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College of Science**



**Bio-Ecological study of Marbled Teal *Marmaronetta
angustirostris* in Hor AL-Dalmaj /Iraq**

A Thesis

**Submitted to the College of Science, University of Baghdad In partial
fulfillment of the requirements for the degree of**

**Doctorate of Philosophy
In Biology - Ecology**

By

Salwan Ali Abed

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College of Science - University of Pune (2009-2010)**

Supervised by

Prof. Dr. Maysoon M. Al-Tae

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Summary

This study tackles some possible aspects of the ecological and biological statuses of Marbled Teal (Threatened –Vulnerable bird species) by means of field surveys and systematic monitoring that were conducted along the four seasons during the year (2013) in one of the ecologically important and prominent and less studied wetlands of the Middle Euphrates, that is Hor Al-Dalmaj as a highly important wetland on the national, regional and international levels according to Key Biodiversity Areas (KBA), Important Bird Areas (IBA) and Important Plant Areas (IPA) in addition to other world criteria.

Hor Al-Dalmaj contains suitable habitat for this hardly studied bird species on the national and regional (Middle East) levels. The results of the current study approved that this wetland provides Marbled Teal appropriate environment for the sustaining of the bird's activities like feeding and breeding, and despite that the bird faces different types of threats, the area demonstrates good factors for the species in case it get managed in the proper way

Five field observation sites have been chosen basic on specific criteria of which mostly that they represent different wetlands habitat scenarios in order to have as through idea as possible about the status of the bird in Hor Al-Dalmaj and the identification of the environmental parameters favored by the bird like water quality and vegetation cover. Systematic field observations in Hor Al-Dalmaj show that Marbled Teal favors shallow water ponds and avoids open water areas in wetlands. Laboratory analysis conducted for the purpose of the study for the bird's feces and gizzard content show that the Marbled Teal is generally

omnivores as we've found that it includes both the plant and zoo components.

In spite of the ecological importance of Hor Al-Dalmaj, it is under different kinds of pressures and threats like the unstable of the hydrological scheme, agricultural expansion and intensification, pollution, disturbance, habitat destruction and over-hunting. These threats are interchanging in their impacts as they affect Marbled Teal and its life in Hor Al-Dalmaj, so the wetland and species both suffer the impacts of these pressures.

This study is considered the first effort of its kind in Iraq and in the Middle East towards studying the Marbled Teal *Marmaronetta angustirostris* that was carried in Hor Al-Dalmaj, Southern Iraq. The finding of this effort illustrate its importance as it paves the way for further study and observation for the bird and this important Wetland itself.

The area is characterized by many merits that make it unique and outstanding from the ecological and recreational perspectives. Hence, it is recommended that a management plan for the purpose of the hydrological, ecological and developmental preservation for Hor Al-Dalmaj and the diversity of flora and fauna it nourishes. This can go side by side with certain activities on the part of the authorities like the enforcement of the Iraq environmental legislations and the application of the international and regional convention, especially those related to the establishment and sustaining of protected areas.

Introduction:

The location of Iraq as well as the morphology and diversity in habitat made it one of the countries that are rich in biodiversity (Allouse, 1953). Iraq has considerable area of nine different Eco-region of which some are threatened habitat (WWF, 2006). The different habitats have created colorful panorama of diversity for flora and fauna species that include endemic and threatened species (Salim, 2004). Iraq is well known with its wetland of different types, as there are considerable number of lakes and marshland that harbor good biological diversity being providing the shelter and food for different creatures (IMoE, 2014b).

The Wetlands of Iraq have their international importance on the global, regional (Middle East), as well as national level (Scott & Carp, 1982). In addition to the endemic and threatened birds that occur in these marshland, millions of individual birds using these area either as wintering destination, or key stop over sites during their long ranged annual migration over Eurasia and Africa (Salim, 2010).

Iraq lies under two main global fly ways that forms two out of three major fly ways over western Palearctic zoo geographic region, as well as the most important fly way of waders and shorebirds (Boere and Stroud 2006). George and Vielliard (1970) have mentioned that only Hammar and Hwaiza provide probably two third of the wintering waterfowl in the Middle East, this made the area of marshes an area of global importance. The wetland of southern Iraq provide key breeding and wintering ground for considerable number of Marbled Teal and this is obvious based on historical survey as well as the regular field survey made recently after marshland restoration (IMoE, 2014b).

Marbled Teal *Marmaronetta angustirostris* is a monotypic bird species that can be considered as an intermediate between the Dabbling ducks and Diving ducks.(Vaurie,1960 and Johnaguard,1961, Aerc,2003).

Marbled Teal is congregator species with a fragmented distribution within the Western Palearctic and North Africa like (Algeria, Senegal, Tunisia, Morocco),Eastern Mediterranean like (Turkey, Syria, and Egypt) Western and Southern Asia like(Iraq, Iran, India and Chine). It is still poorly understood regarding to the movement of this bird between these region and has received surprisingly little attention from biologists and the only scientific papers published on this species before the present decade were studies of its taxonomy (Green,1993,1996).

Studies of the ecology of the Marbled Teal are now ongoing in several European countries with the main aim of developing the required measures of habitat management and conservation to prevent further population declines (Green, 2000).

Marbled Teal has relatively wide global distribution its range from china and eastern India and Bengal (Eastern distribution) (Green 1993). As for Middle East the Marbled Teal is either resident or migrant birds over some countries (Salim, *et al*,2006, Porter and Aspinall, 2010). The distribution extend as west as some countries around Mediterranean to reaching Spain and Morocco (Green,1996). In Iraq Marbled Teal is local breeding resident in the scattered wetland over central and southern Iraq with more concentration in the southern marshes, and it is seem that in Al-Dalmaj marsh Marbled Teal breeds in relatively considerable number and population get in annual increasing when the wintering population arrives (Salim,2010).

Marbled Teal prefers shallow marsh rich in emergent and submerged vegetation (Green,1993,1998b,2000). It is also prefers the marshes of fresh and brackish waters with good submerged and emerged vegetation (Salim, *et al*, 2006), and avoided open water that are mainly associated with reed beds and preferred the areas with saline marsh (Gonzales, *et al*, 2012).

The Marbled Teal *Marmaronetta angustirostris* was described by Menetris in (1832) and considered as a globally threatened species that undergoing a rapid population decline (Green, 1993, 1996, Collar *et al*,1994).

Background information:

Al-Dalmaj wetlands are vast wetlands at the Middle Euphrates area. The northern part of Dalmaj is located around 120 km southeast to Baghdad City, 37 km northwest of kut city, and 38 km north east to Diwaniya city (Direct distances) (Map-1). It can be reached either from Wasit side via the Al-Rahma agricultural project, or from Diwaniya side through Afak sub district. It consists of relatively deep-water lake with vast marshland habitat of dense and scattered reed beds (IMoE, 2014b). The wetlands of Dalmaj include considerable diversity in the fauna species including the richness in the Waterfowl species during winter as well as the existence of many threatened and endemic bird species that made it eligible to be considered as a Key Biodiversity area (KBA) and Important Bird Area (IBA) (Salim, 2010).



Map(1): Location of Dalmaj marsh

Obviously , Al-Dalmaj wetland provide good habitat for Marbled Teal due to the existence of the food and shelter either for resident population as well as the wintering population. the dense reedbeds in addition to the dense vegetation at the margins of the marsh and over the shallow part considered as a good shelter for hiding the nest and the chicks during the breeding season, while the area of open water provide good foraging area , such habitat are very common and extensive in Al-Dalmaj wetlands (Salim, pers comm,2013).

Study Objectives:

- 1- To provide more data and information for increasing the knowledge of this threatened bird by shading light on its occurrence, status of the migrant population, as well as the threats facing this bird in Iraq.
- 2- To provide more data and information about the biological and ecological requirement that will contribute to the national conservation efforts in protecting this threatened species.
- 3- To Provide information and statistics to the management plan for Dalmaj proposed protected area.
- 4- To provide basic information for the species action plan (Marbled Teal) being a threatened species, that were recommended by

National Biodiversity Strategy Action Plan (NBASP) and National Environment Strategy Action Plan (NESAP).

- 5- Knowing the effect of the water quality and related circumstances on the distribution and population of Marbled Teal in Al-Dalmaj Wetlands.

Literature review:

Avifauna of Iraq:

Few references tackled the issue of the birds of Iraq. Allouse (1962) considered the basic reference for Avifauna of Iraq, however Allouse (1953) summarized many papers, articles, and reports of the former expert who have surveyed different places in Iraq during the late 18th century through to the 19th century. The first reference (Allouse 1960) in its three volume has described thoroughly the checklist of birds of Iraq, and illustrated the status of each bird species up to the time of publishing the third volume. Through the 1960s, 1970s, 1980s, very few scientific works were made to describe the status of the bird in Iraq through this period, till publishing the "First Field Guide to the Birds of Iraq " by Salim and other experts at 2006.

Salim *et.al.*, (2006) has summarized the status of the birds in Iraq after adding the new findings and new records made by the same author, and other experts. Another important reference that described the status

of bird in Iraq by Porter *et.al.*, 2010 after gathering the results of the Key Biodiversity Areas (KBA) program made by the Ministry of Environment and other partners Organization through the period 2005-2010 that covered more than 150 sampling areas over entire Iraq.

Anseriformes in Iraq :

Despite the fact that Iraq includes considerable number of different types of wetland, however very few studies were covered the waterfowl in Iraq (Scott and Carp, 1982) . Al Rubaee (2006) has described the status of the waterfowl in the marshes of southern Iraq and referred to 134 bird species that returned in utilizing these marshes.

Mahdi (1982) has presented his work in titled " Waterbirds in Iraq and the Arab Nations (in Arabic) " described some water - related birds in Iraq mainly based on Allouse s " Birds of Iraq ". The former (Mahdi 1982) did not covered all of the waterfowl species in Iraq and did not add considerable information on what Allouse in (1961) has presented in his through book.

Salim *et al.*, (2009) have described the status of waterfowl in the marshes of southern Iraq after restoration, and indicated to the effect of re-flooding of the marshes on the restoration large number of ducks and geese and other waterbirds. When the waterfowl species that Salim (2010) have described in their work was the Marbled Teal and its status in the marshes of southern Iraq with an indication to the major threats that face these birds.

Marbled Teal *Marmaronetta angustirostris*:

The etymology of scientific name, *Marmaronetta angustirostris*, comes from the Ancient Greek marmaros, marbled and netta, a duck, and Latin angustus, narrow or small and rostris billed (Jobling, 1991).

Marbled Teal *Marmaronetta angustirostris* is considered a globally threatened species with the classification of *vulnerable* by the IUCN (Groombridge, 1993) and BirdLife international (Collar *et al.* 1994). Moreover, it is classified as Endangered at the European level by Bird life international (Tucker and Heath, 1994). This species appears to have suffered a rapid population decrease, evidenced in its core wintering range, resulting from widespread and extensive habitat destruction. Hence, it qualifies as Vulnerable. Nevertheless, data are scarce and some birds may have relocated to other wintering sites. Apparent increases in the western Mediterranean population probably proves improved observer coverage rather than true changes. Marbled Teal population has suffered a long-term decline and widespread loss of habitat (Aerc, 2003).

Field Characters and Measurements:

Marbled Teal is about 39-42cm in length, and the wing-span is about 63–67 cm. It is a small dabbling duck with narrow bill, relatively long neck, big shaggy head, dark patch around eye and generally pale spotted, grey-brown plumage; no speculum. Sexes are similar and have no seasonal differences; juvenile is though distinguishable (Cramp and Simmons, 1977).

The length of the adult ranges between 42-45cm, The wing of the adult 190-215mm, the length of the tail from the base of central feather to the top is 70-85 mm, bill length is 41-48mm and tarsus length is 32-39mm (Allouse, 1962).

Classification & Description of Marbled Teal:

Kingdom: Animalia

Phylum: Chordata

Class: Aves

Order: Anseriformes

Family: Anatidae

Subfamily: Aythyinae

Genus: *Marmaronetta*

Species: *M. angustirostris* (Ménétriés, 1832).

Johnsgard (1961) indicated that the male of Marbled Teal is very similar to females, but when it is observed carefully it is distinguish by its darker and more extensive eye-patch, more developed crest and differently colored and slightly longer bill. The male has a glossy black bill, whereas the female has a dull black bill with a greenish patch of variable size at the base of the upper mandible (Navarro& Robledano, 1995).

Conservation Status:

The IUCN Red List and is ranking Marbled Teal as (VU). The IUCN Red List of Threatened Species is the best-known worldwide conservation status listing and ranking system (Figure-1). Species are classified by the IUCN Red List into nine groups set through criteria such as decline rate, population size, distribution geography, and degree of population and distribution fragmentation. When discussing the IUCN Red List, the official term "Threatened" is mixture of three categories: Critically Endangered, Endangered, and Vulnerable. (IUCN 2012).

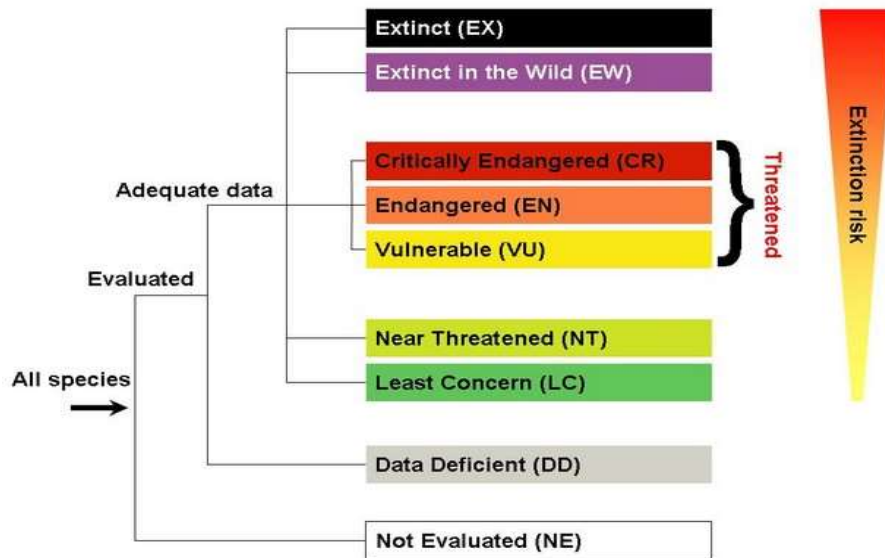


Figure (1): International Union for Conservation of Nature IUCN criteria

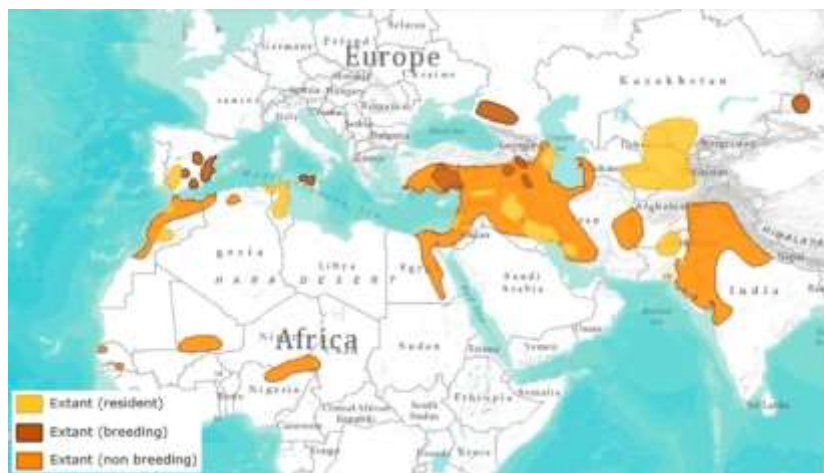
Conservation efforts urge accurate and reliable information, without which programs designed to conserve the species rely heavily on guesswork to identify the causes of the decline and priorities of remedial action (Green 1993,1996).

Global Distribution :

Marbled Teal is indigenous in southern Spain and North Africa and from Middle East to west China and it has a fragmented distribution in the western Mediterranean (Spain, Morocco, Algeria and Tunisia wintering in north and sub-Saharan west Africa), the eastern Mediterranean (Turkey, Jordan and Syria wintering south of Egypt) and western and southern Asia (Map.2) (Azerbaijan, Armenia, Russia, Turkmenistan, Uzbekistan, Tajikistan, Kazakhstan, Iraq, Iran, Afghanistan, Pakistan, India and China wintering in Iran, Pakistan and north-west India) (Green 1996). Surveys in the winter of early 2010 recorded forty four thousand individuals in southern Iraq (Salim 2010), more than the previously estimated world population

(BirdLife International (2004a). This may not represent a genuine population increase, but is perhaps more likely a product of the restoration of the marshes of southern Iraq since 2002, which has probably now resulted in the concentration in this area of most of the Marbled Teal population wintering in south-western Asia, combined with improved observer coverage. Prior to 1991, the estimated population was thirty four to forty thousand individual birds.(BirdLife International 2004b)

Numbers wintering in Iran have fallen from twenty five to thirty thousand (1985-1992) to five thousand in 1993 and three thousand and seven hundred in 1995 (Delany *et al.*1999). Estimates of a wintering population of three thousand birds in 1997 (Green and El Hamzaoui, 1998) and a count of four thousand in Tunisia in 1999 (Bos, *et al.*, 2000).



Map(2): Global distribution of Marbled Teal

Habitat:

Green (1993,1996) indicates that Marbled Teal is adapted to seasonal or otherwise temporary wetlands habitat. It favors shallow habitat rich in emergent and submerged vegetation and apparently prefers brackish, seasonal or temporary wetlands (Esther *et al.*, 2012). For

breeding, it favors more permanent wetlands, while it prefers newly flooded areas outside the breeding season. indicate that Marbled Teal generally prefers waterbodies of rich cover in the form of reeds or inundated *Tammarix* bushes, and keeps away from open waters (Green, 1996).

The concentration of all duck species lies at well vegetated, brackish lakes and their avoidance of saline lakes and their requirements for extensive, well vegetated and highly productive wetlands in the breeding and post breeding periods (Batt *et al.*, 1992; Elmberg *et al.*, 1993). Emergent vegetation providers ducks and invertebrates with shelter (Voigts, 1976; Nummi & Pöysä, 1993). Additionally, submerged vegetation provides home for invertebrates and is essential duck food itself (Krull, 1970; Anderson & Low, 1976; Godin & Joyner, 1981).

Diet:

Marbled Teal diet considerably varies in terms of seasons and sites as well as age. Marbled Teal feeds mainly on vegetation, aquatic plants (seeds, roots, tubers and green parts). It also consumes some aquatic insects, larvae, molluscs and worms. Diptera are important component of Marbled Teal's diet, especially before and during breeding season. Moreover, small seeds become increasingly important beyond breeding season with feces of post-breeding birds in Turkey composed of 95% dry weight *Scirpus* seeds (Green and Sánchez, 2003, Fuentes, *et al.*, 2004, Green and Selva, 2000).

Most of the duck species reveal favoring selection for beds of *Potamogeton pectinatus*, due to their importance as foraging habitat. This

plant and the invertebrates that live on it are primary foods for many duck species (Krull, 1970; Anderson & Lows, 1976; Sondergaard, *et al.*, 1996; Green & Selva, 2000).

Green (1998b) describes feeding towards water depth as not confined to Marbled Teal, which feeds near the surface. The *scirpus*-only zone may have been more important to Marbled Teal because *S.litoralis* seeds represent important part of its diet (Green & Selva, 2000).

Breeding:

Nests are sometimes built close to one another, although they become increasingly spaced out as population density decreases (Kear 2005, Green 1998b). Nesting was recorded from mid-April to late June, and broods from mid-April to mid-September (Kear 2005).

Kear (2005) and Green (1993) describe the breeding site when the nests are usually built on the ground at the water edge, beneath a covering of vegetation. They may also be built above water in *Typha* stands and are reported to have been found in the roofs of reed huts (Hawkes 1970; Kear 2005).

The study that Green in (2000) has conducted on breeding habitat is mainly temporary Mediterranean-type wetlands and Marbled Teal breeds in fairly dry, steppe-like areas on shallow freshwater, brackish or alkaline ponds with well-vegetated shorelines (Green 1993), and rich emergent and submerged plants (Kear 2005). In addition, Marbled Teal is said to breed in delta marshes where receding waters leave behind large spots of shallow water with abundant sedges and bulrushes (Johnsgard 1978). Marbled Teal is also said to use slow rivers and saline coastal lagoons, and man-made wetlands including fish-rearing

ponds and small reservoirs. Although it favors brackish wetlands, it tends to avoid waters of high salinity. Microhabitat requirements are strongly influenced by diet as the bird uses similar habitat during the non-breeding season (Green 1993). Navarro and Robledano (1995) indicate that Marbled Teal in Spain can breed in saline wetlands offer extensive areas of emergent vegetation is present. Declining wetland size and increasing isolation from other wetlands cause decrease in the richness of duck and other waterfowl species (Marchant, 1963a ,1963b; Brown & Dinsmore, 1986; Nudds, 1992; Elmberg *et al.*, 1993,).

Threats:

Salim (2010) mentions in his report that over 50% of suitable habitat in Iraq may have been destroyed during the 20th century. Wetlands drainage for agriculture occurs across its range, most significantly in Iraq where the Marbled Teal remains threatened by fluctuating water levels and local water shortages.

Marbled Tal is also threatened by illegal hunting and persecution, exacerbated by its being the principal wildfowl target for hunters in dry

season (Hanna *et al.*,2011,. Salim,2014). Reed cutting, burning and grazing commonly cause habitat decline for the ducks community occurrence in general. Pollution from agricultural, industrial and domestic sources is a threat at many sites (Salim, 2004).

Behavior:

Marbled Teal behavior is dispersive and in part migratory, it shows variable, nomadic movements and is capable of dispersal searching of suitable habitat at any time of the year according to the variation of circumstances (Scott and Rose 1996; Kear 2005; Del Hoyo *et al.* 1992). A general tendency for a more southerly distribution has been mentioned during the non-breeding season and more northerly distribution during breeding season (BirdLife International, 2008).

Marbled Teal is considered as to be highly gregarious post-breeding and during the non-breeding seasons when it occurs in large flocks (Del Hoyo *et al.* 1992, Green *et al.* 2002). During the breeding season it is more dispersive and might occur in wider range of habitats, although Marbled Teal often mix with conspecifics in pairs, except during the courtship displays, Marbled Teal is relatively silent (Cramp and Simmons, 1977).

Marbled Teal in Iraq:

Porter, *et al*, in 2010 has mentioned in the provisional checklist of the birds of Iraq that the Marbled Teal is a resident breeder and wintering bird species with most concentration in southern Iraq.

Earlier Iraq historical record that indicated that Marbled Teal present in small number of stragglers in January , February and March. A

flock of eight was seen in April and thereafter throughout the summer all that seen in a Bund pool at Sheikh Omar. At Kut it is essentially a summer resident, appearing in April and breeding in dykes and irrigation canals among corn crops in the district in May . Also it is the common breeding duck of southern Iraq and there are no records from the North. (Moore & Boswell,1956). Southern Iraq is probably the most important breeding area in the world for Marbled teal its around 4000-6000 pairs probably breed that representing some 40-60% of the world population (Evans M.1994). A female was seen by Bryan in (1958) on the Alwand river near the refinery in September, also it has not apparently been recorded previously north of Baghdad. Chapman & McGeochin (1956) observed at Habbaniya to the west of Baghdad. In the recent studies on the birds of Kurdistan, northern Iraq, there is no record for Marbled Teal (Ararat, 2009).

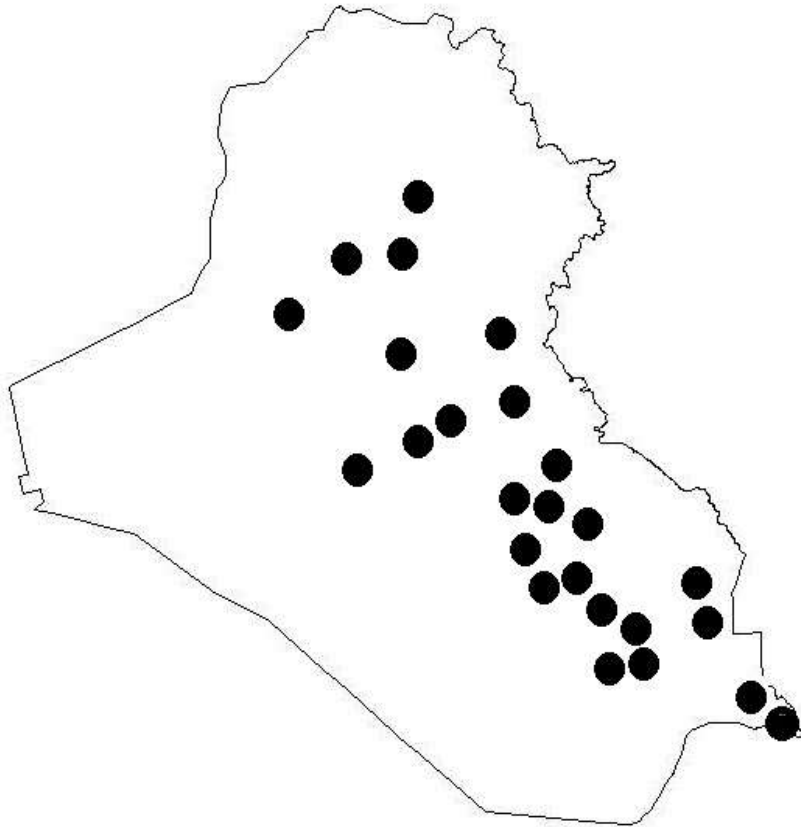
The Marbled Teal *Marmaronetta angustirostris* is known to breed widely in Mesopotamia (Green, 1993). Ticehurst *et al.* (1922) reported it to be a fairly common breeder in southern Iraq; Moore and Boswell (1956) found it breeding along dykes and irrigation canals in the Kut area, in the Hai area and at Haur Al Shuwaija.

In the wetlands of Iraq, Evans in 1994 made his study on general review for the birds of the republic of Iraq and mentioned that Marbled Teal was recorded in many area like Huweija marshes as passage migrant, Anah , Rawa and Habaniyah lake in Al-Anbar province and Hindiya Barrage in Babil province and Bahr al Milh in Karbala province as summer visitor, Mahzam and lake tharthar in Salah AlDin province and Shatt Al Garraf in Dhi Qar province as a winter visitor, Shaikh Sayed marshes in Diyala province was occurs outside breeding season at least 180 in January in 1968, Suwayqiyah marsh in Wasit province as a

common resident, Maraiba marsh in Wasit province as well as Sarut marsh and Chibaish area in Maysan province and Samara Dam in Salah Al-Din province and Shat Al-Arab marshes in Basra province as a probably breeds (Map-3). While during the KBA survey made by IMoE and other partners organization have found the Marbled Teal in other additional wetland (in addition to the wetland above) like Dalmaj , Huwaiza, Hammar, Ibin Najim and Fao wetland (IMoE, 2014b).

Surveys in the winter over southern Iraq recorded 23,000 individuals of the Marbled Teal in the marshlands of this area. These observations made it necessary to update the previously estimated world population of 14,000-26.000. This illustrates that the main global population exists in Iraq, specifically over the wetlands southern Iraq (Salim, 2010).

Very few references have tackled the status of Marbled Teal in Dalmaj wetland. The previous surveys showed that the Dalmaj wetland is one of the key areas for wintering and breeding of this birds in Iraq, and showed some considerable count of individuals birds in this area (IMoE, 2014b). Salim , 2011 has made some early surveys on some biodiversity aspects in Al-Dalmaj Wetlands (including the marsh area) and summarized the status of Marbled Teal in Dalmaj as regular winter visitor and breeding bird species in considerable number. The lack of information about this bird species in this key wetland in Iraq necessitate on shading more light on the status of vulnerable birds in Dalmaj wetland.



Map(3): Location where the Marbled Teal recorded (Historically and Recently)

Hor Al-Dalmaj was described as Important Bird Area that described by Evans in(1994).

The Main Outfall Drain (MOD) is the major feeder for Al-Dalmaj Wetlands via a feeding canal. The total length of the MOD is 565 km, which is divided into three sectors of the which the middle sector is part of function hydrological system in association with Al-Dalmaj Wetlands, also it is consider one of the saline lakes in Iraq (Mousa, 2013).

Al-Dalmaj is one of the most important Iraqi wetlands for fish and Bird (IMOIE 2014b; Coad, 2010). Many waders and waterfowl occur in Al-Dalmaj Wetlands in large numbers as well as passerines (Salim, 2010).

Dalmaj area lies within two Terrestrial Eco-regions (Map-4) :-

- 1- Tigris-Euphrates alluvial salt marsh,
- 2- Arabian desert and eastern Sahara-Arabian xeric shrub lands

Map(4): Eco-regions of Iraq with main two Eco-regions that present in Dalmaj Wetlands (IMoE, 2014a)

Boere & Stroud ,2006 and BirdLife International show that Iraq is situated within three major global Flyway for migratory land and water birds which they are the West Asia/East Africa Flyway, Central Asia Flyway, and Mediterranean-Black Sea Flyways (Map-5). In addition, East Atlantic Flyway are taken for the world's largest migration system with over two billion passerines and none-passerines migrating from their breeding platform in Europe and Central-Western Asia toward wintering grounds in Africa each year (Hahn, *et al.*, 2009).

Map(5): Location of the Property (●) in Relation to: 1) West Asia/East Africa Migration Route for Waders (source: Boere & Stroud 2006) 2) West Asia/East Africa Flyway for Shorebirds (pale red shading) (Source: Boere & Stroud 2006).

According to Boere & Stroud's (2006) and BirdLife International, Al-Dalmaj area lies within the ranges of some of the above-mentioned flyways.

Materials and Methods : -

Hor Al-Dalmaj is an area that consist large waterbody of an open water (lake habitat) and marshes dense reedbeds (marsh habitat). Hor Al-Dalmaj was selected to be the study area for this study based on the criteria below :

1. Being a wetlands of very rich biodiversity, especially in fauna and avifauna.
2. Dalmaj in one of the key wetlands in Iraq that holds considerable numbers of Marbled Teal in comparison with other wetlands.
3. Dalmaj provides good variety of different wetland habitats that allows studying the bird under various conditions and different cases the matter that enriches the outcomes of the study.
4. This study considered as a contribution for the environmental studies in Dalmaj, being unstudied area.

The field survey was comprised of selecting sampling sites scattered throughout the study area of Dalmaj to collect enough information that would best give an overview of the environmental conditions as a whole. The five major criteria for choosing the sites inside Dalmaj were as follows:

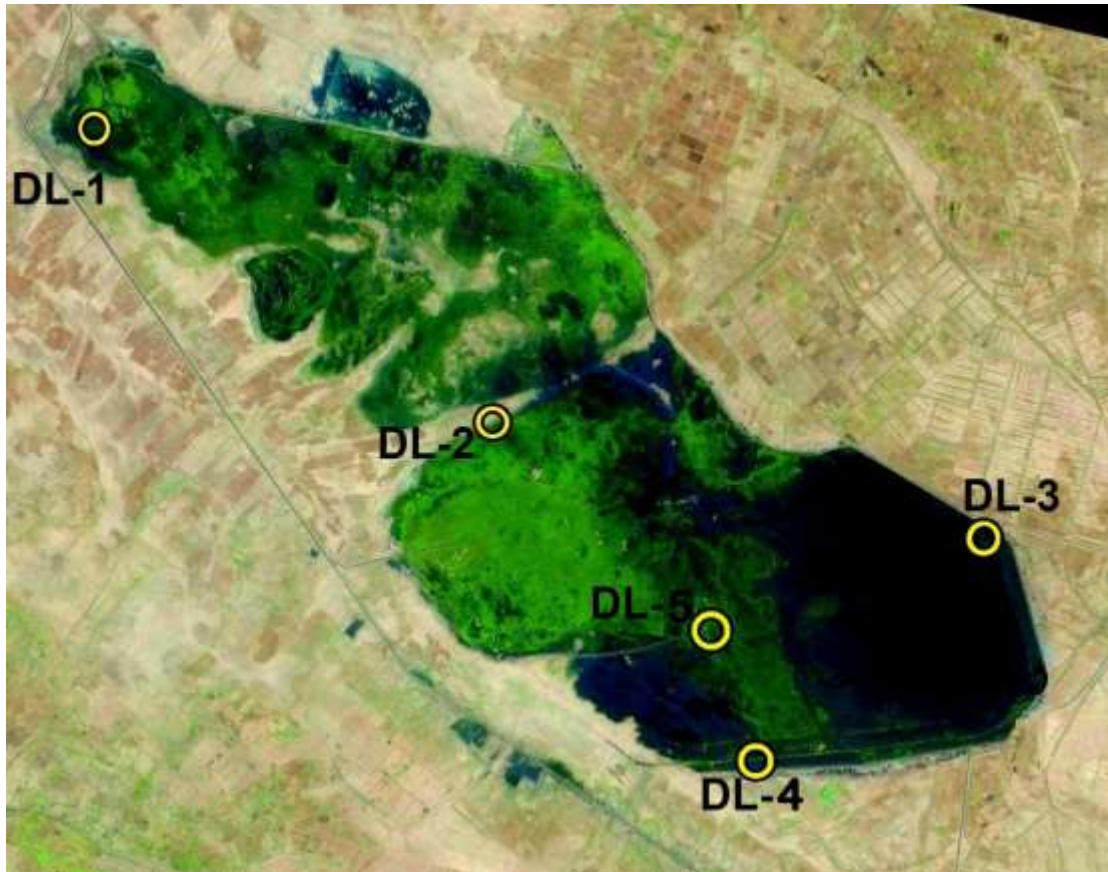
1. Sites widely representative of all different types of habitats within the Study Area.
2. Sites known historically (through previous field notes) to be important bio-diverse habitats, at the same time this area should hold the Marbled Teal based on the previous fieldworks.
3. Sampling sites evenly distributed geographically as much as possible to avoid leaving large un-surveyed gaps.
4. The site list should include areas close to the agricultural or other human activities, in order to check the human activity impacts on the habitats of the area. This is to ensure not only pristine areas are surveyed but additional habitats are considered with their existing impacts from human activities.
5. Sites should be accessible (none-restricted access, physically accessible, etc.).

Maps of the study area were created and used in the analysis of collected data, and recent satellite images of high resolution were used during the study and analyzing the data collected from the field.

Five sites were eventually chosen within the polygon of the study area in Dalmaj started from January to December in 2013. A maps of 1:100000 scale were used to trace the field work path and locate the selected sites with the aid of a GPS devise. In the field, the selected sites were found using the “go to” feature on the GPS device, and a path-track was used as well in order to find and stand on the same sites specifically.

The Map and the Table below show the survey sites, their site code, and GPS location.

Table(1): The GPS coordinates and site codes of the ecological survey sites.



Map(6) Satellite image shows the Dalmaj sampling sites (Nasa, 2014).

Sites Description

The description of each sampling sites was given in details, and this includes the location, description of the landscape, habitat and plant description as well as settlement. It also includes the reliable reporting from the locals regarding the threats and the new changes that happen in or around each sampling site.

Plants & Habitats Description

Plant identification was primarily carried out in the field. Plants that could not be identified in the field were identified later by plant experts either based on a sample or a clear pictures in other cases, using the collected specimens, pictures and notes with the following references: Townsend and Guest (1966,1968, 1974, 1980a, 1980b, 1985), (Saadi & Mayah, 1983,and Alwan, 2006).

General information on different types of habitats was based on Townsend and Guest (1966). And this included identifying the different types of dominant (as well as the uncommon) species of shrubs, herbs, and grasses at each site. The amount of vegetation cover at each site was estimated based upon direct observation.

Marbled Teal and other Bird Species

The recording of individual or flocks of Marbles Teal as well as the other bird species in the study area was conducted using area count that includes searching within the area and then noting birds seen within specific area (Williams *et al.*,2004). Both habitats: Aquatic and Terrestrial were surveyed around given central GPS coordinate. The bird lists were made based on direct observation of each individual bird or group of birds, or by noting down a detailed description of the unidentified birds, then checking it with references later.

The researcher using field equipments and 12x50 binoculars conducted the bird surveys in the study area in Dalmaj. The counts were conducted by direct observation from a 4X4 vehicle or by walking through the site in different directions focusing on the suitable areas for Marbled Teal during different times of the year, this includes the open-waters among the reedbeds and other emerged/standing aquatic plants in addition to the shrubs (mainly *Tammarix* spp.) over the edges of the marsh and close to these marshes. All the pictures included in the current work were taken by the researcher.

The breeding evidences based on British trust for Ornithology (BTO) guidelines have been experimented as bellow (Table -2):

Table(2): Guideline of the Breeding Codes for Bird Observations during the survey

The following field guides were used during the fieldwork: Mullarney *et al.*,(1999), Porter, *et al.*, (1996), Porter & Aspinall (2010), and Salim *et al.*, (2006). Allouse (1953, 1960, 1961, 1962,) was consulted to review the status of the bird species over the area as a whole.

Food Analysis Methodology:

The faecal sample were collected from Dalmaj Wetlands where the groups of Marbled Teal observed resting out of the water. The faeces sample removed carefully by knife and care taken not to collect anything stuck to the faeces like pieces of vegetation and soil, and the gizzard samples taken by anatomic tools by the vet . The sample was examine by using light and electronic microscope , pipettes, slide, normal saline and soft tweezers. All the methodology based on following references (Anderberg, 1994; Green , *et al.*,2008; Green & Selva , 2000; Fuentes , *et al.*, 2004; Green& Sanchez, 2003).

Water Assessment:

For the water quality analysis, the field works had cover the measurements of some physical and chemical properties such as pH, TDS, Water Temperature ,EC ,by using (YSI) Portable Field Equipment (556 MPS) and the Turbidity were measured by using Hanna Turbidity meter-2100N. In addition to that the Air temperature were measured by using thermometer (10-100)C^o.

Bird identification:

The bird species in the sampling sites were assessed for their conservation significance in terms of the IUCN Red List (IUCN, 2008) status of the birds that were found at the site. This includes birds of general Conservation Concern (CC), Near-Threatened (NT), Vulnerable (VU), Endangered (EN), and Critically Endangered (CR) species.

The observed Marbled Teal and other birds were recorded in a field notebook that included the Marbled Teal counts by using 40x telescope as well as the other ducks and count in addition to any other related notes. This also included detailed descriptions of the sampling site and any related observations such as the presence of threats of any kind (including timing, scope, and severity of each threat). The recordings were gathered in a Microsoft Excel 2010 spreadsheet that includes the entire list of the birds seen at the site and their counts with using statistical analysis system (SAS,2010) during this study.

Other Fauna

The other fauna (Mammals, Reptiles, and Amphibians) represent very important factors that affect the life of the Marbled Teal, and this is the reason for covering these other fauna individuals in this research. The main aim of a survey is to establish the presence and absence of various

mammal species, which are difficult to survey. Three methods in collecting data of the mammals and other fauna of the survey area were adopted. The observer gained some understanding of the distribution of the mammals but only a very general idea about their populations present during the survey period.

The first method (which was the most commonly used) was to search for tracks for both small and large mammals. The presence of large mammals was indicated from observations of tracks and feces. Mostly Olaus' (2005) "Field Guide for Animal Tracks" was used in identification of the tracks that were seen in the field. When the track found was unclear or partially damaged in the field and did not allow for clear identification regarding the species classification level, only the "group" of the animal (Family or Genus) was referred to.

The second method was interviewing local residents and hunters inside or near the sites to get a basic picture of both common and infrequent mammal sightings. The third method was by anecdotal, direct observation of species in the area during the time of the site visit. The potential for seeing nocturnal species is, by necessity in a rapid assessment conducted during daylight hours, greatly reduced unless such species were disturbed during the field teams' visit to the site.

The same three methods above were used in investigation of other faunal groups. Also, the holes and dens that were seen in the ground or embankments served as a rough indicator for species presence.

Threat Assessments

The survey included a site threat assessment using the Pressure-State-Response (PSR) Model, as outlined by the Birdlife International that report on Monitoring Important Bird Areas. The bulk of this section quotes full sections of this report. The PSR Model relies on three types of indicators:

- **Pressure** - Pressure indicators identify and track the major threats to important bird populations at IBAs. Examples include rates of agricultural expansion, over-exploitation and pollution.
- **State** - State indicators refer to the condition of the site, with respect to its important bird populations. State indicators might be population counts of the birds themselves. They might also be measures of the extent and quality of the habitat required by these birds.
- **Response** - Response indicators identify and track conservation actions: for example, changes in conservation designation, implementation of conservation projects and establishment of Local Conservation Groups (LCGs).

In this survey, only the first indicator was applied (Pressure Indicator) because Dalmaj marshlands is one of the important areas for biodiversity that suffers from the lack of response.

Pressure Indicators

Pressure indicators consist of the following eleven threat types, most of which were assessed for all sites in the field survey:

1. **Agricultural expansion & intensification:** Threats from farming and ranching as a result of agricultural expansion and

intensification, including silviculture, mariculture and aquaculture. Note that wood and pulp plantations include afforestation, and livestock farming and ranching include forest grazing. Agricultural pest control and agricultural pollution-specific problems apply to “5. Overexploitation, persecution & control” and “9. Pollution”, respectively.

2. **Residential & commercial development:** Threats from human settlements or other non-agricultural land uses with a substantial footprint; resulting in habitat destruction and degradation. Note that domestic or industrial pollution-specific problems apply to “Pollution.”
3. **Energy production & mining:** Threats from production of non-biological resources; resulting in habitat destruction and degradation. Note that renewable energy includes wind farms.
4. **Transportation & service corridors:** Threats from long narrow transport corridors and the vehicles that use them; resulting in habitat destruction and degradation, disturbance and collision.
5. **Over-exploitation, persecution & control:** Threats from consumptive use of wild biological resources including both deliberate and unintentional harvesting effects; also persecution or control of specific species. Note that hunting includes egg collecting, gathering includes firewood collection, and logging includes clear cutting, selective logging and charcoal production.
6. **Human intrusions & disturbance:** Threats from human activities that alter, destroy and disturb habitats and species associated with non-consumptive uses of biological resources.

7. **Natural system modifications:** Threats from actions that convert or degrade habitat in service of managing natural or semi-natural systems, often to improve human welfare. Note that “other ecosystem modifications” includes intensification of forest management, abandonment of managed lands, reduction of land management, and under grazing. “Dams & water management/use” includes construction and impact of dykes/dams/barrages, filling in of wetlands, groundwater abstraction, drainage, dredging and canalization.
8. **Invasive & other problematic species & genes:** Threats from non-native and native plants, animals, pathogens and other microbes, or genetic materials that have or are predicted to have harmful effects on biodiversity (through mortality of species or alteration of habitats) following their introduction, spread and/or increase in abundance.
9. **Pollution:** Threats from introduction of exotic and/or excess materials from point and non-point sources causing mortality of species and/or alteration of habitats. Note that domestic and urban waste water includes sewage and run-off; industrial; agricultural and forestry effluents and practices include nutrient loads, soil erosion, sedimentation, high fertilizer input, excessive use of chemicals and salinization; and air-borne pollutants including acid rain.
10. **Geological events:** Threats from catastrophic geological events that have the potential to cause severe damage to habitats and species. The team might not be able to assess these threats due to

lack of information but in most cases the main geological threats facing Iraq are earthquakes.

11. **Climate change & severe weather:** Threats from long-term climatic changes that may be linked to global warming and other severe climatic/weather events. The team might not have adequate information to assess these threats but global warming, desertification and increased dust storm events are potentially significant threats in Iraq.

Each threat class is rated based on its Timing (current to past threats), Scope (size of area affected) and Severity to provide an integrated threat assessment score that did classify the particular threat classification for the site as Low, Medium, High or Very High.

Assessing and scoring threats (Pressure) :

The threats on the studding sites or on the (IBA) based on information collected by site-based monitoring, along with other reliable information were available. Each threat class was rated based on its Timing, Scope and Severity, in relation to how likely affect the "Duck" species which in this study is the Marbled Teal *M. angustirostris*, so the threat assessment will be based on:

Timing, Scope, and Severity scores and combined them to give an impact score as follow :

Impact score of threat = Timings score +Scope score+ Severity Score, so the result scores range from 0 to 9, and results scale from 0-3. It is necessary to know if the score for any one of the timing, scope, and severity for a given threat = 0, then the impact score for that threat =0,

(This means that the impact score has no effect on the species /site and never has the value form 1or 2).

Birdlife International (2006) Monitoring Important Birds Areas: a global framework, Cambridge, UK. Birdlife International. Version1.2. Compiled by Leon Bennun, Ian Burfield, Lincoln Fishpool, Szabolcs Nagy & Alison Satterfield.

Results and Discussion

Hor Al-Dalmaj is characterized of having both terrestrial habitats and large waterbody. The former ranges from arid areas to true desert with sand dunes, while the latter is divided into open-water lake of over 2 m in depth, and true marshes with dense reedbeds and shallower water (less than 1 m in depth). The aquatic areas are fed by and discharge into the Main Outfall Drain (MOD), a large agricultural drainage canal. Water level in Dalmaj is unstable because of the control of the Ministry of Water Resources over the flow of the MOD. There are a number of Embankments that surround Dalmaj to contain the water.

The southern section of Dalmaj is mainly mudflats, featuring *Phragmites* and *Typha* reedbeds as well as submerged plants and occasional dry ground scattered with bushes and terrestrial species. Many waders and waterfowl were observed at the site in large numbers in addition to passerines, most of which were observed breeding.

The eastern part of the site includes much of the open and deeper Dalmaj Lake that is surrounded by the embankment, which makes it favorable habitat for gulls, terns, and fish. To the east of the embankment

there are shallow, saline marshes with a dense strip of reedbeds and *Tammarix* bushes.

The freshwater marshes in the northern part of the site are characterized by rich plant cover, such as *Phragmites*, *Typha* reedbeds and *Tammarix* in drier areas.

Dalmaj is rich in biodiversity, being a wintering ground for numerous waterfowl and a main breeding area for Marbled Teal, Ferruginous Duck, and Red-crested Pochard, which are three of the four known breeding ducks in Iraq.

According to IMoE, 2014b, and During to our surveys that is conducted during twelve months, it seems that Dalmaj Wetlands can be classified into four main habitats that is observed within Dalmaj wetlands and that is :

Desert - Desert Shrub land, in this habitat the characteristic species are *Tamarix aphylla*, *Tamarix aucherana*, *Tamarix macrocarpa*, *Prosopis juliflora*, and *Alhagi graecorum*.

Inland lotic Water, Aquatic communities and Rooted Submerged Vegetation, characteristic species are *Najas marina*, *Potamogeton pectinatus*, and *Ceratophyllum demersum*.

Marsh vegetation - Helophytic vegetation- Reedbeds, and these habitat have characteristic species like *Phragmites australis*, and *Schoenoplectus littoralis*.

Inland lentic water, Patch or lakes and unvegetated still water.

Marbled Teal description:

Marbled Teal is a threatened bird species, and that is why no attempt was made to directly to collect samples to get the description and biometrics. The samples that were gained for this purpose were mainly

collected from either the market or from the hunters in or close to the study area. Most of the color and behavior description were taken through the direct, close observation of alive bird in the study area were the researcher tried to get as closer as possible in order to observe the fine details of the male, female, young bird and chicks, as well as these observations that are related to the behavior.

Adult male:

Generally the bird has gray-brown body, dark mantle with paler under parts. The ends of the upper part of feathers (back, rump , upper tail covers and scapulars) are of pale cream color gives spotted pattern(in contrasting with the dark feathers) of the upper parts. The adult is darker above than below with proud dark stripe around the eye and ear coverts. Nape feathers elongated and forming a pendent, low crest. Primaries pale silver-gray, secondary pale brown fading into gray-brown tips. Tail partly tipped white, with relatively darker center feathers. The breast flanks and under tail coverts are of pale gray-brown feathers with whitish tips gives these part spotted pattern, while the Pelly is whitish. The bill is black with dark gray base. Legs green –brown with blackish webs. (Plate -1).



Plate (1): Adult male of Marbled Teal

Adult female:

It is similar to adult male, but slightly smaller. The crest is either smaller or absent in some female. The color of the bill can be distinguished from the males being comparatively paler, especially at the site of the bill of the female. (Plate-2).



Plate (2): Adult female of Marbled Teal

Juvenile:

It resembles adult, though it is duller and greyer above without creamy spots on back, and almost uniformly cream below with much less distinct markings on flanks (Johansguard, 1961).

Form the direct observation of the intensive field work it looks uniformly pale grey-brown or mortar-coloured, with dark eye-patch and shaggy head. This combination, and lack of coloured speculum, distinguishes it from all other west Palearctic ducks. Accidental Cape Teal *Anas capensis* is larger and greyer with darker back with reverse pattern of spotting (dark centers and light edges), and well-marked speculum, high rounded head, and pink bill (Plate-3).

It is usually shy and unobtrusive, spending much time on reed-covered lakes and slow-moving rivers, usually in pairs or small parties. It swims well, but not usually very far. It flies with slower wing-beats than Teal *A. crecca*, with much less springing take-off, and generally for only short distances into fresh cover. It is generally quiet.



Plate (3): Juvenile of Marbled Teal

Chicks:

Based on some individual chicks that were examined and measured in different places in Hor Al-Dalmaj a one month chick can be described as follows :-

In comparison with other ducks chicks, the chick of Marbled Teal is lesser in sized than Mallard or Red Crested Pochard. The chick is brown in general with some part of dark, pale, or whitish brown. For head, tip, nape is brown with a pale supercilium and dark eye-line. The checks, throat, neck sides, upper breast is creamy white and the sides of the chest is pale brown. The back, rump, tail, winged covert are brown with pale patch at the middle of the back and the winged covets. The belly and under tailed coverts are pale brown.

The pale is blackish gray with whitish/pill tooth. The area around the nostrils is pale gray. The color of the eyes is brown. The legs, including toes are dark gray, and the claws are blackish. (Plate -4).



Plate (4): Chick of Marbled Teal

Measurements:

Allouse (1960) has summarized the measurement for the adult that were collected from different wetland in Iraq as follows:-

The length of the adult ranges between 41-45cm, The wing of the adult 195-212 mm, the length of the tail (from the base of central feather to the top 72-84 mm, bill length 41-48mm, tarsus length 31-38mm. (Table-3-Plate-5). Based on the measurement that were taken from four individuals collected by the researches from different local hunters in different places in Hor Al-Dalmaj , the mean of this measurement were as follows:-

Table (3) : Mean measurement of the Marbled Teal

The measurement that were taken by the researcher were within the natural range of the measurement of the bird of the Marbled Teal that were compiled in Iraq by (Allouse, 1960), also these measurement still

within the natural limits of the measurement of the Marbled Teal in different places worldwide shown by Cramp & Simmons (1977).

Plate (5): Different measurement of Marbled Teal

Habitat:

Given the fact that this study is the first of its kind in Iraq to deal with a highly important duck species, Marble Teal, in one of the most diverse and important area at the national, regional and probably the international levels; it proves very feasible to deal with the subject of the habitat of this bird from the literatures and compare that to the status of Dalmaj to find out whether the wetland supplies the bird with habitat features it requires in such a way that makes Dalmaj attractive to it.

Green and Selva (2000) presents several components of the so-called “good Marbled Teal habitat” when mentions that “the single most important component is high density of suitable food items (mainly invertebrate communities) at shallow depths not exceeding 30 cm will provide Marbled Teal to meet their activity, vitality and nutritional requirements throughout the annual cycle.

Green (1998b) also argues that the Marbled Teal mainly using shallow water ,typically with dense reedbeds, emergent and submerged vegetation. Fresh to saline wetlands are used, but there is some evidence of a preference for slightly brackish sites .

The variation of habitats in Hor Al-Dalmaj (open landscape, dense reedbeds, ponds of open water, dense shrubs, and the hybrids of each of these habitat) creates well-diversified combination of shelter and food resources of considerable spectrum in floral and faunal species.

Through the regular surveys in the study area and the frequent monitoring of the habitats of this bird, it has been observed that it prefers areas with less water and small ponds avoiding open water. It also favors areas with certain plant species like *Tammarix*, *Typha* and *Phragmites* beds. Also, by means of continuous and direct observation for this bird, it appears to occur in areas with submerged plants like *Ruppia sp.*, *Scirpus sp.* and *Stuckenia pectinatus*. These observations show that Dalmaj provides almost all habitat requirements to support Marbled Teal that was shown in the description of the Marbled Teal habitat by Green (1998b).

Moreover, more permanent wetlands seem to be appealing for breeding. Very few Marbled Teal individuals were recorded in the open water. The water depth was not so confining to Marbled Teal.

Predation:

Some references have tackled the issue of the predators and their impact on the ecology of some duck species. However, very few studies were dedicated for studying predators of adult and young Marbled Teal. Green 1993, Navarro and Robledano 1995, indicated that Marsh Harrier (*Circus aeruginosus*) and Black Kite (*Milvus migrans*) are the main Marbled Teal predators. During the present surveys in Dalmaj we have found that the presence of Marsh Harrier is much higher than the Black kite. We can fairly state that the Marsh Harriers were found over most of the sampling site, especially during their winter occurrence with less presence at the eastern site (DL-3).

As for Mammals and other fauna predators, Navarro and Robledano 1995, Green 1998c, indicated to the high impact of the predation of mammals like Red fox and other fauna on Waterfowl, specifically ducks during breeding season.

The table below presents the Carnivore mammals and other fauna species that were found either in or around the sampling sites, and some carnivore mammals and other fauna which can be feeding on the chicks and eggs of birds reported by locals and others (Salim, 2008).

Table (4) : Other Fauna species that were found in the study area

Foraging:

Marbled Teal observed feeding methods are dabbling (dive up, neck dip with part of neck submerged, head dip, bill dip with part of bill submerged), gleaning, and straining items from the water surface (Green, 1998a).

In another study, Navarro (1997) states “Marbled Teal feed mainly by dabbling, with upending observed very occasionally.” However, he earlier stated that Marbled Teal feeds mainly by bill dipping and is the only species observed gleaning and the only dabbling duck observed diving. Overall, Marbled Teal feeding techniques are multiple as the literature mentions and they are summarized by: dabbling, gleaning and picking from the water surface.

However, through the frequent site visits of the study researcher and intensive monitoring of the bird’s behavior, it has been noticed that Marbled Teal feeds generally by dabbling, and the researcher has not observed Marbled Teal using any other feeding technique. This is consistent with Green’s observations (1998a) as he mentions that Marbled Teal main feeding technique is dabbling.

Diet :

Data collected in this study on diet of Marbled Teal were carried out on faeces (15 Samples were collected) and by autopsy of the gizzard of four recently-dead samples, three were found dead during site visits

and one was collected from local hunters. As for faeces, the predominant diet components were mainly consist of plant seeds of *Scirpus spp*, *Stuckenia pectinata*, and *Ruppia spp* (Plate-6).

Some other plants' seeds were found like, *Zannichellia L.* and *Typhae sp L.* Also, there are other unidentified food fragments, but it was not certain that whether they were plants or insects.

Plate (6-A): *Stuckenia pectinata L.* Plate (6-B): *Scirpus spp L.*

Concerning gizzard tests, plant seeds were the dominant diet components and they mainly include *Ruppia sp.*, *Potamogeton pectinatus L.*, *Scirpus sp* and others like Corixidae (Plate-7). There were also fragments of *Chara sp.* and very few unidentified aquatic insects. The researcher things that further studies are still required for better understanding of the diet component of Marbled Teal in Iraq.

Plate (7-A): Corixidae Plate (7-B): *Ruppia spp L.*

This is consistent with several scholars who argue that the dominant content of Marbled Teal diet is omnivores, mainly seeds, though the bird feed on some insect species (Ali and Ripley, 1968; Johnsgard, 1961; Dementiev and Gladkov, 1952; Green and Sanchez, 2003; Fuentes *et al.*, 2004).

Behavior:

Due to the lack information about this bird in Iraq, we observed from the site visits to Dalmaj to monitor the behavior of this bird that it has a number of major behavior categories which are classified into Rest (observed in various times of the day), Swim (observed generally to happen during the hottest times in the day), and Feeding. Other observed

common behaviors include alert, walking and drinking in various times of the day during site visits.

The bird is more active at dusk and dawn. Moreover, singing was observed only during the courtship period (Plate-8) and it uses submerged reedbeds for rest. These observations are consistent with Johnsgard (1965), Cramp and Simmons (1977) accounts on Marbled Teal behavior.

Site visits of this study also show that Marbled Teal is usually seen in pairs or small groups, and sometimes in flocks during winter. Cramp & Simmons (1977) argues that this species is monogamous and pair-bonds are strong during one season. Pairs form in late March to be ready to go to the breeding areas. It was also observed from the site visits that the flight of Marbled Teal performs rather slow and low flight, showing less agility than in other small dabbling ducks, and takes flight less easily from water.

Plate (8): Male display behavior observed in
Dalmaj Wetlands

Breeding:

The mating system of marbled teal is monogamous, but still poorly understood due to the lack of information and research on the bird in Iraq. Marbled teal is sexually monomorphic and field observations showed that males remain with females and their brood playing a guarding role. Our observations indicate that breeding season occurs from early May to mid-July and Marbled Teal breeds alone or in small groups. This species produces only one clutch. Marbled Teal are exceptionally late breeders

compared with the sympatric duck species (Green 1998c; Green *et al.* 1999).

As it was mentioned earlier, the bird is shy. Moreover, its use of certain distraction displays like injury feigning and flying in low heights to draw hunters' attention away from the chicks (this has been seen through the visit sites to Dalmaj); hiding nests and chicks in inaccessible thick aquatic vegetation; and its cryptic capacities like its coloring patterns (though our field experience helped us greatly in spotting the bird) prevent observing the full range of its breeding manifestations. Such case can only be tracked by putting in-effect a monitoring program for at least five years.

The breeding of Marbled Teal in Hor Al-Dalmaj can easily be said here to be a successful activity due to multiple reasons. First, Dalmaj, with its current threatened status, is nevertheless providing acceptably suitable breeding habitat for this bird. Secondly, breeding confirmation of this bird in Dalmaj is based on the British Trust Ornithology like Distraction Displays (DD), recently fledged young (FL).

A Marbled Teal egg has been described in the literature as being ovate, pale straw; 46 x 34 (42-51x32-36) (n=100) (Cramp and Simmons, 1977). To the advantage of this study, it is the first study in Iraq that document the eggs of Marbled Teal in the field in photos. Noteworthy, many sound studies in the world examine this bird and its relevant aspects in captivity. One summer field trip to Hor Al-Dalmaj (May 7th 2014) was in our favor as we found Marbled Teal eggs. The descriptions of them is that they are ovoid and creamy color, weighing about 31.5g. (Plate -9).

Plate (9-A): Egg color

Plate (9-B): Weight of egg

The dimensional measurements of the eggs we found are: length = 45.02mm and width = 34.70mm as the Plate No.10 show. The overall description of Marbled Teal eggs are consistent with that mentioned by Cramp and Simmons (1977) and Kear (2005).

Plate (10-A): Egg length

Plate (10-B): Egg width

Breeding Habitat:

Marbled teal in habits saline to fresh wetlands mainly over the shallow marshland that are rich in emergent and submerge (Green 1993, 1998b, Navarro and Robelndano 1995, Gonzales *et al.*, 2012). Based on the results of the intensive field work that have been made in Al-Dalmaj wetlands, it seems that Marbled Teal prefers the margins of the shallow marshland habitat where they lay their eggs at the relatively higher batches of dry land that are close to the water. It also prefers the relatively dry area that are close to the water edges specially with good vegetation cover mainly under *Tammarix* shrubs.

During the site visits, sum young bird with their parent has been observed with 11 chicks walking behind the female parent, and these breeding evidences were found at the eastern saline ponds that are beyond the embankment (Plate .11). These ponds are artificial depression filled with saline water that do not exceed one meter depth. The ground of these ponds surrounding the area are saline soil (Sabkha), and most of these ponds margined with good shelter of *Tammarix* while some of these ponds has some *Phragmites* reed. As for these ponds it seems that

Marbled Teal use these ponds for breeding and transport their chicks after a few days of fledging to the main water body of Dalmaj. After crossing the embankment, they spend the rest of their life there.

Plate(11-A): Adult with Chicks (Ponds) Plate(11-B): Adult with chicks (Sabkha)

Threats:

Hor Al-Dalmaj faces several very high threats, of which hunting and poaching (large numbers of ducks, other waterfowl, and fish are poached each year through the use of clap-nets, shotguns, and fish nets) are probably the most severe (Plate-12). Agriculture is also a very high threat as most of the dry land inside the site is used for wheat farming and very little remains untouched. However, the lack of fresh water for irrigation has forced many farmers to abandon their farms and these lands have returned to their natural plant cover. Additionally, human intrusion is a very high threat because Dalmaj is a popular weekend hunting and recreation area, particularly during holidays, for residents of Diwaniya city, which does not have many open areas. As Dalmaj is mainly dependent on drainage water from the MOD, it is highly threatened by fluctuation and lack of water caused by upstream dams, inside and outside Iraq. While the MOD should be a permanent source of water, no alternative is available if it dries up, and water level balancing is currently managed without biodiversity preservation concerns of Dalmaj in mind.

The Marbled Teal prefers superficial and seasonal wetlands which are often subject to irregular hydrological regimes and inadequate water management.

Hunting is the highest threat on Marbled Teal, which is considered a relatively attractive target for hunters. The sudden changes in water levels in reservoirs because of their use for irrigation during the breeding season

limit reproductive success. Due to the Marbled Teal characteristic late breeding time, the shortening of the hydrological cycle in Al-Dalmaj area makes it practically difficult for the species to breed successfully in Al-Dalmaj area. Here the marshes dry out quickly in June and July and as a result the breeding pairs are concentrated in fishponds in the central of Hor Al-Dalmaj.

Plate(12): Shows the hunts of Marbled Teal by using the Clap-net

Other Ducks Species:

Accompanying ducks part of the field observations were dedicated towards knowing the duck species that accompanying Marbled Teal in each sample sites. This was to acquire quantitative and qualitative information about the other duck species that used the same habitat. The

table below shows the list of other duck species that accompany Marbled Teal.

The figure above and the table (6) summarize the results of the surveys, and show that there are considerable differences among the different sampling sites over Dalmaj wetlands. It gives a thorough idea about the distribution of the Marbled Teal over the different habitats and within the various heights of reedbeds and the open-water theatres that are used frequently by the Marbled Teal over the different seasons. Marbled Teal in Dalmaj is doing very well in terms of their life cycle in breeding, movements, and wintering unless it is being disturbed and this disturbance affects their natural life cycle in the area. Definitely, the percentage shown in the figure above does not represent the actual population in this area because the sampling sites were only five with a total surveying /observations that does not exceed five percent of the entire area of Dalmaj waterbody; so, there are definitely very much higher numbers than the counts.

Generally, migrant birds arrive in early October and leave in mid-March. Therefore, there is an increase in the population with the arrival of the wintering duck community and declines in the breeding season. Apart from our direct observations, frequent reporting from different hunters and locals (who are able to identify the birds) reported that *"Very large number of Marbled Teal and were seen in different places in Dalmaj of which the highest number might be as high as twenty thousand individuals"* (Per. Comm-Local & hunter, 2013). The number claimed might be true because of the congregator behavior of Marbled Teal when mixing with other duck species. It seems that the congregation phenomena of various duck species, including Marbled Teal, is common

in the Iraqi Wetlands, as Salim (2010) has found these birds congregating in such large number in different wetland over Iraq.

The most significant variation can be found in site DL-5 that lies at the middle of the Southern part of Dalmaj, where the majority of the Marbled Teal populations were found in winter (85 individuals). This site consists of relatively open water area especially to the south of the new canal, with some reedbeds and some areas of sedge plants, and this agreed with Green in 1998b when he is recorded some kinds of ducks in the open water with reedbeds.

The second site that held considerable numbers of the Marbled Teal was the DL-1 that lies at the northern part of Dalmaj. It consists of relatively similar habitats to the previous site (DL-5), but lacks to the large open area of the water, and the open water areas are not larger than few hectares in comparison with DL-1. The reedbeds in this area is comparatively higher than that in DL-1. It seems that large numbers of the Marbled Teal use this area during winter where the researched has recorded more than 70 individuals in this site. The lowest number of Marbled Teal in this area was recorded during spring. Green (1997), recorded the lowest population of Marbled Teal during spring. DL-2 seems to be the best wintering area for Marbled Teal in Dalmaj during the surveys time. More than 75 individuals were found during winter in DL-2 and this number represents the second highest number that we've recorded ever in Dalmaj. It seems that the habitat of this site, that consists of dense reedbeds close to some open water areas with submerged plants, is preferable habitat for the Marbled Teal in winter, but might not be very good area for breeding as we've observed only 36 individuals in summer during our surveys.

It seems that the sites DL-3 and DL-4 do not provide very good habitats for the Marbled Teal either for the wintering birds or during the breeding season. Few birds (a bit over ten) were the highest number of the populations that were found in these two sites during the study time. This might be due to being these sites frequented by the fishermen or for their being close to the road and the embankment of the Lake. This is agreed with Green (1996) when he reviewed the disturbance of the human activities will act on the presence of Marbled Teal.

Table (6): Seasonal variation in the counts of Marbled teal

Water Assessment in relation to Marbled Teal:

Water parameters:

In this study, some of the water parameters were measured to determine the correlation between water parameters and the presence of Marbled Teal in Hor AL- Dalmaj (Table-7).

Conclusion :-

- 1- Based on the literature, it seems that this study is the first of its kind that was tackled in Iraq and the region (Middle East) that tackled the status of Marbled Teal being threatened species, and the lack of related references formed serious obstacle during the study, however, various in-depth studies on the ecology and biology of this species over different places were consulted.
- 2- The variation in the habitats was the main factor that contributed to the richness of the species (in addition to the population) in this area, in addition of the richness that made the area to be considered as Key Biodiversity Area.

- 3- Marbled Teal occurs in Dalmaj in both cases: as Resident and Migrant birds. It breeds in the suitable habitat in Hor Dalmaj in good number, also it winters in this area in good number.
- 4- Marbled Teal breed in Dalmaj around the shallow ponds mainly under good shelter of *Tamarix* or other suitable plant cover, and transport their chicks from these margin to the main waterbody to spent the rest of their life.
- 5- Marbled Teal forages in the relatively shallower marshes in the open areas of water that are surrounding by reedbeds or other aquatic plant. After examining the feces by microscope of wide range of samples, it seems that the majority of Marbled Teal diet in the study area consist of plant parts (including seeds), in addition to zoo contents that represent the minority.
- 6- In Hor Dalmaj, Marbled Teal faces serious threat of hunting that affect directly on the local population and wintering population as well. Some other kinds of threat (like disturbance) were spotted in the study area.

Recommendation :

- 1- Being the illegal hunting and overhunting the main threats that face Marbled Teal in Hor Al-Dalmaj, it is highly recommended to adopt thorough program to reduce this negative case in order to develop the local and the wintering population of this species in Hor AL-Dalmaj.
- 2- It is important to rise the local, regional and national awareness regarding this threatened species and the means for the better practices for its conservation. This should be through working with the local primary schools and the local children, through different sector, up to decision makers level.

- 3- It is crucial to control and reduce the pollution in the study area and this is mainly regarding water pollution as waterbody of Hor Al-Dalmaj is fed by Main Outfall Drain (MOD).
- 4- It is highly recommended to ensure suitable quality of the water in Hor Al-Dalmaj that secures the presence of the suitable habitats of the occurrence of the Marbled Teal in general and also for the breeding of this threatened species.
- 5- Habitat destruction should be avoided in consideration when planning for different purposes in Hor Al-Dalmaj (like agricultural expansion and drying the some marsh areas).
- 6- The region is rich in biodiversity in general and birds in particular, specially the Marbled Teal. Through the results of this study, we recommend making Hor Al-Dalmaj a Protected area, which must be well-managed and by efficient hands.

References:

Aerc Tac, (2003). Checklist of bird taxa occurring in Western Palearctic region, 15th Draft. Available at http://www.aerc.eu/DOCS/Bird_taxa_the_WP15.xls.

Ali, Salim and Riply S.D, (1968).Handbook of the Birds of India and Pakistan. Bombay: Oxford University Press.

Allouse, B.(1953). *The Avifauna of Iraq*. Iraq Natural History Museum, Baghdad.

Allouse, B. (1960, 1961, 1962). *Birds of Iraq I- III Vols*. Arabic eddition. Al-Rabitta Press. Baghdad.

Al-Robaae K (2006). The Breeding of waterbirds in the Marshland of Mesopotamia, Mar. Bul (1) 40-46.

Ararat Korsh (2009) Rapid assessment of birds in Kurdistan, Northern Iraq. BioRisk 3: 187–203

Al-Saad, H.A, M.A. Al-Hello, S.M. Al-Taein and A.A.Z. DouAbul, 2010. Water quality of the Iraqi southern marshes. *Mesopot. J. Mar. Sci.* 25 (2): 79 – 95.

Al-saadi, H. A., and Al-Mayah, A. A. (1983). Aquatic plants of Iraq. Cent. Arab. Gulf. Univ. Basrah, (Arabic).

Alwan, A. A. (2006). Past and present status of the aquatic plants of the marshlands of Iraq. Marsh Bull, 2(1),160-172.

Anderberg, A. L(1994). Atlas of seeds. Part 4 : Resedaceae-Umbelliferae.- Swedish Natural Science Research Council, 281 pp.

Anderson, M.G. and J.B. Low (1976). Use of sago pondweed by waterfowl on the Delta Marsh, Manitoba. Journal of Wildlife Management 40:233-242.

Batt, B.D.J, Afton A.D., Anderson M.G., Ankney C.D., Jonson D.H., Kadlec J.A. and Krapu G.L. (1992). Ecology and Management of Breeding Waterfowl. University of Minnesota Press, Minneapolis and London.

BirdLife International (2004a). Birds in Europe: population estimates, trends and conservation status. Cambridge, UK. BirdLife International (BirdLife Conservation Series No. 12).

BirdLife International (2004b) Birds in the European Union: a status assessment. Wageningen, The Netherlands: BirdLife International.

Birdlife International (2006) Monitoring Important Birds Areas: a global framework, Cambridge, UK. Birdlife International. Version 1.2. Compiled by Leon Bennun, Ian Burfield, Lincoln Fishpool, Szabolcs Nagy & Alison Stattersfield.

BirdLife International (2008) Species factsheet: *Marmaronetta angustirostris*. Downloaded from <http://www.birdlife.org> on.

Boere, G. C. and Stroud, D. A. (2006). The flyway concept: what it is and what it isn't. Pp. 40–47 in G. C. Boere, C. A. Galbraith and D. A. Stroud, eds. Waterbirds around the world. Edinburgh, UK: The Stationery Office.

Bos, J. F. F. P.; Essetti, I. and Gilissen, N. L. M (2000). Record counts of Marbled Teal in Tunisia, October 1999: consequences for population estimates and distribution. *Threatened Waterfowl Specialist Group News* 12: 49-53.

Brayan L. Sage, 1958. Field notes on some birds of eastern Iraq.

Brown, M. and Dinsmore, J. J. (1986). Implication of marsh size and isolation for marsh bird management. *J. Wild. Manage.*, 50 : 392-397.

Chapman E.A and J.A. McGeoch , (1956). Recent field observations from Iraq.

Coad B. W. (2010) Freshwater Fishes of Iraq. PENSOFT Publishers, Sofia-Moscow. No.93.

Collar, N. J., Crosby, M. J. and Stattersfield, A. J. (1994). *Birds to watch 2: the world list of threatened birds*. Cambridge, U.K.: BirdLife International (BirdLife Conservation Series no. 4).

Cramp, S. and Simmons, K. E. L (1977). The birds of the western Palearctic. Vol. 1. – Oxford University Press, Oxford.

Del Hoyo, J.; Elliot, A. and Sargatal, J. (1992). *Handbook of the Birds of the World, vol. 1: Ostrich to Ducks*. Lynx Edicions, Barcelona, Spain.

Delany, S.; Reyes, C.; Hubert, E.; Pihl, S.; Rees, E.; Haanstra, L. and van Strien, A. 1999. *Results from the International Waterbird Census in the Western Palearctic and Southwest Asia 1995 and 1996*. Wetlands International, Wageningen, Netherlands.

Dementiev, G.B, and Gladkov N.A., (1952). Birds of the Soviet Union, Vol.4. Moscow.

Elmberg, J., Nummi P., Pöysä H., and Sjöberg K, (1993). Factors affecting species number and density of dabbling duck guilds in North Europe. *Ecography* 16:251-260.

Esther S.G., Cristina F., Marcos F., Jose L.E and Andy J.G. (2012). Habitat selection of Marbled Teal and White-headed Duck during the breeding and wintering season in south-eastern Spain.

Evans, M. I. (1994). *Important Bird Areas in the Middle East*. Cambridge, U.K.: BirdLife International (BirdLife Conservation Series no. 2).

Fuentes, C., Sánchez, M. I., Selva, N. y and Green, A.J. (2004). The diet of the Marbled Teal *Marmaronetta angustirostris* in southern Alicante, eastern Spain. *Revue d'Ecologie (La Terre et la Vie)* 59: 475-490.

George, PV and J Vielliard, (1970). Mid-winter observations on birds of central and south Iraq. *Bulletin Iraq Natural History Museum* 4: 61–85.

George, P.V. and Mahdi A, (1969). Systematic list of Iraqi vertebrates - Aves. *Iraq Natural History Museum Publication No. 26*.

Godin, P.R. and Joyner, D.E, (1981). Pond ecology and its influence on Mallard use in Ontario, Canada. *Wildfowl* 32: 28–34.

Gonzales, S.E, Fuentes C, Ferrandez M, Jose L. E and Green, A. J, (2012). Habitat selection of Marbled Teal and White-headed Duck during the breeding and wintering seasons in south-eastern Spain. *Bird Conservation International* 0:1-16.

Green A.J, Jenkins K.M, Bell. D, Morris P.J, and Kingsford R.T (2008). The potential role of Waterbirds in dispersing invertebrates and plants in arid Australia. *Fresh water Biology* 53: 380-392.

Green, A. J. 1993. *The status and conservation of the Marbled Teal Marmaronetta angustirostris*. International Waterfowl and Wetlands Research Bureau, Slimbridge, U.K. Wetlands International (IWRB Spec. Publ. 23).

Green, A. J. 1996. International action plan for the Marbled Teal *Marmaronetta angustirostris*. Pp. 99-117. In: Heredia, B., Rose, L. , Painter, M. Globally threatened birds in Europe. Action plans. Council of Europe Publishing, Strasbourg.

Green, A. J. 2000. The habitat requirements of the Marbled Teal (*Marmaronetta angustirostris*), Ménétr., a review. In: Comín, F. A.; Herrera, J. A.; Ramírez, J. (ed.), *Limnology and aquatic birds: monitoring, modelling and management*, pp. 147-163. Universidad Autónoma del Yucatán, Mérida.

Green, A. J., Navarro.J. D, Dolz. J.C and Aragoneses. J, 1999. Timing of brood emergence in a duck community in Mediterranean Spain. *Bird study* 46, 116-118.

Green, A. J.; El Hamzaoui, M. (1998). The status and biology of threatened waterfowl in Morocco. *TWSG News* 11: 25-27.

Green, A. J.; El Hamzaoui, M.; El Agbani, M. A.; Franchimont, J. (2002). The conservation status of Moroccan wetlands with particular reference to waterbirds and to changes since 1978. *Biological Conservation* 104: 71-82.

Green, A. J.; Sánchez, M. I. 2003. Spatial and temporal variation in the diet of Marbled Teal *Marmaronetta angustirostris* in the western Mediterranean. *Bird Study* 50: 153-160.

Green, A.J., (1997). Brood attendance and brood care in the Marbled Teal, *Marmaronetta angustirostris*. *J. Ornithol.* 138:443-449.

Green, A.J.,(1998a).Comparative feeding behavior and niche organization in a Mediterranean duck community. *Canadian Journal of Zoology*, 76: 500-507.

Green, A.J.,(1998b). Habitat selection by the Marbled Teal *Marmaronetta angustirostris*, Ferruginous Duck *Aythya nyroca* and other ducks in the Göksu Delta, Turkey in late summer. *Revue d'Ecologie (La Terre et la Vie)* 53: 225-243.

Green, A.J.,(1998c). Clutch size, brood size and brood emergence in the Marbled Teal *Marmaronetta angustirostris* in the Marismas del Guadalquivir, southwest Spain. *Ibis* 140:670-675.

Green, A.J.; Selva, N. (2000). The diet of post-breeding Marbled Teal *Marmaronetta angustirostris* and Mallard *Anas platyrhynchos* in the Goksu Delta, Turkey. *Revue d'Ecologie (La Terre et la Vie)* 55(2): 161-169.

Groombridge, B., ed. (1993). *IUCN Red List of threatened animals*. Gland, Switzerland, and Cambridge, U.K.: International Union for Conservation of Nature and Natural Resources.

Hahn, S., Bauer, S. and Liechti, F. (2009). The natural link between Europe and Africa – 2.1 billion birds on migration. *Oikos* 118: 624–626.

Hanna A.Raza, O.fadhil, K. Arrarat. Mukhtar Habba, and Mudhafar salim (2011) Animal and bird trade and hunting in Iraq . Human dimension of Wildlife.

Hawkes, B. (1970). The Marbled Teal. *Wildfowl* 21: 87.

International Union for Conservation of Nature (2012). IUCN Red List of Threatened Species(ver.2012.1).Available at: <http://www.iucnredlist.org>.

Iraqi Ministry of Environment (2014b). Inventory of Key Biodiversity Areas of Iraq (KBA). Baghdad, Iraq: Iraqi Ministry of Environment.

Iraqi Ministry of Environment (2014a). National Biodiversity Strategy and Action Plan. Baghdad, Iraq.

Jobling J. A (1991). A Dictionary of Scientific Bird Names. OUP. ISBN 0-19-854634-3.

Johnsgard, P. A. (1978). *Ducks, geese and swans of the World*. University of Nebraska Press, Lincoln and London.

Johnsgard, P.A., (1961). The systematic position of the Marbled Teal. *Bull . Brit. Orn. Club*, 81:37-43.

Johnsgard, P.A (1965). *Handbook of Waterfowl Behavior: Tribe Aythyini (Pochards)*, p 17- University of Nebraska-Lincoln.

Kear, J. (2005). *Ducks, geese and swans volume 2: species accounts (Cairina to Mergus)*. Oxford University Press, Oxford, U.K.

Krull, J.N.,(1970). Aquatic plant-macroinvertebrate associations and Waterfowl. *J. Wildl. Manage.* 34:707-718.

Mahdi Shafeeq, (1982). *Waterbirds in Iraq and the Arab Nations (Arabic)*.

Marchant, S., (1963a). Notes on the winter status of certain species in Iraq. *Ardea* 51: 237–243.

Marchant, S., (1963b). The breeding of some Iraqi birds. *Ibis* 105: 516–557.

Moore, HJ & Boswell, C. ,(1956). *Field observations on the birds of Iraq*. Iraqi Natural History Museum No. 9-10, Baghdad.

Mousa Ahmed, (2013). *Using Indexes to Detect the Environmental Changes of HorAl-Dalmaj and Surrounding Areas in Central Sector of Mesopotamia Plain*.

Mullarney, K, Svensson, L, Zetterstrom, D and Grant, P.J. (1999). *Collin Bird Guide*. London, UK: Collins Publishing.

Navarro, J. D. and Robledano, F., eds (1995). La Cerceta Pardilla (*Marmaronetta angustirostris*) en España. Madrid: Instituto Nacional para la Conservación de la Naturaleza (Colección Técnica).

Navarro, J.D., (1997). Call for help to conserve Marbled Teal in Alicante, Spain. *Threatened Waterfowl Specialist Group News* 10:17-18.

Nudds, T. D. (1992). Patterns in breeding waterfowl communities, pp. 540-567.

Nummi, P & Pöysä, H. (1993). Habitat association of ducks during phases of the breeding season, *Ecography*, 16: 319-328.

Olaus J. Murie, (2005). *A Field Guide to Animal Tracks*, New York: Houghton Mifflin Company.

Porter, RF & S Aspinall, (2010). *Birds of the Middle East*. Christopher Helm, London.

Porter, RF, Christensen, S and Schiermacker-Hansen, P, (1996). *Field Guide to the Birds of the Middle East*. Helm Field Guides. London, United Kingdom: A&C Black Publishers Ltd.

Porter, RF, M Salim, K Ararat & O Fadhel, (2010). A provisional checklist of the birds of Iraq. *Marsh Bulletin* 5(1): 56–95.

Salim M, (2008). Situation of Otters in Dalmaj Wetlands, Iraq. *Otter News* No.49 Spring.

Salim, M. A, R. F. Porter & C Rubec, (2009). A summary of birds recorded in the marshes of southern Iraq, 2005–2008. *BioRisk* 3: 205–219.

Salim, M. A., (2010). Current Status of Marbled Duck *Marmaronetta angustirostris* in Iraq, Conservation Approach. Internal report. Nature Iraq.

Salim, M. A., (2014). Hunter's Guide to the Responsible Hunting [In Arabic]. Al-Zuhoor Press, Baghdad, Iraq. ISBN: 1495.

Salim, M.A., (2011). Biodiversity of the Middle Euphrates: Current status and potentials for Conservation Action plan. Internal report.

Salim, MA, R Porter, P Schiermacker-Hansen, S Christensen & S Al-Jbour. (2006). [*Field guide to the birds of Iraq*].Nature Iraq/BirdLife International, Baghdad. [In Arabic].

Salim, MA, (2004). *Field Observation on Birds in "Abu-Zarag" and "Kirmashiyah" Wetlands 30, Jun – 4, Jul, 2004, Southern Iraq*. Iraq Foundation, unpublished report.

SAS,(2010). Statistical Analysis System, User's Guide. Statistical. Version 9.1thed. SAS. Inst. Inc. Cary. N.C. USA.

Scott, D. A.; Rose, P. M. (1996). *Atlas of Anatidae populations in Africa and western Eurasia*. Wetlands International, Wageningen, Netherlands.

Scott, DA & E Carp. (1982). A Midwinter survey of wetlands in Mesopotamia, Iraq: 1979. Sandgrouse 4: 6–76.

Sondergaard, M., Brunn, L., Lauridsen, T., Jeppesen, E. & Madsen, T. V. (1996).The impact of grazing waterfowl on submerged macrophytes : In situ experiments in a shallow eutrophic lake. Aquatic Botany, 53:73-84.

Ticehurst, CB, PA Buxton & RE Cheesman., (1922). The birds of Mesopotamia. *Journal of the Bombay Natural History Society* 28: 210–250, 381-427, 650-674, 937-956.

Townsend, C. C. and Guest, E. (1966). *Flora of Iraq*. Vol. 2. Baghdad: Ministry of Agriculture of the Republic of Iraq. Printed by Robert Maclehose and Company Limited printers to the University of Glasgow.

Townsend, C.C. and Guest E. (1974). *Flora of Iraq*. Vol. 3. Baghdad: Ministry of Agriculture of the Republic of Iraq. Printed by Robert Maclehose and Company Limited printers to the University of Glasgow.

Townsend, C.C. and Guest E. (1980a). *Flora of Iraq*. Vol. 4. Part 1. Baghdad: Ministry of Agriculture of the Republic of Iraq. Printed by Robert Maclehose and Company Limited printers to the University of Glasgow.

Townsend, C.C. and Guest E. (1980b). *Flora of Iraq*. Vol. 4. Part 2. Baghdad: Ministry of Agriculture of the Republic of Iraq. Printed by Robert Maclehose and Company Limited printers to the University of Glasgow.

Townsend, C.C. and Guest E. (1985). *Flora of Iraq*. Vol. 8. Baghdad: Ministry of Agriculture of the Republic of Iraq. Printed by Robert Maclehose and Company Limited printers to the University of Glasgow.

Townsend, C.C. and Guest, E. (1968). *Flora of Iraq*. Vol. 9. Baghdad: Ministry of Agriculture of the Republic of Iraq. Printed by Robert Maclehose and Company Limited printers to the University of Glasgow.

Tucker, G. M. and Heath, M. F. (1994) *Birds in Europe: their conservation status*. Cambridge, U.K.: BirdLife International (BirdLife Conservation Series no. 3).

Vaurie, C. (1960). Systematic notes on Palearctic birds. No. 41 Strigidae: the genus *Bubo*. American Museum Novitates 2000: 1–31.

Voigts, D.K., (1976). Aquatic invertebrate abundance in relation to changing marsh vegetation.

Wetlands International, (2002). *Waterbird population estimates*. Wetlands International, Wageningen, Netherlands.

William J. Sutherland, Ian Newton, Rhys E. Green (2004). *Bird Ecology and Conservation: A Handbook of Techniques*, Oxford University Press.

World Wildlife Fund (2006). Eco-regions, ver. Jan-06 Retrieved 14 Sep 2009 from <http://gis.wwfus.org/wildfinder>.



جمهورية العراق
وزارة التعليم العالي والبحث العلمي
جامعة بغداد
كلية العلوم

دراسة بيئة وحياتية طائر الحذف المعرق *Marmaronetta angustirostris*

في هور الدلمج/ العراق

مقدمة الى

مجلس كلية العلوم/جامعة بغداد

وهي جزء من متطلبات نيل درجة دكتوراه فلسفة علوم

في علوم الحياة/علم البيئة

الأطروحة مقدمة من

سلوان علي عبيد

ماجستير علوم بيئة - كلية العلوم

جامعة بونه (2009-2010)

بإشراف

أ.د.ميسون مهدي الطائي

شعبان 1435

حزيران 2014

الخلاصة :

تعرض هذه الدراسة بعض المظاهر المحتملة للحالات البيئية والأحيائية لطائر الحذف المعرق (الأنواع المهددة والمعرضة للخطر) بواسطة المسح الحقلي والمراقبة المنتظمة طوال الفصول الاربعة في سنة 2013، أجري المسح في واحد من اهم وابرز الأراضي الرطبة التي لم تأخذ حقها من الدراسات الكافية الا وهو هور الدلمج والذي يعد من اهم المسطحات المائية على مستوى العراق والمنطقة والعالم وفقا لمعايير مناطق التنوع الأحيائي الرئيسية والمناطق المهمة للطيور والمناطق المهمة للنباتات بالإضافة الى المعايير العالمية الاخرى. يمثل هور الدلمج الموطن الطبيعي والمناسب لهذا الطائر على مستوى العراق والشرق الأوسط. توضح نتائج الدراسة

الحالية بأن هور الدلمج يوفر لطائر الحذف المعرق البيئة المثالية لأستمرارية فعالياته الطبيعية كالتغذية والتكاثر. وعلى الرغم من أن الطيور تواجه أنواع مختلفة من التهديدات، توفر هذه المنطقة العوامل الجيدة للأنواع شريطة وجود إدارة جيدة.

تم اختيار خمس مواقع للملاحظة بناء على معايير محددة منها تلك التي تمثل مشاهد و بيئات الأراضي الرطبة المختلفة للحصول على رؤية كاملة قدر الأمكان عن حالة الطائر في هور الدلمج ومدى تماثل البيئة او المحيط للعوامل البيئية المفضلة لدى الطائر كنوعية المياه والغطاء النباتي. وقد أظهرت المشاهدات والملاحظات المنتظمة في هور الدلمج بأن طائر الحذف المعرق يفضل البرك المائية الضحلة ويتجنب المسطحات المائية المفتوحة، كذلك اظهرت التحليلات المختبرية التي اجريت على البراز ومكونات القانصة بأن طائر الحذف المعرق بشكل عام نباتي التغذية، كما وجدنا أنه يحوي بعض المكونات الحيوانية.

على الرغم من الأهمية البيئية لهور الدلمج إلا أنه يرضخ تحت انواع مختلفة من الضغوطات والمهددات مثل عدم استقرار إدارة النظام الهيدرولوجي والتوسع الزراعي والتلوث وكثرة الصيد. هذه التهديدات متغيرة من ناحية قوة تأثيرها على حياة هذا الطائر في هور الدلمج، لذا فإن هذا المسطح المائي والأنواع كلاهما يعاني من تأثيرات هذه الضغوط.

تعتبر هذه الدراسة هي اول جهد من نوعه في العراق والشرق الأوسط للدراسة التي اجريت لطائر الحذف المعرق في هور الدلمج، جنوب العراق، وتعد نتائج هذه الدراسة مهمة كونها من الممكن ان تفتح افاقا جديدة وتمهد الطريق لمزيد من الدراسات للطائر والاراضي الرطبة نفسها.

تتسم هذه المنطقة بكثير من المزايا التي تجعلها فريدة وبارزة من منظور الأستجمام والسياحة البيئية، لذلك يوصى بوضع خطة ادارة لغرض اعتبارها محميات متطورة على المستوى البيئي والهيدرولوجي في هور الدلمج لتوفر التنوع في الأحياء الحيوانية والنباتية التي تغذيها. وهذا من الممكن ان يسير جنباً الى جنب مع بعض الإجراءات من جانب السلطات مثل الزام او تطبيق التشريعات البيئية وتطبيق المعاهدات الدولية وخاصة المتعلقة بتأسيس وانشاء المحميات الطبيعية.