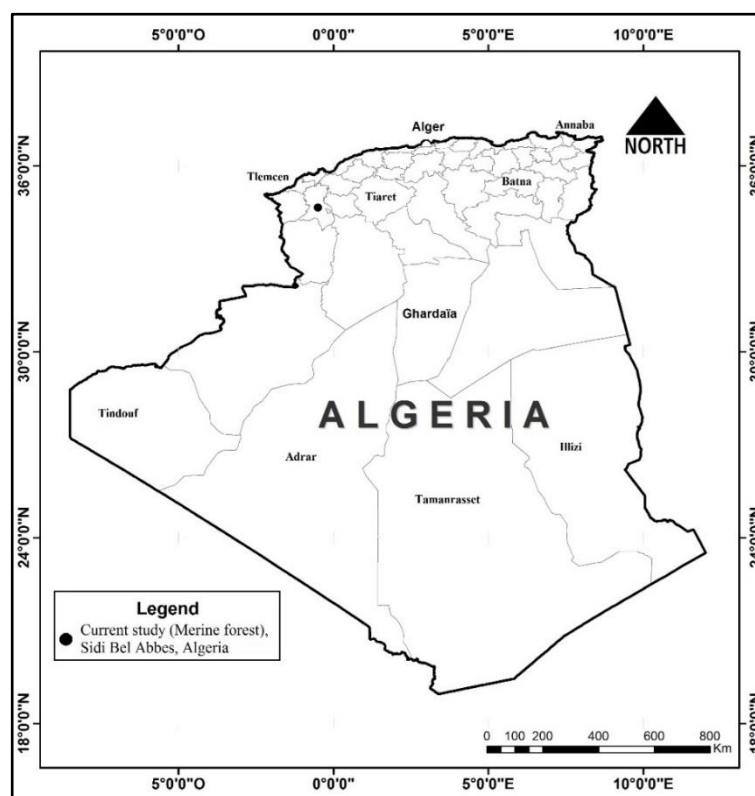


Figure 1. The geographic location of Merine forest, Sidi Bel Abbes, Algeria

For monitoring and define the phenological categories of species of birds, we adopted to the Progressive Frequency Sampling (*Echantillonnage Fréquentiel Progressif "EFP"*) method, which is a point-sampling technique (Blondel, 1975), has already been used in Algeria by several authors such as Moali (1999), Bendjoudi et al. (2013), Farhi (2014), Souttou et al. (2018), Chedad et al. (2020a et b; 2021a et b) and Chedad (2021).

Counts were undertaken by direct observation using a Sonny HV 400 camera. Counts were performed on a regular basis, with weekly/fortnightly, reinforced by additional surveys especially during the main postnuptial and prenuptial migration seasons of birds (Chedad et al. 2021c). Identification of bird species was facilitated by ornithological guidebooks (Heinzel et al., 2004; Svensson, 2010).

The conservation status of bird species at the national level follows executive Fiat 12-235 of 24 May 2012, establishing the list of protected non-domestic animal species, and Ordinance No. 06-05 of 15 July 2006, on the protection and preservation of certain animal species threatened with extinction. At the international level, we based our assessment on the IUCN Red List (IUCN, 2021).



Figure 2. The study area, Merine forest, Sidi Bel Abbès, Algeria

3. RESULTS AND DISCUSSIONS

A- Taxonomic analysis

Appendix 1 covers all avian species observed at least once in our study area (Merine forest). The chronological organization of the species is established according to an alphabetical classification of the systematic orders of the species.

In total, we recorded 71 species belonging to 17 orders and 28 families. The order of Passeriformes are the most dominant with 15 families and 43 species, so more than 53.57% of the species recorded. As for Muscicapidae, Accipitridae and Fringillidae are best represented with 10, 9 and 6 families respectively (Fig. 3, 4). The results obtained represent an equal rate of 17.49% of 406 species reported in Algeria (Isenmann and Moali, 2000).

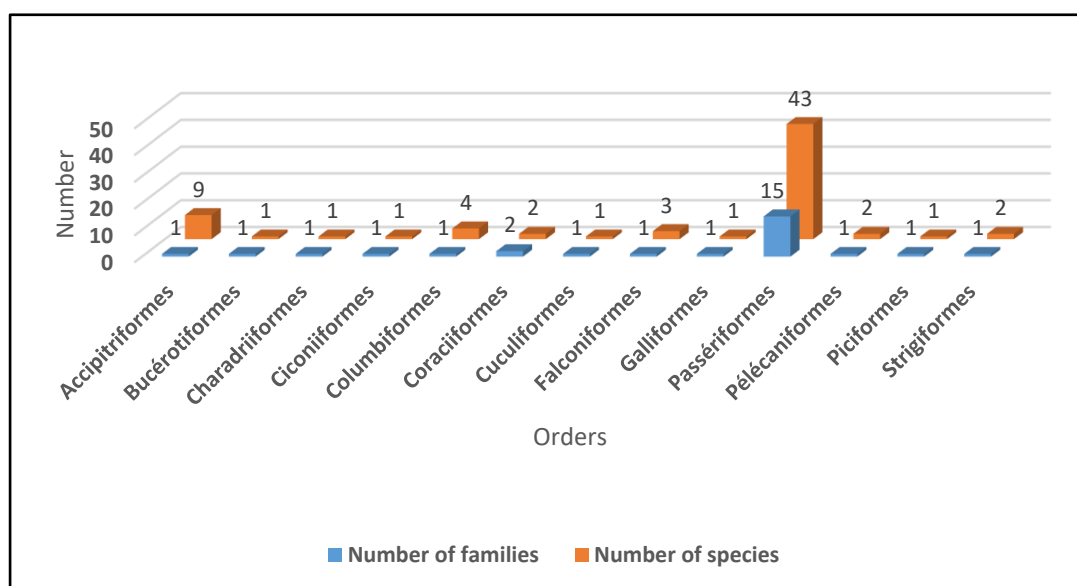


Figure 3. Systematic composition of orders, families and species of birds recorded in Merine

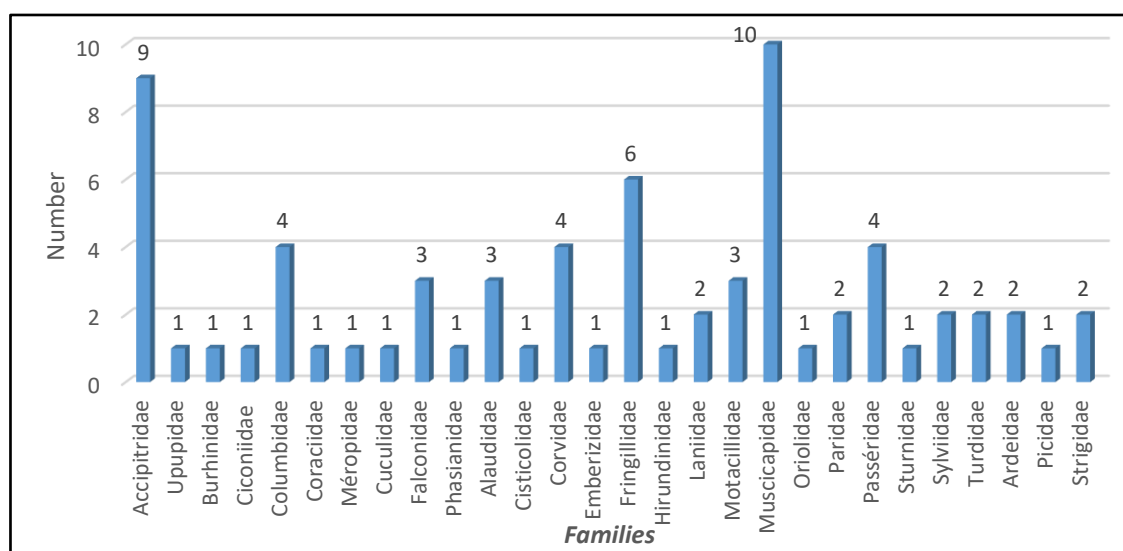


Figure 4. Systematic composition of bird species families recorded in Merine

These results are considered significant compared to the census carried out in a forest environment in El Kala with 86 species given the Passeriformes constituted 65.11% (Benyacoub, 1993). It should be noted that in the Zibans, Farhi & Belhamra (2012) recorded 136 species and in the north of the Algerian Sahara, in the region of Ghardaïa and Ménéa, Chedad (2021) recorded 187 species and finally Bendjoudi et al., (2013) reported 125 species in the Mitidja plain.

In Algeria, recent changes in the range of distribution of some species were initiated by Heim de Balsac (1979) following observations made in the 1970s, species with a rather Saharan distribution had extended northward and this is what they mentioned (Moulai, 2019; Chedad et al., 2021a ;Chedad, 2021 and El Bouhissi, 2021) on the expansion of the range of the House Bunting (from south to north), and the expansion of the range from north to south and great south (Chedad, 2021;Chedad et al., 2020a).

Isenmann and Moali (2000) note that Algeria has 24 species whose distribution is exclusively or partially Saharan, of which only one species is noted in Merine (Pharaoh Eagle-Owl *Bubo ascalaphus*). Finally, it should be noted that this region is shelter to five species out of the six species endemic to North Africa: Barbary Partridge (*Alectoris barbara*), Levaillant's Woodpecker (*Picus vaillantii*), Moussier's Redstart (*Phoenicurus moussieri*), Tristram's Warbler (*Sylvia deserticola*), African Blue Tit (*Cyanistes teneriffae*).

B- Phenological categories

A large part of the Merine avifauna represented by 61 breeding species, of which 46 are sedentary (45 species landbirds and one waterbird species), 15 are migratory species (14 landbirds species and one waterbird species). Non-breeding are represented by 10 passing visitor species (8 landbirds species and 2 waterbirds species), who only make stops through this region (Tab.1). So this forest receives part of the Algerian avifauna that crosses during the two post and prenuptial passages, between Europe and Africa.

Table 1 Phenological categories of Merine avifauna

Type \ Ph. Ca.	breeding		Not breeding
	RB	MB	VP
Waterbirds	1	1	2
Landbirds	45	14	8
Total	46	15	10

Ph. Ca.: Phenological categories (**RB**: Resident breeder, **MB**: Migrant breeder, **VP**: Passing visitors)

The specific richness of the Mediterranean area with about 294 breeding species (Algeria has 214) on a territory three times smaller than the whole of Europe which has just over 400 species (Lebreton and Ledent 1980; Blondel, 1988 and 1995). 103 species of passerine birds that nest in Algeria out of 214 species, represent almost half of the avifauna (48.1%), it is a general dominance throughout the Palearctic zone (Isenmann and Moali, 2000).

Given climate change, agricultural extensions, the appearance of new wetlands, especially artificial etc., all these factors, as well as others, can influence the phenological categories of species, this is what they cited by Chedad et al. (2020b) and confirmed in several species Chedad et al. (2020 a,b; 2021b, c) .

C- Trophic categories

On reading these data, it appears that birds of the trophic categories polyphagous dominate, with 23 species (32.39%), in particular polyphagous with a tendency 'insectivorous, granivorous, frugivorous and mixed'. The second category is represented by insectivorous with 19 species (26.76%). Then come carnivorous and granivorous with 12 and 11 species respectively (16.90 and 15.49%). The last group is, the one with low numbers of omnivorous (8.45%, six species) (Appendix 1 and Fig. 5). These results are explained by the great richness of the arthropodological fauna. Thus, by a great floristic production, of seed, fruit and berry from cultivated and ornamental species native and exotic (Doumandji and Doumandji-Mitiche, 1992). The dominance of insectivorous and polyphagous species varies according to the environment (Milla et al. 2012). The same observations in Ghardaïa and Ménéa in the different regions where insectivorous species and polyphagous are abundant (Chedad 2021), so in the north of the country, at the Hamma test garden (Moulaï and Doumandji, 1996), and in the Algerian Sahel (Milla et al. 2012).

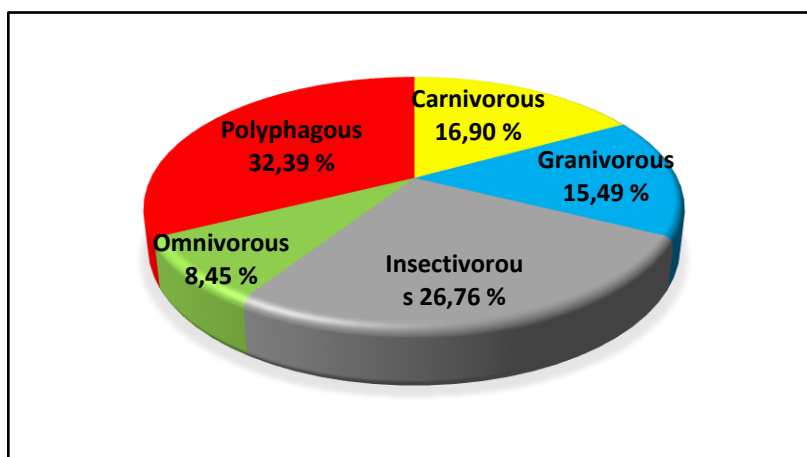


Figure 5. Distribution of Merine avifauna by trophic categories

D- Protection status

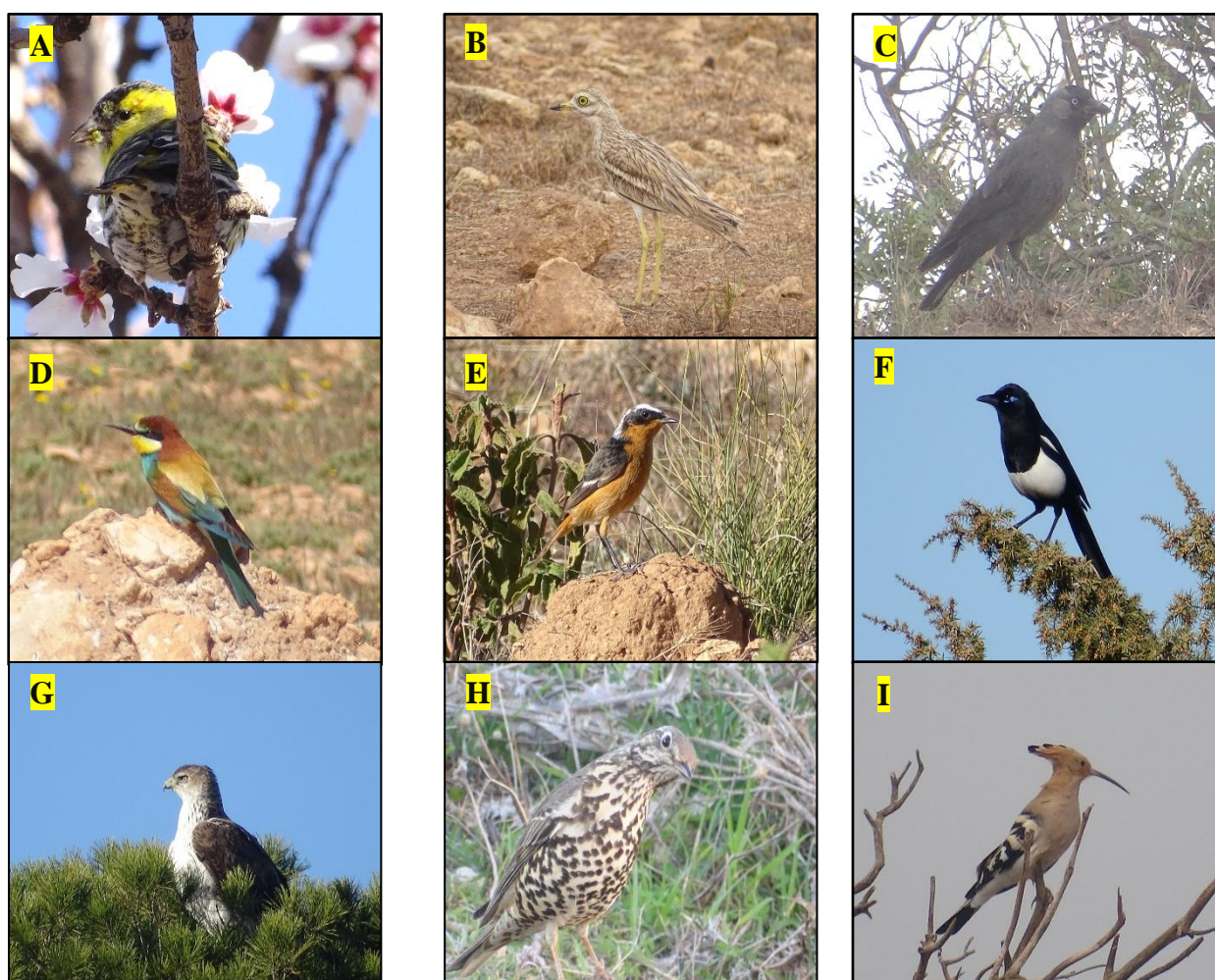


Figure 6. Some remarkable species in the Merine forest (A: *Spinus spinus*, B: *Burhinus oedicnemus*, C: *Corvus monedula*, D: *Merops apiaster*, E: *Phoenicurus moussieri*, F: *Pica mauritanica*, G: *Circaetus gallicus*, H: *Turdus philomelos*, I: *Upupa epops*)

A total of 31 species (43.66%) recorded are protected by Algerian Fiat 12-235 of 24 May 2012, establishing the list of protected non-domesticated animal species, which represent 47.20% of the protected Algerian avifauna (Fig. 6). The Accipitriformes and the Passeriformes predominate with 9 species respectively, on the other hand only one species (Lesser Kestrel, *Falco naumanni*) is protected by Algerian law N°06-05 relating to the protection and the preservation of certain endangered animal species. At the international level, all recorded species have a status of Least Concern in the IUCN Red List except one at "vulnerable" status (European Turtle Dove, *Streptopelia turtur*).

The protected status of the Merine Forest avifauna reflects the importance of this region nationally and internationally.

4. CONCLUSIONS

The Merine Forest is considered as important nesting site for some protected species, including 5 endemic species such as *Alectoris barbara*, *Picus vaillantii*, *Phoenicurus moussieri*, *Sylvia deserticola*, *Cyanistes teneriffae* and as well as an essential stopover site for other species.

The work is the first to highlight the avifaunistic composition of an important forest of North-west Algeria. In the future, it is recommended to carry out other studies the periodic enumeration of waterbirds and landbirds throughout the territory of Sidi Bel Abbes and all the North-west of Algeria and other studies on bio-ecology of certain protected and endemic species.

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Appendix 1 Checklist, protection categories and phenological categories of avifauna observed at Merine

ORDER — FAMILIE				Ph. Ca.	Pr. Ca. (2012)	Pr. Ca. (2006)	Pr. Ca. (UICN)	Tr. Ca.
N°	Scientific name	French name	English name					
A	ACCIPITRIFORMES — ACCIPITRIDAE (12.68%)							
01	<i>Aquila fasciata</i>	Aigle Bonelli	Bonelli's Eagle	RB	P	UP	LC	C
02	<i>Aquila rapax</i>	Aigle ravisseur	Tawny Eagle	PV	P	UP	LC	C
03	<i>Aquila chrysaetos</i>	Aigle royal	Golden Eagle	RB	P	UP	LC	C
04	<i>Buteo rufinus cirtensis</i>	Buse du Maghreb	Long-legged Buzzard (<i>cirtensis</i>)	RB	P	UP	LC	C
05	<i>Circaetus gallicus</i>	Circaète Jean-le-Blanc	Short-toed Snake Eagle	MB	P	UP	LC	C
06	<i>Hieraaetus pennatus</i>	Aigle botté	Booted Eagle	MB	P	UP	LC	C
07	<i>Circus aeruginosus</i>	Busard des roseaux	Western Marsh Harrier	MB	P	UP	LC	C
08	<i>Elanus caeruleus</i>	Élanion blanc	Black-winged Kite	MB	P	UP	LC	C
09	<i>Circus pygargus</i>	Busard cendré	Montagu's Harrier	PV	P	UP	LC	C
B	BUCEROTIFORMES — UPUPIDAE (1.41%)							
10	<i>Upupa epops</i>	Huppe fasciée	Eurasian Hoopoe	RB	P	UP	LC	I
C	CHARADRIIFORMES — BURHINIDAE (1.41%)							
11	<i>Burhinus oedicnemus</i>	Oedicnème criard	Eurasian Stone-curlew	PV	P	UP	LC	I
D	CICONIIFORMES — CICONIIDAE (1.41%)							
12	<i>Ciconia ciconia</i>	Cigogne blanche	White Stork	MB	P	UP	LC	Poly (M)
E	COLUMBIFORMES — COLUMBIDAE (5.63%)							
13	<i>Streptopelia decaocto</i>	Tourterelle turque	Eurasian Collared Dove	RB	UP	UP	LC	G
14	<i>Columba livia</i>	Pigeon biset	Rock Dove	RB	UP	UP	LC	G
15	<i>Columba palumbus</i>	Pigeon ramier	Common Wood Pigeon	RB	UP	UP	LC	G
16	<i>Streptopelia turtur</i>	Tourterelle des bois	European Turtle Dove	MB	UP	UP	VU	G
F-1	CORACIIFORMES — CORACIIDAE (1.41%)							
17	<i>Coracias garrulus</i>	Rollier d'Europe	European Roller	MB	P	UP	LC	Poly(I)
F-2	CORACIIFORMES — MEROPIDAE (1.41%)							
18	<i>Merops apiaster</i>	Guêpier d'Europe	European Bee-eater	MB	P	UP	LC	I
G	CUCULIFORMES — CUCULIDAE (1.41%)							
19	<i>Clamator glandarius</i>	Coucou geai	Great Spotted Cuckoo	RB	P	UP	LC	I
H	FALCONIFORMES — FALCONIDAE (4.32%)							
20	<i>Falco tinnunculus</i>	Faucon crécerelle	Common Kestrel	RB	P	UP	LC	Poly(I)
21	<i>Falco naumanni</i>	Faucon crécerellette	Lesser Kestrel	MB	UP	P	LC	Poly(I)
22	<i>Falco biarmicus</i>	Faucon lanier	Lanner Falcon	PV	P	UP	LC	C
I	GALLIFORMES — PHASIINIDAE (1.41%)							
23	<i>Alectoris barbara</i>	Perdrix gabra	Barbary Partridge	RB	UP	UP	LC	Poly (G)
J-1	PASSERIFORMES — ALAUDIDAE (4.32%)							
24	<i>Galerida cristata</i>	Cochevis huppé	Crested Lark	RB	UP	UP	LC	Poly (M)
25	<i>Melanocorypha calandra</i>	Alouette calandre	Calandra Lark	RB	UP	UP	LC	G
26	<i>Auda arvensis</i>	Alouette des champs	Eurasian Skylark	RB	UP	UP	LC	G
J-2	PASSERIFORMES — CISTICOLIDAE (1.41%)							
27	<i>Cisticola juncidis</i>	Cisticole des joncs	Zitting Cisticola	RB	UP	UP	LC	I
J-3	PASSERIFORMES — CORVIDAE (5.63%)							
28	<i>Garrulus glandarius</i>	Geai des chênes	Eurasian Jay	RB	P	UP	LC	O
29	<i>Pica mauritanica</i>	Pie du Maghreb	Maghreb Magpie	RB	P	UP	LC	O
30	<i>Corvus corax</i>	Grand corbeau	Northern Raven	RB	UP	UP	LC	O
31	<i>Corvus monedula</i>	Choucas des tours	Western Jackdaw	MB	P	UP	LC	O
J-4	PASSERIFORMES — EMBERIZIDAE (1.41%)							
32	<i>Emberiza calandra</i>	Bruant proyer	Corn Bunting	RB	UP	UP	LC	Poly(G)
J-5	PASSERIFORMES — FRINGILLIDAE (8.45%)							
33	<i>Chloris chloris</i>	Verdier d'Europe	European Greenfinch	RB	UP	UP	LC	G
34	<i>Loxia curvirostra</i>	Bec-croisé des sapins	Red Crossbill	RB	P	UP	LC	G
35	<i>Fringilla coelebs africana</i>	Pinson des arbres	Common Chaffinch	RB	UP	UP	LC	O
36	<i>Linaria cannabina</i>	linotte mélodieuse	Common Linnet	RB	UP	UP	LC	Poly(G)

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37	<i>Spinus spinus</i>	Tarin des aulnes	Eurasian Siskin	PV	UP	UP	LC	G
38	<i>Serinus serinus</i>	Serin cini	European Serin	RB	P	UP	LC	G
J-6	PASSERIFORMES — HIRUNDINIDAE (1.41%)							
39	<i>Hirundo rustica</i>	Hirondelle rustiques	Barn Swallow	RB	UP	UP	LC	I
J-7	PASSERIFORMES — LANIIDAE (2.82%)							
40	<i>Lanius excubitor</i>	Pie-grièche gris	Great Grey Shrike	RB	UP	UP	LC	Poly (I)
41	<i>Lanius senator</i>	Pie-grièche à tête rousse	Woodchat Shrike	MB	UP	UP	LC	I
J-8	PASSERIFORMES — MOTACILLIDAE (4.23%)							
42	<i>Motacilla flava</i>	Bergeronnette printanière	Western Yellow Wagtail	PV	UP	UP	LC	I
43	<i>Motacilla alba</i>	Bergeronnette grise	White Wagtail	PV	UP	UP	LC	I
44	<i>Anthus trivialis</i>	Pipit des arbres	Tree Pipit	RB	UP	UP	LC	I
J-8	PASSERIFORMES — MUSCICAPIDAE (14.08%)							
45	<i>Ficedula hypoleuca</i>	Gobemouche noir	European Pied Flycatcher	RB	UP	UP	LC	Poly (I)
46	<i>Phoenicurus moussieri</i>	Rougequeue de Moussier	Moussier's Redstart	RB	P	UP	LC	I
47	<i>Erithacus rubecula</i>	Rougegorge familier	European Robin	RB	UP	UP	LC	Poly(I)
48	<i>Phoenicurus ochruros</i>	Rougequeue noir	Black Redstart	RB	P	UP	LC	Poly(I)
49	<i>Phoenicurus phoenicurus</i>	Rougequeue à front blanc	Common Redstart	MB	P	UP	LC	Poly(I)
50	<i>Saxicola rubicola</i>	Tarier pâtre	European Stonechat	RB	UP	UP	LC	I
51	<i>Oenanthe oenanthe</i>	Traquet motteux	Northern Wheatear	MB	UP	UP	LC	I
52	<i>Oenanthe leucura</i>	Traquet rieur	Black Wheatear	RB	UP	UP	LC	I
53	<i>Oenanthe hispanica</i>	Traquet oreillard	Western Black-eared Wheatear	MB	UP	UP	LC	I
54	<i>Saxicola rubetra</i>	Tarier des prés	Whinchat	PV	UP	UP	LC	I
J-9	PASSERIFORMES — ORIOLIDAE (1.41%)							
55	<i>Oriolus oriolus</i>	Loriot d'Europe	Eurasian Golden Oriole	RB	P	UP	LC	Poly (F)
J-10	PASSERIFORMES — PARIDAE (2.82%)							
56	<i>Parus major</i>	Mésange charbonnière	Great Tit	RB	UP	UP	LC	I
57	<i>Cyanistes teneriffae</i>	Mésange nord-africaine	African Blue Tit	RB	UP	UP	LC	I
J-11	PASSERIFORMES — PASSERIDAE (5.63%)							
58	<i>Passer hispaniolensis</i>	Moineau espagnol	Spanish Sparrow	RB	UP	UP	LC	G
59	<i>Passer domesticus</i>	Moineau domestique	House Sparrow	RB	UP	UP	LC	Poly (G)
60	<i>Passer domesticus X P. hispaniolensis</i>	Moineau hybride	Hybrid sparrow	RB	UP	UP	LC	Poly (G)
61	<i>Petronia petronia</i>	Moineau soulcie	Rock Sparrow	RB	UP	UP	LC	Poly (G)
J-12	PASSERIFORMES — STURNIDAE (1.41%)							
62	<i>Sturnus vulgaris</i>	Etourneau sansonnet	Common Starling	PV	UP	UP	LC	O
J-13	PASSERIFORMES — SYLVIIDAE (2.82%)							
63	<i>Curruca melanocephala</i>	Fauvette mélanocéphale	Sardinian Warbler	RB	UP	UP	LC	Poly(I)
64	<i>Curruca deserticola</i>	Fauvette de l'Atlas	Tristram's Warbler	RB	UP	UP	LC	Poly(I)
J-14	PASSERIFORMES — TURDIDAE (2.82%)							
65	<i>Turdus philomelos</i>	Grive musicienne	Song Thrush	RB	UP	UP	LC	Poly(I)
66	<i>Turdus merula</i>	Merle noir	Common Blackbird	RB	UP	UP	LC	Poly(I)
K	PELECANIFORMES — ARDEIDAE (2.82%)							
67	<i>Ardea cinerea</i>	Héron cendré	Grey Heron	PV	UP	UP	LC	C
68	<i>Bubulcus ibis</i>	Héron garde bœuf	Western Cattle Egret	RB	UP	UP	LC	Poly(I)
L	PICIFORMES — PICIDAE (2.82%)							
69	<i>Picus vaillantii</i>	Pic de Levallant	Levallant's Woodpecker	RB	P	UP	LC	I
M	STRIGIFORMES — STRIGIDAE (1.41%)							
70	<i>Athene noctua</i>	Cheveche d'Athéna	Little Owl	RB	P	UP	LC	Poly (I)
71	<i>Bubo ascalaphus</i>	Grand-duc-ascalaphe	Pharaoh Eagle-Owl	RB	P	UP	LC	C

Ph. Ca.: Phenological categories (**RB**: Resident breeder, **MB**: Migrant breeder, **VP**: Passing visitors) ; **Pr. Ca. (2012)** : Protection status, Fiat 12-235 ; **Pr. Ca. (2006)** : Protection status, Fiat 06-05 ; **P**, : protected; **UP**: unprotected; **Pr. Ca. IUCN**: IUCN Red List (**LC**: Least concern, **VU**: Vulnerable) ; **Tr. Ca.:** Trophic categories [**I**: insectivorous, **G**: granivorous, **C**: Carnivorous, **O**: Omnivorous, **Poly**: Polyphagous, **I**): with a insectivorous tendency, (**G**): with a granivorous tendency, (**F**): with a frugivore tendency, (**M**): Mixed];  : Endemic species.