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## ECOLOGICAL IMPORTANCE OF ZIBAN WETLAND COMPLEX IN ALGERIAN SAHARA

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**ABSTRACT:** We evaluated the diversity and abundance of waterbirds in the Ziban wetland complex during the period 2012 - 2016 for the first time. This study was conducted in an arid region in north-eastern Algerian Sahara. A total of 55 species belonging to 17 families were recorded. The most represented families were Scolopacidae with 14 species then Anatidae with 12 species and Ardeidea with 06 species. According to the phenological status balance 21 species (38.18%) are passage visitor, 19 species (34.55%) are winter visitor, 10 species (18.18%) are Resident breeder, 4 species (7.28%) are migrant breeder and 1 species (1.81%) is casual breeder. The presence of three species near threatened following the IUCN Red List (*Aythya nyroca*, *Limosa limosa*, *Numenius arquata*) and two others vulnerable (*Marmaronetta angustirostris* and *Chlamydotis undulata undulata*) confirms the Ecological significance of the Ziban region for bird's conservation.

**KEY WORDS:** Waterbirds, phenological status, vulnerable, Ziban, Algeria

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Waterbirds community dynamics are complex and influenced by natural factors, bird life cycle (migration, breeding and moulting), water availability and anthropogenic constraints, such as hunting, water extraction and agricultural activities (Mundava et al., 2012). Algeria contains a wide variety of wetlands which are important staging posts and wintering grounds for migrating Palearctic birds (Steavenson et al., 1988; Coulthard, 2001). The Algerian avifauna is moderately well known, due former collected data during the past century by many ornithologists (Heim de Balsac & Mayaud, 1962; Ledant et al., 1981; Isenmann & Moali, 2000). Most of the ecological study of the aquatic avifauna of the Ziban region wetlands is in the form of ecological monitoring of the wintering and reproduction of rare and threatened species (Farhi, 2012; Merouani et al., 2018; Nouidjem et al., 2019). The work that will be exposed here aims to specify the real phenological status of the species considered and to provide information on their ecology as well as on the key role played by Ziban wetland Complex in maintaining a rich and diverse birdlife.

## MATERIAL AND METHODS

### **Study area**

Ziban oasis, located in the south east of Algeria, south of the Aurès Mountains. it has an arid Mediterranean climate, characterized by hot and dry summers, the average annual of rainfall is 361mm and evapotranspiration is 1125 mm. with an average maximum temperature is 41.38 °C in August; the minimum during January with 8.26 °C and the average precipitation is about 128 mm (Nouidjem et al., 2019). Five wetlands make up this eco-complex (Table 1) occupy an area of around 560 000 ha.

Table 1. The main wetlands of the Ziban region.

Wetland	GPS Coordinates	surface	Status
Chott Melghir	34°11'59.11"N,6°16'14.26"E	552 000 ha	Site Ramsar (2001)
Fountains of Gazelles Reservoir	35° 7'56.14"N, 5°35'23.11"E	160 ha	Not classified
Foum El Gherza Reservoir	34°51'53.77"N,5°55'26.24"E	140 ka	Not classified
Wadi Djedi	34°39'44.13"N,5°41'32.22"E	120 ha	Not classified
Wadi Sidi Mhamed Moussa	34°33'17.18"N, 6° 5'22.42"E	20 ha	Not classified

### **Sampling method**

We present here a summary of the results of aquatic avifauna censuses, carried out from August 2012 until April 2016 in all the water bodies of this region. Five wetlands conducted surveys of waterbirds, using a telescope *OPTOLITH* (80 × 20). When the birds group was situated at distance less than 200 m and the number was inferior upon 200 individuals we were counted the birds individually. Unlike this (waterbirds number was superior upon 200 individuals and situated more 200 m), the number of waterbirds was estimated. This method has a sampling error about 5 % (Blondel, 1975).

### **Data analysis**

In this study, we use the test Z with a significance level of  $p \leq 0.05$  to determine the existence of significant differences between the species and between the families, Also Spearman's correlation was carried out to determine the relationship between number of species and number of families.

## RESULTS

### **Inventory and avian community composition**

The study revealed that the avian community of this wetland complex is composed of 55 species belonging to 17 families. The Scolopacidae with 14 species was found to be the richest in species number, followed by Anatidea (12 species), Ardeidae (6 species), Laridae (5) and Rallidae (4). Ciconiidae, Glareolidae and Phalacrocoracidae with only 1 species each (Fig. 1).

The test Z are significantly different between the species presented at the stations ( $Z = 7.88$ ;  $P < 0.0001$ ). The families however are highly significate different ( $Z = 15.34$ ;  $P < 0.0001$ ), indicating a variability of habitats. Spearman correlation coefficients (r) between the number of species presented (n=55) and families (n=17) are highly correlated (r = 0.80).

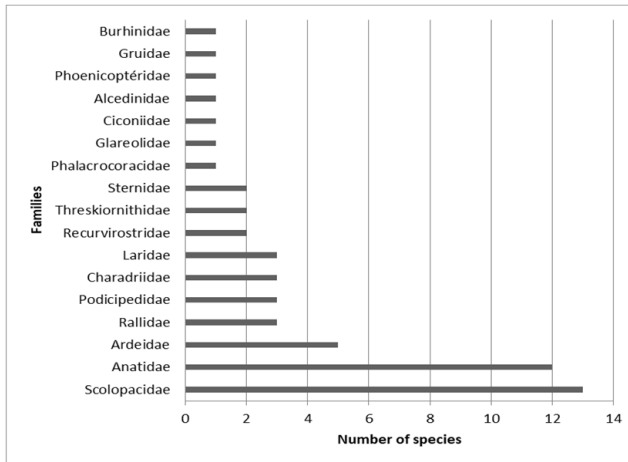


Figure 1. Species richness of aquatic birds belonging to deferent families during the study period at Ziban wetlands.

### **Phenological status**

According to the phenological status balance, 21 species (38.18%) are passage visitor, 19 species (34.55%) are winter visitor, 10 species (18.18%) are Resident breeder, 4 species (7.28%) are migrant breeder and 1 species (1.81%) is casual breeder.

**Passage visitor:** This group includes the birds that are present during the wintering season in the Ziban area and leaving it at the beginning of spring to join their breeding sites. It is primarily composed of Scolopacidae (11 species), Anatidae (6 species) and also from *Podiceps nigriceps*, *Nycticorax nycticorax*, *Phoenicopeterus roseus*, *Charadrius hiaticula* and *Larus ridibundus* (Table 2).

**Winter visitor:** In the spring during their prenuptial passage and in the autumn during their postnuptial passage, these visitors are frequent this region. It is particularly formed of Scolopacidae, Anatidae and Ardeidae with 3 species for each family, Podicipedidae and Threskiornithidae 2 species and all of Phalacrocoracidae, Rallidae, Charadriidae and Gruidae with 1 species (Table 2).

**Resident breeder:** This group is composed mainly of Anatidae and Rallidae (2 species) for each family and all of the Burhinidae, Recurvirostridae, Charadriidae, Alcedinidae, Glareolidae and Laridae presented by only 1 species (Table 2).

**Migrant breeder:** The Migrant breeder groupe in Ziban wetland complex consists of four species, *Ciconia ciconia*, *Himantopus himantops*, *Chlidonias niger* and *Chlidonias hybridus* (Table 2).

**Casual breeder:** One species has the status of Casual breeder presented in the region of Ziban is (Shelduck *Tadorna tadorna*) (Table 2).

### **Specific composition of the waterbird population**

The diversity of species differed from wetland to another depending on the site characteristics, where the high value was observed at Fountains of Gazelles reservoir both in species (44) and families (16), followed by Wadi Djedi , Foum El Gherza Reservoir , and Chott Melghir. However, the low richness was observed at Wadi Sidi Mhamed Moussa, with only 26 species representing 12 families (Fig. 2).

Table 2. The aquatic avifauna recorded in Ziban wetlands during the study periode (S1: Chott Melghir, S2: Fountains of Gazelles Reservoir, S3: Fom El Gherza Reservoir, S4: Wadi Djedi S5: Wadi Sidi Mhamed Moussa).

Families	Species	Status	S1	S2	S3	S4	S5
Podicipedidae	<i>Tachybaptus ruficollis</i>	WV		x	x		
	<i>Podiceps cristatus</i>	WV		x	x		
	<i>Podiceps nigriceps</i>	VP		x	x		
Phalacrocoracidae	<i>Phalacrocorax carbo</i>	WV		x	x	x	
	<i>Nycticorax nycticorax</i>	VP		x	x		
Ardeidae	<i>Bubulcus ibis</i>	WV	x	x	x	x	
	<i>Egretta garzetta</i>	WV	x	x	x	x	x
	<i>Egretta alba</i>	WV		x		x	
	<i>Ardea cinerea</i>	WV	x	x	x	x	x
Ciconiidae	<i>Ciconia ciconia</i>	MB	x	x	x	x	x
Threskiornithidae	<i>Plegadis falcinellus</i>	WV		x	x	x	x
	<i>Platalea leucorodia</i>	WV		x		x	
Phoenicopteridae	<i>Phoenicopterus roseus</i>	VP	x	x	x	x	x
Anatidae	<i>Tadorna ferruginea</i>	RB	x	x	x	x	x
	<i>Tadorna tadorna</i>	CB	x	x	x	x	x
	<i>Anas penelope</i>	VP	x	x		x	
	<i>Anas strepera</i>	VP		x	x	x	
	<i>Anas crecca</i>	WV	x	x	x	x	x
	<i>Anas platyrhynchos</i>	RB	x	x	x	x	x
	<i>Anas acuta</i>	WV		x	x	x	
	<i>Anas querquedula</i>	VP	x			x	
	<i>Anas chrypeata</i>	WV	x	x	x	x	
	<i>Marmaronetta angustirostris</i>	VP	x	x	x	x	x
	<i>Aythya ferina</i>	VP		x	x		
	<i>Aythya nyroca</i>	VP		x	x	x	
	Rallidae	<i>Rallus aquaticus</i>	RB				
<i>Gallinula chloropus</i>		RB	x	x	x	x	
Gruidae	<i>Fulica arta</i>	WV	x	x	x	x	x
	<i>Grus grus</i>	WV	x	x		x	
Burhinidae	<i>Burhinus oedicnemus</i>	RB	x	x		x	x
Recurvirostridae	<i>Himantopus himantops</i>	MB	x	x	x	x	x
	<i>Recurvirostra avosetta</i>	RB	x	x	x	x	
Charadriidae	<i>Charadrius hiaticula</i>	VP		x	x	x	
	<i>Charadrius dubius</i>	WV		x	x		x
	<i>Charadrius alexandrinus</i>	RB	x	x	x	x	x
Scolopacidae	<i>Calidris minuta</i>	VP		x	x	x	
	<i>Calidris ferruginea</i>	VP		x			
	<i>Calidris alpina</i>	VP			x	x	
	<i>Philomachus pugnax</i>	VP	x				
	<i>Gallinago gallinago</i>	WV				x	x
	<i>Limosa limosa</i>	VP		x	x		
	<i>Numenius arquata</i>	VP		x			
	<i>Tringa erythropus</i>	VP				x	
	<i>Tringa totanus</i>	VP	x			x	
	<i>Tringa stagnatilis</i>	VP	x		x	x	x
	<i>Tringa nebularia</i>	VP	x			x	x
<i>Tringa ochropus</i>	WV		x		x		
<i>Actitis hypoleucos</i>	WV	x			x	x	

Laridae	<i>Larus ridibundus</i>	VP		x	x		
	<i>Larus michahellis</i>	RB		x			
	<i>Larus genei</i>	WV		x	x	x	
Sternidae	<i>Chlidonias hybridus</i>	MB		x	x		
	<i>Chlidonias niger</i>	MB		x	x		
Alcedinidae	<i>Alcedo atthis</i>	RB		x	x		
Glareolidae	<i>(Cursorius cursor)</i>	RB	x				x

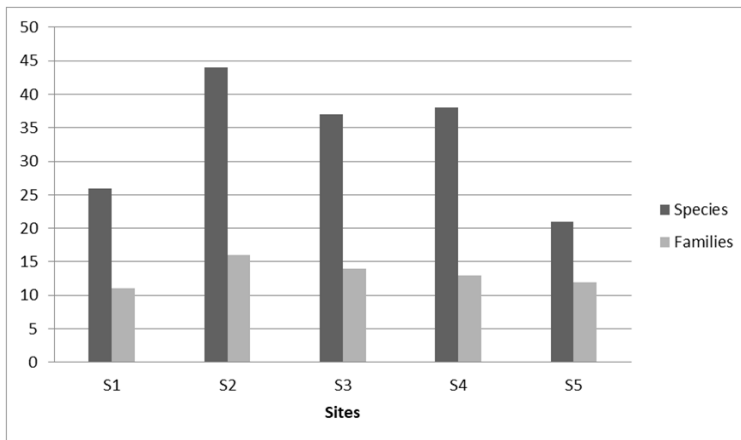


Figure 2. Distribution of families and species in different wetlands.

## DISCUSSION AND CONCLUSION

Species richness is frequently selected as a variable reflecting system state, and is often used in investigations of the effects of human development and disturbance on biodiversity (Conroy & Noon, 1996). Local factors (habitat loss, competitive or predatory exclusion) are known to reduce diversity, either by removing species or preventing the invasion of new species (Martínez–Abraín, 2005). The study area is composed of different habitats by their characteristics are preferred by some waterbirds. Fountains of Gazelles reservoir played a role as a quarter of wintering for waterbirds (Merouani et al., 2018). Wadi Djedi plays an important role in the wintering and breeding of waterbirds and also serves as a stopover site for migrant species during their trans–Saharan migration journeys (Nouidjem et al., 2019). Chott Melghir is a favorable wintering area for the aquatic avifauna of the western Palaearctic, in particular for certain species which are observed with very large numbers, sometimes exceeding 1% of the regional population, such as the case of the Greater flamingo *Phoenicopterus roseus* (Houhamdi et al., 2008).

This current study shows the importance of this region for the conservation of waterbirds in Southeast of Algeria, and the role played by this aquatic ecosystem for the retention of three species near threatened following the IUCN Red List (*Aythya nyroca*, *Limosa limosa*, *Numenius arquata*) and two others vulnerable (*Marmaronetta angustirostris* and *Chlamydotis Undulata Undulata*) confirms the Ecological significance of the Ziban region for bird's conservation.

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