



## Status and wintering time budget of Mallard (*Anas platyrhynchos*) at El Eulma wetland complex Northeast Algeria

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### Abstract

The present study was conducted for three consecutive years 2007-2010 to study the ecologic status of *Anas platyrhynchos* and the diurnal behavior for the winter season 2009-2010 at El Eulma wetlands complex northeast Algeria. Half monthly counts depicted the phenology of Mallard where the first winter visitors arrive in early September, reach a large size between late September and early October, disperse in mid-winter and occupy the sites during breeding season till early summer. Mallard population frequenting mainly S. Bazer (Ramsar Site) exhibited stability through the three- year period observations and had a high attraction to this site. Monitoring diurnal activity time budget using scan sampling method every half-hour for eight hours during the wintering season displays that the dominant behaviours are sleeping and resting that account for 85.18% and 4.23%, respectively of mean percentage time spent. Whereas, Feeding accounts for only 3%; comfort activities account for less than 5 %. Moreover, Mallard shows a great flexibility in foraging methods with dominance of dabbling (59%) followed by surface feeding (24%) and finally grazing on the shores (17%). Thus, the results suggest that El Eulma wetlands complex is one of the main wintering quarters in Algeria for Mallard and S. Bazer is used as daylight roost area.

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## Introduction

Waterfowls are considered as excellent model for determining the state of natural ecosystems (Eybert *et al.*, 2003), they are bio indicators of the diversity of natural environments (Blondel, 1975). Mallard *Anas platyrhynchos* is one of the most remarkable components of wetlands (Bibby *et al.*, 1998).

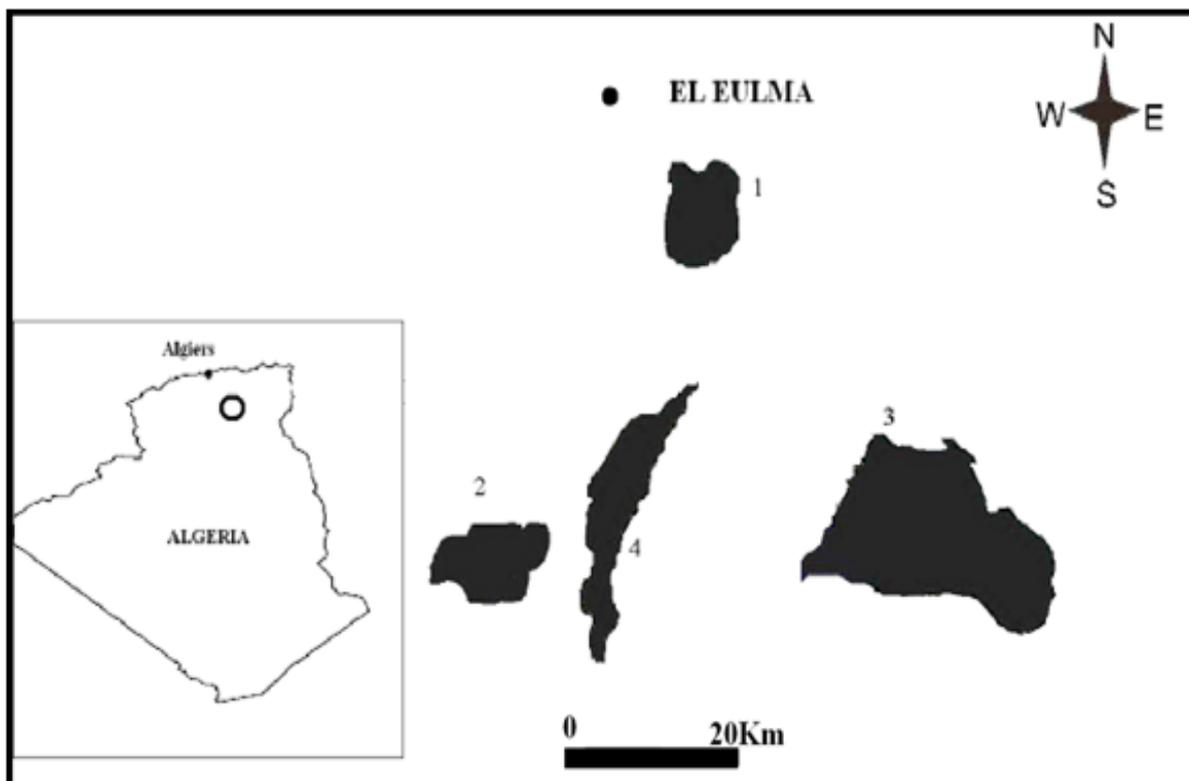
Early studies reported that Mallard overwinter in Algeria where sporadic winter counts in the past provided an estimation of Algerian population that did not exceed few thousands individuals during 1972-1994 (Chown and Linsley in Isenmann and Moali, 2000). In a recent survey, Samraoui and Samraoui, (2008) have reported the species as a highly dispersed water bird over Algerian wetlands and frequented different habitats. Moreover, it was reported to be a widespread breeding species in few wetlands sites mainly in Northern coastal region of Algeria. Time budgets have proved to be an important tool for revealing the ecological requirements of wildfowl by relating feeding activity to habitat selection (Baldassare *et al.*, 1988; Paulus, 1988).

The mallard could be useful to understand the geographic variation in wintering strategies and to identify key ecological requirement of the species for management purposes. Due to lack of information on regular census and on diurnal behavior of Mallard population in Algeria, the present study is aimed to study the status, the phenology, the spatiotemporal distribution, the habitat use and the diurnal activity time budgets of Mallard at the Ecologic complex of the Hauts Plateaux northeast Algeria.

## Materials and methods

### Description of study sites

The Hauts Plateaux, sandwiched between the Sahara Atlas and the narrow coastal plains of Algeria, include an impressive number of wetlands. Most of these are vast, shallow salt lakes that have been little studied and are poorly known. The wetland complex of EL Eulma (Fig.1) is part of this huge complex and is bordered by the towns of EL Eulma in the north and Batna and M'sila in the south.



**Fig. 1.** Map of the wetlands complex of EL Eulma, in the Algerian Hauts Plateaux, Site locations are: 1 = S. Bazer, 2 = S. El Hamiet, 3 = Chott El Beidha, 4 = Chott El Frain.

In locality designations, the words Sebkhet (salt lake), oued (wadi) are abbreviated to 'S' and 'O', respectively. The main water bodies found within this complex (mean altitude of 900 m) are:

Sebkhet Bazer (35°63'N, 5°41'E): The permanent salt lake (4,379 ha) in the region, fed by rainfall and by the seasonal streams, Oued El Guitoune, Oued Djermane and mainly by Oued El Mellah which is permanent (houses and industrial sewages). It was classified as Ramsar Site in 2004 and an Important Birding Area (IBA).

Sebkhet El Hamiet (35°55'N, 5°33'E): This temporary salt lake is composed of Sebkhet (1400 ha) and a humid meadow (200 ha) on its surround. Water level is changeable according to seasons and years. It was classified as Ramsar Site in 2004.

Chott El Beidha (35°35'N, 5°48'E): This 12,223 ha temporary salt lake is composed by a sebkhet (90%) fed mainly by rainfall and a humid permanent meadow (10%) covered by halophyte vegetation. It was classified as Ramsar Site in 2004.

Chott El Frain (35°59'29"N, 5°46'65"E): This 16,750 ha temporary salt lake is accessible through National road 77 and departmental road 64. It is bordered by AinAzal town to the south and AinLahdjer town to the west. It is fed mainly by rainfall.

#### Methods

Twice-monthly counts were carried out from September 2007 to July 2010 using an Optolyth x 20-60 telescope. Individual birds were counted when the numbers present were small. When more than 200 birds were present, an estimation of the population size was achieved by dividing the flock into small equal parts and through extrapolation (Tamsier and Dehorter, 1999).

Time budgets were monitored at twice-monthly intervals, starting from October 2009 to March 2010, using scan sampling (Altmann, 1974). All scans lasted 8h (with a scan carried out every half hour between 08:00h and 16:00h, with a total of 88 hr devoted to these observations.

Behaviour was divided into ten activities: feeding, swimming, preening, resting, sleeping, flying, agonistic Behaviour, walking, loafing and courtship. Feeding was additionally divided into four strategies: surface feeding, dabbling, upending and grazing.

During the year 2009 -2010 the maximum water depth did not exceeded 18 cm and the minimum was 6 cm at S. Bazer.

#### Statistics and Analysis

The hourly data set were analyzed was to determine the mean percentage time spent by Mallard in each activity for the whole winter season. Standard errors are indicated as  $\pm$  SE.

#### Results

##### *Mallard phenology and status*

The three-year survey revealed that El Eulma wetlands complex shelter Mallard *Anas platyrhynchos* during winter and breeding season. Sebkhet Bazer showed to be the most frequented site by Mallard. Site occupation starts in early September, reaches a maximum in late October (mean value > 700) (Fig. 2A) which coincided with new arrival of waterbirds at the site, then after a gradual decline occurs in mid-winter (November–December).

A partial recovery in mean numbers occurs in late winter. However, the population remains fairly stable within spring time at mean values that range between 200-300 individuals.

This corresponds with breeding season of the Mallard. The latter remains all over the breeding season at the site until late June where few (<20) individuals were present (Fig. 2A).

As opposed to the regular presence of Mallard at S. Bazer, S. El ElHamiet and ChottBeidha exhibited, sharp fluctuations and a decline in numbers with similar maximal winter counts (479 individuals) recorded in early and late November 2007 at Chott El Beidha and S. El Hamiet, respectively.

Due to low rain falls during the years 2008-2010, both site dried out which led to a long-term abandonment by water birds to elsewhere. Water birds were present only during September-October at Chott El Beidha (300-500 individuals), which corresponds usually with arrival time of wintering waterfowl at study sites (Fig. 2 B, 2 C).

The maximal counts recorded within 2007-2010 were quite similar in numbers and in date of sampling for S. Bazer which reflects the carrying capacity of the site; whereas, it declined by 24-160 times over the 2007-2010 at S. ElHamiet; and 2.5-1.5 times over the same period at Chott El Beidha (Table 1).

**Table 1.** Maximum counts of Mallard in each main site (M. C. S) with date of sampling at El Eulma wetlands complex.

Site	Winter	M.C.S	Date of M.C.S
Sebkhet Bazer	2007- 2008	800	03/10/2007
	2008-2009	802	26/09/2008
	2009-2010	1050	03/10/2009
Sebkhet El Hamiet	2007- 2008	479	22/11/2007
	2008-2009	20	31/01/2009
	2009-2010	3	03/10/2009
Chott El Beidha	2007- 2008	758	07/11/2007
	2008-2009	500	09/10/2008
	2009-2010	300	27/10/2009

Mallard population during activity time budget at S. Bazer fluctuated and ranged between 32-400 individuals (Fig. 2D). The lowest number were recorded in late November (32 individuals) while the progressive increase in numbers in March corresponds with approaching breeding season.

**Table 2.** Time devoted to different activities during 8 hours daylight by Mallard at S. Bazer over winter season 2009 - 2010.

Behaviour	Time devoted in hours
Sleeping	6.81
Resting	0.34
Preening	0.34
Feeding	0.26
Swimming	0.11

#### *Mallard activity time budget*

The diurnal activity time budgets recorded for Mallard within S. Bazer indicate that sleeping was the dominant diurnal activity where birds devote more than 4/5 (85.18%) of their mean time spent sleeping (Fig. 3).

Mallard allocated less than 5 % on comfort activities where the mean percentage time devoted to resting, swimming and preening was 4.23%, 4.21% and only 1.33%, respectively. As the water bird is nocturnal, the mean time spent feeding was only 3.19% (Fig. 3). Locomotion was scarce (1.03%) and used only when water bird moves on the shores. As the study site was rarely subjected to human disturbance or to other possible predator such as dogs, flying exhibited a mean percentage time of less than 1%. Courtship, loafing and agonistic behaviors were rarely observed during our diurnal survey and had less than 1% of the mean time allocated diurnally (Fig. 3).

Seasonal changes in mean time apportioned to sleeping showed minor fluctuations paralleled with increase in time spent feeding on early winter with mean percentage time value of ~ 82% which coincided with water birds arrival at site. The highest value for sleeping was recorded in mid-winter (early December, 94.85%) and the lowest value was recorded in early spring (late March, ~ 71%) that corresponds with breeding season start (Fig. 4).

The seasonal changes in diurnal time spent feeding at S. Bazer exhibited a slight elevation in early winter with a value of 6%, then after feeding behavior declined sharply within mid-winter where the lowest values (0%) were recorded in late November and early December when birds allocated more time to sleeping. Not until early spring where the Mallard showed a restoration in diurnal feeding activity with values above 7% (Fig. 4).

Feeding, as the second major activity, was accomplished in three ways: dabbling with a value of 59%, surface feeding with a value of 24% and grazing on the shores with a value of 17% (Fig. 5). Mallard as granivorous duck was seen in cereal fields foraging in early winter, sowing period, and in late winter early spring. Upending as another feeding strategy used commonly for feeding in deep water was not observed due to the lack of depth during the study period.

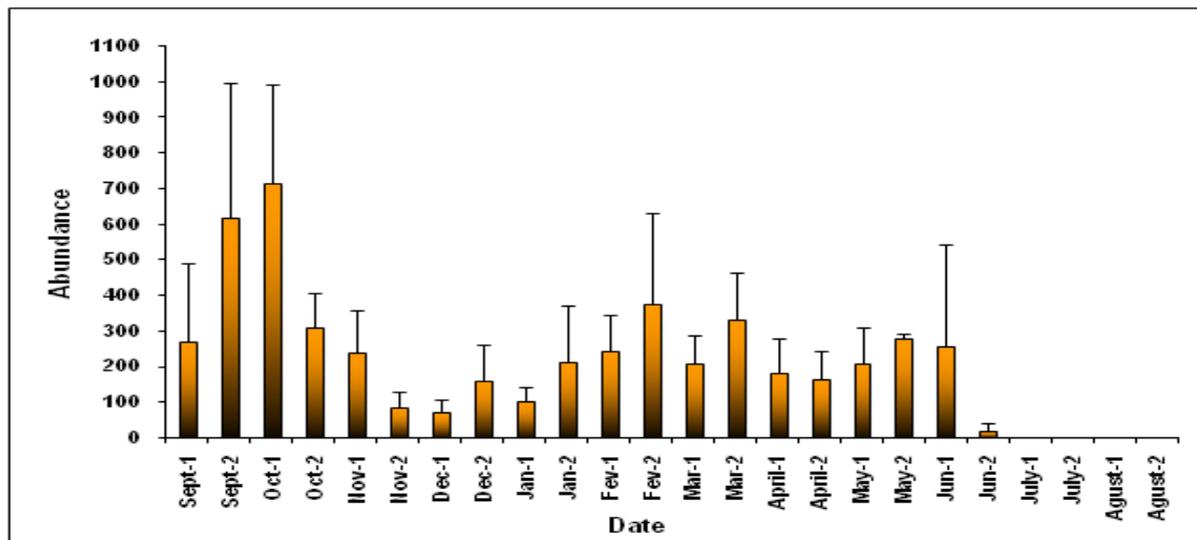


Fig. 2A. Half monthly counts of Mallard at S. Bazer for three- year period: 2007-2010.

Comparison of average time allocated to different activities within eight hours of daylight observations shows that the main activity was sleeping and accounts for 6.81 hours, followed by resting with a value 0.34 hour, whereas; preening and feeding account for 0.34 hour and 0.26 hour, respectively (Table 2).

## Discussion

### *Mallard phenology and status*

This study indicates for the first time the importance of wetlands complex of El Eulma as one of the main wintering quarters for Mallard *Anas platyrhynchos* like many other waterfowls in the eastern Hauts Plateaux in Algeria (Samraoui *et al.*, 2006; Boulekhssaim *et al.*, 2006; Baaziz and Samraoui, 2008; Samraoui and Samraoui, 2008; Bara *et al.*, 2013; Ouldjaoui *et al.*, 2013; Aberkane *et al.*, 2014; Meziane *et al.* 2014; Bouakkaz *et al.*, 2016). Moreover, it illustrates its status, spatiotemporal distribution and diurnal activity time budget.

Early records (Chown and Linsley in Isenmann and Moali, 2000) showed that European Mallard overwinter in Algeria between October and April in Tell where sporadic winter counts in the past produced an estimated Algerian population total of 1600-9200 individuals counted during 1972-1994. At Lack Oubeira, 3000-5000 counted on 17 January 1992. The species was also recorded in the Sahara: 30-40 individuals in January 1976 at Djamaa, Ghardaia and even Tassili and Ahagar (Neithammer, 1963). In 2004, Algerian Directorate General of Forests (DGF) reported that 100 individuals were counted at S. Bazer in 2000 and 63 at Chott El Beidha in 1999. In a survey undertaken of 100 major wetlands across ten distinct regions of Algeria, Samraoui and Samraoui, (2008) have reported the species as a highly dispersed wetland bird over 47 wetlands and frequents different habitats.

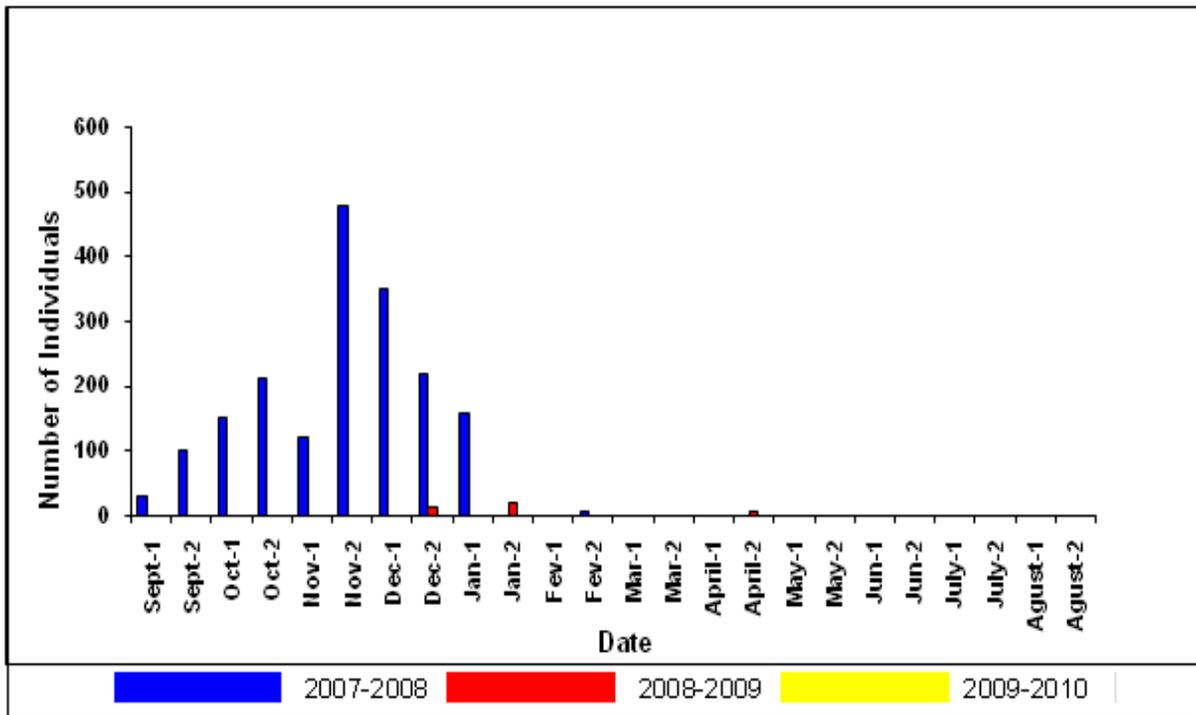


Fig. 2B. Half monthly counts of Mallard at S. El Hamiet during three-year period: 2007-2010.

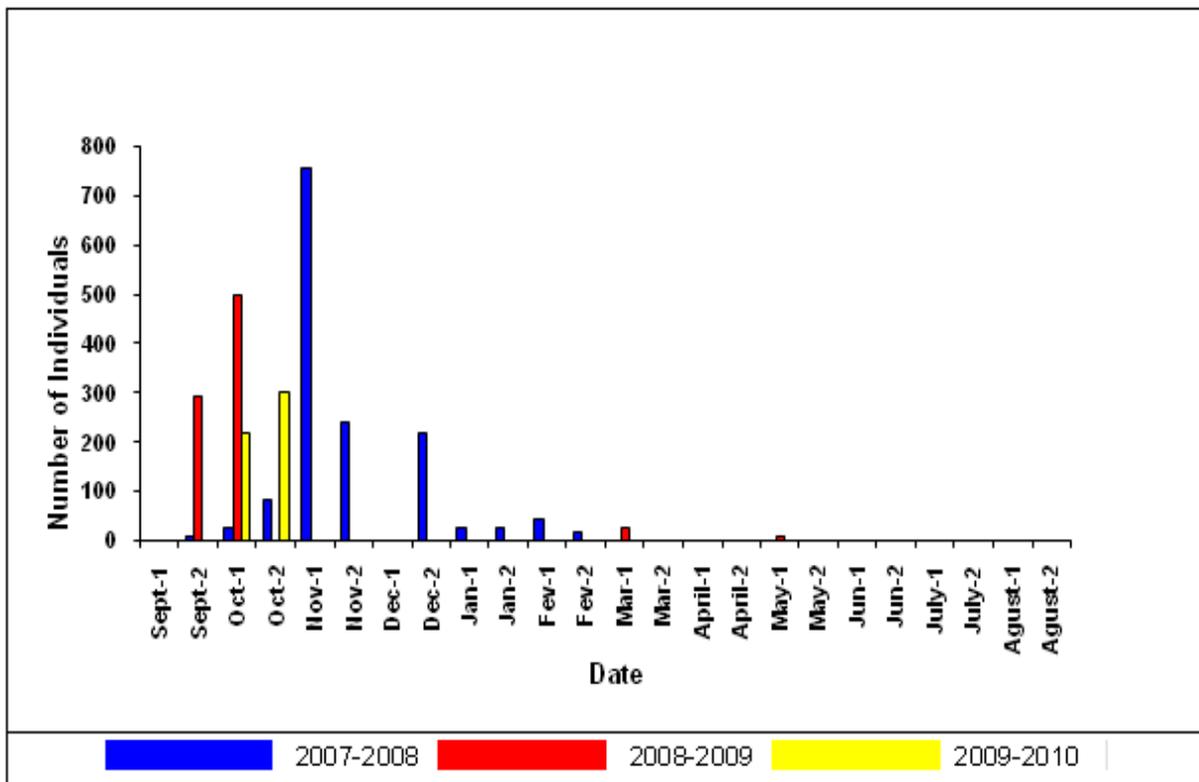
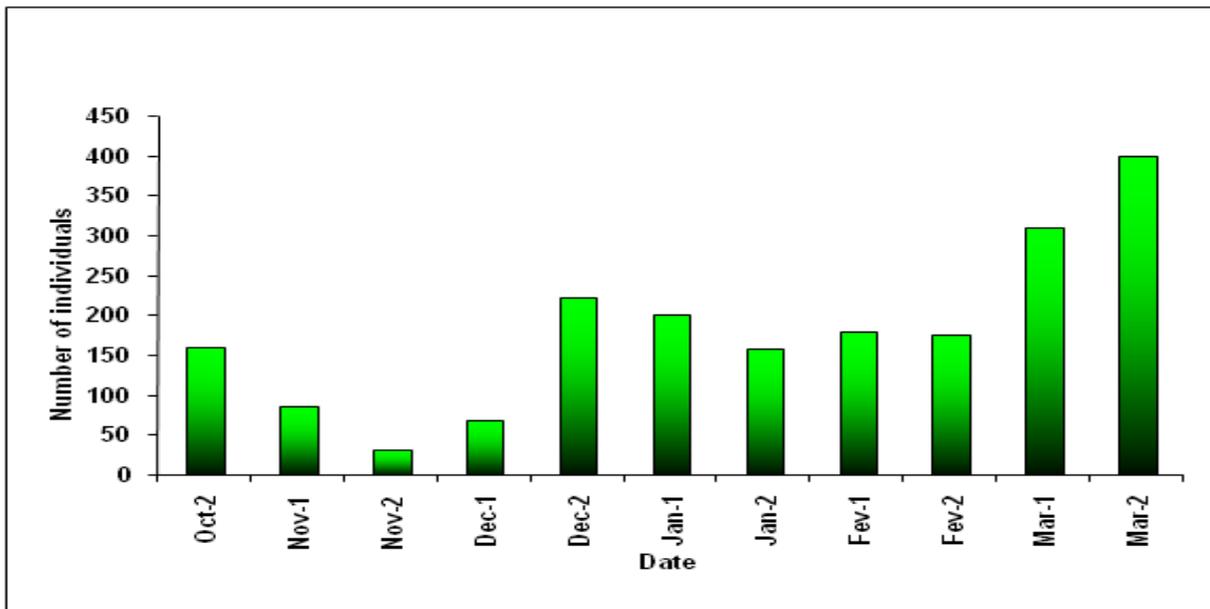


Fig. 2C. Half monthly counts of Mallard at Chott El Beidha during three-year period: 2007-2010.

Despite the above data, no regular census of the Mallard was carried out in Algeria at all sites during winter seasons so far.

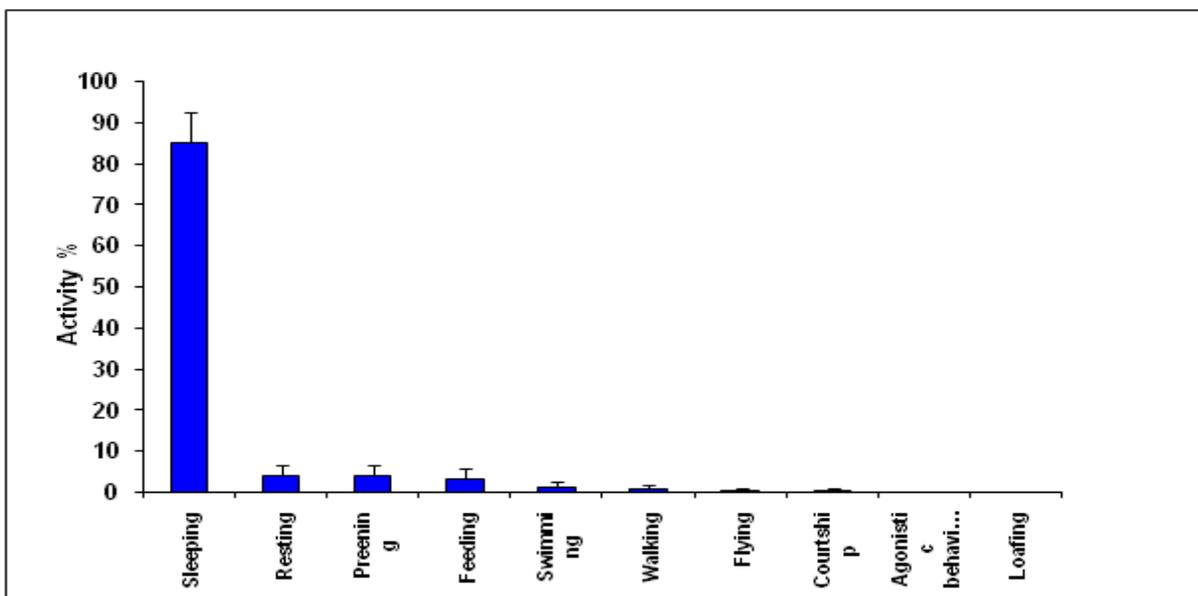
Thus, the present study is at least a contribution to a fair estimation of Mallard population size in part of the Hauts Plateaux Northeast Algeria.



**Fig. 2D.** Counts of Mallard within diurnal activity time budget over winter season, 2009 -2010.

Furthermore, the results of a three year regular phenological survey on mallard indicates that the first winter visitors arrive in early September, reach a bulkiness between late September and early October, disperse in mid- winter and occupy the sites during

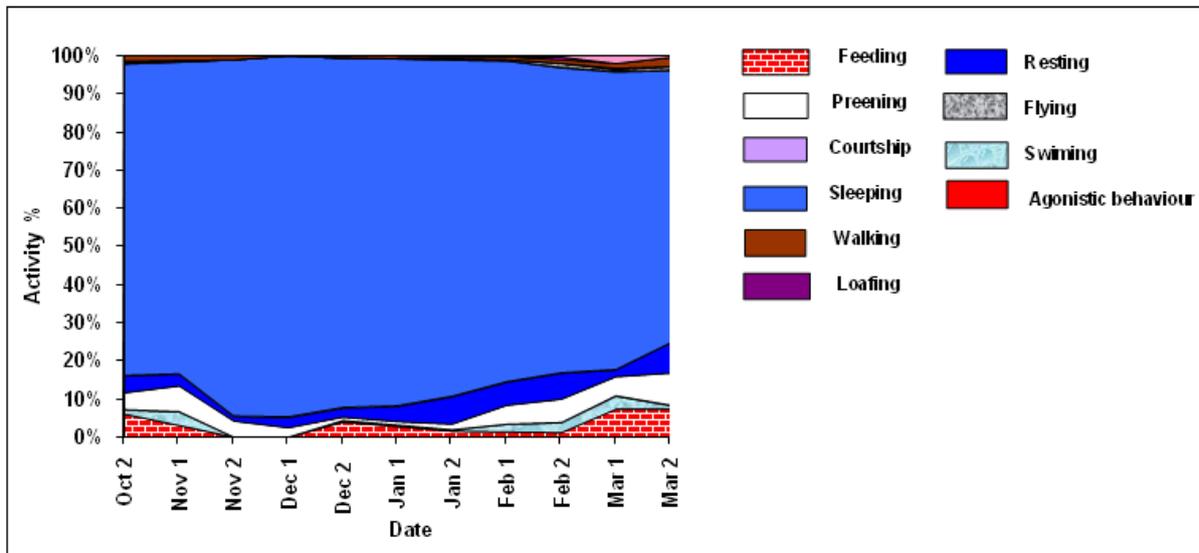
breeding season till early summer. In Fact S. Bazer as an important birding area (Samraoui and Samraoui, 2008) shelters the species either for wintering or breeding where many couples were seen with their broods swimming (persobs).



**Fig. 3.** Mean time spent on different diurnal activities by Mallard at S. Bazer during winter 2009-2010.

Moreover, the present study indicates stability in Mallard population frequenting mainly S. Bazer over the three year observations. This regular recurrence can be explained, at least in part, by: (1) the fact that Mallard winters in shallow waters where optimal depth varies between 20 to 40cm (Heitmeyer, 1985

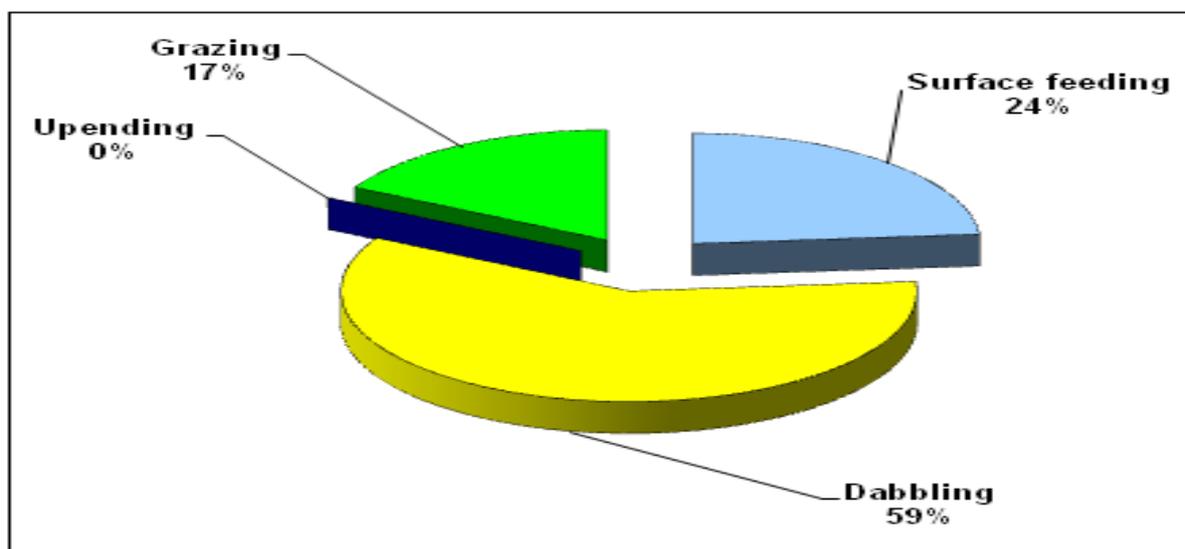
cited in Allen, 1987; Tamisier and Dehorter, 1999); (2) Ducks, were also shown to concentrate on ponds of intermediate invertebrates' richness and intermediate size suggesting that pond size as well as food abundance affect their distribution (Guillemain *et al.*, 2000; Khemis *et al.*, 2016).



**Fig. 4.** Seasonal changes in mean time spent in different diurnal activities by Mallard, at S. Bazer during winter 2009-2010.

The fact that S. Bazer did not dry up completely within the study period winters, hence, it was the most attractive site for Mallard probably due to its permanent affluent which feeds the site with sewage water and important food stock, yet, this assumption require further investigation.

The differences in preferring habitats within our study sites might be due to an adequate water depth and quality (Allouche, 1988), the type of food available that was found to influence the presence, in a given site, of specific species according to their needs (Verhoeven, 1980; Britton and Podlejski, 1981; Del Hoyo *et al.*, 1992).



**Fig. 5.** Mean percentage of total time spent feeding during eight hours observation using different feeding strategies by Mallard at S. Bazer over winter 2009 – 2010.

Thus, the results suggest that El Eulma wetlands complex, as a part of the huge HautsPlateaux, is one of the main wintering (and possibly breeding) quarters in Algeria for Mallard.

*Activity time budget*

Since Mallard is generally a nocturnal species (Guillemain *et al.*, 2002) depending on tactile food selection (Tamisier and Dehorter, 1999),

our data exploit diurnal observations and thus can only provide a partial overview of the activity time budget during winter at S. Bazer. Sleeping was the dominant behavior within the wintering period. An early investigation carried out in North America by Turnbull and Baldassarre, (1987) showed that resting was the major diurnal activity with a mean percentage time ranging from 39% to 54% that was less than the mean time allocated to resting and sleeping (89%) at S. Bazer. This discrepancy might be due to the geographical differences or to other unknown factors. Feeding ecology of wintering granivorous dabbling ducks *Anas* spp has been intensively studied in Camargue, South France where the birds feed very little by day (<10%) and at night fly far from roosts to a variety of feeding habitats e.g. freshwater marshes and rice fields (Tamisier, 1976). Guillemain *et al.*, (2002) indicated mean values of 4-22% allocated to feeding at daylight hours for different habitats in France. These findings are in accordance with our results on mean time spent feeding (3.19%).

In winter, Mallards feed primarily on seeds but also on invertebrates associated with leaf debris and wetlands, agricultural grains, and to a limited extent, leaves, buds, stems, rootlets, and tubers (Heitmeyer, 1985 cited in Allen, 1987). S. Bazer located in an area where the main agricultural activities depends on cereals: Durum wheat, Common wheat and Barley may offers a good opportunity for Mallard to high energy food sources that can increase efficiency and minimize feeding time of Mallard. This reduced feeding time may allow additional time for other behaviours such as sleeping and resting, yet this assumption require further studies on body composition and diet analysis at our study sites. In fact, Mallards was shown to spent less time in feeding because they participated in evening feeding flights to flooded cornfields on the refuge (Baldassarre and Bolen, 1984 in Turnbull and Baldassarre, 1987).

The seasonal pattern of feeding displayed by Mallards during the present study appear not to be consistent with the usual trend exhibited by wintering waterfowls with a peak in feeding activity in Autumn

followed by a decline in winter and an increase in feeding corresponding to the premigratory "fattening" period of early spring (Paulus 1988; Tamisier and Dehorter, 1999). The reasons for such an inconsistency are unclear, but regrettably information on the nocturnal behavior of Mallards is at present lacking. Moreover, the seasonal trends in time budget of non-breeding waterfowl are closely related to food availability and quality and to energy requirement of individuals (Miller, 1985).

#### *Foraging behavior*

Waterfowls foraging strategies varies across the winter period (Tamisier *et al.*, 1995). The dominance of dabbling over other feeding strategies by Mallard at S. Bazer confirms previous observation where they reported that ducks use a wide range of methods, and show great flexibility in foraging behavior (Thomas, 1982) which may reflects (1) the opportunistic nature of waterfowl (Cramp and Simmons, 1980) and (2) differences in depth profiles, trophic resources between sites and /or years (Thomas, 1982; Pöysä, 1986; Stephens and Krebs, 1986; Tamisier and Dehorter, 1999).

Unfortunately, the model of "functional unit system" (Tamisier, 1974, Tamisier, 1985) was not investigated in the present study due to field constraints, but we do believe that S. Bazer played a role of resting (daylight roost) area for the year 2009-2010 because few Mallard flocks were observed to commute to a nearby wetland " Oued El Mellah " that was about 2-3 km far from S. Bazer (Pers. observ).

In so far as the present study is limited by the lack of data on nocturnal activity time budget, food resources and body composition; further studies are needed to highlight the relationship between these factors and behavior at the Haut Plateaux wetlands Complex.

#### **Conclusion**

El Eulma wetlands complex showed to be one of the main wintering quarters for mallard, whereas, S. Bazer by its hydrological regime was the most suitable and attractive site that shelters hundreds of individuals as a daylight roost area.

Monitoring diurnal activity time budget showed that sleeping was the main behavior compared to others activities. Furthermore, the bird used different strategies for feeding predominated by dabbling followed by surface feeding and finally grazing. Thus, further studies are suggested to highlight the environmental threats on the ecology of this species.

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