Brieven

Relict Gull numbers at Beidaihe, China, in autumn 1992

The recent paper by Heintzenberg & Dierschke (1996) documented the occurrence of large numbers of Relict Gulls *Larus relictus* on Happy Island, Hebei Province, China, in August-September 1994. In addition to documenting the numbers recorded at this locality, the authors included a table that detailed the maximum autumn and winter counts of Relict Gulls in Hebei Province and South Korea during 1986-95. Counts of seven on 25 September 1986 and 18 October 1987 were given as the maximum recorded counts from the sandflats at Beidaihe, Hebei Province. It is, therefore, worth while documenting the higher numbers recorded by ourselves and other birders at this site in the autumn of 1992.

The first Relict Gull was noted on 7 September 1992, with a peak in this month of five on 17 September (Williams 1994). Numbers then increased during October with 13 present on 7 October and the autumn peak of 15 on 19-20 October; no more than 11 were noted until the end of October. 12 were present on 5 November and four were still present when coverage ended on 10 November (Bradshaw & Rowlands 1993). All birds recorded were in first-winter plumage.

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Trends in systematics

Taxonomy of Houbara and Macqueen's Bustards and neglect of intraspecific diversity

Houbara Bustard *Chlamydotis undulata* is unique among bustards for being one of the very few true desert species (Cowan 1996). Because of its adaptation to desert environments its world range is much more extensive than that of other bustard species (Roberts 1985). Three subspecies are typically recognized, *C u macqueenii* (hereafter *macqueenii*) in eastern Egypt, Arabia, and central Asia from north-western Kazakhstan east to Mongolia and wintering from the Persian Gulf to north-western India and in central China, *C u undulata* (hereafter *undulata*) in northern Africa from northern Mauretania to western Egypt and *C u fuertaventurae* (hereafter *fuertaventurae*) on Fuerteventura, Lanzarote and Graciosa, Canary Islands. A comparative study of the courtship behaviour of *macqueenii* and *undulata* by a multidisciplinary team headed by Philippe Gaucher of the National Wildlife Research Center at Taif, Saudi Arabia, now reveals that both the visual signals of the courtship display and the vocalizations associated with the display differ in many parameters (Gaucher et al 1996). These results are supplemented by a mitochondrial DNA (mtDNA) sequence analysis which indicates that *macqueenii* and *undulata* are also distinct at the molecular level. This study necessitates a new interpretation of Houbara Bustard taxonomy and should have consequences for conservation.

The courtship display is performed by the male and is addressed mainly to females. It is characterized by the erection of filamentous feathers on the neck and head and by stereotypical move-

237 Macqueen's Bustard / Oostelijke Kraagtrap *Chlamydotis macqueenii*, male at start of feather erection, Taif, Saudi Arabia *(National Wildlife Research Center Photo Library)* **238** Houbara Bustard / Westelijke Kraagtrap *Chlamydotis undulata undulata*, male at start of feather erection, Taif, Saudi Arabia *(National Wildlife Research Center Photo Library)* **239** Macqueen's Bustard / Oostelijke Kraagtrap *Chlamydotis macqueenii*, male with full feather erection during display run, Taif, Saudi Arabia *(National Wildlife Research Center Photo Library)*

240 Macqueen's Bustard / Oostelijke Kraagtrap *Chlamydotis macqueenii*, male showing almost complete feather erection just prior to display run, Taif, Saudi Arabia *(National Wildlife Research Center Photo Library)*. **241** Houbara Bustard / Westelijke Kraagtrap *Chlamydotis undulata undulata*, male showing almost complete feather erection just prior to display run, Taif, Saudi Arabia *(National Wildlife Research Center Photo Library)*. Note differences in plume colour at side of neck (black and white in *macqueenii*, black only in *undulata*) and degree to which head plumes fall over bill, particularly evident when comparing plates 240 and 241

ments and postures which make the bird very conspicuous. Gaucher et al (1996), who studied the behaviour and vocalizations of *macqueenii* and *undulata* both in the field and in captivity, showed that the visual aspects of the display of the two forms differ in two important ways. First, the trills on both sides of the neck are black in *undulata*, whereas they are black and white in *macqueenii*. The crest in *undulata* is white and remains erect during display, but in *macqueenii* the crest is black and white and falls down over the bill. So, both the colour and position of the feathers used during the display are different (compare, especially, plates 240 and 241). Second, during the running phase of the display, *undulata* runs at almost twice the speed of *macqueenii*. In addition, the neck swings at a much greater amplitude in *macqueenii* than in *undulata*. Gaucher et al (1996) did not study the courtship behaviour of *fuertaventurae* but an earlier study by Hinz & Heiss (1989) indicates that it is very similar to that of *undulata*.

If no potential partner is close to the displaying male, a calling phase sets in. Although calls can be heard by observers up to 50 m away, the fact that calling is part of the display was not known until Alekseev (1985) noticed it in *macqueenii*. Gaucher et al (1996) now show that the auditory stimulus during display differs between *undulata* and *macqueenii* in no less than 12 acoustic parameters. For example, *undulata* utters a series of four notes, which together last 9 sec, followed by an interval of about 2 sec before the next series of notes starts, whereas *macqueenii* typically gives a series of 25-40 notes, lasting 12 sec, followed by an interval of 12-18 sec. During a series, the notes of *macqueenii* show variation in melodic structure, intensity and rhythm, whereas in *undulata* no such variation occurs.

A genetic analysis accompanied the behavioural and vocal data. Gaucher et al (1996) sequenced 300 base pairs of the mtDNA genome from populations of *macqueenii* from Pakistan, Saudi Arabia and Sinai, Egypt, *undulata* from Algeria and *fuertaventurae* from the Canary Islands. Phylogenetic analysis of these sequences showed that *macqueenii* and *undulata* form separate monophyletic groups of populations, indicating that the division based on morphology is correct and that both groups are on separate evolutionary tracks. The sequences were also used to calculate genetic distances. The genetic distance of *macqueenii* and *undulata* was 1%. MtDNA sequences of *undulata* and *fuertaventurae* showed no differences.

Previous taxonomic studies had to rely on morphological characters, which are often unreliable or insufficient to predict the level of reproductive isolation. The new study focussed on courtship behaviour because courtship is directly involved in pair-formation (Gaucher et al 1996) and thus forms a reliable indicator of species recognition in the birds themselves. The fact that the pair-formation mechanisms of *undulata* (and *fuertaventurae*) differ in so many ways from those of *macqueenii* strongly suggests that both forms are reproductively isolated and that they should be treated as separate biological species: Houbara Bustard, with two subspecies, *C u fuertaventurae* and *C u undulata*, and Macqueen's Bustard *C macqueenii*. The subspecies *C u fuertaventurae* is currently recognized on the basis of minor quantitative differences from *C u undulata*, such as its smaller size and darker plumage. The small differences between *fuertaventurae* and *undulata* can be explained by recent colonization of the Canary Islands from North Africa or by the occurrence of gene flow between North African and Canary Island populations.

The authors carried out a DNA analysis because with 'only morphological and behavioural characteristics, deciding whether a population has the status of a species or subspecies will remain difficult'. This is ironic because the reverse is true: genetic differences have little to do with reproductive isolation, whereas (in the houbara bustard complex) morphological and behavioural characters are directly involved in pair-formation. The genetic distance of 1% is consistent with the fact that *macqueenii* and *undulata* represent separate species but, because of the low correlation between reproductive isolation and genetic distance, it cannot be used as evidence for or against a particular taxonomic arrangement under the Biological Species Concept (BSC).

Recent versions of the Phylogenetic Species Concept (PSC) have stressed the need to examine multiple characters before conclusions can be drawn about the taxonomic status of populations (eg, Zink & McKitrick 1995). The phylogenetic information in the new study, in combination with existing knowledge of morphological variation (Cramp & Simmons 1980, Osborne 1989), now offers the possibility to interpret character variation in the houbara bustard complex under a PSC framework. Under the PSC, *macqueenii* and *undulata* would represent separate species because both are characterized by unique qualitative morphological features and because gene-

tic analysis shows that both form monophyletic groups of populations. Based on present knowledge of geographical variation in the houbara bustard complex, no other population would qualify as separate phylogenetic species. Thus, despite using different criteria, the BSC and PSC indicate similar species limits in the houbara bustard complex. The populations of Houbara Bustard on the Canary Islands probably do not form a separate phylogenetic species because of the absence of qualitative differences between these and North African populations and because there is no evidence that they represent a separate monophyletic group of populations. Three individuals of Macqueen's Bustard in the Sinai, Egypt, formed a separate cluster in the genetic analysis (Gaucher et al 1996), but this was based on a difference in a single base pair and there is currently no evidence which would indicate that the Sinai population of Macqueen's Bustard represents an independent evolutionary unit. Osborne (1989) noted that the sedentary Arabian population of Macqueen's Bustard has shorter wings and wider and longer skulls than the migratory population in central Asia, which, he suggests, indicates that there is little mixing of Arabian and central Asian birds. However, there is no genetic differentiation between these populations and in the absence of other evidence they would not qualify as separate phylogenetic species.

Because of the central role of species in biology, most behavioural, faunistic and conservation studies are conducted and documented at the level of species, even if the relevant species involve two or more well-marked subspecies. When species are split, the ignorance for intraspecific variation often becomes painfully apparent. The Houbara Bustard illustrates how the fixation at biological species-taxa leads to the neglect of information about intraspecific diversity. In the discussions of behaviour and vocalizations in Cramp & Simmons (1980) and Johnsgard (1991), no distinction was made between *macqueenii* and *undulata*, which may have given the impression that there are no differences in behaviour and vocalizations below the 'species' level. Even though several aspects of the display of both species had already been published, the detection of any differences in the display became virtually impossible because in handbooks information about Houbara Bustard and Macqueen's Bustard has typically been synthesized into one account. There are probably many other cases where intraspecific diversity is obscured by the fixation on species in handbooks and other secondary sources. If subspecies, which are traditionally defined on the basis of plumage and biometrical characters, have had an independent history of evolutionary change it is not unlikely that differences in other characters have evolved, such as behaviour and vocalizations. In accounts of polytypic species, descriptions of behaviour, vocalizations and other characters, should therefore remain accompanied by information about the relevant subspecies.

In faunistic studies, likewise, it is necessary to collect information for each subspecies separately, because migration and vagrancy patterns of populations from separate breeding areas may differ. If no distinction is made, such patterns may become distorted or may go unnoticed, resulting in a loss of information. Although records of 'houbara bustard' are known from all over Europe (Cramp & Simmons 1980), vagrancy patterns turn out to be different if records of Houbara and Macqueen's Bustards are considered separately. In Europe, there are only very few records of Houbara Bustard, mostly in the Mediterranean region. Houbara Bustard has been recorded in Italy in 1844, 1879 and 1937 (Pierandrea Brichetti in litt), in Switzerland in 1839 and 1916, and on Malta in 1841 and 1866 (Glutz von Blotzheim et al 1973). Records in Spain are also believed to refer to Houbara Bustard (Glutz von Blotzheim et al 1973). Macqueen's Bustard, however, has been recorded in many European countries, although most of the c 50 European records date from the 19th century. In the second half of the 20th century, records are known from Britain (1962), Germany (1968), Italy (1975 [2], 1976) and Poland (1977). Recent records in Slovenia (1970), Sweden (1974) and Lithuania (1988) probably also involve Macqueen's Bustard. It is very likely that the decline of records in Europe is due to the dramatic fall in numbers of both species.

There is a number of factors contributing to the decline of Houbara Bustard and Macqueen's Bustard, though hunting is by far the main cause. The evidence for this is overwhelming (see reviews in Johnsgard 1991 and del Hoyo et al 1996), so claims by the hunting lobby (eg, Upton 1989) that climate change is responsible for much of the decline can be dismissed. Although hunting has been practiced by falconers for 100s of years, using camels as their mode of transportation, hunting has changed dramatically since the mid 1950s and early 1960s due to the in-

crease of fire-arm licences and the advent of the jeep. Rich Arab falconers seeking to retain cultural links with their ancestors view their hunting trips as an expression of their roots (del Hoyo et al 1996) and travel to nearly all countries where Houbara or Macqueen's Bustards regularly occur. In addition to fire-arms and specially adapted jeeps, hunters now also use falcons with radiotags, modern communication equipment and even helicopters and spotter planes to locate, approach and kill bustards (Roberts 1985, Oriental Bird Cl Bull 5: 6-8, 1987, Birding World 9: 24, 1996). Each year 100s of Houbara Bustards and 1000s of Macqueen's Bustards are killed. For instance, in 1984 more than 250 Houbara Bustards were killed by Arab hunters in Morocco (Br Birds 78: 640, 1985) and in the winter of 1984-85 no less than 4955 Macqueen's Bustards were killed in Pakistan (del Hoyo et al 1996). In Algeria, c 1000 Houbara Bustards are killed each year by foreign Arab hunting parties in the pre-desert zone of the Auree Mountains and the Sahara Atlas alone (de Smet 1989).

Perhaps the most satisfying aspect of the new study are its implications for conservation. Due to the focus on species-level taxa in conservation, the threat status of the subspecies in the houbara bustard complex was not evaluated separately. The houbara bustard complex was not considered in the second edition of *Birds to watch* (Collar et al 1994), the current world list of threatened species, probably because central Asian populations of Macqueen's Bustard turned out to be much larger than previous reports indicated. The total population of Macqueen's Bustard is now estimated at 40 000-60 000 individuals (del Hoyo et al 1996). Houbara Bustard, however, has become very rare and has disappeared from large parts of its range in Egypt and Morocco (eg, Saleh 1989, Dutch Birding 18: 141, 1996), but the fact that it was considered conspecific with the less rare Macqueen's Bustard precluded it from being listed as threatened in the current red data book (Collar et al 1994). There clearly is reason for dissatisfaction if the conservation of a distinct form is impeded by the fact that it is considered conspecific with another form. Because there is good evidence that Houbara Bustard and Macqueen's Bustard represent separate species, Houbara Bustard will probably be reinstated as a threatened species. This would be a positive step, but it is based on the presumption that taxa only deserve consideration from conservationists if they are ranked as species under the BSC.

The fixation on biological species and the ignorance for intraspecific diversity in conservation is controversial. Because diversity can be detected at many levels below the level of species and even individuals can be distinguished with modern molecular assays, there clearly is a threshold below which biodiversity must be ignored in conservation biology, but it is not obvious where that threshold should be placed. Two different views on the units of conservation can be distinguished in conservation biology. One view maintains that in this era of diminishing biodiversity and limited resources we should restrict our attention to biological species, because these units are better known, fewer in number and more distinctive than the proposed alternatives, such as subspecies or phylogenetic species, which place the threshold at lower levels. This essentially is the view of BirdLife International and was recently defended by Collar (1996). An estimated 27 000-28 000 subspecies and monotypic biological species are recognized (Mayr & Gerloff 1994); if the PSC would be applied on a global scale, the number would probably be close to 20 000 phylogenetic species (Zink 1996). If phylogenetic species or subspecies would replace the biological species as the unit of conservation, the number of taxa to be monitored by conservationists would increase to roughly two or three times the current number. Collar (1996) argued that the adequate monitoring of all these forms would not only be impractical, perhaps even impossible, but it would also be at the expense of the more distinct biological species, which he feels should be given priority. Collar (1996), thus, defends a policy of preserving biological species. For some subspecies, such as Azores Bullfinch *Pyrrhula pyrrhula murina*, he would make an exception; these subspecies are selected on a case-by-case basis.

Recently, an alternative view has emerged. According to this view, the biological species should be abandoned as the unit of conservation because it has resulted in the ignorance of many distinct evolutionary taxa, with potentially disastrous consequences for the preservation of biodiversity. Hazevoet (1996) suggested that the phylogenetic species should be adopted as the unit of conservation. Using his research on the avifauna of the Cape Verde Islands, Hazevoet (1996) argued that the ignorance of variation below the level of biological species could result in the extinction of some highly distinct taxa. For instance, Cape Verde Purple Heron *Ardea (purpurea) bournei*, endemic to the island of Santia-

go, is rapidly heading for extinction even though protective measures have been advocated for over 30 years. The main reason for the general lack of attention for this bird is the fact that it is currently classified as a subspecies of the widespread Purple Heron *A purpurea*, because its plumage suggests that it may interbreed with Purple Heron if the two would come into contact. However, in many respects this taxon is as distinct as many biological species. The PSC advocated by Zink & McKitrick (1995) and Hazevoet (1996) emphasizes the unique characters of these taxa, rather than their presumed ability to interbreed. It is unlikely that this controversy will be resolved quickly; in the interim, conservation policies using the biological species as the unit of conservation, like the Endangered Species Act in the United States (see O'Brien & Mayr 1991) and the policy of BirdLife International, will remain controversial.

The ignorance of intraspecific variation is still widespread and continues to have negative consequences for the study of behaviour, migration and vagrancy patterns and conservation. As noted before (Avise 1994), ignorance of diversity and neglected taxonomies can kill. In the houbara bustard complex, such ignorance is no longer possible because the new study by Gaucher et al (1996) provides compelling arguments for the recognition of Houbara Bustard and Macqueen's Bustard as separate species, but it may well define the fate of other distinct forms.

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