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# AVIFAUNA OF ALGIERS SAHEL, ALGERIA: CHECKLIST AND OVERVIEW OF THE CURRENT STATUS

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**Abstract.** The southern coastal areas of the Mediterranean Sea are considered an essential stopover for birds and an important place for their wintering and reproduction. Over a four-year period, from December 2019 to December 2023, a study on the avifauna of the Algiers Sahel region was carried out, using the point count method. This study was reinforced by subsequent surveys. A total of 246 species (102 of which were water birds) were recorded, belonging to 23 orders and 64 families. Among these, Passeriformes constituted the largest group with 25 families and 93 species, making up nearly 37.80% of the total. To classify these species, five phenological groups were established, with resident breeders constituting the predominant category, comprising approximately one-third of the total species. Seven trophic classes emerged, with invertivores emerging as the most prevalent, comprising 34 water birds and 84 land birds. Additionally, polyphagous birds ranked second in abundance with 40 species (16.26%). Biogeographically, the avifauna has 16 different origins. The Palearctic type accounted for almost 24.39% of the observed species. Monitoring efforts provided valuable insights into the state of the ecosystem and helped inform strategies aimed at reducing species loss.

## INTRODUCTION

According to the international community of ornithologists, the World Bird List 14.1 includes 11,032 living species (and 162 extinct species), organized into 44 orders, 253 families, and 2,384 genera. The list also includes 19,802 subspecies (Gill et al. 2024). The Mediterranean region is a crucial biodiversity hotspot for global bird species (Bergier and Thévenot 2010; Hamza et al. 2023). Studying these populations can help explain new ecological concepts (Chedad 2021). Human-induced habitat destruction, the introduction of invasive species, and climate change pose threats to birds by affecting their habitats, food resources, and increasing predation risk (Chedad et al. 2021c).

Ledant et al. (1981) published the first update of the list of birds present in Algeria, comprising 336 species at the time. Subsequently, Isenmann and Moali (2000) presented a new synthesis of the Algerian avifauna, providing more in-depth details on the status of each species, resulting in a list comprising 406 species. The ornithological monitoring has begun and extensive studies have been carried out in a wide variety of environments: urban areas, parks and gardens (Aouissi et al. 2017; Djelmoudi 2017; Boulaouad 2018; Siouda 2021; Aouissi et al. 2021; Chedad et al. 2021b), forests (El Bouhissi et al. 2021, 2023; Boucif et al. 2022), wetlands and oases (Guezoul et al. 2002, 2012; Ababsa et al. 2013; Cherif et al. 2017; Bezzalla et al. 2019; Loucif et al. 2020; Djitli 2021; Chedad et al. 2021a, 2023a, b; Marref et al. 2023).

The specific geographical location of the Algiers Sahel makes it a crucial region for the passage of migratory bird species as well as a habitat for resident birds (Milla et al. 2006). Previously, many researchers such as Doumandji et al. (1993), Moulaï and Doumandji (1996), Behidj and Doumandji (1997), Makhloufi et al. (1997), Isenman and Mouali (2000), Milla et al. (2012), Bendjoudi et al. (2013), Cherif et al. (2017), Djelmoudi (2017), Boulaoued (2018), and Djitli (2021) have contributed to the understanding of the region's avifauna. Their work has laid the foundation for this study, which seeks to build upon and update their findings to reflect current ecological conditions and avian population dynamics.

The main goal of this study is to update the phenological status of avian species in the Algiers Sahel region by providing a comprehensive checklist, detailing biogeographic assets, categorizing phenological patterns, and highlighting protection cases in accordance with national and international laws. This research is crucial for nature conservationists and environmental managers.

## MATERIALS AND METHODS

### *Study area*

The study focused on the Algiers Sahel region, which has a subhumid climate and is geographically defined by the Mediterranean Sea to the north, Mont Chenoua to the west, the Mitidja Plain to the south, and Oued Réghaia to the east (Figure 1; Oulebsir and Benacer 1973). This study was carried out mainly at five stations, each representing one of the three main biotope types. The first type comprises forests, specifically the Paradou forest (1), situated at 36°44'30.20"N, 3°01'50.50"E and an altitude of 55 meters, spans 14 hectares, hosts various tree species, such as *Morus*, *Pinus halepensis, Pinus sylvestris* and is a habitat for numerous bird species. Similarly, the expansive Ben Aknoun forest (2) is located at 36°44'9.69"N, 3°01'0.26"E. This forest, situated at an altitude of 50 meters and covering 304 hectares, hosts various tree species, such as *Pinus halepensis* and *Pinus pinaster*. The second type includes parks and gardens, such as the Hamma experimental garden (3) at 36°44'53.00"N, 3°04'34.00"E and an altitude of 30 meters, covering 32 hectares. Additionally, the garden of the El Harrach Higher National Agricultural School (4), located at 36°43'8.13"N, 3°09'3.06"E and an altitude of 50 meters, features a large collection of ornamental plants organized into three distinct strata: (1) arborescent stratum (2 to 20 meters), (2) shrubby stratum (1 to 2 meters), and (3) herbaceous stratum (0.1 to 1 meters). Lastly, the third type encompasses a wetland, specifically the Réghaïa marsh (5) at 36°46'9.68"N, 3°20'9.66"E, with an altitude of 35 meters and covering an area of 10 hectares. The marsh, with a depth of seven meters, is surrounded by fields and olive trees in its immediate vicinity. Additional observations were made in various locations, covering the Algiers marine zone, which extends over a length of 50 km, urban areas, and open lands. This comprehensive approach aimed to document all bird species present in the region.

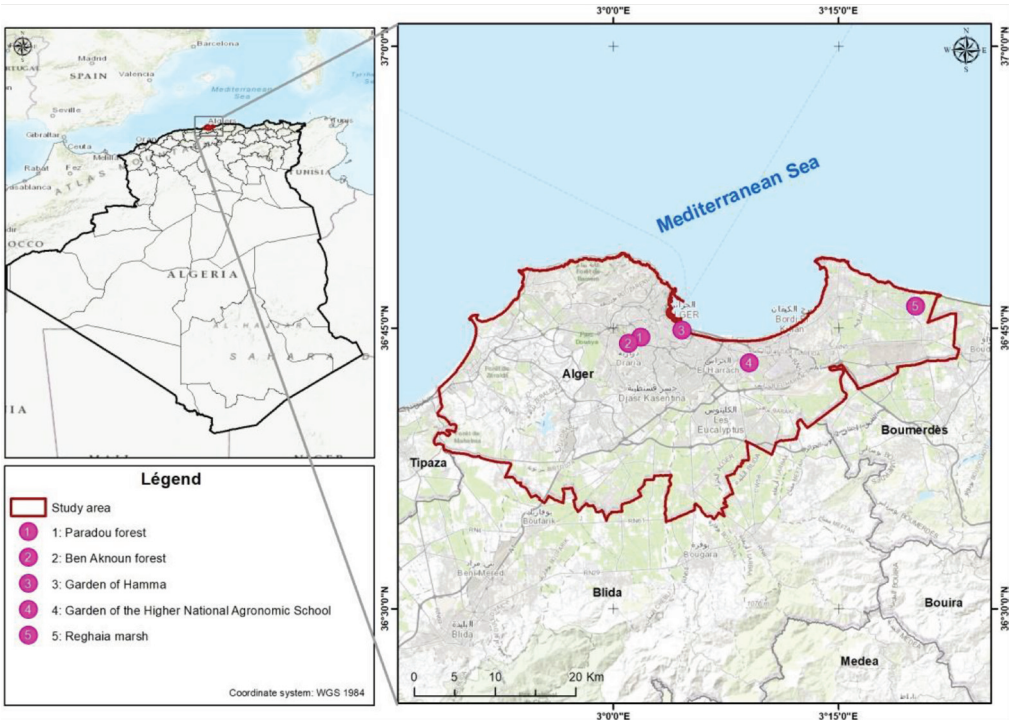


Figure 1. Geographical location of the Algiers Sahel, illustrating the selected localities.

### *Data collection and statistical analysis*

We conducted a survey of bird species in the study area to gather comprehensive data on their diversity and distribution. We used a qualitative method, specifically progressive frequency sampling (*Echantillonnage Fréquentiel Progressif "EFP"*) (Ochando 1988), to establish a list of species present at the study station.

Without limiting the observer's range, the recording of the presence or absence of species upon dawn break within 5–6-hour long transects was done (Blondel 1975). This approach offers advantages such as affordability and simplicity while being applicable throughout the day and beyond the breeding season. However, it does not provide data about local bird population densities (Ochando 1988). Additionally, water bird counts were conducted using fixed observation posts around wetland areas (Ramade et al. 1984). When groups containing fewer than 200 individuals approached these stations, researchers performed individual counts. For larger flocks that maintained considerable distances from the observers, visual estimates were made instead (Lamotte and Bourlière 1969; Blondel 1975).

In determining the biogeographical origins of birds, we utilized the classification system presented by Voous and Thomson (1960), which delineates 23 faunal types within bird populations. Furthermore, these faunal types have been grouped into five main categories: Holarctic origin, Afrotropical, Indomalayan, Australasian and Neotropical (Blondel and Bourlière 1979).

For bird counting we used equipment such as a telescope (KONUSPOT 20-60X80), a pair of binoculars, a Canon E*OS-1D X Mark II* and Nikon D500 (Objective AF-S NIKKOR 200-500mm f/5.6E ED VR), an ornithological guide such as the Heinzel Guide to European, North African, and Middle Eastern birds for species identification, a notebook to record observations according to the methods used, and a car to move from one observation point to another. The counts were conducted regularly, with monthly surveys being supplemented by additional observations, particularly during the peak postnuptial and prenuptial bird migration seasons in various biotopes (Chedad et al. 2021a).

The species classification is based on an alphabetic listing according to the most recent version of the International Order of Birds [IOC World Bird List] (Gill et al. 2024). In Algeria, the conservation status of bird species at the national level is guided by Decree 12–235, published on 24 May 2012, which describes the list of protected non-domestic animal species. In addition, Ordinance n° 06–05 of 15 July 2006 concerns the protection and preservation of endangered animal species. At the international level, our evaluation is guided by the IUCN Red List (IUCN 2024).

The R software (R Development Core Team 2022) was used to perform statistical analyses and produce graphs. Before performing a one-way ANOVA to test the variation of species count data throughout the years between phenological status and trophic status, we checked for data normality using Shapiro-Wilk tests.

## RESULTS

### *Systematic list of Algiers Sahel avifauna*

We identified 246 species, divided into 23 orders and 64 families (Table 1), 102 of which were water birds. Passeriformes was the most represented order, with 93 species in 25 families (37.80%). Charadriiformes come in second with 9 families and 55 species (22.35%). The families Anseriformes, Pelecaniformes, and Accipitriformes have even fewer species represented (18 , 12, and 12, respectively), while Gruiformes and Strigiformes have 8 and 7 species, respectively. The other families do not exceed five species (Table 1, Figure 2).

The highest number of avian species was found in Ben Aknoun and Paradou forests, with 95 species totalling

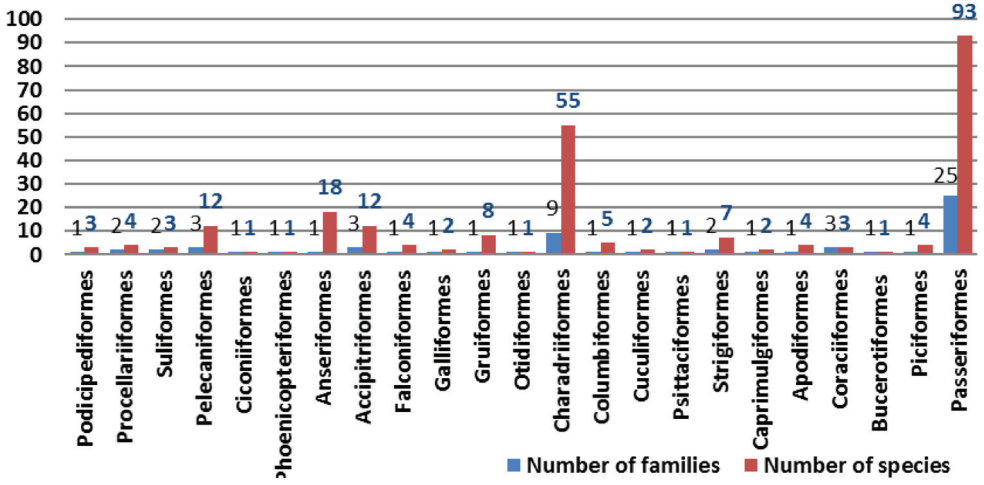


Figure 2. Number of avian families and species in the Algiers Sahel region.

Table 1. Systematic list of Algiers Sahel avifauna.

| Order–Family | | Bio. Ori. | Ph. St. | Pr. St. | | | Ref. | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| N° | Scientific name | | | A | B | C | 1 | 2 | 3 | 4 |
| A | Podicipediformes–Podicipedidae | | | | | | | | | |
| 1 | *Podiceps nigricollis* (C.L. Brehm, 1831) | OW | MB | 0 | 0 | LC | 1 | 0 | 1 | 1 |
| 2 | *Tachybaptus ruficollis* (Pallas, 1764) | OW | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 3 | *Podiceps cristatus* (Linnaeus, 1758) | OW | MB | 0 | 0 | LC | 1 | 1 | 1 | 0 |
| B-1 | Procellariiformes–Procellariidae | | | | | | | | | |
| 4 | *Puffinus yelkouan* (Acerbi, 1827) | M | RB | 0 | 0 | VU | 1 | 1 | 1 | 1 |
| 5 | *Calonectris diomedea* (Scopoli, 1769) | M | RB | 0 | 0 | LC | 1 | 1 | 0 | 1 |
| 6 | *Calonectris borealis* (Cory, 1881) | M | MB | 0 | 0 | LC | 0 | 1 | 1 | 0 |
| B-2 | Procellariiformes–Hydrobatidae | | | | | | | | | |
| 7 | *Hydrobates pelagicus* (Linnaeus, 1758) | M | MB | 0 | 0 | LC | 1 | 0 | 1 | 1 |
| C-1 | Suliformes–Sulidae | | | | | | | | | |
| 8 | *Morus bassanus* (Linnaeus, 1758) | OW | W | 0 | 1 | LC | 1 | 1 | 1 | 0 |
| C-2 | Suliformes–Phalacrocoracidae | | | | | | | | | |
| 9 | *Phalacrocorax carbo* (Linnaeus, 1758) | OW | MB | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| 10 | *Gulosus aristotelis* (Linnaeus,1761) | OW | W | 0 | 1 | LC | 1 | 1 | 0 | 0 |
| D-1 | Pelecaniformes–Pelicanidae | | | | | | | | | |
| +11 | *Pelecanus onocrotalus* (Linnaeus, 1758) | E | PV | 0 | 0 | LC | 0 | 0 | 1 | 0 |
| D-2 | Pelecaniformes–Ardeidae | | | | | | | | | |
| 12 | *Bubulcus ibis* (Linnaeus, 1758) | IA | MB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 13 | *Nycticorax nycticorax* (Linnaeus, 1758) | C | MB | 0 | 0 | LC | 1 | 0 | 1 | 1 |
| 14 | *Egretta garzetta* (Linnaeus, 1766) | AM | MB | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| 15 | *Ardea alba* (Linnaeus, 1758) | C | RB | 0 | 1 | LC | 1 | 1 | 0 | 1 |
| 16 | *Ardeola ralloides* (Scopoli, 1769) | IA | W | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| 17 | *Ardea purpurea* (Linnaeus, 1766) | IA | RB | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| 18 | *Ardea cinerea* (Linnaeus, 1758) | P | W | 0 | 0 | LC | 1 | 1 | 0 | 1 |
| 19 | *Ixobrychus minutus* (Linnaeus, 1766) | An | M | 0 | 1 | LC | 1 | 0 | 1 | 0 |
| +20 | *Botaurus stellaris* (Linnaeus, 1758) | E | M | 0 | 1 | LC | 0 | 0 | 1 | 0 |
| D-3 | Pelecaniformes–Threskiornithidae | | | | | | | | | |
| 21 | *Plegadis falcinellus* (Linnaeus, 1766) | OW | RB | 0 | 1 | LC | 1 | 0 | 1 | 1 |
| 22 | *Platalea leucorodia* (Linnaeus, 1758) | OW | PV | 0 | 1 | LC | 1 | 0 | 1 | 1 |
| E | Ciconiiformes–Ciconiidae | | | | | | | | | |
| 23 | *Ciconia ciconia* (Linnaeus, 1758) | P | MB | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| F | Phoenicopteriformes–Phoenicopteridae | | | | | | | | | |
| 24 | *Phoenicopterus roseus* (Pallas, 1811) | U | RB | 0 | 1 | LC | 1 | 0 | 0 | 1 |
| G | Anseriformes–Anatidae | | | | | | | | | |
| +25 | *Cygnus olor*(Gmelin, 1789) | E | PV | 0 | 0 | LC | 0 | 0 | 1 | 0 |
| 26 | *Anser anser* (Linnaeus, 1758) | E | MB | 0 | 1 | LC | 1 | 0 | 1 | 0 |
| 27 | *Marmaronetta angustirostris* (Ménétries, 1832) | M | W | 0 | 1 | NT | 1 | 1 | 1 | 0 |
| 28 | *Anas crecca* (Linnaeus, 1758) | H | MB | 0 | 0 | LC | 1 | 1 | 0 | 1 |
| 29 | *Spatula querquedula* (Linnaeus, 1758) | P | W | 0 | 0 | LC | 1 | 0 | 1 | 1 |
| 30 | *Oxyura leucocephala* (Scopoli, 1769) | Sr | W | 1 | 0 | En | 1 | 0 | 0 | 1 |
| 31 | *Netta rufina* (Pallas, 1773) | Sr | RB | 0 | 0 | LC | 1 | 1 | 0 | 1 |
| 32 | *Tadorna tadorna* (Linnaeus, 1758) | Sr | RB | 0 | 1 | LC | 1 | 0 | 0 | 1 |
| 33 | *Mareca penelope* (Linnaeus, 1758) | E | MB | 0 | 0 | LC | 1 | 0 | 1 | 0 |
| 34 | *Anas platyrhynchos* (Linnaeus, 1758) | H | RB | 0 | 0 | LC | 1 | 0 | 1 | 1 |
| 35 | *Mareca strepera* (Linnaeus, 1758) | H | W | 0 | 0 | LC | 1 | 1 | 1 | 0 |
| 36 | *Anas acuta* (Linnaeus, 1758) | P | W | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 37 | *Spatula clypeata* (Linnaeus, 1758) | H | W | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 38 | *Aythya ferina* (Linnaeus, 1758) | P | PV | 0 | 0 | VU | 1 | 1 | 0 | 1 |
| 39 | *Aythya nyroca* (Güldenstädt, 1770) | TM | MB | 0 | 1 | NT | 1 | 1 | 1 | 1 |
| 40 | *Aythya fuligula* (Linnaeus, 1758) | P | W | 0 | 0 | LC | 1 | 1 | 0 | 1 |
| +41 | *Aythya collaris* (Donovan, 1809) | P | W | 0 | 0 | LC | 0 | 0 | 1 | 0 |
| +42 | *Melanitta nigra* (Linnaeus, 1758) | E | W | 0 | 0 | LC | 0 | 0 | 1 | 0 |
| H-1 | Accipitriformes–Accipitridae | | | | | | | | | |
| 43 | *Milvus migrans* (Boddaert, 1783) | OW | MB | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| 44 | *Circus aeruginosus* (Linnaeus, 1758) | P | RB | 0 | 1 | LC | 1 | 1 | 0 | 1 |
| H-2 | Accipitriformes–Pandionidae | | | | | | | | | |
| 45 | *Pandion haliaetus* (Linnaeus, 1758) | P | RB | 0 | 1 | LC | 1 | 1 | 0 | 0 |
| H-3 | Accipitriformes–Accipitridae | | | | | | | | | |
| 46 | *Accipiter nisus* (Linnaeus, 1758) | P | RB | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| 47 | *Buteo rufinuscirtensis* (Cretzschmar, 1829) | PXM | RB | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| 48 | *Circaetus gallicus* (Gmelin, 1788) | PXM | RB | 0 | 1 | LC | 1 | 1 | 1 | 0 |
| 49 | *Elanus caeruleus* (Desfontaines, 1789) | U | RB | 0 | 1 | LC | 1 | 1 | 1 | 1 |

| Order–Family | | Bio. Ori. | Ph. St. | Pr. St. | | | Ref. | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| N° | Scientific name | | | A | B | C | 1 | 2 | 3 | 4 |
| 50 | *Aquila fasciata* (Vieillot, 1822) | IA | RB | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| 51 | *Hieraaetus pennatus* (J.F.Gmelin, 1788) | TM | MB | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| 52 | *Aquila chrysaetos* (Linnaeus, 1758) | TM | MB | 0 | 1 | LC | 1 | 0 | 1 | 0 |
| +53 | *Torgos tracheliotos* (Forster, 1791) | OW | PV | 0 | 0 | En | 0 | 0 | 1 | 0 |
| +54 | *Accipiter gentilis* (Linnaeus, 1758) | P | PV | 0 | 0 | LC | 0 | 0 | 1 | 0 |
| I | Falconiformes–Falconidae | | | | | | | | | |
| 55 | *Falco tinnunculus* (Linnaeus, 1758) | OW | RB | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| 56 | *Falco naumanni* (Fleischer, 1818) | TM | MB | 1 | 0 | LC | 1 | 1 | 0 | 1 |
| 57 | *Falco peregrinus* (Tunstall, 1771) | C | RB | 1 | 0 | LC | 1 | 1 | 1 | 1 |
| 58 | *Falco eleonorae* (Gené, 1839) | TM | MB | 0 | 1 | LC | 1 | 1 | 0 | 1 |
| J | Galliformes–Phasianidae | | | | | | | | | |
| 59 | *Alectoris Barbara* (Bonnaterre, 1790) | M | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 60 | *Coturnix coturnix* (Linnaeus, 1758) | AM | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| K | Gruiformes–Rallidae | | | | | | | | | |
| 61 | *Fulica atra* (Linnaeus, 1758) | P | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 62 | *Gallinula chloropus* (Linnaeus, 1758) | C | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 63 | *Porphyrioporphyrio* (Linnaeus, 1758) | IA | RB | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| 64 | *Rallus aquaticus* (Linnaeus, 1758) | P | RB | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| 65 | *Crex crex* (Linnaeus, 1758) | P | M | 0 | 0 | LC | 1 | 1 | 1 | 0 |
| 66 | *Zapornia parva* (Scopoli, 1769) | P | MB | 0 | 0 | LC | 1 | 1 | 1 | 0 |
| 67 | *Zapornia pusilla* (Pallas, 1776) | P | MB | 0 | 0 | LC | 1 | 1 | 1 | 0 |
| 68 | *Porzana porzana* (Linnaeus, 1766) | P | MB | 0 | 1 | LC | 1 | 1 | 1 | 0 |
| L | Otidiformes–Otididae | | | | | | | | | |
| +69 | *Ardeotis arabs* (Linnaeus, 1758) | IA | PV | 0 | 0 | NT | 0 | 0 | 1 | 0 |
| M-1 | Charadriiformes — Haematopodidae | | | | | | | | | |
| 70 | *Haematopus ostralegus* (Linnaeus, 1758) | C | W | 0 | 0 | NT | 1 | 1 | 1 | 1 |
| M-2 | Charadriiformes–Recurvirostridae | | | | | | | | | |
| 71 | *Himantopus himantopus* (Linnaeus, 1758) | C | RB | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| 72 | *Recurvirostra avosetta* (Linnaeus, 1758) | TM | W | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| M-3 | Charadriiformes– Glareolidae | | | | | | | | | |
| 73 | *Glareola pratincola* (Linnaeus, 1766) | TM | W | 0 | 0 | LC | 1 | 1 | 0 | 0 |
| M-4 | Charadriiformes–Charadriidae | | | | | | | | | |
| 74 | *Charadrius hiaticula* (Linnaeus, 1758) | A | W | 0 | 0 | LC | 1 | 1 | 0 | 1 |
| 75 | *Charadrius dubius* (Scopoli, 1786) | A | W | 0 | 0 | LC | 1 | 0 | 1 | 1 |
| 76 | *Charadrius alexandrines* (Linnaeus, 1758) | C | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 77 | *Vanellus vanellus* (Linnaeus, 1758) | P | W | 0 | 0 | NT | 1 | 1 | 0 | 1 |
| 78 | *Pluvialis apricaria* (Linnaeus, 1758) | A | W | 0 | 0 | LC | 1 | 0 | 0 | 1 |
| *79 | *Charadrius morinellus* (Linnaeus, 1758) | A | W | 0 | 0 | LC | 1 | 0 | 0 | 0 |
| 80 | *Pluvialis squatarola* (Linnaeus, 1758) | A | W | 0 | 0 | LC | 1 | 1 | 0 | 1 |
| +81 | *Pluvialis fulva* (Gmelin, 1789) | A | W | 0 | 0 | LC | 0 | 0 | 1 | 0 |
| M-5 | Charadriiformes–Scolopacidae | | | | | | | | | |
| 82 | *Actitis hypoleucos* (Linnaeus, 1758) | H | W | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 83 | *Arenaria interpres* (Linnaeus, 1758) | A | W | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 84 | *Calidris canutus* (Linnaeus, 1758) | A | MB | 0 | 0 | NT | 1 | 1 | 1 | 1 |
| 85 | *Calidris alba* (Pallas, 1764) | A | MB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 86 | *Calidris minuta* (Leisler, 1812) | A | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 87 | *Calidris temminckii* (Leisler, 1812) | A | MB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 88 | *Calidris ferruginea* (Pontoppidan, 1763) | A | W | 0 | 0 | NT | 1 | 1 | 1 | 1 |
| 89 | *Calidris alpina* (Linnaeus, 1758) | A | W | 0 | 0 | LC | 1 | 1 | 0 | 1 |
| 90 | *Gallinago gallinago* (Linnaeus, 1758) | H | W | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 91 | *Limosa lapponica* (Linnaeus, 1758) | P | MB | 0 | 0 | NT | 1 | 1 | 1 | 1 |
| 92 | *Limosa limosa* (Linnaeus, 1758) | P | MB | 0 | 0 | NT | 1 | 1 | 0 | 0 |
| 93 | *Numenius phaeopus* (Linnaeus, 1758) | H | W | 0 | 0 | LC | 1 | 1 | 0 | 1 |
| 94 | *Numenius arquata* (Linnaeus, 1758) | P | PV | 0 | 0 | NT | 1 | 1 | 1 | 1 |
| 95 | *Calidris pugnax* (Linnaeus, 1758) | P | W | 0 | 0 | LC | 1 | 1 | 1 | 0 |
| 96 | *Tringa erythropus* (Pallas, 1764) | S | W | 0 | 0 | LC | 1 | 1 | 0 | 1 |
| 97 | *Tringa totanus* (Linnaeus, 1758) | P | W | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 98 | *Tringa nebularia* (Gunnerus, 1767) | S | W | 0 | 0 | LC | 1 | 1 | 0 | 1 |
| 99 | *Tringa ochropus* (Linnaeus, 1758) | P | W | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 100 | *Tringa glareola* (Linnaeus, 1758) | P | W | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 101 | *Tringa stagnatilis* (Bechstein, 1803) | S | W | 0 | 0 | LC | 0 | 1 | 1 | 0 |
| M-6 | Charadriiformes–Stercorariidae | | | | | | | | | |
| +102 | *Stercorarius pomarinus* (Temminck, 1815) | P | MB | 0 | 0 | LC | 0 | 0 | 1 | 0 |
| *103 | *Stercorarius parasiticus* (Linnaeus, 1758) | P | MB | 0 | 0 | LC | 1 | 0 | 0 | 0 |

| Order–Family | | Bio. Ori. | Ph. St. | Pr. St. | | | Ref. | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| N° | Scientific name | | | A | B | C | 1 | 2 | 3 | 4 |
| 104 | *Stercorarius skua* (Brünnich, 1764) | P | PV | 0 | 0 | LC | 1 | 1 | 1 | 0 |
| M-7 | Charadriiformes–Laridae | | | | | | | | | |
| 105 | *Rissa tridactyla* (Linnaeus, 1758) | P | W | 0 | 0 | VU | 0 | 1 | 1 | 0 |
| 106 | *Chroicocephalus ridibundus* (Linnaeus, 1766) | P | W | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 107 | *Ichthyaetus audouinii* (Payraudeau, 1826) | OW | W | 0 | 1 | LC | 1 | 1 | 1 | 0 |
| 108 | *Ichthyaetus melanocephalus* (Temminck, 1820) | Sa | W | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 109 | *Hydrocoloeus minutus* (Pallas, 1776) | Sa | W | 0 | 0 | LC | 0 | 1 | 1 | 0 |
| +110 | *Xema sabini* (Sabine, 1819) | Sa | PV | 0 | 0 | LC | 0 | 0 | 1 | 0 |
| 111 | *Larus canus* (Linnaeus, 1758) | Sa | MB | 0 | 0 | LC | 1 | 0 | 1 | 0 |
| 112 | *Larus genei* (Breme, 1839) | Sa | MB | 0 | 0 | LC | 1 | 1 | 0 | 0 |
| 113 | *Larus fuscus* (Linnaeus, 1758) | Sa | MB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 114 | *Larus michahellis* (Naumann, 1840) | Sa | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 115 | *Gelochelidon nilotica* (Gmelin, 1789) | C | PV | 0 | 1 | LC | 1 | 0 | 0 | 1 |
| 116 | *Thalasseus bengalensis* (Lesson, 1831) | C | MB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 117 | *Thalasseus sandvicensis* (Latham, 1787) | C | W | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 118 | *Sternula albifrons* (Pallas, 1764) | C | RB | 0 | 1 | LC | 1 | 1 | 0 | 1 |
| 119 | *Hydroprogne caspia* (Pallas, 1770) | C | RB | 0 | 0 | LC | 1 | 1 | 1 | 0 |
| +120 | *Chlidonia shybrida* (Pallas, 1811) | C | MB | 0 | 1 | LC | 0 | 0 | 1 | 0 |
| +121 | *Chlidonia sleucopterus* (Temminck, 1815) | C | MB | 0 | 0 | LC | 0 | 0 | 1 | 0 |
| 122 | *Chlidonia sniger* (Linnaeus, 1758) | C | MB | 0 | 0 | LC | 1 | 1 | 1 | 0 |
| M-8 | Charadriiformes–Alcidae | | | | | | | | | |
| 123 | *Alca torda* (Linnaeus, 1758) | TM | PV | 0 | 0 | NT | 1 | 0 | 1 | 0 |
| M-9 | Charadriiformes– Burhinidae | | | | | | | | | |
| 124 | *Burhinus oedicnemus* (Linnaeus, 1758) | TM | MB | 0 | 1 | LC | 1 | 1 | 1 | 0 |
| N | Columbiformes — Columbidae | | | | | | | | | |
| 125 | *Columba livia* (Gmelin, 1789) | TM | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 126 | *Columba palumbus* (Linnaeus, 1758) | ET | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 127 | *Streptopelia turtur* (Linnaeus, 1758) | ET | MB | 0 | 0 | VU | 1 | 1 | 1 | 1 |
| 128 | *Streptopelia decaocto* (Frivaldszky, 1838) | IA | RB | 0 | 0 | LC | 1 | 0 | 0 | 0 |
| 129 | *Spilopelia senegalensis* (Linnaeus1766) | ET | MB | 0 | 0 | LC | 1 | 0 | 1 | 1 |
| O | Cuculiformes–Cuculidae | | | | | | | | | |
| 130 | *Cuculus canorus* (Linnaeus, 1758) | P | MB | 0 | 1 | LC | 1 | 0 | 0 | 1 |
| +131 | *Clamator glandarius* (Linnaeus, 1758) | P | MB | 0 | 1 | LC | 0 | 0 | 1 | 0 |
| P | Psittaciformes–Psittaculidae | | | | | | | | | |
| 132 | *Psittacula krameri* (Scopoli, 1769) | Eth | RB | 0 | 0 | LC | 1 | 0 | 0 | 1 |
| Q-1 | Strigiformes–Tytonidae | | | | | | | | | |
| 133 | *Tyto alba* (Scopoli, 1769) | C | RB | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| Q-2 | Strigiformes–Strigidae | | | | | | | | | |
| 134 | *Strix aluco* (Linnaeus, 1758) | P | RB | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| 135 | *Otus scops* (Linnaeus, 1758) | OW | MB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 136 | *Athene noctua* (Scopoli, 1769) | TM | RB | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| 137 | *Asio otus* (Linnaeus, 1758) | H | RB | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| 138 | *Asio flammeus* (Pontoppidan, 1763) | H | PV | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| 139 | *Bubo ascalaphus* (Savigny, 1809) | H | RB | 0 | 0 | LC | 0 | 1 | 1 | 0 |
| R | Caprimulgiformes–Caprimulgidae | | | | | | | | | |
| 140 | *Caprimulgus europaeus* (Linnaeus, 1758) | P | RB | 0 | 1 | LC | 1 | 1 | 0 | 1 |
| 141 | *Caprimulgus ruficollis* (Temminck, 1820) | P | RB | 0 | 1 | LC | 0 | 1 | 1 | 0 |
| S | Apodiformes–Apodidae | | | | | | | | | |
| 142 | *Apus apus* (Linnaeus, 1758) | P | MB | 0 | 0 | LC | 1 | 1 | 0 | 1 |
| 143 | *Apus pallidus* (Shelley, 1870) | M | MB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 144 | *Tachymarptis melba* (Linnaeus, 1758) | M | PV | 0 | 0 | LC | 0 | 1 | 1 | 0 |
| 145 | *Apus affinis* (Gray, 1830) | M | PV | 0 | 0 | LC | 0 | 1 | 1 | 0 |
| T-1 | Coraciiformes— Alcedinidae | | | | | | | | | |
| 146 | *Alcedo atthis* (Linnaeus, 1758) | OW | RB | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| T-2 | Coraciiformes–Meropidae | | | | | | | | | |
| 147 | *Merops apiaster* (Linnaeus, 1758) | OW | RB | 0 | 0 | LC | 1 | 1 | 1 | 0 |
| T-3 | Coraciiformes–Coraciidae | | | | | | | | | |
| 148 | *Coracias garrulus* (Linnaeus, 1758) | TM | MB | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| U | Bucerotiformes–Upupidae | | | | | | | | | |
| 149 | *Upupa epops* (Linnaeus, 1758) | OW | RB | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| V | Piciformes–Picidae | | | | | | | | | |
| *150 | *Dryobates minor* (Linnaeus, 1758) | P | RB | 0 | 1 | LC | 1 | 0 | 0 | 0 |
| 151 | *Jynx torquilla* (Linnaeus, 1758) | P | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 152 | *Picus vaillantii* (Malherbe, 1847) | U | RB | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| 153 | *Dendrocopos major* (Linnaeus, 1758) | P | PV | 0 | 1 | LC | 1 | 1 | 1 | 1 |

| Order–Family | | Bio. Ori. | Ph. St. | Pr. St. | | | Ref. | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| N° | Scientific name | | | A | B | C | 1 | 2 | 3 | 4 |
| W-1 | Passeriformes–Alaudidae | | | | | | | | | |
| 154 | *Alauda arvensis* (Linnaeus, 1758) | P | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 155 | *Calandrella brachydactyla* (Leisler, 1814) | P | PV | 0 | 0 | LC | 0 | 1 | 1 | 0 |
| 156 | *Galerida theklae* (Brehm, 1857) | P | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 157 | *Galerida cristata* (Linnaeus, 1758) | P | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| W-2 | Passeriformes–Hirundinidae | | | | | | | | | |
| 158 | *Hirundo rustica* (Linnaeus, 1758) | H | MB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 159 | *Delichon urbicum* (Linnaeus, 1758) | P | MB | 0 | 0 | LC | 1 | 1 | 1 | 0 |
| *160 | *Cecropis daurica* (Laxmann, 1769) | P | MB | 0 | 1 | LC | 1 | 0 | 0 | 0 |
| 161 | *Riparia riparia* (Linnaeus, 1758) | P | MB | 0 | 0 | LC | 1 | 0 | 1 | 1 |
| W-3 | Passeriformes–Motacillidae | | | | | | | | | |
| 162 | *Motacilla alba* (Linnaeus, 1758) | P | W | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 163 | *Motacilla cinerea* (Tunstall, 1771) | P | MB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 164 | *Anthus pratensis* (Linnaeus, 1758) | E | W | 0 | 0 | NT | 1 | 1 | 0 | 1 |
| 165 | *Anthus campestris* (Linnaeus, 1758) | E | PV | 0 | 0 | LC | 0 | 1 | 1 | 0 |
| 166 | *Anthus trivialis* (Linnaeus, 1758) | E | PV | 0 | 0 | LC | 0 | 1 | 1 | 0 |
| 167 | *Anthus spinoletta* (Linnaeus, 1758) | E | PV | 0 | 0 | LC | 0 | 1 | 1 | 0 |
| 168 | *Motacilla flava* (Linnaeus, 1758) | P | MB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| W-4 | Passeriformes–Troglodytidae | | | | | | | | | |
| 169 | *Troglodytes troglodytes* (Linnaeus, 1758) | H | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| W-5 | Passeriformes–Pycnonotidae | | | | | | | | | |
| 170 | *Pycnonotus barbatus* (Desfontaines, 1789) | Eth | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| W-6 | Passeriformes–Prunellidae | | | | | | | | | |
| +171 | *Prunella modularis* (Linnaeus, 1758) | P | MB | 0 | 0 | LC | 0 | 0 | 1 | 0 |
| W-7 | Passeriformes–Turdidae | | | | | | | | | |
| 172 | *Turdus merula* (Linnaeus, 1758) | P | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 173 | *Turdus viscivorus* (Linnaeus, 1758) | ET | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 174 | *Turdus philomelos* (Brehm, 1831) | ET | MB | 0 | 0 | LC | 1 | 1 | 1 | 0 |
| W-8 | Passeriformes–Muscicapidae | | | | | | | | | |
| 175 | *Muscicapa striata* (Pallas1764) | ET | MB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| *176 | *Ficedula albicollis* (Temminck, 1815) | E | MB | 0 | 0 | LC | 1 | 0 | 0 | 0 |
| 177 | *Ficedula hypoleuca* (Pallas, 1764) | E | MB | 0 | 0 | LC | 1 | 1 | 1 | 0 |
| 178 | *Erithacus rubecula* (Linnaeus, 1758) | E | W | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 179 | *Phoenicurus moussieri* (Olphe-Galliard,1852) | E | W | 0 | 0 | LC | 1 | 1 | 1 | 0 |
| 180 | *Luscinia svecica* (Linnaeus, 1758) | P | W | 0 | 0 | LC | 1 | 1 | 0 | 1 |
| 181 | *Luscinia megarhynchos* (Brehm, 1831) | E | MB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 182 | *Ficedula hypoleuca* (Pallas, 1764) | E | MB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 183 | *Phoenicurus ochruros* (Gmelin, 1774) | PXM | MB | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| 184 | *Phoenicurus phoenicurus* (Linnaeus, 1758) | E | PV | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| 185 | *Monticola solitaries* (Linnaeus, 1758) | M | MB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 186 | *Oenanthe oenanthe* (Linnaeus, 1758) | P | MB | 0 | 0 | LC | 1 | 0 | 1 | 1 |
| 187 | *Oenanthe hispanica* (Linnaeus, 1758) | M | MB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 188 | *Saxicola rubicola* (Linnaeus, 1766) | P | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| *189 | *Saxicola rubetra* (Linnaeus, 1758) | P | MB | 0 | 0 | LC | 1 | 0 | 0 | 0 |
| 190 | *Cercotrichas galactotes* (Temminck, 1820) | P | MB | 0 | 0 | LC | 1 | 1 | 1 | 0 |
| W-9 | Passeriformes–Sylviidae | | | | | | | | | |
| 191 | *Sylvia atricapilla* (Linnaeus, 1758) | E | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 192 | *Curruca melanocephala* (Gmelin, 1789) | TM | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 193 | *Sylvia borin* (Boddaert, 1783) | E | PV | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 194 | *Curruca communis* (Latham, 1787) | ET | MB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 195 | *Curruca subalpine* (Temminck, 1820) | E | PV | 0 | 0 | LC | 0 | 1 | 1 | 0 |
| 196 | *Curruca hortensis* (J.F. Gmelin,1789) | E | MB | 0 | 0 | LC | 1 | 1 | 1 | 0 |
| 197 | *Curruca iberiae* (Pallas, 1764) | ET | MB | 0 | 0 | LC | 1 | 1 | 1 | 0 |
| 198 | *Curruca conspicillata* (Temminck, 1820) | ET | MB | 0 | 0 | LC | 0 | 1 | 1 | 0 |
| 199 | *Curruca undata* (Boddaert, 1783) | ET | MB | 0 | 0 | NT | 1 | 1 | 1 | 0 |
| 200 | *Curruca sarda* (Temminck, 1820) | ET | MB | 0 | 0 | LC | 0 | 1 | 1 | 0 |
| W-10 | Passeriformes–Paridae | | | | | | | | | |
| 201 | *Cyanistes teneriffae* (Lesson, 1831) | E | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 202 | *Parus major* (Linnaeus, 1758) | P | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| W-11 | Passeriformes–Cettidae | | | | | | | | | |
| 203 | *Cettiac etti* (Temminck, 1820) | TM | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| W-12 | Passeriformes–Certhiidae | | | | | | | | | |
| 204 | *Certhia brachydactyla* (Brehm, 1820) | E | RB | 0 | 0 | LC | 1 | 1 | 0 | 1 |
| W-13 | Passeriformes–Oriolidae | | | | | | | | | |
| 205 | *Oriolus oriolus* (Linnaeus, 1758) | ET | MB | 0 | 1 | LC | 1 | 1 | 1 | 1 |

| Order–Family | | Bio. Ori. | Ph. St. | Pr. St. | | | Ref. | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| N° | Scientific name | | | A | B | C | 1 | 2 | 3 | 4 |
| W-14 | Passeriformes–Laniidae | | | | | | | | | |
| 206 | *Lanius senator* (Linnaeus, 1758) | M | RB | 0 | 0 | NT | 1 | 1 | 1 | 1 |
| 207 | *Lanius excubitor* (Linnaeus, 1758) | M | PV | 0 | 0 | LC | 1 | 0 | 1 | 0 |
| W-15 | Passeriformes–Corvidae | | | | | | | | | |
| 208 | *Corvus corax* (Linnaeus, 1758) | H | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| W-16 | Passeriformes–Sturnidae | | | | | | | | | |
| 209 | *Sturnus vulgaris*(Linnaeus, 1758) | ET | MB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 210 | *Sturnus unicolor* (Temminck,1820) | ET | MB | 0 | 0 | LC | 0 | 1 | 1 | 0 |
| W-17 | Passeriformes–Passeridae | | | | | | | | | |
| 211 | *Passer domesticus* (Linnaeus, 1758) | TM | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 212 | *Passer hispaniolensis* (Temminck, 1820) | TM | MB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 213 | *Passer montanus* (Linnaeus, 1758) | P | PV | 0 | 0 | LC | 1 | 0 | 1 | 1 |
| W-18 | Passeriformes–Fringillidae | | | | | | | | | |
| 214 | *Fringilla coelebs* (Linnaeus, 1758) | E | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 215 | *Chloris chloris* (Linnaeus, 1758) | ET | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 216 | *Linaria cannabina* (Linnaeus, 1758) | ET | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 217 | *Carduelis carduelis* (Linnaeus, 1758) | ET | RB | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| 218 | *Serinus serinus* (Linnaeus, 1766) | M | RB | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| 219 | *Spinus spinus* (Linnaeus, 1758) | ET | MB | 0 | 0 | LC | 1 | 1 | 1 | 0 |
| 220 | *Loxia curvirostra* (Linnaeus, 1758) | ET | PV | 0 | 1 | LC | 0 | 1 | 1 | 0 |
| 221 | *Coccothraustes coccothraustes* (Linnaeus, 1758) | U | PV | 0 | 1 | LC | 0 | 1 | 1 | 0 |
| W-19 | Passeriformes–Emberizidae | | | | | | | | | |
| 222 | *Emberiza calandra* (Linnaeus, 1758) | ET | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 223 | *Emberiza sahari* (Levaillant, 1850) | M | PV | 0 | 0 | LC | 1 | 0 | 0 | 0 |
| 224 | *Emberiza cirlus* (Linnaeus, 1766) | M | PV | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 225 | *Emberiza cia* (Linnaeus, 1766) | ET | PV | 0 | 0 | LC | 0 | 1 | 1 | 0 |
| +226 | *Emberiza citronella* (Linnaeus, 1758) | E | PV | 0 | 0 | LC | 0 | 0 | 1 | 0 |
| 227 | *Emberiza schoeniclus* (Linnaeus, 1758) | E | PV | 0 | 0 | LC | 1 | 1 | 0 | 1 |
| W-20 | Passeriformes–Phylloscopidae | | | | | | | | | |
| 228 | *Phylloscopus collybita* (Vieillot, 1817) | P | W | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 229 | *Phylloscopus trochilus* (Linnaeus, 1758) | P | MB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 230 | *Phylloscopus bonelli* (Vieillot, 1819) | M | MB | 0 | 0 | LC | 1 | 1 | 1 | 0 |
| 231 | *Phylloscopus ibericus* (Ticehurst, 1937) | M | MB | 0 | 0 | LC | 1 | 1 | 0 | 0 |
| 232 | *Phylloscopus sibilatrix* (Bechstein, 1792) | ET | PV | 0 | 0 | LC | 1 | 1 | 1 | 0 |
| W-21 | Passeriformes–Acrocephalidae | | | | | | | | | |
| 233 | *Acrocephalus schoenobaenus* (Linnaeus, 1758) | ET | PV | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 234 | *Acrocephalus scirpaceus* (Hermann, 1804) | ET | MB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| +235 | *Acrocephalus paludicola* (Vieillot, 1817) | ET | PV | 0 | 0 | VU | 0 | 0 | 1 | 0 |
| 236 | *Iduna pallida* (Hemprich & Ehrenberg, 1833) | M | MB | 0 | 0 | LC | 1 | 0 | 1 | 1 |
| 237 | *Hippolais polyglotta* (Vieillot, 1817) | M | MB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| 238 | *Hippolais icterina* (Vieillot, 1817) | ET | PV | 0 | 0 | LC | 0 | 1 | 1 | 0 |
| 239 | *Acrocephalus arundinaceus* (Linnaeus, 1758) | ET | MB | 0 | 0 | LC | 0 | 1 | 1 | 0 |
| 240 | *Acrocephalus melanopogon* (Temminck, 1823) | ET | MB | 0 | 0 | LC | 1 | 0 | 1 | 0 |
| W-22 | Passeriformes–Locustellidae | | | | | | | | | |
| 241 | *Locustella luscinioides* (Savi, 1824) | ET | RB | 0 | 1 | LC | 1 | 1 | 1 | 1 |
| +242 | *Locustella naevia* (Boddaert 1783) | ET | MB | 0 | 0 | LC | 0 | 0 | 1 | 0 |
| W-23 | Passeriformes–Cisticolidae | | | | | | | | | |
| 243 | *Cisticola juncidis* (Rafinesque, 1810) | IA | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |
| W-24 | Passeriformes–Regulidae | | | | | | | | | |
| +244 | *Regulus regulus* (Linnaeus, 1758) | ET | MB | 0 | 0 | LC | 0 | 0 | 1 | 0 |
| +245 | *Regulus ignicapilla* (Temminck, 1820) | ET | PV | 0 | 1 | LC | 0 | 0 | 1 | 0 |
| W-25 | Passeriformes–Malaconotidae | | | | | | | | | |
| 246 | *Tchagra senegalus* (Linnaeus, 1766) | Eth | RB | 0 | 0 | LC | 1 | 1 | 1 | 1 |

Bio. Ori.: Biogeographical origin, Ar: Arctic, C: Cosmopolitan, Sa: Sarmatic, P: Palearctic, OW: Old World, IA: Indo African, ET: European Turkestani, M: Mediterranean, TM: Turkestan-Mediterranean, PXM: Paleo Xero Montane, H: Holarctic, E: European, Eth: Ethiopian, S: Siberian, An: Anthropic, U: Unknown; Ph. St.: Phenological status (W: wintering, RB: resident breeder, MB: migrant breeder, AV: Accidental visitor, PV: passage visitors); Pr. St.: protection status, A: Ordinance n° 06-05 of 15 July 2006, B: Executive Decree n° 12-235 of 24 May 2012, C: The International Union for Conservation of Nature, IUCN (LC: Least Concern, NT: Near Threatened, VU: Vulnerable, EN: Endangered ); Ref.: References (1: Current study; 2: BirdLife International; 3: Before 2000 "Ledant et al. 1981; Isenmann and Moali, 2000"; 4: After 2000 "Milla et al. 2012; Bendjoudi et al. 2013; Cherif et al. 2017; Djelmoudi 2017; Boulaoued 2018; Djitli 2021" ; *: a single observation ; +: Old documentation ; 0: no , 1: yes.

38.61%. In the second place are open lands with 85 species (34.55%), followed in the third place by water body species with 81 species, equivalent to 32.92%. Garden habitats are in the fourth place with 63 species (25.60%), then marine habitats with 53 species (21.54%), vegetation and crops with 33 species (13.41%), pre-urban habitats with 20 species (8.13%), and finally urban habitats with 15 species (6.09%) (Figure 3). In the current study conducted in the Algiers Sahel region over a four-year period, we identified a total of 205 bird species, including the observation of new species such as *Dryobates minor* in 2019, *Cecropis durica* in 2020, *Saxicola ruberta* in 2020, *Ficedula albicollis* in 2021, *Charadrius morinellus* in 2022, and *Stercorarius parasiticus* in 2023. Birdlife International lists 190 of these species. In comparison, studies before the year 2000 documented 201 species, while those after the year 2000 reported an average of 156 species.

### *Biogeographical origin of Algiers Sahel avifauna*

The avifauna of the Algerian Sahel includes 16 of the 23 faunal types delineated by Voous and Thomson (1960). The Palearctic type predominates, with 60 species (24.39%). With 32 species, or 13.0% of the total, the European Turkestani type follows closely behind. The European and Mediterranean types follow, with 26 and 20 species, respectively, or 10.56% and 8.13% of the total. The Cosmopolitan, Old World, and Turkestan-Mediterranean types collectively contributed 16 species, or 6.50%, while the Arctic and Holarctic types each included 13 species, a rate of 5.28%. The other categories were recorded less frequently (Table 1, Figure 4).

### *Phenology of Algiers Sahel avifauna*

Between 2019 and 2023, resident breeding species predominate, accounting for a third of the total with 92 species, or 37.39% (40 water birds and 52 land birds). Migratory breeding species ranked second, with a total of 57 species, or 23.17% (16 water birds and 41 land birds), totalling 57 species, equivalent to 23.17% (16 water birds and 41 land birds). Wintering species are in third place, with 44 species, or 17.88% (36 water birds and 8 land birds). The passing visitors represent 14.22%, with 35 species (12 water birds and 23 land birds). On the one hand, accidental visitor species make up a mere 11.54% of the total, indicating their presence in nearly negligible numbers (3 water birds and 15 land birds) (Tables 1, 2).

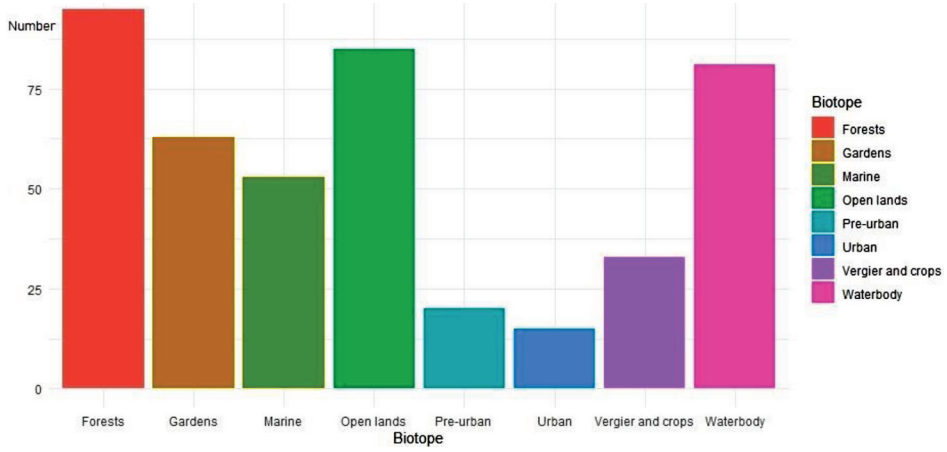


Figure 3. Number of avian species across biotopes.

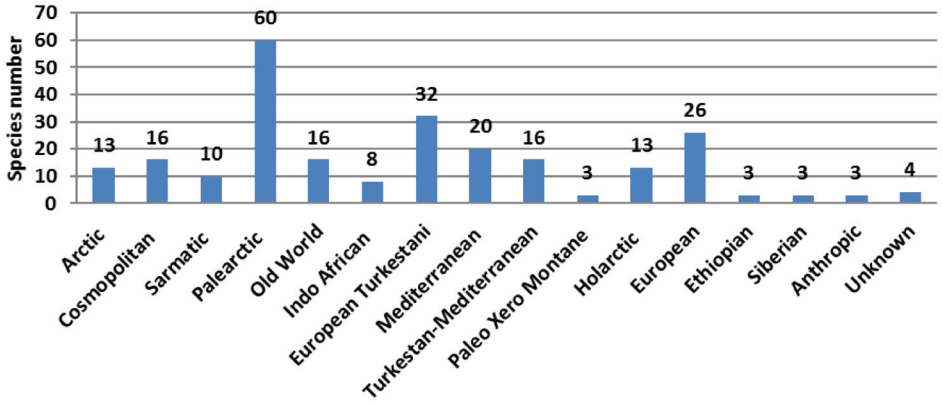


Figure 4. Biogeographical origin types of Algiers Sahel avifauna.

Table 2. Phenological status of Algiers Sahel avifauna.

| Ph. St. / Type | Resident breeder | Migrant breeder | Wintering | Passage visitor | Accidental visitor | Total |
|---|---|---|---|---|---|---|
| Water birds | 40 | 16 | 36 | 12 | 3 | 107 |
| Land birds | 52 | 41 | 8 | 23 | 15 | 139 |
| Total | 92 | 57 | 44 | 35 | 18 | 246 |

Ph. St.: Phenological status.

Table 3. Trophic status of Algiers Sahel avifauna.

| Tr. St. / Type | Polyphage | Invertivore | Scavenger | Granivore | Carnivore | Piscivore | Omnivore | Total |
|---|---|---|---|---|---|---|---|---|
| Water birds | 34 | 34 | 19 | 0 | 0 | 15 | 1 | 103 |
| Land birds | 6 | 84 | 7 | 29 | 15 | 0 | 2 | 143 |
| Total | 40 | 118 | 26 | 29 | 15 | 15 | 3 | 246 |

Tr. St.: Trophic status

### *Trophic status of Algiers Sahel avifauna*

With 118 species, accounting for 47.96% of the total, invertivores emerge as the most numerous trophic category, comprising 34 water birds and 84 land birds. Polyphagous birds rank second with 40 species (16.26%), distributed among 34 water birds and 6 land birds. Granivores and scavengers occupy the third position, each with around twenty species, representing percentages between 11.78% and 10.56%. Piscivores and carnivores are less numerous, totalling 15 species, or 6.09%. Omnivores, encompassing only 3 species (1 water bird and 2 land birds), are present in smaller numbers (Table 3). It is noteworthy that, regardless of the station studied, invertivores and polyphagous birds exhibit clear dominance.

The variation of species count data throughout the year between phenological status (ANOVA: F value = 3.547, df = 4, $p < 0.0207$) and trophic status (ANOVA: F value = 9.472, df = 6, $p < 2.25$ e-05) was significant. Consequently, the time of the year during which species are observed and their dietary habits exert a significant impact on the observed species diversity.

### *Protection statutes of Algiers Sahel avifauna*

Nationwide in Algeria, Decree No. 12-235 of 24 May 2012, which establishes the list of protected species, covers the protection of 64 species, representing 26% of the species identified during this study. However, only the Lesser Kestrel, Peregrine Falcon, and White-headed Duck are specifically protected by Ordinance No. 06-05 of 15 July 2006 on the legal protection and preservation of endangered animal species. Worldwide, 91.46% of the species listed are of "Least Concern" status, according to the IUCN Red List. Fourteen species are classified as "Near-Threatened" and five as "Vulnerable". Finally, two species, the Turkey Vulture and the White-headed Duck, are considered "Endangered" (Table 1).

## DISCUSSION

In this study carried out in the Algiers Sahel, a total of 246 avian species were inventoried, categorized into 23 orders and 64 families. These species account for 73.21% of the 336 species documented across Algeria by Ledant et al. (1981). Additionally, they represent 60.59% of the overall 406 Algerian species cited by Isenmann and Moali (2000). This is a significant percentage, underscoring the importance of the findings in relation to a broader avian diversity in Algeria. It should be noted that the number of birds recorded in this study is higher than the figures reported by other previous studies, such as Milla et al. (2012), which reported 78 bird species throughout the Algiers Sahel region. In addition, Bendjoudi et al. (2013) recorded 125 bird species in the Mitidja plain. Bougaham, Moulai (2014) observed 62 breeding bird species after conducting 90 listening points in six areas of floral formations in the Bejaia region. In the pre-Saharan steppes of the Zibans, Farhi et al. (2016) noted the presence of 42 species. Boulaoued (2018) recorded 156 species, in the Algiers Sahel, with a marked predominance of Passeriformes. Finally, in the M'Zab region (northern Algerian Sahara), Chedad et al. (2023a) observed the presence of 203 species, a considerable number that represents more than 50% of the Algerian avifauna. The results obtained in this study partially converge with those found by Boulaoued (2018).

The large number of bird species found in this study is due to the fact that it surveyed various types of habitats, including the whole Ben Aknoun and Paradou forests, the Hamma experimental garden, the park of the Higher National Agronomic School, the Réghaïa marsh, and other biotopes like the marine region, open lands, pre-urban areas, and urban areas. The inclusion of diverse ecosystems contributed to a more extensive inventory and a richer representation of avian diversity in the studied region.

The increase in the number of bird species can also be explained by the variety of observation methods put in place, the professional photographic equipment used, increased awareness of the importance of biodiversity, and habitat preservation and conservation that can provide safe areas for birds, encouraging their increase.

The surge in bird numbers might also be attributed to the confinement measures implemented during the Coronavirus Disease 2019 (COVID-19) pandemic period, spanning from January 2020 to September 2020 (9 months). The reduced human disturbance, increased tranquility in the wild, and availability of stable bird habitats with sufficient food supply likely contributed to the adaptation and thriving of avian species, thus explaining the observed increase (Gill et al. 2024).

In the context of bird species diversity in various countries, Algeria records 451 species, Tunisia 424, and Morocco 454 (BirdLife International 2024). However, in examining the avifaunal diversity across nations in the northern Mediterranean region, Italy 324, France 724, and Spain 563 (BirdLife International 2024). The diversity of bird species within certain geographical areas can fluctuate due to various factors, most likely associated with the diversity of available habitats. Countries that are larger or offer a greater variety of natural environments (forests, wetlands, coasts, mountains, etc.) can host a greater diversity of species (Maggini et al. 2020). This is also explained in terms of the countries' geographical positions. Countries with coastal areas, along major migration routes, or with various climates, such as France and Spain, can attract and host a greater diversity of birds (Aharon-Rotman et al. 2021). Human activities such as urbanization, pollution, deforestation, intensive agriculture and hunting can affect bird species diversity (Chedad et al. 2023a). Countries where these pressures are lower can maintain a greater variety of wildlife habitats. In the specific case of northern Mediterranean countries, there are differences due to the variety of ecosystems, climates and seasonal bird migrations. Spain, for example, has a higher avifaunal diversity due to its variety of landscapes, mountains and wetlands, as well as its strategic location for bird migrations (Uehara et al. 2023).

The biotope with the highest species richness is forests, which represent 38.61% of all species recorded in this study. It is important to note that the number of birds identified in this study exceeds figures from earlier studies, such as that carried out by El Bouhissi et al. (2021), which accounted for 17.49% in the Merine forest of Sidi Bel Abbes. Open lands closely follow forests, with a representation of 34.55%. However, it's worth noting that Djelmoudi (2017) documented a lower percentage of 23% at the Zeralda hunting reserve. This is largely attributed to biotic interactions, the abundance of food resources, and stability. Waterbody species secure the third position with 32.92%. In the humid zone of Kef Doukhan, Ghardaia, Chedad et al. (2020) documented 53 bird species. In comparison, the present study recorded 81 bird species at Réghaïa Marsh. Factors like observation seasons, sampling techniques, or the particular characteristics of the studied wetlands may have an impact on the similarity in findings. Additionally, the seasons of observation can play a role, as species composition may vary according to seasonal migrations and climatic changes. The frequency of surveys and the duration of the study can also contribute to this similarity.

Garden birds are represented at 25.60%, while Boulaoued (2018) noted a slightly lower percentage of 20.66% in the Algiers Sahel region. The relatively close percentages between the present study and the findings of Boulaoued (2018) could be attributed to similar ecological conditions, overlapping study areas, and comparable sampling methods. Pre-urban species make up 8.13%, and urban species contribute to 6.09%. Aouissi et al. (2021) reported a slightly lower percentage of 7.90% in the urban region of Annaba. This could be attributed to various forms of pollution, human disturbance, limited food resources, and shelter for these species in urban and pre-urban environments.

In general, the avifauna of the Algiers Sahel region is predominantly of Palearctic origin, accounting for 24.39% of all species. More specifically, it includes species with European-Turkestani, Holarctic, European, and Mediterranean origins, totalling 13%, 10.56%, 8.13%, and 5.28%, respectively. The Cosmopolitan, Old World, and Turkestan-Mediterranean types collectively contributed 6.50%, while the Arctic and Holarctic types each accounted for 5.28%. The other categories were recorded less frequently. The region's geographical location at the intersection of North Africa and Europe, which creates conditions favourable to the exchange of species between these two continents, largely explains this composition. Palearctic species may migrate to these regions to overwinter or breed. The predominance of Palearctic origins may also be the result of historical changes in climate and geology, which may have influenced the distribution of species. Earlier connections between North Africa and Europe probably facilitated the movement of species between these regions. According to Blondel (2018), around 37.2% of all bird species in Algeria are Palearctic. Palearctic and European types are predominant in France. Blondel (2022) mentions that today's Mediterranean avifauna is predominantly Palearctic in origin, with a few exceptions, and a limited representation of other biogeographic types. He also points out that vast deserts have acted as barriers since the end of the Pliocene, limiting the dispersal of Palearctic species, thus explaining the more restricted nature of

north-south exchanges between continents. Deserts have a hostile climate and environmental conditions that are unsuitable for many bird species. Extreme temperature variations, lack of food and water resources make crossing deserts difficult, if not impossible, for many birds. Our results coincide with those found by Milla et al. (2012), Farhi et al. (2016), Boulaoued (2018) and Boulaoued et al. (2021), explaining the diversity of habitats, such as wetlands, forests, grasslands and coastal areas in the Algiers Sahel, which offer favourable conditions for different bird species. Palearctic species can find suitable food resources and habitats in this region.

The observations made in the present study differ in part from Bergier and Thenevot (2010), who note that the avifauna of the woodland environments studied consists mainly of species of Arctic origin, among which the European type dominates. This difference can be explained by the fact that Morocco is geographically closer to Europe than Algeria, and by the high altitudes of the High Atlas. This geographical proximity may favour species exchanges between Morocco and Europe. Birds of European origin can more easily reach Morocco for reasons of natural dispersion, seasonal migration or climatic variations.

Resident breeding species rank first, accounting for 37.39%, due to the fact that they find sufficient food resources of insects, grains, and invertebrates in the Algiers Sahel region, as well as favourable climatic conditions. As sedentary birds often establish nesting territories and are attached to specific areas for breeding, they may not feel the need to migrate to other regions, as migratory species do. Migrant breeding species and wintering bird species remain important, representing 23.17% and 17.88%, respectively, given the favourable trophic conditions of the environment. The passing visitors and accidental visitor species represent 14.22% and 11.54 %, respectively. The results obtained in the present work are in line with those of authors who have worked in similar environments, such as Milla et al. (2012) and Boulaoued (2018). Forest and garden environments are home to a variety of undergrowth that creates ideal conditions for hosting numerous bird species. In contrast, studies carried out in wetlands reveal that most of the species recorded are migratory. According to El Haouati et al. (2015), Cherif et al. (2017), Djitli (2021), and El Bouhissi et al. (2023), this observation is specifically noted in the Réghaïa Marsh wetland, and in the wetlands of eastern Algeria according to Boudiaf (2021) and Loucif et al. (2020). While it is possible that future surveys will detect other passing species, be they water birds or land birds, so that the survey is complete. It is also important to take into account past observations (Ledant et al. 1981; Isenmann and Moali 2000) which help understand potential changes in distribution and identify key passage areas and migratory corridors. This distribution remains constant, highlighting the remarkable preponderance of sedentary species in the Sidi Moussa-Oualidia lagoon complex in Morocco (El Hamoumi et al. 2022) and in Lac de Tunis, Tunisia (Sahbani et al. 2022). Despite the alterations and disturbances caused by human activity, these sites preserve a remarkable diversity of exceptional birds. The ability of birds to quickly adapt to their environment explains this phenomenon.

The dominance of invertivores and polyphagous birds in the Algiers Sahel region, representing 47.96% and 16.26% of all species, can be explained by the abundance of arthropod fauna and a high production of flowers, seeds, and fruits. These birds have developed specific foraging and capture techniques to feed on insects and other small animals. Invertebrates play a key role in ecosystems as prey for many birds. Their abundance and role in the food chain can influence the presence and abundance of invertivores in the region. Moreover, the dominance of invertivores or polyphagous birds varies according to the environment. In forests, both types of trophic regimes are equally prominent. Milla et al. (2012), Boulaoued (2018), and Mezerdi and Farhi (2022) indicate the same. The last authors cited indicate that from the end of October until the following spring, most insects hide in their overwintering forms, in which case the birds migrate. This decline in food resources prompts birds to seek out regions where food is more abundant and accessible. Tropical or subtropical regions are common destinations for migratory birds, as they offer more favourable conditions in terms of food and climate. In terms of gardens, insectivores dominate. This is also reported by Milla et al. (2012) and Boulaoued (2018). Arthropod numbers rise in spring, coinciding with the arrival of summer migratory birds. On the other hand, at the Marais de Réghaïa, it is the polyphagous birds that come to the fore, a fact previously mentioned by Milla et al. (2012), Boulaoued (2018), and Benzina et al. (2022) in the same environment. For these birds, their diet is not stable. It varies from one season to the next depending on the availability of nutritive resources in the environment (Milla et al. 2006). Generally, the Algiers Sahel region is extremely rich in flora and fauna, and consequently offers significant food resources, enabling the settlement of birds belonging to different trophic categories, in particular invertivores and polyphagous birds.

Decree No. 12-235 of 24 May 2012, which establishes the list of protected species, covers 64 species, representing 26% of the species identified during this study. However, only the Lesser Kestrel, Peregrine Falcon, and White-headed Duck are specifically protected by Ordinance 06-05 of 15 July 2006, which establishes the list of protected non-domestic animal species, relating to the preservation of certain endangered animal spe-

cies. Internationally, 91.46% of the species listed are of "Least Concern" status, according to the IUCN Red List. Fourteen species are classified as "Near-Threatened" and five as "Vulnerable". Finally, two species, the Turkey Vulture and the White-headed Duck, are considered "Endangered". These statuses are defined in accordance with various criteria that assess the biological risks of extinction. These criteria include factors such as climate change, environmental pollution, excessive hunting, and habitat fragmentation, such as urbanization, which can isolate bird populations (IUCN 2020). Protected status for the birds of the Algerian Sahel shows how important this area is on a national and international level. The Lac de Réghaïa wetland is especially important because it meets three criteria (1, 2, and 3) of the Ramsar Convention, which are usually enough to find wetlands that are of international importance: Criterion 1: the Réghaïa coastal marsh, considered a site of international importance, plays a major qualitative role for migratory birds; Criterion 2: this site is home to four rare species, two of which are classified as vulnerable on the Red List: *Aythya nyroca* and *Marmaronetta angustirostris*, while the third, *Oxyura leucocephala*, is listed as endangered; Criterion 3: Lake Réghaïa is home to plant and animal species that are important for maintaining biological diversity.

During the comprehensive avifauna survey of the Algiers Sahel region, a total of 246 bird species were identified. This endeavour also led to the exciting discovery of new species, including *Stercorarius parasiticus*, *Cecropis daurica*, *Ficedula albicollis*, *Saxicola rubetra*, *Charadrius morinellus*, and *Dryobates minor*. These additions contribute to the enriched biodiversity of the region and underline the significance of ongoing avian monitoring efforts. These results, derived from prolonged and detailed observation, reflect a relatively high number of species. According to Birdlife International, of these 205 species, 190 are also listed, indicating some stability or a slight increase over the years. The difference of 15 species compared with the current study could be explained by variations in observation methodology, updated site information or data sources. Earlier studies, including Ledant et al. (1981), Isenmann and Moali (2000), recorded 201 bird species in the Algerian Sahel before the year 2000, suggesting some stability or little change in bird species composition over time in this region, probably due to the constant availability of food sources. However, more recent research by Milla et al. (2012), Bendjoudi (2013), Cherif et al. (2017), Djelmoudi (2017), Boulaoued (2018), and Djitli (2021) reported an average of 156 bird species in the Algerian Sahel, suggesting a decrease from the current study. These lower figures could be attributed to variations in observation and sampling methods, as well as to the use of less sophisticated equipment and cameras with less powerful zoom. They could also be influenced by changes in biodiversity over time, environmental and climatic changes, and above all, the adaptation of species to their habitat.

## CONCLUSION

In the Sahel region of Algeria, we have determined the presence of 246 bird species (102 of which are waterfowl) belonging to 23 orders and 64 families, including 7 new species. Analysis of the birds' ecological niches in various biotopes has highlighted the importance of the water bodies of the Algerian Sahel, such as the sea and Lake Réghaïa. The same time, it confirms that Lake Réghaïa plays a crucial role as a Ramsar site for the avian species studied. This region is crucial for both land and water bird species, serving as a significant stopping, wintering, and breeding zone. Long-term monitoring programmes are essential for detecting potential risks. Investing in training programmes, seminars, and scholarships will aid in cultivating local competence in ornithology, conservation biology, and ecological research. The favourable outcomes seen throughout the research region emphasize its essential contribution to sustainable conservation. Conducting further bird censuses might provide more findings and enhance the bird inventory for this area, so aiding in the enduring conservation of bird species and their habitats. In order to advance, additional research is imperative. Subsequent investigations could concentrate on exploring less-explored habitats, employing advanced monitoring methods like telemetry and ecological modelling to anticipate future trends in avian populations. Moreover, fostering collaboration among researchers, conservationists, and policymakers is crucial for devising effective strategies for the management and preservation of avian fauna.

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### *Conflict of interests*

The co-authors report no conflicts of interest.

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### *Data availability*

The data used to support the findings of this study can be made available on reasonable request from the corresponding author.

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