

Ecology and conservation of three globally threatened waterfowl species breeding in Tunisian wetlands: The Ferruginous Duck, Marbled Teal and White-Headed Duck

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Fieldwork was conducted between April 2023-Jun 2023. During this period, a total of 40 wetlands were visited over the entire territory of Tunisia. The selected wetlands include a mosaic of different wetland types, namely coastal lagoons, freshwater lakes, continental salt lakes, and hill dams under different levels of protection (Table 1).

Table 1. List of wetlands selected for waterbird surveys and habitat assessments

Site	X	Y	Region
Joumine	36°58'44.39"N	9°36'18.82"E	Bizerte
Sejnane	37°10'45.08"N	9°27'51.87"E	Bizerte
Melah	37° 4'35.64"N	9°26'48.87"E	Bizerte
Ghezala	37° 3'11.29"N	9°32'24.01"E	Bizerte
Sidi Soltane	36°52'11.5"N	9°33'29.0"E	Bizerte
Oued Ettine	36°51'56.03"N	9°37'15.84"E	Bizerte
Ghar ElMelh	8'41.00"N	10°10'55.38"E	Bizerte
Dam of Mlaâbi	36°51'N	10°56'E	Nabeul
Mornaguia	36°50'N	10°13'E	Ariana
Sidi Abdelmonem	36,857544	10,9287	Nabeul
Lake Tunis	36°45'N	10°30'E	Ben Arous
Sebkhet Sedjoumi	36°45'N	10°08'E	Tunis
Lagoon Soliman	36°42'N	10°30'E	Nabeul
Lagoon Tazarka	36,529293	10,840788	Nabeul
Lagoon of Korba	36°41'N	10°56'E	Nabeul
Dam of Lebna	, 36°42'N	10°56'E	Nabeul
Dam of Al Masri	36°31'N	10°29'E	Nabeul
Halk el Menzel	36°00'N	10°30'E	Sousse
Laabid	36°49'1.64"N	10°42'8.26"E	Nabeul
Dam of El khatéf	36,847843	11,030572	Nabeul
Dam Hmira/ Khairat	36,15254	10,212848	Sousse
Dam Takrouna	36,146492	10,309437	Sousse
Hill lake Boulabousse	36,242532	10,180937	Zaghouan
Dam of Oued Rmal	36,349398	10,345004	Zaghouan

Sebkhet sidi khelifa	36,236051	10,456328	Sousse
Oued EL Kebir	36°51'59.32"N	8°43'22.34"E	Jendouba
El Ogla	36°11'11.99"N	10° 4'53.59"E	Zaghouan
Khmiss	35°43'32.77"N	10°47'46.94"E	Monastir
Dam of El Houareb	35,568073	9,74002	Kairouan
Goubellat	36°34'58.32"N	9°48'10.76"E	Beja
Sidi Djedidi	36°25'11.79"N	10°27'19.40"	Nabeul
Gdir EL Goulla	36°46'59.63"N	10° 3'35.86" E	Ariana
Chiba	36°42'6.95"N	10°46'16.24"E	Nabeul
Sidi Saad	35°22'11.52"N	9°40'52.58"E	Kairouan
Borj kastile	33,66584	10,952827	Medenine
Douz Laâla	33,473179	8,982673	Kébili
Snam	33,469688	8,954093	Kébili
Ghidma	33,431699	8,795167	Kébili
Sebkhet Nouaïel	33,536186	8,778982	Kébili
Blidatte	33,5593	8,8609	Kébili

Waterfowl survey

Waterfowl surveys were carried out between April 2023-Jun 2023. This period was chosen as it corresponds to a minimal migratory movement period for these breeding waterbirds in Tunisia. Each wetland was visited two times on different dates. Observations were made between 06:00–11:00 h and 16:00–18:00 h, under favorable meteorological conditions to ensure good visibility and hence bird detectability, and no observation was conducted during windy days. During each visit, at least two observers of the field team recorded Ferruginous Duck, Marbled Teal and White-Headed Duck detected using binoculars (10x42) and a spotting scope (20x – 60x). Bird surveys were carried out from the shore and from accessible vantage points that cumulatively allowed total surveys of each study wetland. We conducted between 6 and 14 observation points in each wetland, depending on its shape and size.

Result

Among the three studied species, Marbled Teal (*Marmaronetta angustirostris*) was the most abundant and widely distributed species. This species has occupied 25% of sites during the two visits respectively. The abundance of this species has ranged between 75 (first visit) and 82 (second visit) individuals (Table 2). The Ferruginous Duck (*Aythya nyroca*) was the second abundant species. This species was recorded in 9 wetlands (Table 2). During the first survey, the total number of this species was 40 birds, while in the second visit it was 45 birds (Table 2). The White-headed Duck (*Oxyura leucocephala*) has the lowest abundance and distribution. It has been recorded in 10% (first visit) and 15 % (second visit) of wetlands. The abundance of this later species has ranged between 21 and 34 individuals (Table 2). Moreover, for the three Anatidae species the 1% level of the Ramsar Convention has been exceeded. According to our surveys, the Lake of Tunis, Sebket Sedjoumi, Lagoon of Soliman and Lagoon of Tazarka, Sebket Halk el Menzel, Sebket Khniss, Sidi Saad, Borj kastile, Douz Laâla, Snam and Blidatte are the most important sites for these three globally threatened waterfowl species during the breeding period. Although, some of these wetlands are protected by Tunisian law, many sites remain unprotected and threatened by real estate development, urban construction, urban waste and illegal hunting. Therefore, it is important to transform these wetland complexes into protected zones since they are crucial sites for overwintering waterbirds in Tunisia. It would be therefore beneficial to intensify monitoring campaigns by the ministry of agriculture, water resources and fisheries and/or the ministry of environment, coastal protection and planning agency on these wetlands, especially during the breeding period in order to reduce disturbance on these threatened waterfowl species.

Table 2: Number of Marbled Teal (MT), Ferruginous Duck (FD), and White-headed Duck (WHD) recorded in each wetland during the two visits.

Site	Visit 1			Visit 2		
	MT	FD	WHD	MT	FD	WHD
Joumine	0	0	0	0	0	0
Sejnane	0	0	0	0	0	0
Melah	0	0	0	1	0	0
Ghezala	0	0	0	0	0	0
Sidi Soltane	0	0	0	0	0	0
Oued Ettine	0	0	0	0	0	0
Ghar ElMelh	0	0	0	0	0	0
Dam of Mlaâbi	0	0	0	0	0	0
Mornaguia	0	0	0	0	0	2
Sidi Abdelmonem	0	0	0	0	0	0
Lake Tunis	2	2	2	4	4	3
Sebkhet Sedjoumi	4	2	16	3	3	22
Lagoon Soliman	8	4	0	7	6	3
Lagoon Tazarka	2	0	0	4	2	0
Lagoon of Korba	0	0	0	0	0	0
Dam of Lebna	0	0	0	0	0	0
Dam of Al Masri	0	0	0	0	0	0
Halk el Menzel	6	2	0	5	3	0
Laabid	0	0	0	0	0	0
Dam of El khatéf	0	0	0	0	0	0
Dam Hmira/ Khairat	0	0	0	0	0	0
Dam Takrouna	0	0	0	0	0	0
Hill lake Boulabousse	0	0	0	0	0	0
Dam of Oued Rmal	0	0	0	0	0	0
Sebkhet sidi khelifa	0	0	0	0	0	0
Oued EL Kebir	0	0	0	0	0	0
El Ogla	0	0	0	0	0	0
Khniiss	8	2	0	11	5	2
Dam of El Houareb	0	0	0	0	0	0
Goubellat	0	0	0	0	0	0
Sidi Djedidi	0	0	0	0	0	0
Gdir EL Goulla	0	0	1	0	0	2
Chiba	0	0	0	0	0	0
Sidi Saad	2	3	2	0	0	0
Borj kastile	0	21	0	0	17	0
Douz Laâla	35	0	0	38	0	0
Snam	4	2	0	6	3	0
Ghidma	0	0	0	0	0	0
Sebkhet Nouaïel	0	0	0	0	0	0
Blidatte	4	2	0	3	2	0
Total	75	40	21	82	45	34



White-headed Ducks observed in Sebkhet Sedjoui



Marbled Ducks observed in wetland of Douz Laâla (region of Kébili)



Ferruginous Ducks observed in the wetland of Borj kastile