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RESEARCH ARTICLE Open Access

Evaluation of different wetland preferences of wintering waterbird species in Çanakkale, Turkey

Çanakkale (Türkiye)'de kışlayan su kuşu türlerinin farklı sulak alan tercihlerinin değerlendirilmesi

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ABSTRACT

In the study, International Waterbird Census (IWC) conducted in 2021 in wetlands with different habitat characteristics around the Dardanelles were evaluated. 3086 individuals belonging to 30 waterbird species were counted in Kavak Delta, 31 species and 1150 individuals in Çardak Lagoon, 22 species and 3906 individuals in Gökçeada Salt Lake, 11 species and 289 individuals in Suvla Salt Lake and 8 species and 84 individuals in Uzunhızırlı Pond. The highest species diversity (Shannon-Wiener Indices, H: 2,473) and the highest species richness (Margalef Index, M: 4,257) were calculated in the Çardak Lagoon. As the number of habitats in the wetland increased, the number of species also increased ($p<0.0001$). As a result, the data obtained revealed the importance of the wetlands for the winter visitor waterbirds, and pioneering data were presented for the sustainability of the wetlands in future studies.

ÖZ

Yapılan çalışmada, Çanakkale Boğazı çevresinde farklı habitat özelliklerini barındıran sulak alanlarda 2021 yılında yapılan kış ortası su kuşu sayımları değerlendirilmiştir. Farklı sulak alanların barındırdığı habitat sayısı ve kapladığı alanlar ile su kuşu tür sayısı ve toplam birey sayıları karşılaştırılmıştır. Kavak Deltası'nda 30 su kuşu türüne ait 3086 birey, Çardak Lagünü'nde 31 tür ve 1150 birey, Gökçeada Tuz Gölü'nde 22 tür ve 3906 birey, Suvla Tuz Gölü'nde 11 tür ve 289 birey ve Uzunhızırlı Göleti'nde 8 tür ve 84 birey sayılmıştır. En yüksek tür çeşitliliği (Shannon-Wiener İndeksleri, H': 2,473) ve en yüksek tür zenginliği (Margalef İndeksi, M: 4,257) Çardak Lagünü'nde hesaplanmıştır. Sulak alanda bulunan habitat sayısı arttıkça tür sayısı da artmıştır ($p<0,0001$). Sonuç olarak elde edilen veriler kapsamında araştırmanın yapıldığı sulak alanların kış ziyaretçisi su kuşları için önemleri ortaya konmuş ve ileri yıllarda yapılacak çalışmalarda sulak alanlarının sürdürülebilirliğinin takibi için öncü veriler sunulmuştur.

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1. INTRODUCTION

Wetlands, where biodiversity and production are much higher than terrestrial areas, provide important ecosystem services in terms of sustainability (Clarkson et al., 2013). In this respect, wetlands are among the most important ecosystems of the earth with their ecological and economic values (Keddy-Hector, 2000). However, in wetlands, which are one of the ecosystems where human influence is intense, it is stated in many researches that biological diversity and thus sustainability are damaged (Şekercioğlu, 2010; Çağırankaya & Meriç, 2013; Yıldız Karakoç, 2017; Uysal & Uysal 2021). Wetlands are the most threatened habitats due to the effects of global warming and anthropogenic activities that disrupt the water regime such as settlements concentrated around, dense agricultural lands, drainage of polluting sources to wetlands, improper agricultural practices and aggressive irrigation. It is estimated that more than 50% of the total wetland surface has been lost in the last century (Mitsch & Gosselink, 2007). Considering the ecological importance of wetlands, it is necessary to reveal their

importance in terms of biodiversity and to initiate conservation activities urgently.

Waterbirds, which constitute the most remarkable animal group of wetland ecosystems, are indicators of sustainability and functionality as the vertebrate class that responds most rapidly to changes in wetland ecosystems (Custer & Osborne, 1977; Bellio & Kingsford, 2013). Waterbirds, which can be used as bioindicators, provide information about the monitoring of their populations, their distribution in wetlands, population parameters such as their densities, richness, diversity, and the quality of habitats, and any change in their habitats may cause a change in the distribution of individuals and populations (Sinav, 2019). It is stated that the use of bird species as an indicator of biodiversity in wetland performs better alone compared to other taxa (Larsen et al., 2012). In addition, bird species attract people's attention with their visual features and contribute to the formation of wetland awareness.

The vast majority of waterbirds populations are migratory. Especially in Northern Europe, breeding waterbirds populations migrate south to wintering areas in order to survive the winter conditions. During this period, the most intense waterbird populations in our region are observed. Midwinter Waterbirds Censuses (IWC) are one of the most important methods in terms of evaluating changes in waterbird populations on a regional or global scale and changes in wetlands in the long term (Erciyas Yavuz & Kartal, 2012). The International Waterbirds Census (IWC) is one of the most common biodiversity monitoring programs that assess waterbirds populations within the framework of various international agreements, including the African-Eurasian migratory Waterbirds Agreement and the Ramsar Convention (Sayoud et al., 2017). Collecting and evaluating IWC censuses on a global scale by standardizing them and transferring them to common databases is considered necessary for taking appropriate conservation decisions for waterbirds and wetlands in the future.

With the global climate change, bird species can spend the winter months in more northern latitudes with milder weather conditions. In a study conducted by Nilsson & Hermansson (2021) on Gotland Island (Sweden) in the Baltic Sea, in IWC censuses between 1969-1978 and 2013-2020, the average total number of waterbirds overwintering between the two periods increased from 32,000 to 111,500, and the observed increase stated that it may be associated with increasingly mild winters in recent years (Nilsson & Hermansson, 2021). Despite being one of the most important biodiversity hotspots in the world, increased monitoring efforts for waterbirds are needed, especially in the southern half of the Mediterranean Basin (Galewski et al., 2011).

Wetlands contain different types of habitats (such as reeds, wetlands, saline meadows and sand dunes) and the diversity of habitats is likely to affect species diversity and abundance. Wang et al. (2020) in their study, examined the effects of the wintering period and habitat change caused by human activity on the diversity of wintering waterbirds. Significant differences were found between the three wetland habitats (natural lake, artificial aquaculture ponds, and artificial paddy fields) in terms of species composition and abundance, but there was no significant difference between habitats in terms of the number of waterbirds (Wang et al., 2020). Some studies have shown that artificial wetlands gradually become waterbirds habitats as natural wetlands decline (Bellio et al., 2009; Chen & Zhou, 2011). However, numerous studies have shown that waterbirds communities are more diverse in natural wetlands than in artificial wetlands, and artificial wetlands cannot replace the function of natural wetlands (Ma et al., 2004; MacGregor-Fors, 2008; Yu et al., 2014).

The Dardanelles Strait, located in the Northeastern part of the Mediterranean basin, is located on one of the important migration routes in the Western Palearctic region. Breeding waterbirds populations in Europe migrate further south to wintering areas in order to survive the winter conditions where food is difficult and adverse weather conditions prevail. In this respect, the wetlands of Çanakkale, located in Turkey and its northwestern part, serve as an important shelter for these species. However, in the literature review, no research was found in which the IWC counts in Çanakkale were evaluated. But there are studies evaluating IWC counts conducted in important wetlands in Turkey and around the world and the anthropogenic factors on the areas. (Yarar et al., 1996; Yavuz & Boyla 2013; Çağlayan et al., 2005; Suseven et al., 2006; Onmuş, 2007; Arslangündoğdu, 2009; Akarsu & Balkız, 2010; Erciyas Yavuz & Kartal, 2012; Özkoç et al., 2019; Nilsson, 2020; Ulusoy & Bulut, 2020; Nilsson & Hermansson, 2021). In the two-year IWC census, 26975 individuals from 14 species and 13158 individuals from 19 species were

counted, respectively, in the Obruk Dam Lake, which has a surface area of 5021 hectares (Ulusoy & Bulut, 2020).

There are ornithofaunal richness researchs conducted in our study areas in the Çanakkale. In the previous study (Özcan et al., 2008) in the Kavak Delta, where the research was carried out, 130 bird species belonging to 14 order and 40 families; 102 bird species belonging to 15 order and 35 families in Çardak Lagoon (Samsa, 2012); 132 bird species belonging to 15 order and 40 families in Uzunhızırlı Pond (Uysal & Tosunoğlu, 2016); 154 bird species belonging to 20 order and 44 families in Suvla Salt Lake (Uysal & Uysal, 2021); 178 bird species have been reported in Gökçeada Salt Lake (Samsa, 2014).

In the study, it is aimed to evaluate the 2021 IWC censuses of wetlands (Kavak Delta, Çardak Lagoon, Uzunhızırlı Pond, Suvla Salt Lake, Gökçeada Salt Lake) located on the shores of the Dardanelles and having different habitat characteristics. In addition, it is aimed to evaluate the effect of the area covered by the wetland and the different habitat types (such as artificial wetland, salty meadows, beaches and brackish water ponds) on the number of wintering waterbirds species, abundance and diversity indices.

2. MATERIAL AND METHOD

2.1. Definition of study area

Within the scope of the research, IWC counts were made in five wetlands around the Dardanelles Strait, which is one of the important migration routes in the Western Palaearctic region. Kavak Delta has the characteristics of a delta and marine coastal wetland covering an area of 1400 hectares. Çardak Lagoon covers an area of 190 hectares and is shaped as a morphological coastal arrow and lagoon. Uzunhızırlı Pond covers an area of 85 hectares and is an artificial wetland created for irrigation. Suvla Salt Lake (220 hectares) and Gökçeada Salt Lake (200 hectares) are marine and coastal wetlands and are brackish / salty lagoon type (Tosunoğlu et al., 2014). The location of the wetlands where IWC counts are made is given in Figure 1.

EUNIS habitat classification was used to determine the habitat types in the surveyed wetlands. EUNIS habitat classification is a habitat classification method supported by the European Environment Agency (EEA) and determined jointly on habitat types at the European scale (Ürker & Özen, 2020). This classification method allows for broader analysis of habitats in relation to pressures on ecoregions, climate, soil and environment, as well as species. In addition, it is a way of comparing data with other countries, as well as a tool for recognizing European habitat types according to a standardized terminology (Ürker & Özen, 2020). In this study, the main headings and first degree subheadings were taken into account while determining the ENUIS habitat types. The EUNIS habitat types of the wetlands where the research was conducted are given in Table 1.

Figure 1. The location of the research areas in the western palaearctic region (1: Kavak Delta, 2: Çardak Lagoon, 3: Uzunhızırlı Pond, 4: Suvla Salt Lake, 5: Gökçeada Salt Lake)

2.2. Sampling method

IWC censuses are made between January 15 and February 15, when the seasonal migration movements of waterbirds on a global scale are the least and they are clustered in wetlands. Standard counts from the same points in the same areas are very useful in analyzing population trends in the long run. Within the scope of the research, IWC censuses were carried out on 16 January 2021 in the Kavak Delta, Uzunhızırlı Pond and Suvla Salt Lake; on 17 January 2021 in Gökçeada Salt Lake and on 21 January 2021 in Çardak Lagoon with the permission of the Ministry of Agriculture and Forestry, numbered E-21264211-288.04-1785587, under the coordination of Nature Conservation and National Parks. In order to count all the waterbirds in the area without disturbing them and causing them to fly, observation points that will allow to see the entire area were determined and counts were made from these observation points with the help of a telescope. After the census was completed, transect observations were made in the area, and small species with higher mobility were counted. All areas were divided into 1x1 km² grids and observation points were determined that saw the area completely, and observations were made in equal time in each area. All

counts were made by the same observer. The sources of Collins Bird Guide (Svensson et al., 2009), Çanakkale Kuşları (Tosunoğlu et al., 2016) and Trakus Türkiye'nin Kuşları (Trakus, 2021) were used for species identification. The Turkish Bird List (Kirwan et al., 2008) was used to list the identified species, and the Turkish Bird Names List (Barış et al., 1996) was used for Turkish nomenclature. The data obtained during the observations were recorded in the pre-prepared observation forms.

2.3. Data analysis

The frequency, dominance, species richness, species diversity and regularity of distribution in the wetlands where the research was conducted were evaluated using diversity indices. Bird species diversity was calculated using the Shannon-Wiener (limited between 0-5) (Shannon & Weaver, 1963) diversity index; species richness using the Margalef index (unlimited) (Margalef, 1958); and the regularity of species distribution using the Pielou index (limited between 0-1) (Pielou, 1966). Diversity indices were used to assess differences in species diversity in the different wetlands surveyed. When calculating the frequency (frequency, f), the percentage expression of the number of observations in which the species is seen divided by the total number of observations, while the dominance (d) is given as the percentage expression of the ratio between the number of individuals belonging to a species and the total number of individuals belonging to all species (Kocataş, 1997). In the analysis of the data, descriptive statistical analyzes were made using the SPSS program. The area covered by the wetlands (hectares) and the total number of observed individuals, the number of habitat types the wetland has and the total number of observed species were proportioned. The significance was tested with the "single sample chi-square" test according to the obtained ratios and observation areas (Özdamar, 2013).

3. RESULTS

In the 2021 IWC censuses carried out in the wetlands where the research was conducted, a total of 43 species from 9 order and 12 families and 8515 waterbirds were counted. 3086 individuals from 30 species included in 8 order and 10 families in the Kavak Delta; 1150 individuals from 31 species, including 8 order and 10 families in Çardak Lagoon; 84 individuals from 8 species included in 4 order and 4 families in Uzunhızırlı Pond; 289 individuals from 11 species, including 7 order and 7 families, in Suvla Salt Lake; 3906 individuals from 22 species, including 5 order and 8 families in Gökçeada Salt Lake were identified. The distribution of species and individual numbers by areas is given in Figure 2.

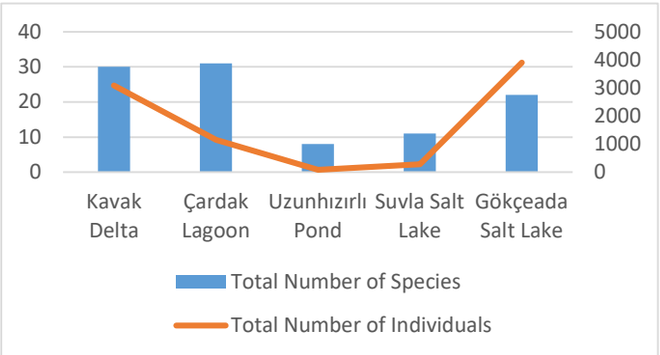

Figure 2. Number of species and individuals by areas

The families with the highest number of species in all areas were Anatidae (10 species) and Laridae (9 species), Scolopacidae (6 species). According to the criteria of the International Union for Conservation of Natural Life and Natural Resources (IUCN) RedList (Version 2020/1) among the observed species; Tundra Swan (*Cygnus columbianus*) European EN (Endangered); Northern Lapwing (*Vanellus vanellus*), Eurasian Curlew (*Numenius arquata*) and Common Kingfisher (*Alcedo atthis*) European scale VU (Vulnerable); Common Coot (*Fulica atra*), Little Gull (*Hydrocoloeus minitus*), and Red-breasted Merganser (*Mergus serrator*) are endangered in the NT (Near threatened) category. Other species are in the LC (Least concern) category. The number of individuals of endangered species observed in the areas is given in Table 2.

While giving the species lists, besides the IUCN criteria, the convention on the international trade of endangered wild animal and plant species (CITES), the status according to the criteria of the protection list of wild animals distributed in Turkey (BERN), and the distribution of the number of individuals observed according to the wetlands are given (Table 3).

Table 1. EUNIS habitat types observed in the wetlands where the research was conducted (1: Kavak Delta, 2: Çardak Lagoon, 3: Uzunhızırlı Pond, 4: Suvla Salt Lake, 5: Gökçeada Salt Lake)

EUNIS HABITAT TYPES	1	2	3	4	5
A: Marine Habitats					
A7: Pelagic water column	X	X		X	X
A5: Coastline with Sublittoral Sediment Stacks (Coastal lagoons etc.)	X	X		X	X
B: Coastal Habitats					
B1: Coastal dunes and beaches	X	X		X	X
B2: Pebble beaches		X			
C: Continental (Terrestrial) Surface Waters					
C1: Stagnant surface waters	X	X	X	X	X
C2: Rivers	X				
C2.11: Freshwater springs	X	X	X		
C2.15: Saltwater Water Resources	X	X		X	X
C2.3: Creeks and streams with continuous soft flow, not affected by tides	X			X	
C2.5: Non-permanent streams (Streams with seasonal flow)	X		X		
C3: Littoralzon of terrestrial inland waters			X		
C3.6: Stream banks without vegetation or with sparse vegetation.	X				
C3.62: Graveled stream banks without vegetation	X				
D: Mud, Swamp and Peatlands					
D5: Free standing reeds	X	X	X	X	X
D6: Terrestrial salt-brackish marshes and reeds	X	X		X	X
D6.2: Terrestrial brackish stagnant water beds	X	X		X	X
TOTAL NUMBER OF HABITATS	**14**	**10**	**5**	**9**	**8**

Table 2. List of endangered waterbirds species identified during the study and distribution of individual numbers observed in wetlands

Tür	IUCN Europe	IUCN Global	Kavak Delta (n)	Çardak Lagoon (n)	Uzun hızırlı Pond (n)	Suvla Salt Lake (n)	Gökçe ada Salt Lake (n)
Tundra swan (*Cygnus columbianus)*	EN	LC	0	0	4	0	0
Northern lapwing (*Vanellus vanellus*)	VU	NT	30	0	0	0	2
Eurasian curlew (*Numenius arquata*)	VU	NT	113	7	0	0	8
Common kingfisher (*Alcedo atthis*)	VU	LC	1	0	0	1	0
Common coot (*Fulica atra*)	NT	LC	0	5	0	0	29
Little gull (*Hydrocoloeus minitus*)	NT	LC	0	0	0	0	30
Red-brested merganser (*Mergus serrator*)	NT	LC	0	6	0	0	0

Table 3. List of waterbirds species identified in the 2021 IWC census (1: Kavak Delta, 2: Çardak Lagoon, 3: Uzunhızırlı Pond, 4: Suvla Salt Lake, 5: Gökçeada Salt Lake)

Familia	Common Name	Species	BERN	CITES	IUCN (Europe)	IUCN (Global)	1	2	3	4	5
Gaviidae	Black-throated Loon	*Gavia arctica*	List II		LC	LC	6	21		8	
Podicipedidae	Little Grebe	*Tachybaptus ruficollis*	List II		LC	LC	10	43	2		
Podicipedidae	Great Crested Grebe	*Podiceps cristatus*	List III		LC	LC	6	16			
Podicipedidae	Clack-necked Grebe	*Podiceps nigricollis*	List II		LC	LC	5	15			
Ardeidae	Little Egret	*Egretta garzetta*	List II		LC	LC	2	6	1		1
Ardeidae	Great Egret	*Ardea alba*	List II		LC	LC	6	5	4	1	2
Ardeidae	Grey Heron	*Ardea cinerea*	List III		LC	LC	3	8	4	1	1
Phalacrocoracidae	Great Cormorant	*Phalacrocora xcarbo*	List III		LC	LC	12	94	3	3	
Phalacrocoracidae	European Shag	*Gulosus aristotelis*	List II		LC	LC	4	319			
Phoenicopteridae	Greater Flamingo	*Phoenicopterus roseus*	List II	App	LC	LC	52	12		32	323
Anatidae	Mute Swan	*Cygnus olor*	List III		LC	LC		18		15	

Familia	Common Name	Species	BERN	CITES	IUCN (Europe)	IUCN (Global)	1	2	3	4	5
Anatidae	Tundra Swan	*Cygnus columbianus*	List II		EN	LC			4		
Anatidae	Ruddy Shelduck	*Tadorna ferruginea*	List II		LC	LC	180	2		70	1011
Anatidae	Common Shelduck	*Tadorna tadorna*	List II		LC	LC		17	52	106	1136
Anatidae	Eurasian Wigeon	*Mareca penelope*	List III		LC	LC	604	3			49
Anatidae	Gadwall	*Marecas trepera*	List III		LC	LC					16
Anatidae	Eurasian Teal	*Anas crecca*	List III		LC	LC	10	9	14		63
Anatidae	Mallard	*Anas platyrhynchos*	List III		LC	LC	500				88
Anatidae	Northern Shoveler	*Spatula clypeata*	List III		LC	LC		95			16
Anatidae	Red-brested Merganser	*Mergus serrator*	List III		NT	LC		6			
Rallidae	Eurasian Coot	*Fulica atra*	List III		NT	LC		5			29
Recurvirostridae	Pied Avocet	*Recurviros traavosetta*	List II		LC	LC					8
Charadriidae	Common Ringed Plover	*Charadrius hiaticula*	List II		LC	LC		10			
Charadriidae	Kentish Plover	*Charadrius alexandrinus*	List II		LC	LC	39	11			33
Charadriidae	European Golden Plover	*Pluvialis apricaria*	List III		LC	LC	85				
Charadriidae	Grey Plover	*Pluvialiss quatarola*	List III		LC	LC	73	25			4
Charadriidae	Northern Lapwing	*Vanellu svanellus*	List III		VU	NT	30				2
Scolopacidae	Sanderling	*Calidris alba*	List II		LC	LC		4			
Scolopacidae	Little Stintu	*Calidris minuta*	List II		LC	LC	40				
Scolopacidae	Dunlin	*Calidris alpina*	List II		LC	LC	564	190			56
Scolopacidae	Eurasian Curlew	*Numenius arquata*	List III		VU	NT	113	7			8
Scolopacidae	Common Redshank	*Tringa totanus*	List III		LC	LC	5	12			
Scolopacidae	Common Greenshank	*Tringa nebularia*	List III		LC	LC	1				
Laridae	Little Gull	*Hydrocoloeus minutus*	List II		NT	LC					30
Laridae	Black-headed Gull	*Larus ridibundus*	List III		LC	LC	10	134			14
Laridae	Slender-billed Gull	*Chroicocephalu genei*	List II		LC	LC	1	1			2
Laridae	Audouin's Gull	*Ichthyaetus audouinii*	List II		LC	LC				2	
Laridae	Mew Gull	*Larus canus*	List III		LC	LC	1	1			
Laridae	Yellow-legged Gull	*Larus michahellis*	List III		LC	LC	715	17		50	1014
Laridae	Common Gull-billed Tern	*Gelochelidon nilotica*	List II		LC	LC		1			
Laridae	Sandwich Tern	*Thalasseus sandvicensis*	List II		LC	LC	7	43			
Laridae	White-winged Tern	*Chlidonias leucopterus*	List II		LC	LC	1				
Alcedinidae	Common Kingfisher	*Alcedo atthis*	List II		VU	LC	1			1	

*Abbreviations: International endangered status (IUCN, 2021); En = Endangered NT = Near Threatened, VU = Vulnerable, LC = Least Concern, Bern Convention criterion; List II = Strictly protected, List III = Protected; CITES category; List II = Species with a global population or distribution concentrated in Europe and strictly protected.

According to the number of species and individuals of the counted waterbirds, the highest number of species was observed in Çardak Lagoon (31 species) and the highest number of individuals in Salt Lake of Gökçeada (3906 individuals). The highest species diversity of waterbirds (Shannon-Wiener Indexes) is in Çardak Lagoon (H´: 2,473) and Kavak Delta (H´: 2,145); The lowest species diversity was found in Uzunhızırlı Pond (H´: 1,291). The highest species richness (Margalef Index) is in Çardak Lagoon (M: 4,257) and Kavak Delta (M: 3,609); The lowest species richness was found in Uzunhızırlı Pond (M: 1,58). While the regularity of the species distribution (Pielou Index) was highest in Çardak Lagoon (J´: 0.72), it was the lowest in Gökçeada Salt Lake (J´: 0.57). The changes in the diversity indexes calculated according to the individual numbers of the waterbirds counted in the IWC census are given in Figure 3.

When the changes in the diversity indices are examined, it is observed that the diversity and species richness in our study areas are quite variable between wetlands during the winter period. The diversity indexes calculated according to the number of species and individuals of the waterbirds detected in our areas, and the total number of

species, total number of individuals, frequencies and abundances of waterbirds are given in Table 4.

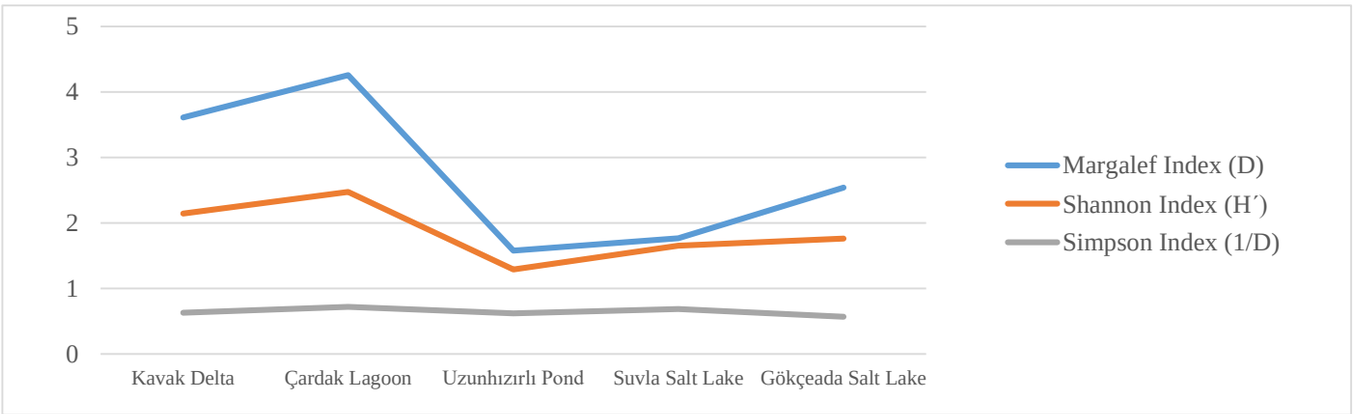

Figure 3. Variations of diversity indices calculated according to individual numbers of waterbirds

Table 4. Diversity indicators of waterbirds (1: Kavak Delta, 2: Çardak Lagoon, 3: Uzunhızırlı Pond, 4: Suvla Salt Lake, 5: Gökçeada Salt Lake)

Diversity Indexes	1	2	3	4	5
Number of Species	30	31	8	11	22
Number of Individuals	3086	1150	84	289	3906
Margalef Index(D)	3,609	4,257	1,58	1,765	2,539
Shannon Index (H´)	2,145	2,473	1,291	1,652	1,761
Pielou Index(J´)	0,631	0,72	0,621	0,689	0,57
Natural Logarithm of Species Number (ln S)	3,401	3,434	2,079	2,398	3,091
Natural Logarithm of the Number of Individuals (ln N)	8,035	7,048	4,431	5,666	8,27

A ratio was formed by dividing the number of species recorded in each wetland and the number of EUNIS habitat types found in the wetland. The significance of the obtained ratios according to the wetlands was tested with the "single sample chi-square" test. A significant difference was found between the number of habitats and the number of recorded species ($p<0.0001$). As the number of habitats in the wetland increases, the number of species also increases (Table 5).

Table 5. The result of the chi-square test between the total number of habitats and the number of recorded species

Wetland	Total Number of Habitats	Number of Registered Species	Number of Habitats / Number of Species (Observed Ratio)	Expected Rate	Chi-square (X2)	P
Kavak Delta	14	30	47	52		
Çardak Lagoon	10	31	32	52		
Uzunhızırlı Pond	5	8	63	52	32,7	<0,0001
Suvla Salt Lake	9	11	82	52		
Gökçeada Salt Lake	8	22	36	52		

A ratio was formed by dividing the total number of individuals recorded in each wetland and the area (hectares) of the wetland, and the significance of the obtained ratios was tested with the "single sample chi-square" test according to the wetlands. A significant

difference was found between the wetland area and the total number of observed individuals ($p<0.0001$). As the wetland area grew, the total number of recorded individuals decreased (Table 6). The expected situation was that the total number of recorded individuals would increase as the wetland area grew. However, it is thought that other variables that were not included in the calculation (parameters such as hunting pressure in the wetland, water quality in the wetland, nutrient abundance, shelter, shallow wetlands suitable for feeding) affected the high number of individuals in Çardak Lagoon and Gökçeada Salt Lake despite their small area.

Table 6. The result of the chi-square test between the wetland area and the total number of recorded individuals

Wetland	Wetland area (Hectares) (H)	Total Number of Individuals Registered (n)	Observed Rate h/n	Expected Rate	Chi-square (X2)	P
Kavak Delta	1400	3086	76	48,8		
Çardak Lagoom	190	1150	101	48,8		
Uzunhızırlı Pond	85	84	45	48,8	131,3	<0,0001
Suvla Salt Lake	220	289	17	48,8		
Gökçeada Salt Lake	200	3906	5	48,8		

4. DISCUSSION AND CONCLUSION

Within the scope of the research, 43 species and 8515 individuals included in 9 order and 12 families were counted in IWC made in Kavak Delta, Çardak Lagoon, Uzunhızırlı Pond, Suvla Salt Lake and Gökçeada Salt Lake (Çanakkale, Turkey).

IWC counts are observed by point counting method with a telescope from a distance in order not to cause the mobility of birds in wetlands and to prevent the counted groups from being counted again. The method used is made from different observation points, allowing to see the entire wetland. However, in the censuses, small and more mobile species with few individuals and requiring more detailed observation for identification, may be overlooked. For these species, after the whole area is counted with the point count method, observation is made in the wetland with the transect observation method. As a matter of fact, field studies were carried out again in the first week after the IWC census in the same wetlands and during the IWC censuses, unregistered species were identified. These species are; although not included in the diversity index calculations, the Red-throated Loon (*Gavia stellata*), Parasitic Jaeger (*Stercorarius parasiticus*), Black Tern (*Chlidonias niger*), Spur-winged Lapwing (*Vanellus spinosus*), Red-throated Pipit (*Anthus cervinus*) in Kavak Delta and Red Knot (*Calidris canutus*), Common Merganser (*Mergus merganser*) in Çardak Lagoon. In this context, sometimes IWC counts may not be enough to understand how rich and valuable a wetland is in terms of birds. Wetlands should be monitored continuously in order to have sufficient scientific data and to be able to protect areas with this information.

Gökçeada Salt Lake and Çardak Lagoon are candidate areas to meet the criteria of Important Bird Areas (IBA) according to the individuals listed (Gökçeada Tuz Gölü, *Tadorna ferruginea*-1011 individuals; Çardak Lagoon, *Gulosus aristotelis*-319 individuals). IBA's are geographies that have special meaning for the survival of bird species (Kılıç & Eken, 2004). B1 level fields according to IBA criteria; It regularly hosts more than 1% of one or a few species of waterbirds, migratory routes, or other distinctive subpopulations that are concentrated in groups at certain periods. According to the IBA criteria, areas at level B1 regularly contain more than 1% of one or more waterbirds species, migratory routes or other significant subpopulations that are concentrated in communities at certain periods. In addition, *Cygnus columbianus*, *Vanellus vanellus*, *Numenius arquata*, *Alcedo atthis*, *Hydrocoloeus minitus* and *Mergus serrator* species recorded during IWC censuses are in the status of near threatened (Near Threatened) species in Europe according to IUCN RedList (Versiyon 2020/1) criteria. In this respect, it is very important to continue to monitor wetlands and bird species and populations in wetlands.

In the IWC censuses made between 1993 and 2018 in Sarıkum Lake, which is 785 hectares in size, a maximum of 38 species and a maximum of 18112 individuals were counted in the censuses carried out for 17 years (Özkoç et al., 2019). In our study, 43 species and 8515 individuals included in 12 families were counted in wetlands covering

a total area of 2095 hectares (Kavak delta 1400 hectares; Çardak Lagoon 190 hectares; Uzunhızırlı Pond 85 hectares; Suvla Salt Lake 220 hectares; Gökçeada Salt Lake 200 hectares).

Birds exhibit more flexible mobility in wintering areas compared to breeding areas. In this way, it is known that waterbirds respond quickly to rapidly changing weather conditions (Potvin et al., 2016; Santangeli & Lehikoinen, 2017). In a study conducted in Europe (Pavón-Jordán et al., 2018), 25 wintering waterbirds species were monitored and revealed that birds go northeast in warm winters and southwest in cold winters. In this study, it is stated that this change, which occurs due to temperature, is related to both local and northern weather conditions. In this respect, when evaluating IWC censuses, it should be evaluated together with censuses in a wider area.

There are few winter census studies conducted in wetlands in the Marmara Region of Turkey. In the census conducted by Arslangündoğdu (2006) in the Bosphorus, 13 waterbirds belonging to 8 families were recorded and a total of 14,183 individuals were counted. Although the number of species is lower compared to our study areas, the number of individuals is higher. In the censuses made in the Bosphorus, the habitat structure was limited to the sea, marina and coastal areas, while in our study, wetlands with more habitat types such as lagoons, lakes and deltas were counted. In another study carried out in December, in 7 different wetlands in the Sakarya Basin, 29 species of waterbirds belonging to 11 families were identified. A total of 55,884 individuals were counted in the study, and approximately 94% of this number was recorded in Sapanca Lake (Arslangündoğdu, 2009). Sapanca Lake, with an area of 7749 hectares, is approximately 4 times larger than the total of our study areas, so although the number of species is lower, an expected situation in terms of the total number of individuals has been presented.

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Artificial wetlands can be a temporary substitute habitat for wintering waterbirds for relatively short periods of time (Wang et al., 2020). Artificial wetlands (rice fields, irrigation dams, etc.) are attracting more and more attention in waterbirds conservation efforts, as they are potential replacement habitats for natural wetlands (Hsu et al., 2019; Zhang et al., 2014). Uzunhızırlı Pond, which is one of our research areas, is a dam lake created for irrigation purposes in the 1970s. The *Pelecanus crispus* species, which was detected in Uzunhızırlı Pond in the 2018-2019-2020 IWC census and is under global threat, was not recorded in the 2021 IWC census. In this respect, it is very important to make censuses in artificial wetlands and to make necessary conservation efforts.

In the study, a significant difference was found between the number of habitats in the wetland and the number of recorded species and the wetland area and the total number of individuals observed ($p<0.0001$). As the number of habitats in the wetland increased, the number of species also increased. Although this is an expected result, the total number of recorded individuals decreased as the wetland area increased. Parameters such as hunting pressure in the wetland, water quality in the wetland, nutrient abundance, shelter, and shallow wetlands suitable for feeding are thought to affect the high number of individuals in our small areas such as Çardak lagoon and Gökçeada Salt Lake. Wang et al., (2020) also revealed that habitat quality is an important factor affecting the distribution of waterbirds in wintering areas (Wang et al., 2020).

Wetlands are important ecosystems that increase bird species diversity in our country (Karadeniz et al., 2009). Our study areas are at a critical point in terms of bird migrations, thanks to the Dardanelles Strait, which is one of the two narrow straits in western Turkey (Uysal, 2016). The areas with rich habitat diversity in Çanakkale on this route are important resting and feeding areas for birds during spring migration. Wetlands on the migration routes serve as stations for migratory bird species to complete their long migration journeys. Destruction and loss in these areas can have very dramatic consequences for many species. In this respect, the protection of Kavak Delta, Çardak Lagoon, Uzunhızırlı Pond, Suvla Salt Lake and Gökçeada Salt Lake is very important for migratory birds. Gökçeada Salt Lake and the northern shores of Gökçeada are protected as an Important Natural Area-INA and a "Wetland of National Importance" with the decision taken in 2018. In this respect, hunting is prohibited in the area. Although Gökçeada Salt Lake is the second study area with the smallest surface area, it was the area where most waterbirds wintered. It can be said that hunting pressure is a very important negative anthropogenic effect for waterbirds. Kavak Delta, which is another protected area, has a protection status as a special environmental protection zone and protected area. However, since the entire area is not within the boundaries of the conservation status, there are sections open to hunting. On the other hand, Suvla Salt Lake, Çardak Lagoon and Uzunhızırlı Pond do not have any protection status.

Habitat destruction can have a sharp negative impact on the population of wetland birds. Therefore, if the amount and quality of wetland habitat decreases, wetland dependent bird populations in the region can also be expected to decrease (Uysal & Uysal, 2021). During the censuses in our study areas, anthropogenic factors that negatively affect the wetland and bird species were determined. These factors are: poaching, agricultural areas starting without leaving a buffer zone around the wetland, mixing of herbicides and insecticides used in agricultural areas into the wetland, erosion of the soil in bare agricultural areas in the windy area throughout the year have been identified as the main negative anthropogenic effects.

As a result of the research, IWC counts in the wetlands around the Dardanelles Strait, which is an important migration route in the Western Palaearctic region, were evaluated and data that will allow the follow-up of the areas with the censuses to be made in the coming years were presented. The importance of the wetlands where the research was carried out for winter visiting waterbirds, changes in diversity indices and anthropogenic factors that threaten ornithological diversity have been revealed. These data are important in terms of being a pioneering data for future studies in investigating the effect of wetland changes on bird species.

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REFERENCES

Akarsu F, Balkız Ö (eds) (2010). Türkiye Kış Ortası Su Kuşu Sayımları 2008-2009-2010. Ankara: Doğa Derneği Yayını, 155p.

Arslangündoğdu Z (2006). İstanbul Boğazı Kış Ortası Su Kuşu Sayımı. *Journal of the Faculty of Forestry Istanbul University* 56(1): 141-147.

Arslangündoğdu Z (2009). Sakarya Havzası Sulak Alanlarında Aralık Ayı Su Kuşu Sayımı. *İstanbul Üniversitesi Orman Fakültesi Dergisi* 59(2): 1-14.

Barış S, Bilgin C, Oksay S, Göksu A, Ertan A, Eken, G (eds) (1996). Ankara: Türkçe Kuş İsimleri Doğal Hayatı Koruma Derneği & Ankara Kuş Gözlem Topluluğu Yayını.

Bellio MG, Kingsford RT (2013). Alteration of Wetland Hydrology in Coastal Lagoons: Implications for Shorebird Conservation and Wetland Restoration at a Ramsar Site in Sri Lanka. *Biological Conservation* 167:57– 68.

Bellio MG, Kingsford R, Kotagama SW (2009). Natural versus artificial- wetlands and their waterbirds in Sri Lanka. *Biological Conservation* 142: 3076–3085.

Chen JY, Zhou LZ (2011). Guildstructure of wintering waterbird assemblages in shallow lakes along Yangtze River in Anhui Province, China. *Shengtai Xuebao/Acta Ecologica Sinica* 31(18): 5323–5331.

Clarkson BR, Ausseil AE, Gerbeaux P (2013). Wetland ecosystem services. In Dymond JR (ed). Ecosystem services in New Zealand – conditions and trends. Lincoln, New Zealand: Manaaki Whenua Press, 192-202.

Custer TW, Osborne RG (eds) (1977). Wading Birds As Biological Indicators: 1975 Colony survey. Washington, D.C.: U.S. Fish and Wildlife Service, p28.

Çağırankaya S, Meriç BT (2013). Türkiye’nin Önemli Sulak Alanları: Ramsar Alanlarımız. Ankara: Orman ve Su İşleri Bakanlığı, Doga Koruma ve Milli Parklar Genel Müdürlüğü, Hassas Alanlar Dairesi Başkanlığı, 97-107.

Çağlayan E, Kılıç DT, Per E, Gem E (2005). Türkiye kış ortası su kuşu sayımları. Ankara: Doğa Derneği.

Erciyas Yavuz K, Kartal E (eds) (2012). Türkiye Kış Ortası Su Kuşu Sayımları 2011. Samsun: Ondokuz Mayıs Üniversitesi Yayınları, p48.

Galewski T, Collen B, McRae L, Loh J, Grillas P, Gauthier-Clerc M, Devictor V (2011). Long-term trends in the abundance of Mediterranean wetland vertebrates: from global recovery to localized declines. *Biological Conservation* 144: 1392–1399.

Hsu CH, Chou JY, Fang WT (2019). Habitat selection of wintering birds in farm ponds in Taoyuan, Taiwan. *Animals* 9: 113.

IUCN (2021). The IUCN Red List of Threatened Species. Version 2021-1. http://www.iucnredlist.org. Downloaded on 10 January 2021.

Karadeniz N, Tırıl A, Baylan E (2009). Wetlands Management in Turkey: Problems, Achievements and Perspectives. *African Journal of Agricultural Research* 4(11): 1106-1119

Keddy-Hector DP (ed) (2000). The birds of North America online. Philadelphia: No. 549.

Kılıç DT, Eken G (eds) (2004). Türkiye’nin Önemli Kuş Alanları 2004 güncellemesi. Ankara: Doğa Derneği.

Kirwan GM, Boyla KA, Castell P, Demirci B, Özen M, Welch H, Marlow T (eds) (2008). The Birds of Turkey: A Study of The Disturbution, Taxonomy and Breeding of Turkish Birds. London: Christopher Helm, p512.

Kocataş A (1997). Ekoloji ve Çevre Biyolojisi. İzmir: Ege Üniv. Basımevi, p564.

Larsen FW, Bladt J, Balmford A, Rahbek C (2012). Birds as biodiversity surrogates: will supplementing birds with other taxaimprove effectiveness?. *Journal of Applied Ecology* 49(2): 349–356.

Ma ZJ, Li B, Zhao B (2004). Are artificial wetlands good alternatives to natural wetlands for waterbirds?. A case study on Chongming Island, China. *Biological Conservation* 13: 333–350.

MacGregor-Fors I (2008). Relation between habitat attributes and bird richness in a western Mexico suburb. *Landscape and urban planning* 84(1): 92–98.

Margalef R (1958). Information theory in ecology. *General Systems Yearbook* 3: 36-71.

Mitsch W, Gosselink J (2007). Wetlands. New York: Willey.

Nilsson L, Hermansson C (2021). Changes in numbers and distribution of wintering waterbirds around Gotland 1969–2020. *Ornis Svecica* 31: 78-93.

Nilsson L (2020). Changes in numbers and distribution of wintering waterbirds at the south coast of Scania, Sweden, during 55 winters, 1964–2018. *Ornis Svecica* 30: 38–52.

Onmuş O (2007). Türkiye Kış Ortası Su Kuşu Sayımları 2007. Ankara: Doğa Derneği, p29.

Özcan H, Akbulak C, Kelkit A, Tosunoğlu M, Uysal İ (2008). Ecotourism Potential and Management of Kavak Delta (Northwest Turkey). *Journal of Coastral Research,* 25(3): 781-787.

Özdamar K (ed) (2013). Sampling methods. SPSS ile Biyoistatistik. Ankara: Nisan Kitapevi, 237-61.

Özkoç ÖÜ, Yavuz N, Yavuz KE (2019). Sarıkum Gölü'nde Kışlayan Su Kuşları. *Kahramanmaraş Sütçü İmam Üniversitesi Tarım ve Doğa Dergisi* 22(4): 631-640.

Pavón-Jordán D, Santangeli A, Langendoen T, Lehikoinen A (2018). Distribution changes, species richness and the role of protected areas in Europe and Northern Africa. The case study of waterbirds. In: ECCB2018 5th European Congress of Conservation Biology. 12th-15th of June 2018, Jyväskylä, Finland. Open Science Centre, University of Jyväskylä.

Pielou EC (1966). The measurement of diversity in different types of biological collections. *Journal of Theoretical Biology* 13: 131-144.

Potvin DA, Välimäki K, Lehikoinen A (2016). Differences in shifts of wintering and breeding ranges lead to changing migration distances in European birds. *Journal of Avian Biology* 47(5): 619-628.

Samsa Ş (2012). Çardak (Çanakkale/Türkiye) Lagünü Avifaunası. Msc, Çanakkale Onsekiz Mart Üniversitesi, Çanakkale, Türkiye.

Samsa Ş (2014). Gökçeada Kuşları. Çanakkale: Gökçeada Doğa ve Kültür Varlıkları, Çanakkale Valiliği Yayınları. 155-180.

Santangeli A, Lehikoinen A (2017). Are winter and breeding bird communities able to track rapid climate change? Lessons from the high North. *Diversity and Distributions* 23(3): 308-316.

Sayoud MS, Salhi H, Chalab B, Allali A, Dakki M, Qninba A, El Agbani MA, Azafzaf H, Feltrup-Azafzaf C, Dlensi H, et al. (2017). The first coordinated trans-North Africanmid-winter waterbird census: The contribution of the International Waterbird Census to the conservation of waterbirds and wetlands at a biogeographical level. *Biological Conservation* 206: 11-20.

Shannon CE, Weaver W (1963). The Mathematical Theory of Communication. Urbana: University of Illinois Press, p117.

Sinav L (2019). Türkiye'deki Kuş Türü Zenginliğinin Coğrafi Varyasyon Deseni. Msc, Hacettepe Üniversitesi, Ankara, Türkiye.

Suseven B, Onmuş O, İsfendiyaroğlu S (eds) (2006). Kış ortası su kuşu sayımı (KOSK) raporu. Ankara: Doğa Derneği.

Svensson L Mullarney K, Zettersröm D (eds) (2009). Bird Guide: The Most Complate Guide to The Birds of Britain and Europe (2nd ed.). London: Collins Yayınları, 448s.

Şekercioğlu CH (2010). Ecosystem functions and services. New York: Conservation biology for all, 45-72.

Tosunoğlu M, Gül Ç, Önder Ü, Küçüksöylemez A, Gürel H (2014). Çanakkale İli Sulak Alan Envanteri. Çanakkale: Doğa Koruma ve Milli Parklar Yayınları: p34.

Tosunoğlu M, Uysal İ, Erdoğan A (2016). Çanakkale Kuşları. Çanakkale, T.C. Orman ve Su İşleri Bakanlığı, 2. Bölge Müdürlüğü, Çanakkale Şube Müdürlüğü, p216.

Trakus (2021) Türkiye'nin Anonim Kuşları. https://www.trakus.org/, Downloaded on 05 February 2021.

Ulusoy K, Bulut Ş (2020). Wintering Bird Diversity and Population Sizes at Obruk Dam Lake (Corum) in Turkey. *Hittite Journal of Science and Engineering* 7(4): 353-358.

Uysal İ, Tosunoğlu M (2016). The Avifauna Of The Wetland Areas of Gelibolu Peninsula. In: 5. Uluslararası Ornitoloji Kongresi 10-13 Mayıs 2016, Çanakkale/Turkey.

Uysal İ, Uysal İ (2021). Suvla Tuz Gölü (Çanakkale/Türkiye)'nün Ornithofaunası ve Su Kuşları Çeşitlilik Göstergeleri'nin Aylık Değişimi. *Etoxec* 1: 14-26.

Uysal İ (2016). Gelibolu Yarımadası'nın (Çanakkale-Türkiye) Kuş Göç Rotaları ve Rüzgar Enerji Santralleri'nin (RES) Kuş Popülasyonları Üzerine Etkileri. Phd, Çanakkale Onsekiz Mart Üniversitesi, Fen Bilimleri Enstitüsü 424123, Çanakkale, Türkiye.

Ürker O, Özen A (2020). Işıklı Gölü ve Gökgöl Sulak Alanlarında Avrupa Doğa Bilgi Sistemi (EUNIS) Habitat Sınıflandırmasının Değerlendirilmesi. *Erzincan Üniversitesi Fen Bilimleri Enstitüsü Dergisi* 13(2): 518-531.

Wang X, Chen J, Zhou L (2020). Effects of human activities on the diversity of waterbirds wintering in a shallow lake of the middle and lower Yangtze River floodplain, China. *Diversity* 12(8): 302.

Yarar M, Magnin G, Tireli A (1996). Türkiye Sulak Alanları Kış Ortası Su Kuşu Sayımı. İstanbul: Doğal Hayatı Koruma Derneği.

Yavuz KE, Boyla KA (2013). Türkiye Kış Ortası Su Kuşu Sayımları. Ankara: Doğa Derneği.

Yıldız Karakoç D (2017). Türkiye'de sulak alanlar. Ankara: Ankara Üniversitesi.

Yu CX, Yang G, Lu Z, Li D, Zhou F (2014). Habitat use by waterbirds in coastal wetlands during migratory seasons in Shankou Nature Reserve, Guangxi, South China. *Oceanologia et Limnologia Sinica* 45: 513–521.

Zhang Y, Xie HB, Zeng WB (2014). The waterfowl community structure and waterflowl habitat-selection analysis for four artificial wetlands type in spring in Chongming Dongtan, China. *Chinese Journal of Zoology* 49: 490–504.