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AUTHOR(S)

Brendan P. Kavanagh, Howard King

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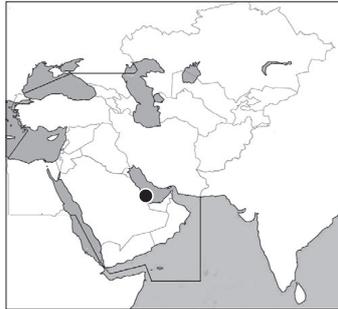
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Observations from 1998 – 2006 on the breeding population of Sooty Falcons *Falco concolor* on the Hawar Islands, Kingdom of Bahrain

BRENDAN KAVANAGH AND HOWARD KING



The breeding population of Sooty Falcons was observed on the Hawar islands from 1998-2006. The number of breeding pairs and the total productivity of the population were recorded annually. The population declined by 33% during that period, from 15 to 10 breeding pairs. The annual productivity fluctuated between 0.92 and 1.33 chicks per pair, but without any apparent trend. These figures are below the mean recorded in other populations. A recent review of the literature would indicate that the world population of this species has been seriously overestimated and further research is needed as a matter of urgency.

Brendan Kavanagh and Howard King, RCSI-Medical University of Bahrain, P.O. Box 15503, Kingdom of Bahrain..
e-mails: bkavanagh@rcsi-mub.com howardk@batelco.com.bh

INTRODUCTION

The Sooty Falcon *Falco concolor* is a migratory species, which breeds across eastern North Africa, from eastern Libya through Egypt, Jordan and Israel to the coasts of Red Sea and Arabian Gulf, through the Middle East to southwest Pakistan (Cramp & Simmons 1980, del Hoyo *et al* 1994, Jennings 1995). While there is little information on the total world population of the species, the present IUCN Red List of threatened species compiled by Birdlife International (BLI) (2007a) categorises the species as of 'Least Concern' and gives an estimated world population of 100 000 individuals (unchanged from 2006, BLI 2006) – this calculation is based on the proportion of birds seen in their winter grounds in Madagascar and SE Africa when compared with Eleonora's Falcon *F. eleonora* (Moreau 1969, Walter 1979a, Brown *et al* 1982). These earlier data were more recently upheld by del Hoyo *et al* (1994) who suggested a population of 40 000 breeding pairs (bp), which took into account birds not ready to breed, while the IUCN evaluators, Ekstrøm and Butchart (BLI Red List Authority) in BLI (2006 & 2007) cite Ferguson-Lees *et al* (2001) as the most recent authority used to support these data. However, a recent analysis alarmingly suggests that these figures may overestimate the population 40-fold (Jennings & Sadler 2006) (see below and also **Appendix 1**).



Plate 1. Typical Sooty Falcon *Falco concolor* habitat. © Juhani Kyyrö



Plate 2. Sooty Falcon *Falco concolor* chicks. © Juhani Kyyrö

Observations from 1998 – 2006 on the breeding population of Sooty Falcons on the Hawar Islands

For their breeding grounds, the birds utilize inland canyons or cliffs in rugged or mountainous desert areas and small arid uninhabited islands largely lacking vegetation (Beaman & Madge 1998) (**Plate 1**). Within the Gulf from Kuwait to the Gulf of Oman, Sooty Falcons are known to breed in all countries at low levels (Aspinall 1994, King 1999, IUCN 2006). In Bahrain, a small number of birds breed on the Hawar islands east of Bahrain and west of Qatar (Nightingale & Hill 1993, King 1999). This population has been the subject of an annual census since 1998. This short note reports on the breeding success and annual productivity of this population between 1998 and 2006.

MATERIALS AND METHODS

The annual survey began in 1998 as part of an evaluation of the Hawar islands (**Map 1**) as a unique area for conservation. This project was sponsored by the Bahraini Government, through the late Amir HH Shaikh Isa Bin Salman Al Khalifa, who issued Edict No 16 in 1996 establishing the Islands as a Nature Reserve. Full details of the results of this Hawar survey are contained in King (1999). Two breeding surveys were conducted annually from 1998 to 2006, one in early summer to establish the number of bp, the other in late summer to establish their annual productivity. The latter survey counted the number of free flying young produced. Data analysis was performed using Microsoft Office Excel 2003.

RESULTS

The number Sooty Falcon pairs on the Hawar islands, some 10 to 15 per annum (**Table 1**), has been recorded in all years from 1998 to 2006. The trend has been one of gradual decline in the total number of bp on the islands over the period of the survey (**Fig 1**). The number of pairs on Hajiyat and Wakur was stable while the number on Hazwarah, the main breeding colony, declined. The highest number of bp (15) was recorded in the first year of the survey, 1998, while the lowest number on record (10) was found in 2006. This represents a decline of 33% over the nine years of the survey.

The total productivity of the Sooty Falcon population has been recorded each year between 1998 and 2006 (**Table 1**). The average annual productivity of this population has ranged between 11 and 17 chicks, annual productivity being at its highest in 1998 and 2004 (17) and the lowest occurring in 2001 and 2006 (11)



Map 1. The Hawar Islands. © Howard King

(Fig 2). There has been a gradual decline in the annual productivity of the population over the period of the survey.

The relationship between total productivity and population size is at Fig 3. There is a general trend of greater numbers of chicks being produced in years that had higher numbers of breeding pairs.

Table 1. The number of breeding pairs of Sooty Falcon *Falco concolor* on the Hawar Islands 1998-2006. Also included are additional sightings of single birds, the total number of fledged birds and annual mean productivity per pair of the population.

Year	Pairs	Hazwarah Island	Hajiyat Island	Wakur Island	Additional observations	Young Fledged	Annual Productivity/Pr
1998	15	11	2	2	+1 (seen)	17	1.33
1999	14	11	1	2	None	14	1.00
2000	11	7	2	2	None	16	1.45
2001	12	8	2	2	None	11	0.92
2003	11	7	2	2	None	14	1.27
2004	13	10	2	1	+1 (Wakur)	17	1.31
2005	12	9	1	2	None	16	1.33
2006	10	7	2	1	+1 (Wakur)	11	1.10
Means	12.25	8.75	1.75	1.75		14.5	1.21

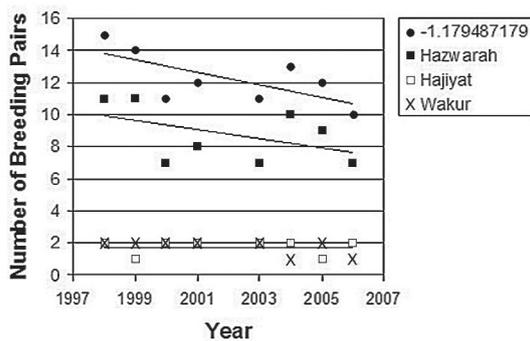


Figure 1. The number of breeding pairs of Sooty Falcon *Falco concolor* on the Hawar Islands from 1998 to 2006.

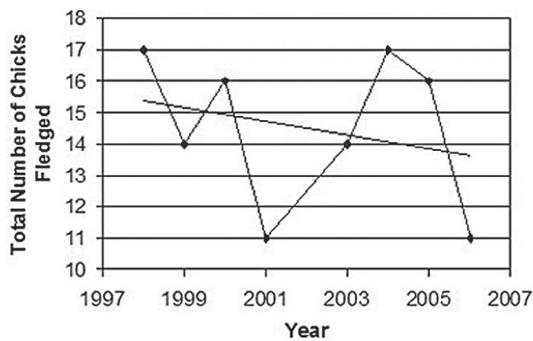


Figure 2. The total annual productivity of the Sooty Falcon *Falco concolor* population on the Hawar Islands from 1998 to 2006.

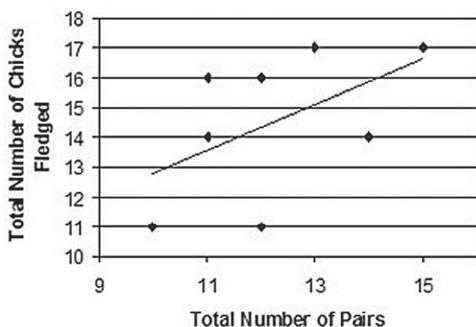


Figure 3. The relationship between the total annual productivity and number of breeding pairs of Sooty Falcons *Falco concolor* on the Hawar Islands between 1998 and 2006.

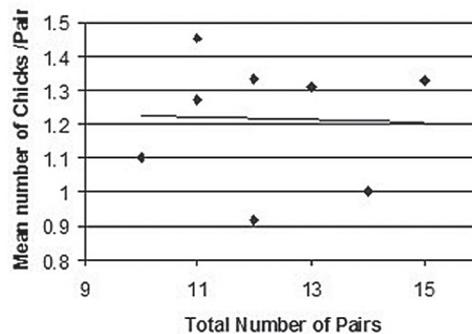


Figure 4. The relationship between the mean annual productivity and the size of the Sooty Falcon *Falco concolor* population on the Hawar Islands between 1998 and 2006.

Observations from 1998 – 2006 on the breeding population of Sooty Falcons on the Hawar Islands

The mean productivity of the Sooty Falcon population during the period of the survey from 1998 to 2006 is shown in **Table 1**. Mean productivity ranged between 0.92- 1.45 chicks per pair, with a mean of 1.21 chicks (+/- 0.19 (n=8)). The lowest success was recorded in 2001 and the highest in 2000. No trend was observed in these data (**Fig 4**).

DISCUSSION

The Sooty Falcon population has decreased on the Hawar islands by 33% between 1998 and 2006. It is difficult to explain this decline given the protected status of the islands and the absence of any disturbance to or modification of the habitat. It is more plausible that the decline is due to either poor productivity, leading to poor recruitment to the breeding population or to excessive mortality of adults and young birds on migration or in their winter quarters. In the former case one is assuming that locally bred birds are recruited to the population which we cannot substantiate from our data. Nor is there any evidence in the literature to elucidate the discussion further.

The extent of mortality of falcons on migration or in their winter quarters cannot be substantiated as no studies have been published on either the migration route of the birds or on the ecology and survival of birds in Madagascar or East Africa. Further research on the populations in their winter quarters is important if we are to develop a better understanding of the ecology and population dynamics of these falcons. The total productivity of the population in part is influenced by the decline in the number of pairs. However it will also be affected by other factors including climatic conditions, availability of prey both in the lead up to breeding and while chicks are in the nest and the extent of human disturbance during the breeding season. Although there was some evidence of harvesting of unfledged chicks from Hazwarah island, we think there was only a limited impact on the productivity of the whole population, because most of the nest sites are inaccessible. The individual pair productivity was not recorded annually, which makes it difficult to establish the impact of total nest failure on the productivity of the population.

The average annual productivity per pair shows no clear trend, suggesting that competition between pairs in years of high density does not occur. This would suggest that prey density is affected more by the year rather than the density of breeding Sooty Falcons – the latter circumstance aligns with the dependency of breeding pairs on a food source which is on migration to feed their chicks (eg Walter 1979b, del Hoyo *et al* 1994). There were no data available on annual variation in prey density on Hawar.

Del Hoyo *et al* (1994) reported that up to four chicks may be fledged per pair while the normal is two to three. A clutch of four chicks has never been observed in the Hawar population (HK pers obs) – in 2006 the maximum number of chicks per pair was two (**Plate 2**), several pairs producing only one chick. It would appear that the average annual productivity of 1.21 chicks (± 0.19 , n=8) at Hawar is significantly lower than that recorded in other populations (mean 2.34 chicks, del Hoyo *et al* 1994). Gaucher *et al* (1995) compared the productivity of two populations of Sooty Falcon in the Red Sea coast of Saudi Arabia and found mean annual productivities of 1.14 (sd +/- 1.23, n = 14) and 2.30 (sd +/- 2.30, n = 20) chicks per nest. The lower productivity relates to the Farasan Archipelago, which comprises several rocky islands far offshore where few large migrant birds pass, while the higher figure, recorded in the same year, relates to the southern Red Sea coast's (Gishran area) sandy shores and mangrove-covered islets, where more abundant larger prey was recorded. They attributed this variation in productivity of the falcons to differences in the abundance and regular occurrence of migrant birds during the chick-rearing season.

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Walter (1979b) recorded Sooty Falcon bp on the Hawar islands during his survey of the Oman population in 1978. All four nests had 3 chicks while the Oman population had an average 2.67 chicks per pair. During the current survey for this paper, we did not record any nests of three chicks or any clutches of 3 eggs (HK pers obs). Thus the current clutch size and level of productivity at Hawar would appear to be lower than previously recorded and may be incapable of maintaining the population in the absence of immigration from other populations.

The declining number of bp has not been compensated for by any increase in the productivity of the population. We have no data to support the notion that recruitment to the breeding population is from the cohort of chicks produced the previous or second previous year. We have no information on the fidelity or dispersal of the young or adults in the population and no information on the survival of each cohort from year to year. In the absence of these data it is not possible to ascertain the key factors controlling the fluctuations in the population of falcons breeding on Hawar though the decline over the past nine years does give great cause for concern. The first three chicks were ringed in Hawar in 2006. It is hoped that a sustained ringing effort in future years may help to cast further light on the recruitment to and dispersal from the Hawar population in the future.

At a conservation workshop on the Fauna of Arabia, held in Sharjah, UAE, in February 2006, Jennings & Sadler (2006) estimated that the total Gulf and Gulf of Oman population of Sooty Falcon was below 100 pairs, of which the Hawar islands accounted for 20%, but as shown above, the decline of the Hawar population since 1998 to only 10 pairs in 2006 may mean that the situation is even worse. In an evaluation of both published and unpublished data, Jennings (in prep) suggests that the total Arabian population of this species may be close to 500 pairs between the Red Sea and the Gulf of Oman, an area thought to contain a major proportion of the world population. This is supported by Gaucher *et al* (1995) who estimated the world population at less than 1000 pairs. These data are greatly at variance with the present published population estimates of 100 000 birds (IUCN 2007) or 40 000bp (del Hoyo *et al* 1994). The current classification of the Sooty Falcon by the IUCN may be seriously flawed (See **Appendix 1**). Should these latest data be substantiated, the Sooty Falcon should be reclassified as 'Endangered' as proposed by Jennings & Sadler (2006) instead of 'Least Concern'. At the very least, the Sooty Falcon should immediately be recategorised as 'Insufficient Data', pending further urgent research and re-evaluation of the most recent data on the species¹.

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¹ A draft of this short note was sent to BirdLife International, who have added this species to their Web Forum for urgent discussion.

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Appendix 1. A short review of the history of the population figures cited by IUCN for the status of Sooty Falcon *Falco concolor*.

Sooty Falcon *Falco concolor* is currently evaluated by the IUCN as 'Least Concern' (BLI 2006, 2007a), which assessment appears based on two factors:

1. The population density in its winter quarters in Madagascar.
2. Information on its global distribution in the northern hemisphere.

However, a retrospective examination of the original publications shows inconsistencies, brought about by assessments, which in hindsight comprise unsupported assumptions and extrapolations – these undermine the species' current IUCN evaluation, which the above paper argues is far too optimistic. I assert that there are major gaps in our knowledge that have remained unaddressed for over 40 years. Consequently, educated guesses made at that time have not been tested by hard data, rendering the hypothesis underlying the IUCN evaluation fragile, at the very least.

In elaboration of the first factor, I begin with Hartmut Walter's book on Eleonora's Falcon *F. eleonorae* (Walter 1979b). He had studied that species for 12 years and in December 1973 during his field studies had travelled to Madagascar to observe Eleonora's Falcons in their wintering grounds. During his stay (16 Dec 73 – 3 Jan 74) he spent three days in the field (24 -26 Dec) in the area around Morondava on the western coast, where the habitat in the area "... consisted of mixed and man-modified coastal plain. There were large agricultural areas (several dozen hectares) with dry or flooded rice fields; there were forest clearings not much larger than 1 or 2 hectares where the forest had recently been burned out, leaving the major tree trunks standing, and there was a dense secondary forest, often only 5 to 10m high". He indicated that most of the falcons in that forest were Sooty Falcons, only a few Eleonora's Falcons being observed with certainty. However he continues, "...without direct comparison, the two species are not easily distinguished from each

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other", later adding, "As a result of bad light (rain, dusk, distance) it was often impossible to distinguish the two species at all", but not withstanding this, he nevertheless estimated that, "The ratio was 10:1 or even higher in favour of this sibling species of Eleonora's Falcon", ie Sooty Falcon.

On the afternoon of 26 Dec, at 17.50 Walter went by road between the village of Andranomena and the town of Morondava. It had just stopped raining and the sun had appeared. There was no wind. He observed large numbers of falcons, first 6-8, then 'more than 25', and later another 42 birds crossing the road from east to west. "...all were Sooty Falcons except a rather reddish light-phased Eleonora's Falcon. I took many photographs, and we gave up counting". He further stated, "This last observation confirmed my assumption about the relative commonness of the two Palearctic falcons in this Morondava sector of Madagascar around Christmastime".

These data have been key in the evaluation of the status of the Sooty Falcon population. Walter estimated a Sooty Falcon density from his road trip through the rural habitat around Morondava (5 individuals/km²). He extrapolated from this conclusion that, if all this habitat locally was similarly occupied ("...at least 1000 km² of this habitat"), the estimated wintering population locally would be some 5000 individuals. Subsequently, by back-calculating on the basis of the proportion of light- and dark-phase Eleonora's Falcons in the European breeding population, Walter predicted the number of dark falcons which were not Sooty Falcons. Though well-meaning, this tautological or circular argument is an invalid approach, and though it is not directly relevant to my note on Sooty Falcon in Bahrain, it strongly suggests that all conclusions on Eleonora's and Sooty Falcon populations made at this time must be re-evaluated.

Furthermore, there were several assumptions in his line of argument that cast doubt on the validity of his ratio of 10:1 in favour of Sooty Falcons:

1. Accurate identification of each species was difficult.
2. The result is based on a tiny sample size producing too few data (a single afternoon road trip).
3. Evenness of falcon distribution within the habitat is unsubstantiated.
4. Clumping of falcon numbers around a food source or roost site was not considered.
5. The differing habitat preferences of the two species were not considered.

I am not disputing the importance of Walter's observations and his contributions to our knowledge of Eleonora's and Sooty Falcons. What I must call into question is the lack of scientific rigour in the use of his observation by subsequent authors. Moreau (1969) stated, "Evidently the Sooty Falcon must be much more numerous than Eleonora's, which is reliably estimated at 2500 pairs +/- 500, so that 10 000 of them would exist each autumn" citing Walter (1968) six years before the latter's visit to Madagascar. Cade (1982) subsequently misinterpreted this in concluding that Moreau was estimating the Sooty Falcon population at 10 000 birds. Moreau's figure refers to the population of Eleonora's Falcons in autumn as based on the breeding population (after Walter) plus the young birds produced. In fact, Walter (1979a) guesstimated the real population of Eleonora's Falcons at 12 000 individuals based on data up to the end of Dec 1977. Cade re-estimated the Sooty Falcon population figure upwards to 20 000, based on this revised estimate of the Eleonora's Falcon population.

Further to this, Brown *et al* (1982) accurately reported Walter's (1979a) estimates of the Eleonora's Falcon population (minimum 4825-5790; mean 11 000-13 000; maximum 17 500-21 000 birds), but took the unwarranted step of applying Walter's limited-area and doubtfully justified 10:1 ratio to arrive at a Sooty Falcon population of 50 000-200 000. I have not been able to uncover any documented publication in which Walter himself put these two separate estimates together for that purpose.

The IUCN evaluation of the status of the Sooty Falcon draws significantly from Ferguson-Lees & Christie (2001), who make a compounding unwarranted assumption about the size of the Sooty Falcon world population. From the most recent estimates available to them of the Eleonora's Falcon population (based on data collected through the 1990s), they multiplied this number by 10 to arrive at a world population of 40 000 breeding pairs of Sooty Falcon. Bearing in mind that this process is based on Walter's 1973 one-day road trip in Madagascar, I submit that it actually represents an extraordinary acceptance of tenuous data from one era to another. Admittedly, Ferguson-Lees & Christie (2001) note that the low densities occurring on breeding grounds are not compatible with the high population estimates of Walter & Cade, but they pin their hopes on undiscovered populations in remote likely breeding areas. Although Ferguson-Lees & Christie (2001) did not actually mention a total world population of: ".around 100 000 individuals", their 'order of magnitude'¹ figure (repeated in Ferguson-Lees & Christie 2005) on the map, '5', represents a '10 001-100 000' estimate, the higher figure being cited as 'up to' in the IUCN list. Because of the above concerns, BirdLife International have now raised the subject on their Globally Threatened Bird Forum (BLI 2007b) (Stuart Butchart & Jez Bird pers comm).

¹ Editor's Note. When I was taught 'orders of magnitude' in mathematics, Order 1 was 0-9, not 1-10, which would make Order 5, 10 000- 99 999, but I concede that its use here by Ferguson-Lees & Christie is more easily understandable to the lay person and remains consistent with the same approach in the under-rated 1983 *The Shell Guide to the Birds of Britain and Ireland*, by James Ferguson-Lees, Ian Willis and JTR Sharrock.