Ecology of Wintering of Common Shelduck (*Tadorna tadorna*) in Sebkhet Djendli (Batna, Hauts Plateaux, East of Algeria)

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**ARTICLE INFO**

**Article history:**
Received 12 November 2014
Received in revised form 31 December 2014
Accepted 22 January 2015
Available online 25 February 2015

**Keywords:**

**ABSTRACT**

The Shelduck *Tadorna tadorna* is a wintering water bird in Sebkhat Djendli (Hauts plateau, East of Algeria). The population size and the diurnal budget time were carried out in this sebkhat during the wintering period 2003/2004. The number of this duck reaches the maximum in January (9200 individuals) due to the arrival of the wintering ducks in the Sebkhat. The study of the diurnal budget time revealed that the feeding is the main activity of the duck (*Tadorna tadorna*) fellow by the swimming (14%), the preening (13%), the sleeping (3%) and the flying (3%). The species used the ground (terrestrial part) near the sebkhat in morning and the shallow part of the site in afternoon. Finally, this study was shown the ecological function of SebkhatDjendli in the wintering strategy of the common shelduck.

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**INTRODUCTION**

In order to determine the role, typology and performance of Algerian wetlands, many studies about water birds were done since 1996 by L.R.Z.H (Laboratoire de recherches sur les zones humides) in northeast of Algeria [25, 10, 12]. Moreover, the data concerning the phenology and spatio-temporal distribution of water birds in these wetlands is associated to the study of behavior of Anatidae[12, 16], especially the determination of the wintering strategy of these water birds (Anatidae) and the role of these sites for them. Also the highly productivity of these wetlands compensate the energy loose by the water birds during the migration [15, 19].

Globally, the anatidae wintering in Europe and expose different modalities in these wetlands that seem as a (functional unit), other views they live in two sites, the first (roosting ground) invested during the diurnal period, gives calm to the water birds and the second during the nocturnal period, seems as a feeding ground when the duck exhibits its trophic activity [27, 28, 29, 32, 21]. These two sites show different characteristics. The roosting ground (brackish, poor of any aquatic vegetation) gives a large security and in the opposite of the first one, the feeding area is very large and richness with aquatic vegetation [30, 31, 32].

Also the Common shelduck *Tadorna tadorna* is a diving duck, usually breeding in Lake Tonga (Northeast of Algeria and Ramsar sit since 1984) and Lac des oiseaux [8], it is very abundant in our wetlands. The study of the diurnal and nocturnal budget time shows an important analyses, first concerning the eco-ethology of this birds and second the ecology of our wetlands.

**Study Area:**

The eco-complex of wetlands in the Hautsplateaux (east of Algeria) renowned by diversity of aquatic system, it cover a large and important surface which extend between Setif (1200 m, elevation) and Ain El-Beida (800 m). With an area of 300 Km it is formed by 15<sup>th</sup> brackish wetlands. The majority of these wetlands become dry during the summer period and the other covered with water only during a rainy season. The largest sites and
wetlands of the Hauts plateau du Constantinois are surrounded in the sebkhas region which are landlocked between Oum El Bouaghi, Batna and Kanchela (Fig 1).

The majority of these wetlands are very salty, inaccessible and few scientific data describe them. The ground surrounded these Sebkhas is salty and used by the local farmer to produce cereal (the durum wheat and barley). In the uncultivated ground we can found a species of vegetal adapted to this hard environment. The mainly are Brassicaceae *Maureciconia arvensis*, *Matthiola fructicola* and *Diplotaxis muralis* and Chenopodiaceae *Atriplex halimus*, *A. patula*, *Suaeda fruticosa* and *Salicornia fruticosa*. Since February 2nd 2004, the forest department in Oum El Bouaghi nominated 5 new wetlands that classified as Ramsar site, the main wetlands of the Hauts plateau are:

**Garaet Tarf** (35°38.42'N, 07°01.281'E): Is the largest sebkha in the region (25500 ha), situated in the east of the eco-complex [5] and lodge a very diversify aquatic avifauna (Johnson 1979). Every winter we can count 3200 Greater flamingo *Phoenicopterus roseus*, 20000 Common shelduck *Tadorna tadorna*[6] and several Anatidea.

**Garaet Ank Djemel** (35°45.225’N, 06°54.442'E): With an area of 8550 ha (Fig 1), this site is frequented during winter by diversify aquatic avifauna, 52 species of water birds are counted (personal observation).

**Garaet El Maghssel** (35°49.581’N, 06°43.529'E): This wetlands about 110 ha is situated in the north of Garaet Ank Djemel (Fig 1). It is an inaccessible area due it location between mountains. During this study 14 species of water birds are observed.

**Garaet Guellif** (35°45.225’N, 06°54.442'E): It is the very important wetlands in the Hauts plateau (in east of Algeria). Situated approximately of Garaet Tarf and with an area of 5525 ha (Fig 1). This Garaet is surrounded by cultivated ground (mainly the Durum wheat *Triticum durum*). This site is frequented during the winter by many water birds [22].

**Chott Tinsilt** (35°53.975’N, 06°29.581'E): Is a 3600 ha wetlands (Fig 1), that received waste water of Souk Naamane district. Thus it is exploited as a feeding ground during the diurnal period by the water birds such as Great flamingo, common shelduck and Ruddy shelduck [7, 18].

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**Fig. 1:** Location map of the study area. The bleu area is SebkhatDjendli (Batna, Haut plateaux).
Garaet Ezzemoul (35°53.137’N, 06°30.200’E): Also called sebkhat Ouled Zouai. This is a natural site of Great flamingo breeding [24] in 2005, 5000 chicks born in this wetland [26]. In 2006, 3750 chicks [7]. The salty water characterized this sebkha. It is exploited by E.N.A.S.E.L (Algerian main factory) to produce salt.

Etang de Timerganine (35°39.241’N, 06°57.468’E) and Lac Boulbilet (35°44.542’N, 06°47.222’E): Are 250 ha and 180 ha respectively and the only freshwater ponds in the Hauts plateau (Fig 1). Harbor a high level of biodiversity (flora and avifauna), 30 vegetable taxa and 57 taxa are inventoried [34].

Ougla Touila (or Sekbhat Boucif) (35°47.829’N, 07°04.494’E): This pond of 175 ha is the nearest wetland in Oum El Bouaghi (Fig 1). It is situated in the north of Garaet Tarf and filled by water during the rainy season [22].

Garaet Djendli (35°41.466’N, 06°31.193’E): This pond is situated in a south of Garaet Ezzemoul (Fig 1). It occupy an area of 3750 ha and sparse with farm house in the oriental and meridional part. It is frequented by Common shelduck Tadorna tadorna, Great flamingo Phoenicopterus roseus, Ducks and White stork Ciconia ciconia [2].

Garaet Gémot (35°38.303’N, 07°00.506’E): It is a 57 ha wetland pond located in Hauts plateau and annex of Garaet Tarf (Fig 1). Dividing in two parts by the national road (linking Oum El Bouaghi and Khenchela). This site is surrounded by Tamarix gallica and Scirpus lacustris.

Chott Melah (35°36.446’N, 07°05.136’E): Situated in the south of Garaet Tarf, have an area of 85 ha and rarely emerged by water (Fig 1). It is frequented by Wader (Scolopacidae), Eurasian spoonbill Platalea leucorodia and White stork Ciconia ciconia.

Chott Zehar (35°36.135’N, 07°03.314’E): Is an annex of Garaet Tarf (Fig 1), this shallow pond of 76 ha is frequented by Common shelduck Tadorna tadorna, and Northern shoveler Anas clypeata.

Garaet Ouled M’barek (35°20.261’N, 07°15.429’E) and Garaet Ouled Amara (35°23.378’N, 07°20.315’E): These two wetlands of 340 ha and 950 ha respectively are situated in the southern of the eco-complex of Hauts plateau (Fig 1) with a depth of 1.5 m and 2.5 m respectively. These are a breeding site of Ruddy shelduck, Black winged sill and Pied avocet [23].

MATERIAL AND METHODS

In the Tundra or the Tropic region, the food deficiency allows the birds periodically migrate a long way to get these trophic resources [20]. The aims of this topic is study the ecology of the Common shelduck Tadorna tadorna in the salty wetlands of Hautsplateaux (east of Algeria).

Regular diurnal counts were done during two successive wintering season (from October 2003 to April 2005) with telescope Meopta (20 x 60). Individual count is done when the number of birds is under 200 individuals, however if the number of birds exceed 200 individuals, we estimated the population size by dividing visual range into strip, counting one range and extrapolating the number of population [16, 1]. The spatial distribution of the birds was situated upon a map using a vegetal landmarks. The monitoring of the diurnal budget time was carried out during two wintering season using instantaneous scan sampling [3, 4, 17]. This sampling was started morning (07:30) to afternoon (16:00). The total time allocated to the observation is 128 hours. The activities measured are: feeding (in the border and/or on water), swimming, preening, sleeping and flying. The matrix of data collected is analyzed using multivariate statistical test provided by the ADE-4 software [9, 33].

RESULTS AND DISCUSSION

Phenology of the Common shelduck in Sebkha de Djendli:

The first individual of the common shelduck start to occupy Sebkha de Djendli early September and remain to the end of April, which confirm the wintering status of this duck in the Hauts plateau [6]. Globally, the graphic of the temporal occupation take a bell shape, the number of shelduck is reduced in September then increase gradually due to the massive arrival of the wintering population (the maximum recorded is 9200 individual in January) (Fig. 2), then the number of the shelduck gradually drop at the end of the wintering period (we observed just 100 individual). After April, the sebkha is drained due to the hot temperature.

The common shelduck are observed scattered in several groups in the Sebkha (Fig 2). Early morning, these anatidea occupy the bank in the site and occidental and septentrional parts and exhibit intense trophic activity. Contrariwise, in afternoon the ducks leave this quietness part of the Sebkha and occupy the center of the site.

Diurnal time budget of the Shelduck:

The study of the general diurnal time budget of the common shelduck in Sebkha de Djendli during the wintering season 2003/2004 is dominated by the feeding activity (68%) which is observed either on the bank or on the water. This activity is followed by the swimming (14%), the preening (13%), the sleeping (3%) and the flying (3%) (Fig. 3).
Fig. 2: Abundance of the Shelducks in SebkhatDjendli during the wintering period 2003/2004.

Fig. 3: Budget time of the Shelduck in Sebkhat Djendli during the wintering season 2003/2004.

The monitoring of this diurnal time budget of the shelduck shows that:
1. The sleeping is a morning activity, it occupies 8% of the time budget for the first wintering shelduck then it decrease gradually to 2% at the end of the wintering season (Fig. 4).
2. The graphic of the swimming activity shows 2 characteristics; first the swimming is observed in the vespers period and second this activity is constant during all the study period (Fig. 4).

3. The preening is a fundamental activity to the water birds [32]. It is almost observed in the morning. The graphic of this activity shows a rate of 10% at the start of the wintering period. This rate reaches gradually the maximum in November then decrease between 7 and 8% until the end of the wintering season (Fig. 4).

4. The feeding activity which dominate the diurnal budget time of this duck in Sebkha de Djendli is observed on the center of the water or on the bank. This activity is done on the bank in morning (during the lowest temperature of water) and on the center of water in vespers period either by tilt body or by filtering water with beak (Fig. 4).

5. The flying activity which takes a low proportion in the general diurnal activity budget is observed in morning. It characterized the post-migration period (in October) of the wintering population of Shelduck in Sebkha de Djendli (Fig. 4).

**Fig. 4:** Temporal evolution of the budget time of the Shelduck in Sebkhat Djendli. A: sleeping, B: feeding on water, C: swimming, D: feeding in bank, E: preening, F: Flying.

**Statistical analysis:**

The multivariate analysis (C.A) with a factorial layout 1 x 2 which keeps 61 % of a general information, shows a structured temporal distribution of the shelduck activities in sebkhat Djendli marked by climatic change (Fig. 5). In fact, between early September 2003 and late April 2004 (the wintering period of common shelduck in sebkhat Djendli), the diurnal time budget is divided in three various periods (Fig. 5):

1. At the start of the wintering period (mainly September and October), the shelducks exhibit either a roosting behavior in the center of water observed in the morning or a feeding behavior in the bank of the sebkhat observed in the afternoon.

2. Then during November 2003, December 2003 and January 2004, the shelducks changed the damaged plumage. This moult which coincide with the cold period improve the adaptive condition of the birds to keep the corporal temperature.

3. The last period (between February and April 2004) the shelducks swim in the middle of the sebkhat de Djendli, this activity is associated to the feeding behavior. Also, the flying activity is a natural reaction of these ducks mainly due to disturbance in the sebkhat caused by the local riparian. Such as all anatidae, the common
shelduck *Tadorna tadorna* grouped in the middle of the site during the post-migration period and exhibit a gregarious behavior [27, 29, 30, 32, and 21].

Thus, the abscissa axis separate the type of feeding in the sebkhat. In fact, between September 2003 and January 2004, the feeding of the shelducks was observed mainly in the bank of the site due to the low temperature of the water (low abundance of the insects in the water), while between January to April 2004, the rising of the water temperature makes that ducks occupy the middle of the site to feed. These ducks show several modality of feeding: switchover in the shallow part of the sebkhat, by head and by beak. Concerning the ordinate axis which exposed the characteristics and modalities between the after and/or before migration period, in the first period the preening of the plumage is associated to the flying activity and in the second the swimming activity is noted in morning or in afternoon at sebkhat de Djendli.

Fig. 5: Factorial layout of the corresponding analysis of the Shelduck in SebkhatDjendli during the wintering season 2003/2004. Inertia axis 0.35, 0.26, 0.18, 0.07, 0.05 and 0.03.
Conclusion:
In semi-arid environment, to differ between zonal and no zonal ecosystems is difficult because the heavy conditions in these ecosystems. However the sebkhas approved a specific and single factors due to the rising of the salt at the surface of water forming a salty ground called Chotts that occupy a large part of Algeria. This concentration of the salt in the ground decreases the abundance of the vegetal cover in these sites.

In Sebkhat Djendli three Chenopodiaceae are observed: Salicorniafruticosa, Atriplexhalimus and Suaedafruticosa. These plants which adapted to this extremely environment indicate the concentration of the salt in this area.

Due to the single climatic condition in the sebkhat, a various taxa of flora were observed. 117 species were identified in a small strip which situated between a durum wheat Triticum durum area and the sebkha. We can noted in these small strips: the Brassicaceae such as Moricandiaarvensis, Sisymbriumribulianum, Alysummontanum, Matthiolafrutucosa and Raphanusrhapansistrum and the Asteraceae such as Centaureacalcitrapa, Calendula arvensis, Taraxacumlaevigatum, Artemisia herba alba, Anthemisperdunculta and Senecio vulgaris[22].This microhabitat is used by the water birds during the wintering period owing to the quietness. The shelduck occupy the bank of the sebkha to find some thermoregulation (warmer temperature) and foraging (seeds availability) advantages in terrestrial area [1].

The common shelduck Tadorna tadorna is present in the sebkhat de Djendli with a high number. Globally this duck invested the shallow part of the site mainly in the area with a large distribution of the insect larva. The feeding is the major activity of the shelduck in sebkhat Djendli and in all wetlands of the complex. Three modality of feeding are used: switchover the body, by head or by beak. This results expose the diurnal behavior of the common shelduck Tadorna tadorna during the wintering season 2003/2004, however a study of the ecology and the behavior of all ducks (Anatidea) that wintering in the region in order to prove the role of feeding/roosting of these wetlands.

This study give a new update data concerning the wintering strategy of the shelduck Tadorna tadorna in Algeria, especially in sebkate Djendli (Batna, Haut plateau, East of Algeria) and it is interesting to survey the behavior of this duck in different bio climatic region in order to assess local statue of this species.

ACKNOWLEDGMENTS

The authors gratefully acknowledge M. Abdelatif GASMI of the direction of Forest, Batna (Algeria) for his help.

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