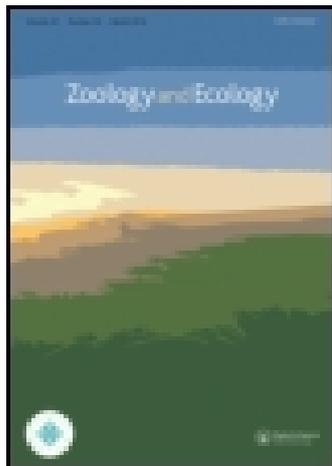


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Phenology and diurnal behaviour of the Northern Shoveler *Anas clypeata* in the Guerbes-Sanhadja wetland complex (north-eastern Algeria)

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Phenology and diurnal behaviour of the Northern Shoveler *Anas clypeata* in the Guerbes-Sanhadja wetland complex (north-eastern Algeria)

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An ecological study of the Northern Shoveler *Anas clypeata* in the wetlands of the Guerbes-Sanhadja eco-complex (Skikda, north-eastern Algeria) which was performed during wintering season (from September 2012 to March 2013) showed that the species was regularly wintering in these ecosystems during the seven months of observation. The highest numbers were recorded during December 2012 (1943 individuals) at Garaet Hadj-Taher, although this wetland was the last to be colonized if we compare it to other wetlands. Garaet Hadj-Taher hosted more than half of the wintering population of the Northern Shoveler in the Guerbes-Sanhadja eco-complex. Sleeping activity (diurnal resting) dominated over other diurnal behaviours of this Anatidea at Garaet Hadj-Taher by representing almost two-thirds of total results (63.74%). This activity was observed among gathered individuals in the centre of this wetland. The second place was taken by swimming (15.10%) followed by preening (10.49%), feeding (7.03%) and finally flying (3.64%), showing the results of diurnal counting for the Northern Shoveler in Garaet Hadj-Taher and all other wetlands in the Guerbes-Sanhadja complex.

Žiemos sezono metu (nuo 2012 m. rugsėjo iki 2013 m. kovo) ekologinio komplekso Guerbes-Sanhadja šlapžemėse (Skikda, Alžyro šiaurės rytų dalis) atlikti šaukštasnapės anties (*Anas clypeata*) tyrimai parodė, kad jos ten žiemojo visus septynis stebėjimo mėnesius. Didžiausias gausumas (1943 individai, t.y., daugiau kaip pusė komplekse žiemojančios populiacijos) užregistruotas 2012 m. gruodį Garaet Hadj-Taher šlapvietėje, kurioje paukščiai apsistojo vėliausiai. Joje didžiąją laiko dalį (63,74%) antys praleisdavo miegodamos, dažniausiai – susitelkę šlapžemės centre. Paukščių elgsenos stebėjimui Garaet Hadj-Taher ir kitose Guerbes-Sanhadja šlapžemėse parodė, kad mažiau laiko buvo skiriama plaukiojimui (15,10%); dar mažiau – plunksnų valymui (10,49%), maitinimuisi (7,03%) ir skraidymui (3,64%).

Keywords: Northern Shoveler; *Anas clypeata*; wetlands; Guerbes-Sanhadja; time budget

Introduction

The Northern Shoveler *Anas clypeata* (Anatidae) is the only zooplanktivorous duck (Thomas 1976; Pirot 1981; Pirot, Chessel, and Tamisier 1984; Madge and Burn 1988) regularly attending the southern coasts of the Mediterranean and the entire Western Palearctic. It practically winters in all north-eastern Algerian wetlands (Ledant et al. 1981; Isenmann and Moali 2000). The highest numbers are often recorded in the National Park of El Kala, mostly in two largest Ramsar sites in the region: Lake Tonga, marsh water body, 2400 ha; and Lake Oubeira, endorheic water body, 2300 ha (Ledant and Van Dijk 1977). The Guerbes-Sanhadja complex, located in the west of El Kala, also hosts a population of this surface feeding duck far exceeding 3000 individuals during the wintering season (Metallaoui and Houhamdi 2008, 2010; Metallaoui 2010; Metallaoui et al. 2014). The ecological role of wetlands in maintaining aquatic birds and the etho-ecological studies remain poorly documented in our country, but the monitoring of diurnal

behaviour of many species of Anatidae is illustrated in some Algerian wetlands during their wintering.

The Northern Shoveler as the most dominant member of Anatidae in Algeria has the status as a wintering migrant. During the winter period, the Western Palearctic region hosts three large populations of Shovelers. The most important is in the Black Sea/Mediterranean region, estimated to host 220,000 individuals, followed by the West Mediterranean region (175,000 individuals) and Northwest Europe (40,000 individuals). In Garaet Timerganine, the largest number of Shovelers was observed during the 2007–2008 wintering period, with a maximum of 380 individuals. Garaet Hadj-Taher has hosted larger numbers of individuals, e.g. 2500 in January 2007 (Metallaoui and Houhamdi 2010).

The most important objective of this study is to follow the ecology of the Northern Shoveler *Anas clypeata* during its presence in the principal wetlands of the Guerbes-Sanhadja complex (Skikda, north-eastern

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Table 1. Principal wetlands of Guerbes-Sanhadja complex.

	Wetlands	Coordinates	Area (ha)
1	Garaet Dahria	36°59' N, 7°17' E	60
2	Garaet Haouas	36°58' N, 7°18' E	260
3	Nechaa Demnat Attaoua	36°56' N, 7°14'780 E	280
4	Garaet Ben M'hamed	36°57' N, 7°16' E	380
5	Garaet Messaoussa	36°52'N, 07°15'E	300
6	Nechaa Kellalba	36°5'516 N, 7°17'576 E	75
7	Garaet Sidi Lakhdar	36°54'780 N, 7°12'055 E	25
8	Garaet Chichaya	36°53'791 N, 7°18'230 E	50
9	Garaet Sidi Fritis	36°53'975 N, 7°17'437 E	40
10	Garaet Hadj-Tahar	36°51'774 N, 7°15'957 E	112
11	Garaet Sidi Makhlouf	36°53'094 N, 7°18'248 E	50
12	Garaet Boumaïza	36°49'155 N, 7°18'975 E	70

Algeria) in order to contribute to the ecological studies (phenology, models of spatio-temporal distribution and diurnal budget activities) and wintering strategy in the north-African hydrosystems.

Description of Guerbes-Sanhadja wetland complex

The Guerbes-Sanhadja wetland complex situated in the east of Skikda is composed of a dozens of lakes (Table 1, Figures 1–4) which are classified as Ramsar sites according to the criteria 2, 3, 6 and 8 since 2 February 2001 (Samraoui and De Belair 1997; Metallaoui 2010). These hydrosystems are shallow (0.8–1.2 m) and rich in helophytes and aquatic plants (*Nymphaea alba*, *Typha angustifolia*, *Phragmites australis*, *Scirpus maritimus*, *Scirpus lacustris* *Iris pseudoacacurus* and rare Pteridophyte *Salvinia natans*). The Garaets are bordered by a belt of lush vegetation composed mainly of *Juncus acutus*, *Juncus maritimus*, *Olea europea*, *Pista chialentiscus*, *Myrthus communis*, *Asphodelus aestivus*, *Rubus ulmifolius*, also as lawns dominated by grasses *Cynodan dactylon* and *Paspalum distichum*. The land around the site is used exclusively by residents for gardening. Each year these wetlands host a diversity of birds of about 79 species belonging to 18 families, and some of them are in the Red List of IUCN (International Union for Conservation of Nature), such as the White-headed Duck *Oxyura leucocephala*, Ferruginous Duck *Aythya ferruginous* and Purple Gallinule *Porphyrio porphyrio* (Metallaoui and



Figure 1. General view of Garaet Hadj-Tahar (taken on 28 March 2012 by W. Amor Abda).



Figure 2. General view of Garaet Ben M'hamed (taken on 25 February 2012 by S. Merzoug).



Figure 3. General view of Garaet Haouas (taken on 25 February 2012 by S. Merzoug).

Houhamdi 2008, 2010; Metallaoui et al. 2009; Bara et al. 2013). In a few recent years, three species have been observed for the first time in the complex: Greater Scaup (Metallaoui and Houhamdi 2007), Red-crested Pochard *Netta rufina* (Metallaoui and Merzoug 2009) and Lesser Flamingo (Merzoug, Rouibi, and Houhamdi 2010).

Materials and methods

The monitoring of the Northern Shoveler was realized during a wintering season defined to be a period between September 2012 and April 2013 with a telescope Konus

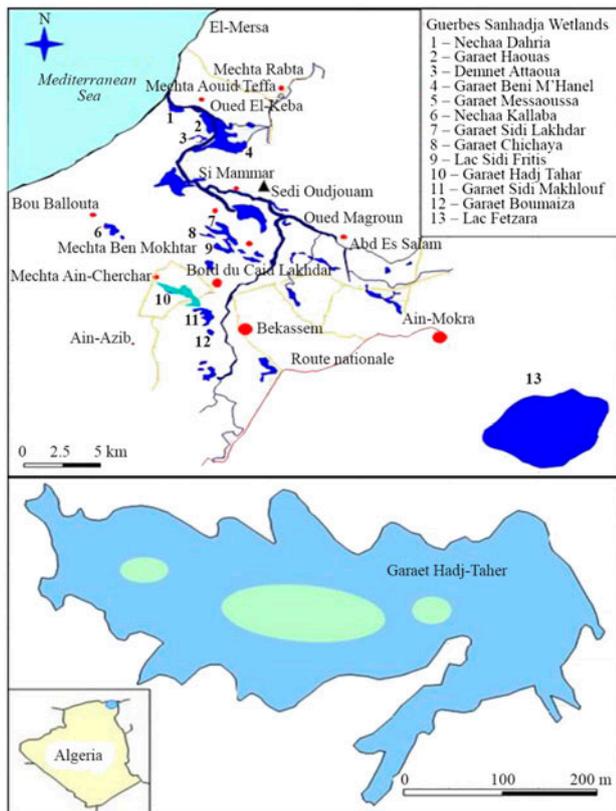


Figure 4. Location of Guerbes-Sanhadja complex and spatio-temporal occupation of Garaet Hadj-Tahar by Northern Shoveler *Anas clypeata*.

40 × 60, where the birds were counted fortnightly (twice a month). Several techniques are often used for the counting of aquatic birds, but in our case, we have chosen to use a method based on an exhaustive counting of birds or individual groups of birds near the bergs with less than 200 individuals and a visual estimation of isolated groups and counting the highest numbers (Blondel 1975; Legendre and Legendre 1979). Once enumerated, the repartition and the models of spatio-temporal distribution of these birds were determined in all wetlands (Houhamdi et al. 2008; Hafid et al. 2013).

Further, a particular monitoring of diurnal behaviour was performed during the entire wintering season at Garaet Hadj-Taher with regular scans every hour from 9:00 am to 4:00 pm (Altman 1974; Baldassare et al. 1988; Losito, Mirarchi, and Baldassare 1989; Tamisier and Dehorter 1999). Five activities were measured: sleeping, feeding, swimming, preening and flying (Houhamdi and Samraoui 2001, 2003).

Results and discussion

Phenology and wintering

The Northern Shoveler started to colonize the wetland complex Guerbes-Sanhadja from September with very

low numbers, not exceeding 150 individuals. Progressive arrivals were registered bringing the total abundance of this diving duck to 1943 individuals observed during the second half of December (Figure 5(a)). Immediately after, continuous collapses were noted announcing the progressive departures of groups of this Anatidae along the length of the winter period (spring migration). Out of a dozen of wetlands, only seven were attended by dabbling ducks. The highest numbers were recorded at Garaet Hadj-Tahar, although it was occupied from the end of October (Figure 5(b)). The species was also observed during all visits to four wetlands of this complex (Figure 5). During this wintering season, Garaet Ben M'hamed (Figure 5(c)) and Garaet Haouas (Figure 5(d)) received a maximum of around 400 individuals (December) while groups having frequented Garaet Dahria (Figure 5(e)) and Garaet Messaoussa (Figure 5(f)) contained 40 birds. The species were also observed with very low numbers in two other bodies of water, Garaet Chichaya and Garaet Sidi Fritis (5 and 12 individuals, respectively) at the beginning of the wintering season.

In six wetlands, the Northern Shoveler was mainly observed in the central regions of wetlands. These areas were cleared of all vegetation and away from disturbances.

Study of diurnal behaviours

The record of diurnal behaviours of the Northern Shoveler *Anas clypeata* after 105 h of observation and following the spreading during the wintering season of September 2012–April 2013 at Garaet Hadj-Tahar was dominated by the activity of sleeping which held almost two-thirds of the total (63.74%). It was followed by swimming (15.10%), preening (10.49%), feeding (7.03%) and finally flying (3.64%) (Figure 6).

The following of these activities for the entire wintering season expose to us significant differences characterizing each period (Figure 7). Sleeping which took a small part at the beginning of the wintering season (17%) increased significantly to the rates of 83% during November (maximum recorded during this study).

It gradually decreased until the first week of February and then increased again towards the end of the wintering season. Indeed, after long voyages, waterfowl, mainly Anatidae (surface ducks and diving ducks) exhibit diurnal rest and sleeping characterized by groupings of these birds either in water or on the banks and areas swaying waters (Paquette and Ankney 1998; MacCluskie and Sedinger 1999). Swimming, often associated with feeding activity in many species of Anatidae (Houhamdi and Samraoui 2001, 2003, 2008; Metallaoui et al. 2014), was observed with a rate of 20% from the beginning of wintering. It dropped by half and remained more or less stable until the end of January, and then reincreased to the rates ranging between 32 and 36% between February and April (Figure 7). The preening (cleaning the

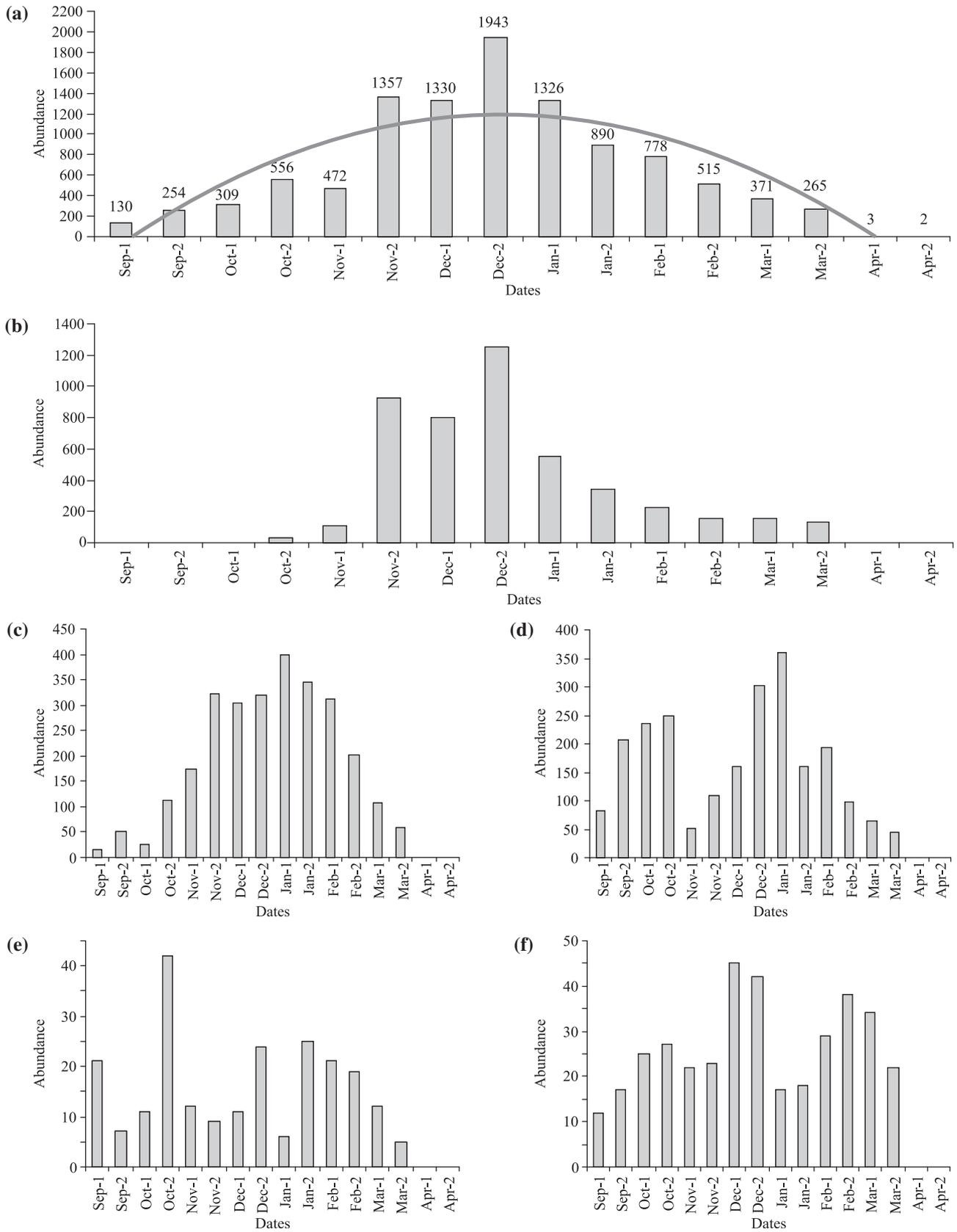


Figure 5. Evolution of Northern Shoveler *Anas clypeata* in Guerbes-Sanhadja complex (2012–2013): (a) total number, (b) Garaet Hadj-Tahar, (c) Garaet Ben M'hamed, (d) Garaet Haouas, (e) Garaet Dahria and (f) Garaet Messaoussa.

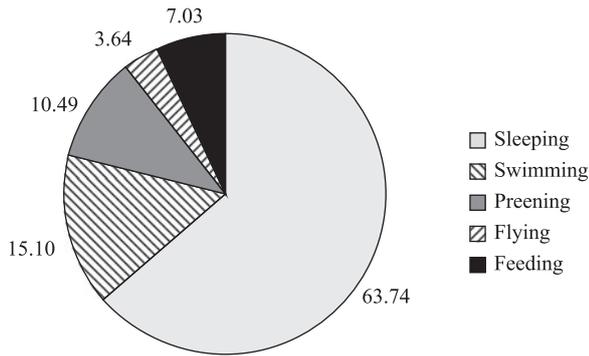


Figure 6. Assessment of diurnal budget activities of Northern Shoveler in Garaet Hadj-Tahar.

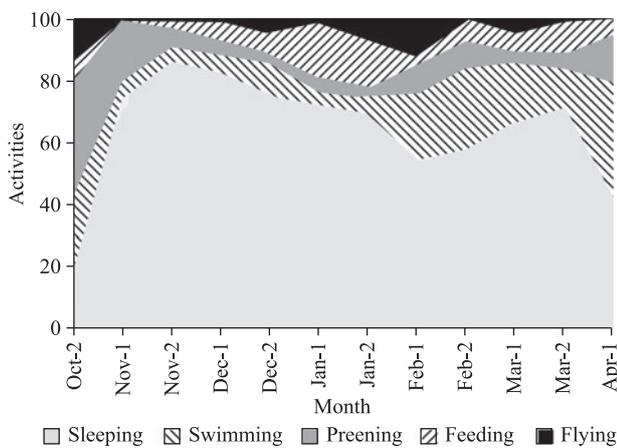


Figure 7. Evolution of diurnal budget activities of Northern Shoveler during the wintering season.

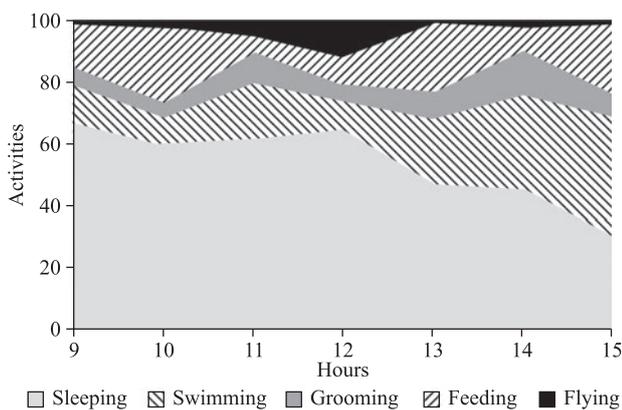


Figure 8. Evolution of diurnal budget activities of Northern Shoveler during the day.

plumage) and the usual toiletries characterize the first individuals occupying the water in the month of October, confirming the data from the scientific literature observed at other sites (Tamisier 1974, 1985; Campredon 1982, 1984a, 1984b). It was observed with the rates approaching 36%, a third of results during this period. It suddenly

dropped and stabilized at around 6–8% until April. It increased again and reached 15% at the end of the study (Figure 7). Almost nocturnal feeding (Tamisier et al. 1987; Tamisier and Grillas 1994; Tamisier and Dehorter 1999) was observed in the daytime outcome of these activities. It took a small share and the highest rates were recorded during the months of December and January (20%) before stabilizing at around 8–10% until the end of the study (Figure 7). Flights manifested by Northern Shovelers generally correspond to the flight of groups and rearrangements of places by two or three individuals who fly from one group to join another (Houhamdi 1998, 2002). It was noted in the first occupants of the Garaet during the months of December, January and February with a peak of 13% recorded in the first half of February (Figure 7).

The evolution of these five activities during the day shows us that only one part of the activity of sleeping which dominated in this assessment was mainly observed in the morning with the rates well above 60% (Figure 8). It gradually fell from 1:00 pm. At the end of the day the observed rates were half of what was recorded during the morning (Figure 8). Swimming is an activity that exposes the inverse of sleeping. It was observed with low levels as the day began (~10%) to exhibit a progressively increasing rate of four to five times higher than those noted in the morning. Preening and feeding are two activities more or less stable throughout the day. Flying was sporadic. The highest rates were found in mid-day (Figure 8).

Conclusion

The Guerbes-Sanhadja eco-complex (42,100 ha area) designated as a Ramsar site since 2 February 2001 is a wintering place for many species of water birds, including Northern Shoveler *Anas clypeata*. According to the data of our observations, this species occupied the wetlands very early (at the beginning of September) and remained there until the end of April with a varied time enrolment. This zooplanktonophagous duck was distributed on open areas of wetlands, often at the centre of Gareats near other Anatidae (surface ducks and diving ducks).

From 12 wetlands in this complex, only three were hosting the highest numbers (more than 50% of total abundance). A maximum number of 1943 individuals were recorded during the end of December. The colonization of Garaet Hadj-Tahar (112 ha) by the Northern Shoveler was late (end of October), and it hosted the highest numbers. The other two lakes, Garaet Ben M’hamed (380 ha) and Garaet Haouas (260 ha), located near the Mediterranean and diametrically opposed relative to the Oued El Kebir, each accommodated a maximum number of around 400 individuals.

The monitoring of diurnal budget activities of this dabbling duck at Garaet Hadj-Tahar shows a system dominated by sleeping with rates above 60%, showing the role of daytime presentation of this wetland. This

activity followed by swimming, preening, flying and feeding activity was noted only in the centre of the water body in the open places. The activities of swimming and feeding were observed mainly at the end of the day confirming the start of the night feeding in Anatidae.

Despite the relative importance of hydrosystems of this complex in the maintenance, conservation and maintenance of populations of wintering waterfowl, mainly Anatidae, these environments are continuously receiving important anthropogenic loads in winter and nesting periods on the balance of biodiversity in these areas. A management plan is being developed for the conservation and restoration of plant and animal biodiversity in the named complex.

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