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ORIGINAL ARTICLE

CURRENT CONSERVATION STATUS OF THE MIGRATORY WESTERN MARSH HARRIER THROUGHOUT THE UNESCO SITE IN AL-CHIBAYISH MARSH, SOUTH OF IRAQ

Abdullah S. Al-Saraf♦ and Ahmad J. Al-Azawi
Department of Biology, College of Science, University of Baghdad, Baghdad, Iraq.
♦Corresponding author: alsarafabdullah95@gmail.com

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ABSTRACT

Monitoring migrating raptors is among the most cost-effective and simple methods for forecasting shift in the ecosystem and environment. The Western Marsh Harrier *Circus aeruginosus* (Linnaeus, 1758) (Accipitriformes, Accipitridae) represents a widely wintering, on-passage raptor over Iraq's southern Mesopotamian marshlands. However, recent information related to this species' population trend, as well as its spatial and temporal migration patterns, is not fully known. From October 2021–June 2022, nine ornithological field surveys were undertaken in the Central Marshes (UNESCO Site, RAMSAR Site, and Iraq's National Park). Three transect lines were chosen, and the surveying plot covered 40,000 hectares (400 Km^2). Our recent surveys recorded a total of 64 harriers passing over the Central Marshes. The species density was determined using a distance sampling method; perpendicular distances were gauged using a digital range finder. During our surveys, the Central Marshes hosted a migratory population of ≈3,508-21,499 harriers. In addition, we assessed the breeding status of this bird species in the surveyed area; however, no confirmed breeding was found. Furthermore, illegal hunting/trapping were identified as the main threat facing the species in Iraq.

Keywords: Breeding, *Circus aeruginosus*, Conservation, Density, Iraq, Migration, Wetlands.

INTRODUCTION

All over the globe, birds of prey's presence within an ecosystem indicates a highly diversified ecosystem (Sergio *et al*., 2006; Tinajero *et al*., 2017), within which these birds form communities and act as an indicator of the health of the environment (Gousy-Leblanc *et al*., 2021). Moreover, they play a regulatory role by exerting top-down pressure on other species that they predate (Therrien *et al*., 2014; O'Bryan *et al*., 2018; Terraube and Bretagnolle, 2018). Diversified species of scavenger raptors consume a remarkable amount of biomass, reducing the probability of an outbreak of other organisms that might carry infectious diseases (García-Alfonso *et al*., 2019). Nevertheless, high numbers of predating birds are at risk of declining in numbers, and some are even facing extinction (Gousy-Leblanc

et al., 2021). The Western Marsh Harrier *Circus aerugi*nosus (Linnaeus, 1758) represents a raptor bird species that can migrate over long-distances and that moves in a leap -frog pattern from the Siberian platform through the Iranian plateau towards Iraqi southern wetlands (Al-Sheikhly and Al-Azawi, 2019a). Its distribution ranges from Western Europe to Central and East Asia, Mongolia, Asia Minor, and north Africa; its wintering occurs along the Indian subcontinent, sub-Saharan Africa, and southern Europe (GRIN, 2023). The species *Circus aeruginosus* was divided into two subspecies, *C. aeruginosus aeruginosus* (Linnaeus, 1758) and *C. aeruginosus harterti* (Zedlitz, 1914), which is restricted to Morocco and Tunisia (Clements *et al.*, 2022). In addition, raptors were recorded to have two major pathways of migration in the western Palearctic. However, birds are migrating to the wetlands of southern Iraq through the West African and Eurasian-East African (western Black Sea) flyways (Polakowski *et al*., 2014; Al-Sheikhly and Al-Azawi, 2019a). Iraq is considered to be among the many countries across which raptors migrate. They are known to winter in the Arabian Peninsula and Africa. Nevertheless, investigations on the wintering status of the migratory raptors in the south of Iraq are not sufficient (Al-Sheikhly *et al*., 2017). The marshlands of southern Iraq were recognized as wetlands of international importance among 33 others known or believed to have some importance for migratory birds in Iraq (Scott and Crap, 1982; Scott, 1993; Al-Sheikhly and Al-Azawi, 2019b). Based on the current taxonomic checklist for avian species in the Middle East, Caucasus, and Central Asia, Iraq has 42 taxa of birds of prey (Blair *et al.*, 2018; Al-Sheikhly and Al-Azawi, 2019b).

During spring and autumn, the major flyways are used by large numbers of migratory raptors, avoiding high mountain chains and large bodies of water and becoming concentrated in large numbers at a small number of bottleneck sites all over the Red Sea, Mediterranean Sea, and Black Sea (Verhelst *et al*., 2011). To reach the Middle East during autumn, these birds that migrate from the eastern part of the western Palearctic use two main flyways: one that follows each side of the northern Caspian Sea and the Black Sea regions, avoiding the northern Red Sea and the eastern Mediterranean Sea, and one that moves across Palestine, taking the Dead Sea-Kfar Kasem-Eliat-Suez and North Negev pathways, reaching Sinai (Fülöp *et al*., 2018; Al-Sheikhly and Al-Azawi, 2019a). The second major route follows the southeastern part of the Caspian Sea, which crosses the north Arabian Peninsula and the Arabian Gulf through the Hormuz Straits and the southern Red Sea through the Bab El-Mandeb Straits between Djibouti and Yemen (Panuccio *et al.*, 2018).

The Euphrates and Tigris rivers' freshwater supplies are primarily what sustain the vast open water surfaces that make up the Mesopotamian marshlands. They have a total estimated area of about 900,000–2,000,000 ha, extending into southern Iraq and crossing the alluvial plain that belongs to the Arabian Gulf Delta (Haba *et al.*, 2017). They comprise three main marshes, namely Hawizeh Marsh, Hammar Marsh, and the Central Marshes (commonly known as Al-Chibayish Marshes) (Al-Mansori, 2008). The southern Iraqi Mesopotamian marshes encountered intense deterioration of their ecosystems due to a nearly complete systematic drying-out process that targeted the shelters of political rebels in 1991. However, the area was eventually reflooded in 2003 and 2004 (Al-Sheikhly and Nader, 2013). Considered amongst the largest wetlands in Iraq, Al-Chibayish Marshes stretch over a large

territory that is permanently occupied by freshwater and extends over the three governorates of Mayssan, Thi Qar, and Basra, with a total area estimated at around 219,700 ha (Evans, 1994; RSIS, 2023). It has been identified as a wetland of international importance, a Key Biodiversity Area (KBA) site, and an Important Bird Area (IBA038) (Cramp and Simmons, 1980; Evans, 1994; Nature, 2017). The highly important values that the Central Marshes provide to the environment and culture all over the region have prompted its declaration as a RAMSAR site, a United Nations Educational, Scientific, and Cultural Organization (UNESCO) site, and the first national park, in Iraq (Mesopotamian National Park MNP) (Pearce, 2013; IMOE, 2014; UNESCO, 2016; RSIS, 2023).

Numerous nocturnal species of raptors migrate, sometimes covering extremely lengthy distances (Newton, 2008). It is believed that the main driver for migration in birds is the seasonal change in food supply availability in the breeding areas; late summer decreases cause migration out of breeding sites, whereas springtime increases allow them to migrate back (McGrady, 2018). These variations in food availability are usually related to changes in environmental conditions like temperature, length of day, and rainfall (Alerstam, 1990; Newton, 2008). Birds of prey migrating are classified into two types: soarers and active fliers (Kerlinger, 1989; Zalles and Bildstein, 2000). Migrating soarers (*e.g.*, eagles, buzzards, vultures) seek upward airstreams and avoid traversing large expanses of open waters, while active fliers (*e.g.*, falcons, harriers), on the other hand, are less susceptible to open water and other terrains (McGrady, 2018).

The Western Marsh Harrier is classified as a “Least Concern” species on the BirdLife International list (BirdLife, 2023). It was abundant in the past along its breeding habitats at the Euphrates, Hammar Marsh, and Basra marshes (Ticehurst *et al.*, 1922). This species was commonly recorded in the area of Suweicha Marsh in Kut City as well as the meadowland between Suweida and Chabbab on the northern Tigris River (Moore and Boswell, 1956; Allouse, 1960). According to historical literature, prior to the 1990s, the Marsh Harrier species was prevalent in the Mesopotamian wetlands (Scott, 1995; Hussain, 2014). In 1997, large numbers of this species (286 individuals) were observed to be wintering in this region (Scott and Carp, 1982). However, the extensive hydrological drainage carried out in the 1990s had a detrimental impact on the occurrence of this species, as well as approximately 40 other bird species found in the marshlands in numbers that are considered of global significance (Evans, 1994; Scott, 1995). This drainage has caused a significant decline (>10%) in the regional populations of the Western Marsh Harrier (Evans, 1994; Scott, 1995). Despite this, low numbers are still continually visiting the Mesopotamian Marshlands (Abed, 2007; Fazaa *et al.*, 2017).

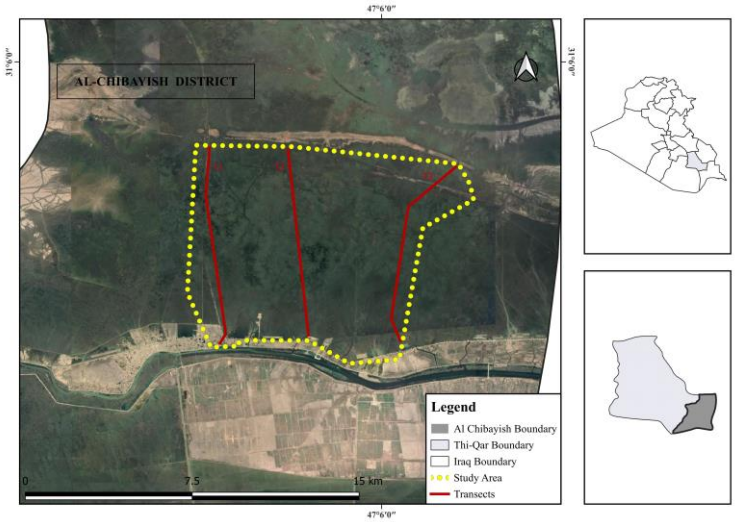
Previous studies have recorded the presence of the Western Marsh Harrier in the restored areas of the marshes, with Abed (2007) noting its abundance as the most commonly observed raptor species between May 2004 and May 2005 without providing a specific count of individuals. (Salim *et al.*, 2012) also listed it as one of the bird species of the southern Iraqi marshes observed between 2005 and 2008, without providing a specific count of individuals. Additionally, Fazaa *et al.* (2017) reported the recording of 28 individuals observed in the

Central Marshes between October 2013 and June 2014. More recently, Al-Sheikhly and Al-Azawi (2019a) reported 93 individuals observed in the Central Marshes between February 2018 and April 2019, with a population estimate ranging from 922.7 to 7689.5 individuals.

As a result, this study was carried out to add to the existing understanding of the migratory status and population size of the Western Marsh Harrier, as one of the major migratory birds of prey through the Iraqi southern wetland, given the scarcity of current knowledge on its geographical dispersal, spatial distribution, and temporal migration in the Mesopotamian wetlands in general and in the Central Marshes in particular.

MATERIALS AND METHODS

Study Area: The area under consideration encompasses extensive vegetation of common reed beds covering an estimated extent of 40,000 hectares (400 km^2) within the Central Marshes (Map 1). This vast wetland ecosystem is located within the ecoregion of the Tigris-Euphrates Alluvial Salt Marsh (PA0906). This ecoregion is characterized by a relatively low elevation, with the majority of the landscape situated at an altitude of 6 m a.s.l. The overall topography is defined by large freshwater surfaces, mostly in the form of lakes, bordered with extensive beds of common reed *Phragmites australis* (Cav.) Trin. ex Steud., 1841, and *Typha* sp. mixed with emergent and submerged aquatic vegetation. The weather conditions in the study area during our field surveys were mostly sunny and clear, with the exception of one partial sandstorm encountered on March 19, 2022, from 1:00 p.m. to 05:00 p.m. local time. The temperature during autumn and spring surveys was around 32°C, and around 11 °C during winter.



Map (1): The Central Marshes area in Southern Iraq (also known as Al-Chibayish Marshes), shows the boundaries of the study area and transect lines.

Field Methods: We used the distance sampling method, which was first described by Sutherland (2006) and subsequently used by Al-Sheikhly and Al-Azawi (2019a), to conduct a line transect survey. Three distant watercourses (each with a length of 10 km) extending over a research area of 40,000 ha were selected at random and then surveyed using a motor canoe. Transect (T1) geographical zone (30°96′71″N 47°02′45″E) began at the initial channel in Al-Hamrawiah, Al-Moajid Village, and examined the western portion of the Central Marshes; transect (T2) geographical zone (30°97′17″N 47°06′58″E) began on the Abo-Sobat watercourse in Al-Chibayish area and examined the middle portion of the Central Marshes; and transect (T3) geographical zone (30°97′14″N 47°10′86″E) began at Al-Kinziri Village and ended on Zichri Lake, examining the eastern portion of the Central Marshes (Map 1).

Transect lines and the timing of the survey were chosen at random to decrease bias. Transect lines were carefully surveyed at low speeds (20–30 km/h) to ensure more accurately-identified species. Individuals of the species observed on either side of the boat within a fixed distance (300 m) were recorded. It is important to note that individuals observed on the way back through the transect were not recorded in order to avoid double counting and ensure the accuracy of data collection. Stopover sites were implemented every 15 minutes with (30–45 min) intervals of stop-time at each stopover site. From October 2021 to June 2022, nine field surveys took place in the Central Marshes, each lasting 3 days (one transect per day) and 6-8 hours per transect. Field observations were achieved by following the double-observer approach (primary and secondary observers/recorders). Each survey had a different starting time to reduce bias. A Canon EOS/DSLR 80D camera body attached to a 150×500 mm Sigma lens with an image stabilizer was used to document the species/habitat. A Mileseey digital range finder Pro (300m, accuracy ± 1mm) was used to measure the distance and angle of the observed individual. The age of the individuals of the species observed was categorized based on Al-Sheikhly and Al-Azawi (2019a) into two categories: juvenile/immature (≥2 years old) and adult/mature (≤3 years old).The breeding of the species in the Central Marshes was assessed according to the British Trust for Ornithology's (BTO) breeding evidence (BTO, 2023). We also conducted interviews with the locals whenever possible. In order to determine the present population size of the migratory/wintering Western marsh harrier in the study area, we employed standardized field methodologies and mathematical calculations to minimize bias probabilities. We also accurately measured the distance to the species using a digital range finder. It's worth noting that the more accurate the distance measurements, the more accurate the estimation of density (Sutherland, 2006)

Data Analysis: In each survey, Marsh Harrier density was estimated using distance sampling based on precise distance analysis as a simple estimate of density using line transect data (Sutherland, 2006; Al-Sheikhly and Al-Azawi, 2019a). The estimated density ($D^{\wedge}$) of Marsh Harrier was extracted by applying the equation below:

$$D^{\wedge} = n\sqrt{([2n/\pi \sum_i (x_i^2)]/(2L))}$$

Where n = the total number of individuals observed, L = the length of the transect, x_i= the perpendicular distance of the animal observed from the line transect (Sutherland, 2006). The calculation of the perpendicular distance (x_i) was achieved by applying the equation:x_i x_i=Z

sin Θ, where Z = the distance between the observer and the bird (m), and Θ = the measured observation angle (Al-Sheikhly and Al-Azawi, 2019a). The observation distance (Z) and the observation angle were measured accurately by using a range finder.

The estimated Marsh Harrier density was then extrapolated on the total area of the Central Marshes to offer the most accurate population estimate/extrapolation for the Marsh Harrier observed (Fazaa *et al.*, 2015; Al-Sheikhly and Al-Azawi, 2019a). Extrapolation was achieved via the multiplication of the species estimation of density from our survey by the Central Marshes' overall area (219,700 ha).

Statistical Analysis: The differences between the results for the age/sex ratio of the Marsh Harriers migrating/wintering in the Central Marshes were tested using the Chi-square (X^2) goodness-of-fit test (McDonald, 2014). Our null hypothesis suggested there was no significance between age/sex in the species migratory population (H_o= $P_{juvenile/immature}$ = $P_{adult\ male}$ = $P_{adult\ female}$).

RESULTS

Population size: The Western Marsh Harrier was recorded in a field survey that was carried out over a period of nine months, spanning from October 2021 to June 2022. During the survey, a total of 64 individuals were recorded, distributed as 31 juveniles/immature, 11 adult males, and 22 adult females. The lowest count of this species was recorded in October 2021; a total of four individuals (three juveniles and one adult female) were carefully observed. The observations were conducted at a distance range of 65.3–102.0m, with observation angles of 16–62°. The data collected during the observation period was analyzed, and the results indicated that the estimated density was 0.015 individuals/ha. Additionally, the estimated population of individuals in the study area was calculated to be ≈3508 individuals.

In November 2021, a total of seven individuals (four juveniles and three adult females) were carefully observed. The observations were conducted at distances ranging from 12.1–95.2 m, with observation angles of 10–37°, the estimated density was 0.042 individuals/ha. Additionally, the estimated population was calculated to be ≈9227 individuals. In December 2021, a total of thirteen individuals (seven juveniles, two adult males, and three adult females) were carefully observed. The observations were conducted at a distance range of 25.7–119.2 m and observation angles of 10–44°. The data collected indicated that the estimated density was 0.039 individuals/ha. Additionally, the estimated population was calculated to be ≈8568 individuals.

In January 2022, when the highest count of the Marsh Harrier occurred, a total of eighteen individuals (nine juveniles, two adult males, and seven adult females) were carefully observed. The observations were conducted at distances ranging from 12.8–171.6 m, with observation angles between 3–41°. The estimated density was 0.097 individuals/ha. Additionally, the estimated population of individuals was calculated to be ≈21499 individuals. In February 2022, a total of thirteen individuals (four juveniles, three adult males, and six adult females) were carefully observed. The observations were conducted at distance ranges of 24.9–150.3 m,

with observation angles of 12–67°. The data collected indicated that the estimated density was 0.046 individuals/ha. Additionally, the estimated population was calculated to be ≈10309 individuals.

In March 2022, a total of nine individuals (four juveniles, four adult males, and one adult female) were carefully observed. The observations were conducted at distance ranges of 35.8–228.5m with observation angles of 13–47°. The data collected indicated that the estimated density was 0.02 individuals/ha. Additionally, the estimated population was calculated to be ≈4531 individuals (Tab.1). For the months of April, May, and June of 2022, no individuals of these species were observed in the study area, indicating the end of their migration period.The results of this study indicate that the migratory/wintering population size of the Western marsh harrier in the study area is ≈3508-21499 individuals (mean ± SD = 8706.9 ± 1727.5). Regarding the distribution of the observed individuals of the species with the transect line along which they were observed, transect three had the largest count of individuals, with 29 individuals recorded over the course of the survey, while transect one had the lowest count of individuals recorded with only 14 individuals (Diag. 1).

Table (1): Total number of age classes of the Western Marsh Harrier *Circus aeruginosus* with estimated species densities, wintering/migratory population size, and differences among sex/age groups in the Central Marshes in Southern Iraq (October 2021– June 2022). y = year; Z = range of distance from the observer to the detected bird; Θ = range of observation angles.

	2021			**2022**					
Age/Month	Oct	Nov	Dec	Jan	Feb	March	April	May	June
Juvenile/immature (y 1-2)	3	4	7	9	4	4	0	0	0
Adult male (>3y)	0	0	2	2	3	4	0	0	0
Adult female (>3y)	1	3	4	7	6	1	0	0	0
∑	4	7	13	18	13	9	0	0	0
Z (m)	65.3-102	12.1-95.2	25.7-119.2	12.8-171.6	24.9-150.3	35.8-228.5	0	0	0
Θ (°)	16-62	10-37	10-44	3-41	12-67	13-47	0	0	0
Estimated density (ind/ha)	0.015	0.042	0.039	0.097	0.046	0.02	0	0	0
Estimated population	3508	9227	8568	21499	10309	4531	0	0	0

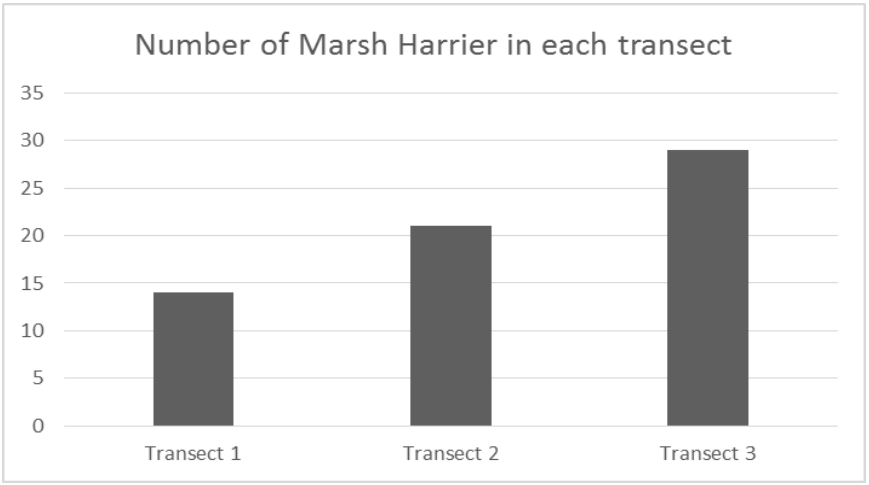


Diagram (1): Showing the number of Marsh Harriers observed in each transect during the study period.

Migration: While performing our field surveys, we kept in mind the best possible period of time to observe the highest count of the species during migration season, especially during autumn (October–November), winter (December–February), and spring (March–April). The migrating species increased in numbers after October 2021, reaching the peak of the migration in January 2022 with a total of 18 individuals observed. The winter count is most likely to be more representative of the actual numbers of migrating/wintering populations of the species inside the Central Marshes. Afterward, the number of migrating/wintering individuals started to fade in the following months, reaching its end in April 2022 (Tab. 1).

Juvenile/immature Marsh Harriers were observed migrating earlier and in larger numbers inside the Central Marshes than adults. The results of the statistical analysis test showed that the dominant age/sex group inside the study area was juvenile/immature harriers (n = 48.4375%), followed by adult females (n = 34.375%), and lastly by adult males (n = 17.1875%), while the difference between age classes was significant (P = .009).

Observations were made regarding the movement of the Marsh Harrier inside the study area; individuals were observed alone and did not form flocks (Pl. 1). Moreover, individuals were frequently seen in close proximity to areas where illegal electro-fishing was taking place, suggesting that the leftover fish from these activities may constitute an easy prey source for the species.

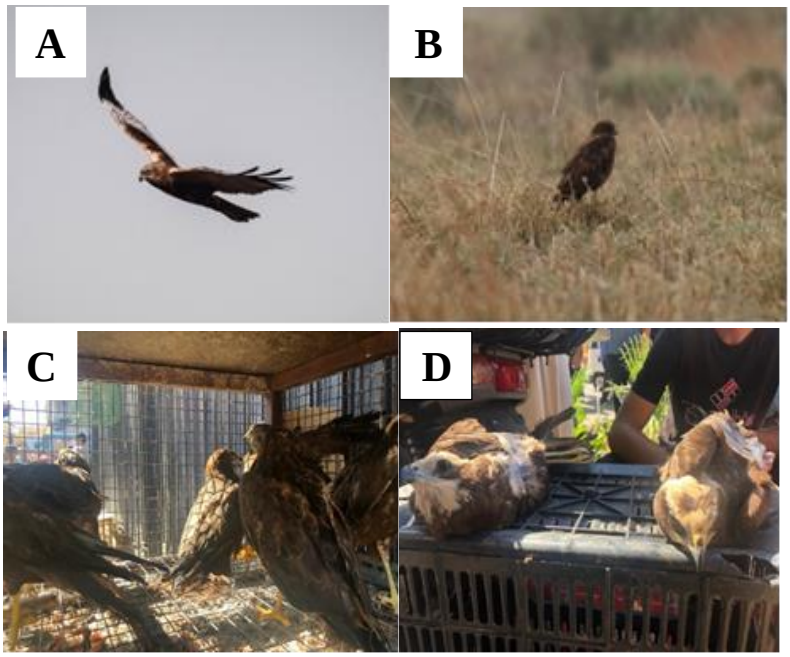


Plate (1): Showing the study subject, the Western Marsh Harrier *Circus aeruginosus*; (A) Adult Marsh Harrier in the Central Marshes, (B) Juvenile Marsh Harrier in the Central Marshes, (C) Multiple juvenile Marsh Harriers are Harrier being sold at Suq-Al-Ghazil in Baghdad, (D) Two juvenile Marsh Harriers were Harrier tapped and are being sold at Suq-Al-Ghazil in Baghdad.

Breeding :We undertook surveys inside the Central Marshes to assess the breeding status of the Western Marsh Harrier in the area. Despite our concentrated endeavors, no individuals of the species were observed. Moreover, we extensively surveyed a large portion of the most likely areas for the marsh harrier to breed (dense reed beds). No occupied breeding area was found, no display of courtship or individuals in pairs was observed, and no nest was detected, without evidence of any current or previous breeding attempts in the area.

Conservation notes : During our surveys, we visited many of the local animal marketplaces in Iraq, including the biggest animal marketplace in Baghdad (Suq-Al-Ghazil), which opens only on Fridays and sells all kinds of animals (wild and domestic). We found many migratory raptors being sold in the market for locals as domestic animals or to be mummified as trophies, including more than 200 individuals of the Western Marsh Harrier in very bad health conditions in very small plastic/metal cages or taped (Pl. 1). We also observed many illegal hunting/trapping methods during our field research.

During our field surveys, we encountered multiple other species of raptors inside the study area. We included their IUCN conservation status and their taxonomic order following Al-Sheikhly and Al-Azawi (2019b) as follows; Greater Spotted Eagle *Clanga clanga* (Pallas,

1811) (Vulnerable); Steppe Eagle *Aquila nipalensis* (Hodgson, 1833) (Endangered); Eastern Imperial Eagle *Aquila heliaca* (Savigny, 1809) (Vulnerable); Black-winged kite *Elanus caeruleus* (Desfontaines, 1789) (Least Concern), Long-legged Buzzard *Buteo rufinus* (Cretzschmar, 1829) (Least Concern); Eurasian Sparrowhawk *Accipiter nisus* (Linnaeus, 1758) (Least Concern); Common Kestrel *Falco tinnunculus* (Linnaeus, 1758) (Least Concern); Pallid Harrier *Circus macrourus* (S. G. Gmelin, 1770) (Near Threatened).

DISCUSSION

The Western marsh harrier has been a regular raptor in the Mesopotamian wetlands, having been recorded on a regular basis starting in the 1920s (Al-Sheikhly and Al-Azawi, 2019a). However, few research efforts have been conducted with regard to its migrating/wintering population. Hence, this study aimed to provide quantifiable information about the size of the migrating/wintering population inside the Central Marshes (Iraq), along with the migration pattern. Population size information can be very important in monitoring population trends, which can also be a predicting factor for the health and trends of the ecosystem. Historically, the Western Marsh Harrier was observed in abundance in the Mesopotamian Marshlands. This was prior to the 1990s, when the massive draining of the marshes took place (Scott, 1995; Hussain, 2014). Large numbers of the species (286 harriers) wintered in the Mesopotamian marshes in 1979 (Scott and Carp, 1982). The aforementioned extensive hydrological draining had a devastating effect on the population and numbers of more than forty bird species that occurred in the marshes in a pattern of global significance. It resulted in a reduction (>10%) in the size of the regional population of the Western marsh harrier (Evans, 1994; Scott, 1995). Nevertheless, the marsh harrier is continually visiting the Mesopotamian wetlands, although at lower counts (Abed, 2007; Fazaa *et al.*, 2017).

The results of this study indicated that the migratory/wintering population size of the Western marsh harrier in the study was ≈3508-21499 individuals (mean ± SD = 8706.9 ± 1727.5). Our results align with a previous study conducted in the Central Marshes that suggested that the number of migrant individuals of this bird species increased in the months following the start of the migration (Al-Sheikhly and Al-Azawi, 2019a). This number is also similar to that of the individuals that migrate from Western and Eastern Europe to sub-Saharan Africa (Strandberg *et al.*, 2008; Agostini and Panuccio, 2010; Agostini *et al.*, 2017). The genus Circus is known to adopt a pre-migration movement strategy to ensure sufficient resources for wintering, moulting, migration, and recovering from breeding. It also uses this strategy to reduce intraspecific competition (Limiñana *et al.*, 2008; Trierweiler *et al.*, 2008).

Our work showed that the migration of this species inside the study area was dominated by juvenile/immature harriers (n = 48.4375%), followed by adult females (n = 34.375%), and lastly by adult males (n = 17.1875%), while the difference between age classes was significant (P = .009). These results are consistent with the findings of previous studies by Al-Sheikhly and Al-Azawi (2019a), who found that the number of juveniles was dominant (n = 53.57%), followed by adult females (n = 24.26%), and finally adult males (n = 16.17%), with the results being significantly different. Furthermore, the results found in our study are in agreement with the findings of Kjellén (1992) on the migration of the same avian species

throughout the Falsterbo Peninsula in Sweden during autumn, in which juveniles (n = 1594.78%) were more numerous than adult females (n = 273.13%) and adult males (n = 216.9%). However, these observations were in contrast to studies conducted along the Central Mediterranean flyway, such as the one by (Agostini *et al*., 2017), which reported a greater presence of adult Marsh Harriers.

One of the findings of our study is that juvenile Western marsh harriers tend to arrive faster than adults to the Central Marshes and gradually increase in numbers from October to January (3-9), respectively. This aligns with previous findings in the same area, which found an increase in the count of juveniles from September to January (7-21, respectively) (Al-Sheikhly and Al-Azawi, 2019a). Juveniles have the tendency to travel shorter distances during migration with a lower rate of speed than adults (Strandberg *et al.*, 2008). Studies on Marsh Harriers migrating over the Falsterbo Peninsula have also found that there is a significant differential timing in migration between juveniles and adult females ($p < 0.05$), as well as between adult females and males ($p < 0.001$) (Kjellén, 1992). However, individuals of this species coming from western and eastern Europe were recorded to require several refueling stopovers before flying over the Mediterranean Sea in a long-distance migration process with high levels of energy consumption (Agostini *et al.*, 2017). Additionally, ring recovery records have shown that adult individuals have the tendency to engage in autumn migration at a rather earlier time as compared to juveniles (Strandberg *et al.*, 2008), similar to their counterparts that cross the flyway of the Central Mediterranean (Agostini *et al.*, 2017). However, previous studies found that marsh harriers from western Europe that migrate throughout the Sahara Desert have no significant variation in the timing, duration, or speed of migration between sexes during both autumn and spring migrations. One exception is the tendency of adult females to migrate at faster rates as compared to adult males during spring (Strandberg *et al.*, 2008; Panuccio *et al.*, 2013).

The breeding status of the Western Marsh Harrier in the Central Marshes and adjacent regions remains uncertain. Despite previous reports of breeding in the southern marshlands near Basra and Hamar Lake during the months of March and May in the 1920s (Ticehurst *et al.*, 1922), studies performed more recently, particularly those conducted following the widespread reflooding of the Iraqi marshlands in 2004, have not yielded confirmed evidence of breeding in these areas (Abed, 2007). Additionally, Fazaa *et al*. (2017) documented the absence of this avian species in the study area during the months of April and June 2014, and no confirmed breeding was reported during the 2018-2019 survey (Al-Sheikhly and Al-Azawi, 2019a). Our current study also included multiple extensive interviews with local Marsh Arabs, which did not yield any evidence of breeding in the Central Marshes in recent years. Furthermore, no adults displaying courtship behavior, territorial behavior, or nesting sites were observed, which suggests that the Western Marsh Harrier may no longer breed in the Central Marshes. However, further field observations may be necessary to confirm or refute this claim.

Illegal hunting and trapping of migratory raptors have been identified before as a major threat to the Iraqi migratory raptor population (Al-Sheikhly *et al.*, 2017). Other studies on

migration routes suggested that identifying threats to migratory raptors, such as trapping or shooting, is important since it could lead to changes in conservation measures in the future (Porter and Beaman, 1985). The Iraqi Protection of Wild Animals' Legislation (Law No. 17 released on February 15, 2010) prohibits the illegal hunting of 34 avian species in Iraq. Regrettably, the Western Marsh Harrier is not included. Moreover, the lack of enforcement of the current wild animal protection laws could lead to a regional decline in certain raptor species (Al-Sheikhly, 2011). It is worth mentioning that many protected raptor species are being sold in public in Iraq, especially in Suq-Al-Ghazil in Baghdad during their migration/wintering season, and this marketplace is fully protected by the local Iraqi police, which are responsible for the security of the marketplace. The lack of reinforcement of the already existing laws encourages illegal hunters to continue the persecution of indigenous and migrant species in Iraq.

As mentioned in this research, we employed standardized field methodologies and mathematical calculations to minimize bias probabilities. However, it is important to acknowledge certain considerations. The limited availability of data regarding habitat classification in this area of the marshlands posed challenges in identifying suitable surveying sites and applying appropriate methodologies. We made assumptions that the species utilized the entire geographical area of Al-Chibayish Marsh. We also assumed that the habitats in this region are classified in a uniformly consistent pattern, although this is a simplification. Previously, Al-Sheikhly and Al-Azawi (2019a) indicated that the migration started in early September, which is a limitation in our research since we had logistical and security-influenced circumstances that inhibited the research from starting earlier than October 2021.

CONCLUSIONS

A total of 64 individuals of the Western Marsh Harrier were observed from October 2021 to March 2022. The highest count of individuals recorded was in January 2022, with 18 individuals observed, while the lowest count of individuals recorded was in October 2021, with only 4 individuals. The population extrapolation estimated for the Western Marsh Harrier in Al-Chibayish Marsh during the 2021–2022 surveys was ≈3,508–21,499 individuals. No evidence for the breeding of the Western Marsh Harrier was detected. Transect 3 had the highest count of individuals, while Transect 1 had the lowest count. Juvenile Marsh Harriers tend to migrate to the Central Marshes faster than adults. Illegal hunting and trapping of the Marsh Harrier was identified as a major threat facing the species in Iraq. We also recommend that the Marsh Harrier get added to the list of protected avian species in Iraq for the continual survival and flourishment of this species in the country and the region. The continued monitoring of the population trend in the Central Marshes is recommended, as it could be a useful tool to monitor shifts and changes in the ecosystem. The survey efforts covered only one of the four sites of international importance, so it is recommended to conduct similar studies at the other three sites, such as Western and Eastern Al-Hammar Marsh and Hawizeh Marsh in southern Iraq.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to declare. We "the authors" have followed and signed the scientific research ethics announced by the journal.

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حالة الصون الحالية لمرزة المستنقعات المهاجرة في جميع أنحاء أهوار الجبايش (موقع اليونسكو)، جنوب العراق

عبد الله سعد الصراف و أحمد جاسم العزاوي
قسم علوم الحياة، كلية العلوم، جامعة بغداد، بغداد، العراق.

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الخلاصة

تعد مراقبة الطيور الجارحة من بين أكثر الطرق فعالية من حيث التكلفة والأكثر بساطة للتنبؤ بالتغيرات في النظام البيئي والبيئة. ويعد طائر مرزة المستنقعات الغربية *Circus aeruginosus* (Linnaeus, 1758) رتبة Accipitriformes عائلة Accipitridae طائراً جارحاً يمر في فصل الشتاء على نطاق واسع فوق مستنقعات جنوب بلاد ما بين النهرين في العراق. ومع ذلك، فإن المعلومات الحديثة المتعلقة باتجاه تجمعات طائر مرزة المستنقعات الغربية وأنماط الهجرة المكانية والزمانية ليست معروفة بالكامل. في الفترة من تشرين الأول 2021 إلى حزيران 2022. أجريت تسعة مسوحات ميدانية لعلم الطيور في الأهوار الوسطى (موقع اليونسكو، موقع رامسار، ومنتزه العراق الوطني). اختيرت ثلاثة خطوط مقطعية وغطت منطقة المسح 40.000 هكتار (400 كم2)، سجلت المسوحات التي أجريناها مؤخرًا ما مجموعه 64 طائر مرزة المستنقعات عبر الأهوار الوسطى. حدِّدت كثافة الأنواع باستخدام طريقة أخذ العينات عن بعد؛ قيست المسافات العمودية باستخدام جهاز تحديد المدى الرقمي. خلال الاستطلاعات التي تم اجراؤها. استضافت الأهوار الوسطى عددًا من تجمعات الطائر المهاجرين يتراوح بين ≈3508 و21499 طائر. بالإضافة إلى ذلك، قمنا بتقييم حالة تكاثر هذا الطائر في منطقة الدراسة؛ ومع ذلك، لم يتم العثور على تكاثر مؤكدة. علاوة على ذلك، حدِّد الصيد / الاصطياد غير المشروع على أنه التهديد الرئيسي الذي يواجه الأنواع في العراق.