



E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2017; 5(1): 540-545
© 2017 JEZS
Received: 14-11-2016
Accepted: 15-12-2016

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Diurnal time budget of wintering Teal *Anas crecca crecca* (Anatidae) at Garaet Hadj-Tahar (Skikda, Northeast Algeria)

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Abstract

During three seasons of study of wintering Teal *Anas crecca crecca* at Garaet Hadj Tahar (wetlands Complex of Guerbes-Sanhadja, Algeria), it was found that Teal began to colonize the lake at the end of August to remain there until mid-March each year. The maximum number is usually registered during the mid-winter season, between the months of December and January, where we record 506 individuals.

Monitoring of Teal diurnal behaviors during this study (294 hours of observation), highlights the role of daytime delivery of this lake that the total balance sheet is dominated by the sleeping activity with 40%. Swimming activity come second with 28.8% of daytime delivery, followed by feeding activity which holds 13.8%, and by preening (plumage cleaning), with 12.7% and finally the flight with 4.7%. Multivariate treatment of these data shows that the wintering season is divided into three characteristic periods: the beginning of wintering season; characterized by the observation of positioning flights accompanied by a regular cleaning of plumage, mid-winter; dominated by the sleeping and the end of the season; characterized by increased power associated with swimming.

Keywords: Wintering, diurnal behaviors, *A. crecca crecca*, Garaet Hadj-Tahar, Algeria

1. Introduction

At Western Palearctic, waterfowl mainly Anatidae coming from different nesting areas in northern Europe, usually regroup in their winter quarters in the Mediterranean and exhibit a quite particular gregariousness [1-5]. On the northern shores, it appears that these ducks can exploit their wintering areas in a quite particular way called "functional unit" where regular trips between neighboring wetlands are observed at each dawn and each dusk [6-12]. On the southern shores of the Mediterranean (North Africa), little realized studies show us a little different schema where most duck species use a single wetland throughout the wintering season [13-20]. In this region of Western Palearctic, monitoring and analysis of diurnal behavior of these avian species (Anatidae family) on other wintering areas becomes a priority to understand and explain the dynamics and strategies wintering birds adopted by the fact that the special requirements can vary considerably from one species to another and even within the same species belonging to populations from geographically distinct areas, mainly due to differences of adaptation of these birds after a long migrations [5, 15, 19]. Birds often adapt to different degrees of changes in their behavior to acquire their needs in the face of environmental changes [21, 15]. Teal *Anas crecca crecca* is the most abundant species duck in the world, it breeds in the temperate Eurasia and migrate to the Mediterranean and Asia in the winter. The habits and wintering movements of Teal have been studied extensively in Europe [22-24]. Teal numbers in most parts of Europe are at their highest since the initiation of winter counts However, the situation may not be as favourable in other regions, especially in Asia, north-eastern Africa and the eastern Mediterranean, where Common Teal numbers have not fared as well [25]. Main wintering areas appear to be situated in Western Europe, the Mediterranean and Caspian Sea area, and in India and Pakistan [26]. In Algeria common teal overwinters in high but varying numbers between late September and April, mainly October to February on the Tell wetlands, particularly in the Oran region, El Kala and at Bougezoul. The species is also seen on passage and during winter in the Saharan oases [27].

The aim of this study is to convey the wintering ecology (abundance, spatial and temporal distribution and monitoring of diurnal time budget), of Teal *A. crecca crecca* (Anatidae), wintering in a protected wetland, Garaet Hadj-Tahar (wetland complex of Guerbes-Sanhadja and Ramsar site since 2002).

1.1 Study area

Garaet Hadj-Tahar (36°51'N 07°15'E), situated in the community of Ben-Azzouz (department of Skikda, northeast Algeria), is a stretch of freshwater covering an area of 112ha (Figure 1, Photos 1 and 2). It is part of the Guerbes-Sanhadja wetland complex, designated as a Ramsar site since 2001 and selected as an important area for the conservation of birds^[28, 19]. This water body has the shape of an elongated oval and is situated about 20 km from the Mediterranean^[29, 20].

This large coastal plain is bordered by the coastal hills of Skikda in the west and by the massive coastal forest of Chetaïbi in the east. The altitudes of this area range between 0 and 200 m. About 48.5% of the terrain has an incline lower than or equal to 3%. The main lithological units are essentially formed from windy and alluvial deposits. The flora and fauna of this region owes its uniqueness to its geomorphologic diversity. Located at a bioclimatic crossroads, the area is distinguished for high biodiversity richness^[30, 31].

The site plays an important role in the breeding and wintering of some species of waterfowl, notably the white headed duck *Oxyura leucocephala*, classified as endangered, the purple swamphen *Porphyrio porphyria*^[32] and the ferruginous duck *Aythya nyroca*^[19], classified as near threatened^[29]. It also extremely boasts rich floral diversity distinguished for rare species such as *Nymphaea alba*, *Typha angustifolia*, *Phragmites australis*, *Scirpus maritimus*, *Scirpus lacustris*, and *Iris pseudacorus*, which practically cover from 60 to 70% of the total surface of the wetland, and also Pteridophyte *Salvinianatans*. The lake is bordered by a belt of vegetation mainly composed of *Juncus acutus*, *Juncus maritimus*, *Olea europea*, *Asphodelus aestivus*, *Rubus ulmifolius*, and grasslands dominated by *Cynodon dactylon* and *Paspalum distichum*^[20] The Garaet constitutes a basin, which receives rainwater from surrounding mountains. The average depth of water therein varies between 0.80 and 1.20 m, but it may suddenly increase after torrential rains. The land surrounding the site is used by the residents exclusively for the cultivation of such vegetables as watermelon, melon, and tomatoes^[33].

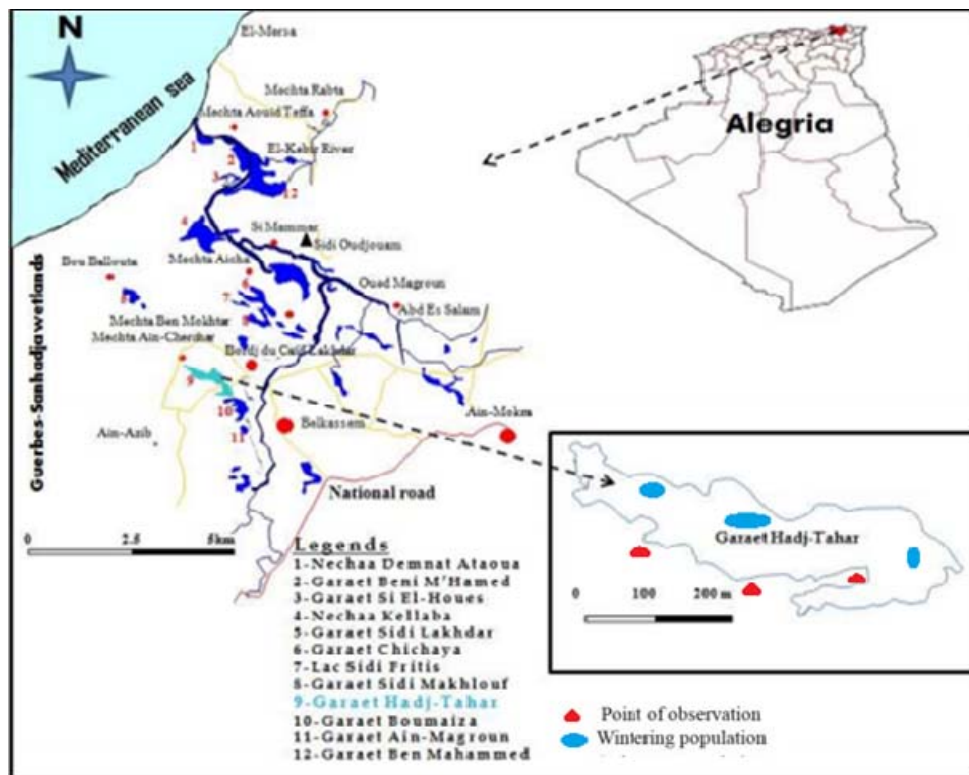


Fig 1: Location map of Garaet Hadj-Tahar and distribution of Teal *Anas crecca crecca*



Photo 1: General views of GaraetHadj-Tahar (a): OrientalSector, (b) western sector. (Photos taken on 24/ 12 / 2013 by Nabil Charchar).

2. Materials and Methods

Phenology and diurnal behavior of Teal *A. crecca crecca* were studied at Garaet Hadj-Tahar during three successive wintering seasons (2012-2013, 2013-2014 and 2014-2015), from the end of August until mid-April. Birds were counted fortnightly (twice a month). Individual counting is possible when Teal group is near to observation points (within 200m) and counts less than 200 individuals and a visual estimation is made otherwise (group includes more individuals and situated in a far and away distance) [34, 35, 36]. The distribution of birds was determined on the water body in order to conclude the different distribution modalities and spatio-temporal occupation of the wetland by Teal.

During the same campaign, regular monitoring of diurnal activities rhythms of Teal *A. crecca crecca* was realized. It was organized on every hour from 8 am to 16h during all the observation time of birds in the water body using the Scan method: *instantaneous scan sampling* [37, 38, 39, 5, 36]. The measured activities are feeding, sleeping (essential activities), swimming, preening and flying (comfort activities). Finally, to understand the course of the wintering season, data collected on this budget time of diurnal activities are then exploited using multivariate Factorial Analysis of Correspondence (FAC), with the ADE-4 software.

3. Results and Discussions

3.1 Evolution of population (bird number)

The monitoring of the evolution of the temporal occupation graph of Garaet Hadj-Tahar by this Anatidae exposes a Gaussian by showing maximum peaks observed during the months of December and January (Fig. 2). In general, Teal starts to colonize the wetland at the end of August of each year where a group of some birds (5-10 individuals) are often observed at the center of the water body. This very small number continues to increase progressively with the arrival and gathering of other Teal coming from other near lakes until January (Fig.2), thus exposing the maximum recorded for species in this lake (506 individuals registered during the first ten days of January 2014). Immediately after, continuous collapses are noted. They translate departures and dispersions of small groups of Teal to other larger sites, bringing the total abundance to tens of individuals registered during March and then to zero during April, indicating the end of the wintering season.

The first occupants of the Garaet disperse on the north-western area of the water body. They are mixed with other species of Anatidae very abundant in the site, represented mainly by the Northern Shoveler *Anas clypeata*, the Ferruginous Duck *Aythya nyroca*, the White-headed Duck *Oxyura leucocephala*, the Mallard *Anas platyrhynchos* [40, 41, 42, 19, 20]. This gregariousness and these gathering provide to Teal and other birds, especially the Anatidae, calm and security [13, 14, 43, 15, 16, 44, 18].

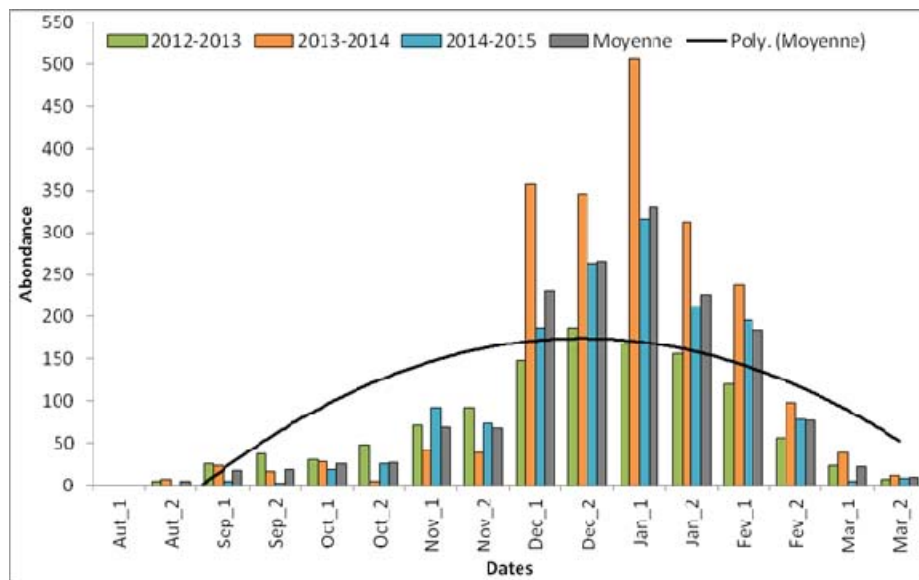


Fig 2: Abundance of the Teal *Anas crecca crecca* in Garaet Hadj-Tahar (from August 2012 to March 2015).

3.2 Study of diurnal behaviours

The record of diurnal behaviours for three wintering seasons (2012-2013, 2013-2014 and 2014-2015), or during 294 hours monitoring, of Teal *A. crecca crecca* wintering at Garaet Hadj-Tahar, was dominated by the activity of rest (diurnal sleeping), which held 40% (Figure 3), showing the role of diurnal delivery of this wetland. It was followed by swimming (mobility and movement in water) with 28.8%, then feeding activity that gathers 13.8% and preening (cleaning the plumage) with 12.7%, and finally the flight observed with a total of 4.7% (Figure 3).

The following of these activities throughout the wintering season shows a great variation in time (Figure 4). Indeed, sleeping which already held the third of diurnal activities

budget at the beginning of the study increases gradually to reach a maximum of 67% observed during the beginning of January. Immediately after, these rates relapse to show values close to 27% during the last part of the study. Diurnal sleep during the wintering season is considered, often for Anatidae (surface ducks and diving duck), a very effective way to minimize energy expenditure and avoid energy waste [5, 13, 43, 15], which will be used during their migration (way back or across the Mediterranean).

Contrary to sleeping, swimming exhibits a "U" curve, where the highest values were recorded at the beginning and at the end of the study. These rates decrease during the wintering mid-season. So, after crossing the Mediterranean, a great agitation is observed in the first ducks occupant Garaet Hadj-

Tahar. These every wild Anatidae [13], often exhibit very apparent activity and often move in all directions. The same findings are noted in Teal at the end of the season. This activity allows birds to gather and form the groups to prepare their spring migration to the nesting usual places. Low fluctuations are recorded for three other activities (feeding, preening and flying), except that the diurnal feeding activity increases slightly towards the end of the wintering season and in individuals eclipses, for the first occupant of the site, we recorded the highest rate of cleaning the plumage (21% of total assets). These birds are obliged to maintain their plumage and change the damaged feathers to begin and carry the new wintering season [13, 17, 41, 19, 20, 31]. The very little flight observed in this species expose more or less stable rates throughout the wintering season, once again showing Teal prefer swimming to regroup instead of take flight to be easy prey for diurnal rapacious (mainly Marsh reeds *Circus*

aeruginosus) breeding in this eco-complex wetland.

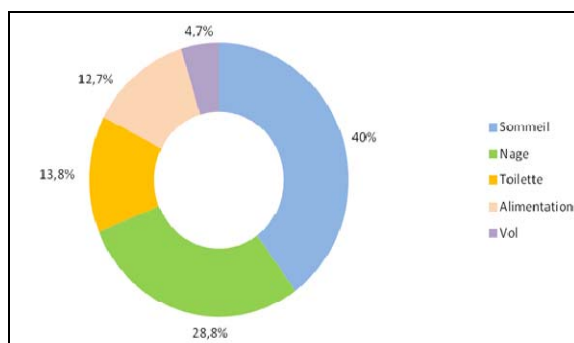


Fig 3: Total diurnal activities rhythms of Teal *Anas crecca crecca* during their wintering at Garaet Hadj-Tahar.

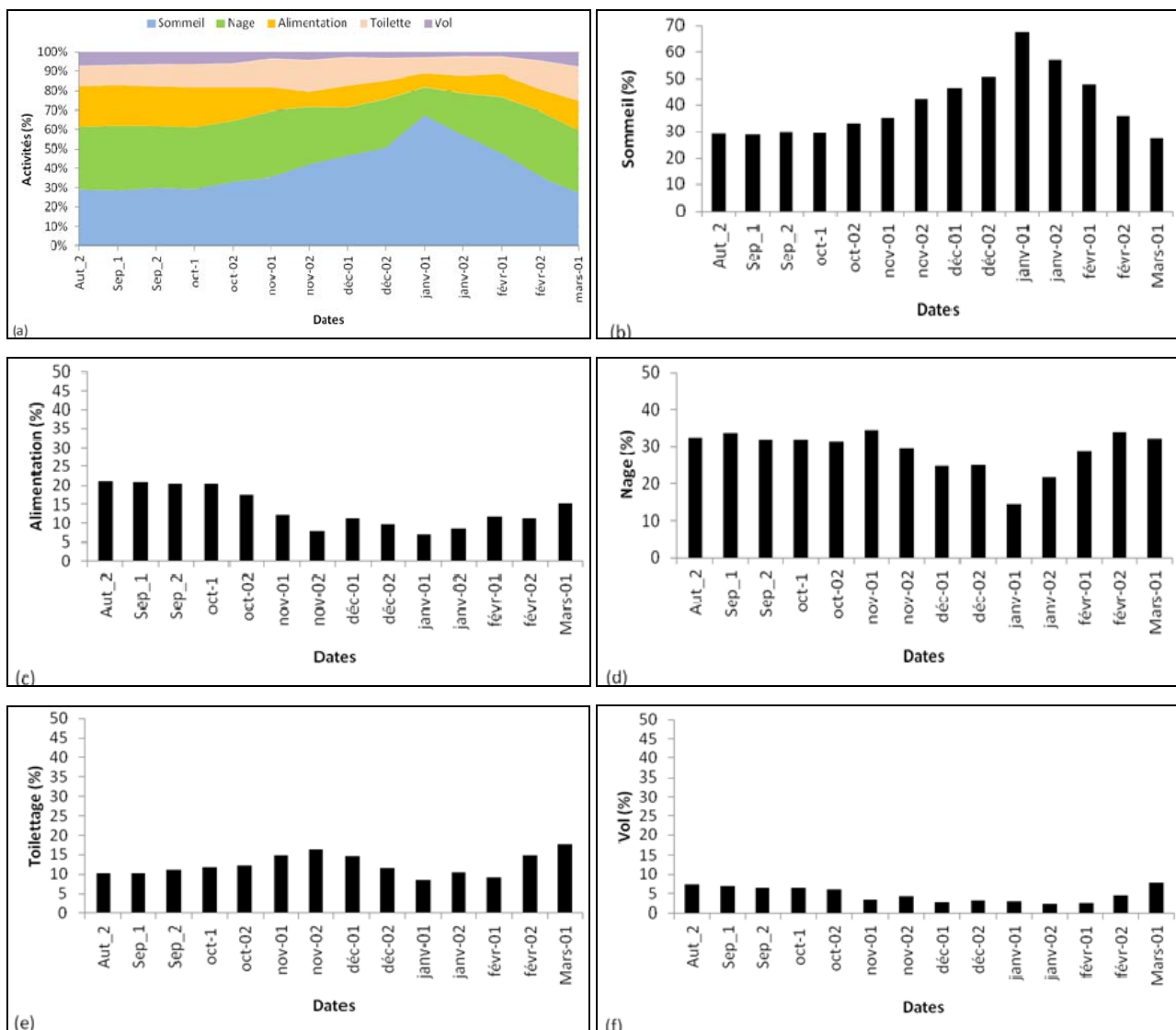


Fig 4: Evolution of diurnal activities rhythms of Teal during their wintering at Garaet Hadj-Tahar. (a) total assets, (b) sleeping, (c): swimming, (d): feeding, (e): maintenance of the plumage, (f): flight.

3.3 Multivariate statistical treatment of diurnal activities rhythms

Multivariate statistical analysis through the FAC in its 1x2 factorial design that brings together 93% of the information shows us on one hand, the wintering season is subdivided into three periods more or less distinct:

- The start of the wintering season including August, September and October where we observe the activities of cleaning the plumage and flight. Thus, in its first occupant of the lake (eclipses individuals), and after a trans-Mediterranean migration, are obliged to change their damaged feathers which take a primordial portion in

this assessment. We also observe regular positioning flights allowing these birds to regroup.

- The mid-wintering composed of November, December and January where Teal display their primordial activity; sleeping, which is the best means of energy conservation.
- Finally, the end of the wintering season (February and March), where birds preparing their new breeding season are obliged to restore their energetic reserves to better conduct their pre-nuptial migration to the usual nesting sites.

Furthermore, we observe both factors (y-axis and x-axis), opposing the two essential activities of Teals. Indeed, the factor 1 (y-axis), opposes sleeping activity to the other four activities. This activity characterizes the whole winter season and mainly mid-winter. Factor 2 (abscissa axis), separates the feeding activity of other activities sleep, flight and maintenance of the plumage. Feeding is always associated with swimming allowing birds to feed on the water surface in the open areas clear from vegetation and away from other ducks occupying the same sectors of Garaet.

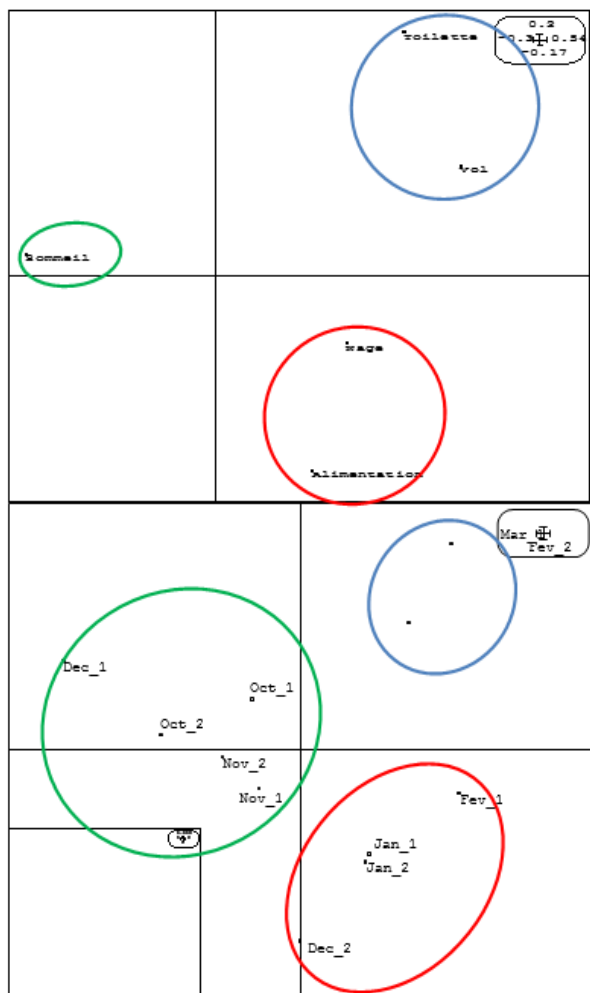


Fig 5: Factorial diagram 1 × 2 of the AFC applied to the data on the rhythm of diurnal activities of Teal *Anas crecca crecca* wintering in Garaet Hadj-Tahar. Axes of inertia: 0.62, 0.31, 0.05 and 0.02.

4. Conclusion

At Garaet Hadj-Tahar, the Teal is a regular wintering Anatidae. It begins to colonize the water body at the end of August where we observe the first eclipses individuals distributed on the northern regions of Garaet. Beyond

September with the arrival of other birds, the numbers gradually increase and begin to colonize the puddles of north-western area dominated by tufts of *Typha angustifolia*. They show a very noticeable gregariousness verifying the data observed on Mediterranean sites [5, 13].

These Teal show a diurnal behavior dominated by sleeping observed throughout the wintering season which holds almost a half of the diurnal balance sheet. Therefore it appears from the diurnal balance sheet that Garaet Hadj-Tahar plays a role in diurnal delivery for these birds. Note that this activity is accented with the progress of wintering season and is favored by the aggregating behavior of these birds. Overall, throughout the period of their presence in the site or during the seven months and a half, wintering season is subdivided into three periods more or less distinct; the beginning of the wintering period from the end of August until late October, then mid-season from November until the end of January and finally the end of the season recorded during February and March. During February and March, feeding activity increases gradually allowing Teal to prepare their pre-nuptial migration to their usual breeding sites located on the northern shores of the Mediterranean.

5. Acknowledgements

This work is from 2012 as part of the preparation of a PhD thesis in Ecology and Environment. The authors of this manuscript are grateful to thank all persons which contributed to the realization of this work Mr. Merzoug Seyfeddine, Md. Halassi Ismahane, Mr. Elafri Ali (PhD students working in the same complex) and Mr. Zemmouri Layachi teacher at the University of Guelma, Algeria.

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