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Original Article

Contrasting changes in the abundance and diversity of Northern Iranian birds assemblages from 2011 to 2015

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ABSTRACT

Birds are distributed in wide range based on flight power and structural changes in their composition. So, the ecological diversity and density can be indicative of the environmental changes. This study was conducted for the first time in the north of Iran to quantify and compare the temporal abundance in the taxonomic diversity of bird assemblages. Data were collected by the Iranian Environmental Protection Agency from 22 key sampling sites from 2011 to 2015 in Golestan Province. During the 5-years period, 13 abundance and diversity metrics with the average abundances of 123 species for each site were calculated. In terms of the number of birds in a particular species, mallard and greater flamingo were the most abundant species, and Anatidae family was the most abundant bird family in all monitoring data. Based on ecological indicators, the most diversity in species has been observed in 2012.

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Introduction

Today's biodiversity has declined throughout the world, and as a result, there is a decline in lack of continuity of ecosystem services. However, there are international agreements for the conservation of biodiversity, but the destruction of habitats, the introduction of environmental pollution, and excessive hunting have led to a sharp decline in a large number of organisms, especially birds. Iran has a unique geographical location with a remarkable diversity of birds with different geographical origins which are living and breeding in Iran. This diversity is because of the fact that Iran is located at the confluence of three animal regions, including Palearctic, Oriental, and Ethiopia (Afrotropical). Because much of the country lies in the Palearctic biogeographic area, not only birds but also other animal and plant species are dependent on this large geographical area (Riazi and Mirazmanhehi 2006). Therefore, considering this climate and habitat diversity, there are 105 Important Bird and Biodiversity Areas (IBAs) in Iran that are valuable internationally. Also, more than one million birds from more than 520 species live in these habitats, annually (Mansoori 2008). Among the Iran's birds' species,

there are almost 100 native species that live and breed in the Northern strip of Guilan, Mazandaran, and Golestan (Riazi and Mirazmanhehi 2006). Certainly, the Northern ecosystems of Iran, particularly mountains and grassland of the Caspian forests and the Golestan National Park, are small and suitable habitat for variety of birds. This area is not only changed by human activities but also by global factors such as climate changes and greenhouse impacts which are effective on the diversity of bird species. Unfortunately, in recent years in Iran, the number of overwintering birds has been significantly on decline because of hunting pressure, habitat destruction, and transformation of wetlands into farmlands or residential units. Other reasons for habitat destruction and hunting of these very valuable species are the lack of funds for environmental protection, shortage of manpower, and lack of scientific and native culture (Yousefi et al 2015). Therefore, it is necessary to study birds' population status through permanent monitoring. The study of birds' population diversity in different habitats in the Naghadeh county in West Azerbaijan Province has shown that out of a total of 140 bird species identified, 53% are terrestrial, and Jaccard similarity index proved that different species of birds in agricultural habitats or farms have the highest similarity with steppe habitats (Sheykhi Ilanloo et al 2014). This is a very important warning because the destruction of natural habitats and wetland ecosystems in each area, especially in the north of Iran, can change the diversity of native water birds toward increased diversity of terrestrial species (Sheykhi Ilanloo et al 2014). There are few studies that show changes of ecological indicators (diversity, density,

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richness, and abundance) on bird communities at intervals of several years (Khanaposhtani et al 2012). However, this study is the first study which was conducted on birds counted in Golestan Province in a relatively long period (5 years). Since previous studies have been carried out in a short timeframe, the results of this study can be used for better planning and management of the Northern ecosystems in long term. Also, the correlation, similarity, and human pressures affecting the Northern ecosystems can be estimated by comparing results across different years.

Materials and methods

Study area

Golestan Province with an area of over 20000 km² is limited to Turkmenistan country, Semnan, Mazandaran, and North Khorasan Province from the north, south, west, and east, respectively (Figure 1). The prevailing climate in the Golestan Province is temperate Mediterranean, but the Gorgan Plain has the semi-desert and warm climate because of its proximity to the Karakum Desert (in Turkmenistan), increasing distance from the sea, and reduced height (Riazi and Mirazmanhehi 2006).

The IBAs in Golestan Province are Alagol, Ajigol, and Almagol wetlands. The three wetlands that are considered as the International Wetlands of Golestan Province cover more than 30000 hectares.

Data collection

It should be noted that in Iran, data collection has many problems such as the lack of monitoring facilities like professional cameras and bird equipment. Therefore, all of this data have been collected, evaluated, and provided by the Iranian Environment Organization, and data collection process has not been carried out by the researcher.

Statistical analysis

Data analysis was carried out using Excel, Past, and SPSS softwares. Ecological parameters of the richness, diversity, dominance, similarity, frequency, composition, population structure, and distribution pattern of the species were analyzed on an annual basis. All statistical tests were performed at a significance level of 5%. Also, for analyzing the difference between bird's behavior, R software (vegan package) was used.

Results

The total number of bird species counted in 5-year period (2011–2015) is 548661 (Table 1), and the highest number of birds belonged to the year 2012 with 181340. The highest counted species were related to greater flamingo (*Phoenicopterus roseus*) with 18.11% and mallard (*Anas platyrhynchos*) with 16.93%. In Table 1, the species name was sorted by the numbers with more than 100 individuals.

The Figure 2 shows the largest number of bird family related to ducks with a population of more than 250,000 individuals. It should be noted that, for better demonstration and comparison, families with less than 5,000 individuals were not considered in the calculation and comparison process.

The following table shows the ecological indices values of birds such as abundance, richness, evenness, dominance, similarity, and diversity from 2011 to 2015 (Table 2). The greatest number of species (frequency) was reported in 2013. The Margalef's richness index shows the highest value in 5-years period in comparison to other richness indices. Another important point in this result is the Shannon similarity index which has very similar value with the Brillouin similarity index. Therefore, it shows that the ecological structure of communities of birds is very similar in Golestan Province during the study period.

According to the result of the DCA test (Figure 3), there is a significant difference between the number of birds per year. Based



Figure 1. The case study (Golestan Province).

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