



# The importance of Fouwarate marshland for wintering and breeding of the threatened ducks populations in Morocco.

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## 1 SUMMARY

Merja Fouwarate is a marshland located in the North of Morocco, on the Atlantic coast, close to the Sebou estuary; it belongs to a large complex of marshes which occupied the Gharb plain and are actually drained in their majority for agricultural purposes. This wetland is richly vegetated and favorable to several water bird species, both as breeding habitat and migration stopovers. The last severe droughts which affected Morocco reduced drastically these habitats and their bird populations were therefore reduced; but since the beginning of this century, abundant rainfall insures therefore to this wetland good flooding and a rich bird population. That why we planned a weekly monitoring of the bird population, which was held between August 2009 and August 2010 and permitted to study the phenology and the reproduction cycle of the waterbirds. The majority of waterbird species remain in relatively low numbers, but the great importance of this site is due to the presence of several species globally or regionally threatened. Among them, Anatidae are represented with eleven species, two of them (Marbled Teel and Ferruginous Duck) are listed in the global Redlist and have significant breeding populations in the site. Three other species nest in this site and the others are visitors. According to our study the importance of Anatidae populations, as well as Ardeidae and Rallidae, assign to this wetland an international importance, thanks to several Ramsar criteria (1, 2, 4 et 6). This wetland was already included in the Moroccan Master Plan of Protected Areas, as 'Site of Biological and Ecological Interest'.

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## 2 INTRODUCTION

The Merja Fouwarate is a marshland located in the North-West of Morocco, on the north-eastern border of Kénitra city. It is considered among the few actual representatives of a large complex of freshwater marshes that occupied the Gharb lowland. During the drought crises of the end of the last century, this wetland was severely reduced and seemed agonizing under several human aggressions; but during the beginning of the 21<sup>st</sup> century, several breeding

birds were recorded in this site; the most interesting observations concern rare species (Purple Gallinule *Porphyrio Porphyrio*, Red-knobbed Coot *Fulica cristata*, Marbled Teel *Marmaronetta angustirostris*) which populations increased progressively and give to this site a great ecological importance (Lahrouz, 2007). However, this wetland has special importance for the implementation of environmental education (including teaching) and ecotourism



(bird watching, hiking). These values permitted to include this wetland in the Moroccan Master Plan of Protected Areas (AEFCS, 1996) as a Site of Biological and Ecological Interest, commonly named 'SIBE'.

The analysis of the bird winter censuses in the Merja Fouwarate (Lahrouz, 2007) reveals very low bird numbers before 2006, except some thirty Common Shelducks and a ten of Northern Shovelers recorded in 1993. This poverty was linked to the drought crises that affected the natural wetlands in Morocco, including the large marchlands of the Gharb

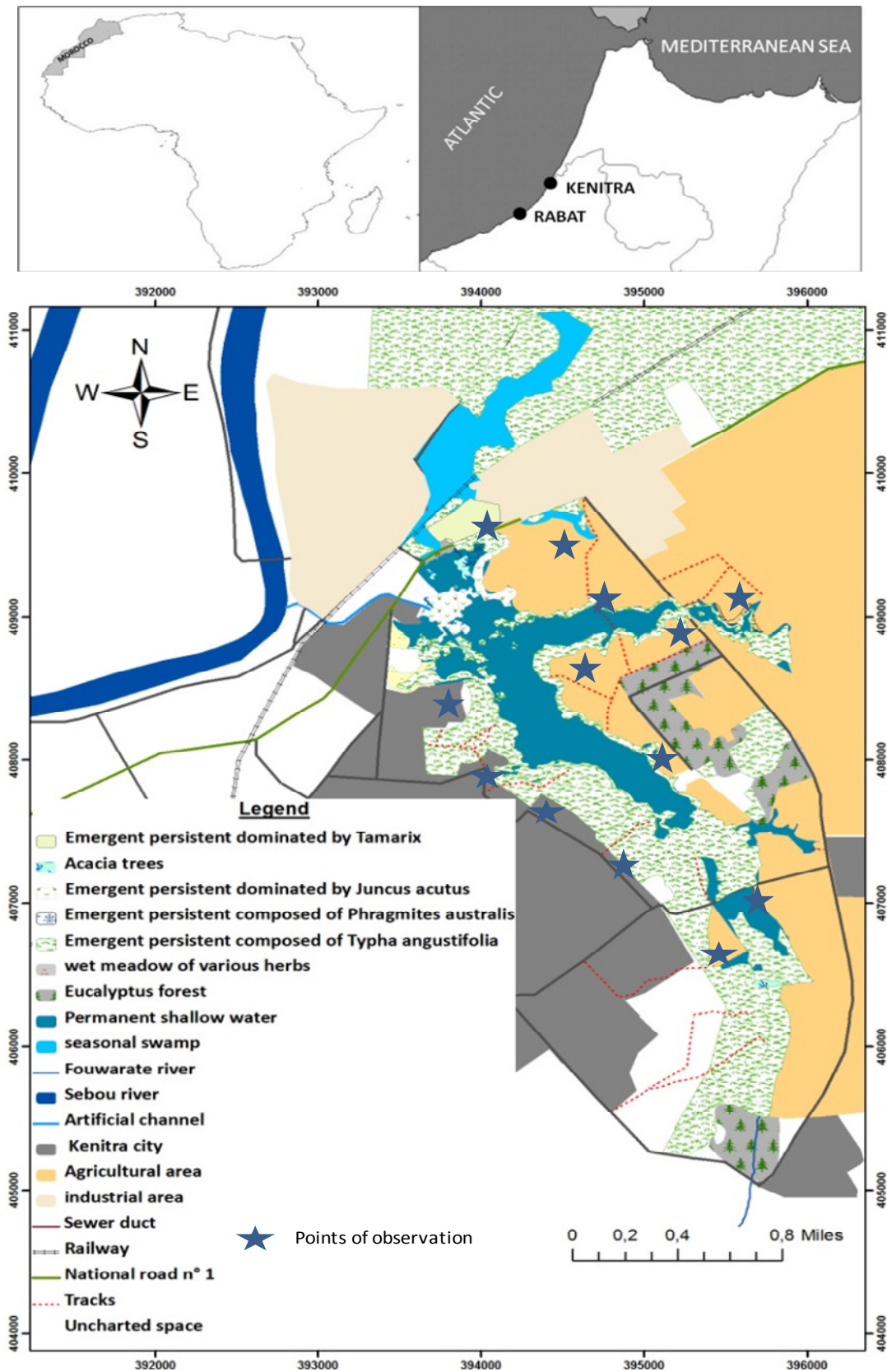
plain. The improvement of the hydrology of the site, due to the abundant rains of the last decade. These favorable hydrologic conditions have allowed induction of good diversity as well as extension of the wetland habitats, mainly the emergent vegetation (reed, typha and rush) and shallow open waters. Waterbird populations of the site increased, both in numbers and in diversity: the 2006 winter census revealed presence of six species (Lahrouz, 2007) whereas between 2008-2010 the number of species increased to 10-11 species in (Lahrouz *et al.*, 2012).

### 3 METHODOLOGY

This article is based on the results of a water-bird monitoring on a weekly basis in the site during a complete annual cycle (August 2009 to August 2010), using a pair of binoculars and a telescope. In order to carry out a complete survey, the wetland area was divided into 13 sectors of observation, defined according to the availability of observation points in order to dominate the entire site, including the areas of concentration of birds. This paper was made after preliminary bird surveys conducted in 2008, but it is also based on the knowledge gained at the site of an earlier study (Lahrouz, 2007) and winter counts of waterbirds (El Agbani & *al.*, 1990; Dakki & *al.*, 1991; El Agbani & Dakki 1992; Dakki & El Agbani 1993; Dakki & *al.*, 1995; El Agbani & *al.*, 1996; Dakki & *al.*, 2002;). The analysis concerns mainly the phenology of the duck populations, with special focus on the patrimonial species (rare or endangered).

**3.1 Presentation of the site:** The Fouwarate marshland (N34°15', W06°30') occupies a small depression located 3-6 meters over the Atlantic sea level, near the lowest part of the Sebou River and

on the north-eastern side of Kénitra city (Figure 1). This depression corresponds to a natural outlet of a small lowland river system, composed with three tributaries (Oued Fouwarate, Oued Bled El Ghaba and Oued Fou), which converge few kilometers before reaching the Fouwarate depression. In addition to the local ground waters, the site is flooded mainly with natural streaming waters of the Fouwarate river basin, knowing that the rainfall is relatively abundant in this basin (650 mm/year). However, some sewage channels coming from eastern neighborhoods of the city flow still into the wetland. These waters are partly drained to the Sebou River, through Oued Swaret, a small natural stream which was converted to artificial channel. Merja Fouwarate has a form of a large channel, 100-200 meters wide and oriented in SE-NW direction; some local channels make its north-eastern border irregular, while its limit with the city is more regular. The optimal inundation of this wetland reaches about 620 ha, but during dry summers this inundated surface is frequently half reduced.





**Figure 1:** Location and habitats of Merja Fouwarate (Northwest of Morocco)

**3.2 Wetland habitats are dominated by two major types:**

- *emergent hydrophytes* (reed, typha, rush, bulrush), which occupy permanent and semi-permanent waters and extend now to more than half of the site, while they were reduced during the 1980-2000 drought crises to few insignificant pools.
- *Shallow open waters*, characterized with great seasonal variation of depth, showing during dry season large mud flats or small meadows.

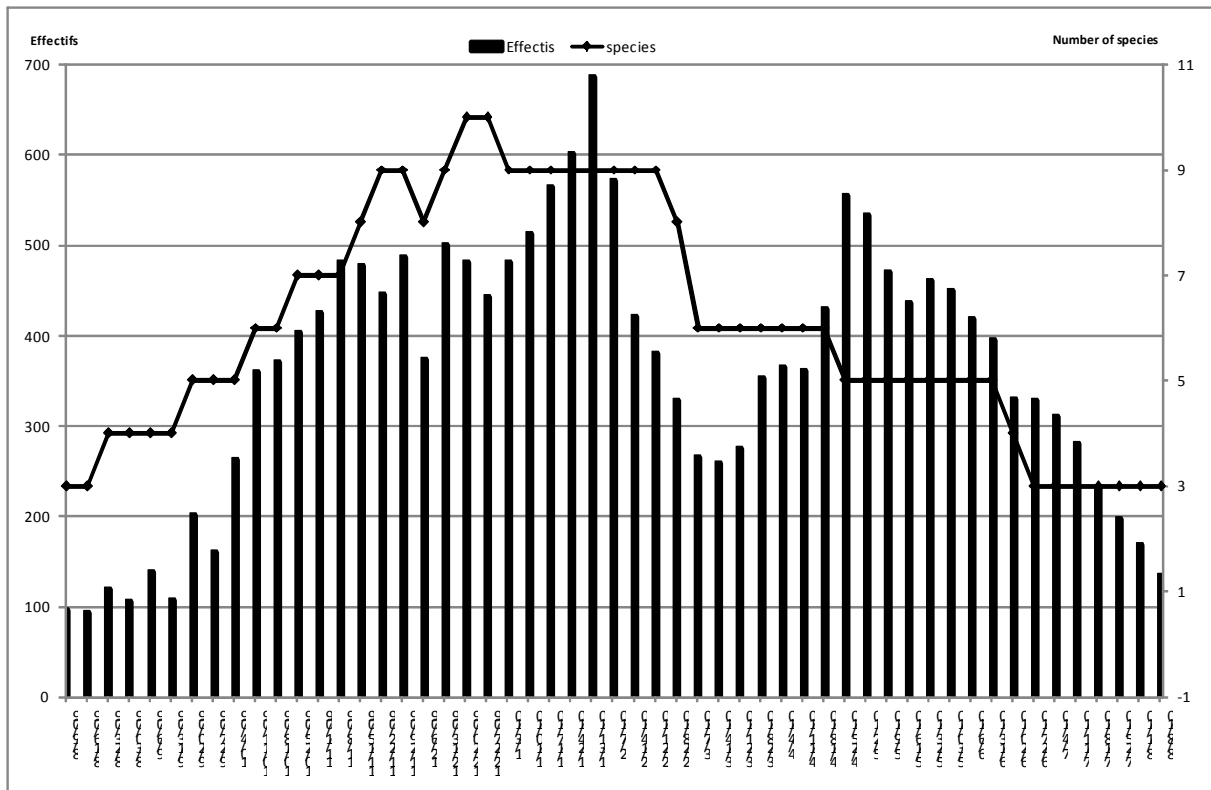
Various human activities are recorded generate dysfunctions of the wetland. Urbanization is considered as the largest threat because of wastewater discharge into the wetland and land use. Industries, which are actually limited to few factories located on the northern edge of the site, may expand on natural habitats, including wetlands. Farming activities are continuously practiced, while the agriculture seems to be threatened by the urban and the industrial expansion.

**4 RESULTS AND DISCUSSION**

**4.1 Overview of the Anatidae populations:**

Eleven Anatidae species are present in the site, all of them are visitors and only three species (*Anas platyrhynchos*, *Marmaronetta angustirostris* and *Aythya nyroca*) have significant sedentary populations. The first migratory birds arrive into the site early September (*Anas chrypeata* and *Anas platyrhynchos*),

afterwards the number of ducks (all species included) increases gradually to 700 individuals in the winter. (Figure 2). The departure of the wintering visitors started early February, date from which the number of ducks decrease gradually, reaching its minimum at the third week of March.



**Figure 2:** Evolution of the Anatidae population in Merja Fouwarate between August 2009 and August 2010.



The increase of numbers recorded since late March could be linked both to prenuptial migratory stopovers (*Anas crecca* and *Aythya nyroca*) and the appearance of new-born individuals in the site (*Anas platyrhynchos*, *Marmaronetta angustirostris*, *Netta rufina*, *Aythya ferina* and *Aythya nyroca*). *Aythya nyroca* is the most abundant Anatidae in the site, with a spring population of 458 individuals while *Anas platyrhynchos*, *Anas clypeata* and *Marmaronetta angustirostris* do not exceed the third of this number.

## 4.2 Phenology of the species

### 4.2.1 Migrant Anatidae

**4.2.1.1 *Tadorna tadorna*:** In Morocco, this species is a winter visitor, with contingents originating from the Mediterranean/Black Sea population (Wetlands International, 2006). Its largest concentrations (nearly 90% of the national population) are regularly recorded in the North western wetlands (El Agbani & al., 1997; Dakki & al., 2002), but its distribution extends more to the South till the Anti-Atlas Mountains (El Hamoumi, 2000). In Merja Fouwarate, a group of 34 wintering individuals was seen from mid-December 2009 to early February 2010 (Figure 3) while in Sidi Bou Ghaba 90 birds have wintered in 2001 (Cherkaoui; 2003)

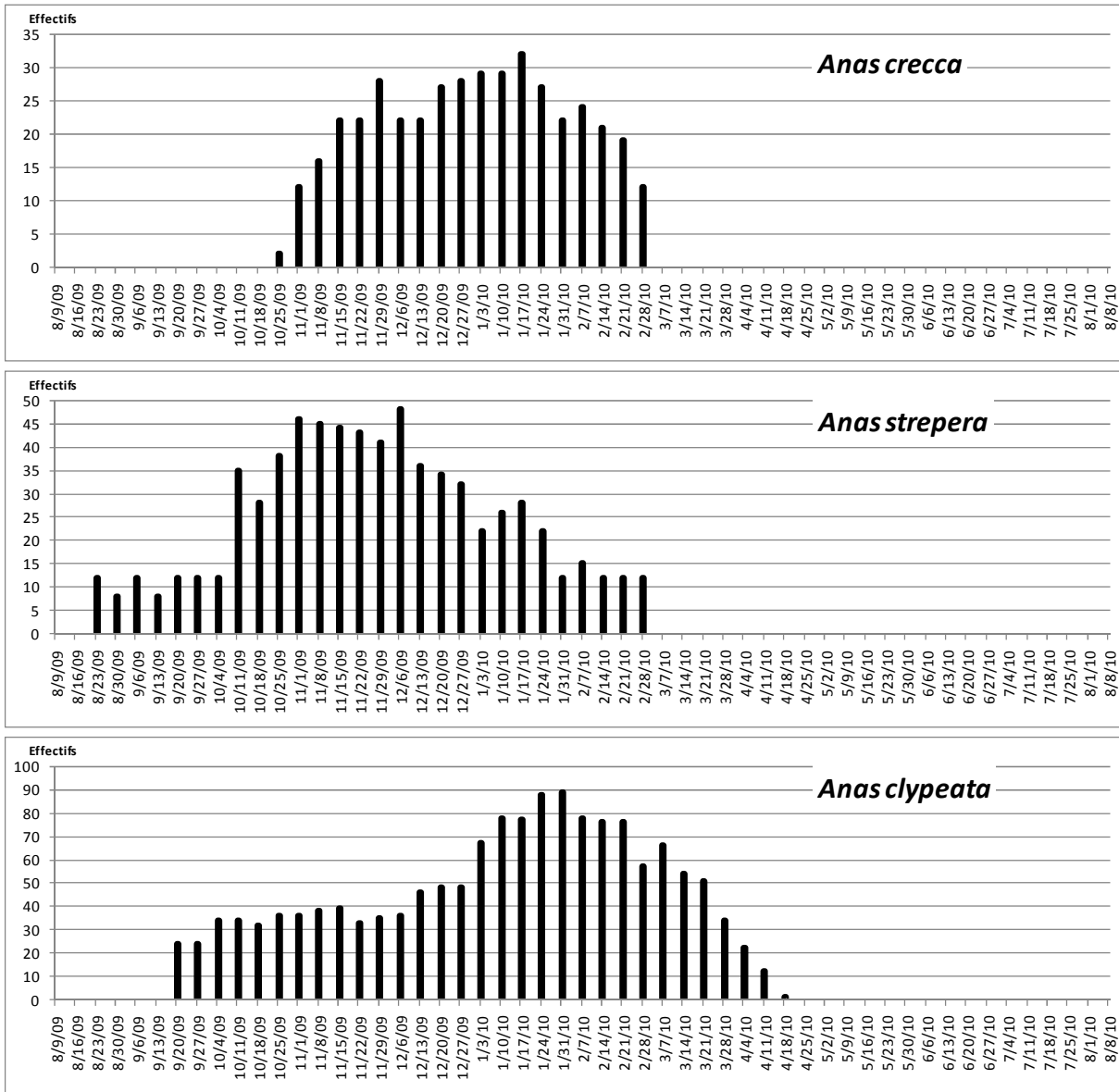
**4.2.1.2 *Anas strepera*:** This duck winters regularly in Morocco, but in small numbers, concentrated in the Northwest of the country (El Agbani & al., 1997). Arrivals in the Merja Fouwarate are noted until August (10 individuals), the number increases significantly (around 40 individuals) until the second decade of October. The wintering numbers show gradual decrease during January and February, and the species leave the site at the end of this month (Figure 3). In Sidi Bou Ghaba, a maximum of 10 birds wintered between 2001 and 2002 (Cherkaoui, 2003).

**4.2.1.3 *Anas clypeata*:** Morocco hosts regular winter visitors of this species, of which the national population size is about 6% of the Mediterranean/Black Sea/West Africa regional population (Wetlands International, 2006). These wintering birds congregate mainly in the Northwest of the country (El Agbani & al., 1996; Dakki & al., 2002); the Sidi Boughaba Lake (very close to Fouwarate) is one of the best wintering sites for this species (2500 individuals counted by Cherkaoui 2003). In the marsh of Fouwarate, the bird arrivals start in September, their numbers remain low (less than 40 individuals) until mid-December reaching 90 individuals during the last decade of January. Departures are noted from late February until mid-April (Figure 3).

**4.2.1.4 *Anas crecca*:** In Morocco the Green-winged Teal is a regular winter visitor, which has a large distribution in the country but with high variation of the total numbers (El Agbani & al., 1996). In Merja Fouwarate, it occurs in low numbers with a maximum of 32 individuals (In Sidi Bou Ghaba, up to 620 birds were counted in January 2002). First arrivals were recorded at the end of October, while the last spring migrants were seen until early May (Figure 3).

**4.2.1.5 *Aythya fuligula*:** Three winter observations of this species have been done in the Merja Fouwarate: 2 birds on January 2006 (Lahrouz, 2007) and same number in December 2009. Up to 10 birds were seen in Sidi Boughaba in 2001 (Cherkaoui, 2001).

**4.2.1.6 *Aythya marila*:** This wintering duck was reported four times from the site: January 31, 2006, December 15, 2006 (Lahrouz, 2007), December 22, 2008 and December 29, 2009. Four birds were recorded on December 2006 and only two birds in the three other observations.



**Figure 3:** Phenology of the Anatidae migrant species in Merja Fouwarate between August 2009 and August 2010.

#### 4.2.2 Breeding and migrant Anatidae

**4.2.2.1 *Anas platyrhynchos*:** Morocco hosts a sedentary population of this species to which are regularly added European migrants (wintering). The same status is found in the Merja Fouwarate as well as other Moroccan wetlands (Agbani, 1997, EL Hammoumi, 2000, and Cherkaoui, 2003) between February and August, only 10-30 individuals were visible, but at the beginning of September this number increases slightly with a maximum of 140 individuals during October and November (Figure

3), and decreases gradually during the winter (December and January). The first breeding activities start early February in Fouwarate. These results are coherent with phenology defined for this species in other Moroccan wetlands: Merja Zerga, Lower Loukkos (El Agbani & al., 1996), Sidi Boughaba lake (El Agbani & al., 1996 and Cherkaoui, 2003), Sidi Moussa-Walidia complex (El Hamoumi & al., 2000), Middle Atlas lakes (Chillasse, 2004), . According to the variation of brood numbers, two separate cohorts could be defined in



this site: for the first one, eggs hatchings started in the second week of March and ended in the first week of April while the second series of hatchings occurred during the month of May. This means that egg-laying occurred in two separate periods: between mid-February and early March and during April. Temporal variation in the number of broods shows two maxima of five and twelve, respectively for both cohorts, bringing to seventeen the minimum number of couples who nested on the site in 2010 breeding season. However the maximum size of this population could also be estimated by the total number of broods of the same size observed during the year, which total is 24 for great size chicks.

**4.2.2.2 *Marmaronetta angustirostris*.** The Marbled Teal, a globally vulnerable species (BirdLife International, 2010), is considered as endangered bird in Europe (BirdLife International, 2004). It is considered among the most threatened Anatidae in the Western Palaearctic, where the breeding population is reduced to few isolated areas in Spain and North Africa (Green, 1993). Morocco hosts significant numbers of this species; the wintering population exceeds frequently 50% of the estimated size of the regional population (Dakki & al. 2002; Wetlands International, 2006). During our monitoring in Merja Fouwarate, this species was one of the most abundant ducks (Figure 4). From March to September, its numbers were around 30 individuals and exceeded exceptionally the threshold of 40 individuals. These small changes can not reveal migration movements, knowing that this species is furtive and may escape to our observation with least disturbance. However, the increase of numbers between mid-May and mid-June coincides with the appearance of chicks. From the second decade of October, small migrant contingents arrived to the site and their numbers will increase gradually and reach 90 individuals in mid-December. The winter population will be stabilized around 70 individuals until the end of February. The maximum number of broods per date, observed on May 16<sup>th</sup>, is twelve, which could be assimilated to the number breeding pairs in the site. The first observation of broods in the site was on May 2<sup>nd</sup>; it concerns four broods, one of them with large size chicks that very likely hatched on the second week of April, which suppose that the egg-laying starts very likely the first week of March. The

latest observation of hatched chicks (three broods) was done on May 16<sup>th</sup>, suggesting that egg-laying took place on mid-April. With this phenology, the Marbled Teal gives a great ecological importance to Merja Fouwarate, which could be added to the nine Moroccan wetlands hosting regular breeding population of this duck (El Agbani & al., 1996a). Moreover, considering the number of marbled duck wintering regionally, 3000-5000 birds according to Wetlands, 2006; this site hosts more than 2% of the wintering population of the western Mediterranean. These results ensure to Merja Fouwarate more Ramsar criteria<sup>1</sup> (particularly criteria 2, 4 and 6).

**4.2.2.3 *Netta rufina*:** This duck nests in Morocco with a small population, scattered on 5-6 wetlands, in the Northwest of Morocco, the most regular observations came from three wetlands: Merja Smir (El Agbani & al., 2009) on the Mediterranean coast, and Merja Ain Chouk (Lower Loukkos) and Sidi BouGhaba (Cherkaoui, 2003), on the Atlantic littoral. In addition to this breeding population, regular winter visitors come from Central Europe and Western Mediterranean (Wetlands International, 2006) and are concentrated mainly in the Northwestern wetlands (El Agbani & al., 1996, Dakki & al., 2002). Currently; few individuals (group of 10-25 individuals) winter regularly in Merja Fouwarate; during our monitoring, this duck was seen since mid-November which with a maximum number of 35-45 wintering birds in January 2010 (Figure 4). During spring season (March-June), the counts do not show more than ten individuals; however, two juveniles that belong to two different females were observed on May 30<sup>th</sup>: This observation is considered as the sole breeding proof of this species in the site.

**4.2.2.4 *Aythya ferina*:** Morocco hosts nearly 14,000 wintering birds of this species (Dakki & al., 2002), which number represents 1.4% of the population of Central Europe-Mediterranean-Black Sea (Wetlands International, 2006). Merja Fouwarate was frequented by a small group of this pochard, with a maximum of 20 birds throughout the autumn (Figure 4) and 66 birds in the winter. This number declined then gradually, but the species was observed in the site until mid-June; this number decreased gradually. However; the species

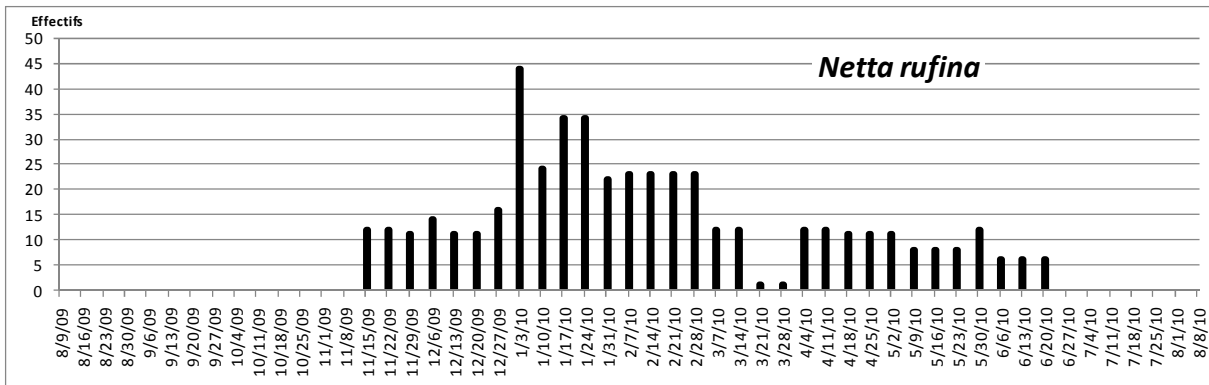
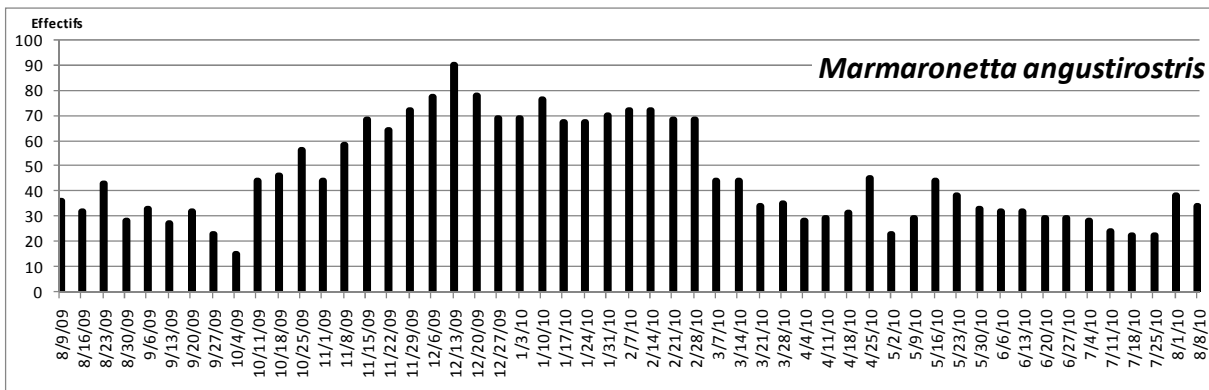
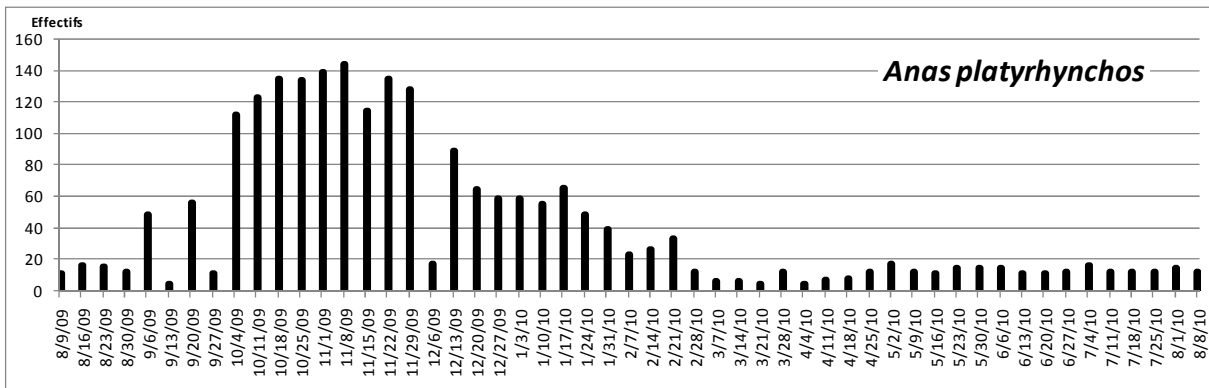
<sup>1</sup>See :[http://www.ramsar.org/ris/key\\_ris\\_index.htm](http://www.ramsar.org/ris/key_ris_index.htm)



remain in the site until mid-June. Only four pairs have nested.

**4.2.2.5 *Aythya nyroca*:** The species is classified as globally near-threatened (BirdLife International, 2010) and as vulnerable bird in Europe (BirdLife International, 2004). In Morocco, it is considered as endangered species (El Agbani & *al.*, 2011), it breeds in 2-3 sites only and the sedentary population did not exceed 10 pairs during the 1990s (El Agbani & *al.*, 1996). The winter visitors rarely reached a hundred of individuals (Dakki & *al.*, 2002); however, consequently to the good flooding of Merja Fouwarate, their number currently exceeds

450 birds. In January 2010, this wetland hosted nearly 458 individuals, which exceeds largely the threshold of 1% of the regional population (2400-2500 according to Wetlands International; 2006). The species have been seen in the site throughout all the year (Figure 4); its numbers were lower than 100 individuals during most of the autumn and varied around 120-160 individuals between mid-October and mid-January. The wintering population size showed a spectacular increase (about 350 wintering birds), followed by a rapid decrease during the first half of February (departure of winter visitors).





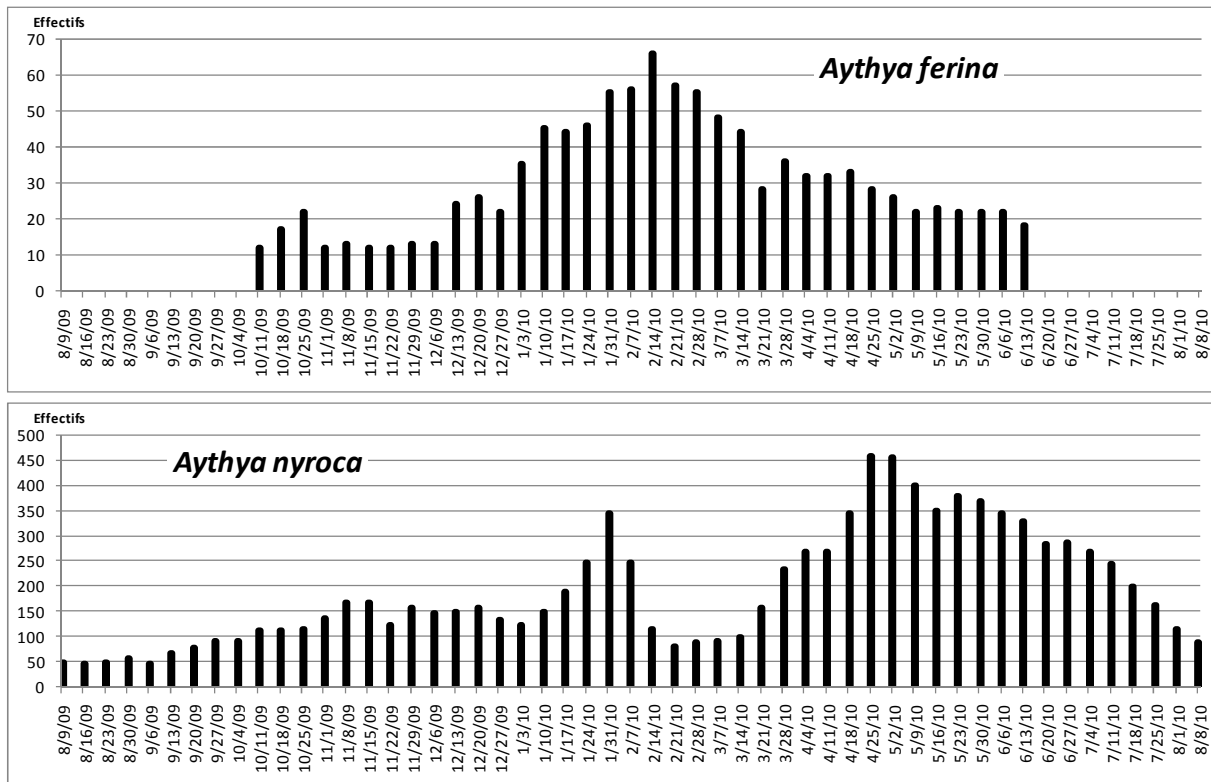


Figure 4: Phenology of the breeding Anatidae in Merja Fouwarate between August 2009 and August 2010.

This duck numbers decreases in March and rise up to about 460 birds by the end of April. These arrivals contains certainly breeding birds, which began nesting late April; however, the number decrease again during the nesting activity which very likely is due to migrant bird departures. Egg-laying started probably at the end of March, since the first chicks were seen on April 18<sup>th</sup>, and continued until early June (the last hatched chicks were seen on June 6<sup>th</sup>). During the 2010 breeding season, 229 observations of ducklings were counted, with maxima of 40 to 45 families seen respectively on May 9<sup>th</sup> and 23. The number of ducklings (all ages

combined) is relatively low during April, and shows rapid rise early May, reaching a maximum of 332 juveniles on May 9<sup>th</sup>. The breeding population shows a linear decline that reduces its size to about 300 birds in late June and to 100 birds in August. Atypical low numbers are sometimes recorded and could be related to disturbance due to poaching and urbanization activities. These results mean that Merja Fouwarate is highly favorable as wintering site for this threatened duck, but it is more especially remarkable as nesting site, considering that it hosts the greatest breeding population of Morocco.

## 5 CONCLUSIONS

The bird monitoring carried out at weekly basis in Merja Fouwarate during the annual cycle between August 2009 and August 2010 revealed the presence of 11 species of ducks. Five of these are breeders (*Anas platyrhynchos*, *Netta rufina*, *Aythya ferina*, *Aythya Nyroca* and *Marmaronetta angustirostris*) and the others are visitors. Two ducks vulnerable globally, *Marmaronetta angustirostris* and *Aythya nyroca*, form good

breeding numbers in the Fouwarate (at least 12 pairs of Marbled Teal and 45 pairs of Ferruginous Duck) while their wintering numbers (up to 90 of Marbled Teals and about 360 of Ferruginous Ducks). Highest numbers of the Ferruginous duck (458 birds) were seen during the spring 2010, this abundance being the largest concentration observed in Morocco. These ornithological values were



possible only with the improvement of the hydrologic conditions, more especially with the abundance of water and emergent vegetation during the breeding season. The analysis of the phenology of Ducks in this wetland verifies several Ramsar criteria offering an international importance to this site:

- presence of 6 species with unfavorable conservation status in Europe (*Marmaronetta angustirostris*, *Aythya Nyroca*, *Aythya ferina*, *Aythya fuligula*, *Aythya marila*, and *Anas chipeata*) two of them (*Marmaronetta angustirostris* and *Aythya Nyroca*) being on the World Red-listed of birds (criterion 2) and have a significant breeding population in the site (criterion 4);
- two species (*Marmaronetta angustirostris* et *Aythya Nyroca*) winter in the site with numbers exceeding the 1% threshold of their regional populations of origin (criterion 6);

Merja Fouwarate is one of the last survivors of a large complex of freshwater marshes which occupied the Gharb plain; in addition, it contributes significantly to reduce inundation impacts and to insure recharge of the Ma'mora aquifer; these characters constitute good Ramsar hydrologic

criterion favorable to classify this site as wetland of international importance. Moreover, the abundance of six ducks (*Tadorna tadorna*, *Marmaronetta angustirostris*, *Aythya Nyroca*, *Anas platyrhynchos*, *Anas strepera* and *Netta rufina*) exceeds the 1% threshold of their actual average national number, ranking this site among the best Moroccan wetlands for wintering and breeding of these species. The ecological importance of this intra-urban marshland, formerly unclear and mostly related to its flora, has already led to assign to this wetland the national status of 'Site with Biological and Ecological Interest', but this has never been accompanied by practical conservation measures. Nevertheless, the attempt to drain the wetland is offering giving the absence of a management plan for conservation and because the site is currently completely enclosed by the human buildings. Consequently, the first measure we propose to improve the ecological quality of Merja Fouwarate is to classify it urgently as Ramsar site, which could support the protection of this wetland against degradation. Moreover, the results of this study provide solid data to enhance the educational and eco-tourism activities, as sustainable development alternative which may benefit local population and promote conservation of the wetland ecological values.

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