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Houbara Bustard

Chlamydotis undulata ⓘ

VU Vulnerable | Names (34) | Subspecies (2)

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Revision Notes

Introduction

A mid-sized and generally sandy-brown bustard, the Houbara Bustard is a remarkably distinctive species, especially during display when its white crest and breast feathers are erected to spectacular and unusual effect. The nominate taxon formerly occurred in arid, sandy, semi-desert habitats across North Africa, from Morocco and Western Sahara in the west to the Egyptian Nile Valley in the east, but its populations have been heavily depleted. A second subspecies, *C. u. fuertaventurae*, is confined to the Canary Islands in Macaronesia, on three, but primarily just two islands, where no more than 600 individuals are estimated to remain. Both of these taxa were formerly considered conspecific with the allopatric [Macqueen's Bustard \(*Chlamydotis macqueenii*\)](#) of southwestern and Central Asia.

Assessing the global conservation status of wild populations of this declining species has been hampered greatly by its naturally cryptic behavior, its occupation of difficult-to-access but increasingly degraded semi-desert scrublands, unquantified but anecdotally high hunting pressure, and large annual releases of captive-bred birds. Despite the species' extensive

range, spanning more than 4,000 km west to east, it is evaluated as Vulnerable to extinction according to IUCN Red List Criteria. Except on the Canary Islands, the critical threat to the Houbara Bustard is hunting, as it is highly prized as quarry for falconry. In the Canary Islands, collisions with overhead lines account for the highest percentage of mortalities; a threat which is expected to increase in the African range of the species as renewable energy developments spread throughout the Houbara's sunny habitats.

In most range states in continental Africa, and above all Morocco, the surviving wild populations of this species have been augmented by continued releases of very large numbers of captive-bred birds produced through artificial insemination. These breeding programs were introduced to provide sufficient stock to meet hunting demand, with the implicit presumption that they would also relieve pressure on wild populations. However, the utility and impact of these programs have been questioned, and at least one population now appears to consist largely of captive-bred individuals and their progeny, and is reported to not be self-sustaining without further releases. Captive breeding can alter physiological, life history, and behavioral traits, and in this case has evidently led to reduced fitness of released birds. Concerns remain around the potential effects on the viability of other wild populations as they interbreed with released birds. Taken in concert, the Houbara Bustard faces a perfect storm of threats to its survival in the wild from the combination of overgrazing, climate-driven habitat degradation, development, unsustainable hunting, and concerns around the potential side effects of captive-bred releases.

Identification

Field Identification

A mid-sized, somewhat turkey-like bustard with mottled sandy-brown and dark brown upperparts, and a white crown with a vertical black stripe on the neck. In flight, the species can look particularly pale, long-tailed, and long- and narrow-winged, with a bold white patch in the primaries; the upperparts are otherwise rather variegated. When displaying, elongated plume feathers on the neck and head are erected. The belly is whitish, and the legs and irides are pale yellowish.



Male displaying, with elongated plume feathers on the neck and head erected.

Similar Species Summary

Unlikely to be mistaken for any other species.

Similar Species

The white patch in the primaries is smaller and less obvious than in the more petite [Little Bustard \(*Tetrax tetrax*\)](#) and the more powerful and robust [Great Bustard \(*Otis tarda*\)](#).

In addition to a few records (none recent) in southern Morocco, the [Arabian Bustard \(*Ardeotis arabs*\)](#) occurs in Mauritania, from where there are no recent records of Houbara Bustard, and is by any measure unlikely to be confused with it due to its much larger size, all-gray neck, more solidly brown upperparts, and its black cap. Identification of distant individuals, perhaps compounded by heat haze, nevertheless still demands caution.

In flight, the wing pattern of the present species and that of the comparably sized [Nubian Bustard \(*Neotis nuba*\)](#) are rather similar, but they should not be confused at rest, given the latter's distinctly warmer and more contrasting plumage, including the black chin and throat. These two species do not overlap geographically, but their distributions come comparatively close in the southwest of the Houbara Bustard range, thus a vagrant of either species might appear in the range of the other.

Note that there exists the possibility that the formerly conspecific and more migratory [Macqueen's Bustard \(*Chlamydotis macqueenii*\)](#) could be observed west of the Nile in Egypt, i.e., within the range of the present species. These two species are perhaps most easy to separate when displaying, but a non-breeding Macqueen's Bustard in western Egypt is very unlikely to be so cooperative! The latter has black-tipped white crown feathers (versus all white), white-based black neck plumes (versus all black), and a pale blue-gray foreneck base and breast in mature males (versus peppered black and white). No other bustards or similar-sized birds otherwise occur within the range of Houbara Bustard.

Plumages, Molts, and Structure

Plumages

The Houbara Bustard has ten full-length primaries (numbered distally, from innermost p1 to outermost p10), 16–17 secondaries (numbered proximally, from outermost s1 to innermost s12 or s13, and including four tertials, numbered distally, t1 to t4), and 20 rectrices (numbered distally on each side of the tail, from innermost r1 to outermost r10). Longest primaries are pp7/8, pp7–10 are notched on the inner web, and pp6–9 are emarginated on the outer web (1). Geographic variation in appearance is slight (see [Systematics](#)). The following molt and plumage descriptions cover both subspecies and are based on those of Cramp and Simmons (1), Johnsgard (2), and Collar (3), along with an examination of [Macaulay Library images](#). See [Molts](#) for information on Humphrey-Parkes molt and plumage terminology used by Birds of the World. Houbara Bustard may or may not have alternate plumages (see below and [Molts](#)); in any case, ornamental plumes appear to be formative or basic feathers, as found in cranes and ardeids (cf. 4, 5). Sexes are similar in Juvenile Plumage, differ on average in Formative

Plumage, and differ more extensively in definitive plumage(s), as based primarily on the seasonal development of ornamental plumes; definitive appearance appears to most often be attained in Second Basic Plumage in females and Third Basic Plumage in males. Timing of plumages (e.g., fresh versus worn) listed below based on peak times of breeding and molt (see [Molts](#)) but variable plumage states may be found over more prolonged periods.

Natal Down

Present at the natal site, primarily in April–August. Down is short, thick, somewhat woolly, and comprises a complex marbled pattern of white, brown, and rufous with black highlighting, likened to a carpet (see image below). Natal down may vary to adapt to background substrate; in some chicks it may be more golden and buff ([6](#)). The upperparts are complexly patterned and the underparts are primarily white.

Juvenile (First Basic) Plumage

Present primarily in July–October. Similar to Definitive Basic Female, but upperparts washed buff or yellowish buff and the ornamental plumes on the head and neck reduced or absent. Crown uniformly tan; remainder of head and neck mostly grayish, the sides of neck with short black marks as opposed to ornamental frilled feathering; dark marks in scapulars and among upperwing-coverts slightly less distinct. Juvenile outer primaries and rectrices are narrower and more pointed or tapered at their tips than basic feathers, and the pattern to the rectrices less distinct, with buff and dusky bars and broad buff to tawny tips. Note also that the wings and tail of juveniles are shorter than in adults ([1](#)).



Natal Down (subspecies *fuertaventurae*).



Juvenile (subspeci

Formative Plumage

Present primarily in November (when fresh) to September (when worn). See [Molts](#) regarding the likelihood that a First Prealternate Molt and First Alternate Plumage do not occur; in any

event, plumage changes little if at all between November and September, except for effects of feather wear.

Examination of [Macaulay Library images](#) suggests that the Preformative Molt may be partial, with at least some or most birds showing formative back feathers and scapulars contrasting distinctly with worn juvenile upperwing secondary coverts (although beware basic coverts are paler than upperpart feathers in all plumages), especially in spring when juvenile coverts are abraded (see images below). Juvenile flight feathers are characterized by being contrastingly short, narrow, tapered or rounded at their tips, and abraded, the juvenile primaries brownish with some buff or off-white marks at their tips, and the juvenile rectrices have faded buff tips. In the formerly conspecific and migratory [Macqueen's Bustard \(*Chlamydotis macqueenii*\)](#), the inner primaries and tertials may begin partial replacement during an incomplete Preformative Molt on the non-breeding grounds, but study is needed as to whether or not this occurs in the resident Houbara Bustard. The upperparts in Formative Plumage may also average duller yellowish gray, and ornamental plumes are reduced in size and number (see below).

In Formative Plumage, female and male differ on average but sexing is complicated by individual variation in timing of molts and maturation rates; by spring, sexing may be possible for most or all birds by the increased development of formative ornamental plumes in males compared to females. Length values for formative males can be similar to those of Definitive Basic Females (above), while those of Formative Females are short and hardly project beyond normal feathering [\(1\)](#).



Formative Male (subspecies *fuertaventurae*).



Possible Formative

Second Basic and Alternate Plumages

Present primarily in November (when fresh) to September (when worn); see [Molts](#) regarding alternate plumages in this species. Some individuals (predominantly males) retain one or more juvenile primaries and probably also some secondaries in the center of the tract during the Second Prebasic Molt, permitting identification of Second Basic Plumage; other remiges are uniformly replaced and do not show the contrast of older birds (see below). In these, basic inner primaries and middle secondaries contrast with juvenile outer primaries and adjacent secondaries, which are narrow, brown, and abraded. Many birds (primarily females) replace all primaries and secondaries during the Second Prebasic Molt and these cannot be reliably

separated from those in Definitive Basic Plumage. Second basic ornamental plumes of males very possibly average less extensive than in later basic plumages (cf. [7](#) and [8](#) regarding ornamental plume development by age in [Great Bustard \(*Otis tarda*\)](#)) and some males may defer breeding maturity for up to six years ([3](#)), so it is possible that birds with fully developed plumes may be 3-4 years old, or older. Examination of [Macaulay Library images](#) (see below) indicates that incomplete Second Prebasic Molts (leading to Staffelmauser patterns in subsequent molts) occurs in occasional individuals (see images below), but it appears to be less common than in the migratory Macqueen's Bustard (which see), due to the lack of time and energy constraints related to migration in this species.




Possible Second Basic Male (subspecies *fuertaventurae*).



Possible Second B

Definitive Basic and Alternate Plumages

Present primarily in November (when fresh) to September (when worn). See [Molts](#) as to whether or not Definitive Prealternate Molts and a Definitive Alternate Plumage can occur; in any event, plumage changes little if at all between November and September, except for effects of feather wear.

Crown pale brownish with a sometimes hidden central line of white erectile feathers (cf. [ML420449131](#) ). Rest of head and neck grayish, sometimes with indistinct dusky eyeline and often a dusky subauricular stripe (variably surrounded by brownish buff to white) and crescent at rear of ear-coverts. Neck with black lines composed of erectile filamentous plumes (the "frill") that broaden on the sides of the neck (often meeting on the nape); on the sides of the neck, these feathers are white tipped black and are longer and become all white on the lower neck. Rest of upperparts from nape to uppertail-coverts patterned dark and pale brown, forming a checkerboard-like appearance. Tail brown, tinged cinnamon or rufous basally with fine and indistinct narrow barring, up to four broad blackish bars, and a white tip that can be speckled black (see images above and below). Upperwing secondary coverts are similarly patterned to the upperparts but are paler and grayer basally, and more vermiculated with black rather than with a checkerboard appearance, the vermiculations becoming finer from the lesser to greater coverts, and the latter also with a black subterminal band and white tips.

The outer primaries (pp6–10) are white with black tips, p5 usually shows a mottled white base, and the inner primaries (pp1–4) and secondaries are largely black with narrow white tips,

creating a striking pattern in flight. The lesser primary coverts are black with narrow white tips and the greater primary coverts are black with broad white bases, creating a distinct white patch on the edge of the wing in flight. Chin and throat brownish buff to white with a dusky malar streak. Upper breast grayish, with ornamental black-and-white feathers extending on the sides from the neck frill and forming a bib of longer pectoral plumes on the lower breast. Rest of underparts cream to whitish, the flanks often with short distinct black bars. Underwing-coverts and bases to the secondaries and primaries from below largely white, with black tips to a row of lesser coverts forming a narrow bar (cf. [ML553521651](#) 📷, [ML473839251](#) 📷).

Sexing the Houbara Bustard in the field can be difficult. Although males average 10% larger than females in almost all morphometric traits (see [Linear Measurements](#)), their values overlap and the plumage does not always exhibit obvious dimorphism, especially during the non-breeding season ([1](#), [2](#)). The best means of sexing by plumage is the extent of the ornamental plumes, although because these develop slowly over the winter and early spring, time of the year must be considered. Generally, males show a broader black neck-band and longer basic occipital and pectoral plumes than females at a given time of year. When fully grown, the occipital plumes of definitive basic males can be up to 100 mm long, the neck plumes up to 190 mm, and the pectoral plumes up to 120 mm in length (and apparently longer based on [Macaulay Library images](#)) whereas these values in definitive basic females are up to 70 mm, 110, and 90 mm ([1](#)). Behavioral differences related to territoriality and courtship can also be used for sexing (see [Behavior](#)).



Definitive Basic, probably Female (subspecies *fuertaventurae*).



Definitive Basic Fe

Definitive Basic Plumage is separated from Formative and Second Basic Plumages by showing uniformly basic upperwing coverts and flight feathers, without retained juvenile feathers (see Formative and Second Basic Plumages above). The outer primaries can show an even molt cline from browner p6 to blacker p10 based on protracted molting, with the outer primaries also broader, more truncate at the tip, fresher, and blacker than retained juvenile feathers. Often there will be Staffelmauser patterns among pp6–10, with two or three sets of feathers (defined as a more worn feather distal to a fresher feather; [9](#)) indicating older birds, in at least Third Basic Plumage for those with three sets of primaries; these are more likely in males and

may be rare in females. In addition, basic rectrices are uniformly broad and square-tipped, and show a more distinct pattern with whiter tips than retained juvenile feathers of Formative Plumage (see images above and below). Ornamental plumes average longer within each sex (see Formative Plumage above), and those of second basic birds may average in between those of Formative and Definitive Basic Plumages.



Definitive Basic Male (subspecies *fuertaventurae*).



Definitive Basic Male

Molts

Molt and plumage terminology follows Humphrey and Parkes ([10](#)) as modified by Howell et al. ([11](#)). Under this nomenclature, terminology is based on evolution of molts along ancestral lineages of birds from ecdysis (molts) of reptiles (cf. [12](#)), rather than on molts relative to current breeding seasons, locations, or time of year, the latter generally referred to as "life-cycle" molt terminology ([13](#)). Prebasic molts often correspond to "post-breeding" or "post-nuptial" molts, prealternate molts usually correspond to "pre-breeding" molts, and preformative molts mainly to "post-juvenile" molts; however, there is a lack of equivalency due to different bases of definition ([14](#)). The terms prejuvenile molt and juvenile plumage are preserved under Humphrey-Parkes terminology (considered synonyms of first prebasic molt and first basic plumage, respectively) and the former terms do correspond with those in life-cycle terminology.

The Houbara Bustard may exhibit a Complex Basic Strategy, a Complex Alternate Strategy or, perhaps most likely, a Simple Alternate Strategy (cf. [11](#), [15](#)), including complete prebasic molts and a partial to incomplete preformative molt, and possibly a limited prealternate molt in the definitive cycle but probably not the first cycle (see below). The following is based primarily on information in Cramp and Simmons ([1](#)), augmented by an examination of [Macaulay Library images](#). Based on the latter and the extent of plumage wear and ornamental plume development, molt timing appears to be in July–September, as expected following nesting which peaks in March–July (see [Breeding: Phenology](#)), although protracted breeding by some individuals may result in more prolonged molting seasons as well; study is needed.

Prejuvenile (First Prebasic) Molt

Complete, primarily May–July, on or near natal territory. Details of juvenile plumage development are needed for Houbara Bustard.

Preformative Molt

Often termed “post-juvenile molt” under life-cycle terminology. Based on [Macaulay Library images](#) this molt appears to be partial in at least some individuals, including most to all body feathers but few upperwing coverts. It may be more rapid and less extensive than in [Macqueen's Bustard](#) (see Molts under that species), where this molt may commence on or near the breeding grounds in August–October and be completed on the non-breeding grounds in November–March with some flight feathers replaced ([1](#)), but further study is needed. An apparent lack of individuals molting primaries in November–May may indicate that these feathers are not replaced during the Preformative Molt as they apparently are in Macqueen's Bustard, or it could be that more flight feathers may be replaced due to the lack of constraints related to migration ([1](#)). Further study of first-cycle molts is needed in both species.

Second and Definitive Prebasic Molts

Often considered “first post-breeding molt” and “adult post-breeding molt,” respectively, under life-cycle terminology. Occurs primarily in July–September but may commence earlier in some birds (especially non-breeding individuals including those undergoing Second Prebasic Molt) and extend into early winter in others that breed later in autumn. Ornamental plumes appear to be basic and may not become fully grown until late winter (see discussion and images under [Plumages](#)).

Primaries and the corresponding primary coverts are replaced distally (p1 to p10), secondaries may be replaced convergently from both ends of the tract, and rectrices are generally replaced distally (r1 to r10) on each side of the tail, with some variation possible; this molt sequence is maintained through subsequent prebasic molts albeit often with incomplete replacement. [Macaulay Library images](#) of Houbara Bustard and other bustards flying in active primary molt are uncommon, indicating that they may remain largely sedentary during these periods (primarily in July–September). Extent of replacement of rectrices in need of study. Replacement of secondaries even less well known but some feathers in the center of the tract are often retained in some individuals, especially males (see images below).



Female commencing Definitive Prebasic Molt (subspecies *fuertaventurae*).



Male completing I









The Second Prebasic Molt appears to be usually complete but may be incomplete in some birds, with up to three juvenile outer primaries (among pp8–10) and some juvenile middle secondaries retained (see images under [Second Basic Plumage](#)). Examination of [Macaulay Library images](#) indicates that subsequent Definitive Prebasic Molts are incomplete in some to many individuals (especially males). Following incomplete molts, the subsequent prebasic molt appear to commence where the previous molt terminated, resulting in complex Staffelmauser (stepwise) patterns, whereby each molt series commences at the terminal point of the previous prebasic molt while often initiating new series ([16](#), [9](#), [5](#)). Replacement in such individuals can proceed in two or three waves through the primaries, resulting in an equal number of “sets” of feathers following completion ([9](#)), especially among the longer pp6–10, which take more time to grow. Staffelmauser appears to be a product of insufficient time to undergo a complete wing feather molt but has adaptive benefits in producing multiple small gaps in the wing during molt, with the bird retaining the ability to fly and forage ([17](#), [18](#)). Staffelmauser-like patterns appear also to occur among secondaries in bustards, and definitive prebasic molt of rectrices is occasionally incomplete, but study is needed.

In Gruiformes (of which Otidiformes used to be considered a part), molt of primaries is proximal ([19](#)), unlike the distal replacement of bustards, perhaps helping to justify placement of Otidiformes in a separate order. However, molt of primaries in the Gruiform family [Sarothruridae](#) (flufftails) is divided into two series, pp1–5 and pp6–10, and it appears quite possible that similar separate series occur in Houbara Bustard and other bustards, based on their complex molt patterns and [Macaulay Library images](#) (see images below). In this case, Staffelmauser may be further complicated and would be expected to occur more frequently among pp6–10 than among pp1–5 due to the larger outer than inner primaries, requiring more time for complete growth (cf. [20](#)). More study is needed on the interesting molting patterns of bustards.

Incomplete Prebasic Molt (subspecies *fuertaventurae*).

Incomplete Prebas

Definitive Prealternate Molt

In the migratory and formerly conspecific [Macqueen's Bustard \(*Chlamydotis macqueenii*\)](#), limited prealternate molts of at least some upperpart feathers appear to occur, but there is less evidence for their occurrence in Houbara Bustard; in general, migratory species are more likely to undergo prealternate molts than related non-migratory species due to the effects of increased annual solar exposure in migratory species. Examination of [Macaulay Library images](#) taken in March–June, when alternate plumages would be expected in this species, indicates uniformly worn feathering in most individuals (e.g., [ML597373961](#) ; [ML450001701](#) ; [ML615754154](#) ; [ML556792791](#) ; [ML616087869, left-hand bird](#) ) whereas others possibly show scattered fresh upperpart feathers indicating the presence of a limited prealternate molt (e.g., [ML557572921](#) ; [ML322204891](#) ; [ML616087869, right-hand bird](#) ). It is likely that incipient prealternate molts occur in at least a small proportion of individuals, but study is needed to confirm this and the occurrence of Definitive (but probably not First) Alternate Plumages. See remarks under [Plumages](#).

Bare Parts

The following is based on the literature ([1](#), [2](#), [3](#), [21](#)) and an examination of [Macaulay Library images](#). Bare-part coloration of adults and juveniles is apparently similar, but differs in nestlings.

Bill

In juveniles and adults the relatively strong bill (rather compressed dorso-ventrally) is bluish gray or greenish gray to yellowish or horn at the base of the mandible with a darker to blackish maxilla. In hatchlings it is initially blackish to olive-gray, then becomes gray with a narrow black band on the maxilla adjacent to the white tip. By the juvenile stage the bill has reached adult-like coloration.

Iris and Facial Skin

In juveniles and adults the iris is pale sandy to sandy olive or pale yellow, occasionally pale brownish orange. In hatchlings it can be paler and grayish, but quickly becomes yellow by the

juvenile stage. The orbital skin is gray with a darker slate inner rim.

Tarsi and Toes

In juveniles and adults the legs and feet are olive-gray to plumbeous yellow or medium-bright yellow. They may become brighter during the pre-breeding and breeding periods as opposed to the molting and non-breeding periods (study needed). The foot comprises three very short cushioned toes, but no hind toe ([22](#)). Claws are dark gray to black. In hatchlings the legs and feet can be gray to olive-gray but appear to become yellow by the juvenile stage.



Adult Female (subspecies *undulata*).



Adult Male (subsp

Measurements

Linear Measurements

Overall Length. 65–75 cm (males), 55–66 cm (females) ([1](#)).

Wingspan. 135–170 cm ([1](#)).

Linear measurements, in mm, with means, standard deviation, and sample sizes in parentheses (where available), from Cramp and Simmons ([1](#)):

Wing Length. *C. u. undulata*: males 365–413 (383 ± 13.9 , $n = 9$), females 346–347 ($n = 2$); *C. u. fuertaventurae*: males 365–381 (371 ± 6.08 , $n = 6$), females 342–349 ($n = 2$).

Bill Length. *C. u. undulata*: males 28–33 (31.4 ± 1.81 , $n = 11$); *C. u. fuertaventurae*: males 29–33 (30.5 ± 1.83 , $n = 6$).

Tarsus Length. *C. u. undulata*: males 89–104 (96.8 ± 4.07 , $n = 11$); *C. u. fuertaventurae*: males 87–95 (90.8 ± 2.94 , $n = 6$).

Mensural data provided from larger sample sizes by Alonso et al. ([23](#)) are comparable to those in Cramp and Simmons ([1](#)), but indicate shorter tarsus lengths, likely due to differences in measuring technique. Those reported by Alonso et al. ([23](#)) for the nominate subspecies are: females 88.0 mm (SD = 4.7, $n = 146$); males 98.5 mm (SD = 5.6, $n = 142$). 1.31 kg (SD = 0.104,

$n = 21$), and for the Canary Houbara: females 81.9 mm (SD = 4.3 $n = 21$); males 90.3 mm (SD = 4.0, $n = 29$).

Mass

For wild-living individuals of subspecies *C. u. undulata*, mean weight of females 1.33 kg (SD = 0.12, $n = 146$), and of males 1.95 kg (SD = 0.17, $n = 142$) (23).

For wild-living individuals of subspecies *C. u. fuertaventurae*, mean weight of females 1.31 kg (SD = 0.104, $n = 21$), and of males 1.82 kg (SD = 0.118 $n = 32$) (23).

Systematics

Systematics History

Traditionally (e.g., 24, 25) this species was treated as conspecific with [Macqueen's Bustard \(*Chlamydotis macqueenii*\)](#) of southwestern and Central Asia, which is often known as the "Asian Houbara". That the two houbara species (as recognized here) form reciprocally monophyletic groups is now unrefuted (26, 27, 28, 29, 30, 31) and they are thought to have diverged nearly one million years ago (29, 31). Combining these molecular data with courtship (see 32, 3, 33) and plumage features (34), as well as differences in vocalizations (35, 34), the case was gradually made for their treatment as separate species (34, 36, 37, 38), although not without dissent and concern that the differences described "may well be functionally relatively trivial and would not prevent interbreeding" (39). Adopting the Tobias et al. (40) system of scoring phenotypic characters to determine taxonomic rank (where a score of seven or more denotes a species), del Hoyo and Collar (41) itemized and scored these differences as follows (*Chlamydotis macqueenii* features listed first): "Black-tipped white vs all-white crown with white-based black vs all-black ornamental neck plumes ([score]3); pale blue-grey vs finely peppered black-and-white foreneck base and breast in mature male (2); position of crown feathers in display, falling forward over bill vs sweeping up and back (2); vocal differences in display (sequence ends in series of notes rather than one single note) (2)."

Geographic Variation

Relatively minor in overall plumage coloration (and perhaps size) alone.

Subspecies

Two subspecies recognized (42).

EBIRD GROUP (MONOTYPIC)

Houbara Bustard (Canary Is.) *Chlamydotis undulata fuertaventurae* ⓘ

C. u.
fuertaventurae

 eBird map

 908 photos

 0 recordings

Systematics History

Houbara fuertaventurae [Rothschild and Hartert, 1894, Novitates Zoologicae](#) 1:689.—
Fuerteventura, Canary Islands, Spain.

The holotype, a male collected at Oliva on 20 March 1889 by R. Gómez, is held at the American Museum of Natural History, New York (AMNH 547565) ([43](#)).

Distribution

The majority of the population now occurs on the larger islands of the easternmost Canaries—Fuerteventura and Lanzarote—with much smaller numbers on Graciosa (off the northern tip of Lanzarote), and only occasional sightings on the islet of Lobos (at the north end of Fuerteventura) ([44](#), [45](#), [46](#), [47](#)). Historically, this subspecies was present also on the islands of Gran Canaria, Alegranza, and possibly even Tenerife ([48](#)).

Identification Summary


Overall darker than *C. u. undulata* ([3](#)), with the upperparts, wing-coverts, and tail more heavily and darkly vermiculated black brown, invading the paler cinnamon-buff ground color to a greater extent ([1](#)). Slightly smaller in linear measurements and mass than nominate *C. u. undulata* ([23](#)).



Lateral view (subspecies *fuertaventurae*).

Dorsal view (sub:)

EBIRD GROUP (MONOTYPIC)

Houbara Bustard (North African) *Chlamydotis undulata undulata* 

C. u. undulata
+1

 eBird map

 12 photos

 0 recordings

Systematics History

Psophia undulata [Jacquin, 1784, Beiträge zur Geschichte der Vögel](#), p. 24, [Pl. 9](#).—"Africa"
(based on an aviary specimen brought from Tripoli).

The whereabouts of Jacquin's specimen, which was taken from Tripoli to Vienna's Tiergarten Schönbrunn (zoo), is unknown but it is probably no longer extant; it is certainly not at the Naturhistorisches Museum Wien ([49](#)).

Distribution

Formerly widespread across pre-Saharan North Africa, from Morocco, Western Sahara, and Mauritania in the west, to the north coast and Western Desert of Egypt in the east, where it was locally common into the 1980s ([50](#)). Following recent declines, the easternmost limit of its range appears to have retracted to Libya ([51](#)). Between 2022 and 2023, almost 7,000 captive-bred individuals have been released near the coast of northern Egypt (<https://houbarafund.gov.ae/ breeding-release>), these birds probably are the product of mixed Algerian and Moroccan genetic lineages.

Identification Summary

Described under [Plumages](#).



Lateral view (subspecies *undulata*).

Dorsal view (sub:

Related Species

Published analyses of phylogenetic relationships within the Otidae have thus far been

limited to use of mitochondrial sequences. Rather unsurprisingly, these data resolved *Chlamydotis undulata* as being the sister species of its sole congeneric, [Macqueen's Bustard \(*Chlamydotis macqueenii*\)](#) (26, 27). Divergence times of the two taxa have been debated in the literature: Idaghdour et al. (28) suggested the two species split ca. 430,000 years ago, whereas Pitra et al. (29) calculated a much older divergence time of ca. 1 million years. The latter projection was validated by Korrida and Schweizer (31) who, using more powerful analysis and broader sampling, predicted that the two species diverged during a period of extreme aridity approximately 0.9 million years ago.

Chlamydotis forms a clade with [Otis](#) (26, 27, 52). Identity of the species within the sister clade of these two genera is less clearly resolved, with [Eupodotis](#) and [Afrotis](#) suggested by the work of Horreo et al. (52) and Pitra et al. (26), but [Ardeotis](#) and [Eupodotis](#) suggested by Broders et al. (27).

Hybridization

Molecular research indicates that the two houbara species diverged approximately one million years ago (31), and interbreeding in the wild has not been documented.

Captive breeding was initiated prior to the relatively recent recognition of the two houbaras as separate species. In this context, hybrid offspring have been successfully created at large scale via artificial insemination.

Nomenclature

Sometimes known as the "African Houbara" (53), with [Macqueen's Bustard \(*Chlamydotis macqueenii*\)](#) then usually referred to as the "Asian Houbara" (54).

Names in other languages:

Arabic: حبارى إفريقي

French: Outarde houbara

Kabyle: Tirzi

Spanish: hubara

Fossil History

Lydekker (55) described a Middle Miocene specimen from Bavaria with similar measurements to a houbara, though its identity as a bustard has been questioned (56). A new species, *Chlamydotis mesetaria*, morphologically similar to modern-day houbara was identified in a Pliocene deposit on the northern Iberian Plateau (57). Vojinstvens'kyj (58) commented on a Pliocene specimen of the fossil species *Chlamydotis pliodeserti* from Odessa, Ukraine, named by Serebrovs'kyj in 1941, which the first-named author synonymized with *Gryzaja odessana* Zubareva, 1939 (see 59).

In more recent pre-history, fossil remains of *Chlamydotis undulata sensu lato* dating to 10,000 BP have been found at Qermez Dere site in Iraqi Kurdistan, and dating to 11,000–13,000 BP in

Galilee ([60](#)). Excavations at archeological sites have revealed extensive human use of *Chlamydotis undulata sensu lato* in Jordan ([61](#)). Remains have also been found at human sites in the upper Euphrates Basin ([62](#)).

Distribution

Distribution

The nominate subspecies is currently sparsely distributed across more than 4,000 km of North Africa west of the Nile River ([63](#), [1](#), [64](#), [65](#)). On mainland Africa (nominate *undulata*), there are no recent records of purely wild birds in Mauritania, although this country was always at the extreme southwestern edge of the species' geographic and ecological range ([66](#), [67](#), [68](#)). In Western Sahara and Morocco, the species was at least formerly quite widely distributed and locally common ([69](#), [70](#), [71](#), [72](#)), but there are hardly any recent records in the first-named territory ([67](#)). In Morocco, some managed areas are supplemented by releases of tens of thousands of captive-bred birds of mixed Moroccan-Algerian lineage, and at least one of those populations is believed to be no longer self-sustaining without continued releases, even if hunting were to cease ([73](#), [74](#)).

In central North Africa, the Houbara Bustard occurs across the pre-desert zone of Algeria and Tunisia ([75](#), [76](#), [51](#), [66](#)), although in the latter country its once widespread distribution in the south and center has been greatly reduced to only a "small relict population" ([77](#), [78](#)), and its range in Algeria has evidently been significantly overestimated, and also regularly supplemented with captive-bred birds from Moroccan breeding centers (K. de Smet in [67](#)). Further east, the species occurs in Libya, where its distribution has apparently shifted south in recent years (see [79](#)) and large numbers have not persisted since at least the 1970s ([80](#)), whilst in western and northern Egypt—where the species was formerly also quite widespread ([81](#), [50](#))—the wild form of the species may now be extinct ([51](#), [67](#)). Recent releases of captive-bred birds, likely of mixed Moroccan/Algerian ancestry, have occurred along the Mediterranean coast. Thus the overall picture today is of remote and scant remnant wild populations scattered across small parts of North Africa, but most contemporary sightings are more likely to be of released birds and their progeny ([67](#)).

Subspecies *fuertaventurae* is now restricted to the easternmost islands of the Canaries, principally on Fuerteventura and Lanzarote, with much smaller numbers on Graciosa, and now only occasional records on the islet of Lobos, where the species was formerly resident ([44](#), [48](#), [82](#), [46](#)). Even in this archipelago, the distribution is fragmented, with the largest numbers in central Lanzarote and northern Fuerteventura, but much smaller pockets in southwest Lanzarote and across the southern half of Fuerteventura ([83](#), [47](#), [84](#)).



This species is very rare nowadays in Western Sahara.

It occurs in small n

Historical Changes to the Distribution

The overall picture is of greatly reduced populations across the North African range of this species, and of extirpated or small relict populations of wild ancestry replaced or supplemented, at many sites repeatedly or even annually, by large numbers of captive-bred birds.

In the west, on the Atlantic seaboard, the Houbara Bustard at least formerly occurred in Mauritania (in Tiris Zemmour, Adrar, and Inchiri, but not as far as once reported ([68](#))) along the border with Western Sahara, although the habitat here has always been regarded as marginal, and recent confirmed records appear to be entirely lacking ([85](#)), except for captive-bred released individuals (some 2,200 birds in the period 2017–2018; [67](#)). In Morocco, the Houbara Bustard was widely but sparsely distributed south of the High Atlas, and it was locally abundant in eastern Morocco until at least the 1950s. The species is now much reduced in numbers (but perhaps not in overall range within the country), especially in Dadès-Draa and Tafilalt, with particularly grave losses in the semi-desert areas of Middle Moulouya since the 1960s ([86](#), [71](#)). Widespread extirpation of wild populations is understood to have occurred in Morocco, driven by ongoing pressures from falconry and the associated releases of over 200,000 captive-bred individuals ([65](#), [71](#), [67](#), [87](#)). In Tunisia its range has been greatly reduced, the species having been lost from the north of the country ([69](#), [65](#)). In Algeria, still common in Hammada du Guir and “fairly well represented” around El Golea in the 1970s, but already “very rare” in the Dayas ([75](#)). Historically present on the coastal plain and of Libya north of Ajadabia, south of the Jebel Akhdar range and east to the Egyptian border, with flocks of hundreds of birds noted in the 1940s (Bullman in [51](#))). In Egypt wild populations may well have been extirpated comparatively recently ([51](#)). In the latter country, it was formerly common in the Mediterranean coastal desert west of Alexandria, and near Wadi el Natrun ([88](#)), and the species remained at least locally numerous in parts of this region until the early 1980s ([81](#), [50](#)). Goodman and Meininger ([50](#)) considered that the final stronghold of the Houbara Bustard in Egypt seemed to be between Matruh and Salum. Captive-bred birds, likely of mixed Moroccan/Algerian lineages, have since been released in El Omiyed National

Park.

In the extreme southeast of the species' distribution, there are said to be old (but no recent) records from northern Sudan ([89](#), [90](#), [65](#); although Nikolaus [[91](#)] was unable to locate any). Its current status there is unknown ([64](#)), but in contrast to Goriup ([65](#)) who thought that the species might still occur, despite the number of falconry parties that visit the country, Collar ([67](#)) considered the evidence for its occurrence in Sudan to be unconvincing. Dowsett and Forbes-Watson ([92](#)) listed Houbara Bustard (including both *Chlamydotis macqueenii* and *Chlamydotis undulata*) as a vagrant to Sudan, presumably in relation to the Macqueen's Bustard (*Chlamydotis macqueenii*) recorded in November 1920 (see [Movements and Migration](#) for the latter species).

In the Canaries (subspecies *fuertaventurae*), the species has apparently always been confined to the easternmost islands, but it was considered reasonably numerous in the late 1800s, with a decline becoming evident in the 1930s ([93](#), [1](#)). Whilst Bannerman ([93](#)) was mistaken to declare the subspecies extinct, it formerly did also occur on Alegranza ([48](#), [82](#)) and historically it was known from Gran Canaria ([93](#)), and has only relatively recently been discovered to occur in small numbers on Graciosa ([82](#)). This taxon was also formerly much more abundant on the islet of Lobos, where Houbara Bustard certainly bred in the 1950s, and perhaps even more recently, but is probably now solely a visitor from nearby Fuerteventura ([82](#)).

Habitat

Habitat

Arid sandy semi-desert with tussock grass, flat, bare, stony plains dotted with xerophytic and halophytic scrub, wormwood steppe, and sandy grasslands, often visiting marginal cultivation during the non-breeding period. Scrub cover used in Morocco includes *Artemisia*, *Farsetia occidentalis*, *Hammada scoparia*, and *Nucularia* ([71](#)). Flat open areas offering good long-range visibility and more humid flats that are relatively well vegetated are selected in eastern Morocco, where areas subject to heavy usage by shepherds and their herds are shunned ([94](#)). The species occurs up to 1,850 m in the southern foothills of the Eastern High Atlas in Morocco ([71](#)).

The Fuerteventura population uses cultivated fields (gavias) year-round, but it mainly occupies areas covered by xerophytic vegetation such as *Salsola vermiculata*, *Launaea arborescens*, *Lycium intricatum*, and *Suaeda vera*, with the sandiest parts dotted with *Euphorbia paralias*, *Lotus* sp., *Ononis natrix*, and various Chenopodiaceae and Polygonaceae ([82](#)). Habitat selection in the Canary Islands also involves a preference for relatively level areas with less than 60% rock cover, a low density of roads and tracks, and at least 650 m from urbanization ([95](#)); here, topographic and anthropic features are the main determinants of the species' presence and habitat use, with sloping terrain, proximity to urban areas, density of paved roads and rural tracks all known to negatively impact the Houbara Bustard ([95](#), [83](#)).



Bird in its habitat; Meknès-Tafilalet, Morocco.



Bird in its habitat; !

Habitat in Breeding Range

In the Middle Atlas of Morocco, it has been found that habitat use differs between the sexes during the breeding season, but not in the non-breeding season. In spring, when food resources are abundant and uniformly distributed spatially, males preferred "temporarily flooded areas" and females selected "reg [stony desert] with tall perennials" offering both food and cover for nests ([96](#), [97](#)).



Breeding habitat; Canarias, Spain.

© Peter Castell Fuerteventura, Canarias, Spain | Feb 2003 [Macaulay Library](#)

Habitat in Nonbreeding Range

In the Canary Islands, the predictable food resource offered by gavias makes a significant contribution to the maintenance of this subspecies ([98](#)); satellite telemetry indicates that the birds use cultivated lands during the drier non-breeding season and fallows during the breeding season ([99](#)).

Movements and Migration

Dispersal and Site Fidelity

In Morocco, there are fewer than a handful of records (in May, August, and November) outside the normal range ([70](#)). Erratic movements, apparently in response to local weather conditions, have been reported in Morocco ([70](#)). Sightings of some of the "Houbara Bustard" reported in Europe in the 1800s may have referred to dispersive or irruptive movements of birds from Morocco, e.g., perhaps into Spain, rather than being indicative of migratory movements ([1](#), [100](#), [101](#)).

The insular subspecies *C. u. fuertaventurae* is known to move between islands within the Canaries (see [102](#), [101](#), [103](#)). A recent observation on Fuerteventura of a ringed individual originating from a breeding center in Morocco is notable, indicating the potential for fairly long over-water crossings ([104](#)) as are also known for [Macqueen's Bustard \(*Chlamydotis macqueenii*\)](#). From a conservation standpoint, this discovery is of distinct concern, given that the Canaries were thought to harbor the last genetically unmodified, fully wild population of this species ([67](#)).

Migration Overview

In North Africa, nominate *C. u. undulata* undertakes at least small, relatively local movements between what are apparently separate breeding and non-breeding grounds, with the latter being somewhat changeable according to conditions prevailing at the time ([96](#), [105](#), [106](#)). The Canarian subspecies *C. u. fuertaventurae* undertakes seasonal movements between breeding and non-breeding areas ([107](#)).

Migratory Behavior

In the Canary Islands, telemetry research found that more than one-third of individuals belonging to both sexes ($n = 41$) move away from their breeding areas, typically undertaking such post-nesting seasonal movements at night ([101](#)).

Control and Physiology of Migration

A genetic component to the distance and direction of migration has been noted in the closely-related [Macqueen's Bustard \(*Chlamydotis macqueenii*\)](#), of which there are both resident and migratory forms ([108](#)). Information is needed for the Houbara Bustard.

Diet and Foraging

Feeding

The feeding behavior of *Chlamydotis undulata* has not been well documented, although it appears similar in almost all respects to the formerly conspecific [Macqueen's Bustard \(*Chlamydotis macqueenii*\)](#). Launay and Paillat ([109](#)) documented the latter, noting that birds

orient their body slightly downwards with the neck bent backwards on itself and the bill pointed downwards. Birds move slowly but purposefully, pausing when they encounter food. When the resource is plant material, the bird adopts what Launay and Paillat (109) termed "picking posture" with precise and deliberate movements of the neck in order to take one food item at a time. When catching and handling animal food items, one of four behaviors is exhibited: (1) "sticking behavior," observed when birds were taking ants; (2) "chasing behavior," exhibited across short distances, terminating in a springing movement of the body; (3) "flying prey catching behavior," when birds (rarely) attempt to catch flying insects, occasionally accompanied by rather unimpressive leaps into the air; and (4) "large prey handling posture," used for tackling comparatively larger prey items such as scorpions.



0:00 / 0:47

Bird foraging.

© Josep del Hoyo Fès-Boulemane, Morocco | 03 Apr 2007 [Macaulay Library ML 201269651](#) | [eBird S64819680](#)

Diet

Apparently variable and opportunistic year-round, with no clearly discernible seasonal or geographical pattern. The diet includes a wide range of vegetable matter (including fruits, seeds, shoots, leaves, and flowers) as well as some animal material, particularly Coleoptera, but also other invertebrates and small vertebrates (e.g., scorpions, small snakes, and lizards).

Detailed analyses of stomachs of birds killed by falconers in Morocco have identified plant material of the families Poaceae, Chenopodiaceae, Rhamnaceae, Asteraceae, and Brassicaceae, with the dominant species identified being *Launaea nudicaulis*, *Scorzonera undulata*, *Diploaxis harra*, and *Hordeum vulgare*. The animal component of the diet exclusively comprised invertebrates, chiefly Coleoptera and Hymenoptera, including four main families, namely Tenebrionidae, Curculionidae, Chrysomelidae, and Formicidae. There were no significant dietary differences between wild birds and those originally raised in captivity (110), nor between the sexes in a study undertaken during the non-breeding season (111). Other reports of stomach contents and observations of birds feeding in Morocco and

Tunisia comprised mainly vegetable matter: *Artemisia* (Compositae), *Lycium* fruits (Solanaceae), and *Argania* drupes (Sapotaceae) ([112](#), [113](#), [114](#), [115](#)), as well as grains ([116](#)) including barley ([112](#)); animal food reported by some of the same authors included ants (Formicidae), beetles (Buprestidae, Tenebrionidae, and Chrysomelidae), grasshoppers (Orthoptera), arachnids, reptiles, and snails ([116](#), [112](#), [114](#), [115](#)). During two days of observations in Algeria, Gaucher ([117](#)) observed a nesting female feeding on plant matter, mainly Leguminosae (fruits of *Farsetia stylosa* and *Argyrolobium uniflorum*), Zygophyllaceae (fruits and flowers of *Fagonia glutinosa*), and Cistaceae (buds, leaves, and flowers of *Helianthemum ruficomum*), as well as ants (Formicidae) and beetles (Tenebrionidae).



0:00 / 0:40

Bird feeding on flowers.

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In the Canary Islands, however, the diet of *C. u. fuertaventurae* appears to be skewed in favor of animal matter, with large quantities of the ant *Messor maurus* (Formicidae) and the beetle *Zophosis plicata* (Coleoptera) being consumed ([118](#)), and Bannerman ([93](#)) also reported snails, caterpillars, lizards, and dung beetles being taken; vegetable food comprised mainly annual plants, flowers of *Launaea arborescens*, and fruits of *Lycium intricatum*. In agricultural areas of the archipelago, Houbara Bustard will also eat alfalfa (*Medicago sativa*), cultivated peas, chickpeas, and trefoils, and, in summer, fruits of the fig *Ficus carica* ([118](#)).

Food Selection and Storage

Caching not noted. Information on food selection needed.

Nutrition and Energetics

Data not yet published, but likely available from captive breeding centers.

Metabolism and Temperature Regulation

Data not yet published, but likely available from captive breeding centers.

Drinking, Pellet-Casting, and Defecation

Considered to be probably adapted to survive without drinking (93) and it has been suggested that the species derives sufficient moisture from dew on vegetation eaten in early morning (114).

Sounds and Vocal Behavior

Sounds and Vocal Behavior

More or less silent, with the exception of low-frequency booms produced by males during display.

Vocalizations

Development

Male chicks produce contact and distress calls that exhibit individual signatures (119); data on female chicks unpublished.

Vocal Array

The displaying male Houbara Bustard utters 2–11 (120) low, deep booming notes at two-second intervals (121) with no variation in structure (34), and decreasing in intensity and frequency over the course of the series. Booming is said to be audible to observers up to 50 m away. In Canarian populations, nocturnal booming sequences contain more booms than daytime series (122). Inter-individual variation in these vocalizations may provide information for individual discrimination (120). Male vocalizations during display differ between Houbara Bustard and Macqueen's Bustard (*Chlamydotis macqueenii*), which were formerly considered as conspecific (34).

Nonvocal Sounds

None reported.

Behavior

Behavior

Ethograms on Macqueen's Bustard (*Chlamydotis macqueenii*) were published by Mendelssohn et al. (123), Ponomavera (124), and Launay and Paillat (109), with Collins (125) listing similar behaviors for Houbara Bustard, but nevertheless further research is clearly required to establish that these species' ecologies are highly analogous.

Locomotion

Wingbeats are shallow, reminiscent of a slow flick rather than a true beat, but the species is capable of achieving speeds of up to 65 km/h ([1](#)). Average flight speed during seasonal movements among male and female Houbara monitored with telemetry in the Canary Islands was approximately 9 m/s (32 km/h; [107](#)). Flight is usually fairly low, but birds will rise higher in the air to avoid a stooping falcon, and is powerful and fast (N. J. Collar in [1](#)). Prefers to run from danger, rather than fly, although above all the species relies on its cryptic coloration (and by squatting down) to escape predation; after running away, the bird may pause to relocate the threat, then run farther, fly a distance, and finally squat upon landing; alternatively, however, sometimes a fleeing bustard may take flight immediately, then run on after landing again (N. J. Collar in [1](#)).

Gait is similar to that of many other bustards. The slow walk of this species has been described as "mincing", and in alarm it will jerk its neck back and forth in a manner said to recall the movements of a swimming [Eurasian Moorhen \(*Gallinula chloropus*\)](#).



0:00 / 0:34

Bird walking.

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Self-Maintenance

Self-maintenance behavior of the present species is probably similar to that described for the formerly conspecific [Macqueen's Bustard \(*Chlamydotis macqueenii*\)](#).

Agonistic Behavior

Agonistic behavior of the present species is probably similar to that described for the formerly conspecific [Macqueen's Bustard \(*Chlamydotis macqueenii*\)](#).

Sexual Behavior

Mating System

The species has been suggested to breed via an "exploded-lek" mating system in which males form loose aggregations where they display, and are visited and selected by females (97). However, this has been disputed, as analyses of an eastern Moroccan population found that the species did not fulfill common expectations of a lek-mating system: there was no male reproductive skew, suggesting no apparent selective female mate choice, and no apparent male benefit from lekking; in contrast, a high level of polyandry (60% of nests) was recorded, suggesting that sperm competition may operate (126). Corresponding to expectations of a lekking system, only a small percentage of breeding female home ranges and nests were located within leks (96). Males concentrate on their display grounds, to which they remain exceptionally faithful both within and between breeding seasons (105, 106).



0:00 / 0:18

Male displaying.

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Courtship, Copulation, and Pair Bond

The highly visual breeding display of males was described and illustrated by Gaucher et al. (34). First, a pre-running display involves the feathers at the sides and base of the neck and on the crest being erected while the male moves forward, slowly placing one foot directly in front of the other. This is followed by a running display, during which the base of the head lies on the back between the wings, display feathers obscure the breast and face, and the male runs in a straight line or circularly while swinging his neck. The male may then stand and perform calling behaviors as described under [Vocalizations](#).

Differences in display behavior (and appearance) from Macqueen's Bustard (*Chlamydotis macqueenii*) were elucidated in some detail by Collar and Combreau (33).



0:00 / 1:41

Male displaying.

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Brood Parasitism of Conspecifics

Intraspecific brood parasitism (egg dumping) has been identified via genetic analysis of eggs collected for captive breeding, with a conservative estimate of brood parasitism in 27% of all clutches, and is especially prevalent in larger clutches ([126](#)).

Social and Interspecific Behavior

Solitary during the breeding season, but gregarious and prefers to form same-sex flocks during the non-breeding season ([1](#)). During the breeding season on the Canary Islands, 95% of male and 70% of females were observed singly, and the remainder in groups of 2–5 individuals ([127](#)).

Predation

In Morocco, 74% of nests monitored by camera trap were predated ([73](#)). Among those lost, 90% were predated by red foxes (*Vulpes vulpes*), and the remainder by golden jackals (*Canis aureus*), free-ranging feral dogs, desert hedgehogs (*Paraechinus aethiopicus*), [Common Raven \(*Corvus corax*\)](#), and [Brown-necked Raven \(*Corvus ruficollis*\)](#).

Breeding

Breeding

Many facets of this species' breeding biology remain unknown over much of its range, with most of the available data stemming from captive-breeding and release programs (which don't always provide information that can be inferred to pertain to wild populations), and from

the Canary Islands.

Phenology

The breeding season throughout the species' range extends from November to June, but most birds breed in March/April prior to the onset of the boreal summer and the hottest months (6, 3). Rainfall is probably the primary factor affecting the timing of breeding (113). For example in Morocco, courtship display is regularly observed in March and April, but sometimes also in September and October after good autumn rains, and eggs have been recorded in all months between December and early June (but mostly in March and April, with later clutches perhaps mainly or exclusively replacements), and there is one record of a brood in the third week of October, suggesting the clutch was initiated in late September, after unseasonably heavy rainfall in August of the same year (71). Eggs have been recorded in April in western Egypt (50) and in the Canary Islands between January and April, occasionally as early as December (93, 44).



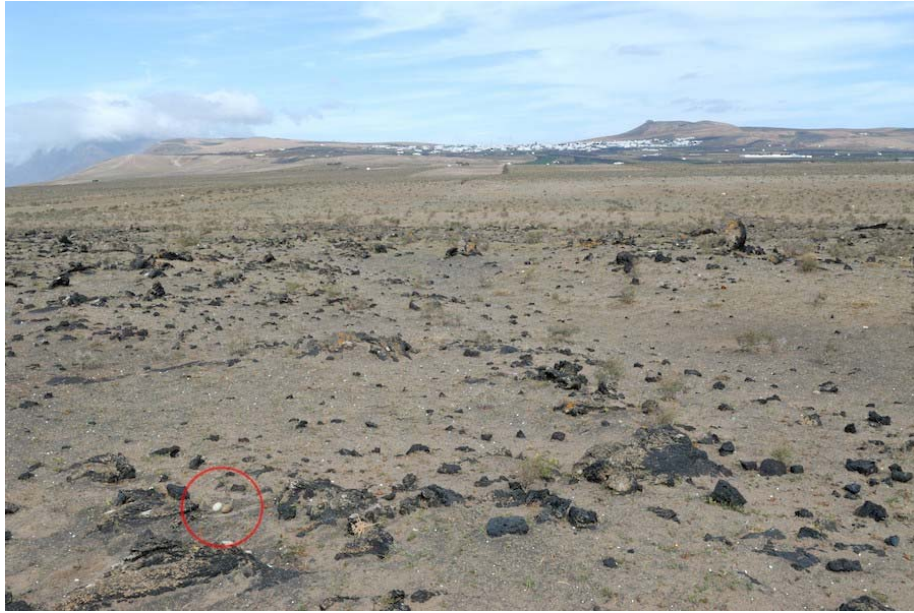
Bird incubating; March, Fès-Boulemane, Morocco.



Bird incubating; M

Nest Site

On open ground but usually near cover (1). Nests in Algeria were always located on the slopes of elevated land features, affording a long-distance view and protection from flooding by seasonal rains; most ($n = 21$) were oriented south, whilst three nests were oriented east, and one north. Vegetation was usually present within 0.2–1.2 m of the nest (6).



Nest site (circled in red); Canarias, Spain.

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Nest

Structure and Composition

Like most bustards, the Houbara Bustard creates a simple, shallow depression on the ground ([6](#)). In captivity, females apparently pick up nearby stones and place them beside the nest, or even on their back from which they fall off ([6](#)).

Dimensions

Approximately 15 cm in diameter ([6](#)).



Nest.

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Eggs

The eggs of this species have been described as having a relatively smaller yolk and relatively more albumen than those of [Macqueen's Bustard \(*Chlamydotis macqueenii*\) \(128\)](#). Note, however, that the samples used in this study were from captive-bred lineages, for which deviations in egg weight and volume have been associated with age, inbreeding, and generations in captivity ([129](#)).

Shape

Subelliptical ([6](#)).

Size

C. u. undulata: 58–68 × 43–48 mm (mean 62 × 45 mm, $n = 60$) ([130](#)); or mean length 62.6 mm (range 56.4–71.0 mm; SD = 3.0 mm); mean width 44.0 mm (40.8–47.1 mm; SD = 1.4) ([6](#)).

C. u. fuertaventurae: 60–69 × 42–49 mm (mean 65 × 45 mm, $n = 22$) ([93](#)).

Mass

Estimated at 67–68 g for both subspecies ([130](#)).

Egg weight and volume are noted to decrease in captivity in association with increasing age, inbreeding, and number of generations in captivity ([129](#)). At one captive-breeding complex in Morocco, mean egg weight was 62.4 g (SD 6.2, $n = 85,314$ data points, 4,545 individuals) ([129](#)).

Color and Surface Texture

Quite variable, from pale blue-green with light brown blotches to dark olive-brown blotched with black. The color of eggs of the nominate subspecies is typically (but not always) consistent within clutches, but can differ between them ([6](#)). Those of subspecies *fuertaventurae* have been described as rich buff-brown, sparingly spotted and blotched with chocolate-brown, and underlain with purple markings ([93](#)).

Clutch Size

One to three eggs have been recorded in a clutch ([1](#), [71](#)). In Algeria, 64% (of $n = 56$) of clutches comprised two eggs, 34% three, and 2% just one ([6](#)).



Clutch of three eggs.



Clutch of two eggs.

Incubation

Egg Laying

Eggs are typically laid two or three days apart ([6](#)).

Incubation Period

Typically 23–24 days ([6](#), [131](#)).



0:00 / 0:29

Bird incubating.

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Hatching

Not well known, although Gaucher ([6](#)) noted that hatching is relatively synchronized, even when eggs were laid 48–72 hours apart, which suggests that incubation commences only when the clutch is completed.

Young Birds

Chicks have golden and buff down adorned with fairly intricate white, black, and sepia markings ([6](#)).



Downy chick, age 1–2 days.

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Sex Ratios and Sex Allocation

The sex ratio in a wild population has been estimated just once; recent surveys on Lanzarote (in the Canaries) revealed an imbalance in favor of females, with 1.41 females per male ([127](#)).

Parental Care

Birds are precocial after hatching and thus comparatively independent ([6](#)); nonetheless, young stay with the female parent into their first autumn.

Cooperative Breeding

Not observed.

Brood Parasitism by Other Species

Not recorded.

Fledgling Stage

Information needed.

Immature Stage

Information needed.

Demography and Populations

Measures of Breeding Activity

Few data from wild populations in North Africa, but recent surveys over three years on Lanzarote, in the Canary Islands, have suggested that the annual production of juveniles there

varies between 5.83 and 19.57 juveniles per 100 females ([127](#)).

Life Span and Survivorship

Information on life span of wild individuals needed.

Harris et al. ([87](#)) used tracking data from a large-scale translocation program in Morocco to estimate long-term survival in a reinforced population of *Chlamydotis undulata undulata*. They estimated annual survival rates of captive-bred and wild-born individuals, and considered sources of individual and temporal variation in survival, including how age-specific rates vary between captive-bred and wild-born birds. Mean annual survival of adult captive-bred females was 0.492 (95% CI = 0.381–0.602), adult captive-bred males 0.408 (95% CI = 0.300–0.530), and adult wild-born birds 0.723 (95% CI = 0.651–0.785) ([87](#)). Survival of wild-born bustards was relatively high and constant beyond the first year of life, whereas survival of captive-bred birds increased more gradually in early years, approaching that of wild-born individuals in older ages: annual survival of first-years was also similar for male and female captive-bred bustards (females: 0.432; 95% CI = 0.321–0.549; males: 0.446; 95% CI = 0.316–0.576), and survival of wild-born bustards in their first year was 0.307 (95% CI = 0.159–0.443) ([87](#)).

Disease and Body Parasites

Information is available concerning diseases and parasites of trafficked Houbara Bustard, and of flocks within breeding centers (e.g., [132](#), [133](#), [134](#)). However, these birds are held at artificially high densities and may be exposed to vectors not encountered in the wild ([135](#)). In the United Arab Emirates, recent jumping of deltacoronaviruses between falcons and bustards has been recorded ([136](#)).

Causes of Mortality

Quantitative data needed for mainland populations, in which hunting and poaching will undoubtedly play a major role.

Alonso et al. ([137](#)) investigated cause-specific mortality in Canarian populations of Houbara Bustard (*Chlamydotis undulata fuertaventurae*). Of 51 individuals tagged with solar-powered loggers for a mean 3.15 years, seven were killed on aerial lines (13.73% of the sample; five on power lines, two on telephone lines), one (1.96%) on a wire fence, four on roads (7.84%), and one was predated by a cat (*Felis catus*) (1.96%) ([137](#)). Also, in the Canary Islands, 66 dead bustards were found under powerlines during two periods in 2008, leading Garcia-del-Rey and Rodriguez-Lorenzo ([138](#)) to estimate that 92 and 23 individuals probably died in that year on Lanzarote and Fuerteventura, respectively. There is also additional evidence of collisions with vehicles, with two road-killed bustards being found on Lanzarote over the course of twice-monthly surveys across a 12-month period in 2010/2011 ([139](#)); and four road-killed individuals (all males) were reported on Lanzarote, Fuerteventura, and La Graciosa) during 2017–2023 ([137](#)).

Population Spatial Metrics

Individual Distance

During the breeding season, males in Morocco display at distances of 550 ± 84 m (106), and within home ranges of 8 km^2 that overlapped considerably (105). In southern Tunisia, density of males was calculated as 0.04 males per km^2 (140).

In relation to female density during the breeding season, a survey of $1,800 \text{ km}^2$ of the Boudenib Plateau in Morocco located 51 nests, or an average of one nesting female per 36 km^2 (but none in the same area during a repeat survey in 1999), whilst around Merzouga (Tafalilt), an area of $1,600 \text{ km}^2$ harbored 20 nests in 1998, or one nesting female per 15 km^2 , but just five nests in the following year (one female per 60 km^2) (Peske and Dawson in 71). A study in eastern Morocco found little overlap between female breeding areas and male leks, and 78% of nests were located away from leks (96).

Home Range Size

In eastern Morocco, home ranges were calculated from radio-tagged birds, with the mean annual home range of males (17 km^2) being smaller than that of females (146 km^2), and the majority of male home ranges had a unimodal distribution (86%), whereas 67% of female home ranges were multimodal (105). Consequently, the amplitude of female movements was larger (mean: $44 \text{ km}/13 \text{ km}$).

A study using radio telemetry during the breeding season in Morocco found females to occupy larger home ranges ($14.1 \pm 9.4 \text{ km}^2$) than males ($3.3 \pm 2.1 \text{ km}^2$) (96).

A satellite telemetry study of Canarian populations identified seasonal variation in home ranges, with smaller movements made during the breeding season (displaying males, $0.61 \pm 0.43 \text{ km}^2$, $n = 19$; non-displaying males, $2.61 \pm 1.52 \text{ km}^2$, $n = 6$; breeding females, $0.89 \pm 0.60 \text{ km}^2$, $n = 6$; non-breeding females, $2.13 \pm 1.17 \text{ km}^2$, $n = 18$; males during non-breeding season, $1.12 \pm 0.61 \text{ km}^2$, $n = 19$; females during non-breeding season, $1.43 \pm 1.18 \text{ km}^2$, $n = 6$) (99).

Population Status

The Houbara Bustard is currently assessed as Vulnerable by IUCN, with "very rapid" declines registered over the past decade (141). The same assessment tentatively suggests a global population of 10,450 to 14,975 individuals, noting however that estimation of the wild population is complicated by the low population density of this species, its cryptic behavior and remote habitats, but also by large-scale releases of captive-bred birds which in places vastly outnumber the remaining wild birds (see [Conservation and Management](#)).

The limited distribution of the Canarian subspecies has been more comprehensively surveyed, with a population of 537–577 individuals estimated, of which 440–452 are on Lanzarote, 85–109 on Fuerteventura, and 12–16 on La Graciosa (142). Sex ratio on the island of Lanzarote is estimated at 1.41 females per male (127).

Population Regulation

An eight-year study in Morocco in a population regularly supplemented with captive-bred Houbara Bustard found daily nest survival rate to be negatively impacted by local population

density ([143](#)).

Conservation and Management

Conservation Status **VU** [Vulnerable](#)

VULNERABLE. CITES Appendix I and CMS Appendix II. Listed as Vulnerable (A2cd+3cd+4cd) by BirdLife International, according to IUCN Red List criteria ([53](#)) because of an ongoing rate of decline exceeding 30% (but less than 50%) per three generations. Identifying the precise rate of decline in this species has proven problematic ([53](#)) owing to difficulties in estimating its numbers across the vast expanse of North Africa (its distribution may cover as much as 6,100,000 km², but equally could be just 25% of this) ([65](#), [53](#)). However, reports in Morocco of all populations being "severely reduced" ([71](#)), in Algeria of 1,000 birds being killed annually ([76](#)), and in Tunisia of substantial declines ([77](#)), the likelihood that declines in this species exceed 30% is high. Status almost throughout its distribution is very difficult to gauge owing to the species' highly cryptic coloration, elusive behavior, and remote and often inhospitable habitat ([67](#)). The breeding range of nominate *undulata* includes northernmost Mauritania ([144](#), [64](#), [145](#)) but apparently only captive-bred and released birds remain ([67](#)), Western Sahara (pitifully few recent records; [67](#)), Morocco, Algeria, Tunisia (where it is now very rare and restricted to the far south; [77](#)), Libya (where information is sparse; [67](#)), and Egypt west of the Nile (where speculated to be now extirpated; [51](#)), perhaps with old records from Sudan ([89](#), [65](#)), but presence there (formerly or currently) seems to be at best unproven ([91](#), [67](#)).

In the late 1900s, the population of nominate *undulata* was estimated to number at least 9,800 individuals, of which more than 50% were in Algeria, 30% in Morocco, and 10% in Libya ([65](#)), but the available country and regional estimates on which this was based were quite possibly unreliable, and in any case numbers of wild-bred birds now are expected to be significantly fewer ([67](#)). Subsequently, just 1,240 individuals were thought to remain in Morocco ([51](#)). Overall, the nominate subspecies was estimated to have declined by 25% prior to 2004, but thereafter was thought to be increasing in eastern Morocco and western Algeria following a captive-breeding and release program (however, see [Management](#)). A population in eastern Morocco which has been heavily and repeatedly reinforced with captive-bred birds is no longer self-sustaining without further releases and has consequently been removed from the global Red List population assessment ([73](#), [67](#), [74](#), [141](#)). In addition to unsustainable hunting (facilitated by captive-breeding programs), threats include intensive agricultural practices, human disturbance, and habitat degradation due to overgrazing by livestock (see [Effects of Human Activity](#)). An Action Plan for *undulata* in North Africa was published in 2005 ([51](#)).

The population of subspecies *fuertaventurae* in the Canary Islands was most recently (2004–2006) estimated at ca. 1,000 birds: 384–459 on Fuerteventura, 383–806 on Lanzarote, and 11–17 on La Graciosa ([146](#)), with a 2018 survey of Lanzarote alone indicating a population there of 440–452 individuals ([127](#)). This contrasts to some extent with previous estimates: in 1979, just 80–100 birds on Fuerteventura and 15–20 on Lanzarote ([147](#)); 69–86 in April 1984 on Fuerteventura ([148](#)), between 153 and 378 on the same island in December 1989 ([82](#)), and 241 there in late 1994 ([102](#)); and on Lanzarote 60–67 individuals were counted in April 1991 ([82](#)), 130 in December 1993 ([102](#)), and 268 there in late 1994 ([102](#)). Numbers are believed to

be decreasing across all of Fuerteventura, but increasing in parts of Lanzarote (83). Nevertheless, these surveys have been subject to differing methodologies and levels of coverage, and numbers may also fluctuate in response to the vagaries of environmental conditions (67). In the early 1990s, when the population of *fuertaventurae* was estimated to comprise 200–400 pairs, it was assessed (separately from *undulata*) as Endangered on the IUCN Red List (149). The Canarian subspecies has been affected by collisions with powerlines, as well as by habitat loss and disturbance, due to abandonment of traditional agriculture, overgrazing, illegal hunting, tourist developments, military activity, and even truffle hunting (150; see below). SEO/BirdLife purchased a 209 ha reserve to protect the species on Fuerteventura in 2005, and *fuertaventurae* has also benefited from improved protection from poaching, reduction of grazing, and habitat management in protected areas (151). Various plans have been elaborated for conserving this subspecies (152, 153, 150), but there is no formal governmental-supported recovery plan for the taxon (67). The status of the Houbara Bustard in Europe, which comprises only the Canary Island population, is evaluated as VU (D1) (154).

In the current estimation of ornithologists and conservationists working to save both this species and Macqueen's Bustard (*Chlamydotis macqueenii*), preserving the Houbara Bustard in mainland Africa, at least in a form capable of self-sustaining in the wild, will demand a near-superhuman effort and much good fortune. It will require not only restoring North Africa's degraded semi-desert rangelands, but also the involvement and support of all stakeholders to limit hunting to sustainable and scientifically determined quotas, facilitated by limited supplementation using only high-quality captive stock (155, 67).

Effects of Human Activity

Habitat Loss and Degradation

Habitat degradation, compounded by a desiccating climate and undermining of sustainable pastoralist traditions, is believed to be an important cause of the species' decline across North Africa (156, 51, 157, 158, 67). In Algeria, farming and livestock pressures (as well as the ongoing impacts of climate change) have caused critical degradation in both water and vegetation (157, 159). Desert rangeland is said to be "becoming degraded at an alarming rate through overgrazing" in southern Tunisia (160). Disentangling the impact of desert degradation from that of hunting can be difficult; however, in the Canary Islands, where hunting is now non-existent (see below), habitat loss for windfarms and quarries, deterioration due to overgrazing by goats, use of off-road vehicles, and other factors at critical sites have led to population declines (161, 162, 150). The total extent of suitable habitat on Fuerteventura has been estimated at ca. 34,300 ha, mainly in the north of the island where two protected areas for the species have been established (65). Between 1996 and 2011, 13% of Houbara Bustard habitat is thought to have been lost, with another 15% projected to be lost by 2025 (163). Sand extraction is an increasing and uncontrolled threat in these areas too, and has permanently damaged one important locality on Lanzarote (164, 67), whilst tourist developments (including road building) have increased almost exponentially and have probably also had a detrimental impact on the population of *C. u. fuertaventurae* (65, 82, 67).

Hunting and Trapping

Excluding the Canary Islands, where such activity has been banned since 1971 (82), the scale

and intensity of hunting and poaching throughout the range of the Houbara Bustard has caused rapid reductions in its population size. In the past, *C. u. fuertaventurae* also suffered from the collection of eggs and the snaring of females at nests (93), as well as hunting. Throughout the rest of the species' distribution, the birds are hunted by firearms from automobiles and in large numbers by falconry, occasionally opportunistically, but more typically on vast concessions of land leased to elites, to which large parties of hunters and falcons are flown in, sometimes at the invitation of national governments (e.g., that of Algeria) (67). Over much of the species' range, the impact and scale of hunting is unquantified, but there are unlikely to be populations which have not been subject to some level of falconry (67). In Egypt, large hunting parties (once, in 1992, a single hunting trip is said to have comprised of 23 coachloads and lasted 20 days; 165) are thought to be the principal reason for the probable extirpation of the Houbara Bustard, whilst in Morocco the number released (see [Captive Breeding](#)) suggests that hunting there is now taking place on an industrial scale, such that the viability of the species' ancestral population in the country is questionable (155). Indeed, due to the scale of hunting in the country and likely genetic swamping from captive-bred individuals, Collar (67) suggested that the ancestrally wild population of the species might be effectively extirpated in Morocco.

Collisions with Stationary/Moving Structures or Objects

Bustards are highly vulnerable to collisions with powerlines (166). However, in this species' range in Africa, this issue is either not relevant or has not been quantified.

In the Canary Islands, 66 dead Houbara Bustard were found under powerlines during two periods in 2008, leading Garcia-del-Rey and Rodriguez-Lorenzo (138) to estimate that 92 and 23 individuals probably died in that year on Lanzarote and Fuerteventura, respectively, which represents substantial mortality for a taxon with a global population that in all likelihood numbers no more than 1,000 mature birds (146). The recent growth in tourist infrastructure will undoubtedly have led to a greater number of lines, wires, and cables with the potential to kill or injure bustards (67). There is also evidence of collisions with vehicles with two road-killed bustards being found on Lanzarote over the course of twice-monthly surveys across a 12-month period in 2010/2011 (139); and four road-killed individuals (all males) on Lanzarote, Fuerteventura, and La Graciosa) during 2017–2023 (137).

Management

Captive Breeding

Captive breeding, undertaken at a large scale using artificial insemination, has become an increasingly applied tool for the conservation of both species of *Chlamydotis*, with calls a decade ago for substantial introduction of captive-bred stock to prevent extinction (30). Dolman et al. (155) identified at least 19 breeding centers for this species and the formerly conspecific [Macqueen's Bustard \(*Chlamydotis macqueenii*\)](#). The largest of these, at Missouri in Morocco, released 230,000 Houbara Bustard across North Africa between 1998 and 2024 (houbarafund.gov.ae/breeding-release). The bulk of the captive-bred birds from this center have been released into Morocco. Smaller numbers of captive-bred individuals have been released in other range states, e.g., 2,200 in Mauritania during 2017–2018 (167), 500 in 2008–2010 (67) and 300 in 2010–2011 (155) in Libya. A total of 12,000 of these birds were released over multiple years through 2023 into Algeria (155, 67, houbarafund.gov.ae), and

almost 7,000 into Egypt during 2022–2023 (houbarafund.gov.ae/breeding-release).

However, even these represent figures from just a single breeding center.

Considering the cumulative scale and duration of releases from all captive-breeding centers, concerns have been raised about the impacts of genetic swamping of remaining wild populations with maladaptive genes from captive-bred lineages (155). Research within one of these breeding centers has found that removal of sexual selection within the captive-breeding environment is correlated with lower investment into reproduction in terms of fewer eggs per season and lighter-weight hatchlings (168). A 24-year study of more than 12,000 individuals within a captive-breeding center identified reductions in breeding performance (including sperm count, number of days when display was performed, number of eggs laid, and egg volume) to be related to generations in captivity, inbreeding, and age of birds (129), factors which will be aggravated in the long term without the regular addition of specimens from the wild to the breeding stock. In turn, the accession of wild founders to breeding stock is complicated not only by the small number of individuals remaining in the wild, but also the introgression of genes from massive releases of captive-bred individuals from these same breeding centers into the wild. Collar (67) suggested that it was possible that genetic swamping from introduced birds may have led to the original wild population becoming effectively extinct in North Africa. Two longer-term studies of the demographic structure and population dynamics of a reinforced population in Morocco conclude that the population is no longer self-sustaining and requires continued releases to persist, even in the absence of hunting (73, 74).

Priorities for Future Research

Priorities for Future Research

Further research is needed to evaluate the impacts of the current management strategy of large-scale, long-term releases of the Houbara Bustard produced by artificial insemination over multiple generations. Genomic, behavioral, immunological, and ecological studies could illuminate the consequences of this approach for the persistence of wild, self-sustaining populations.

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Year-round

Migration

Breeding


Non-Breeding

Distribution of the Houbara Bustard



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Recordings

 **40**
Videos

eBird range map for Houbara Bustard

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