

## New Data on the Staging and Winter Behavior of the Red-Crested Pochard *Netta rufina* in Lake of Birds (North-Eastern Algeria)

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### ABSTRACT

The Lac des Oiseaux, located in the northeastern part of Algeria, provides suitable conditions for migratory aquatic birds during winter. Designated as a Ramsar site in 1999, the lake has been a seasonal home to 11 to 12 diverse Anatidae species. In the winter of 2023, a rare sighting occurred at the study site - the red-crested pochard, *Netta rufina*. This species is infrequently observed in the country's wetlands, usually in limited numbers. During its stay at the bird lake, we conducted regular counts and observed a maximum of 103 individuals in January, including 61 males and 41 females. This population was concentrated around the waist of the lake, particularly in its southwest area, away from disturbances and close to helophytes like cattails of *Typhas* and *Bulrushes*. A detailed study of daily activity patterns, conducted over 312 hours with an average of 8 hours per day, revealed that sleeping was the most common activity for both sexes (49%), followed by swimming (23%). Activities such as feeding, grooming, and displaying constituted only 9% of the time. Aggressive behaviors such as theft and antagonism were the least frequent, accounting for just 1% of the time budget. These findings underscore the significance of this wetland as a wintering site and a sanctuary for various Anatidae species, including rare ones viz. the species under study.

### INTRODUCTION

The overwintering strategies employed by migratory birds, along with the resources provided by wintering sites during this period, play a significant role in the reproductive success of these birds in their nesting habitats (Krapu, 1981; Ankney *et al.*, 1991; Tamisier *et al.*, 1995).

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A comprehensive understanding of species ecology, their interactions with the environment, and especially their ethological behaviors is crucial for defining the functioning and ecological significance of a host site 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, the several studies carried out in particular 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**). Nevertheless, the wintering strategies, as well as the diurnal behavior of the diving ducks remain unknown (**Atoussi, 2008; Houhamdi & Samraoui, 2008**).

The red-crested pochard, *Netta rufina*, is considered one of the rare diving ducks in Algeria (**Isenmann & Moali, 2000**). According to the latest IUCN ranking for threatened animal species, the red-crested pochard holds the status of "least concern" globally (**IUCN, 2016**). However, it is regarded as nearly extinct in Algeria (**Ledant et al., 1981; Isenmann & Moali, 2000**) and vulnerable in Morocco (**El-Agbani & Qninba, 2011**).

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

Currently, the red-crested pochard is observed in various locations in the region of Oranie and the highlands, albeit with relatively low numbers. Nevertheless, evidence of its nesting has been reported by **Oudihat et al. (2017)** at Dayet El-Ferd (700 ha) in the wilaya of Tlemcen, located in the north-west of Algeria, where nearly 500 individuals have been counted during the wintering period. The species mainly frequents chotts, sebkhas, saltworks and dams (**Oudihat et al., 2017**). In the east of the country, this 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 were recorded 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 abundant, with 10 species (Ziane *et al.*, 2016; Boubekeur *et al.*, 2020). In 2013, the lake hosted the prolonged stay of the red-crested pochard during winter for the first time (Personal observation).

The study aimed to conduct a census of the red-breasted pochard at the Lake of Birds, estimate its wintering strategy and phenology by observing its daily activities and distribution on the lake. Additionally, the study emphasized the role of this lake as a wintering area for rare Anatidae species in Algeria.

## MATERIALS AND METHODS

### 1. Site description

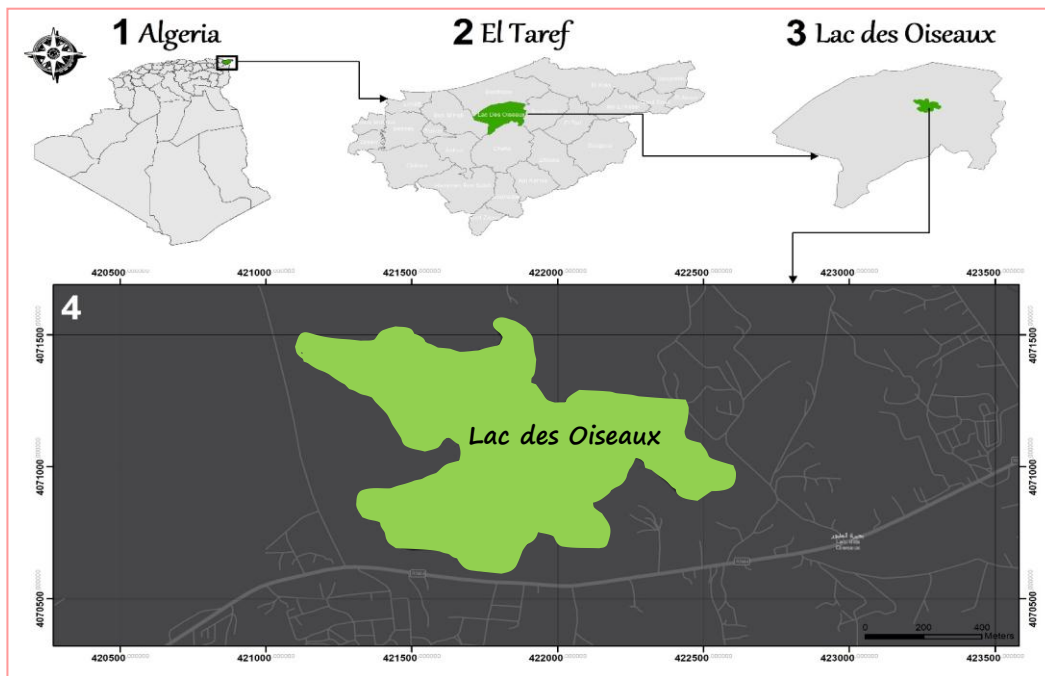
The Birds Lake also called "Garâat Ettouyour" (36° 47'N 08° 7'E) is a freshwater pond classified as Ramsar since 1999 and piece of the complex of wetlands in the wilaya of El Tarf (Boubekeur *et al.*, 2020). It covers an area of 70 hectares in the middle of winter, which can decrease to 40 hectares in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

The hydrography of the lake network primarily depends on weather conditions (Houhamdi & Samraoui, 2002). It is limited to a few streams, which are torrential in winter and dry most of the year (Fig. 1). The lake is also fed by groundwater sources (Samraoui *et al.*, 1992; Houhamdi & Samraoui, 2002).

Regardless of its small size, it is considered a sanctuary for over than 10,000 birds per year (Boumezbear, 1993; Ziane *et al.*, 2016). Furthermore, it shelters the nesting of numerous protected species (Photo 1). For instance, the ferruginous duck *Aythya nyroca*, the western swamphen *Porphyrio porphyrio* and the white-headed duck *Oxyura leucocephala* (Houhamdi & Samraoui, 2002) are among the nesting- sheltered species.

The periphery of this limnic ecosystem is frequented by a significant mammalian fauna, including the jackal (*Canis aureus*), fox (*Vulpes vulpes*), hedgehog (*Atelerix algirus*), wild boar (*Sus scrofa*) (Maazi, 1992; Ziane, 1999) in addition to the mongoose (*Herpestes ichneumon*) (Personal observation).

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



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



**Photo 1.** General view of the Lake of Birds during the wintering period (BAALIA, 2023)

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## 2. Methods

The daily monitoring of the red-crested pochard (*Netta rufina*) was conducted from January the 3<sup>rd</sup>, 2023 to February the 10<sup>th</sup>, 2023. Due to the species' limited roosting during this period, we conducted daily outings to count their numbers, observe their movements, and document their distinct activities. The census was done by direct observation of the species using a telescope (Kowa, TSN-82/M) whose magnification varies from 20 to 60 times and 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 capable of covering all the fractions of the site where the red-crested pochard is found. This division was reported in a real way on the map of the lake, which was divided into sectors.

To analyze the activity budgets, we conducted observations for a total of 312 hours over 39 consecutive days. Data collection occurred throughout the day, from 8 a.m. to 4 p.m. During this period, we documented seven distinct daily activities observed in wintering individuals: feeding, resting, grooming, as well as swimming, flight, courting behavior, and both inter and intra-specific interactions termed "antagonism."

## RESULTS

### 1- Population «count» and phenology

The red-crested pochard began arriving at the Lake of Birds on January the 3<sup>rd</sup>, with an initial population of 23 individuals, and stayed until mid-February (Fig. 2). The population rapidly increased, reaching a peak of 103 individuals during the second week of January. Subsequently, the numbers fluctuated between 50 and 100 individuals. By the end of January, the population decreased to 20 individuals, with most individuals leaving in early February. Only two individuals extended their stay until February the 9<sup>th</sup> before departing permanently from the area.

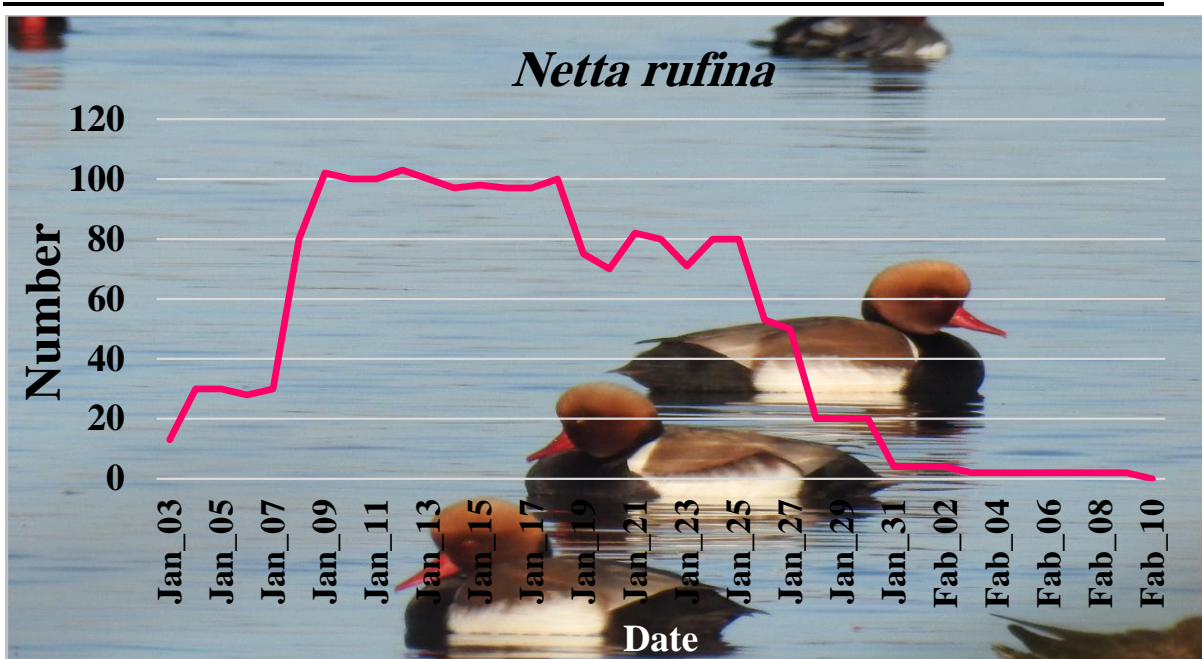
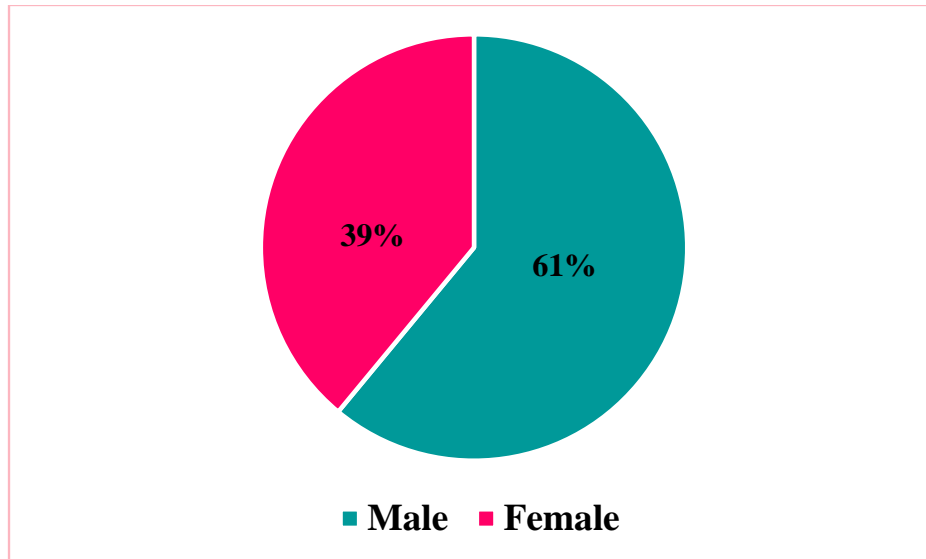


Fig. 2. Daily variation in numbers of red pochard at the level of the Lake of Birds "Lac des Oiseaux"

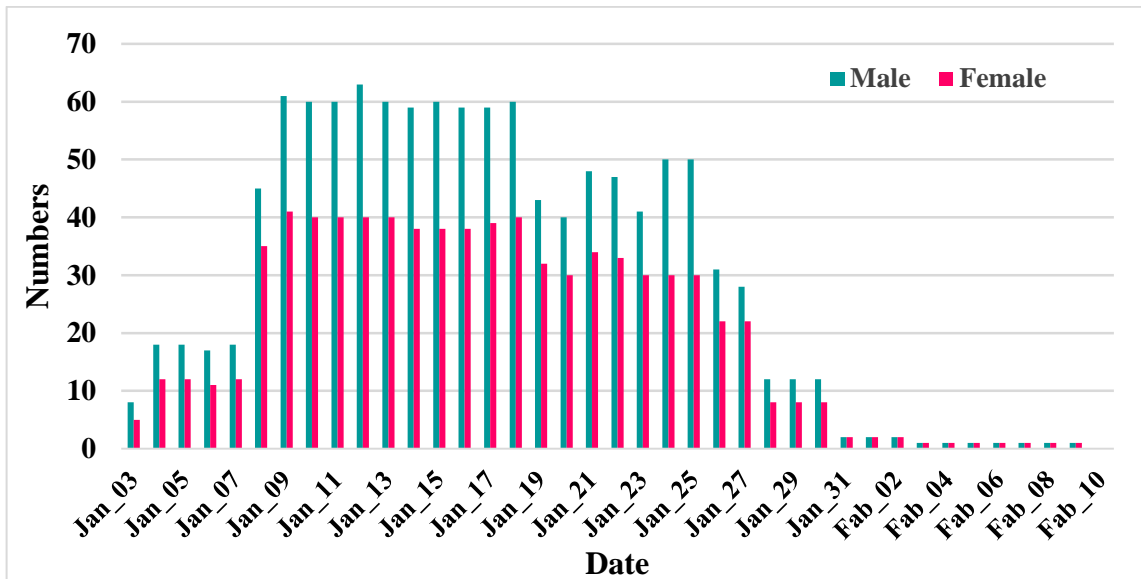
## 2. Demographic structure of the population

During the monitoring period of the red pochard, the location hosted 104 adult individuals, comprising 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 study site



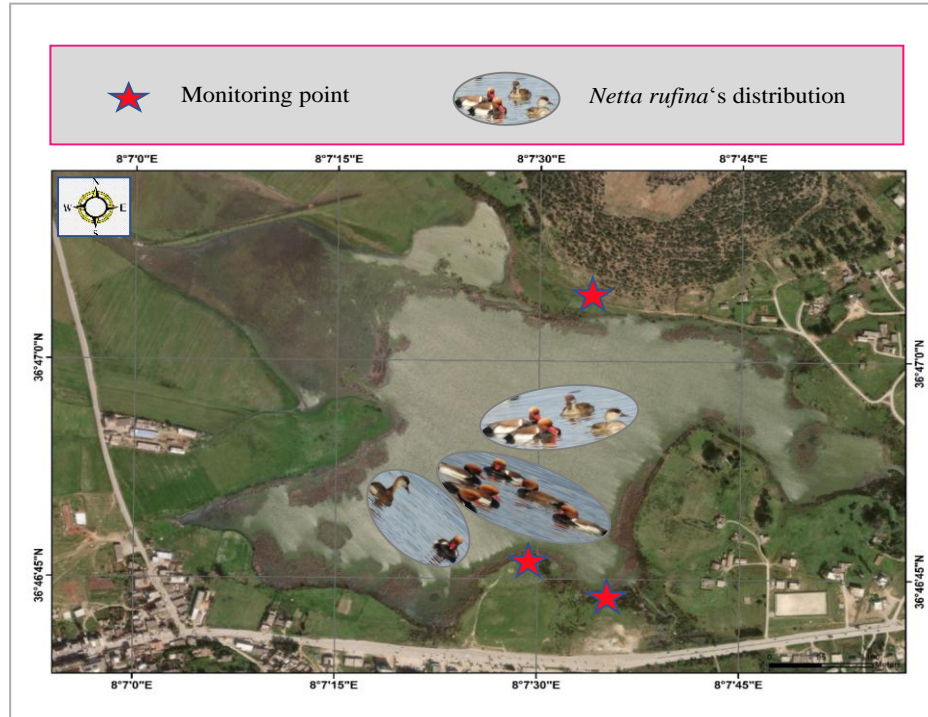
**Fig. 4.** Changes in number of males and females of red-crested pochard during its stay at the study site

### 3. Spatio-temporal distribution on the site

The distribution of red pochards on the lake throughout the day is variable. They are usually found in pairs or groups, rarely alone, and readily interact with other Anatidae, especially shovelers, Eurasian ducks, and occasionally Eurasian coots. Upon arrival, the red-crested pochard population congregates in the southeast area of the Lake of Birds "Lac des Oiseaux". Throughout the day, they gradually spread across the entire site, moving from the southwest to the center and to a lesser extent, the west. Eventually, the individuals return to their initial location in the southeast. Generally, red pochards



prefer the southeast side and the center of the lake, where the highest numbers were observed during the study period (Fig. 5).

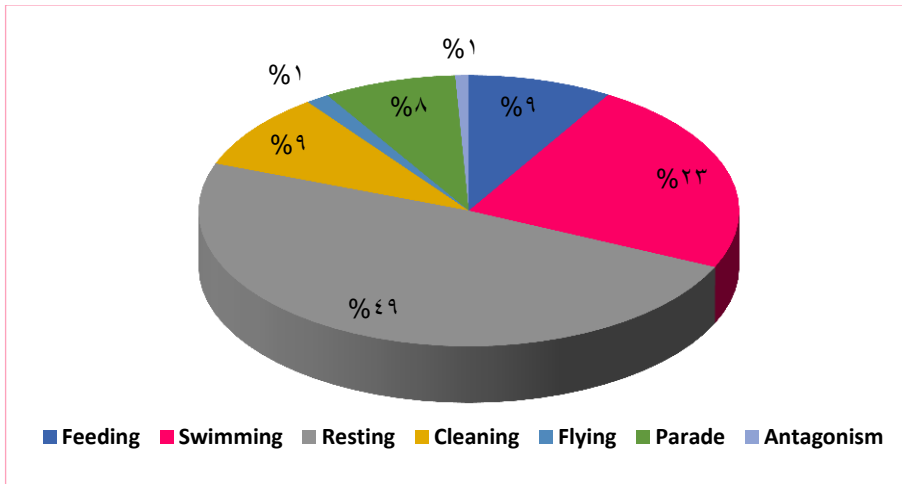


**Fig. 5.** Spatial distribution map of the red pochard *Netta rufina* at the level of the studied site

#### 4. Behavioral monitoring « activity rhythm »

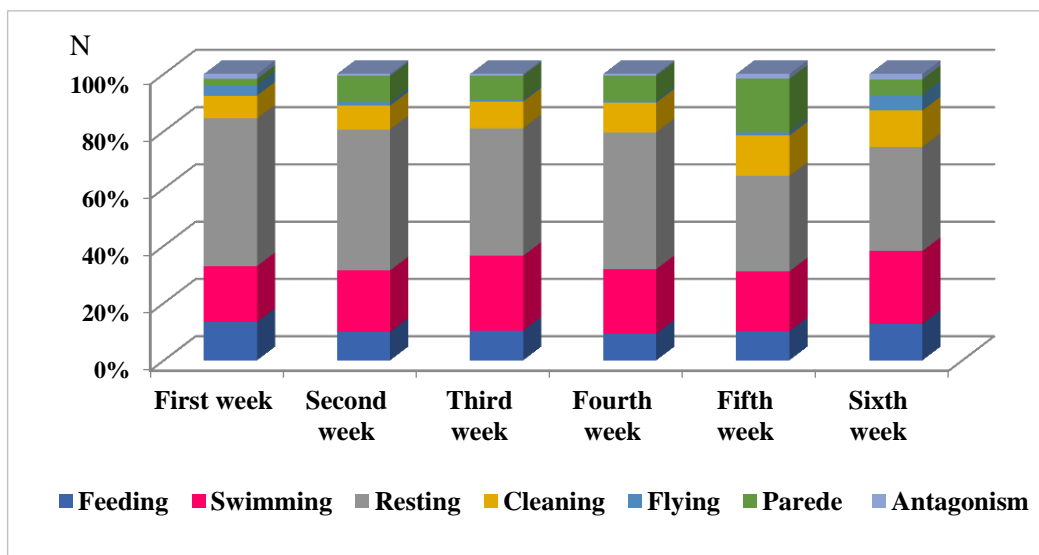
The analysis of the red-crested pochard's diurnal activity patterns at the lake under study (Lac des Oiseaux) reveals that sleeping, characterized by the head turned and placed on the back with the bill tucked down the scapulars (Photo 2), is the predominant activity, accounting for 49%. Swimming follows at 23%, while feeding, grooming, and courtship activities combined constitute 9% of their time. Theft and antagonism have the lowest rates at 1% (Fig. 6).





**Fig. 6.** Overall summary of the daily activities of the red-crested pochard during its stay at the Lake of Birds

The weekly analysis of the red pochard's activity patterns at the lake under study reveals a clear prevalence of resting activities (comfort) throughout its winter stay (Fig. 7 & Photo 2). The highest rates of sleep were observed during the initial week of observation, peaking at 50%. Swimming activities constituted a quarter of their time (25%) during the entire study period. Feeding and grooming activities varied between 5% and 9%, with courtship activities gradually increasing from 2% to 8% by the end of the observation period. Theft and antagonism exhibited minimal values, never exceeding 1% of their daily activities.

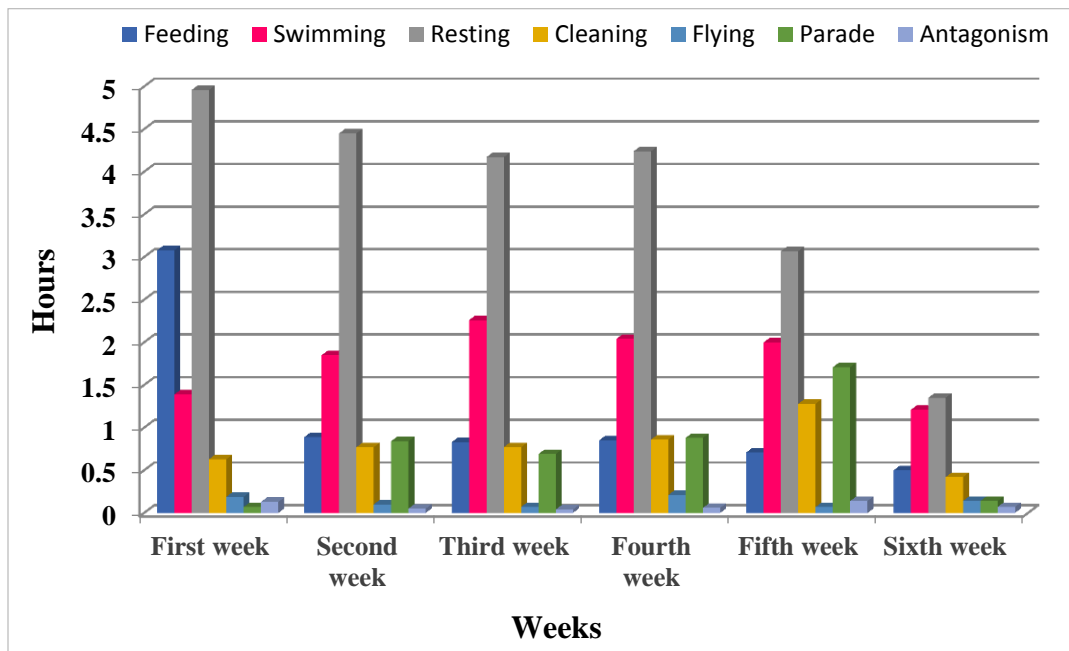


**Fig. 7.** Weekly evolution of the diurnal activity rhythms of the red-crested pochard at the level of the Lake of Birds "Lac des Oiseaux"



**Photo 2.** The red-crested pochard (*Netta rufina*) engaged in seven daytime activities during its wintering period at Lac des Oiseaux showing: 1. Sleeping, 2. Swimming, 3. Feeding, 4. Parrying, 5. Grooming, 6. Antagonism, and 7. Flying (**BAALIA, 2023**)

The observations highlight distinct patterns of behavior in the red-crested pochard at the lake under study during the day. The majority of the time is spent in comfort activities, with variations from 5 hours at the beginning of the monitoring period to 21 minutes towards the end. Feeding time decreases significantly from 3 hours in the first week to 30 minutes in the last week. Grooming and parrying activities have fluctuating durations, with peak values of 1 hour and 28 minutes, respectively, during the fourth week. Theft and antagonism are rare activities, each lasting no more than 20 minutes throughout the entire wintering period of the red-crested pochard. Fig. (8) can be used as a visual representation of these observations.



**Fig. 8.** Weekly variation in diurnal activities of the red pochard at the level of the Lake of Birds

## DISCUSSION

The red-crested pochard is considered an occasional species in Algeria, as indicated by previous studies (Ledant *et al.*, 1981; Isenmann & Moali, 2000). While, it is abundantly observed in Morocco, as postulated in the study of El-Agbani (1997).

The first nesting of the red-crested pochard in Algeria, involving only one pair, was detected at Dayet El Ferd in the far north-western region of the country by Oudihat

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*et al.* (2017). At this site, the authors also noted a wintering population of 500 individuals (Oudihat *et al.*, 2017).

In the study region, particularly at the Lake of Birds, a singular observation of nine individuals was reported by Houhamdi (2020) in February 2000. During that time, the ducks made a brief stop at the lake, but during our study, they revisited the area, this time in larger numbers exceeding 100 individuals and for a more extended period.

The El Tarf region experienced significant drying of its substantial wetlands in the summer and fall of 2022, coupled with a delay in the rainy season in 2023. This influenced the dispersion patterns of migratory birds across various wintering sites in the region, particularly at the Lake of Birds in comparison to larger lakes, including Tonga, Oubeira, and the Mekhada marshes (personal observation). The lowered water levels at the Lake of Birds during this period made food resources more accessible, a phenomenon previously noted by Ziane *et al.* (2016).

By February, when winter conditions intensify, the red-crested pochards and other Anatidae species leave the Lake of Birds to settle in more spacious areas with abundant food resources.

Understanding the population structure by sex is a crucial aspect of analyzing the demographic characteristics of a species (Campredon, 1983). Our findings indicate the presence of 63 male individuals and 41 female individuals, with no immatures observed. Similar patterns are observed in other Anatidae species such as the green-winged teal (Tamisier, 1972), garganey, pintail (Roux *et al.*, 1976), mallard (Nilsson, 1976), and whistler (Campredon, 1983). In these species, the proportion of males surpasses that of females, even within southern wintering grounds.

One hypothesis that can be proposed is that differential migration of the sexes is indeed a reality in this species. Males might tend to winter further south than females and immatures, leading to the observed sex ratio imbalances during wintering periods. The allocation of the red pochard at the level of the Lake of Birds is changeable; it resorts to placing it 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 exhibits varying habitat preferences in accordance with its annual cycle. During wintering and moulting periods, the species tends to be highly social (Heiser, 1992). In winter, it frequents lagoons, lakes, and ponds with fresh or slightly brackish water, preferably ones surrounded by vegetation providing shelter (Durlet, 2005). The red-crested pochard's diet is primarily herbivorous, focusing on deep-submerged macrophytes. However, during winter, it may predominantly consume seeds, leading to its concentration in the central and southern regions of the lake during the day.

Observations of the diurnal activities of the red-crested pochard at the Lake of Birds indicate that resting is the predominant activity during winter, with sleep being the preferred method for conserving energy (Tamisier, 1972). Previous research, especially by Harbi (2010) and Bendjedid *et al.* (2020), confirms that the wetlands of northeastern Algeria, particularly the Lake of Birds, serve as crucial stopover and resting sites for migratory avifauna during winter (Houhamdi & Samraoui, 2008; Chettibi *et al.*, 2013; Halassi *et al.*, 2016). Oudihat *et al.* (2017) noted that swimming is the second most common activity for the red-crested pochard, accounting for 23% of its time at Diyet el Ferd. This aligns with our observations at the Lake of Birds, where the red-crested pochard spent 33% of its time swimming. This increased swimming activity is likely due to anthropogenic disturbances at the lake, as well as the need to search for food throughout the entire lake.

Feeding activities during the night, a common behavior in Anatidae, displayed relatively low values, not exceeding 9% in our study. These results are consistent with observations in the Island of France "l'Île de France", where a value of 12% was reported (Flamant & Sibley, 2011). Grooming, crucial for plumage maintenance in Anatidae, is a significant activity, especially during the pre-nuptial period (Tamisier & Dehorter, 1999; Houhamdi & Samraoui, 2001, 2002, 2003; Bouchaala *et al.*, 2017; Khemis *et al.*, 2017).

Flight and aggression are infrequently observed in the red-crested pochard at the Lake of Birds. However, recorded instances suggest interactions with other Anatidae species present in the area, as well as occasional disturbances from natural (e.g., aerial predators like the Marsh Harrier, *Circus aeruginosus*) and human-related factors (e.g., road traffic, presence of shepherds, fishermen, and hunters).

## CONCLUSION

As a synopsis, famed for its arresting reception of migratory aquatic birds, the Lake of Birds, 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 which 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 the Lake of Birds, and the noise defilement created by vehicles crossing the N44 road next to the lake).

The maintenance of this species depends significantly on preserving its natural habitat. This can only be achieved through a diverse range of studies conducted as part of ongoing surveillance efforts, understanding the vulnerabilities of species in Algeria.

Equally important is the cooperation of individuals, who are mindful of the delicate nature of these wetlands and the vibrant fauna residing there.

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