BIRTH SEASONALITY IN CAPTIVE BOVIDS AT AL WABRA WILDLIFE PRESERVATION (AWWP), QATAR

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Summary

Twenty six African and/or Asian bovid species kept at Al Wabra Wildlife Preservation, Qatar (latitude 25 °N, longitude 51 °E, altitude < 100m above sea level) were evaluated for their birth seasonality. A broad range of breeding patterns could be observed, from breeding throughout the whole year (e.g. blackbuck, dorcas gazelle, idmi gazelle, Speke´s gazelle), to explicit seasonality (e.g. mouflon, nilgai, Nubian ibex, wild goat) in breeding patterns. In general, natural breeding patterns were preserved in captivity. In some species, deviations from patterns reported in the wild are evident, with longer birthing seasons in captivity, sometimes with calves being born the whole year round. This applies mainly for species where birthing correlates with the rainfall season in the wild (e.g. beira antelope, idmi gazelle). It can be speculated that when water, and subsequently food, is supplied constantly, breeding is no longer seasonally restricted, indicating that the respective species are mainly resource-controlled in their reproduction. In species in which reproductive seasonality is preserved in captivity, day length itself is speculated to trigger oestrus activity (e.g. wild goat, Nubian ibex).

Introduction

Ruminants are commonly kept in zoos. At Al Wabra Wildlife Preservation (AWWP), Qatar, the bovid family (i.e. hollow-horned ruminants) forms the main mammal collection. As many different species are kept and large numbers of newborns could be registered, AWWP offers a vast database, which was in this case evaluated for birth seasonality. As no “breeding regime” is applied and animals have the opportunity to breed around the year, and therefore the intrinsic breeding patterns can be investigated and compared to those reported from the wild.

Methods

Data of 26 species (table 1) were evaluated. All available data on ruminant newborns for the years 2004 - 2007 were analysed, data sources being the AWWP newborn handbook (Mar 04 - Dec 07) and stock list (Jan 04 - Feb 07) programme.
The following breeding pattern categories were defined:

- Non-seasonal: Continuous breeding throughout the whole year, newborns being constantly delivered. A completely evenly distributed birth rate would be 8.3 % of the newborns being born each month. Considered species fluctuate +/-8 % (0 - 16 % of the calves being born per month).

- Seasonal, one-peaked, spring: One clear peak in spring time (min 90 % of the calves being born in spring time, defined as the period from February to April), minimal activity throughout the rest of the year.
- Seasonal, one-peaked, fall: One clear peak in fall (min 90 % of the calves being born in fall, defined as the period from August to October), minimal activity throughout the rest of the year.
- Seasonal, two-peaked: Two calving peaks (min 90 % of the calves being born in February to May and September to November). Highest activity being in the early year, activity raised as well late in the year, low activity throughout the rest of the year.
- Wave-like, spring high: Newborns delivered throughout the whole year, intensified activity (min 55 % born) between January and April.
- Wave-like, spring-time low: Newborns delivered throughout the whole year, reduced activity (less than 12 % born) between April and June.
- Wave-like, summer high: Newborns delivered throughout the whole year, intensified activity in summer.
- Unclear: No obvious breeding pattern recognisable - neither seasonality nor clear non-seasonality.
- No further analyses: species in which not more than 5 newborns were reported in the evaluated period were not considered for further analyses.

Table 1: Bovid species at AWWP evaluated on birth seasonality for the years 2004 - 2007 and some biological characteristics.

Scientific name	**Common name**	**No. of recorded births**	**Breeding pattern***	**Natural calving season***	**Calving season preserved**	**Natural social structure§**
Family Bovidae, Subfamily Aepycerotinae						
Aepyceros melampus	impala	1	-		-	ssh[2]
Family Bovidae, Subfamily Antilopinae						
Antilope cervicapra	blackbuck	63	n-s	n-s - 2p[2]	yes	h,ssh,mh[2]
Dorcatragus megalotis	beira antelope	55	wsh	spring[6]	no	p, h[2]
Gazella bennettii	chinkara gazelle	87	n-s	Apr - May n-s[7]	yes, partly	h, p[9]
Gazella gazella ssp.	idmi gazelle	191	n-s	1p - 2p[2]	no	h[2], ssh[9]
Gazella dama ruficollis	dama gazelle	15	wsh	Apr - Jun[3]	partly	mh[2]
Gazella dorcas	dorcas gazelle	78	n-s	Mar - May[7]	no	mh, ssh[2]
Gazella dorcas ssp. *pelzelni*	Pelzeln's gazelle	256	n-s	see dorcas gazelle		p, h[9]
Gazella granti	grant gazelle	5	-	2p[11]	-	h,mh[3]
Gazella subgutturosa marica	rheem gazelle	61	2	Jan - Feb[4]	partly	mh[2]
Gazella rufifrons	red-fronted gazelle	90	n-s	n-s[2]	yes	h, p, mh[2]

Scientific name	Common name	No. of recorded births	Breeding pattern*	Natural calving season*	Calving season preserved	Natural social structure§
Gazella saudiya	Saudi gazelle	31	n-s			
Gazella soemmerringii berberana	Soemmerring´s gazelle	172	wsh	Apr[3]	no	ssh[9], mh[2]
Gazella spekei	Speke´s gazelle	93	n-s	May - Jun[4]	no	mh[2]
Gazella subgutturosa subgutturosa	Persian goitered gazelle	155	2p	Apr - May[2]	no	mh[2]
Gazella thomsonii	Thomson's gazelle	31	wsh	wsh[4]	yes	mh[9], ssh[4]
Litocranius walleri	gerenuk	45	n-s	n-s[5]	yes	h[9], solitary, ssh[2]
Madoqua saltiana phillipsi	Philip's dikdik	32	unclear	2p[10]	no	p[2]
Family Bovidae, Subfamily Bovinae						
Boselaphus tragocamelus	nilgai	43	1f	Sep - Oct[2]	yes	mh, ssh[2]
Family Bovidae, Subfamily Caprinae						
Capra aegagrus	wild goat	8	1sp	spring	yes	ssh[8]
Capra ibex nubiana	Nubian ibex	12	1sp	Mar[2]	yes	ssh[2]
Ovis orientalis isphahanica	isfahan mouflon	10	1sp	Apr[1]	yes	ssh[8]
Ovis orientalis laristanica	laristan mouflon	62	1sp	Apr[1]	yes	ssh[8]
Family Bovidae, Subfamily Hippotraginae						
Addax nasomaculatus	addax	62	wspl	winter - spring[2]	no	mh[2]
Oryx beisa	beisa oryx	58	wspl	n-s[2]	partly	mh[2]
Oryx leucoryx	Arabian oryx	14	wsph	n-s[7]	partly	mh[2]

*n-s = non-seasonal, 1sp = one peak (spring), 1f = one peak (fall), 2 = two peaks, wsh = wave, summer high, wsph = wave, spring high, wspl = wave, spring low

§ssh = single-sex herds, mh = mixed herds, h = harems, p = pairs

[1]IUCN (2009)

[2]ULTIMATE UNGULATE (2009)

[3]ANTELOPE & GIRAFFE TAG (2009)

[4]ARKIVE (2009)

[5]AFRICAN WILDLIFE FOUNDATION (2009)

[6]GIOTTO et al. (2008)

[7]ANIMAL DIVERSITY WEB (2009)

[8]SHACKLETON and SHANK (1984)

[9]according to information provided by AWWP

[10]MALOIY et al. (1988)

[11]WOODLAND PARK ZOO (2009)

Results

The evaluated species at AWWP could be categorised as follows (table 1):

- Non-seasonal: blackbuck (2 - 14 % of all newborns being born per month), chinkara gazelle (5 - 15 %), dorcas gazelle (4 - 14 %), gerenuk (0 - 13 %), idmi gazelle (4 - 11 %), Pelzeln's gazelle (6 - 10 %), red-fronted gazelle (6 - 13 %), Saudi gazelle (3 - 16 %), Speke´s gazelle (3 - 15 %) (figure 1).
- Seasonal, one-peaked, spring: isfahan mouflon (0 - 90 % of all newborns being born per month, 90 % being born in March), laristan mouflon (0 - 74 %, 97 % in February to April), Nubian ibex (0 – 58 %, 91 % in February to March), wild goat (0 - 75 %, 100 % in February to April) (figure 2).
- Seasonal, one-peaked, fall: nilgai (0 - 53 % of all newborns being born per month, 93 % being born in August to October) (figure 3).
- Seasonal, two-peaked: Persian goitered gazelle (0 - 43 % of all newborns being born per month, 77 % being born in March to May, 14 % in September to October), Arabian goitered (rheem-) gazelle (0 - 46 %, 75 % in February to May, 18 % in September to November) (figure 4).
- Wave-like, spring-time high: Arabian oryx (0 - 29 % of all newborns being born per month, 57 % being born in January to April) (figure 5).
- Wave-like, spring-time low: addax (2 - 15 % of all newborns being born per month, 11 % being born in April to June), beisa oryx (0 - 17 %, 8% in March to June) (figure 6).
- Wave-like, summer high: beira antelope (0 - 22 % of all newborns being born per month, 44 % being born in May to July), dama gazelle (0 - 20 %, 46 % in June to August), Soemmering´s gazelle (2 - 19 %, 60 % in April to July), Thomson's gazelle (0 - 23 %, 58 % in May to July) (figure 7).
- Unclear: Phillip´s dikdik (0 - 25 % of all newborns being born per month) (figure 8).
- No further analyses: impala (1 reported newborn), Grant's gazelle (5 reported newborns).

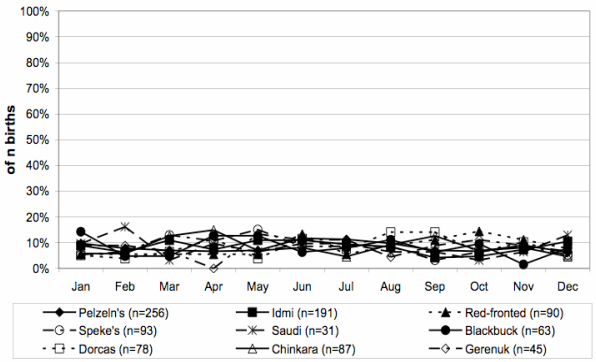

Figure 1: Species showing non-seasonality on births: blackbuck (Antilope cervicapra), chinkara gazelle (Gazella bennettii), dorcas gazelle (Gazella dorcas), gerenuk (Litocranius walleri), idmi gazelle (Gazella gazella.), Pelzeln's gazelle (Gazella dorcas ssp. Pelzelni), red-fronted gazelle (Gazella rufifrons), Saudi gazelle (Gazella saudiya), Speke's gazelle (Gazella spekei).

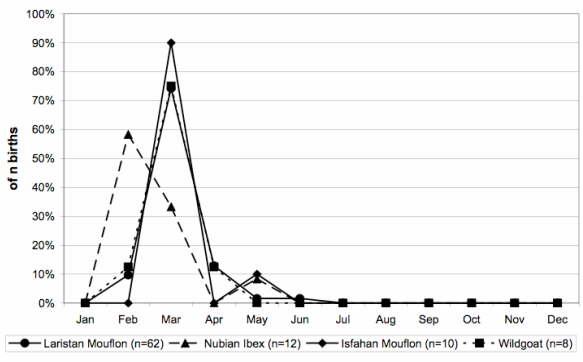

Figure 2: Species showing a spring-peaked seasonality on births: isfahan mouflon (Ovis orientalis isphahanica), laristan mouflon (Ovis orientalis laristanica), Nubian ibex (Capra ibex nubiana), wild goat (Capra aegagrus).

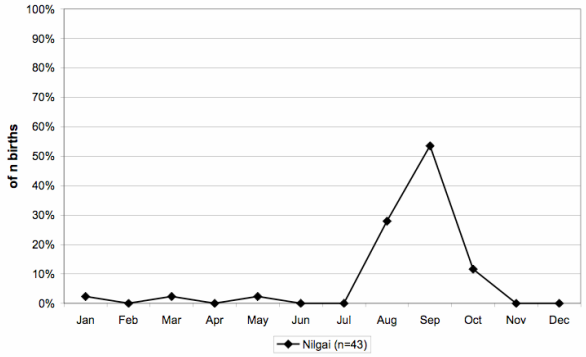

Figure 3: Species showing a fall-peaked seasonality on births: nilgai (Boselaphus tragocamelus).

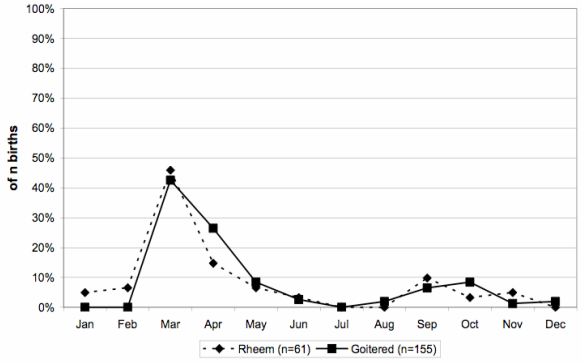

Figure 4: Species showing a two-peaked seasoality on births: Persian goitered gaelle (Gazella subgutturosa sub-gutturosa), Arabian goitered (rheem) gazelle (Gaella subgutturosa marica).

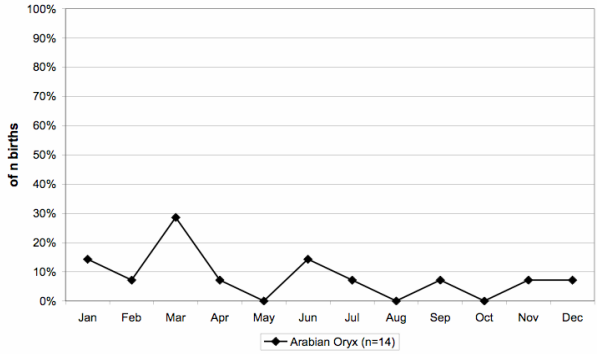

Figure 5: Species showing a wave-like birthdistriution with intensified activity in spring: Arabian oryx (Oryx leucoryx).

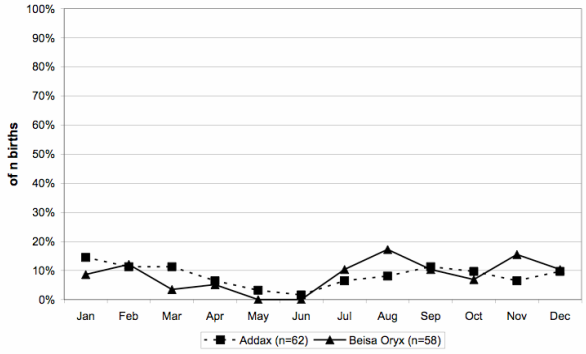

Figure 6: Species showing a wave-like birthdistribution with reduced activity in spring: addax (Addax nasomaculatus), beisa oryx (Oryx beisa).

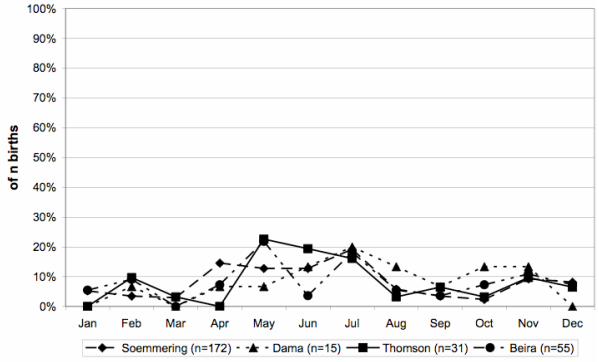

Figure 7: Species showing a wave-like birthdistribution with intensified activity in summer: beira antelope (Dorcatragus megalotis), dama gazelle (Gazella dama ruficollis), Soemmering's gazelle (Gazella soemmeringii berberana), Thomson's gazelle (Gazella thomsonii).

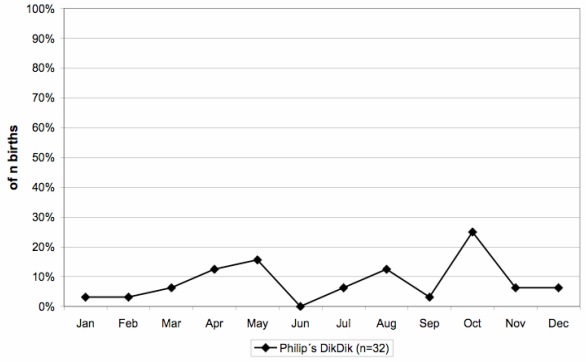

Figure 8: Species showing no clear breeding pattern: Phillip´s dikdik (Madoqua saltiana phillipsi).

Discussion

Although all observed species at AWWP are exposed to the same climate (the only exception being beira antelopes with air-conditioned facilities), and males are available throughout the year (therefore no manmade effect on breeding occurs), a broad range of different breeding patterns could be observed, ranging from non-seasonal, all year round birthing (e.g. idmi gazelle, dorcas gazelle, Speke´s gazelle) to restricted seasons lasting only 1 to 2 months (e.g. Nubian ibex, wild goat). Species naturally living in mixed herds seem to tend towards non-seasonal, all year-round breeding in their natural habitat as well as in captivity, whereas many species naturally living in single sex herds seem to tend towards a strictly seasonal birthing pattern. Whereas in most species breeding patterns are preserved in captivity, in some species deviations do appear. In species where day length seems to trigger oestrus cycle (caprinae) (SHACKLETON and SHANK, 1984), birthing seasonality is highly preserved at AWWP. This also applies for the only observed bovine species, the nilgai. Antelopine species at AWWP show both a preservation as well as change of their natural breeding regime. A change for instance appears in beira antelopes, where in the wild calves are born mainly, but not exclusively, in spring (rainy season) (GIOTTO et al., 2008). The same correlation between natural calving season and rainfalls can be found for example in idmi gazelles (ULTIMATE UNGULATE, 2009) or Soemmering´s gazelles (ANTELOPE & GIRAFFE TAG, 2009). At AWWP these species show calving throughout the whole year, for Soemmering´s intensified in summer. This change might be due to unlimited water and/or food supply in captivity. These observations might be helpful in managing captive bovid populations; for example, in species that do not preserve a natural breeding seasonality in captivity but breed around the whole year (but whose calves show a distinct seasonal mortality pattern, e.g. less survival in the summer), a distinct breeding management (denying male access to females so that no calves are born in the critical months) could be a viable option. On the other hand, these findings pose the interesting question what the different costs of different evolved reproduction strategies might be – why it might have been more adaptive for some species to evolve an inflexible, innate breeding cycle that is not linked to the actual resources but (presumably) day length only, and why for other species a more flexible reproductive cycle is more adaptive. One potential answer can probably be found in differences in the predictability of the various natural habitats.

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