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Bird species in the Arac Stream of Safranbolu in Türkiye

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Abstract

This study was conducted between 2022 and 2023 to identify bird species in the Arac Stream in the Safranbolu district in the province of Karabuk, Türkiye. A total of 54 bird species belonging to 14 orders and 32 families were identified during the survey. Of the species observed, 11 (20.4%) were summer migrants, 1 (1.8%) was a winter migrant and 42 (77.8%) were resident species.

Summer migrants included the white stork (*Ciconia ciconia*), turtle dove (*Streptopelia turtur*), hoopoe (*Upupa epops*), bee-eater (*Merops apiaster*), swift (*Apus apus*), the bullfinch (*Carpodacus erythrinus*), tree pipit (*Anthus trivialis*), black-headed bunting (*Emberiza melanocephala*), red-rumped swallow (*Cecropis daurica*), house martin (*Delichon urbicum*) and crag martin (*Ptyonoprogne rupestris*).

The results of the study show that the forests and wetlands of Karabuk province provide important habitats and food sources for wildlife, especially birds. The wetlands in the region not only provide temporary shelter for migratory birds, but also contribute significantly to the biodiversity of the wetland ecosystem by hosting resident species throughout the year.

These findings emphasize that the protection of the Arac Stream and its surrounding habitats is crucial for the conservation of regional biodiversity.

Keywords: avifauna, biodiversity, migratory birds, Arac Stream, Safranbolu

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Türkiye Safranbolu Araç Çayı'ndaki kuş türleri

Özet

Bu çalışma, Karabük ili Safranbolu ilçesindeki Araç Çayı'nda bulunan kuş türlerini tespit etmek amacıyla 2022-2023 yılları arasında gerçekleştirilmiştir. Araştırma sonucunda, 14 takım ve 32 familyaya ait toplam 54 kuş türü tespit edilmiştir. Tespit edilen türlerden 11 (%20,4) yaz göçmeni, 1 (%1,8) kış göçmeni ve 42 (%77,8) yerli türdür.

Yaz göçmeni türlerden Leylek (*Ciconia ciconia*), Üveyik (*Streptopelia turtur*), İbibik (*Upupa epops*), Arıkuşu (*Merops apiaster*), Ebabil (*Apus apus*), Çütre (*Carpodacus erythrinus*), Ağaç incirkuşu (*Anthus trivialis*), Karabaşlı çinte (*Emberiza melanocephala*), Kızıl kırlangıç (*Cecropis daurica*), Ev kırlangıcı (*Delichon urbicum*) ve Kaya kırlangıcı (*Ptyonoprogne rupestris*)'nın yayılış gösterdiği tespit edilmiştir.

Çalışma sonucunda, Karabük ilinin ormanları ve sulak alanlarının, özellikle kuşlar başta olmak üzere yaban hayatı için kritik öneme sahip habitat ve besin kaynakları sağladığını görülmüştür. Bölgedeki sulak alanların, göçmen kuşlara geçici barınma imkânı sunmasının yanı sıra, yerli türlere yıl boyunca ev sahipliği yaparak sulak alan ekosisteminin biyolojik çeşitliliğine önemli katkıda bulunduğu tespit edilmiştir.

Araç Çayı ve çevresindeki habitatların korunması, bölgesel biyoçeşitliliğin sürdürülmesi açısından kritik önem taşımaktadır.

Anahtar kelimeler: kuş faunası, biyoçeşitlilik, göçmen kuşlar, Araç Çayı, Safranbolu

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1. Introduction

Avifauna is a crucial component of global biodiversity and serves as one of the key indicators of the health and functionality of ecosystems [1]. Birds (Aves) are often used as model organisms in biological monitoring studies due to their taxonomic and ecological diversity, broad habitat range and sensitivity to environmental change [2]. Currently, around 11,000 bird species have been identified worldwide [3, 4]. With their distribution and abundance changing rapidly due to climate change, habitat loss and other anthropogenic factors [5].

Due to its location at the intersection of the zoogeographical regions of the Palaearctic, Ethiopia and the Orient and its diverse ecosystems, Türkiye has a rich avifaunal diversity [6]. The regular observation of around 500 bird species in our country clearly shows this richness [7]. In addition, Türkiye's geographical location within the migration system between Eastern Europeand Africa is of crucial importance [8]. There are many studies conducted on birds in Türkiye [9-12].

The life cycle of birds consists of three basic phases: Breeding, wintering and migration, with each phase presenting different ecological requirements and challenges [13]. Especially during migration periods, birds are exposed to various ecological barriers and anthropogenic threats when traveling long distances [14]. In this context, the protection of resting and feeding areas along migratory routes is of crucial importance for the sustainability of migratory bird populations [15].

The province of Karabuk, especially the Arac Stream and its surroundings, is of great ornithological importance due to its location along the main and secondary bird migration routes leading south from the Black Sea [8]. However, factors such as rapid urbanization, agricultural expansion and deforestation are exerting significant pressure on bird habitats and may affect the composition and dynamics of bird communities in the region.

The lack of a comprehensive study of bird diversity in the Arac Stream and its surroundings in Safranbolu, a UNESCO World Heritage Site, prevents a proper understanding of the ornithological importance of the region. This knowledge gap hinders the development and implementation of effective conservation strategies. Therefore, the systematic identification of bird species in the region and the understanding of their population dynamics are crucial for the conservation of biodiversity.

This study was conducted to determine the bird species occurring in and around the Safranbolu Arac Stream, to assess the seasonal population densities and to calculate the biodiversity of bird species in the region.

2. Materials and methods

The study was conducted in the Arac Stream ecosystem (41°12'37.68 "N, 32°40'9.98 "E) within the boundaries of Safranbolu district in Karabuk province, which is located in the western Black Sea region of Türkiye (Figure 1). Karabuk province is characterized by heterogeneous forest cover, which occupies about 73% of its area. These forested areas have a rich floristic composition of different tree and plant species. The dominant tree species include *Abies* sp. (fir), *Fagus* sp. (beech), *Pinus* sp. (pine), *Platanus* sp. (plane tree), *Juglans* sp. (walnut), *Fraxinus* sp. (ash), *Alnus* sp. (alder), *Quercus* sp. (oak), *Salix* sp. (willow), *Corylus* sp. (hazel), *Taxus* sp. (yew), *Prunus* sp. (cherry), *Tilia* sp. (lime), *Acer* sp. (maple), *Cornus* sp. (dogwood), *Buxus* sp. (boxwood), *Pyrus* sp. (wild pear), *Laurus* sp. (laurel), *Rosa* sp. (rose), and *Rubus* sp. (blackberry). The floristic composition of the region is characterized by elements belonging to the Euro-Siberian phytogeographic region [16, 17].

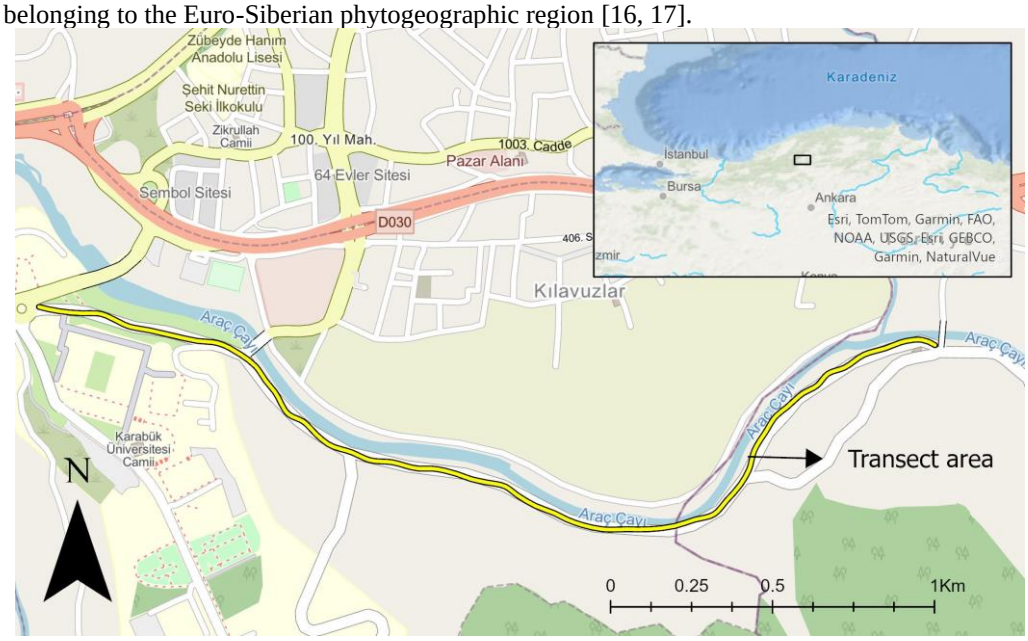

Figure 1. Transect area in the province of Karabuk

The surveys were carried out over a 12-month period between 2022 and 2023. Avifauna observations were conducted twice daily in the first and third week of each month, in the morning (07:30-10:00) and evening (15:30-19:30). These periods cover the main activity times of the birds [18].

The line transect method was used to identify and count bird species [19]. The transect was established along an approximately 5 km stretch of the Arac stream, extending from the iron and steel campus of Karabuk University to the Safranbolu district boundary. During each observation session, the researchers moved along the transect at a constant speed (approx. 2 km/h) and recorded all bird species observed.

Remote observation techniques were used during the observations to avoid disturbing the birds and to observe their natural behaviors. Olympus 10x50 S binoculars were used for this purpose. A Canon EOS R7 mirrorless camera with a Canon RF 800mm f/11 IS STM lens was used for closer examination and photographic documentation. This equipment made it possible to capture high-resolution images of distant and mobile birds.

Appropriate camouflage was used to minimize the potential impact of the researcher's presence on bird behavior [20].

Internationally recognized sources were used for species identification, including Lars Svensson's "Collins Bird Guide" [21] and "Birds of Türkiye", published by the Anonymous Birdwatching Society of Türkiye [22]. The taxonomic classification and nomenclature followed the current International Ornithologists' Union (IOC) World Bird List [4].

Descriptive statistics were used to calculate species percentages based on their migration status (resident, summer migrant, winter migrant).

3. Results

A total of 54 bird species were identified in this study, which was conducted in the Arac Stream ecosystem in Safranbolu between 2022-2023. These species belong to 14 orders and 32 families. The analysis of taxonomic distribution revealed that the order of passerine birds dominated with 32 species (59.3%). The distribution of identified bird species according to the orders and families showed in Figure 2.

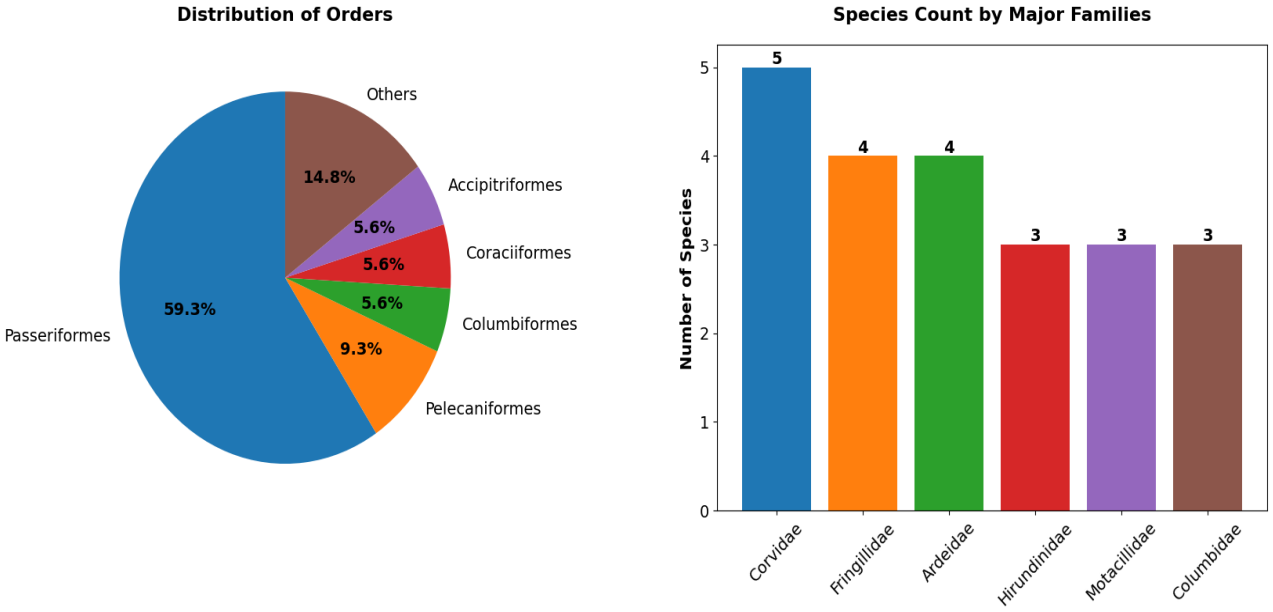

Figure 2. The distribution of identified bird species according to the orders and families

The ecological status of the observed species was distributed as follows: 42 (77.8%) resident species, 1 (1.8%) winter migrant and 11 (20.4%) summer migrants. Summer migrants included the following species: *Ciconia ciconia* (white stork), *Streptopelia turtur* (turtle dove), *Upupa epops* (hoopoe), *Merops apiaster* (bee-eater), *Apus apus* (swift), *Carpodacus erythrinus* (bullfinch), *Anthus trivialis* (tree pipit), *Emberiza melanocephala* (black-headed bunting), *Cecropis daurica* (red-rumped swallow), *Delichon urbicum* (house martin) and *Ptyonoprogne rupestris* (cliff swallow).

The seasonal analysis revealed that the highest species diversity and individual density was observed in the spring months. Especially after March, a remarkable increase in the arrival of migratory species was observed.

Table 1. Bird species recorded in the Arac stream ecosystem, Safranbolu, Türkiye (2022-2023)

No.	RDB	Status	IUCN	Order	Family	Turkish Name	Scientific Name
1	A5	R/f	LC	Columbiformes	Columbidae	Kumru	*Streptopelia decaocto*
2	A5	R/f	LC	Columbiformes	Columbidae	Kaya Güvercini	*Columba livia*
3	A3	SM/d	LC	Columbiformes	Columbidae	Üveyik	*Streptopelia turtur*
4	A3	SM/e	LC	Ciconiiformes	Ciconiidae	Leylek	*Ciconia ciconia*
5	A2	R/d	LC	Pelecaniformes	Ardeidae	Büyük Ak Balıkçıl	*Ardea alba*
6	A3	R/e	LC	Pelecaniformes	Ardeidae	Küçük Ak Balıkçıl	*Egretta garzetta*
7	A3	R/e	LC	Pelecaniformes	Ardeidae	Gri Balıkçıl	*Ardea cinerea*
8	A2	R/d	LC	Pelecaniformes	Ardeidae	Erguvani Balıkçıl	*Ardea purpurea*
9	A3	R/e	LC	Pelecaniformes	Threskiornithidae	Çeltikçi	*Plegadis falcinellus*
10	A5	R/f	LC	Anseriformes	Anatidae	Yeşilbaş	*Anas platyrhynchos*
11	A3	R/e	LC	Suliformes	Phalacrocoracidae	Karabatak	*Phalacrocorax carbo*
12	A2	R/d	LC	Coraciiformes	Alcedinidae	Yalıçapkını	*Alcedo atthis*
13	A2	SM/d	LC	Coraciiformes	Upupidae	İbibik	*Upupa epops*
14	A3	SM/e	LC	Coraciiformes	Meropidae	Arıkuşu	*Merops apiaster*
15	A3	R/e	LC	Gruiformes	Rallidae	Sutavuğu	*Gallinula chloropus*
16	A3	R/e	LC	Charadriiformes	Charadriidae	Halkalı Küçük Cılıbıt	*Charadrius dubius*
17	A3	SM/e	LC	Apodiformes	Apodidae	Ebabil	*Apus apus*
18	A4	R/e	LC	Passeriformes	Corvidae	Alakarga	*Garrulus glandarius*
19	A5	R/f	LC	Passeriformes	Corvidae	Leş Kargası	*Corvus cornix*
20	A5	R/f	LC	Passeriformes	Corvidae	Saksağan	*Pica pica*
21	A5	R/f	LC	Passeriformes	Corvidae	Kuzgun	*Corvus corax*
22	A5	R/f	LC	Passeriformes	Corvidae	Küçük Karga	*Coloeus monedula*
23	A3	R/e	LC	Passeriformes	Fringillidae	Florya	*Chloris chloris*
24	A3	R/e	LC	Passeriformes	Fringillidae	Saka	*Carduelis carduelis*
25	A4	R/f	LC	Passeriformes	Fringillidae	İspinoz	*Fringilla coelebs*
26	A2	SM/d	LC	Passeriformes	Fringillidae	Çütre	*Carpodacus erythrinus*
27	A2	R/d	LC	Passeriformes	Paridae	Mavi Baştankara	*Cyanistes caeruleus*
28	A3	R/e	LC	Passeriformes	Paridae	Büyük Baştankara	*Parus major*
29	A3	R/e	LC	Passeriformes	Turdidae	Karatavuk	*Turdus merula*
30	B2	WV/d	LC	Passeriformes	Turdidae	Öter Ardıç	*Turdus philomelos*
31	A2	R/d	LC	Passeriformes	Sylviidae	Bıyıklı Kamışçın	*Acrocephalus melanopogon*
32	A3	R/d	LC	Passeriformes	Sylviidae	Kamışbülbülü	*Cettia cetti*
33	A3	R/e	LC	Passeriformes	Motacillidae	Ak Kuyruksallayan	*Motacilla alba*
34	A2	R/d	LC	Passeriformes	Motacillidae	Dağ Kuyruksallayan	*Motacilla cinerea*
35	A3	SM/e	LC	Passeriformes	Motacillidae	Ağaç İncirkuşu	*Anthus trivialis*
36	A3	R/e	LC	Passeriformes	Muscicapidae	Kızılgerdan	*Erithacus rubecula*
37	A3	R/e	LC	Passeriformes	Muscicapidae	Taşkuşu	*Saxicola rubicola*
38	A5	R/f	LC	Passeriformes	Passeridae	Serçe	*Passer domesticus*
39	A3	R/e	LC	Passeriformes	Passeridae	Ağaç Serçesi	*Passer montanus*
40	A4	SM/e	LC	Passeriformes	Emberizidae	Karabaşlı Çinte	*Emberiza melanocephala*
41	A3	SM/e	LC	Passeriformes	Hirundinidae	Kızıl Kırlangıç	*Cecropis daurica*

Table 1. Continued

42	A5	SM/f	LC	Passeriformes	Hirundinidae	Kaya Kırlangıcı	*Ptyonoprogne rupestris*
43	A3	SM/e	LC	Passeriformes	Hirundinidae	Ev Kırlangıcı	*Delichon urbicum*
44	A2	R/d	LC	Passeriformes	Aegithalidae	Baştankara	*Aegithalos caudatus*
45	A12	R/d	LC	Passeriformes	Troglodytidae	Çitkuşu	*Troglodytes troglodytes*
46	A12	R/d	LC	Passeriformes	Regulidae	Çalıkuşu	*Regulus regulus*
47	A12	R/d	LC	Passeriformes	Cinclidae	Derekuşu	*Cinclus cinclus*
48	A5	R/f	LC	Passeriformes	Sturnidae	Sığırcık	*Sturnus vulgaris*
49	A2	R/d	LC	Passeriformes	Remizidae	Çulhakuşu	*Remiz pendulinus*
50	A3	R/d	LC	Accipitriformes	Accipitridae	Şahin	*Buteo buteo*
51	A3	R/e	LC	Accipitriformes	Accipitridae	Atmaca	*Accipiter nisus*
52	A12	R/d	LC	Piciformes	Picidae	Aksırtlı Ağaçkakan	*Dendrocopos leucotos*
53	A2	R/d	LC	Strigiformes	Strigidae	Kukumav	*Athene noctua*
54	A12	R/d	LC	Falconiformes	Accipitridae	Kaya Kartalı	*Aquila chrysaetos*

RDB categories [16]: A2: Vulnerable; A3: Rare; A4: Low risk; A5: Widespread; A12: Data insufficient; B2: Winter visitor Status: R: Resident; SM: Summer migrant; WV: Winter visitor Breeding status: d: Annual local breeding; e: Regular breeding species of local importance; f: Widespread breeding species [7, 23].

All identified bird species were classified as LC (Least Concern) according to the categories of the IUCN Red List [24]. However, according to the categories of the Red Data Book of Türkiye (RDB), the distribution of species was as follows: A2 (Vulnerable): 8 species (14.8%), A3 (Rare): 20 species (37.0%), A4 (Low Risk): 3 species (5.6%), A5 (Widespread): 9 species (16.7%), A12 (Data insufficient): 4 species (7.4%), and B2 (Winter visitor): 1 species (1.9%). *Ardea alba*, *Ardea purpurea*, *Alcedo atthis*, *Upupa epops*, *Carpodacus erythrinus*, *Cyanistes caeruleus*, *Acrocephalus melanopogon* and *Motacilla cinerea* are important ecological indicator species and are classified as endangered species (A2) [25-28].

The study has shown that the preservation of riparian vegetation and understory flora is crucial for the presence and persistence of bird species that use the stream banks. Of the species identified, 18 (33.3%) breed annually locally (d), 25 (46.3%) are regularly breeding species of local importance (e), and 11 (20.4%) are widespread and breed in most regions (f).

4. Conclusions and discussion

This study, in which 54 bird species were documented, represents 10.8% of the known avifauna of Türkiye and shows the significant ornithological value of the area. In total, 77.8% of the species are resident, 1.8% are winter migrants and 20.4% are summer migrants. In a similar study, 74 species were identified in Lake Karakuyu. 32% of the species were resident, %9 were winter migrants, 30% were summer migrants and 28% were transit migrants [29]. In the Besevler campus of Ankara University, 66 bird species were detected, of which 30% were residents, 6.1% were summer migrants, 21.2% were winter migrants, 30% were transients and 3% were vagrant species [30]. Compared to similar studies, our results were relatively different. In our study area, 77.8% of species were resident, which is significantly higher compared to Lake Karakuyu and the Besevler Campus. The proportion of migratory species in our study area was relatively low (22.2%), which can be attributed to Arac Stream being on a secondary migration route rather than a primary flyway. This difference suggests that the wetlands in the study area serve as important resting and feeding areas during migration periods.

The dominance of passerines (59.3 % of species recorded) corresponds to the general composition of the avifauna in Türkiye, where Kirwan et al. [6] reported about 55 % of species from this order. This similarity indicates that our study area represents a typical cross-section of the avifauna of Türkiye.

The distribution of species among the RDB categories emphasizes the importance of the region for nature conservation. The presence of 8 species (14.8%) in category A2 (endangered) and 20 species (37.0%) in category A3 (rare) shows that the Arac stream ecosystem plays an important role in biodiversity conservation strategies in Türkiye.

The presence of waterbirds such as *Ardea* spp, *Egretta garzetta*, *Alcedo atthis* and *Cinclus cinclus* indicates a healthy aquatic ecosystem. However, on-site observations revealed that untreated sewage is being discharged directly into the stream. Water pollution and habitat degradation pose a significant threat to the survival of these species. Iliker

et al. [31] similarly emphasized the negative effects of water pollution and habitat loss on waterbirds in Turkish wetlands.

The discharge of domestic and environmental waste into the Arac Stream has the potential to disrupt the aquatic ecosystem food chain. This disruption could impact numerous bird species, especially those that rely on aquatic food resources [32]. In addition, erratic rainfall patterns and increased flooding due to global warming have a negative impact on bird populations and may affect breeding cycles, timing of migration and availability of food resources.

The co-occurrence of forest species (*Dendrocopos leucotos*, *Garrulus glandarius*) and open habitat species (*Upupa epops*, *Merops apiaster*) demonstrates the heterogeneity of habitats. This diversity enables the coexistence of species with different ecological requirements [33].

Birds serve as excellent models for assessing the impact of land-use change on taxonomic and functional diversity, as they vary in their sensitivity to habitat degradation [34]. However, the conversion of natural habitats to anthropogenic land use is one of the greatest threats to biodiversity conservation [35]. Stream restoration works, parking structures and similar construction activities observed in the study area can lead to loss or displacement of species over time.

The ecological structures of wetlands are particularly important for the needs of waterbirds in terms of shelter, stopover and feeding. As noted by the Turkish Environmental Foundation [36], areas typically no more than 6 m deep, where sunlight penetrates to the bottom to allow phytoplankton and zooplankton to develop, and which are covered with tall vegetation such as reeds, provide ideal conditions for hiding, nesting and shelter for waterbirds. The disturbance of the natural river structure and the concrete channelization will undoubtedly have a negative impact on the aquatic ecosystem. This study, conducted during the restoration phase of the river, will serve as an important basis for assessing the future impact on bird species.

In summary, this study shows that the Safranbolu Arac Stream is an important area for bird biodiversity at both national and regional levels. The fact that the region provides critical habitats for both resident and migratory species emphasizes the importance of conservation efforts. Future research should focus on studying the effects of seasonal changes on bird communities, habitat preferences and the long-term effects of anthropogenic threats.

For the protection of biodiversity and sustainable development of the Safranbolu district in Karabuk province, more comprehensive studies should be conducted in cooperation between the relevant government institutions, civil organizations, researchers and scientists.

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