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## Population Fluctuation and Diurnal Time Budgeting of White-Headed Duck (*Oxyura Leucocephala*) During Winter at Garaet Hadj Tahar (Skikda, North East Algerian)

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### Cover Page Footnote

We are grateful to all volunteers who participate to sampling during study period. Also, we thanks all riparian of Garaet Hadj Tahar. The authors thanks referees who performed the first version of this manuscript.

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## POPULATION FLUCTUATION AND DIURNAL TIME BUDGETING OF WHITE-HEADED DUCK (*OXYURA LEUCOCEPHALA*) DURING WINTER AT GARAET HADJ TAHAR (SKIKDA, NORTH EAST ALGERIAN)

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### ABSTRACT

This study was focused on the ecology and behavior of the White-headed Duck (*Oxyura leucocephala*) at Garaet Hadj Tahar (Guerbes-Sanhadja, North East of Algeria). Sampling was carried out during two wintering seasons (2017-2018 and 2018-2019). High number of this duck was recorded in 2018/19 (350 individuals). We observed two *Oxyura* population, the first sedentary, and the second, hosted the Garaet during the wintering season. Diurnal time budget was dominated by the comfort activities the sleeping with a rate of 39.13%. Following by swimming (37.76%), feeding (17.59%) grooming (4.58%), courtship ritual (0.56%) and flying (0.38%). The feeding of white-headed duck is done exclusively by diving. Beside, this waterbird associated between Feeding by diving and grooming in order to minimized energy. The accessory activities such as: courtship ritual, flying were done by this duck at the end of wintering. This results confirm that Garaet Hadj Tahar is considered as wintering site for this threatened species. Biological Conservation plan (BCP) must be applied at level of this wetland in order to manage bioresources and threatened waterbirds.

**Keywords:** White-headed duck, time budget, Garaet Hadj Tahar, ecology, behavior.

### INTRODUCTION

White-headed Duck (*Oxyura leucocephala*) is the only *Oxyura* ducks which is native of the Palaearctic (Green and Hunter 1996; Sanchez et al., 2000). This waterbirds is globally threatened, classified as "Endangered" by IUCN (Groombridge, 1993), Birdlife International (2004), European Union Directive on the Conservation of Wild Birds, and CITES convention (Convention on International Trade in Endangered Species). The number of individuals at global scale was probably over 100.000 at the start of the 20th century, dropping to around 20.000 in 1996 (Green and Hunter, 1996), with global population decreased to around 8.000-13.000 individuals (Li and Mundkur, 2003). Competition and

hybridization with Ruddy Duck (*Oxyura jamaicensis*) is the main long-term threat to the survival of this species (Green and Hunter, 1996; Hughes et al., 2006; Munoz-Fuentes et al., 2007). Climate change can also be the cause of decreasing numbers. Many lakes in the Central Asia dried up during the last few years (Hughes et al., 1999). This duck is also hunted illegally during the breeding season. Hunting and egg collecting is the most likely reason for the specie's extinction in some countries (Hughes et al., 2006). In the Mediterranean basin, the extinction of several populations in the 19th and 20th centuries left an area very fragmented and occupied by often small populations (Houhamdi et al., 2009).

This waterbird is observed regularly in 26 countries and accidentally in 22 others (Hughes et al., 2006). Algeria

is one of the seven countries with a significant population throughout the year (Isenmann and Moali, 2000). The species is recorded in the wetlands of the eastern coast of the country, in particular at the eastern region of El Kala (Ledant and Vandijk, 1987; Lazli et al., 2011; Chettibi et al., 2013; Meziane et al., 2014), as well as on the Guerbes-Sanhadja complex (Metallaoui et al., 2009) and in eastern highlands wetland (Houhamdi et al., 2009; Seddik et al., 2012). Although the Guerbes-Sanhadja eco complex was the third breeding site for this duck in Algeria, after Lac Tonga and Lac des Oiseaux. The number of nesting was not known and only one nest was recorded in 1991 (Fishpool and Evans, 2001) and three in 2006 (Metallaoui and Houhamdi, 2008).

The aim of this study was monitoring the White-headed Duck population in Garaet Hadj Tahar (wetland of northeast Algeria). We have fixed three main objectives, 1) describing population fluctuation of this waterbird during two winters (2017/18 and 2018/19), 2) comparing the population number of this waterbird in relation to previous data recorded in this wetland, 3) assessing diurnal time budgeting of this duck.

## **MATERIAL AND METHODS**

### ***Study Area***

Garaet Hadj-Tahar (36 ° 51'N 07 ° 15'E; 200 m above sea level) is 112 ha freshwater wetland located in Guerbes-Sanhadja eco-complex (Western Numidia, north-east Algeria) (Bara et al, 2020). The main lithological units are essentially formed by aeolian and alluvial deposits (Abdi et al., 2016). The average depth of the water body varies between 0.80 and 1.20 m, increasing following torrential rains. Garaet Hadj Tahar bringing in Numidia as trophic resources storage in particularly gastropods (Planorbis planorbis) which plays a key role in

waterbirds breeding success (Atoussi et al., 2013; Amor Abda et al., 2015).

### ***Data Sampling***

The current study was done during two consecutive wintering seasons (2017/18 and 2018/19), twice during each calendar month between September and April. This White-headed Duck counts were done in early morning from three fixed observation points (three volunteers per sampling point achieved counting) using Konuspot ornithological telescope (20x60). The duration of observation was 15 min (Blondel, 1995). When ducks were near the observation point and their number did not exceed 200 individuals, ducks were counted individually. If group size was more than 200 individuals, visual estimations were carried out by dividing the visual field into several strips, counting ducks in a single strip and extrapolating the number to the whole population (Blondel, 1995; Bara and Segura, 2019). For diurnal time budgeting, individual bird was Scanned (Instantaneous scan sampling) (Altmann, 1974; Losito et al., 1989; Merzoug et al., 2014) for 15 minutes every hour between 8 am and 4 pm and activities measured as sleeping, swimming, feeding (either by diving or on the surface), grooming, flying and courtship. Average time spent on each activity was calculated and the proportion of the time spent on each activity calculated against the average of the time used in observation. All these activities were recorded according to mimetic situation of the duck during the observation. Sleeping when duck is in stillness and closing eyes. Swimming when duck is in movement on the surface. Feeding when duck is both in movement and eating. Grooming when duck is cleaning feathers. Flying when duck is leaving the surface of wetland due to disturbance. Courtship ritual when male/female ducks are in sexual attraction by dancing, vocalizations, sound

production and displays of beauty or strength.

### ***Statistical Analysis***

Normality of data distribution was tested. Then, we have applied two non-parametric tests, first Wilcoxon-Mann-Whitney in order to compare between 2017/18 and 2018/19 waterbirds census. Second, Kruskal-Wallis test in order to compare between different part of winter (early, mid and end winter). PCA analysis was performed to test the relationship between the seven activities. Significant level  $\alpha$  is 5%. Statistical tests were done using XLSTAT (2014.5.03).

## **RESULTS**

### ***Population fluctuation***

The census of White-headed Duck at Garaet Hadj Tahar showing a gradual increase in numbers sharply increases. Wintering population start appearing in September with a gradual increasing in numbers. The peak of duck number was noted at mid-winter (167 in January 2017/18 and 350 in March 2018/19), then population starts declining till April. We noted a significant variation between different part of winter in number of this duck ( $K= 14.79$ ,  $p\text{-value}= 0.001$ ). But, no inter annual (2017/18 and 2018/19) significant fluctuations was recorded ( $N= 16$ ,  $U= 131$ ,  $p\text{-value}= 0.925$ ). The first arrivals taking place from December 2017/18 and from the first half of January 2018/19. A from these dates to reach 167 individuals during the second ten days of January of the 2017-2018 season (Figure 1). The numbers are 39 individuals at the beginning of March. In 2018/19 we recorded maximum numbers of this duck (350 individuals) followed by a collapse until the end of the same month (Figure 1). But, at the end of March we noted only fifteen breeding pairs. Figure 2 represent the census data of White-headed Duck at this Garaet during the years 2008, 2009,

2011, 2014 and 2015. The maximum number of this duck was recorded during the wintering season 2015 (350 individuals). While in 2008, Garaet Hadj Tahar recovering the minimum number of this duck (only 67 individuals).

### ***Diurnal time budgeting***

White-headed Duck spent major part of its diurnal time in sleeping (39.13%) and swimming (37.76%). Feeding (17.59%) and grooming (4.58%) utilized appreciable part of the time while flying (0.38%) and courtship ritual (0.56%) took only a minor proportion the time (Figure 3).

Sleeping remained the main activity throughout winters with maximum recorded for the first ten days of October (46.47%) and February (48.00%) and lowest at the beginning of December and April. Swimming, second activity consuming more of the time, but the time spent in this activity fluctuated irregularly with peaks appearing in April (21.82%) and November (45.00%). Peak feeding, mainly by diving, was recorded in April (42.30%) and surface feeding was observed only in September (3.84%), when the depth of the water did not exceed 0.50 m. Time devoted to grooming was higher at the beginning of September (8.13%) and end of April (8.37%) with some second half of February (0.92%). Courtship ritual was observed in April (in order to characterized breeding starting) and flying was noted in reply to disturbances, hunting or on noticing some raptors (Figure 4).

PCA revealed 65.36 % of information (Figure 5). The F1 axes separated between two modality of this duck feeding. We noted that feeding in surface was associated to comfort activity (in this case sleeping activity). In return, feeding by diving was associated to grooming and the duck minimized energy by two activities. F2 axis separated

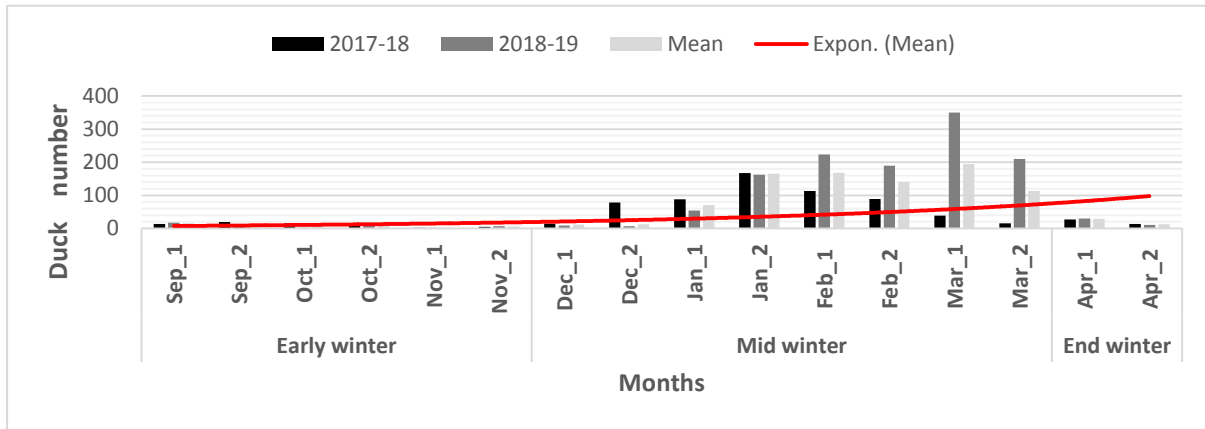


Figure 1: Population fluctuation of Whit-headed Duck (*Oxyura leucocephala*) at Garaet Hadj Tahar during different calendar months (2018-19 and 2019-20 winters).

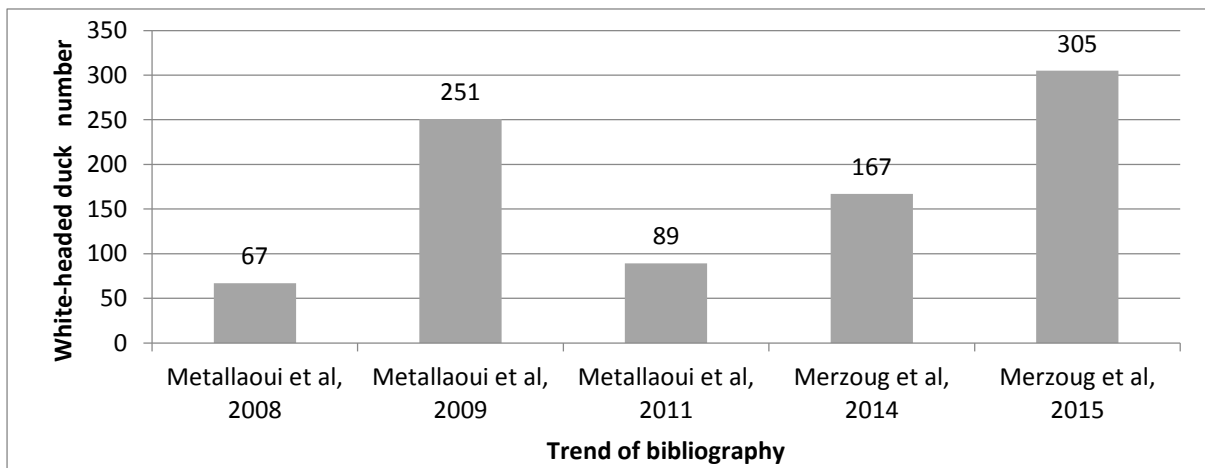


Figure 2: Population fluctuation of White-headed Duck (*Oxyura leucocephala*) at Garaet Hadj Tahar during last years (data from Mettalaoui et al., 2008, 2009, 2011; and Merzoug et al., 2014, 2015).

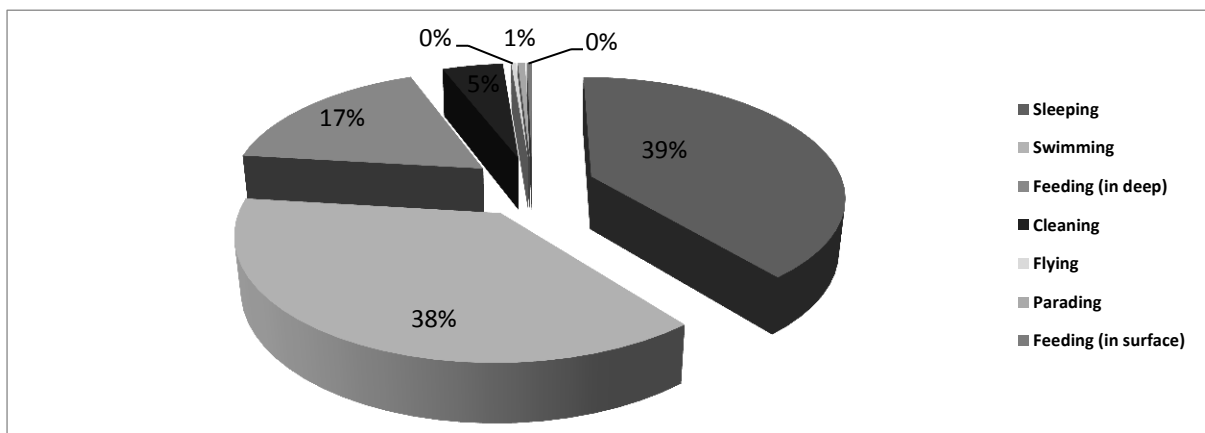


Figure 3: Diurnal time budget of White-headed Duck (*Oxyura leucocephala*) at Garaet Hadj Tahar during wintering period.

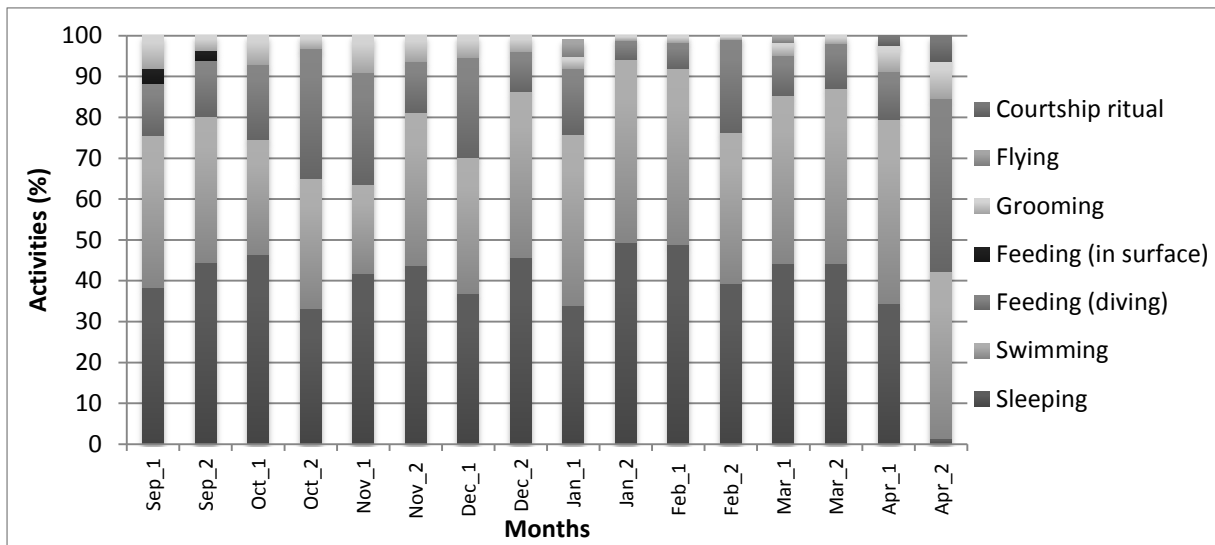


Figure 4: Diurnal time budget of White-headed Duck (*Oxyura leucocephala*) at Garaet Hadj Tahar during calendar months of the wintering period.

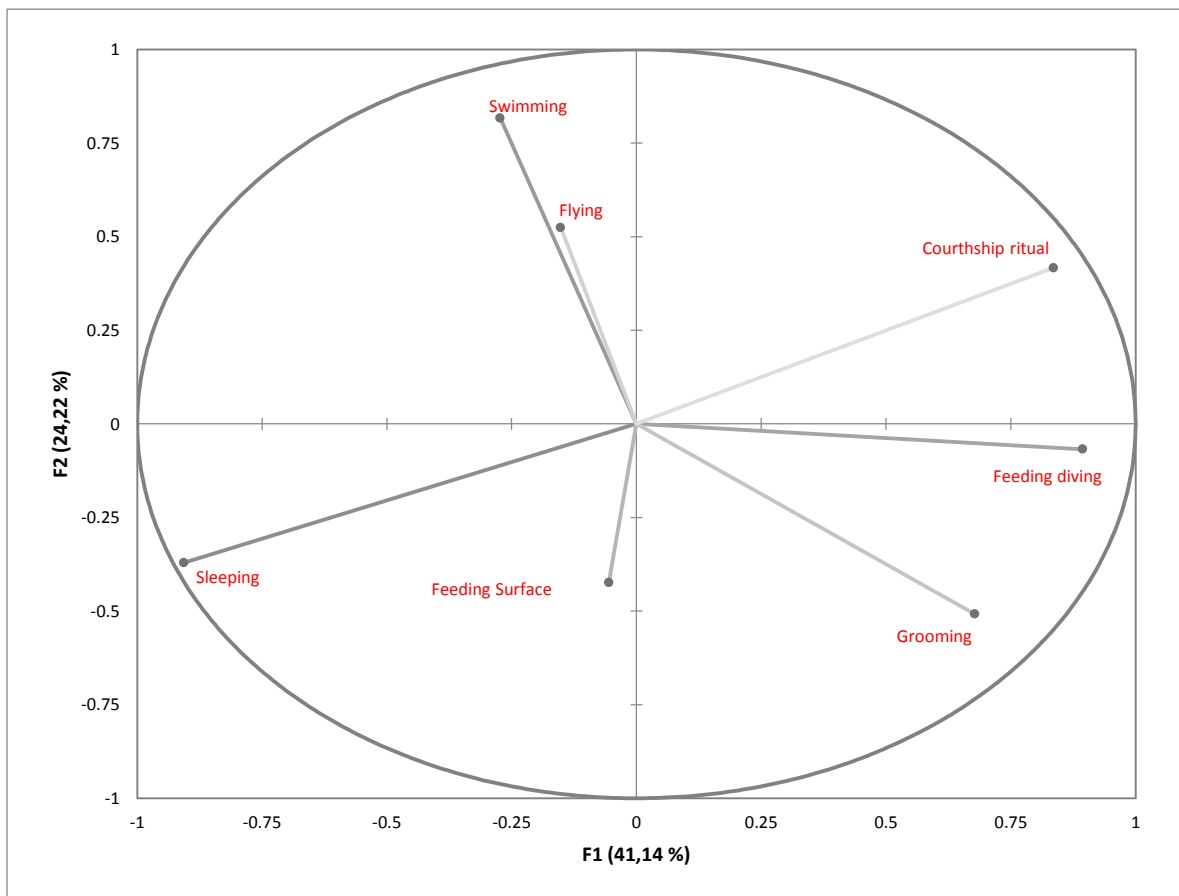


Figure 5: PCA map of the diurnal time budget activities of the White-headed Duck at Garaet Hadj Tahar (Guerbes Sanhadja eco complex). F1 axis eigenvalue= 2.88, variability= 41.14%.

between main activities (feeding, sleeping and grooming) and accessory activities. These accessory activities (swimming, flying and courtship ritual) were done at the end of wintering period (Figure 5).

## DISCUSSION

Since first record of Algerian White-headed Duck population in the mid-19th century, this waterbird has retained its status as a winter visitors and a breeder. This population is known as resident in the northeast wetlands of Algeria, such as El Kala National Park (Lazli et al., 2011; Chettibi et al., 2013), Boussedra Swamp (Meziane et al., 2014) and Garaet Hadj Tahar (Metallaoui and Houhamdi, 2008; Bara and Segura, 2019).

Our study reveal increase in numbers of this duck compared to that recorded for previous years, going from 67 individuals in 2006 to 350 in 2019 (which represents 4% of the world population). This increasing in numbers indicated the effect of rainfall on the water level of the Garaet. Decreasing in numbers at the end of season indicated the departure wintering ducks to their breeding quarters. Also, we can assumed that this increasing in numbers is due to several conservation programs (i.e. conservation program in Spain). In Algeria, wintering population of white-headed duck native from Spain increased from 22 individuals in 1977 to 786 in 1992, then 1453 in 1999, 2300 in January 2000 and 4480 in September 2000 (Torres Esquivias, 2000; Hughes et al., 2006).

Sleeping activity was compulsory for saving energy losses. This represented the main comfort activities of Anatidae that saves the maximum amount of energy (Tamisier et al., 2003). Our data were similar to those reported by Metallaoui et al. (2009) for Garaet Hadj Tahar, Chettibi et al. (2013) for Lake Tonga, and Meziane et al. (2014) in Boussedra swamp. Furthermore, we noted that diurnal time budget of *Oxyura* spp. in Garaet Hadj

Tahar was similar to those found on Lake Burdur in Turkey (Green et al., 1999). Nevertheless, we noted a significant difference in time budget comparing to White-headed Duck of high plains of Oum el Bouaghi in eastern Algeria (Houhamdi et al., 2009). Indeed, time budget of the *Oxyura* spp. dominated by sleeping, compensate energy losses. It is also a way of responding to the climatic conditions of the region as well as a preparation for pre-nuptial migration.

The change in feeding methods (either by diving or on surface) probably reflects a combination of several factors, such as water depth, the richness of trophic resources, distribution and food competition between individuals (Atiénzar et al., 2012; Lazli et al., 2014). Our results show that feeding of *Oxyura* spp. was dominated by diving, besides this feeding on surface was only required during September. We assumed that the diet is based on the larvae of benthic Chironomids. According to Sanchez et al. (2000) the distribution of this duck is linked to the distribution of Chironomids in the wetland. Ducks did not visit wetlands with a biomass of less than 1.5 g/m<sup>2</sup> Chironomids, which corresponds to a density of less than 15,000 per Chironomids. This dependence on Chironomids has been shown in Lake Burdur in Turkey (Green et al., 1999). These benthic insect are relatively tolerant to eutrophication of water. Which makes the White-headed Duck more tolerant to eutrophic areas than many other waterbirds (e.g., those that depend on submerged macrophyte). Foraging was recorded upon occupation of the site by the White-headed Duck. Showing a low values at the start of wintering which have continued to increase to reach a maximum value in April. This probably means fattening in preparation for the breeding season. This activity is often nocturnal in all Anatidae (Tamisier et al., 2003). According to Green et al. (1999), White-headed Duck spent 92% of its night time foraging. This



may be due to lack of disturbance, avoidance of diurnal predators, thermoregulation, and greater food availability (Tamisier et al., 2003).

Grooming has been observed throughout the season but it is important especially at the beginning and at the end of the season (September and April). Grooming has two function: cleaning the plumage and removing ectoparasites and removing the feathers from the body during molting. Flying is only observed during the attacks of the Marsh Harriers *Circus aeruginosus* or when poachers or Cattle enter the water. Aggressive interactions between individuals was vacant in Garaet Hadj Tahar, however many studies have pointed out that this behavior is noted when trophic resources are limited.

## CONCLUSION

In conclusion, present results highlight Algeria's role as one of the important wintering areas for the White-headed Duck (a globally threatened species) in the Western Palearctic. Garaet Hadj Tahar (Guerbes-Sanhadja wetland complex) hosts most of *Oxyura* spp. population in Algeria, with Lake Tonga (El Kala National Park) and the Boussehra swamp. Also, Garaet Hadj Tahar hosts two different populations, one sedentary (about fifteen pairs) and another wintering (with a maximum of 350 individuals). This could be explained by the availability of food resources at Garaet Hadj Tahar.

Despite conservation status of the Garaet, which hosting many threatened species such as white-headed duck. This wetland faces conservation problems with uncontrolled expansion of agriculture that requires intensive water pumping. In addition, poaching and unregulated hunting influence the wintering and nesting of these waterbirds populations.

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## CONFLICT OF INTEREST

Authors of this article declare that there is no conflict of interest.

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