

RESEARCH ARTICLE

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Avian diversity of Fars province (Southwestern Iran) with note on the zoogeographical composition

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Abstract

Rich avifauna of Fars province, SW Iran, is a stem from high diversity of habitat and climate beside its geographical position as a crossroad between Palearctic, Oriental, and Afrotropical realms. It shares the greatest number of bird species with the Palearctic region, however two other faunal realms, including Oriental and Afrotropical have a pronounced influence on its avifauna. It seems its bird fauna to be more in common with the Oriental elements than Afrotropical ones; the question addressed in this study. In addition, the province is located east of the Western Palearctic and close to the Eastern Palearctic border. I explored how much its bird elements have in common with the Eastern Palearctic. It is important because in some cases, western and eastern bird elements may come together with a narrow or wide hybrid zone. Based on my expeditions in recent years and pervious published literature, I present the comprehensive annotated checklist including 371 bird species in 197 genera, 68 families and 23 orders. At least 88 species are resident, 193 species are breeding, 33 species are rare and 21 species are vagrant. Based on the international conservation criteria, five species fall under the EN, nine under the VU, 16 under the NT of IUCN and 62 species fall under the appendices of CITES, including eight species in appendix I and 54 in appendix II. Results show that the Fars province shares the greatest number of bird species with the Palearctic region (364). The province lies within the West Palearctic faunal region and as expected, its bird fauna shares a greater number of species with the western Palaeartic than its eastern (346 versus 314). Our results also showed that the two other adjacent faunal regions including Oriental and Afrotropical have influence on its avifauna, and the province shares a greater number of species with the Oriental than to Afrotropical.

Key words: Bird fauna, Conservation, Distribution, Zoogeography, Taxonomy, Iran.

INTRODUCTION

The knowledge of Iranian avifauna traces back to second half of 19th and entire 20th centuries that was almost dotted with pioneering contributions of western researchers (e.g. Blanford, 1876; Schalow, 1876; Witherby, 1903; Beldi, 1918; Capito, 1931; Trott, 1947; Vaurie & Koelz, 1949; Koelz, 1950; Marien, 1950a, 1950b, 1951a, 1951b; Vaurie 1949a, 1949b, 1950a, 1950b, 1951a, 1951b, 1951c; Passburg, 1959; Diesselhorst, 1962; Erard & Etchécopar, 1970; Scott *et al.*, 1975). On the other hand, the first two decades of the current century are more characterized by the studies of Iranian researchers, ornithologists and birdwatchers, which led to the publication of some books, many journal articles and dissertations (e.g. Tohidifar & Kaboli, 2012; Yousefi *et al.*, 2015; Aliabadian *et al.*, 2016; Haghani *et al.*,



2016; Kaboli *et al.*, 2016; Gholamhosseini *et al.*, 2017; Kayvanfar *et al.*, 2017; Khaleghizadeh *et al.*, 2015, 2017; Alaie Kakhki *et al.*, 2018).

Blanford (1876) presented 383 species in his book, then world-famous ornithologist N.A. Zarudny conducted four prominent expeditions during 1896 until 1904 to eastern, central, and western parts of Iran and in 1911 listed a complete list including 714 species and subspecies for Iranian birds (Roselaar & Aliabadian, 2007; Aliabadian *et al.*, 2012). In the 1960s, S.H. Jervis Read listed 430 species (Jervis Read, 1958) and then Scott *et al.* (1975) listed 491 bird species for the country. Later, Scott & Adhami (2006) listed 514 species of birds believed to occur in Iran, and currently, complete checklist of bird species of Iran includes about 556 species (Khaleghizadeh, 2020).

In southwestern Iran, Fars Province is the fourth largest province of the country. The vertebrate diversity of Fars is reflected in several published checklists (freshwater fishes: Esmaeili & Teimori, 2017, herpetofauna: Gholamifard *et al.*, 2012, and mammals: Zarei *et al.*, 2019), but no pervious comprehensive checklist has yet been published on the bird fauna of this part of Iran except for some wetlands (e.g. Banan, 2008; Rahimi *et al.*, 2009; Amininasab & Radmanesh, 2010; Tabiee, 2010; Tabiee *et al.*, 2014) or some local areas (e.g. Zareian *et al.*, 2012; Yousefi *et al.*, 2015) and, an online simple checklist (including 367 species) according to the data collected by the Iran Bird Records Committee (IBRC 2020; <http://iranbirdrecords.ir/>, see Joolaei *et al.*, 2020).

A wide range of geographical and physiographic conditions, coupled with climatologically diverse environments and geographical position as an ornithological crossroads between East Palearctic, West Palearctic, Oriental and Afrotropical regions (Fig. 1), have provided a great diversity of species especially birds in this part of the country (Esmaeili & Teimori, 2017; Gholamifard *et al.*, 2012; Zarei *et al.*, 2019). In this paper, I'm going to provide the comprehensive updated checklist of Fars avifauna and show its zoogeographical composition.

Fars province is located in the southwestern Iran in the Palearctic region and shares the greatest number of bird species with the Palearctic region. However, two other faunal realms have a pronounced influence on its avifauna: the Oriental realm in the southeast, and the Afrotropical in the southwest. It seems its bird fauna to be more in common with the Oriental elements than Afrotropical ones, the question addressed in this study. In addition, the province is located east of the Western Palearctic and close to the Eastern Palearctic border. I explored how much its elements have in common with the Eastern Palearctic. It is important because in some cases, western and eastern bird forms may come together with a narrow or wide hybrid zone.

MATERIAL AND METHODS

Study Area

Fars Province lies between 27° and 31°N and 50° and 55°E in southern Iran and its total area is about 122,608 km² (7.4% of total area of Iran). The map of study area which has been created using Global Mapper 18 (Global Mapper Software LLC, Olathe, Kansas) and Surfer 11 (Golden Software, LLC) is given in Figure 2. The elevation of Fars ranges from 450 m in the south to about 3,943 m in the north, with a mean of 1,491 m. Fars possess three national parks (Bamou, Bakhtegan and Qatruiyeh), one wildlife refuge (Bakhtegan), seven protected areas (Arzhan and Parishan, Mianjangal, Hormod, Bahram-e Goor, Moleh Galeh, Tang-e Bostanak and Margoon, as well as minor parts of the two other protected areas, Dena and Tarom) and 17 non-hunting areas (Fig. 2).

Data collection

The data presented in this checklist comes from the previous (see the selected bibliography) and recently published books and journal articles (especially Roselaar & Aliabadian, 2009; Mansoori, 2013; Kaboli *et al.*, 2016; Khaleghizadeh *et al.*, 2011, 2017), data collected by the Iran Bird Records Committee (IBRC 2020; <http://iranbirdrecords.ir/>, e.g. Joolaei *et al.*, 2020), unpublished reports from the Iranian DoE (Department of Environment) and my field expeditions in Fars province during recent years. Therefore, this checklist is a combination of historic and recent data. Birds were identified in the field based on the

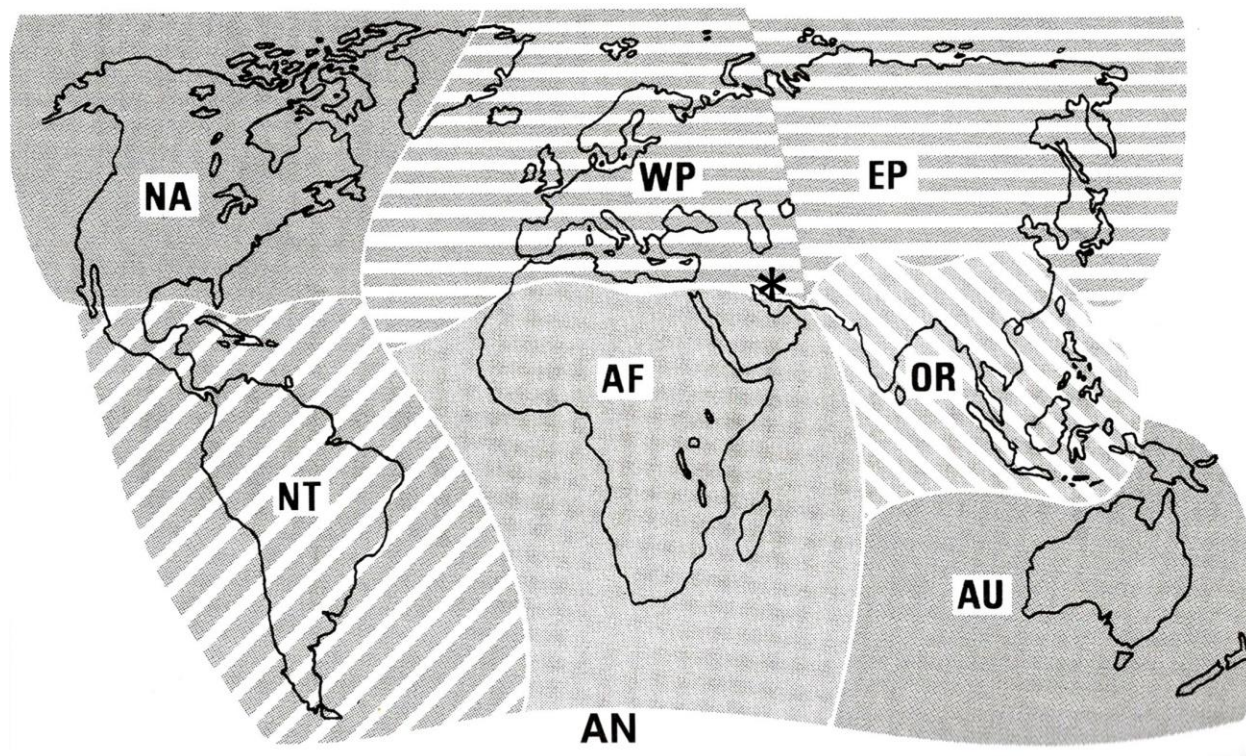


FIGURE 1. Map of global terrestrial zoogeographic regions showing the position of Fars province (southwestern Iran). AU (Australian), OR (Oriental or Indomalayan), EP (East Palearctic), WP (West Palearctic), AF (Afrotropical), NA (Nearctic), NT (Neotropical). (After Madjnoonian *et al.*, 2005). * Indicated the Fars province position.

morphological characteristics using various field guides (e.g. Porter *et al.*, 2004; Svensson *et al.*, 2009; Mansoori, 2013). They were observed through a Vanguard 10x50 Spirit ED Binocular. Photographs were taken using a Canon EOS 760D camera equipped with a Sigma 150-600 mm lens. Taxonomy of IOC World Bird List (v 9.1) was followed.

Status of occurrence for Fars province

Status includes individuals or various populations existing in different parts of the province as residents, summer visitors, winter visitors, passage migrants, or vagrants that extracted from Kaboli *et al.* (2016) and Khaleghizadeh *et al.* (2017), as well as based on my field observations. The status of occurrence of each species in the province is showed by the following abbreviations on the species list:

Resident (R): Bird that remains in a specific area all year round and breed there. Summer visitor and breeding (S): Bird that arrives in spring, remains throughout the breeding season, and leave the region in autumn. Summering non-breeder status is denoted by a 's' letter. Winter visitor (W): Bird that arrives in autumn, remains throughout the winter, and leave the region in spring. Passage migrant (P): Bird that passes over the region in spring or autumn during its migration between breeding grounds in the north and wintering grounds in the south. Vagrant (V): Bird that is recorded outside its regular distribution range and is wanderer in the region.

Rare species

Rare species for Iran extracted from Khaleghizadeh *et al.* (2011), Scott (2008), Roselaar & Roselaar (2009) and Iran Bird Records Committee (IRBC).

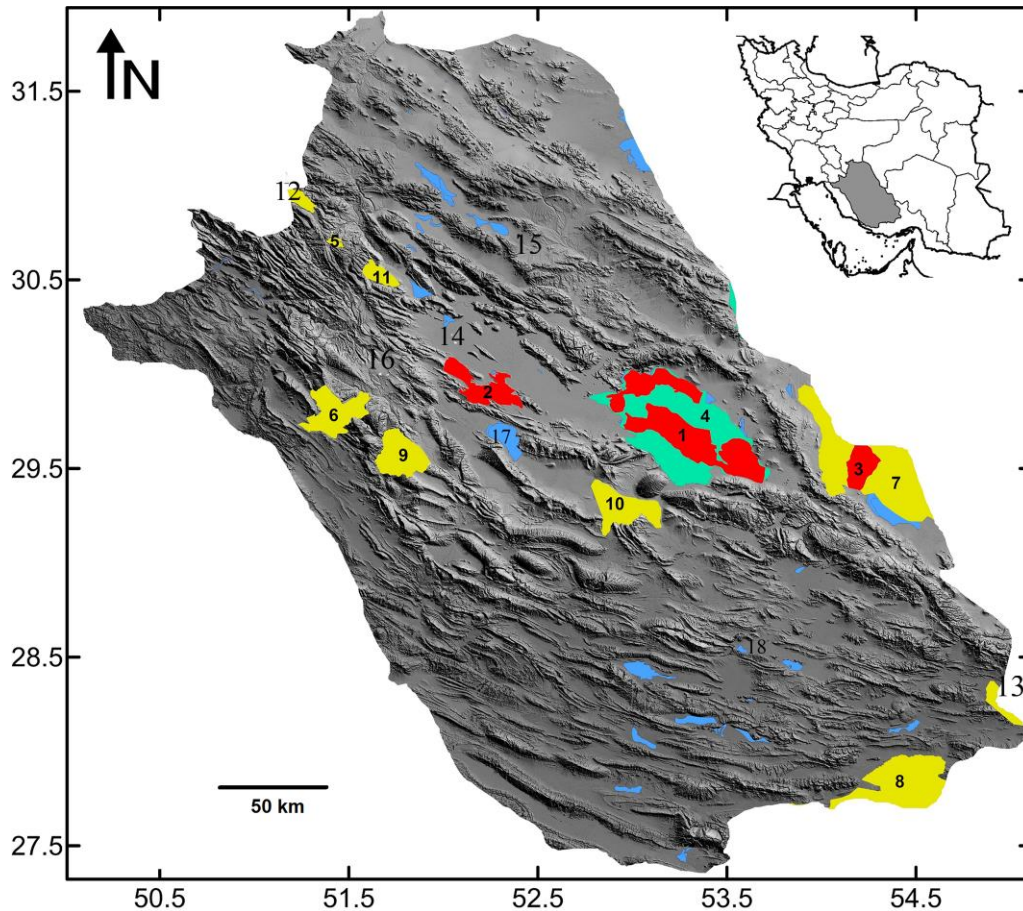


Figure 2. Map of Fars Province, southern Iran showing the area and distribution of protected and Important Bird Areas (IBAs). 1, Bakhtegan National Park; 2, Bamou National Park; 3, Qatruiyeh National Park; 4, Bakhtegan Wildlife Refuge; 5, Margoon Protected Area; 6, Arzhan and Parishan Protected Area; 7, Bahram-e Goor Protected Area; 8, Hermod Protected Area; 9, Moleh Galeh Protected Area; 10, Mianjangal Protected Area; 11, Tang-e Bostanak Protected Area; 12, Dena Protected Area; 13, Tarom Protected Area; 14, Dorudsan Dam; 15, Kaftar Lake; 16, Haft Barm; 17, Lake Maharlu; 18, Harm Lake.

Conservation status

To determine the conservation status of bird species, the IUCN Red list of Threatened Species version 3.1 was used: critically endangered (CR), endangered (EN), vulnerable (VU), near threatened (NT), data deficient (DD) or least concern (LC).

To determine levels of protection from over-exploitation within international trade, appendices of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) were used. The national level of conservation (defined and implemented by the Iranian Department of the Environment: DOE) for each species is presented as endangered (End.), protected (Prot.), unprotected (no letter) and pest species (Pest).

Zoogeographical composition

At first, the distribution (both breeding and non-breeding range) of each bird species in different zoogeographical regions was extracted from Madjnoonian *et al* (2005), and Del Hoyo (2019) was followed for some species that not listed in that. Also, we updated the distribution of all species according to Del Hoyo (2019). Then, the numbers of species that Fars province share with each zoogeographical region was calculated. For this, I inserted all species in the left column of a spreadsheet and each

zoogeographical region in the following columns and occurrence of each species in each zoogeographical region showed by (1). Sum of cells of each column was calculated.

Symbols used for global distribution: AU (Australian), OR (Oriental or Indomalayan), EP (East Palearctic), WP (West Palearctic), AF (Afrotropical), NA (Nearctic), NT (Neotropical).

RESULTS

Diversity

The Fars Province has a rich and diverse avifauna that comprises 371 species in 197 genera, 68 families and 23 orders. Maximum bird species were recorded from the Order belonging to Passeriformes (173 species, 46.63% of the avifauna) and Charadriiformes (55 species, 14.82%). In term of families, Muscicapidae were the most diverse family present with 31 species (8.35% of avifauna) and Accipitridae with 30 species (8.08% of avifauna). Twenty families have only one species each. At least 88 species are resident, 193 species are breeding and 33 species are rare.

Annotated species list

An annotated list of bird species including classification, scientific name, authority, common name, global distribution in the zoogeographical regions, status of occurrence for Fars Province and conservation status (IUCN, CITES, national) is provided (see electronic supplementary material; dx.doi.org/10.6084/m9.figshare.16571280). Species observed by the author are marked with an asterisk in front of the scientific name of each species.

Conservation status

Among the reported species, 341 species (91.91%) are LC, nine VU (2.42%), five EN (1.34%), and 16 species (4.31%) are NT in the IUCN Red List of Threatened Species. Eight species (2.15%) are listed in the Appendix I, and 54 species (14.55%) in Appendix II of CITES. In addition, 15 species (4.04%) are endangered, 72 species (19.40%) are protected and eight species (2.15%) are pest based on the rules and regularities/laws of the Iranian DOE.

6 out of 33 rare species reported from Fars province are birds of prey. In the IUCN category; 2 out of 9 species considered as VU, 4 out of 5 species considered as EN and 3 out of 16 species considered as NT are birds of prey. According to appendices of CITES; 4 out of 8 species listed in appendix I and 46 out of 54 species listed in appendix II are birds of prey. Also, according to the category of DOE, 9 out of 15 species considered as EN and 41 out of 72 species considered as protected are predatory.

Zoogeographical composition

In total, the Fars avifauna shares 364 species with the Palearctic region (345 with the West Palearctic and 313 with the East Palearctic), 240 with the Oriental, 213 with the Afrotropical, 43 with the Nearctic, 34 with the Australian and 26 with the Neotropical. As expected, the Fars shares the greatest number of bird species with the Palearctic (the closest region) and the fewest with the Neotropical (the most remote region), although the distribution of some species reaches Central America, not South America. Despite the general Palearctic nature of the avifauna of southwestern Iran, the significance of this area as a crossroad between three biogeographical regions, the Palearctic, the Oriental and the Afrotropical is apparent and southwestern Iran shares many bird species with the Oriental and Afrotropical. Also, the province lies within the West Palearctic faunal region (eastern margin) and as expected, its bird fauna shares a greater number of species with the western Palearctic (n=345) than its eastern (n=313). When the total species are considered, the province shares a greater number of species with the Oriental (n=240) than to Afrotropical (n=213).

DISCUSSION

The purpose of this study was to gather previously published data, and data obtained from field observations to present a general view of the Fars avifauna (southwestern Iran) and its zoogeographical composition. I conclude that the avifauna of Fars is highly rich (comprise 371 species in 197 genera, 68

families and 23 orders) and taxonomically diverse when compared to the country's total bird fauna (371 versus about 556 species; 66.72%) and to those of its neighbouring provinces in southern Iran such as Isfahan (280 species), Yazd (226 species), Kerman (308 species), Bushehr (327 species), and Kohgiluyeh and Boyer-Ahmad (234 species) (IBRC 2020).

Joolae *et al.*, 2020 was followed for including Common rosefinch *Carpodacus erythrinus* and Twite *Linaria flavirostris* in the checklist, however more confirmation is needed. Some records in published literature and online sources have been made only based on the external morphological features, which in some cases (e.g. complex genera) needs to be confirmed using molecular markers. Five species are included in the current checklist which are not listed by Joolae *et al.* (2020) as following.

Rough-legged Buzzard *Buteo lagopus* is a scarce and irregular winter visitor to south Caspian region; also recorded in Khorasan-e Razavi, Tehran and Fars provinces (Khaleghizadeh *et al.*, 2017). One specimen was recorded on 31 October 1997 at Persepolis, Fars (Darreh-Shoori *et al.*, 2001).

Lanner Falcon *Falco biarmicus* is a scarce resident in north-western Iran, especially in basin of Urumiyeh Lake (Kaboli *et al.*, 2016). It has also been recorded in Hormozgan and Esfahan during the period 2011-2015 (see Khaleghizadeh *et al.*, 2017). Three specimens were recorded from Kaftar Lake, Kamjan Lake, Sivand dam (Fars) in Jan. 2009 by Joolae *et al.* (2009).

European Pied Flycatcher *Ficedula hypoleuca* is a scarce passage migrant in west and north Iran, occasionally east to Fars. It has been observed/collected in Neyriz on 29 March 1940 (Roselaar, *unpubl.* in Khaleghizadeh *et al.*, 2011), but not apparently reported from Fars after that.

Red-headed Bunting *Emberiza bruniceps* is a summer visitor in northern, northeastern and eastern of Iran. Black-headed and Red-headed Buntings are closely related passerine species that were reported to meet in a hybrid zone southeast of the Caspian Sea, Iran, over 70 years ago (Gholamhosseini *et al.*, 2017). One vagrant specimen has observed near Shiraz at spring 2017 by the author. During winter, the two Bunting species flock together on their wintering grounds and when the two species migrate to breeding grounds, it's maybe some specimens of one species migrate with another mistakenly.

Pygmy Cormorant *Microcarbo pygmaeus* is a locally fairly common breeding bird in Guilan and possibly also Khuzestan; locally abundant winter visitor to south Caspian region and uncommon winter visitor to wetlands of Khuzestan. This species was recorded from Parishan Lake (Fars) by Joolae *et al.* (2009).

Lanius excubitor complex is an example of a taxonomically contentious group. *Lanius pallidirostris* is split from *Lanius excubitor* by some authors but not by HBW, Clements, nor H&M4. Restore to status as ssp of *excubitor* pending full resolution of this complex. According to IOC, *L. excubitor* has 12 subspecies including *L. e. excubitor*, *L. e. aucheri*, *L. e. lahtora*, *L.e. pallidirostris*. Monophyletic Southern Grey Shrike *L. meridionalis* is split from Great Grey Shrike based on mtDNA (Olsson *et al.*, 2010).

One major reason for this high species diversity is the large area of the province, as with approximately 122,608 km² (7.4% of total area of Iran), it is the fourth largest province of the country that covered the most of southwestern part of Iran. However, a closer look at the issue will show that the biodiversity in Fars has an ecological background (Esmaeili & Teimori, 2017; Zarei *et al.*, 2019). It possesses three main terrestrial ecoregions, (i) the central Persian desert basins in the north and northeast, (ii) Zagros Mts. forest steppe extended from northwest to the southeast, and (iii) Nubo-Sindian desert and semi-desert ecoregion in the south (Olson *et al.*, 2001), as well as numerous aquatic ecoregions including lakes and rivers. The wide range of geographical and physiographic conditions, coupled with climatologically diverse environments in this province, have provided enormous diversity in this part of Iran (Gholamifard *et al.*, 2012; Esmaeili *et al.*, 2017; Esmaeili & Teimori, 2017; Zarei *et al.*, 2019). Fars also has ten Important Bird Areas (IBAs, Dorudsan dam, Kaftar Lake, Haft Barm, Bakhtegan Lake, Tashk Lake and Kamjan marshes, Bamou National Park, Maharlu Lake, Harm Lake, Hormod Protected Area, Bahram-e Goor, Arjan and Parishan Protected Area; total area 1,176,832 ha) (Evans, 1994; BirdLife International, 2019) (Fig. 2). These natural and man-made IBAs, both act as breeding, wintering and staging grounds and can provide suitable habitats for many bird species, especially many waders and waterbirds. Finally, another main reason for the high species diversity in Fars is its specific

zoogeographic position. Zoographically, Iran is an interesting country, as much of its area is located in the West Palearctic and the birds of Iran are predominantly Palearctic, but specially in southern parts are affected by the Oriental and Afrotropical elements (Madjnoonian *et al.*, 2005; Roselaar, 2006; Coad, 2017). The Palearctic region shares 39% of its species and 97% of its families with the Oriental region and 12% of its species and 88% of its families with the Afrotropical region (Newton 2003) and same pattern also observed in southwestern Iran in Fars province and the province shares the greatest number of bird species with the Palearctic region and then with the Oriental. Thus, the avian diversity of Fars is such that it can be considered predominantly Palearctic, with some Oriental and Afrotropical species. Some oriental bird elements, e.g. Pheasant-tailed jacana and Afrotropical elements, e.g. Namaqua Dove are just wandering in Fars province.

Despite all conservation efforts, the world's biodiversity is in declining (Balnford *et al.*, 2003; Jenkins *et al.*, 2003). Owing to negative effects of human activities on the environment, many taxonomic groups are declining in both their population size and geographic ranges (Duraiappah, 2005). The bird fauna in the world is facing several main common threats mainly due to anthropogenic activities/human-induced disturbances. Considering internationally protected bird species, five species from this checklist are EN in the IUCN Red Data List, which most are birds of prey (4 from 5; 80%) including *Aquila nipalensis*, *Haliaeetus leucoryphus*, *Neophron percnopterus* and *Falco cherrug* and also four species in the appendix I of CITES are birds of prey (4 of 8; 50%) including *Aquila heliaca*, *Haliaeetus albicilla*, *Falco pelegrinoides* and *Falco peregrinus*. Many of the birds of prey have a scatter distribution and protected areas protect only small part of their populations. This checklist also presented 33 bird species for the Fars province that have already been considered as rare species for Iran and these records are important for conservation planning. Although, some forms of legal protection have already been instituted, along with education of local people by the Iranian DOE, nongovernmental organizations (NGOs), and media initiatives; I think that habitat monitoring is urgent for investigating the population status of birds, especially birds of prey. Moreover, gaining basic information about genetic diversity is highly recommended.

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