

New Data on the Staging and Winter Behavior of the Red-Crested Pochard *Netta rufina* in the Lac des Oiseaux (North-Eastern Algeria)

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ABSTRACT

The Lac des Oiseaux in the utmost northeast of Algeria receives a significant migratory aquatic avifauna every year, where adequate circumstances cover its winter requirements. Over the years, this lake, which has been listed as a Ramsar site since 1999, has been the winter home for varying species (11- 12) of the Anatidae family. During the winter of 2023, a species was spotted sighting only once in the study post. This species is the red-crested pochard, *Netta rufina*. It commonly frequents the wetlands in the interior of the country, with relatively low numbers. While, it ordinarily persists in humid zones in the interior of the country, with relatively fading abundances. Pending its stay at Bird Lake, the species number was regularly counted upon noticing a maximum of 103 individuals, including 61 males and 41 females throughout January. This population is situated at the waist-deep of the lake and in its southwest part, away from the turmoil and near the helophytes (cattails of Typhas and Bulrushes). The study of diurnal activity budgets covering 312 hours (8h/ day) showed that sleeping is the most prevalent activity in both sexes (49%), followed by swimming (23%) and feeding, while grooming and displaying exemplify only 9%. Whereas, activities of theft and antagonism recorded the lowest rates, accounting for 1% of the time budget. The results acquired assert the value of this wetland as a wintering position and as a storage location for plentiful species of Anatidae, implicating scarce ones as the species studied.

INTRODUCTION

The greatest overwintering strategies, as well as the resources offered by the winter quarters to migrating birds throughout this period, have a major feature in the venereal success of the latter on the nesting positions (Krapu, 1981; Ankney *et al.*, 1991; Tamisier *et al.*, 1995).

Appropriate knowledge of the ecology of species, their interactions with the environment, and in particular their ethology is considered essential in order to define the

functioning and the ecological role that a host site can play for them (**Hepworth & Hamilton, 2001**).

The behavior of species is mostly evaluated by measuring the intensity of each of their activities over a day on the one hand and throughout the period of their winter occupation of the location on the other hand (**Tamisier, 1972**).

In Algeria, despite the several studies carried out, particularly in the northeast area, on the eco- ethology of aquatic avifauna (**Houhamdi & Samraoui, 2001, 2002, 2008; Aissaoui et al., 2009; Chettibi et al., 2013, 2019; Ziane et al., 2016; Bouchaala et al., 2017; El-Afri, 2017; Bendjedid et al., 2020; Saidi et al., 2022**), the wintering strategies as well as the diurnal behavior of diving ducks remain little unknown (**Atoussi, 2008; Houhamdi & Samraoui, 2008**).

Although the red-crested pochard *Netta rufinai*s is one of the diving ducks deemed rare in Algeria (**Isenmann and Moali, 2000**), in compliance with the latest ranking of the IUCN relative to the red list of threatened animal species, the red-crested pochard occupies the status of "least concern" at the global level of IUCN (**2016**). Yet, it is considered as vulnerable in Morocco (**El-Agbani & Qninba, 2011**) and has almost disappeared in Algeria (**Ledant et al., 1981; Isenmann & Moali, 2000**).

Previously, the species nested at Lake Halloula «the plains of Mitidja» before it dried up (**Heim De Balsac & Mayaud, 1962; Chalabi & Belhadj, 1995**) as well as at Lake Fetzara and in the Constantinois region in 1913 to the East of Algeria (**Ledant et al., 1981**).

Currently, the red-crested pochard has been observed in various locations in the region of Oranie and that of the highlands, with relatively low numbers; notwithstanding, proofs of its nesting has been reported by **Oudihat et al., (2017)** at Dayet El-Ferd (700 ha) in the wilaya of Tlemcen (north-west of Algeria). Thus, nearly 500 individuals have been counted in the wintering period. The species mainly frequents chotts, sebkhas, saltworks and dams (**Oudihat et al., 2017**). In the East of the country, the species was reported for the first time (1 pair) in the Garaet Hadj-Tahar wetland (Guerbes-Sanhadja complex, Skikda wilaya) by **Metallaoui and Houhamdi (2008)** and 9 individuals at Lac des Oiseaux (study site) by **Houhamdi (2020)**.

This lake, situated in the wilaya of El-Tarf and fraction of the major complex of wetlands in Algeria, is home to distinct species of water birds in winter, mainly Anatidae, Scolopacidae, Rallidae, Podicipididae & Ardeidae (**Boubekeur et al., 2020**).

The Anatidae family is the most represented with 10 species (**Ziane et al., 2016; Boubekeur et al., 2020**). In the year 2013, the lake sheltered for the first time the prolonged stay of the red-crested pochard as wintering (**Personal observation**).

The target of this work was to assess the count of the red-crested pochard net at the level of the Lake of Birds, estimate its wintering strategy and its phenology by following its quotidian balance and its distribution on the lake while highlighting the role of this lake as a wintering area for Anatidae species that is rare in Algeria on the other hand.

MATERIALS AND METHODS

1. Site description

The Birds Lake also called "Garâat Ettouyour" (36° 47'N 08° 7'E) is a freshwater pond classified as Ramsar since 1999 and a piece of the complex of wetlands in the wilaya of El Tarf, as postulated in the study of **Boubekeur *et al.* (2020)**. It covers an area of 70 hectares in the middle of winter which can decrease to 40 hectares during the dry period. The lake has a depth of about 2.5 meters and a deposit of organic matter of up to 20cm, as recorded in the work of **Samraoui *et al.* (1992)**.

The network hydrographic of the lake depends basically on weather conditions (**Houhamdi & Samraoui, 2002**); it is restricted to a few streams, torrential in winter and dry most of the year (Fig. 1) in addition to being fed by groundwater (**Samraoui *et al.*, 1992; Houhamdi & Samraoui, 2002**).

Regardless of its small size, it is considered a sanctuary for more than 10,000 birds per year (**Boumezbeur, 1993; Ziane *et al.*, 2016**). Additionally, it shelters the nesting of numerous protected species (**Photo1**), as for instance, the ferruginous duck *Aythya nyroca*, the western swamphen *Porphyrio porphyrio* and the white-headed duck *Oxyura leucocephala* (**Houhamdi & Samraoui, 2002**).

The periphery of this limnic ecosystem is frequented by a significant mammalian fauna, viz. the jackal *Canis aureus*, fox *Vulpes vulpes*, hedgehog *Atelerix algirus* and the wild boar *Sus scrofa* (**Maazi, 1992; Ziane, 1999**). Furthermore, the Mongoose *Herpestes ichneumon* was detected (**Personal observation**).

The species of the lake's aquatic flora have morphological similarities although they belong to diverse varieties, such as *Typha angustifolia*, *Ranunculus baudotii*, *Nymphaea alba*, *Sporobolus maritimus* and *Myriophyllum spicatum*, with some *Cyperus aristatus* spots (**DGDF, 2003**).

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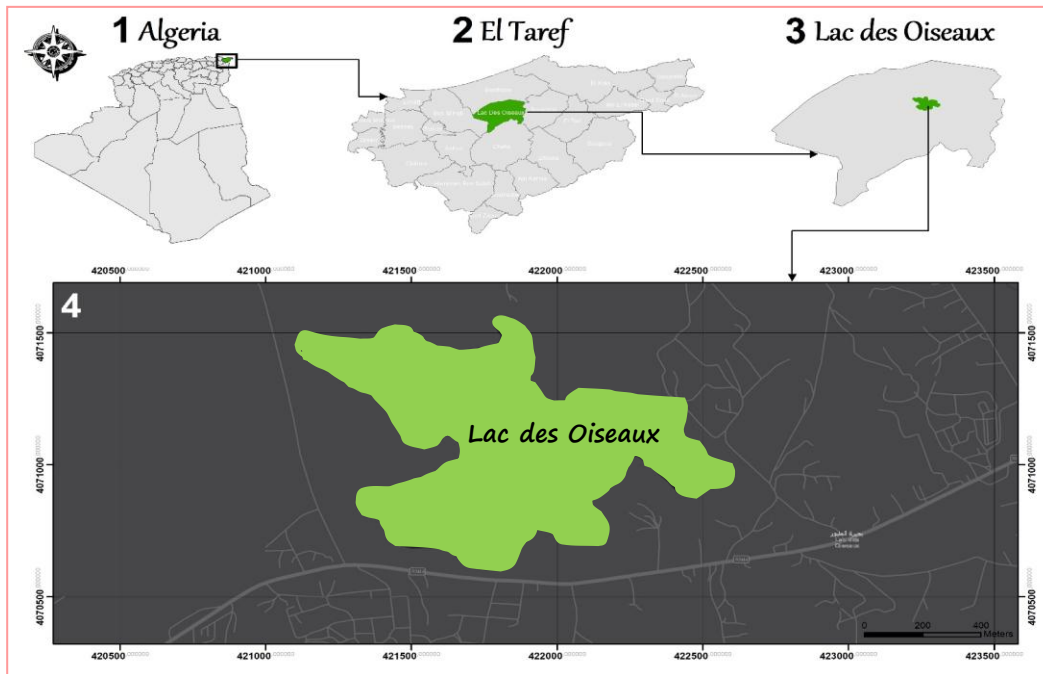


Fig. 1. Geographical location of the “Lac des Oiseaux” study site (BAALIA, 2023)



Photo 1. General view of the Lac des Oiseaux during the wintering period (BAALIA, 2023)

2. Methods

The daily oversight of the red pochard *Netta rufinawas* was carried out from January 3, 2023 till February 10, 2023, which represents the date of the species' departure

from the study site. Due to the scarcity of the species' roosting during this time, we conducted daily outings to count the numbers, monitor their movements, and identify their distinct activities.

The census was done via a direct observation of the species using a telescope (Kowa, TSN-82/M) with magnification of 20- 60 times, and this was done from two observation points.

For a valid estimation of the population size, we adopted the individual count method since the population density is modest, and the surface area of the lake is quite small. We were thus capable of covering all the fractions of the site where the red-crested pochard was found. This division was reported in a real way on the map of the lake, which was divided into sectors.

For analyzing the activity budgets, we counted 312 hours of observations over 39 successive days. The data were collected during the day from 8a.m. to 4p.m. We recorded the development of 7 daily activities practiced by the wintering individuals: food, rest and toilet and other behaviors were noted as swimming, flight, parade and inter and intra specific relations "antagonism"

RESULTS

1. Population «count» and phenology

The red-crested pochard resorts to the Lac des Oiseaux on the third day of January with a population of 23 individuals and dwells there until mid-February (Fig. 2). The number increases extremely rapidly to reach the threshold of 103 individuals over the second week of January, recording numbers that fluctuate between 50 and 100 individuals. Ultimately, in January, the number drops to 20 individuals, who leave the scene at the beginning of February, with the exception of two individuals whose stay extended till day 9 of the same month before leaving the scene once more.

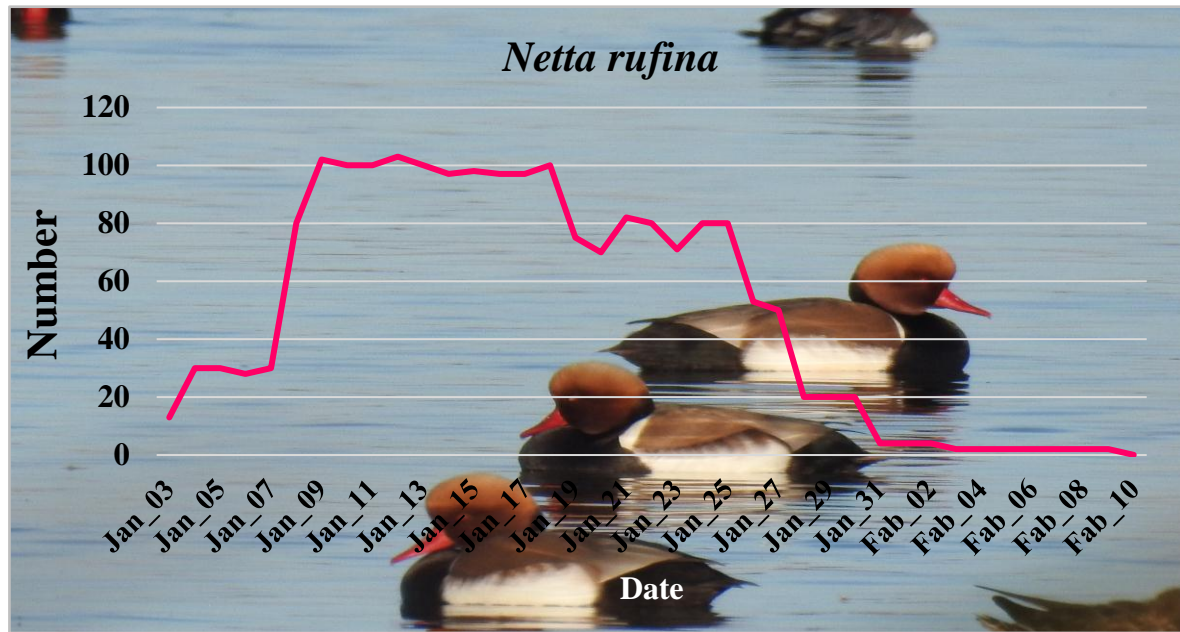


Fig.2. Daily variation in numbers of red pochard at the level of the Lac des Oiseaux

2. Demographic structure of the population

Through the monitoring period of the red pochard, the location hosted 104 adult individuals, including 63 males and 41 females (Fig. 3).

On the threshold of monitoring, the presence of 8 males and 5 females was on record; the number progressively increased for both sexes till it reached a peak of 63 males and 41 females over the second week of January. These values remained practically stable throughout, over the month of January, then began to decrease until reaching a single pair, with the latter leaving the lake at the end of the monitoring period (Fig.4).

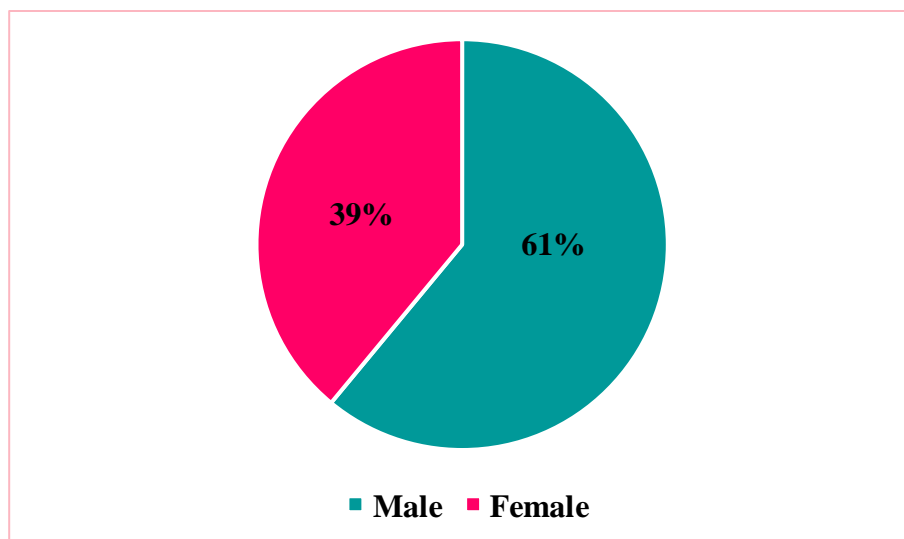


Fig. 3. Sex ratio of red- crested pochard *Netta rufina* at the Lac des Oiseaux

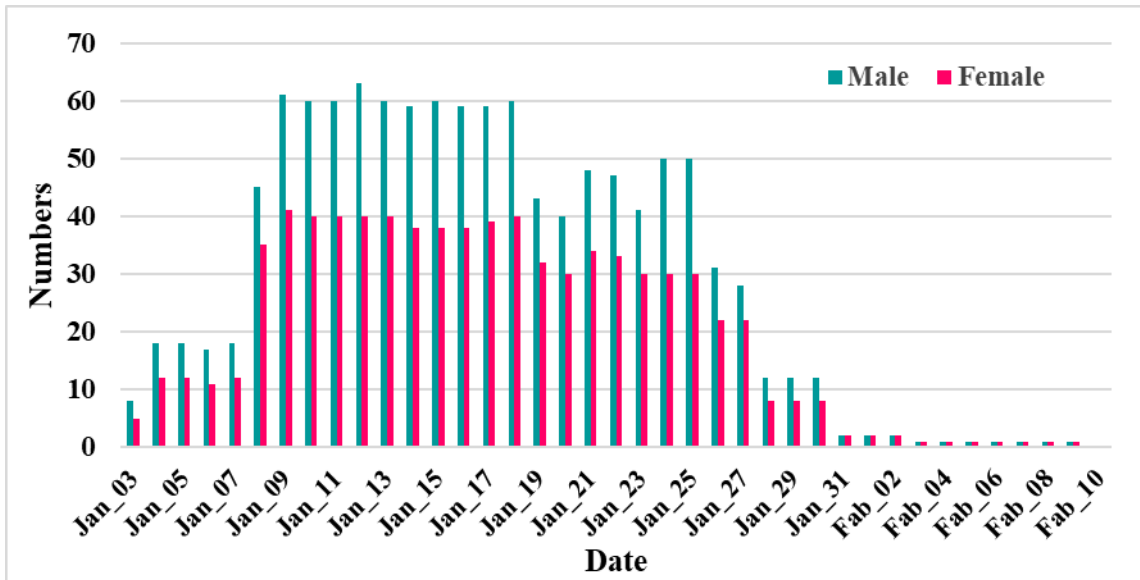


Fig. 4. Changes in number of males and females of red-crested pochard during its stay at Lac des oiseaux

3. Spatio-temporal distribution on the site

The distribution of red pochards on the lake over the day is mutable. It is commonly found in pairs or groups, seldom alone, and mixes readily with other Anatidae species, particularly shovelers, Eurasian ducks, and sometimes Eurasian coots. As soon as it reached the region, the red-crested pochard population assembled to the southeast of the Lac des Oiseaux. During the day, it began to spread over the whole site, going across the southwest to the center and a little less to the west. Eventually, the individuals return to their initial location in the southeast. Generally, the red pochard favors the southeast side and the center of the lake, where the highest numbers were recorded during the study period (Fig.5).

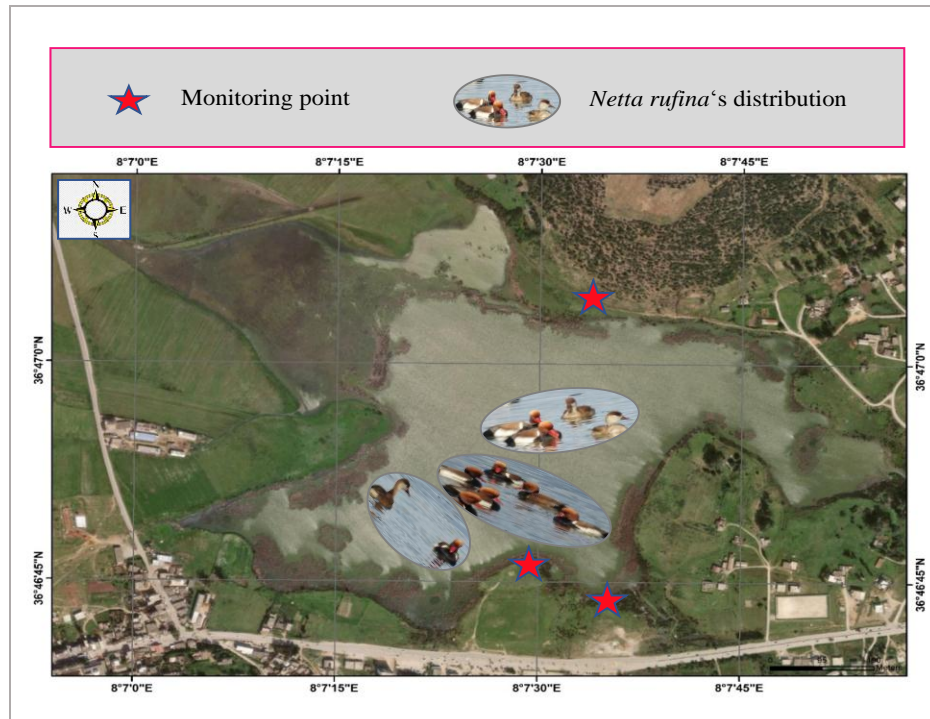


Fig. 5. Spatial distribution map of the red pochard *Netta rufina* at the level of the Lac des Oiseaux

4. Behavioral monitoring « activity rhythm »

Analysis of the results of the diurnal activity rhythms of the red-crested pochard at the Lac des Oiseaux level displays that sleep (extreme recovery status characterized by the head turned and placed on the back with the bill slipped down the scapulars (Photo 2)) is the prime activity skilled by this duck with a percentage of 49%, followed by swimming with 23%, while feeding, grooming, and courtship represented 9%. Theft and antagonism have the lowest rates, representing 1% of the time spent on activities on a daily basis (Fig. 6).

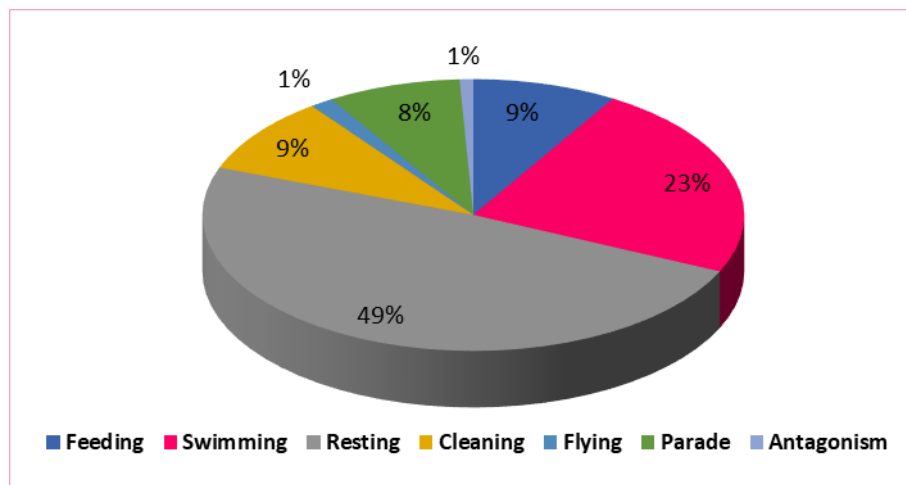


Fig. 6. Overall summary of the daily activities of the Red-crested Pochard during its stay at Lac des Oiseaux

The monitoring of the weekly growth of the activity rhythms of the red pochard at the grade of the Lac des Oiseaux exposes an obvious dominance of comfort activity (rest) throughout its winter period (Fig. 7 & Photo 2); the highest sleep rates were recorded during the first week of the follow-up (50% maximum). The movement activity (swimming) occupied a quarter of the time (25%) during the entire study interval. Foraging duration and plumage maintenance fluctuated between a minimum of 5% and a maximum of 9%; courtship activity recorded a gradual growth rate between 2% and 8% at the end of the position, while theft and antagonism showed extremely fading values that do not exceed 1% of the time during the day.

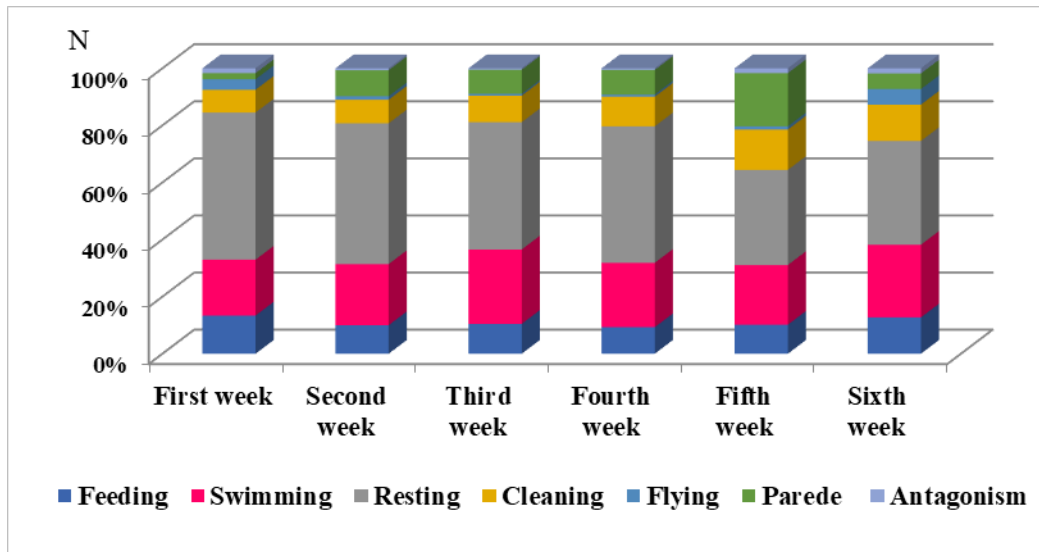


Fig. 7. Weekly evolution of the diurnal activity rhythms of the red-crested pochard at the level of the Lac des Oiseaux



Photo 2. The 7- daytime activities practiced by the red-crested pochard *Netta Rufina* at the level of the Lac des Oiseaux during the wintering period “1 Sleep; 2 Swimming;3 Feeding;4 Parrying; 5 Grooming;6 Antagonism, and 7 Flying” (BAALIA, 2023)

The distinctions during the day are registered in Fig. (8); comfort predominates for roughly the entire follow-up period; its value alters from duration of 5 hours at the start of parking to 21 minutes at the end of parking. The time spent on food was 3 hours the first week; afterwards, it decreased to 30 minutes during the last week.

Concerning grooming and parrying, it was noted that, during the fourth week of parking, their extreme values were respectively 1h28 for the first activity and 1h71 for the second, theft and antagonism are incidental activities, the allotted time of which does not exceed 20 minutes during the whole wintering period of the tufted duck.

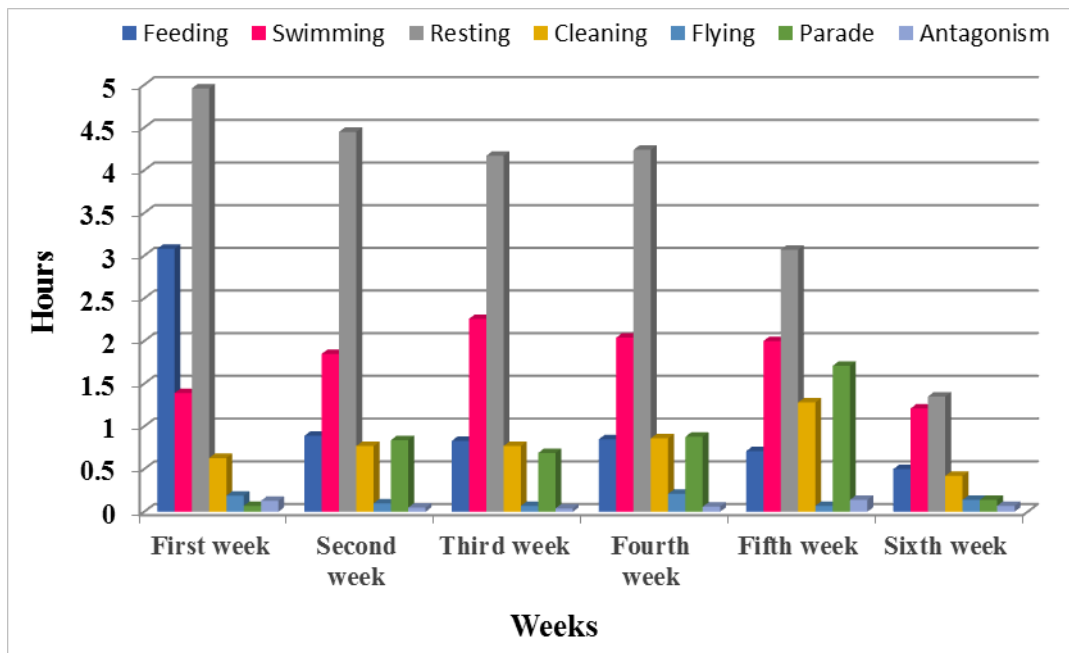


Fig. 8. Weekly variation in diurnal activities of the red pochard at the level of the Lac des Oiseaux

DISCUSSION

The red pochard is an occasional species in Algeria (**Ledant *et al.*, 1981; Isenmann & Moali, 2000**), even though it is abundantly spotted in Morocco, according to **El-Agbani (1997)**.

The first nesting of this Anatidae (only 1 pair) was reported at Deyet El Ferd in the utmost North-West of Algeria by **Oudihat *et al.* (2017)**. At the same site, the authors stated a wintering population of 500 individuals (**Oudihat *et al.*, 2017**).

At the level of the study region and in particular at the level of the study site, the Lake of Birds, a single observation of 9 individuals was stated by **Houhamdi (2020)** during February 2000. The area was fleeting, and parked for a few hours at lake level.

During the present study, this duck made a reversion, but this time with senior numbers exceeding 100 individuals and a longer stay.

The region of El Tarf witnessed a noteworthy drying of its considerable wetlands during the summer and autumn of 2022, besides a postponement in the rainy season in 2023. This affected the dispersal of migratory birds on the various wintering quarters in the region, mainly at the level of the Lac des Oiseaux in comparison with the large lakes in the region such as Tonga, Oubeira, and the Mekhada marshes (**personal observation**). The low water level at this time of the year at Lac des Oiseaux has allowed food resources to be more accessible; this finding has already been stated by **Ziane *et al.* (2016)**.

In the month of February, when the weather conditions become more wintry, the red-crested pochard and other Anatidae species leave the Lac des Oiseaux to settle in other more spacious sites with more abundant food resources.

Knowledge of the structure of a population by sex is a significant element in the analysis of the demographic features of a species (**Campredon, 1983**), the outcomes gained on our site reveal the presence of 63 male individuals and 41 female individuals and an absence of immature. The same type of case is found in distinct species of Anatidae such as the green-winged teal (**Tamisier, 1972**), the garganey and the pintail **Roux *et al.* (1976)**, the mallard (**Nilsson, 1976**), and the whistler (**Campredon, 1983**), in which the proportion of males overtakes that of females, even within the southern winter quarters.

Thus, one hypothesis that can be formulated is that the differential migration of the sexes is a reality in this species, and that the males tend to winter further south than the females and the immature.

The allocation of the red pochard at the level of the Lac des Oiseaux is changeable; it resorts to placing it both in the center of the lake, where it combines with the group of diving ducks, in the south-west zone, and often in the south-east part close to *Typha angustifolia*, sometimes in pairs or in groups.

The red-crested pochard has habitat necessities that might vary in accordance with its annual cycle: the species is particularly gregarious during the wintering and moulting periods (**Heiser, 1992**); over the wintering period, this waterfowl frequents lagoons, lakes, and ponds with fresh or slightly brackish water, which preferably comprise a belt of vegetation serving as shelter (**Durlet, 2005**). Moreover, the diet of the red-crested net is basically herbivorous and prioritizes deep-submerged macrophytes; however, it can adopt a fundamentally seed-eating diet during the wintering period (**Defot du Rau, 2012**). This preferentially expounds its dispersion in the center and south of the lake during the day.

In addition to these congeners in the Camargue (**Boutin, 1986**) and in L'Ile de France (**Flamant & Sibley, 2011**), oversight of the diurnal activities of the red-crested pochard at the Lac des Oiseaux revealed that rest is the activity most skilled in winter, and sleep is deemed the preferable means of saving energy (**Tamisier, 1972**). In this respect, **Harbi (2010)** and **Bendjedid *et al.* (2020)** affirmed that the wetlands of northeastern Algeria, and especially the Lake of Birds, play a role of delivery and rest for migratory avifauna during the wintering period (**Houhamdi & Samraoui, 2008; Chettibi *et al.*, 2013; Halassi *et al.*, 2016**). **Oudihat *et al.*, (2017)** depicted that swimming is the second activity for the red net with a percentage of 23% at Diyet el Ferd. This result is identical to what was observed at Lac des Oiseaux during the present study period since the red-crested pochard spent 33% of its time swimming. This significant activity is due to the anthropic disturbances that the population undergoes at the level of the lake on the one hand, and to the search for food in the whole lake on the other hand. The overwhelmingly night feeding in the Anatidae (**Tamisier 1972; Houhamdi & Samraoui, 2001, 2002, 2003; Saidi *et al.*, 2022**) displays low values that do not exceed 9% over our study; these outcomes coincide with those listed in L'Ile de France (**Flamant & Sibley, 2011**) recording a value of 12%.

On the other hand, grooming is a major activity for the maintenance of plumage in Anatidae in general, correlating with the prenuptial period and displays (**Tamisier & Dehorter, 1999; Houhamdi & Samraoui, 2001, 2003, 2008; Bouchaala *et al.*, 2017; Khemis *et al.*, 2017**).

Flight and malignity are rarely practiced by the red-crested pochard at the level of the Lake of Birds; nevertheless, the values recorded exhibited that this species interacts with other Anatidae species that occupy the site, not to mention the troubles of natural origin, for instance, the existence of aerial predators, fundamentally the marsh harrier *Circus aeruginosus*, or of human origin, for instance, road traffic and the presence of shepherds, fishermen, and hunters.

CONCLUSION

At a synopsis, famed for its arresting reception of migratory aquatic birds, the Lac des Oiseaux, regardless of its small size, further emphasizes that it is a wintering area conducive to different species of waterbirds each year.

The results of the rhythms of the diurnal activities of this Anatid bird detected that the Lac des Oiseaux is deemed a location of diurnal remission, where the sleep activity is the most manifested in spite of the offensives that this lake over and over undergoes (water pollution produced by the cultivation practiced around the lake; the use of pesticides and chemical fertilizers; the drainage of wastewater from the municipality of

Lac des Oiseaux, and the noise defilement created by vehicles crossing the N44 road next to the lake).

What is substantial for the maintenance of this species is the maintenance of its homeland, which can only be done with the variety of studies carried out within the framework of surveillance. These studies should target the attitude of vulnerable species in Algeria on the one hand, aligned with the cooperation of people mindful of the sensitiveness of these wetlands and the fauna that is vivid there on the other hand.

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