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Evolution of the breeding population of the Ferruginous Duck (*Aythya nyroca*, Güldenstädt, 1770) at Lake Tonga (Northeast of Algeria)

Hadia Rizi, Nadia Ziane, Rachid Rouag and Mohamed Salah Boulaakoud

Abstract
The objective of our study is the monitoring of the population of the ferruginous duck (*Aythya nyroca*) in perinesting and nesting periods over two consecutive years (2006 and 2007). The choice of this species is related to its status of species listed in the red list of the IUCN as threatened, it is also protected by the Algerian legislation as threatened with extinction. The study is conducted on Lac Tonga, Ramsar site and one of the most important wetlands for nesting of *Aythya nyroca* in North Africa. The weekly and monthly surveys on the change in the number of adults and chicks and the comparison with Boumezbeur data (1993) show an increase in number, which testify for the importance of the Lac Tonga as a nesting site for a large number of waterbirds.

Keywords: Ferruginous duck, *Aythya nyroca*, perinesting, nidification, Lac Tonga, Algeria

1. Introduction
The Ferruginous duck *Aythya nyroca* according to the latest classification of IUCN (2006) has today's status of threatened species. These species was very common there is more than a century in North Africa [1]. *A. nyroca* breeds principally in south-western Asia (east to China and south to Pakistan and India), central and eastern Europe, and North Africa [2, 3]. The wintering range overlaps with the breeding range and extends to the Middle East, north-east and West Africa (mainly Mali and Nigeria [3] and South-East Asia. In the Mediterranean, the populations of Ferruginous duck are divided into two categories: a Eurasian population located on the North Shore, the second focuses especially in the Maghreb and the Sahel [4-9]. *A. nyroca* is present in Algeria and precisely to the complex of wetlands of El Kala at the lake Tonga [10-13] and in the complex Guèbes-Sanhadja [14]. The species is evaluated as Least Concern in Europe. The population trend is not known, but the population is not believed to be decreasing sufficiently rapidly to approach the thresholds under the population trend criterion (30% decline over ten years or three generations). The European population is estimated at 17.400-30.100 pairs, which equates to 34.800-60.300 mature individuals [15]. The objective of this study is the monitoring the variation in the numbers of this species in Lac Tonga during the nesting period and to compare your data with those of literature.

2. Material and methods
2.1 Study area: Our study was conducted from March to August in 2006 and 2007 on the Tonga Lake. This wetland is with a total surface of 2,500 ha (36° 53 'N; 8°31' E). It represents one of the most important Ramsar sites of Algeria as well as of North Africa [10, 16]. The lake is about 2500 ha and, as a shallow water body with rich vegetation, it represents one of the most important freshwater areas of northeastern Algeria. Vegetation beds composed of emergent and floating-leaved plants are very extensive. The emergent vegetation of Lake Tonga is dominated by common reed (*Phragmites australis* Cav.) and lesser reed mace (*Typha angustifolia* L.) with some admixture of common bulrush (*Scirpus lacustris* L.), and branched burred (*Sparganium erectum* L.) and yellow iris (*Iris pseudacorus* L.). The submerged and surface-floating vegetation of this lake is dominated by white water-lily (*Nymphaea alba* L.), pondweeds (*Potamogeton lucens* L.), and water-milfoil (*Myriophyllum verticillatum* L.) [17]. Lake Tonga is classified by the Ramsar Convention for wetlands primarily for nesting Ferruginous Duck in North Africa [10] and by the presence of the species during the winter period.

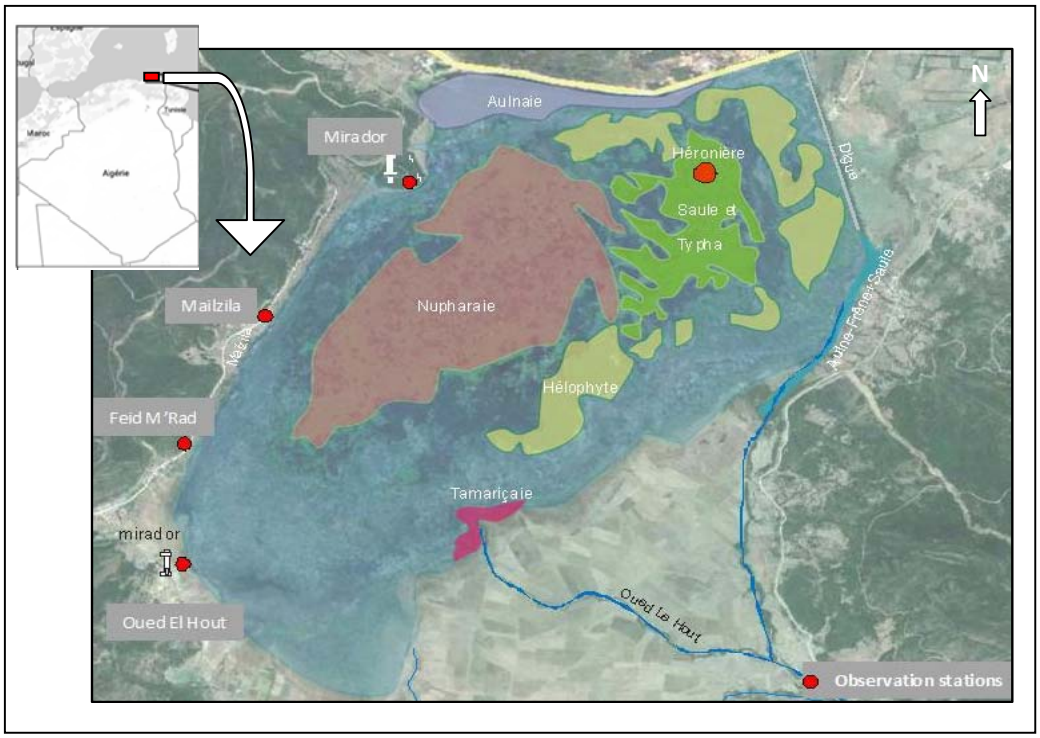


Fig 1: Location of Lac Tonga with major vegetation types and observation stations

2.2 Fieldwork: Our work was conducted during two successive breeding seasons (2006 and 2007) where we have made the identification of observation stations which are four (Mirador, Maizila, Feid M'rad, Oued el hout) located mainly on the west bank of the lake so as to overhang the lake and minimize the impact of the density of vegetation that often proves to be a constraining factor for bird counting operation in general and nesting in a way special. Weekly counts of Ferruginous ducks *A. nyroca* were carried out during the breeding season from Mars to August using an ornithological telescope Optolyth Optik TBS/TBG 80 and a pair of binoculars Kite Pallas (10×42). Individual ducks were counted when the number was small. When the number of individuals exceeded 200, a visual estimate of the population size was achieved. We could count adult females and males, pairs and chicks. Unvaried statistics (t-test) were used to analyze differences between sex and years; with differences considered statistically significant when $P \leq 0.05$. The statistical analysis was carried out using the Excel software and Minitab® 15.1.30.0.

3. Results

3.1 Weekly evolution of the population of the ferruginous duck (*Aythya nyroca*)

In perinesting period, for 2006 the maximum numbers are observed in May with a peak in the fourth week (1752 individuals). During the breeding season, the maximum number of individuals was recorded during the third week of June (1800 individuals), it decreases at the end of June and becomes stable until the end of the season (845-1411 individuals).

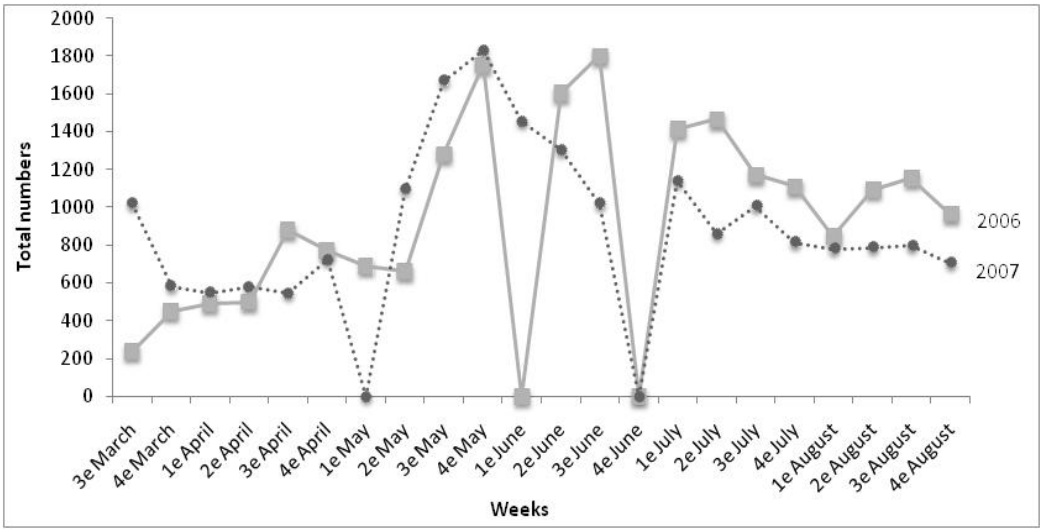


Fig 2: Weekly and monthly evolution of the population of the Ferruginous duck *(Aythya nyroca)* at Lac Tonga (2006-2007)

In 2007, during the period of perinesting, the maximum numbers are also observed during the fourth week of May with numbers ranging from 1752 individuals and 1832 individuals. During the nesting period the maximum number of individuals registered during the second week of June (1304 individuals) and declining until the end of June as in 2006. Between July and August, numbers are also stable and range between (707 and 1139 individuals). Statistical analysis of the weekly variation in the number of the breeding population between the two years of study showed no significant difference ($t = 0.320$, $df = 42$, $p = 0.751 > 0.05$). Comparisons between the numbers of males and females do not show as significant differences either in 2006 ($t = 0.909$, $df = 42$, $p = 0.368 > 0.05$) or in 2007 ($t = 1.484$, $df = 42$, $p = 0.145 > 0.05$).

Females with broods and chicks make their apparitions in the 2nd week of June 2007 and the 3rd week of June in 2006. Most of the ducks are observed between the 2nd week of July and the 3rd week of August for the two years, with peaks of 284 chicks in 2006 and 187 chicks in 2007. The number decreases significantly towards the end of August in both years (see Figure 3) and which corresponds to the time of flight of chicks which is 60 days (Cramp & Simons, 1977)

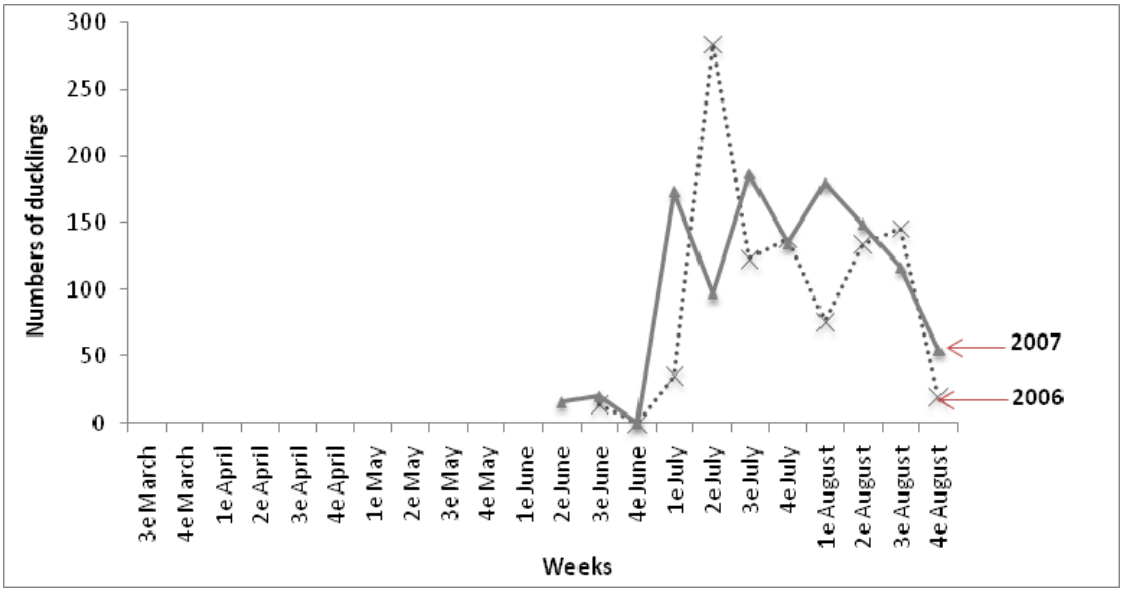
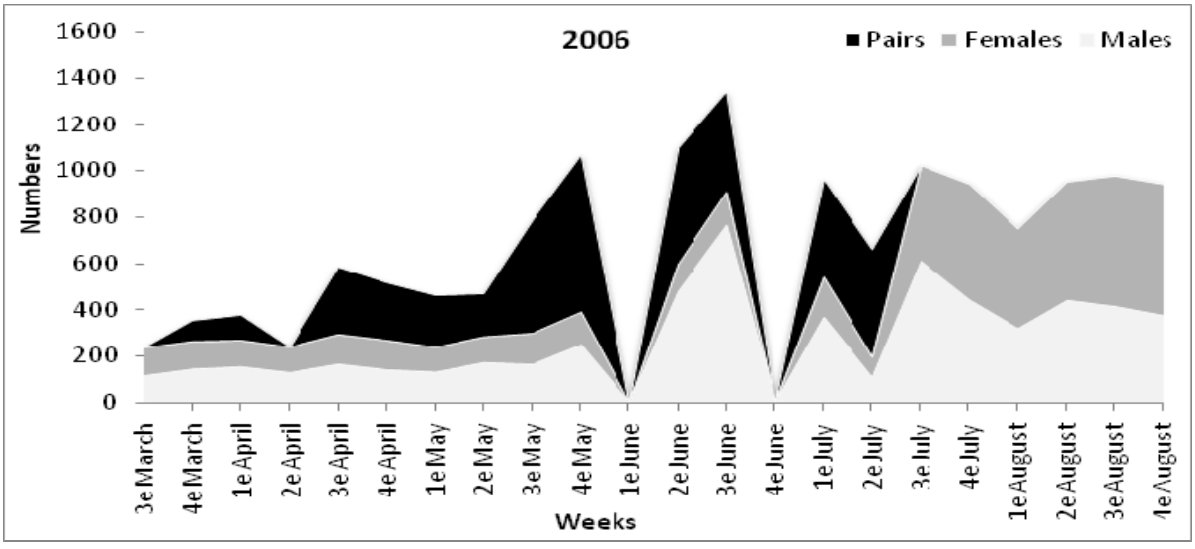


Fig 3: Weekly and monthly evolution of the chicks of the Ferruginous duck *(Aythya nyroca)* at Lac Tonga (2006-2007)

3.2 Evolution of the number of pairs of Ferruginous Duck for 2006 and 2007

In 2006, couples are formed from the third week of March, and the number increases to 225 individuals at the beginning of May. Towards the end of May, there is a significant increase with a peak of 680 couples. The number remains 500 couples to the third week of July. After, couples approach their separation. In 2007, we are also seeing a steady increase from the fourth week of March to also reach a peak of 680 couples by the end of May, and then the number is steadily decreasing for the couples also separate at the end of the month of July.



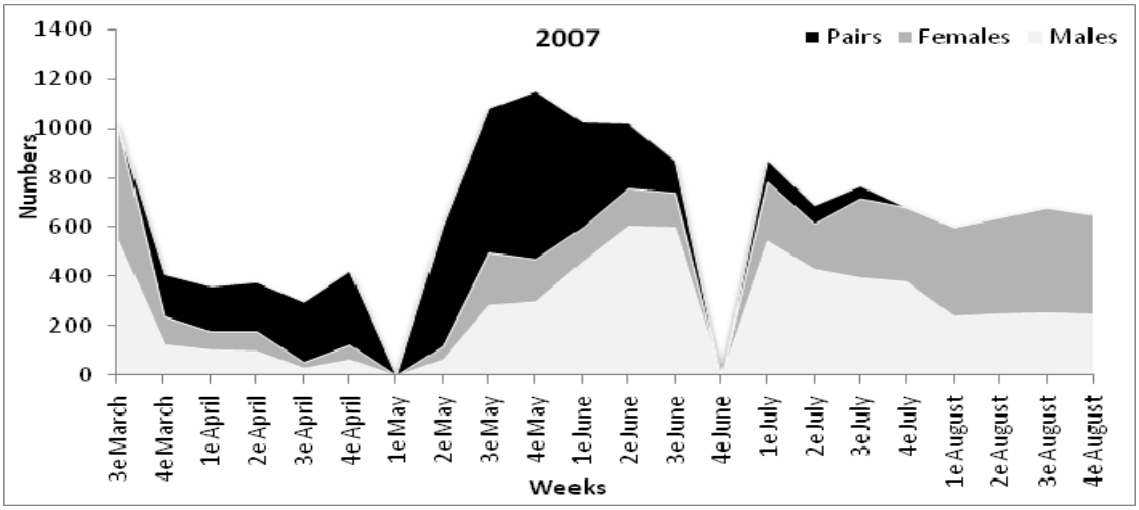


Fig 4: Weekly and monthly evolution pairs of Ferruginous duck at Lac Tonga (2006-2007)

Statistical analysis of the number of pairs in the two years 2006 and 2007 shows no significant difference (t = 0.178, df = 42, p = 0.860> 0.05).

3.3 Sex ratio

The weekly and monthly change in the sex ratio of the Ferruginous duck in 2006 shows values biased in favor male from March to late May (1.76M : 1F). In June the values increase considerably to reach (5.28M: 1F) in the third week. Then there is a decrease in the sex ratio until the inversion of values from the end of July (0. 88M: 1F) to the end of August (0.66M: 1F). The same variation in sex ratio is recorded in 2007 with slightly lower values. The evolution of the sex ratio of the Ferruginous duck shows values biased in favor of males that increase from March to May to reach the value of (1.7M: 1F). In June the values also increase to a maximum of (4. 29M: 1F) in the third week. Then there is a decrease in the sex ratio and a reversal in early August (0. 67M: 1F) until the end.

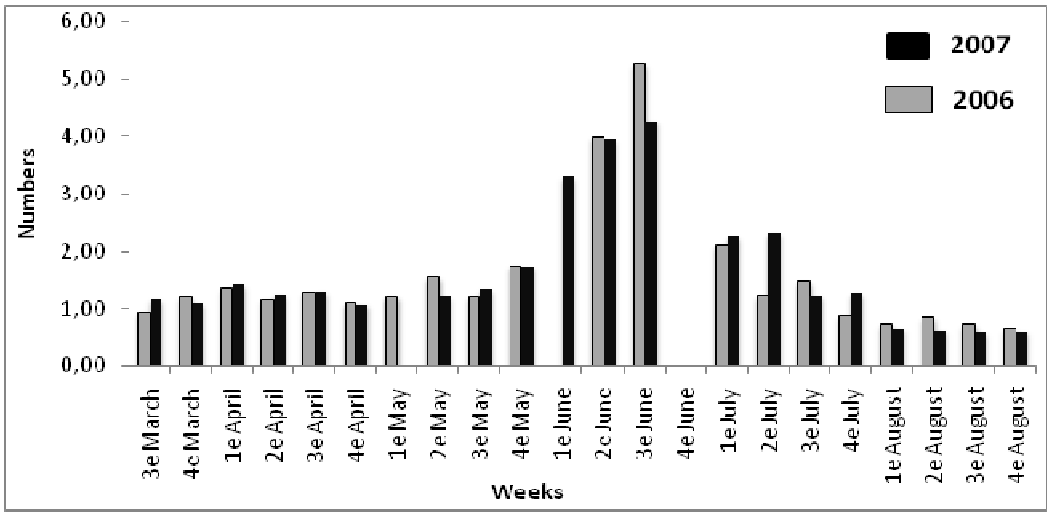


Fig 5: Weekly and monthly evolution of sex ratio of Ferruginous duck at Lac Tonga (2006-2007)

Statistical analysis of the weekly change in the sex ratio between the two years of study showed no significant difference (t = -0287, df = 38, *p* = 0.776> 0.05).

4. Discussion

Besides the breeding season, the numbers of ferruginous duck during the wintering season remain very low with values of 27 and 31 individuals for the years 2006 and 2007 [18]. So, Lake Tonga remains a nesting site of choice for the Ferruginous duck. the annual monitoring of ferruginous duck populations [10] report that the arrival of the ferruginous duck to Tonga lake starts very early in the season, between mid-February and early March where pairs have already formed. In our case, the first arrivals were recorded during the third week of March for two years of study (2006 and 2007). Comparing our results with those of Boumezbeur [10] where in June of 1991 knows the biggest arrivals Ferruginous Duck with a peak of 1494 individuals; we find that for the two successive years of the study (2006 and 2007), we always assist to the arrival of the largest numbers of ferruginous duck during the month of June with respective values 1800 and 1831 individuals.

The estimation of the sex ratio is an approximate value to the extent that the differentiation between males and females in ferruginous duck is not always easy especially as the viewing distances are large. Boumezbeur [10], reports that changes in the sex ratio are recognized throughout the breeding season but especially during the nesting period. An imbalance in favor of males is observed following the disappearance of the female during periods of reproduction and incubation. An imbalance is reports this time in favor of females when number of males decrease from the late July 2006 and early

August 2007. Analysis of ringing recoveries has shown that males of most ducks leave the breeding areas soon after their mates have begun to incubate their eggs and start the journey to the wintering ground. Females rearing young lag behind them but by midwinter have over-flown males to locations, on average, further south [19].

The species is fully protected in Algeria, especially in the National Park of El Kala. Illegal Hunting is serious threat to the species in the entire region. Some are shot on passage in the autumn and on the wintering grounds. Illegal hunting also persists in most wetlands. Actually, one of the highest priorities for this species is to establish systematic annual monitoring of populations to more accurately assess real trends.

5. Acknowledgement

I dedicated this work to the memory of the person who proposed me this theme and who always supported me in my professional and scientific career, the late Mr. Chabi yacine who spent all his life in the service of ornithology and conservation of the nature.

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