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ARTICLE REVIEW

GLOBAL CONSERVATION STATUS OF HOUBARA BUSTARD *CHLAMYDOTIS UNDULATA* (JACQUIN, 1784) (AVES, OTIDIFORMES, OTIDIDAE): A REVIEW STUDY

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ABSTRACT

The current review aims to provide the available updated data for Houbara Bustards *Chlamydotis undulata* (Jacquin, 1784) (Aves, Otidiformes, Otididae) after its being listed on the IUCN Red List as VU Vulnerable, and its population has decreased globally. Also, it's being transmitted from the Gruiformes to the Otidiformes order. The current bibliographical study reviewed the most recent references that deal with houbara bustards: nomenclature, morphology, biological features, habitat, reproduction and breeding, migration patterns, global conservation status, hunting, and species status in Iraq, by searching in the previous literature. The current study reviewed the references about the global conservation status of the Houbara Bustard from the last 30 years (1995-2024). The status of the species in Iraq is that they are still living in the wild without any protection or breeding stations. It is also exposed to poaching by falconers and smugglers. A total of 105670 nucleotides of *Chlamydotis* were recorded on the NCBI website in various regions of the world, and the most recent recordings were reviewed in the current article.

Keywords: Aves, Gruiformes, Houbara bustards, Otididae, Vulnerable.

INTRODUCTION

Background: Previously, the Otididae Family belonged to the Gruiformes Order, but recently, it has become part of the Otidiformes Order (GBIF Secretariat, 2025). The Otididae family includes large or medium birds living in the wilderness and on flat plains. There are 32 species in Asia, Europe, Australia, and Africa, the largest share of which is 23 species, including *Chlamydotis undulata* (Jacquin, 1784) (Billerman *et al.*, 2020).

These birds are characterized by a large head that is slightly flat. The neck is thick and medium in length, and the beak's strong, conical shape is shorter than the head and compressed from the top. The tarsus is thick and medium length, and the lower part of the leg

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is bare of feathers, with strong feet with three fingers front only to lose the back finger. These fingers are short and wide, and like claws that resemble nails. Its feathers are rough and profuse and may be long in some areas of the head and neck (Hammer, 2020). The relatively short tail is much shorter than half the wingspan and consists of 16-20 feathers. And there are under the feathers, especially in the chest area silky soft fluff, males are larger than females, and maybe more beautiful feathers (Winkler, 2020).

By using genetic analysis recently, scientists have identified two species of houbara bustards based on geographical distribution and morphological and behavioral traits, African and Asian Houbara. The first African extends from North Africa to the Nile River. The second is the Asian Houbara or McQueen Houbara, which is found in the East and across Asia (Dolman *et al.*, 2021). Al-Sheikhly and Al-Azawi (2019) revealed that, birds in the Mesopotamian marshes were being negatively impacted by pollution, habitat degradation, and climate change in addition to species persecution. Hadi *et al.* (2021) also pointed out the need to develop a strategy to preserve endangered species of birds in Iraq.

The current review aims make available the updated data for houbara bustards *Chlamydotis undulata* after its being listed on the IUCN Red List as VU Vulnerable, and its population having decreased globally. Also, it's being transmitted from the Gruiformes to the Otidiformes order.

MATERIALS AND METHODS

The current bibliographical study reviewed the most recent references that deal with Houbara Bustards: nomenclature, morphology, biological features, habitat, Reproduction and Breeding, Migration patterns, Global Conservation status, species status in Iraq, hunting, and Molecular studies by searching different references such as books, Journals, and theses in Elsevier, Springer, Nature, web of science, Google Scholar, Research Gate, NCBI website, and reviewing the museum collection of the INHM.

RESULTS AND DISCUSSION

Taxonomy updates

The current study revealed to change in the classification of *Chlamydotis undulata* (Jacquin, 1784) as transmitted from Gruiformes to Otidiformes Order as follows:

Updated classification of *Chlamydotis undulata* according to GBIF Secretariat (2025)

Kingdom, Animalia

Phylum, Chordata

Class, Aves

Order, Otidiformes

Family, Otididae

Genus *Chlamydotis* Lesson, 1839

Species *Chlamydotis undulata* (Jacquin, 1784)

Synonym: *Psophia undulata* Jacquin, 1784

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Morphology

The main feature of the Houbara is the presence of long tufts of black and white feathers on both sides of the neck. Also, there is hazel color with black trimmings (Hammer, 2020). The cheeks are brunette, revealing the upper parts of the hazel-colored light decorated with fine black trims and black spots in the front of the back, epaulets, and wing covers. The lower parts are white with a gray tinge in the throat and black dots in the chest (Stone, 2008).

The five external servers are white, and the outermost third is black. The female is like the male, but the strands are shorter, as well as the feathers of the canal, while the lower parts have some dark trims; the juvenile resembles the female. The iris is light yellow, the beak is dark brown, and the foot is brown (Hammer, 2020). The total length of the body is about 65 cm, the wing 355-380 mm for females and 383-430 mm for males, the tail 185-205 mm, the beak 32-42 mm, tarsus 93-105 mm (Hadi, 2022).

Biological features

These birds are called desert birds because they bear the scarcity of water and food (Tieleman *et al.*, 2002). They are fed on grains, seeds, fruiting and green plants, as well as insects and some reptiles, and given the goodness of their meat and large size; they are considered one of the best hunting birds, and we must work to protect them from extinction. They are known for their extreme caution and so they keep distance from humans and they fight violently to defend themselves. Despite the weight of their bodies, they can run on the ground quickly or fly in the air with the perfection of ease and strength. The bustards live alone or in small groups, but they disperse in pairs in the spawning season and put the nests in pits on the ground among the grasses, wild grasses, and chicks from the nest bars, but they remain under the care of parents for a long time until their growth is complete (Bourass, 2012).

Reproduction and breeding

Males and females only get together during the breeding season, which takes place from December to March, to select a partner. The female departs the males after mating, and throughout the rest of the breeding season, which runs from February to April, both sexes stay alone. The female deposits two or three brown-spotted eggs to blend in with the sandy shallow hole nest. After hatching and being raised by the mother. The chicks can survive independently for up to three weeks throughout the incubation phase. The male houbara does not participate in the process of incubating or rearing the houbara offspring (Campbell, 2023). As they feed alongside their mothers, chicks follow them for protection since they are vulnerable to predators including eagles, hawks, foxes, wolves, reptiles, and snakes (Combreau *et al.*, 2002).

Houbara bustard habitat

It is mostly prevalent in the Canary Islands and North Africa. The native habitat of the Houbara Bustard is large, semi-arid areas with sporadic vegetation cover, such as pebble-sandy deserts. The houbara's capacity to get the minimal amount of water it requires from plants allows it to survive in arid environments. The houbara prefers scattered shrub plains

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because they can locate insects, rodents, invertebrates, and small vertebrates to eat. Additionally, it can use the pebbly sandy soil as camouflage by squatting below the plants to hide from predators (Campbell, 2023).

Migration patterns

Understanding population dynamics and the structure of migratory species requires knowledge of migration paths and linkages (Tourenq *et al.*, 2004). There is a strong correlation with migration on the distribution scale, with a distinct division between the winter zones and migratory routes of Eastern and Western migrants. Combreau (2011) showed that winter regions had a pattern of segregation. However, the relationship is weak at the local level: during the winter, birds that breed inside the borders of our research areas are frequently located hundreds of kilometers away. Among all the birds captured and monitored here, winter has not occurred in the Arabian Peninsula, despite the fact that the Arabian Houbara's winter season is thought to start in Central Asia. Decades of unchecked development and significant habitat loss in this region are probably to blame.

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Both the Asian and African houbaras, *Chlamydotis macqueenii* and *Chlamydotis undulata*, are listed as vulnerable on the IUCN Red List due to overexploitation throughout their entire ranges (IUCN, 2025). Since 1992, the houbara bustard has been conserved in protected areas in Saudi Arabia (Seddon *et al.*, 1995). Combreau *et al.* (2011) revealed the Arabian Peninsula's extreme environmental degradation and uncontrolled off-take. Since the widespread release of captive-bred birds may damage natural populations through introgression, it is crucial to conserve these endangered animals (Dolman *et al.*, 2021). While Roy (2019) revealed that finding sustainable initiatives like managed hunting reserves demonstrate the effectiveness of striking a balance between falconry and houbara preservation.

The current study reviewed the references about the houbara bustard's conservation status from the last 30 years (1995-2024), as shown in Table (1).

Table (1): Data on houbara bustard's state of conservation worldwide during the last 30 years (1995- 2024).

| No. | Global status of the Houbara | The site | References | Conservation status and Breeding |
|-----|------------------------------|---|-------------------------------|---|
| 1 | Endangered | Saudi Arabia | Seddon <i>et al.</i> (1995) | The release of captive-bred houbara into protected areas |
| 2 | Near threatened | The world | Goriup (1997) | Wildlife monitoring |
| 3 | Endangered | Southern Spain | Lane and Alonso (2001) | Wildlife monitoring |
| 4 | At risk | Kazakhstan, China, Pakistan, UAE, Afghanistan, Iran | Combreau <i>et al.</i> (2001) | Captured on their breeding grounds |
| 5 | Vulnerable | Saudi Arabia | Tieleman <i>et al.</i> (2002) | Compression between wild-caught and captive-reared birds. |
| 6 | Endangered | North-western | Morales <i>et al.</i> | Reproductive population in |

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|----|---|-------------------------------------|---------------------------------|---|
| | | Spain | (2002) | wildlife |
| 7 | Endangered | Saudi Arabia | van Heezik <i>et al.</i> (2002) | Breeding ground |
| 8 | Threatened with extinction in the near future | Spain, Madrid | Alonso <i>et al.</i> (2003) | Trends of the houbara Bustard population |
| 9 | The number has since been reduced to a few hundred birds. | Pakistan | Tourenq <i>et al.</i> (2004) | Migration patterns |
| 10 | May face extinction in the wild in the foreseeable future | China, South Kazakhstan, Oman | Tourenq <i>et al.</i> (2005) | Breeding grounds of migrant and resident populations |
| 11 | Endangered | Eastern Morocco | Hingrat and Saint (2005) | Breeding ground |
| 12 | Endangered | Morocco | Hingrat <i>et al.</i> (2007) | Breeding ground |
| 13 | Endangered | Canary Islands, Spain | Carrascal <i>et al.</i> (2008) | Captive-breeding |
| 14 | Endangered | India | Dutta <i>et al.</i> (2011) | Small Protected Areas (PA) |
| 15 | Habitat degradation | Central Asia | Combreau <i>et al.</i> (2011) | Migration patterns |
| 16 | Endangered | Canary Islands, Spain | Schuster <i>et al.</i> (2012) | Captive-breeding |
| 17 | Endangered | Morocco | Hardouin <i>et al.</i> (2015) | Mixed conservation area |
| 18 | Mortalities are increasingly recognized | Uzbekistan | Burnside <i>et al.</i> (2015) | Monitoring mortalities in the wildlife |
| 19 | Unsustainably hunted | Uzbekistan | Koshkin <i>et al.</i> (2016) | Monitoring nests in the wildlife |
| 20 | Severe population decline | Spain | Palacin <i>et al.</i> (2016) | Population viability analysis (PVA) to determine the most significant risks and assess the likelihood of quasi-extinction |
| 21 | Mortality during migration may be an important factor | Spain | Palacin <i>et al.</i> (2017) | Conducted population counts and radio-tracked the wildlife |
| 22 | Endangered species | UAE | Azar <i>et al.</i> (2018) | The reintroduced population of the captive-bred |
| 23 | Vulnerable | UAE | Roy (2019) | Strike a balance between houbara preservation and falconry |
| 24 | Endangered | Canary Islands, Spain | Alonso <i>et al.</i> (2019) | Captive-breeding |
| 25 | Globally threatened | eastern Morocco | Dolman <i>et al.</i> (2021) | Captive-bred |
| 26 | Vulnerable | in North Africa and the Middle East | Dolman <i>et al.</i> (2021) | Hunting limits, restricted prisoner breeding, and a decrease in poaching and trapping |
| 27 | Endangered | Canary Islands, Spain | Carrascal (2022) | Captive-breeding |
| 28 | Endangered | Southern Morocco | Horreo <i>et al.</i> (2023) | Captive-breeding |
| 29 | Endangered | Morocco | Harris <i>et al.</i> | Wild-born |

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| | | | (2023) | Captive-breeding |
|----|----------------------------|-----------------------|----------------------------------|--|
| 30 | Endangered species | Spain | Palacin <i>et al.</i> (2023) | This study demonstrates the importance of extensive mapping of endangered species for efficient EI planning. |
| 31 | Treated species | Canary Islands, Spain | Abril-Colon <i>et al.</i> (2023) | Captive-breeding |
| 32 | Significant decline | Canary Islands, Spain | Ucero <i>et al.</i> (2023) | Captive breeding |
| 33 | On the brink of extinction | Canary Islands, Spain | Alonso <i>et al.</i> (2024) | Captive-breeding |

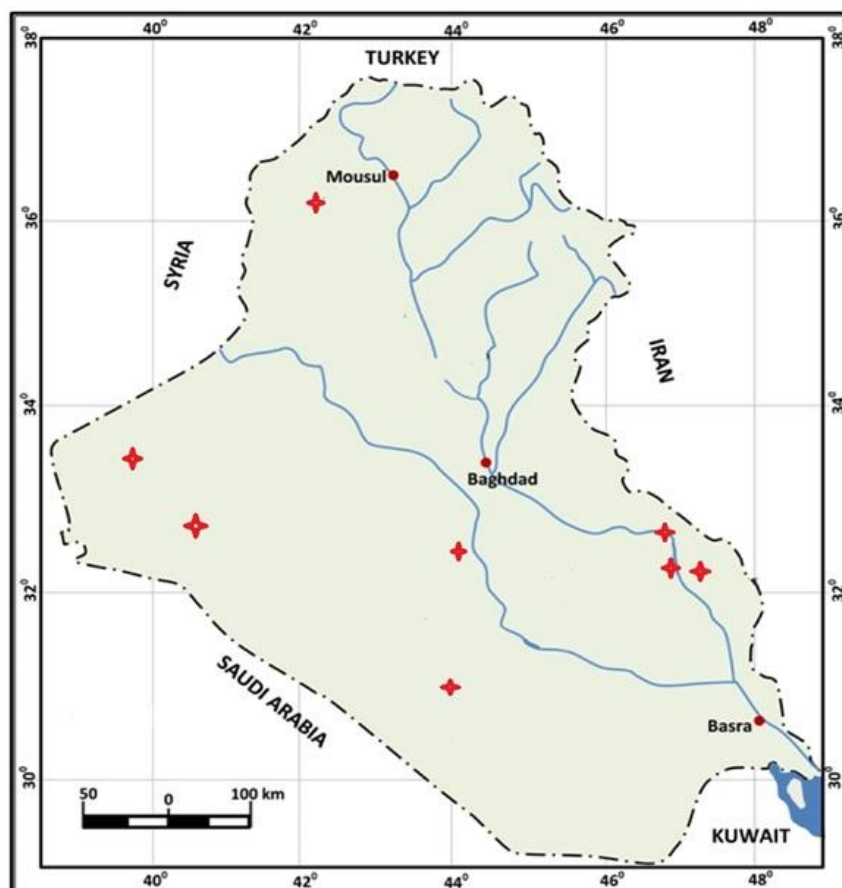
The current study synthesizes conservation trends of the Houbara bustard, which changes from “Near Threatened” to “Vulnerable,” due to overhunting and habitat loss. Furthermore, the current study highlights literature gaps, such as limited data on migration or breeding success in certain regions.

Species status in Iraq

Chlamydotis undulata was listed in the systematic list of the vertebrates of Iraq by Mahdi and Georg, (1969). It is a winter visitor bird, as Allouse (1960), Moore (1957), Al-Dabbagh (1998), and Porter *et al.* (2010) have shown. One voucher specimen of houbara bustards was preserved in INHM “Iraq Natural History Research Center and Museum” collected from the middle of Iraq (Aziziyah Road) (Hadi, 2022). *Chlamydotis undulata* is still in the wild in Iraq without any protection from heavy hunting. There are no protected areas or breeding stations for them. In addition, there is a dearth of research and surveys about it. All data available in Iraq is collected in Table (2), Map (1), and Plate (1, 2).

Table (2): Data on the distribution sites of the Houbara Bustard in Iraq.

| Site | Province | Local in Iraq | Reference |
|-------------------|-------------|---------------|----------------------------------|
| Himreen | Anbar | West | Bachmann and Chappell (2011) |
| Rabea'a | Nineveh | West | |
| Ali-Garbi | Missan | South | |
| Nogratt Al-Salman | Muthanna | South | |
| Al-Dalmaj Marsh, | Al-Diwaniya | South | Mohammad (2014) |
| Huwaiza Marsh | Missan | South | Al- Zubaidi <i>et al.</i> (2017) |
| Al-Dalmaj Marsh | Al-Diwaniya | South | Salim <i>et al.</i> (2020) |
| Aziziyah Road | Wasit | Middle | Hadi (2022) |
| Ba'quba | Diyala | Middle | Specimens in the INHM |



Map (1): The distribution sites of the Houbara Bustard in wildlife in Iraq. [Drawing by the first author].

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Plate (1): The voucher study specimen of the *Chlamydotis undulata* in INHM. [Photographed by the second author].



Plate (2): The female and male of the *Chlamydotis undulata* in INHM. [Fe: Female, Ma: Male. Photographed by the second author].

Houbara hunting

According to the IUCN Red List, Middle Eastern falconers' traditional houbara hunting practice has drastically decreased populations based on wintering. This overfishing has been made worse by habitat loss and degradation, and the species may be especially affected by habitat degradation brought on by related tourism and development activities, as well as military activities (Dolman *et al.*, 2021).

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The International Fund for Houbara Conservation (IFHC) protects houbara bustards from extinction by breeding them to conserve them and increase their numbers (IFHC, 2019). Since its inception, the Fund has succeeded in producing about 400,000 houbara bustards. The National Avian Research Center has conducted extensive scientific research on the environment and migration paths of these birds in their breeding ranges over the past 25 years. This research provided vital environmental information for the conservation of the Houbara (IFHC, 2022).

In Iraq, like its companions in the surrounding countries, the Houbara tops the list of game among hunters and falconers. In addition, the houbara bustard is required in the Gulf States district for falcon training purposes. So, smugglers use various ways to remove the birds. Holding it at night is one of the most common ways to catch houbara bustards in Iraq which is done with a hunting rifle, as well as with falcons, these methods (used in the plains of the eastern Tigris) are the most dangerous and effective for controlling the Houbara bustard population in these areas (the plains of gathering large numbers of migratory houbara). Certainly, as this tragic reality continues, we will soon witness the further decline of the threatened Houbara bustard in Iraq in the coming decades (Haba, 2020). Houbara status in Iraq needs national conservation strategies as is the case with other threatened birds (Hadi *et al.*, 2021).

Molecular studies of *Chlamydotis undulata*

Between 2002 and 2024, the NCBI website documented 105,670 nucleotides of *Chlamydotis* worldwide (NCBI, 2024). This huge number of recordings revealed the importance of these birds. The current study reviewed the most recent recordings of them, including genes, linear DNA, accession number, and references, in Table (3).

Table (3): *Chlamydotis undulata* data of the most recent recordings on the NCBI website.

| | Gene | Linear DNA | Accession number |
|---|--|------------|------------------|
| 1 | CHD gene | 325 bp | AF372010.1 |
| 2 | Mitochondrial cyt specimen voucher 7265 | 1143 bp | AJ511450.1 |
| 3 | B245 Cytochrome | 1143 bp | AY259915.1 |
| 4 | Hap 56 D-loop | 768 bp | EU439704.1 |
| 5 | Partial D-loop haplotype B274 | 854 bp | AJ544568.1 |
| 6 | Cytochrome B (cytb), partial cds | 1,042 bp | KF137583.1 |
| 7 | Cytochrome B (cytb), specimen voucher 7065 | 1,143 bp | AJ511451.1 |

CONCLUSIONS

According to the IUCN Red List, *Chlamydotis undulata* is considered vulnerable. Due to wintering, Middle Eastern falconers' custom of houbara hunting has drastically decreased their numbers. Because of this overhunting, habitat was lost and degraded. Therefore, it has been protected globally in many areas in the last 30 years. Also, there are a huge number of recordings on NCBI websites of nucleotides of *Chlamydotis* worldwide that reveal carrying

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out more importance of these birds. More than that, there is no recording of it from Iraq. So, we recommend the molecular studies for Houbara and recording it in NCBI.

Houbara Bustard *Chlamydotis undulata* is still in the wild in Iraq without any protection from heavy hunting. There are no protected areas or breeding stations for them. Iraq witnessed the further decline of the threatened Houbara bustard Iraq for decades. Therefore, we recommend conducting a protective area to conserve these important birds, as in neighboring countries.

CONFLICT OF INTEREST STATEMENT

The authors announce no conflict of interest concerning the work in the manuscript.

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حالة الحفظ العالمي لطائر الحبارى
Chlamydotis undulata (Jacquin, 1784)
(Aves, Otidiformes, Otididae)
دراسة مراجعة

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الخلاصة

هدفت الدراسة الحالية إلى توفير البيانات المحدثة عن طائر الحبارى *Chlamydotis undulata* (Jacquin, 1784) بعد إدراجه في القائمة الحمراء للاتحاد الدولي لحفظ الطبيعة، باعتباره معرضاً للانقراض وانخفاض أعدادهِ عالمياً. كما تم التحديث في تصنيفهِ العلمي حيث تم نقلهِ من رتبة Gruiformes إلى رتبة Otidiformes. استعرضت الدراسة الببليوغرافية الحالية أحدث المراجع التي تناولت طائر الحبارى من حيث: التسمية، والشكل، والسمات البيولوجية، والموائل، والتكاثر، وأنماط الهجرة، وحالة الحفظ العالمية، والصيد، وحالة الأنواع في العراق، من خلال البحث في الأدبيات السابقة. استعرضت الدراسة الحالية المراجع حول حالة الحفظ العالمية لطائر الحبارى خلال الثلاثين عامًا الماضية (1995-2024)، وحالة الأنواع في العراق وتبين أنها لا تزال تعيش في الحياة البرية دون أي حماية أو محطات اكثار. فضلاً عن أنها معرضة للصيد الجائر من قبل الصقارين والمهربين. تم تسجيل ما مجموعه 105670 نيوكليوتيداً من *Chlamydotis* على موقع NCBI في مناطق مختلفة من العالم، وتمت مراجعة أحدث التسجيلات في بنك الجينات NCBI في التحريات الحالية.