An important breeding site for Marbled Teal *Marmaronetta angustirostris* on the Ounianga Lakes, Chad

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Un site de reproduction important pour la Sarcelle marbrée *Marmaronetta angustirostris* sur les lacs Ounianga, au Tchad. En mai 2023, une importante population reproductrice de Sarcelles marbrées *Marmaronetta angustirostris* a été découverte dans la région des lacs Ounianga, au nord du Tchad. Nous avons estimé qu'environ 800 adultes et plusieurs centaines de canetons étaient présents. En mai 2024, 1.000–1.200 adultes et un grand nombre de jeunes d'âges différents ont été observés. Nous estimons que les lacs Ounianga abritent une population, vraisemblablement bien établie, isolée et probablement résidente, d'au mois 300–400 couples reproducteurs. Des données sur le comportement et l'alimentation de l'espèce, ainsi que sur les menaces qui pèsent sur elle ont été collectées. L'importance de cette découverte dans le contexte des populations actuelles de Sarcelles marbrées ailleurs est soulignée et les objectifs de recherche supplémentaires dans la région des lacs Ounianga sont définis.

Summary. In May 2023 an important breeding population of Marbled Teal *Marmaronetta angustirostris* was found in the Ounianga Lakes area of northern Chad. A total of *c.*800 adults and several hundred ducklings was estimated to be present. In May 2024 an estimated 1,000–1,200 adults and a large number of young of different ages were observed. It is estimated that the Ounianga Lakes harbour a—presumably well-established, isolated and probably resident—population of at least 300–400 breeding pairs. Data on behaviour, food and threats were collected. The importance of this discovery in the context of the current populations of Marbled Teal elsewhere is highlighted and further research aims in the Ounianga Lakes area are set out.

Although constituting the largest wetland area in the Sahara, with 18 lakes and a total surface area of open water of 2,000 ha, the avifauna of the Ounianga Lakes, in northern Chad, designated a World Heritage Site in 2012, remains almost unexplored (e.g. Kröpelin 2007b, 2008, Schönbrodt 2014, Hering 2022, Hering & Schönbrodt 2023, Hering *et al.* 2023a,b), probably due to the difficulty of access and the security situation. The discovery, in January 2009, of more than 500 Marbled Teals *Marmaronetta angustirostris*, and the subsequent count in December 2011 of at least 150 individuals, indicated the potential importance of the lakes for this Near Threatened species (Schönbrodt 2009, 2012, 2014, BirdLife International 2023, West African Bird Database www.wabdab.org). This was confirmed in October 2021, when at least 650 individuals were counted on the two largest lakes, Lake Yoa, close to the town of Ounianga Kebir, and Lake Teli, near Ounianga Serir (Hering 2022). It was suspected that the species might also breed in the area. Here we present the results of our subsequent investigation into possible breeding of Marbled Teal in northern Chad.

Material and Methods

The study was conducted during 18–23 May 2023 and 10–14 May 2024 at several locations in the Ounianga Lakes area. The lakes lie just south of the Erdi Plateau between the Tibesti and Ennedi Mountains, clustered in two areas *c.*50 km apart (Fig. 1). The entire water surface is separated by sand deposited by the trade winds. The saline, hyper-saline and freshwater lake system is permanently fed by fossil groundwater inflow from the Nubian Sandstone Aquifer in a practically rainless region with annual losses due to evaporation exceeding 6 m (Eggermont *et al.* 2008, Francus *et al.* 2013). For a summary of lake morphology, water and bottom-substrate data of permanent waters at Ounianga Kebir and Ounianga Serir, see Kröpelin (2007a,b) and van Bocxlaer *et al.* (2011). We visited the following lakes near Ounianga Kebir (19°02'N 20°30'E): Lake Yoa on 18–20 May 2023 and 10 May 2024, Lake Uma and Lake Mioji on 20 May 2023 and 10 May 2024, and Lake Forodone on 20 and 22 May 2023 and 10–11 May 2024. Lake Motro, between Ounianga Serir and Ounianga Kebir (18°56'30.59"N 20°42'57.80"E) was visited on 20 May 2023. The following lakes near Ounianga

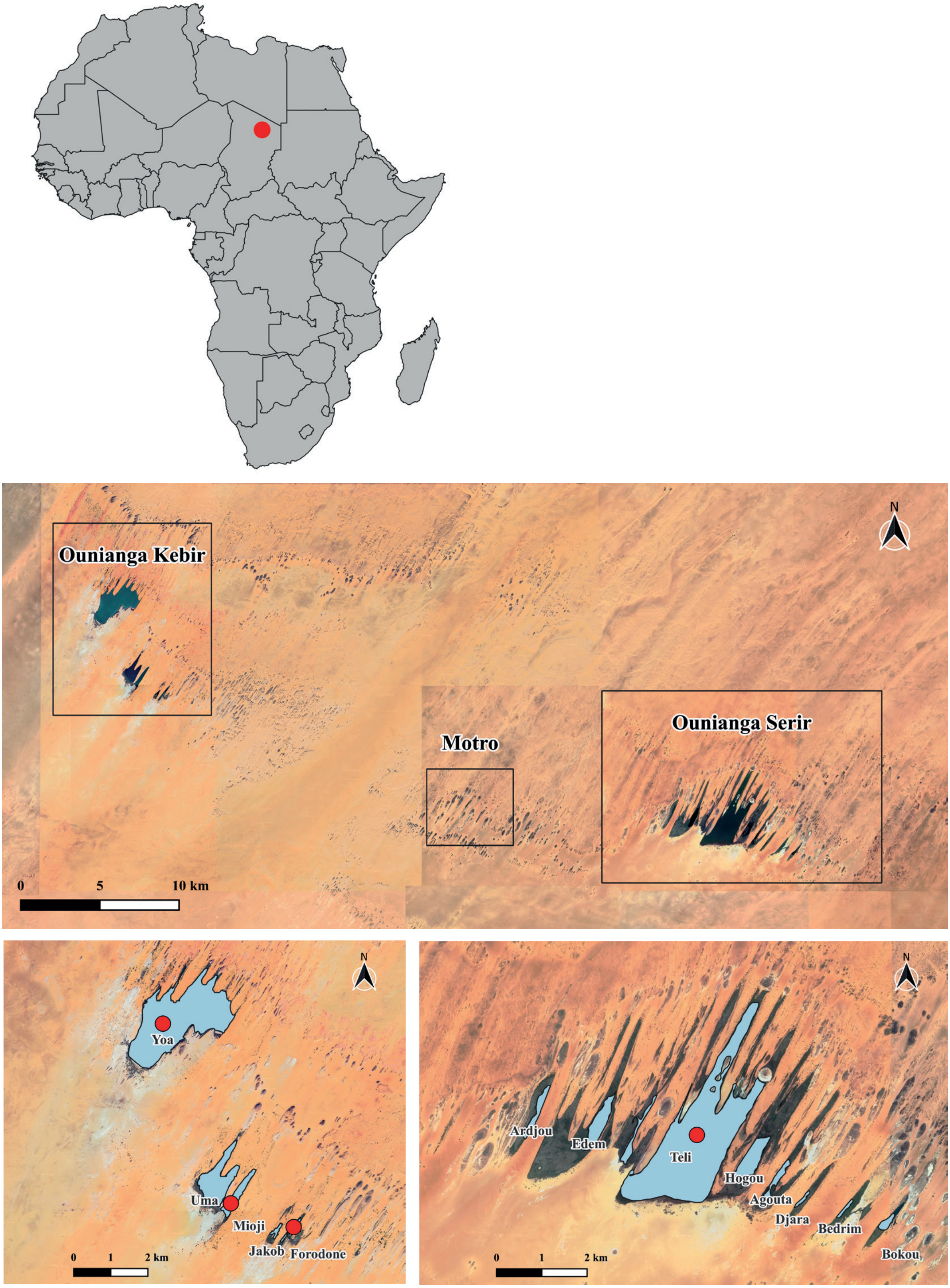

Figure 1. Geographical location of the study areas at Ounianga, Chad; the red dots show where young Marbled Teals *Marmaronetta angustirostris* were observed (© Google Earth and based on Rirongarti *et al*. 2022)

Localisation géographique des zones d'étude à Ounianga, Tchad ; les points rouges indiquent où les jeunes Sarcelles marbrées *Marmaronetta angustirostris* ont été observées (© Google Earth et basé sur Rirongarti *et al*. 2022)

Serir (18°55'N 20°52'E) were also visited: Lake Ardjou and Lake Edem on 21 May 2023, Lake Teli on 21–22 May 2023 and 12–14 May 2024, Lake Hogou and Lake Djara on 22 May 2023, and Lake Agouta on 22 May 2023 and 13 May 2024. Due to shortage of time and the extreme difficulty of access to the shore in some places, these lakes could only be partially surveyed. All the other lakes were either completely overgrown with common reed *Phragmites australis* or we were not permitted to visit them (e.g. Lakes Bedrim and Bokou or Boko). The lakes of Ounianga Serir are currently not normally accessible to foreigners or local visitors from Chad (mainly for political reasons) and it was only through long negotiations with the local council that we were granted access to some of them.

Marbled Teal and all other bird species were counted using 10×42 binoculars. Spotting scopes were not used for security reasons. Waterproof waders were used to approach birds for counting, taking photographs and studying behaviour in areas close to the shore and in shallow water. Fifteen excrement samples were collected on a sandbank in the south-western part of Lake Teli on 13 May 2024; they were soaked in water and examined under a stereomicroscope (Zeiss Technoval 2 and Zeiss Discovery V12).

Max. daytime temperatures reached 48°C in the shade and occasionally more than 55°C in the open. At night, temperatures occasionally exceeded 30°C. In addition to calm days, there were also days with persistently strong winds, which severely restricted observations.

Observations

Numbers of Marbled Teals and evidence of breeding

Lake Yoa, Ounianga Kebir area

The first waterbody we checked was the hypersaline Lake Yoa (Fig. 2a). In the early morning of 20 May 2023 we counted at least 600 Marbled Teals. The majority preferred the south-western part of the lake, many in pairs but mostly in larger groups. Here, especially in the evenings and mornings, they fed for long periods, displayed, preened and rested (Fig. 3). Intra-specific disputes took place on the water and in chasing flights. Comfort and resting behaviour was observed mainly on vegetation-free sandbanks and rocks in shallow water, in common reeds and the sedge *Cyperus laevigatus,* as well as on shores shaded by palms (*Hyphaene thebaica*, *Phoenix dactylifera*) and on palm fronds and trunks lying in the water. Marbled Teals often associated with Cape Teals *Anas capensis*. On 10 May 2024, we counted *c.*180 Marbled Teals at this location, mostly in pairs. That there were already chicks was revealed when a young villager brought us a duckling just a few days old on 10 May.

Lakes Mioji, Uma and Forodone, Ounianga Kebir area

The first female with young in the Ounianga area was seen on 20 May 2023 on the south-eastern shore of Lake Mioji. The ten young were estimated to be *c.*15 days old. Another female had two young of about the same age. In addition, *c.*40 adults were counted, again associated with Cape Teals, here and on neighbouring Lake Uma. On nearby Lake Forodone, we counted 20 adults and one brood of 12, one of nine young, one of seven, three broods of six and one of just two young of different ages (Figs. 2d, 4). Some family groups were certainly missed, as the birds immediately disappeared into the fringing vegetation when we arrived. On 11 May 2024 we found a similar situation on this lake, when there were at least three families with four, seven and 13 young of different sizes.

Lake Motro

On Lake Motro, between Ounianga Kebir and Ounianga Serir, we saw eight *c.*20-day-old young and ten adult Marbled Teals on 20 May 2023 (Fig. 2c). This isolated lake was not checked in 2024.

Lake Teli, Ounianga Serir area

At Lake Teli, of which we surveyed only the south-western part, several hundred ducklings were observed on or near the shore and on a sandbank on 21–22 May 2023 (Fig. 2b). The age of the young ranged from a few to more than 30 days, but the latter were still unable to fly. On the visible part of this 70-ha lake, the largest in the Ounianga Serir area, at least 80–100 adults were seen, without young, mostly in pairs and occasionally associating with Cape Teals. In May 2024, we estimated 1,000–1,200 adults on the visible part of the lake, with young of all sizes on the southern

Figure 2. Four of the five lakes in the Ounianga area, Chad, where Marbled Teals *Marmaronetta angustirostris* with young were observed in May 2023 and 2024: **a.** Lake Yoa, Ounianga Kebir; **b.** Lake Teli, Ounianga Serir; **c.** Lake Motro; **d.** Lake Forodone, Ounianga Kebir (Jens Hering)

Quatre des cinq lacs de la région d'Ounianga, au Tchad, où des Sarcelles marbrées *Marmaronetta angustirostris* avec des jeunes ont été observées en mai 2023 et 2024 : **a.** Lac Yoa, Ounianga Kebir ; **b.** Lac Teli, Ounianga Serir ; **c.** Lac Motro ; **d.** Lac Forodone, Ounianga Kebir (Jens Hering) and western shores; the latter too numerous to count. For example, one sandbank held more than 150 individuals (Fig. 5).

Intensive searches for nests in the fringing vegetation growing in many places on Lake Teli were unsuccessful. We therefore assume that nesting occurs mainly in the dense palm thickets on the shore. On the other lakes of Ounianga Serir, which have extensive reedbeds, only a few or no adults were found. Some of these lakes have a much lower salinity or consist of fresh water (Bocxlaer *et al*. 2011, Schönbrodt 2012, 2014).

In total, we recorded Marbled Teals with chicks on five lakes in the Ounianga area in May 2023 and 2024 (Fig. 1). Based on the counts in May 2023 of *c*.170 adults, nearly 100 young and 600 birds of undefined age, plus an unknown number glimpsed as they disappeared into the reeds, we estimate that there were at least 800 adults and several hundred young at the end of that month. A population of 300–400 breeding pairs in the Ounianga Lakes area is therefore probable. It has to be taken into account that the two largest lakes (Lake Yoa and Lake Teli) could only be surveyed partially and other lakes were not accessible. Thus, the number of breeding pairs may be even higher, as suggested by the 1,000–1,200 adults recorded on Lake Teli in May 2024.

Diet

Almost all Marbled Teals observed feeding rested the mandible on the water surface, the bill half-submerged or the head completely submerged. The reason for this was the presence of thick carpets of brine- or shore-flies of the family Ephydridae concentrated in the shore zones. This seemingly inexhaustible source of protein must surely be one of the reasons for the large numbers of Marbled Teals present in the area. This feeding behaviour, as well as the food source, had already been observed in October, December and January (Schönbrodt 2009, 2012, 2014, Hering 2022). The flies are probably almost exclusively *Haloscatella dichaeta*, a common species in Africa (Schönbrodt 2012, 2014). Excrement samples collected in May 2024 on a sandbank in Lake Teli consisted mainly of fragments of Epyhdridae larvae and pupae (Hering *et al*. 2024). Ephydridae are well known to be a food of Marbled Teal (Iñigo *et al*. 2008). Cape Teal, which is thought to breed here, with pairs observed copulating on Lake Yoa and Lake Teli in May 2023 and 2024, also benefits from this abundant food supply, as do all other waterbird species that use this site during migration and in the boreal winter (Hering 2022).

Figure 3. Marbled Teals *Marmaronetta angustirostris* on the shore at Lake Yoa, Ounianga Kebir, Chad, May 2023 (Jens Hering)

Sarcelles marbrées *Marmaronetta angustirostris* sur la rive du lac Yoa, Ounianga Kebir, Tchad, mai 2023 (Jens Hering)

Figure 4. Female Marbled Teal *Marmaronetta angustirostris* with approximately three-week-old young on Lake Forodone, Ounianga Kebir, Chad, May 2023 (Jens Hering)

Sarcelle marbrée *Marmaronetta angustirostris* femelle avec des jeunes d'environ trois semaines sur le lac Forodone, Ounianga Kebir, Tchad, mai 2023 (Jens Hering)

Interaction with other bird species

No aggressive behaviour was observed towards other waterbird species in the immediate vicinity. Such lack of aggression in Marbled Teal has been noted also by other observers (Navarro-Medina & Robledano-Aymerich 1995). Most frequently observed near Marbled Teals were Cape Teal and occasionally Little Grebe *Tachybaptus ruficollis* and Eurasian Moorhen *Gallinula chloropus*, all possible or confirmed breeders in the area. On Lake Forodone and Lake Teli, Marbled Teal families also consorted with single over-summering male Garganey *Spatula querquedula*, Northern

Figure 5. More than 150 mainly adult Marbled Teals *Marmaronetta angustirostris* on a sandbank in the south-west of Lake Teli, Ounianga Serir, Chad, May 2024 (Jens Hering)

Plus de 150 Sarcelles marbrées *Marmaronetta angustirostris*, principalement adultes, sur un banc de sable au sud-ouest du lac Teli, Ounianga Serir, Tchad, mai 2024 (Jens Hering)

Pintail *Anas acuta* and Northern Shoveler *Spatula clypeata*, and a Eurasian Coot *Fulica atra*. Once, several families showed no visible reaction when an African Wolf *Canis lupaster* ran into the water, approaching to within 20 m. This carnivore, along with Rüppell's Fox *Vulpes rueppellii* and Brown-necked Raven *Corvus ruficollis*, are among possible natural predators of Marbled Teal.

Marbled Teal and humans

The lack of fear of people shown by adult and juvenile Marbled Teals was often striking. In several cases it was possible to approach them to within 20–30 m without triggering any escape behaviour (Fig. 6). This relative fearlessness is certainly due to the lack of hunting. Discussions with local villagers revealed that they have no particular interest in the ducks, though there was a report that, exceptionally, members of the army might shoot a few birds. In addition, the locals probably collect clutches of eggs occasionally and some people catch young to keep in chicken coops. Once we observed children trying to catch ducks by diving, and another time a duckling that was probably caught in this way was brought to us. During the breeding season nests are occasionally destroyed by reed-cutters and grazing animals.

Discussion

Our observations indicate that an important breeding population of Marbled Teals exists in Chad and may have done so for some decades (see Schönbrodt 2014, Hering 2022). Based on observations by Schönbrodt and ourselves, it seems likely that the Marbled Teal shot by Colonel De Barmon on 28 April 1954 at one of the Ounianga Lakes (Dorst & Jouanin 1954) was also a breeding bird. De Barmon is reported to have noted ducks (Marbled Teal and/or Cape Teal?) in February 1953 and their numbers were reported to be about the same in April 1954 (Dorst & Jouanin 1954). It has also previously been speculated that Marbled Teal, along with Cape Teal, may occur at the Ounianga Lakes year-round and may indeed breed there (Dorst & Jouanin 1954, Malbrant & Receveur 1955, Dekeyser & Derivot 1968). The 'ducks' seen on the Ounianga Lakes at the end of April 1956 (Fuchs 1958, P. Fuchs pers. comm. to

Figure 6. Fearlessness of Marbled Teal *Marmaronetta angustirostris* and Cape Teal *Anas capensis* towards an observer, Lake Forodone, Ounianga Kebir, Chad, May 2023 (Jens Hering)

La Sarcelle marbrée *Marmaronetta angustirostris* et le Canard du Cap *Anas capensis* ne montraient aucune peur face à un observateur, lac Forodone, Ounianga Kebir, Tchad, mai 2023 (Jens Hering)

Schönbrodt 2014) were also likely to have been Marbled and/or Cape Teals.

The West African Bird DataBase contains recent records of Marbled Teal from other locations in northern Chad: from just south of Tibesti, at the Ennedi Natural and Cultural Reserve (150 km to the south-east), in the Ouadi Rimé–Ouadi Achim Fauna Reserve (Newby 1979, www.wabdab.org) and, in the boreal spring of 1954 and in September 1957, in the nearby Ennedi Mountains to the east (Niethammer 1955, Kollmannsperger 1958). It remains to be investigated if Marbled Teal also breeds at these other sites in northern and central Chad.

There seems to be just a single previous breeding record of Marbled Teal from the Afrotropical region, in Senegal (Dupuy & Sylla 1981). Otherwise the nearest breeding populations are in northern and north-western Africa, more than 1,500 km away in Libya (Etayeb *et al.* 2014, Isenmann *et al.* 2016), Tunisia (Isenmann *et al.* 2005), Algeria (Isenmann & Moali 2010), Morocco (Thévenot *et al.* 2003) and Western Sahara (Aourir *et al.* 2016, Bergier *et al.* 2017).

Together with the southern European breeding populations, which are based mainly on releases of captive-reared birds (e.g., Botella & Pérez-García 2020), the western Marbled Teal population is currently estimated at 7,500–10,000 individuals (Salvador *et al.* 2023). In contrast, the situation in the eastern Mediterranean is deeply concerning, as it is estimated to comprise as few as 150–250 individuals (Salvador *et al.* 2023). In this context, the newly discovered population reported here of several hundred breeding pairs assumes particular importance. Moreover, the species currently does not seem to be threatened, given the lack of hunting and the absence of significant negative habitat pressures. By contrast, habitat destruction and hunting have significant impacts on the other populations (e.g. Green *et al.* 2002, Brochet *et al.* 2016, 2019), justifying the current conservation classification of Marbled Teal as Near Threatened (BirdLife International 2023).

A more detailed survey of the breeding population in the Ounianga Lakes area in May–July would provide a clearer picture of its total size and status. Given the extent and complex configuration of some of the lakes, the use of a drone and/or a boat would be helpful. The greatest challenge is probably that the northern and western shores of the species' most important known breeding site in the region, Lake Teli, are effectively inaccessible by land.

Further searches might also reveal whether there are other breeding sites for Marbled Teal in northern Chad. Lake Teguedei (18°51'39.86"N 21°23'4.63"E), west of Ounianga, should be investigated, although no Marbled Teals were found there on a brief visit on 14 May 2024, perhaps due to the lake's extremely high salinity. The few lakes in the Ennedi Mountains and surrounding areas are more or less temporary and unlikely to provide suitable breeding habitat. A visit to the Bagada Lake area (17°54'52.18"N 21°40'11.91"E), north of the Ennedi Mountains, on 15 May 2024 did not reveal any suitable breeding sites at the remaining waterbodies due to a lack of shoreline vegetation. In contrast, Lake Anoa (17°46'47.09"N 20°50'37.10"E), at the north-western end of this mountain range, suggested the possibility of breeding given a dense stand of *Phragmites*, but the remaining area of a few hundred m^2 of open water seen on 17 May 2024 was insufficient.

It remains to be clarified whether the Marbled Teals at Ounianga are sedentary or partly nomadic, like northern populations (e.g. Gilissen *et al.* 2002, Botella *et al.* 2022). A project using satellite transmitters, or other suitable technology, would be useful in this regard.

It is possible that this is a well-established, isolated and probably resident population. Low-coverage genomic sequencing has revealed significant albeit relatively slight differences between populations from Spain and Iraq, while there is also a clear differentiation in mtDNA COI haplotypes between these two populations (Ortega *et al.* unpubl. data in Salvador *et al.* 2023). Given these findings, it is perhaps doubtful that Marbled Teals from breeding areas in North Africa and the Mediterranean region overwinter at Ounianga, but more genetic data might resolve this open question. The species' provenance in other areas in Chad and in adjacent countries (e.g. Newby 1979, Green 1993, Scott & Rose 1996, Borrow & Demey 2014, Mallon *et al.* 2015) should also be investigated.

The positive effects of the seemingly inexhaustible dipteran food supply at the hypersaline lakes, as well as the contending factors that limit birdlife here, including extreme temperatures above 60°C and the most violent sandstorms known in the Sahara (S. Kröpelin pers. comm.), are additional reasons for detailed investigations within the framework of a large-scale research project. That this ornithologically poorly unexplored area may harbour further surprises is suggested by the discovery of a remarkably large breeding population of short-winged Eurasian Reed Warblers (*Acrocephalus scirpaceus cinnamomeus*?) and the northernmost breeding record of Black Crake *Zapornia flavirostra* in Africa (Hering *et al.* unpubl.). Designation of the area as a Ramsar Site, Important Bird and Biodiversity Area (IBA) and Faunal Reserve would be justified solely on the basis of the breeding Marbled Teals.

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