Taxonomic, distributional and ecological data on gazelles in Iran

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Abstract. As there is much misunderstanding and misinformation in the literature about the three species of gazelles living in Iran, We review the taxonomic status, distribution, ecology, reproduction and conservation of Iranian gazelles. The population of the Goitred Gazelle (*Gazella subgutturosa*) living west of Zagros mountains seems to be different from eastern populations. The Jebeer Gazelle (*G. bennettii*) has a much more limited range and presently encompasses three well differentiated subspecies. The Arabian Gazelle (*G. gazella*) has been reported only from Farrur Island in the Persian Gulf.

Kurzfassung. Da es in bezug auf die drei Arten von Gazellen, die im Iran leben, in der Literatur viel Missverständnisse und Fehlinformationen gibt, referieren wir hier den taxonomischen Status dieser Arten, Verbreitung, Ökologie, Fortpflanzung und Schutz. Die Population der Kropfgazelle (*Gazella subgutturosa*), die westlich der Gebirgskette des Zagros vorkommt, scheint sich von den östlichen Populationen zu unterscheiden. Bennett's Gazelle (*G. bennettii*) besiedelt ein geographisch eng begrenztes Areal und ist in drei Subspezies vertreten. Die Echtgazelle (*G. gazella*) ist nur von der Insel Farrur Island im Persischen Golf bekannt.

Key words. *Gazella*, Persia, Middle East, Persian Gulf, conservation.

Introduction

Recent surveys of gazelles in Iran (LAY 1967, GROVES 1993, KARAMI & GROVES 1993, HARRINGTON 1977) list three species of gazelles as follows:

1. *Gazella subgutturosa* (Goitred or Persian Gazelle; Ahu in Farsi, Rheem in Arabic), distributed throughout Iran except in the far northwest, along the Caspian sea, and in the southeast;
2. *Gazella bennettii* (Bennett's or Indian Gazelle, or Chinkara; Jebeer or Gebir in Farsi), distributed through central, southern and southeastern Iran;
3. *Gazella gazella* (Arabian Gazelle; Idmi in Arabic), known in Iran only from Farrur Island in the Persian Gulf.

As there is much misunderstanding and misinformation in the literature about these species, and considerable fresh information has accumulated over the past few years, it is appropriate to review their status and distribution, and to give some ecological data.

Taxonomy and distribution

Gazella subgutturosa (Guldenstaedt, 1780)

Surveys by one of us (M.R.H.) have recorded this species in the following provinces of Iran: western Kermanshah, Ilam, southwestern Lorestan, Khuzistan, western Bushehr, Zanjan,

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Tehran, Semnan, Golestan, northern Khorasan, and Baluchistan. It is absent from the mountainous regions of eastern and western Azarbaijan provinces and the Zagross and Alborz ranges, from the Caspian shores, from the shores of the Persian Gulf (except for the one locality in southern Bushehr Province), and from the region of central kavirs (vegetationless salt-flats). In the northwest there is apparently an isolated population in the Caucasus and Transcaucasus valleys of the Republics of Georgia and Azarbaijan (formerly in the USSR); in the northeast, it occurs in Turkmenistan, especially in the Badkhyz Reserve, and on into Kazakhstan and Mongolia.

Much of this range is quasi-continuous. The only major geographic barrier across it is the Zagross Range, and populations to the west of this barrier (extending into eastern Iraq) are noticeably different from those to the east of it (the main Iranian population).

The colour is reddish- or greyish-sandy on the back and flanks, white below and on the buttocks. In younger animals the face is coloured like the body but with a white stripe from above each eye to the nostril, bordered below by a thin, incomplete black line. With maturity this pattern nearly disappears; the face becomes white, with the merest traces of brown stripes on the cheeks. HEPTNER et al. (1961) describe the Caucasus gazelles as being brownish-grey, slightly darker than those of central Asia, with a clear dark flank-stripe and heavy black tail-tuft, while in Turkmenistan they are sandy-brown to sandy-gray in summer, and lighter in winter. The Iranian populations seem to resemble those of Turkmenistan.

The type locality of *Gazella subgutturosa* is the vicinity of Tiblsi; hence if the gazelles of the Caucasus region are to be differentiated subspecifically from those of Iran and Turkmenia, the Caucasus form would be *G. s. subgutturosa* while the form from Iran (except the far west) and Central Asia would be *G. s. seistanica* Lydekker, 1910 (described from Sistan; synonym, *G. s. gracilicornis* Stroganov, 1956, described from Tadjikistan). But at present, the evidence is inconclusive and for the time being it is better to refer all to the nominate subspecies. Within the range, there are regional differences (Tab. 1); males from the northeast (Semnan and Khorasan Provinces, and into Turkmenistan) tend to be somewhat smaller than those from the western edge of the Iranian Plateau (Tehran, Isfahan, Fars), and exceptionally widely-spreading horns occur in Fars, exceptionally narrow horns in Tehran and Semnan.

The populations that are really different are those from west of the Zagross range: Susa (Shoush), Ahvaz, Naftshahr, Dasht-e-Zohab and Khuzestan, and into Iraq east of the Tigris/Euphrates system. These gazelles are much smaller than those east of the Zagross, and the horns of males have an extremely narrow spread with tips very close together. Although samples are very small, they have been kept separate in Tab. 1 because there is some variation; thus skulls from Ahvaz and Susa are smaller than those from Kurdistan or Naftshahr/Dasht-e-Zohab. In colour they resemble those from east of the Zagross except that they have stronger flank-stripes and facial markings and males do not usually develop totally white faces. In size they are like pale-coloured *Gazella subgutturosa marica* of Arabia, from which they differ not only in colour but in their narrower horn spread (*G. s. marica*: mean of tip-to-tip distance 196.3 mm), and in the usual absence of horns in the female. Very small *G. subgutturosa*, probably of the same type, exist in Mond Reserve, near Bushehr, and on Khark Island. It seems likely that these gazelles represent a distinct subspecies. Duncan's test on external measurements (hindfoot, tail, ear length, and weight, males and females taken separately) showed significant differences between specimens from Khark and Khosh Yeilagh, Kolah Ghazi, Siah Pardeh and Ghameshlou.

A female mounted specimen of *G. subgutturosa* said to be from Smyrna (= Izmir, on the Aegean coast of Turkey), in the Leiden Museum, resembles those from western Iran and Kurdistan, except that it possesses horns 185 mm in length.

Bivariate plots of measurements separate these small western gazelles from others. Their horns are relatively long compared to their skull length, while of the main Iranian Plateau group those from Yazd and Esfahan tend to have long horns compared to their skull size, and those from the far northwest (Caucasus and Tehran) have large skulls with relatively short horns.

***Gazella bennettii* (Sykes, 1831)**

The Gebir (so-called Chinkara) are on average smaller than the Goitred Gazelle, with horns which are long, straight, little divergent, and strongly ringed in the male; in the female they are long and substantial, about two-thirds the length of males. The colour may be similar (in the northwestern subspecies) or darker (in the southeastern form), but is sharper, with generally a trace of a darker brown line along the flanks, and at all ages the mid-facial zone is the colour of the body, or darker.

The northern border of the distribution of this species extends from Kavir National Park, in southern Tehran Province, east to Touran P.A., in the southern part of Semen Province; from there it is found sporadically south to the shores of the Persian Gulf and southeast into Pakistan and thence into India. Unlike *G. subgutturosa*, it does not extend northeast across the border into Turkmenistan, northwest of the Zagross range (HEMAMI, KARAMI & GROVES in prep.). Within this area, three well-differentiated subspecies are found (GROVES 1993): *Gazella bennettii fuscifrons* from the lowlands of Sistan and Baluchistan, Hormozgan and *G. b. karamii*, known only from Nayband Protected Region, southern Bushehr Province.

The first two are represented by sufficient specimens, and may be distinguished as follows. *G. b. fuscifrons* is dark in colour, with a more prominent flank-band and face stripes, a conspicuous blackish nose-spot, and a very dark tone on the forehead; it is smaller in size; the horns in the male are more upright, on average shorter, and have a narrower spread with tips that do not turn inward. *G. b. shikarii* is much lighter in colour; probably for this reason it was formerly mistaken by biologists for *G. subgutturosa*, so that for a long time it was not realised that the species was found at all on the Iranian plateau. *G. b. shikarii* also lacks the dark tone on the forehead, and has little or no trace of a dark nose-spot; the male horns are less upright, longer, and more widely spread, and the tips turn in somewhat.

G. b. karamii is still known from a single voucher specimen only, a male skull with horns; it is very small in size. Photos taken by one of us (M.R.H.) show an animal very much like *G. b. shikarii* in external appearance, but brighter: a light reddish sandy-colour, poorly marked on flanks but with a dark nose-spot and dark forehead. The horns in the males in the photos are not as divergent as in the type specimen.

Measurements of skulls and horns are given in Tab. 2. There are small average differences between geographic samples of *G. b. shikarii*. Those from Semnan and Kerman Provinces, on the eastern borders of the subspecies range, clearly differ from neighbouring *G. b. fuscifrons*, and even to some extent are less like *fuscifrons* in having horns that are more divergent. Similarly, in *G. b. fuscifrons*, a specimen from Hormozgan Province, where its range closely approaches that of *G. b. shikarii*, is not closely similar to the latter – in fact has an even narrower horn spread than usual. We do not suggest that the two are specifically distinct, but the zone of intermediacy must be very narrow; the only specimen that might be an intermediate is the type of the putative subspecies *kennioni* (as described by GROVES 1993).

Tab. 1. Skull and horn measurements of *Gazella subgutturosa*.

Locality	Span	Skull length	Horn length (straight)	Horn length (curved)	Tip-to-tip
MALES					
Caucasus	215(2)	282 (1)		107 (1)	196 (1)
Zanjan			413±32 (11)	182±86 (11)	253±65 (11)
Gazvin			406±19 (10)	173±45 (8)	250 ±30 (10)
Tehran	218 (2)	303±56 (7)		126 ±74 (9)	191±57 (8)
Hamadan			368±31 (7)	189± 102 (7)	216±37 (7)
Mooteh	215±2.8 (3)	316±65 (8)	379 ±21 (47)	154±52 (54)	228±36
Esfahan	211±6.5 (4)	300±44 (8)	408±30 (8)	137±58 (16)	215±48
Fars			390±23 (5)	230±34 (5)	273±29 (5)
Yazd	214±7.3 (3)	343±36 (10)		133±53 (10)	221±39 (10)
Kerman		329±24 (4)		152±15 (4)	205±21 (4)
W. Semnan	199 (2)	302±22 (10)	367±33 (14)	142±56 (24)	201±43
Bojnurd			345±22 (4)	123±37 (4)	196±19 (4)
Touran	209 (1)	263±21 (3)		127±6 (3)	180±37 (3)
Mashad	199 (1)	290 (1)	407 (1)	147 (1)	237 (1)
Badkhyz	204±4.2 (14)	306±28 (15)		140±56 (15)	218±40 (15)
Naftshahr	190 (1)	281±106 (5)		90±74 (5)	163±62 (5)
Kirkuk		267±25 (3)		94 (2)	187±38 (3)
Khuzestan	186 (2)	262 ±58 (6)	318 (1)	95±32 (7)	179±22 (7)
Ahvaz, Susa	178 (2)	290 ±19 (4)		91±4 (4)	169±21 (4)
FEMALES					
Caucasus		206 (1)			
Mooteh		197±6.0 (3)			
Fars		197 (1)			
W.Semnan		196±8.5 (3)			
Touran		199 (1)			
Badkhyz		191±7.0 (6)			
Sistan		–		86 (1)	
Krkuk		161±2.1 (3)			
Baghdad		171 (2)			
Susa		178 (1)			

***Gazella gazella* (Pallas, 1766)**

This species is thus far known only from Farrur Island (23°30'N, 54°30'E), in the Persian Gulf southwest of Bandar Abbas. KARAMI & GROVES (1993) recorded that it had been introduced to this island in 1967 from Kavir National Park, but so far the source population has not been located. The animals of the Farrur population are so far the sole known representatives of *Gazella gazella dareshurii*, a subspecies related to but distinct from *G. g. muscatensis* from the opposite mainland of northern Oman. The subspecies was described on the evidence of cranial material; we have more recently seen good photographs of animals from Farrur, showing that their colouration is pale sandy-brown, very different from the deep chocolate-brown of *G. g. muscatensis*.

Tab. 2. Skull and horn measurements of Iranian *Gazella bennettii*.

a) skull: greatest cranial length.

Subspecies	♂	♀
G. b. shikarii	191.5± 3.82 (5)	187.5 ±6.06 (3)
G. b. fuscifrons	183.6 ±4.24 (9)	177.6± 2.52 (5)
G. b. karamii	173.0 (1)	

b) horn measurements of males.

	Horn length	Tip-to-tip	Span
G. b. shikarii			
Kavir, Esfahan	150.3 ±23.15 (8)	289.4± 31.67 (8)	129.0 ±30.13 (8)
Fars	143.7± 17.89 (9)	278.7 ±30.61 (9)	121.5 ±25.18 (8)
Semnan	163.8 ±35.42 (4)	282.0 ±17.34 (4)	149.8 ±40.19 (4)
Kerman	168.0 ±41.0 (4)	283.8 ±29.98 (4)	137.5± 46.49 (4)
G. b. fuscifrons			
Sistan & Baluchistan	251.2± 24.13 (13)	109.7± 30.40 (13)	125.4± 26.25 (13)
Hormozgan	246.0 ±18.52	81.4 (2)	110.6 (2)
G. b. karamii			
Bushehr	228.0	190 (1)	210 (1)

b) horn measurements of females.

	Horn length	Tip-to-tip	Span
G. b. fuscifrons	79.8± 12.52 (5)	177.3± 34.69 (6)	60.0± 16.45 (5)
G. b. shikarii	79.0± 13.58 (3)	187.7 ±6.03 (3)	63.1± 12.04 (3)

Ecology

Gazella subgutturosa

In Transcaucasia, Turkmenistan and Kazakhstan, *Gazella subgutturosa* lives in halophytic desert and semi-desert with saxaul (*Haloxylon*) and other low shrub vegetation such as *Anabasis*, *Artemisia*, *Zizyphus* and *Salsola*. In Saudi Arabia, in the southwest of the range, and Mongolia, in the northeast, their habitat includes sand dune country; this is not the case in Iran. In spring grasses are more important in the diet, in summer moisture-containing plants such as saltwort and pistachio, in autumn saltwort, in winter barnyard grass and forbs. Their annual migrations are correlated with snowfall in winter, and towards water sources in summer (HEPTNER et al. 1961), but they are capable of surviving water shortage by tolerating an increase in body temperature (KINGSWOOD & BLANK 1961).

Gazella bennettii

The predominant plant species in the habitats of this species in Iran are *Zygophyllum* spp., *Haloxylon* sp., *Alhagi persarum*, *Atraphaxis spinosa*, *Tamarix* spp., *Ephedra* spp., *Salsola* spp., *Calligonum* sp., *Astragalus* spp., *Seidlizia rosmarinus*, *Artemisia* sp., *Ziziphus* spp. and

Acacia spp. As noted by RAHMANI & SANKARAN (1991) for India, the species does not require surface water; plants such as *Zygophyllum* in desert basins (Kavirs), in addition to providing the food and shelter (cover) requirements of the animal, can also act as a supply of moisture due to their high water content. It seems that during various natural climatic fluctuations, and under different conditions of interspecific competition, security and phenology of plants, gazelles use different types of plants. *G. bennettii* typically is limited to the edge of deserts and, unlike *G. subgutturosa*, avoids farms and settlements.

Gazella gazella

Acacia sp. is the dominant plant of Farrur. The gazelle population at its peak numbers about 300 heads on the island. These numbers have been subject to periodic reductions in recent decades because of drought and disease.

Behaviour and reproduction

HEPTNER et al. (1961) record large scale autumn migrations for *G. subgutturosa* in Central Asia to avoid deep snow; at this time they gather in large herds. The herds break up during spring, and in summer small single-sex groups of 3–4 animals are usual. The rutting season is in November and early December in Kazakhstan and in the Transcaucasian region; in Turkmenistan and Tajikistan it is earlier, beginning in October. Males at this time develop swollen necks and strongly dilated preorbital glands; they defend territories of 50–120 ha, which they mark with faeces, urine and preorbital secretions, or by digging in the ground or destroying vegetation with their horns; they collect harems of 2–5 or even up to 30 females, with whom they mate as long as the harem remains in their territories. Young are born in April and May in Iran (earlier in Saudi Arabia, later in Central Asia and Mongolia), and twins predominate (KINGSWOOD & BLANK 1996).

Gazella bennettii are generally seen singly or in small herds of 2-6 individuals in Iran; RAHMANI (1990) records similar sizes in India, stating that herds of 8-10 occur but are rare. Group sizes are thus smaller than in *G. subgutturosa*; in particular, the groups of bachelor males so commonly encountered in the latter species do not seem to occur in *G. bennettii*. In the mating season, males become highly territorial and centre their activities in a very restricted area with a conspicuous dung pile in it; neighbouring males fight fiercely (RAHMANI 1998). The more pronounced territoriality and the lack of swollen preorbital glands are a marked difference from *G. subgutturosa*. It seems that *G. bennettii* in the south may have more than one breeding season. In the Nayband Protected Area fawns have been seen in May 1993; in Chahgah (28°28'N, 51°41'E) in southern Bousher, game guards observed a fawn in autumn and two fawns in March 1992. SCHALLER (1977) observed neonates and pregnant females of Indian gazelle in April in Pakistan; he also saw fawns in October and November, concluding that the peak of breeding of this taxon is in spring and autumn. RAHMANI (1988) concluded that births are concentrated after the peak of the monsoon.

Male gazelles appear to use their horns differentially, and perhaps develop local "traditions" for which the horn is more intensively used. In *G. subgutturosa* in northeastern Iran (Semnan, Bojnurd and Neyshabur) the right horn was more worn (>2mm shorter) than the left in 8 specimens, the left in 5, and the horns were equally worn in 5. This asymmetry was reversed in specimens from Moteh, Esfahan and Zanjan: the right horn was more worn in 24, the left in 33, and they were equal in only 8; in specimens from Gazvin these proportions were even more uneven: 1, 6, 3. In *G. bennettii* samples are too small to separate them; overall, the right horn is more worn in 10, the left in 6, and they are equal in 2.

Gait, especially when disturbed, differs characteristically in the three gazelle species. The heavier *G. subgutturosa* runs, close to the ground, with only occasional small leaps. *G. bennetti* and *G. gazella* make high bounds ('stotting') as they run, often zigzagging.

Conservation

Gazella bennettii occurs in 9 protected areas (Tab. 1). It is also a protected species by law. *G. subgutturosa* occurs more extensively, and is still widespread outside protected areas, though heavily hunted, and harassed by humans with vehicles (especially motor-bikes). The chief requirement for the future, for all gazelles, is to ensure adequate protection within protected areas and to prevent illegal hunting outside them. Protection of *G. subgutturosa* is especially important in areas heavily exploited by pastoralists, because its presence in arid country is an excellent indicator of habitat quality.

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