The Egyptian Vulture *Neophron percnopterus* on Socotra, Yemen: population, ecology, conservation and ethno-ornithology

RF PORTER & AHMED SAEED SULEIMAN

Detailed surveys of Socotra's breeding birds 1999–2011 estimate the population of the Globally Endangered Egyptian Vulture *Neophron percnopterus* to be *c*1900 individuals, probably the highest concentration in the world. The paper also covers habitat, general ecology and behaviour as well as population history. Threats and future conservation are discussed.

INTRODUCTION

The resident Egyptian Vultures *Neophron percnopterus* (Plate 1) are widespread, rather tame and in places the most obvious birds on the island of Socotra. As soon as you arrive at the small airport Egyptian Vultures are there to greet you and by the time you have driven the 12 km to the capital Hadibu you may have seen over 50. It breeds on the limestone cliffs and is a familiar bird in and around the towns of Hadibu and Qalansiya as well as the island's numerous villages at all altitudes.

The vultures are often tame—and if food is offered they will venture to within a few metres: a picnic will soon produce a gathering awaiting the leftovers of *eg* a tasty goat. The Socotri are benign to the vulture and this together with a rapidly increasing human population, little in the way of garbage control and nesting sites aplenty in the limestone hills, has doubtless helped to maintain a large population of a species that elsewhere in the world is seriously declining. Thus in 2007, as a result of prolonged and catastrophic declines in Europe, India and Africa (Cuthbert *et al* 2006), this long-lived species was given the status of Globally Endangered (BirdLife International 2011).

There are no other vulture species on Socotra and the only other birds of prey breeding on Socotra are the Western Osprey *Pandion haliaetus*, Socotra Buzzard *Buteo socotraensis*,

Plate 1. Egyptian Vulture *Neophron percnopterus*, east of Hadibu, Socotra, February 2006. © *RF Porter*

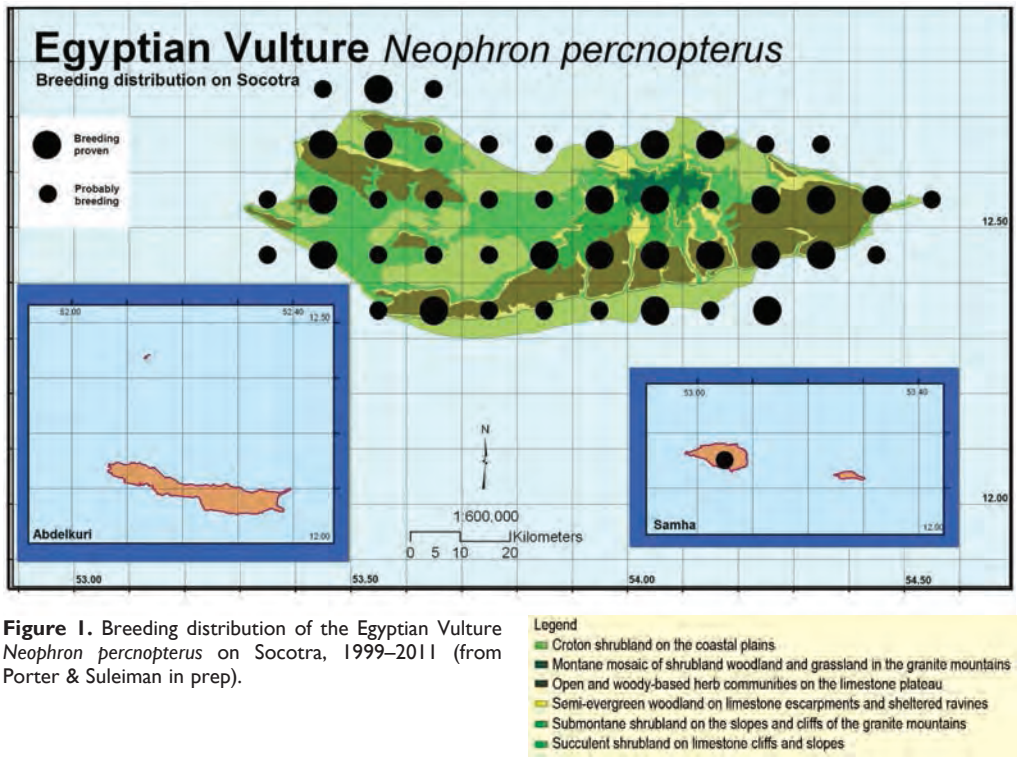

Figure 1. Breeding distribution of the Egyptian Vulture *Neophron percnopterus* on Socotra, 1999–2011 (from Porter & Suleiman in prep).

Common Kestrel *Falco tinnunculus* and Peregrine Falcon *Falco peregrinus* (Porter & Suleiman 2011).

The Socotra archipelago (12.30° N, 54.00° E) is part of the Republic of Yemen. It is situated in the Arabian sea *c*350 km south of the Yemen mainland and comprises the main island of Socotra (area 3579 km^2 and just 230 km east of the Horn of Africa) and three satellite islands and several sea stacks. It rises to 1500 m asl in the granite Haggier mountains though much of the higher areas of the island (500–1000 m) are limestone (Figure 1, which shows the main habitat types). The human population of Socotra is *c*50 000.

The archipelago is famed for its unique flora and fauna, with over 350 species of endemic plants, at least 21 endemic reptiles and ten species of endemic birds (Cheung & DeVantier 2006, Porter & Suleiman in prep). For plant endemism per km^2 alone it is ranked in the top ten islands in the world (Banfield *et al* 2011). This biological richness of the islands encouraged UNESCO to declare the Socotra archipelago as a World Heritage Site in 2008.

Other than livestock (sheep, goats, camels and miniature cattle), which were introduced by man, there are no larger mammals on Socotra other than the introduced Lesser Indian Civet *Viverricula indica*. Furthermore there is no evidence of large-bodied mammals ever having been part of the Socotran fauna (Van Damme & Banfield 2011).

DISTRIBUTION AND POPULATION

The population of Socotra's birds has been studied since 1993 when RFP first visited the island as a member of the OSME team surveying southern Yemen and Socotra (Porter *et al* 1996, Kirwan *et al* 1996). Then, between 1999 and 2011, nine surveys were undertaken by

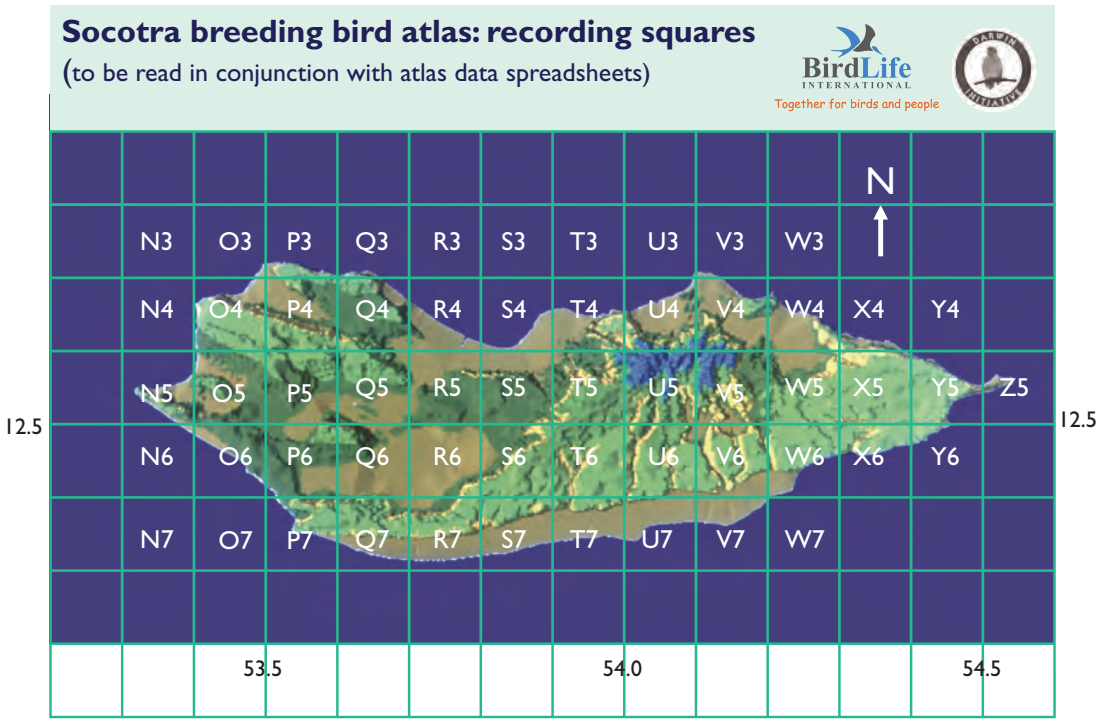

Figure 2. Socotra breeding bird atlas: recording squares.

BirdLife International and the then Socotra Conservation and Development Programme (SCDP) to study the distribution and population of the breeding birds of the archipelago.

Assessing the population of a highly mobile species is not easy, especially on a large island where travel is very difficult to the many remote areas. Thus several methods were employed to help build up a picture and a population estimate: total numbers recorded each visit, counts in the 1/10th degree recording squares, counts at settlements and line transects. We soon discovered that a pattern emerged for vulture distribution with much fidelity to towns, villages and settlements during daytime, and to roost sites at night. All observations were made from the ground and travel was by vehicle, camel or on foot.

Distribution

For recording purposes the islands were divided into 1/10th degree 'squares' (*c*120 km^2)—see Figure 2, which shows those for the main island. From 1999–2011 each square was visited at least twice (and at least half on over ten occasions) to search for proof of breeding of all species. For Egyptian Vulture the evidence was nest building, nests with eggs or young and birds carrying food to nest. In a number of squares actual proof was not obtained but strongly suspected—pairs copulating, birds entering likely nesting caves on cliffs; the latter were recorded as probably breeding. The results are shown in Figure 1. Note that apart from one area on Samba, vultures were only found on Socotra.

All surveys were undertaken during October–April and not during the dry monsoon period of May–September. This latter period might result in spatial changes, with vultures following the regular patterns of transhumance (up in hot weather, down in the cooler weather, Miranda Morris pers comm) though it is unlikely to affect the distribution shown in Figure 1. See also the 'Food' section below. It can be noticed that the proven breeding

Table 1. Total number of Egyptian Vultures *Neophron percnopterus* recorded during each study visit (2–4 weeks) to Socotra, 1999–2011. Where counts were made on several dates at one general locality, the highest has been used.

1999	2000	2001	2004	2006	2007	2007	2008	2011	Mean
580	609	479	533	311	333	400	447	452	460

distribution correlates closely with the distribution of the limestone plateau, escarpments and cliffs.

Numbers recorded per visit: total of daily counts

On each visit to Socotra, 1999–2011, daily counts of vultures were made, attempting to avoid duplication and the totals are shown in Table 1. Coverage was not comprehensive with probably *c*15–20% of the viewable area of the island covered during a visit. The numbers at and around Hadibu were always the highest count and ranged from 80–340 individuals depending on how comprehensively counts were made; the second highest counts were around Qalansiya, the other town on Socotra. If the mean of the daytime counts in Hadibu (135) and Qalansiya (32) is subtracted from the mean of all the counts in Table 1 (460) and the resulting figure (210) is divided by the estimate of the percentage area of the island covered during a visit (say 20%) then an estimate of 1465 individuals is reached. To this should be added the Hadibu and Qalansiya mean counts, thus arriving at an island population estimate of 1630. If a 15% coverage is assumed then this estimate increases to 2120. During each visit we believe that the areas covered were representative of the whole island thus removing a possible source of bias, nevertheless some duplication of counts will undoubtedly have occurred.

Other observers visiting Socotra have aggregated their daily counts. In spring 1993, the OSME team recorded 618 in a week-long survey which covered parts of the northeast, central and southern plain (Kirwan *et al* 1996). In a seven-day period in September 2007, a total of 820 were counted along 224 km of different roads or tracks (J-M & F Thiollay *in litt* to SCDP). In a 13-day period in December 2009/January 2010 a total of 704 were counted (Colin Richardson pers comm). It is likely that these counts will, like ours, include duplications, but the extent is unknown.

Counts in the 1/10th degree recording squares

During each visit to a 1/10th degree square, 1999–2011, all vultures seen were counted and the highest count, irrespective of year, is shown in Table 2. Because of the mobility of vultures, and the fact they can travel up to 70 km/day for food (Cramp & Simmons 1980), these data must be treated with caution. However, as mentioned previously, we discovered much fidelity to sites and areas and the two squares with towns (O4, Qalansiya and U4, Hadibu) consistently held the largest

Table 2. Highest count of Egyptian Vultures, 1999–2011, in each of the 1/10th degree recording squares on Socotra.

Recording square	Highest count
N6	10
O4	115
O5	31
O6	6
P3	10
P4	5
P5	30
P6	10
P7	17
Q4	35
Q5	8
Q6	10
Q7	26
R4	35
R5	40
R6	10
R7	37
S4	41
S5	20
S6	28
S7	6
T4	50
T5	90
T6	40
T7	42
U4	341
U5	27
U6	28
U7	30
V4	68
V5	64
V6	20
V7	21
W4	20
W5	35
W6	45
X5	31
X6	13
Y5	36
Y6	23
Z5	21
Total	1575

Table 3. Summary of daytime counts of Egyptian Vultures in towns and larger settlements, 1999–2011.

Settlement location	Recording square(s)	Range of counts *	Mean count
Hadibu	U4	82–175	135
Qalansiya	O4	20–55	32
North coast settlements to east of Hadibu	V4,W4,X4 & Y5		90
North coast settlements to the west of Hadibu	R4, S4, S5 & T4	45–95	70
Western Skand/Zirag/Firmhen settlements	T5	40–80	60
Nogid plain settlements	Q7, R7, S7, T7, U7, V7 & W7	75–125	110
Ma'alah plain settlements	O5		40
Wadi Ayhaft settlement		35–90	40
Wadi Denegehen settlement	U4	15–25	20
SW coastal settlements	X6 & Y6		30
Total			627

* not always possible to calculate as comprehensive counts not always made.

numbers. Despite obvious biases the total of the highest numbers recorded in each square (1600) is close to that reached by the previous method.

Settlement counts

During 1999–2011 regular daytime counts of Egyptian Vultures were made in Hadibu and Qalansiya and in many larger villages and small settlements throughout the island. We soon found that a pattern emerged and that counts at any one town or village (and even small settlements of 2–10 houses) were surprisingly similar on each visit over the 13-year period. Table 3 summarises the counts made at the larger settlements and settlement groups in named areas and the town counts.

The total in Table 3 does not include counts made at the smaller settlements and their immediate environs, many of which were in the more remote areas of the island. Because of their remoteness probably less than 100 settlements were visited and at these, daytime counts of vultures varied from none to *c*10 with an average of about three per settlement. The number of such small settlements (with populations of less than 100 people) is given as 565, according to a census in 2004 (Elie 2007) thus giving a small settlement total of *c*1700 birds and a total for all settlement counts, including towns, of over 2300.

Line transects

For determining the populations of passerines and near passerines a system of recording using line transects of 60 m band width was developed. However, so that data could also be captured for large birds observed flying over (notably Egyptian Vulture, Socotra Buzzard and Brown-necked Raven *Corvus ruficollis*) the band width for these was extended to 1 km. This we determined would provide a systematic method of collecting some population data that otherwise would have been difficult to obtain.

A total of 385 km of transects were undertaken 1999–2008 throughout the main island of Socotra. Because of the difficulties of access to many parts of the island it was not possible to randomly select the location for transects but, nevertheless, all squares, habitats and altitudes were surveyed. The analysis we adopted for determining the numbers of Egyptian Vultures is based upon summing the average sample density in each habitat type multiplied by the total area of that habitat type across the whole island. Thus for each habitat type the mean density of birds per km^2 is equal to total birds counted divided by total transect length multiplied by transect width: $\Sigma n_i/(w \times \Sigma l_i)$ where n_i is number of

birds counted in transect i, w is the width of the transect and l_i is number of km walked in transect i.

Knowledge of the area of the habitat in which vultures were observed (including 'fly-overs') enables a calculation of the population size for that habitat. So: population estimate for habitat X is the area of habitat X multiplied by the sample mean density of vultures in habitat X. The total island population estimate is the aggregation of the above for each habitat, giving a total of 2021 individuals. Because of the mobility of vultures and the fact that transects are not designed for estimating the population of fly-over birds, this method and calculations should be treated with caution as there is likely to be a bias to over-counting.

The population estimates reached by each method are given in Table 4. From this we suggest that a quotable figure for the population of Egyptian Vultures on Socotra, 1999–2011, is 1900, probably equating to 800 pairs, a figure determined with the help of age ratio counts below.

Table 4. Population assessments of Egyptian Vultures on Socotra, by different methods, 1999–2011.

Totals of daily counts	1630–2120, mean 1875
Recording square counts	1600
Settlement calculation	2300
Line transects	2021

Age ratio counts

The only information we have on clutch size is that depicted in Plate 2, which shows an egg and a recently hatched chick, thus a clutch of two. Although over 30 nests were located most were very difficult to reach and just sitting birds could be observed. Three nests inspected each had one young (Plate 3), but whether these originated from a clutch of two is unknown. From 2006–2011 sample age counts were made of Egyptian vulture groups and the results are

Plate 2. Egyptian Vulture *Neophron percnopterus* nest with egg and young, Socotra, 19 March 2009. © *AS Suleiman*

Plate 3. Videograb. Egyptian Vulture *Neophron percnopterus* at nest with nearly fledged young, Wadi Zirage, Socotra, February 2011. © *RF Porter*

Table 5. Sample age counts of Egyptian Vultures, 2006–2011.

	Total	adults	non adults	juvs only	% non adults	% juvs only
Feb/Mar 06	229	204	25	15	9.5	6.5
Feb/Mar 07	122	107	15	11	12	9
Feb/Mar 11	393	343	40	37	12.5	9.5
Oct/Nov 07	260	217	43	30	16.5	11.5
Oct/Nov 08	189	141	48	37	25	19.5

presented in Table 5. In addition, 820 vultures were aged during a week in September 2007 and a surprising 29.8% were first and second year birds (J-M & F Thiollay *in litt* to SCDP). In Dec 2009/Jan 2010 Colin Richardson (pers comm) estimated the number of juveniles in 704 birds seen to be 10–15%. The data in Table 5 broadly suggest that 85% of the vulture population are adults. Given a population of *c*1900 birds on Socotra this would suggest *c*800 pairs. (We have been careful not to interpret this as breeding pairs as the age of first breeding of Egyptian Vultures on Socotra is not known, but in some populations it can be as late as eight years old (Donazar *et al* 2002)). Whilst these data suggest good productivity for a species with an average lifespan of 14 years (BirdLife International 2011) they require more careful interpretation and comparison with other populations than we feel able to give here.

The population in a global context

The current estimate puts the world population of Egyptian Vultures at 21 400–67 200 individuals (BirdLife International 2011) with 10 500–16 800 individuals in Europe and 2500 individuals in the Middle East, though Jennings (2010) puts the Arabian population alone at 2000 pairs (over 4000 individuals). Thus the Socotra population of *c*1900 individuals (*c*800 pairs) represents *c*3–9% of the global population and over 45% of that in Arabia (including Socotra) using the figure in Jennings (2010). Clearly Socotra is of international importance for the conservation of this vulture, more so because the population appears to be healthy, whereas all others throughout its range are in serious, even catastrophic, decline.

Population history on Socotra

The Egyptian Vulture has been common on Socotra at least since ornithologists first visited the island over 100 years ago. Ogilvie-Grant & Forbes (1903) described it as 'very common at all our campsites' and in 1964 Forbes-Watson said it was 'one of the most obvious birds on Socotra' (Ripley & Bond 1966). Whilst they did not provide quantitative data, it is a reasonable assumption, given the current population, that there had been no major change over this period. Furthermore data collected over the last five years suggests healthy recruitment—see Table 5.

Why does Socotra have such a high population?

Over the last few decades, Egyptian Vulture populations have been seriously declining worldwide as a consequence of poisoning, human disturbance or the reduction in food availability (Cuthbert *et al* 2006). None of these are a problem on Socotra and that is probably the clue to the vultures' healthy population.

There is no persecution or disturbance of vultures, no evidence of direct poisoning, and no persistent pesticides are used in farming practices. There is a ready supply of food

thrown out by households as well as carcases from feasts. Socotra has no dogs, which might compete for food (and which could cause poisons to be used at rubbish dumps to control feral animals) and the only other predator or scavenger (apart from the domestic cat which is sometimes found living ferally) are the introduced Lesser Indian Civets, which are nocturnal. Although rats are poisoned in towns (see 'Threats and conservation' and 'Education') there is no evidence that this is causing the poisoning of non-target species, such as Egyptian Vultures. However we are conscious of the fact that dead vultures are rarely found and there has been no tissue analysis of such birds.

The other highest populations in the Middle East are also on islands: *c*12 pairs on Masirah, Oman, and *c*30 pairs on the Farasans, Saudi Arabia (Jennings 2010). It is worthy of note that on Masirah there are no dogs other than possibly two feral individuals (Chris Hillman & Salim Al Saadi *in litt* to Jens & Hanne Eriksen) or other canids. However on the Farasans there are serious problems of predation by feral cats, White-tailed Mongooses *Ichneumia albicauda* and, to a lesser extent, dogs (Mohammed Shobrak pers comm) but is unclear as to whether these impact the vulture population.

In the past it is unlikely that Socotra supported such a high population of vultures as there is no fossil evidence of large wild vertebrates ever existing on the island (Van Damme & Banfield 2011). Historically, therefore, their diet must have relied heavily on dead marine life such as beached cetaceans, turtles and seabird chicks, but this is speculation. Certainly there could not have been a large population.

On Socotra, whilst there was early human colonisation some 11 000 years ago, the first expansion of settlers occurred *c*3000 years ago (Cerny *et al* 2009, Van Damme & Banfield 2011). During this period the climate, being wetter, was more favourable for human population expansion (De Geest *et al* 2006). Furthermore, this was the time that settlers appeared to be introducing and experimenting with the best cattle and sheep to form domesticated herds and when these became a major component of the island's grazers (Van Damme & Banfield 2011). So it is likely that this was the time of a large increase in the Egyptian Vulture population, a situation parallel to that of the Canary islands, off

Plate 4. Egyptian Vulture *Neophron percnopterus* with white bill, a characteristic of race *gingianus* (but see text for discussion), Socotra, February 2009. © *Rob Felix*

northwest Africa, where it has been shown that colonization by Egyptian Vultures was able to take place after the arrival of human settlers along with their cattle (Agudo *et al* 2010).

Evidence of migration?

There is no evidence of migrant Egyptian Vultures on Socotra. No immigration has been observed and there is no apparent increase in numbers during spring, autumn or winter. Broad-winged soaring birds shun long sea crossings so migration to, or through, Socotra is highly unlikely. Whilst this is supported by the fact that other migrant soaring raptors are very rare or vagrant (Porter & Suleiman 2011), we are mindful that historically Egyptian Vultures and the Socotra Buzzard must have been able to reach the islands and only genetic studies such as those undertaken on the Canary islands (Agudo *et al* 2010) will be able to show the likely origin of the Socotran population.

An interesting observation was made in February 2009 when Rob Felix photographed a bird that superficially showed the characteristics of *gingianus*, the subspecies occurring in India (Plate 4). However, subsequent examination and discussion suggest this bird is of the nominate race and that the white bill resulted from abnormal pigmentation, especially as some toe nails were white and others had a black base. But it is a potential pitfall that could lead to misinterpretation of possible vagrancy.

ROOSTS

Egyptian Vultures leave their roosting sites at first light and return at dusk. A number of roosts were discovered throughout the island, birds typically spending the night on a cliff or in large trees near to a ready food supply. We counted these roosts as birds departed from very first light for one hour; most left their roost in the first 20 minutes. The largest roost was at Hadibu, on the cliffs, and especially *Sterculia africana socotrana* trees near Ras Hebak just to the west of the capital (Plate 5). The highest Hadibu count was on 26 October 2008 when RFP observed 341, counting from a rooftop, as birds flew in to the town from

Plate 5. Videograb. Egyptian Vultures *Neophron percnopterus* roosting at dusk on *Sterculia africana* trees, near Ras Hebak, Socotra, February 2011. © *RF Porter*

their roost sites, at first light, from the south and west. Many would have been missed as they start to leave roosts before it is light enough to count easily and also areas to the east of Hadibu, where birds also roost, could not be observed from the observation spot. On 10 August 2011 (during the dry monsoon) ASS and colleagues made a comprehensive count of birds roosting at the three main sites around Hadibu and these totalled 266.

Roost counts at Hadibu in February and March were lower (112 in Feb 2004, 142 in Feb 2007 and 208 in Feb 2011), possibly due to this being the height of the breeding season with many adults remaining at their nest sites. At sunset on 24 December 2009, 210 birds were counted crossing to the west of Hadibu from their daytime feeding places in the town, spiralling up and disappearing towards escarpments to the west of town to roost (Colin Richardson pers comm). Away from Hadibu, roosts were much smaller with the highest count being up to 60 in *Sterculia africana* trees at Wadi Denegehen (also in recording square U4). Other roosts discovered never exceeded 26 (at Sero February 2007) and all observed were on limestone cliffs.

THE BREEDING SEASON

An Egyptian Vulture has a long breeding season with up to *c*4.5 months from when the first egg is laid to the young flying (Cramp & Simmons 1980); this includes a fledging period of up to 80 days (Donazar & Ceballos 1989). With the dry monsoon sweeping the island May–September, with winds of up to 100 km/h, we were curious as to the effect this might have on the timing of the breeding season on Socotra. The summary of our observations is given in Table 6. This suggests that Egyptian Vultures can be actively involved with breeding from October for eight months at least and that some young will be fledging at the start of the monsoon period. Indeed the young bird and egg in Plate 2 would, if they survived, have fledged at the very end of May. There is then a further period until it is able to soar which Donazar & Ceballos (1989) showed could be up to 28 days, which, if the case on Socotra, could be right in the heart of the monsoon

HABITAT AND NEST SITE

The Egyptian Vulture breeds typically on the widespread limestone cliffs and escarpments which provide a host of nesting caves (Figure 1, Plates 6 & 7). Availability of nesting sites seems not to be a factor that limits the population, nor is competition from other cliff-nesting birds such as the Socotra Buzzard and Peregrine Falcon.

Nests are built in the highest available location on cliffs; we have never observed nests on trees. The same nest site can be used for many years and the nest structure made from a variety of materials including wool from sheep and goats, fish bones, animal skin, sticks and even animal (including human) excrement. Nests have a bad smell and old nests can be large in size—up to one metre diameter.

Vultures can be found feeding anywhere where food is available and thus can be encountered throughout the island, but especially near towns, villages and settlements.

Table 6. Summary of observed breeding activities of Egyptian Vultures on Socotra, 1993–2011.

Display	Oct–Mar, with no obvious peak period
Copulation	End Oct–end Feb, with no obvious peak period
Nests with eggs	Feb–late Mar
Nests with young	Feb–late Mar
Nests with incubating birds (eggs or young)	End Oct–May, with most observed in Feb and Mar
Very recently fledged juveniles	Most observed Feb

Plate 6. Limestone cliffs, typical breeding site for Egyptian Vultures *Neophron percnopterus*, southeast Socotra, February 2007. © *RF Porter*

Plate 7. Typical highland landscape where Egyptian Vultures *Neophron percnopterus* nest, Haggier mountains, Socotra, October 2008. © *RF Porter*

Even a picnic or overnight camp will quickly attract vultures. The beach at the fish souk at Hadibu sees large gatherings as can the remains of goat and cattle carcases after a feast.

FOOD

We observed vultures feeding on any edible organic garbage, especially meat or fish, discarded in towns and villages and after picnics. The Socotri usually throw out their food remains (including cooked food) for the goats and the vultures take advantage of this. Road kill victims are also eaten (Plate 8).

At first light vultures arrive at any settlement to await food remains and in Hadibu a count of vultures that are actually visible sitting on walls, roof tops and high perches can easily top 100, and there are probably three times that number present. On the occasion of a wedding festival the remains of the slaughtered goats and cattle can result in very large gatherings. The largest we recorded was 175 on 3 March 2011 on the outskirts of Hadibu, when 3 cows and 20 goats were the vultures' menu (Plate 9). On that occasion there was a constant procession of birds arriving and leaving, so the actual number taking advantage of the feast would have been much higher. It was also interesting to note that within *c*10 km from Hadibu on this and the following day few vultures were seen; normally there would have been several around all settlements and lunch in the field would always attract 10–20 birds.

Plate 8. Egyptian Vulture *Neophron percnopterus* feeding on Lesser Indian Civet *Viverricula indica* roadkill, Socotra, October 2008. © *RF Porter*

Plate 9. Videograb. Egyptian Vultures *Neophron percnopterus* feeding on remains of wedding feast, Hadibu, Socotra, March 2011. © *RF Porter*

Plate 10. Egyptian Vulture *Neophron percnopterus* feeding on dead fish on beach at Hadibu, February 2006. © *RF Porter*

Plate 11. Egyptian Vulture *Neophron percnopterus* with dead rat *Rattus rattus* (for young in nest), Wadi Zirage, Socotra, February 2011. © *RF Porter*

Plate 12. Egyptian Vulture *Neophron percnopterus* drinking, Socotra, February 2007. © *RF Porter*

Vultures also congregate on the beach near a fish souk or where boats were arriving after the morning catch, to feed on fish remains (Plate 10). The beach at Hadibu near the fish souk rarely had less than 20 vultures at any one time. Other items of food included cattle and human dung (which may explain why Socotra is marvellously free of human excrement), dead crabs and dead rats (Plate 11). For the significance of the latter see 'Threats and conservation'. Gatherings at sources of fresh water, such as wadi estuaries, were frequently observed and drinking seemed to be a regular requirement (Plate 12).

BEHAVIOUR AND DISPLAY

The most commonly observed display, October–March, is the formation-flying pair: one bird slightly above the other and tilting gently as they fly in formation. This sequence may be broken by suddenly tumbling together and occasionally talon-grappling. This display has been well described and interpreted in the Egyptian Vulture (Cramp & Simmons 1980, Mundy *et al* 1992). Two forms of behaviour that seem specific to the birds on Socotra

Plate 13. Mutual preening by Egyptian Vultures *Neophron percnopterus* is common and will often involve three birds, Socotra, February 2011. © *RF Porter*

Plate 14. Threesomes are not uncommon, Egyptian Vultures *Neophron percnopterus*, Socotra, February 2011. © *RF Porter*

Plate 15. Two Egyptian Vultures *Neophron percnopterus* adopt the 'fallen-angel' position, Socotra, October 2008. © *RF Porter*

were described in Porter & Quiroz (2010). The first involves the establishment of social gatherings at which there is much mutual preening and apparent pair-bonding interactions, which could also involve three birds (Plate 13). Such mutual preening was also observed in feeding groups and was often a precursor to copulation, again sometimes a third bird would try to join in (Plate 14). A second behaviour was the 'fallen-angel' display (Plate 15) which is probably a 'threat display and response' by two males (Porter & Quiroz 2010).

It will be noted in the photographs that many birds are stained rusty-orange, some very heavily; this is a feature that is well known in the Egyptian Vulture as a result of iron staining from the soil (Cramp & Simmons 1980). However on Socotra the degree of staining seems unusually high (higher than RFP has ever seen before), no doubt because on Socotra soils formed in red clay-loams with high iron contents resulting from chemical weathering of granite and limestone are widely distributed (Pietsch & Kuhn 2009). Vultures can frequently be observed on the island sunning themselves, to maintain feather care, spreading their wings in a curve around them on the ground and laying still for several minutes at a time.

THREATS AND CONSERVATION

There seems to be no immediate threat to the Egyptian Vulture population on Socotra. The Socotri do not persecute it, nor is it trapped for selling (as we have observed with Socotra Buzzard and Common Kestrel). In the future, urbanisation and greater hygiene and sanitation are likely to have the most profound effect.

The building of metalled roads in the last ten years (before that there were none) has resulted in faster driving and this has resulted in roadkills (Plate 16), probably of vultures that have come to the road to feed on a previous roadkill of a civet or occasionally a goat. In autumn 2008, for example, we counted eight vulture roadkills in three weeks. However, since 2008, crudely built speedbumps to slow traffic to protect goats may result in fewer vulture deaths.

Zinc phosphide rat killer (Plate 17) is commonly used to kill rats in the towns of Hadibu and Qalansiya where there are large numbers (Abduljameel Abdullah pers comm). Provided it is correctly used according to the instructions the risk of secondary poisoning by zinc phosphide is minimal (Marsh 1987) and thus would not appear to be a threat to scavenging birds such as Egyptian Vultures. It should also be mentioned in this context that Temephros used for malaria control on Socotra is a very dangerous toxic substance through the food chain (Van Damme & Banfield 2011), but again there is no evidence that this has caused the death of any vulture. There are no dogs on Socotra and thus the vulture is the top scavenger at rubbish dumps, and animal carcasses. But more importantly there is no need to put out poison at rubbish dumps to control feral dogs as has been the case in other countries.

The veterinary drug diclofenac is not used on Socotra (Abdul Rahman Al-Iryani pers comm). In Asia, and more recently Africa, diclofenac has been shown to be one of the

Plate 16. Egyptian Vulture *Neophron percnopterus* roadkill, near Qalansiya, Socotra, February 2006. © *RF Porter*

Plate 17. The rat poison used on Socotra. © *Abduljameel Abdullah*

main threats to *Gyps* vultures (Woodford *et al* 2008) with birds feeding on the carcasses of cattle that have been treated with the drug. Until we know whether the Egyptian Vulture is also susceptible, this and any other untested veterinary drugs may well pose threats. It is known, for example, from other studies (see Blanco *et al* 2007, 2009, Blanco & Lemus 2010) that other veterinary drugs, mainly antibiotics, are affecting vulture populations in Europe. It is therefore essential that any veterinary product or chemical used in the environment on Socotra is appropriately tested and screened.

The main conservation measure should be to continue to monitor the use of any veterinary products used in sheep, goat and cattle husbandry. The impact of *eg* diclofenac on *Gyps* vulture populations elsewhere in the world must not be repeated on Socotra. It is also important that the tissues of any dead vultures are collected for chemical analysis. In addition the national laws protecting wildlife and controlling the use of poisons, pesticides and veterinary products should be strengthened, in line with international legislation.

Although we are unaware of any vultures, nor indeed any other scavengers such as Brown-necked Ravens, having been found dead in circumstances that might suggest they had been poisoned, it is essential that the risk of direct or secondary poisoning is never underestimated. This is a subject that requires further study

EDUCATION

Environmental education on Socotra should include specific mention of the unique wildlife of the archipelago and the internationally important populations of birds such as the Egyptian Vulture. This should be aimed not only at schools, but also tourists and decision-makers, the latter through appropriate national and international workshops and conferences.

Plate 18. 'Build a bird' Egyptian Vulture used in schools to teach conservation, Socotra. © *RF Porter*

The school syllabus should encourage wildlife projects for students and in this respect the Egyptian Vulture being common and easily seen would be ideal for study. It has already been included in the popular and widely available *Birds & Plants of Socotra* (in Arabic and English) and introduced to children in the form of a 'build-a-bird' model (Plate 18). This model was used as part of a trial for a Darwin Initiative project (that was never completed) to promote an understanding amongst children of the importance of their natural heritage. Amongst the communities on Socotra, education about the safe use of poisons for rat control should be instigated.

VULTURES IN THE LIVES OF THE SOCOTRI: USES, MYTHOLOGY, SORCERY, MEDICINE AND POETRY

This paper would not be complete if we failed to mention the Egyptian Vulture's place in the actions, hearts and minds of the Socotri, and we wish to thank Miranda Morris for her

assistance with this. Her knowledge of the Socotran language and the way of life of the people of the islands, past and present, is second to none.

The Socotri treat the bird with respect. Not only does it help clean up settlements by eating all kinds of refuse (indeed the bird is often now referred to as the 'Soqotran municipality'), but it also acts as a guide to shepherds when an animal is dying, or when a lamb or kid is born as it flies to feed on the placenta. Vultures also reveal when people have butchered for a special meal by flying to congregate around the carcass. Vultures are never trapped, nor the nestlings taken as food, as is the case with several other bird species on the island.

A Socotran view of the Egyptian Vulture

Here is a literal translation of a text recorded by a Socotri from the eastern highlands, the late Ahmad Sa'ad Tahki, for Miranda Morris: "The vulture here on Soqotra: we teach our children never to harm them, never to kill them and never to play around with them. They are a great help to us and we like them. If anything has died, or if something has given birth to dead young, the vultures clear this up for us. They clear up excreta from both humans and animals. They remove anything unpleasant from us so that there is never an unpleasant smell. The dung of the vulture is used as medicine to rub on sores in children. We are fond of them and we protect and look after them. We feel no dislike of them and would never harm them. It is thanks to them that the island has such a sweet smell and is so clean. If you see vultures circling in the air anywhere, in a valley, over a rock, above a pit, you know that there is something there for them to work on.

"Like cats and some reptiles, a vulture can also be the familiar of a witch, or can be the witch herself in disguise, come to spy on us and cause harm. This is another reason that these creatures are not harmed, since to harm them might arouse the anger of a witch and cause her to seek revenge. Those who have a 'spirit' or 'special powers' of their own are always able to tell when one of these creatures (*ie* vulture, wild cat, reptile) is involved in sorcery."

The Egyptian Vulture in traditional medicine

Vulture droppings, dried to a powder and smeared over the body, were formerly regarded as a cure for a variety of skin diseases and conditions, and especially those believed to be a result of sorcery or of having angered the underground spirits (by having excreted, urinated or washed in a place special to them). Multiple sores on the scalp were treated by shaving the hair and applying a paste of vulture droppings mixed with water, or water and salt. The same mixture was rubbed into the skin of a child with a fever. Fever was also treated with vulture feathers: the wing of a vulture or a handful of vulture feathers were placed beside the fire until they began to smoulder and then the patient was placed in the smoke to be fumigated; at the same time he/she also inhaled the smoke. A vulture feather was burned under the patient's nose to treat fainting and dizziness. Swellings were treated with dried vulture droppings: they were put at the side of the fire and the patient was bathed in the smoke. Mastitis in goats and sheep was treated by smearing the inflamed udder with a paste of droppings and water, or water and salt.

There are reports (as yet unconfirmed) of vulture leg-bones having once been adapted to make a simple pipe or flute, much in the same way as were stems of the iconic tree of the island, the 'dragon's blood' tree *Dracaena cinnabari*.

The Egyptian Vulture in stories, songs and poems

Miranda Morris collected and translated the following delightful stories and songs from Socotra.

The vulture as a witch: the vulture used to be considered to be the familiar of witches or even a witch herself, flying here and there and perching on buildings, observing what was going on below.

There is a poem in which a woman says: "Would I could be a vulture, a young grey one circling above you! Snatching strips of the fillet meat from along the backbone, and grabbing at the ribcage meat too!" (The relevance is that these two desirable cuts of meat were customarily eaten by men and not usually offered to women.)

The vulture as a 'bride': these lines are an example of the use Socotri poets made of 'code-language': that is, words or phrases with more than one meaning, the true intention of the poet only being intelligible to those in the know, who share some secret knowledge with the poet, or to people of superior intellect and insight.

In this poem the joke turns on the fact that the popular women's names 'Sa'ida', 'Sa'adiya' are from the same root (s'd) as the Socotri term for the Egyptian vulture, 'sow'iydo'. A man posed this riddle to his nephew, claiming to offer him a bride called Sa'ida: "Wouldn't you like me to arrange a marriage between you and the young girl called 'Sa'ida', one always busily on the move, never still? So that she can sweep out your home for you, and bring the butter-churning to a successful conclusion?"

But the nephew was not taken in by his uncle, and understood the riddle—the offered 'bride' was in fact a vulture. He composed this couplet in reply: "She (*ie* the bride you pretend to offer me) is famous for her clumsiness and stupidity: she pours out the buttermilk from the butter-skin at midday! But you have not yet seen how passionate she is in her devotion to her father-in law (*ie* you, uncle)! She swears that every morning the two of you will greet each other warmly on the nose!" (the traditional Socotri greeting). The uncle had been well and truly beaten. Furious at the suggestion that he might embrace a vulture, he stalked off. (The relevance of the first line is firstly that no woman would do her butter-churning at midday, and secondly that vultures were well known for pecking at the leather skins which were used to hold milk, making holes in them and spilling the contents.)

A story about the wild cat and the vulture. There are two versions of this story. In one version the wild cat accuses the vulture of stinking of carrion and excrement, and tells her that it is because of her terrible smell that people chase her away. The other version has the wild cat coming across a goat which has just given birth in the wild. She starts to feed on the placenta, and when the vulture arrives to share in the feast, the wild cat tells it to go away: her smell is unbearable.

In both versions, the vulture retorts in a poem: "You, wild cat, do not smell as sweet as the *fegehun* plant (the name given to various sweet-smelling plants in the Socotra highlands)! Nor as sweet as the (meat) of the green pigeon. Nor as enticing as the smell of the pale-coloured goats when they shake out their coats." The vulture then criticises the wild cat, and says: "As for you, wild cat, why do you go for the necks of the goats? They hate you for it!"

The wild cat composes a couplet in reply: "It is not me they blame, but their owner. The one who didn't take the trouble to calculate carefully the five months (*ie* of their pregnancy, and bring the goat down to the settlement to give birth)!"

A story about the vulture and the raven. A raven found a vulture sitting beside a sick cow, waiting for it to die so that it could pluck out its eyes and tongue. The sun went down and it began to grow dark, but still the cow had not died. The raven sensed rain in the air, and said to the vulture: "Let's go and find shelter for the night", for he was unwilling to leave

the vulture alone with the cow in case the cow died and the vulture got all the meat. But the vulture was very hungry and unwilling to leave the cow, and she replied with this couplet:

"It won't rain when the moon is shining.
It won't rain at night when the sky is so clear."

But the raven composed a couplet in reply, and said: "It can indeed rain even though the moon is shining. Nightfall can indeed bring rain, even if the skies are clear: rain strong enough to cause a roofed building to collapse, despite the strong columns supporting it." The raven then flew off and sought shelter on its own. It rained heavily in the night. The next morning, when it flew back to where it had left the vulture and the cow, the prescient raven got four eyes to eat — the two of the dead cow and the two of the vulture which had died in the rain.

FUTURE RESEARCH ON EGYPTIAN VULTURES OF SOCOTRA

The following are considered to be priorities for future research and undertaken under the aegis of Yemen's Environment Protection Agency.

1. Undertake a more refined population assessment. The methodology for this should build on that described in this paper and should incorporate mapping of territorial breeding pairs (ideally in randomly selected squares) together with systematic counts at roosting sites.
2. Establish a long-term population monitoring programme. This should preferably be conducted by Socotrans who have been appropriately trained. Several areas with a good population of breeding pairs should be chosen for regular (say 5 yearly) monitoring of occupancy and breeding performance; the roost sites in the environs of Hadibu should be counted twice yearly.
3. Consider a banding programme within the routine monitoring to establish longevity and movements.
4. Research the fossil/sub-fossil bank and conduct genetic studies in an attempt to determine how long Egyptian Vultures have been on Socotra and from where they might have originated.
5. Introduce a system to measure the level of poisons/pesticides and veterinary drugs in vulture tissues.

ACKNOWLEDGEMENTS

We would like to thank the UK Darwin Initiative for funding the visits made in 1999–2004 and 2007. Other visits were privately funded but with support from BirdLife International and the Wetland Trust. During the surveys, we wish to acknowledge the support of team members who joined us, namely Simon Aspinall, Mike Evans, David Flumm, Rod Martins, Omar Al Saghier and Nadim Taleb; also Yohei Suzuki and Tatsou Mori for companionship in the field in 2011 while they were filming vultures and other wildlife on Socotra for Japanese NHK.

Dick Newell gave valuable advice on methodology for measuring vulture populations and we would like to thank the following for answering questions so clearly and promptly: Abduljameel Abdullah, Peter Castell, Serge Elie, Jens and Hanne Eriksen, Rob Felix, Ian Harrison and Colin Richardson.

We would especially like to thank Miranda Morris for her comments and valuable contribution to the section on vultures in the lives of the Socotri. The stories and poems chosen are from the forthcoming *Island Voices: The Oral Art of Soqotra* by Miranda Morris and Tanuf Salim Nuh Di-Kishin. We wish to thank Abdulraqeb Al-Okaishi, Ivaylo Angelov and Kay Van Damme for reading an early draft of the paper and making many helpful suggestions and comments. Last, but not least, we thank Laura Gangoso for her help with references and meticulous and incisive comments on our final draft, which we have tried to faithfully reflect.

REFERENCES

Agudo, R, C Rico, C Vilà, F Hiraldo & JA Donázar. 2010**.** The role of humans in the diversification of a threatened island raptor. *BMC Evolutionary Biology* 10: 384–401.

Banfield, LM, K Van Damme & AG Miller. 2011. Evolution and biogeography of the flora of the Socotra Archipelago (Yemen). *In*: Bramwell, D & J Caujapé-Castells (eds). *The Biology of Island Floras.* Cambridge University Press, UK, pp197–225.

BirdLife International. 2011. Species factsheet: *Neophron percnopterus*. www.birdlife.org.

Blanco G, JA Lemus, J Grande, L Gangoso & JM Grande. 2007. Geographical variation in cloacal microflora and bacterial antibiotic resistance in a threatened scavenger in relation to diet and livestock farming practices. *Environmental Microbiology* 9: 1738–1749.

Blanco G, JA Lemus, F Martínez, B Arroyo & M García-Montijano. 2009. Ingestion of multiple veterinary drugs and associated impact on vulture health: implications of livestock carcass elimination practices. *Animal Conservation* 12: 571–580.

Blanco G & A Lemus. 2010. Livestock Drugs and Disease: The Fatal Combination behind Breeding Failure in Endangered Bearded Vultures. *PLoS ONE* 5(11).

Cerny, V, L Pereira, M Kujanova, A Vaoikova, M Hajek, M Morris & C Mulligan. 2009. Out of Arabia-The Settlement of Island Soqotra as Revealed by Mitochondrial and Y Chromosome Genetic Diversity. *American Journal of Physical Anthropology* 138: 439–447.

Cheung, C & L DeVantier. 2006. *Socotra- A Natural History of the Islands and their People.* Odyssey, Hong Kong.

Cramp, S & KEL Simmons (eds). 1980. *The Birds of the Western Palearctic.* Vol 2. Oxford University Press, UK.

Cuthbert R, RE Green, S Ranade, S Saravanan, DJ Pain, V Prakash & AA Cunningham. 2006. Rapid population declines of Egyptian vulture (*Neophron percnopterus*) and red-headed vulture (*Sarcogyps calvus*) in India. *Animal Conservation* 9: 349–354.

De Geest, P, E Keppens, S Verheyden, H Cheng & L Edwards. 2006. High-resolution Holocene speleothem records from Soqotra Island, Yemen as a tool for Indian Ocean climate reconstruction. *Karst Waters Institute Special Publication* 10: 103–104.

Donázar, JA & O Ceballos.1989. Post-fledging dependence period and development of flight and foraging behaviour in the Egyptian Vulture *Neophron percnopterus*. *Ardea* 78(3): 387–394.

Donazar, JA, CJ Palacios, L Gangoso, O Ceballos, M Gonzales & F Hiraldo. 2002. Conservation status and limiting factors in the endangered population of Egyptian Vulture (*Neophron percnopterus*) in the Canary Islands. *Biological Conservation* 107: 89–97.

Elie, SD. 2007. *The Waning of a Pastoralist Community: An Ethnographic Exploration of Soqotra as a Transitional Social Formation.* DPhil dissertation, Department of Anthropology, University of Sussex, UK.

Jennings, MC. 2010. Atlas of the Breeding Birds of Arabia. *Fauna of Arabia* 25.

Kirwan, GM, RP Martins, KM Morton & DA Showler. 1996. The status of birds in Socotra and 'Abd Al-Kuri and the records of the OSME survey in spring 1993. *Sandgrouse* 17: 83–101.

Marsh, RE. 1987. Relevant Characteristics of Zinc Phosphide as a Rodenticide. *Wildlife Damage Management, Internet Center for Great Plains Wildlife Damage Control: Workshop Proceedings*. University of Nebraska, USA.

Mundy, P, D Butchart, J Ledger & S Piper. 1992. *The Vultures of Africa.* Academic Press, London.

Ogilvie-Grant, WR & HO Forbes. 1903. Birds of Sokotra and Abd-el-Kuri. *In*: Forbes, HO (ed). *The Natural History of Sokotra and Abd-el-Kuri*. RH Porter, London, pp21–63.

Pietsch, D & P Kühn. 2009. Soil developmental stages of layered Cambisols and Calcisols on Socotra Island, Yemen. *Soil Science* 174/5: 292–302.

Porter, RF, RP Martins & F Stone. 1996. The Ornithological Society of the Middle East's survey of southern Yemen and Socotra, March-May 1993: an introduction. *Sandgrouse* 17: 5–14.

Porter, RF & D Quiroz. 2010. Social behaviour of the Egyptian Vulture. *British Birds* 103: 61–64.

Porter, RF & AS Suleiman. 2011. *Checklist of the Birds of the Socotra Archipelago.* www.osme.org.

Porter, RF & AS Suleiman. In prep. *The population and distribution of the breeding birds of Socotra*. BirdLife International, Cambridge, UK.

Ripley, SD & GM Bond. 1966. The Birds of Socotra and 'Abd al-Kuri. *Smithsonian Miscellaneous Collections* 151(7).

Van Damme, K & L Banfield. 2011. Past and present human impacts on the biodiversity of Socotra Island (Yemen): implications for future conservation. *Zoology in the Middle East* Suppl 3: 31–88.

Woodford, MH, CGR Bowden & N Shah. 2008. Diclofenac in Asia and Africa – repeating the same mistake? *Bulletin OIE* (World Organisation for Animal Health) 2008(2): 11–14.

RF Porter, c/o BirdLife International, Wellbrook Ct, Girton Rd, Cambridge CB3 0NA, UK. RFPorter@talktalk.net

Ahmed Saeed Suleiman, consultant (birds and plants), Environment Protection Authority, Socotra, Yemen. qamhem@yahoo.com