

The Sooty Falcon *Falco concolor* in Saudi Arabia

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INTRODUCTION

The Sooty Falcon *Falco concolor* shares with the Eleonora's Falcon *Falco eleonora* the peculiarity of breeding in late summer. This delayed breeding season allows the parents to feed their chicks on the Palearctic migrant birds (Cramp & Simmons 1980). The Red Sea and Arabian Gulf coasts probably form the nucleus of the world Sooty breeding population. The breeding biology of this species has been studied in the Libyan desert (Booth 1961), in Israel (Frumkin 1984, 1986, 1991; Frumkin & Pinshow 1983), in Oman (Walter 1979), in the south (Clapham 1964; von Heuglin 1859) and north (Baha el Din 1984) west coast of the Red Sea. The results presented here deal with a population inhabiting the east coast of the Red Sea in Saudi Arabia.

MATERIAL AND METHODS

An aerial survey was carried out during the breeding season (August) between Jeddah and Jizan along the Red Sea coast. To estimate the breeding populations we flew over all the small islands at altitude of 100m in order to check if they were occupied.

The data presented have been collected between 1st of July to 15th of November during three consecutive years (from 1989 to 1991). The islets were visited three times per month. During these visits, the status of all nests were recorded and the remains of prey were collected. The chicks and in six adult breeding birds were ringed. The adult birds were caught close to the nest with snares or small nets, they were then marked with metallic rings and colored plastic rings such as to identify them without recapturing them. Another means of identification in flight was to cut one primary and to replace it with white pigeon feather, following a standard practice in falconry.

STUDY AREA

From the aerial survey, we identified two main areas where the Sooty Falcons were breeding in significant numbers on islets off the Saudi Red Sea coast, south of Jeddah. The densest population was on three islets north of Al Lith (20°17'N-40°05'E) where we recorded the observations presented here. These islets are located approximately 500 to 3000m off shore.

The shore of the islets north of Al Lith is surrounded by mangrove trees and dense bushes of *Salicornia*. The area where *Salicornia* are growing rarely floods. The central part of the islets is barren (Gaucher *et al* 1988).

An other important population is situated on the Farasan Islands (16°70'N-42°00'E).

DATE OF ARRIVAL AND DEPARTURE

The earliest observation of birds arriving from their wintering ground situated in southeast Africa and Madagascar was the 30th March 1990. The departure from the breeding islands occurred from the beginning of November and by 5th of November only few individuals remained.

NEST SITE AND NESTING DENSITY

The nests are either located under mangrove trees and/or *Salicornia* bushes providing shade to the incubating bird, as the air temperature averages 38 °C in July August (Siraj, 1984). The same nest sites are used each year. Observations of our ringed adult birds seem to indicate that nesting sites are re-used by the same birds.

Nesting density is directly correlated to the length of a rarely flooded upper narrow band of the vegetation surrounding the islets. The mean distance between nests on the three islands was not significantly different, ranging from 28.5m to 20.7m with the maximum and minimum distances of 65m and 7m respectively. These inter-nests distances presented have been measured in 1989 and 1990 which were regarded as good breeding years (see below),

LAYING DATE, HATCHING DATE AND FLEDGING PERIOD

The date of laying showed a degree of synchronization; 90% of the clutches in 1989-90 were initiated between the 10th and 31st of July and 10% were laid between 1st and the 10th August. The incubation period is 27-29 days (Frumkin, 1991) so the hatching period for 90% of the clutches must have been between 15th and 31st of August and from 31st of August to 10th of September for the remainder. The chicks fledged on average 35 days after hatching, so they left the nest between 19th September and 15 October.

In 1991 the results were quite different since only 15% of the detected clutches were laid during the last two weeks of July, whereas 85% of clutches were laid between 5th and 20th of August. Hatching occurred between the 3rd and the 17th of September. Fledging was recorded up to the second and third week of October.

CLUTCH SIZE AND BREEDING SUCCESS

The clutch size ranges from one to three eggs per nest.

The number of eggs per nest was not significantly different between 1989 and 1990, but is significantly different between 1989 and 1991, 1990 and 1991 (Mann-Whitney test; $t = -2.98$, $p = 0.0047$; $t = -2.8$, $p = 0.0072$).

Table 1: Clutch size of the Sooty Falcon on the islets of Al Lith.

Year	Number of nests with			Mean
	1 egg	2 eggs	3 eggs	
1989	1	11	14	2.5
1990	4	12	17	2.39
1991	2	16	4	2.09
Total	7	39	35	2.34

Table 2: Results of the breeding season during three consecutive years in Al Lith.

	1989	1990	1991
Number of nests	26	33	22
Number of eggs	65	79	46
Number of eggs/nests	2.53	2.39	2.09
Number of fledglings	59	70	37
Number of fledglings/nests	2.26	2.12	1.68
Breeding success [%]	90.7	88.6	80.9
Number of fledglings/Number of eggs			
Failures: Dead chicks	3	1	1
Clear eggs or dead embryos	64	68	68

The number of fledglings per egg laid is not significantly different between the three years. The breeding failures, which are less than 20 %, concerned five chicks of which four died from disease (Trichomoniasis) and one disappeared and twenty unhatched eggs, either infertile or with dead embryo.

HUNTING BEHAVIOUR

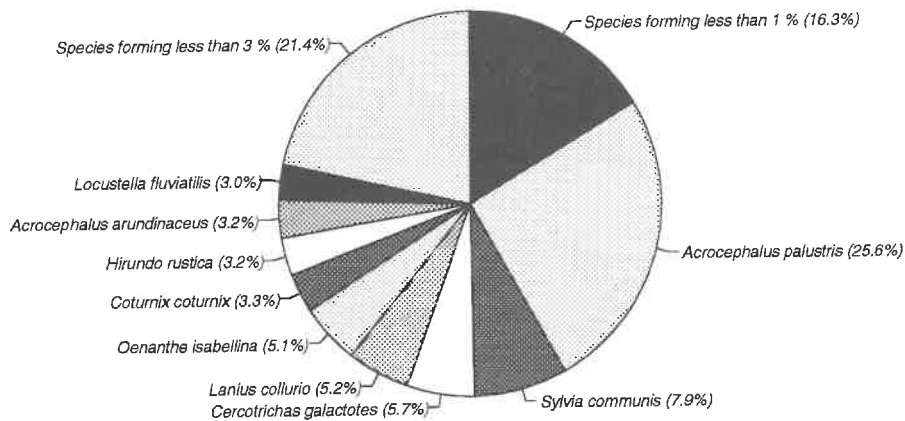
Most of the prey are sighted by the Sooty falcons stalking from the top of the mangrove trees. As the continental beach area is without vegetation for several square kilometers around, the trees and shrubs on the islands are a powerful attraction to the migrant birds. The open area across the sea between the sea shore and islands provides a vulnerability which is fully exploited by the falcons. The efficiency of the falcons seems greatly improved by hunting in groups comprising two to five individuals chasing the same prey. The prey can avoid one or two attacks but it is usually caught at the third attempt. Some passerines prefer to sink in the sea rather than to be caught.

DIET OF THE SOOTY FALCON

In Saudi Arabia, outside the breeding season (between April and June), the Sooty Falcons prey mainly on insects such as locusts, crickets and dragonflies but their diet also includes a small number of passerine birds.

During the breeding season preys are almost exclusively small birds, 98% of which are migrants (see Appendix). We have also recorded a rodent and a crab being taken (Gaucher *et al* 1988). Remains collected between 1989 and 1991, have been identified corresponding to a minimum total of 630 different birds. The most common prey was the Marsh Warbler *Acrocephalus palustris* representing 25.6% of all prey. It was followed by the Whitethroat *Sylvia communis* (7.9%), Rufous Bush Robin *Cercotrichas galactotes* (5.7%), Red-backed Shrike *Lanius collurio* (5.2%) and Isabelline Wheatear *Oenanthe isabellina* (5.1%). Part of these identified preys are complete birds either not eaten or lost in the bushes, possibly during the passing of prey from the male to the female.

Figure 1: Prey of Sooty Falcon in Saudi Arabia (1989-1991).



DISCUSSION

Whereas in our study area and in Israel (Frumkin 1991), most of the Falcons departed between 1st and 5th of November, on the islands situated mid distance between Al Lith and the Negev Desert, in the south of Egypt (24°39'N-35°10'E), seventy Sooty Falcons in family groups were still present on 12th and 13th of November (Baha El Din 1984). Stagg (1984) reported also that Sooty Falcons were present on Kutambil island (17°53'N-41°42'E) on south Saudi Red Sea coast between January and July.

The hunting technique we have observed was already described by Walter (1979) and Clapham (1964), but the Sooties in Oman had a greater tendency to stalk by gliding above the islands rather than perching. The former author also noticed that the falcons hunting in group were more efficient whereas Clapham (1964) reported the opposite.

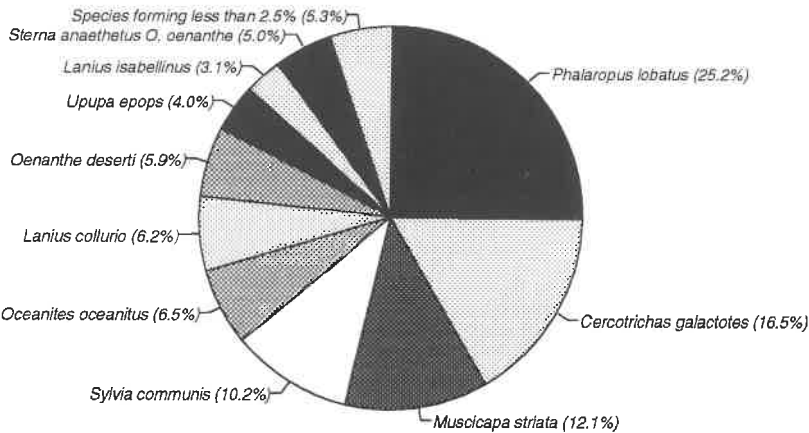
In Walter's study (1979), out of 322 different identified birds, the main prey was the Red-necked Phalarope *Phalaropus lobatus* which represents 25.2% of the total remains of birds, followed by Rufous Bush Chat *Cercotrichas galactotes* (16.5%), Spotted Flycatcher *Muscicapa striata* (12.1%), Common White throat *Sylvia communis* (10.2%), Wilson's Storm Petrel *Oceanites oceaninus* (6.5%), Red-backed Shrike *Lanius collurio* (6.2%).

In Clapham's study (1964) the most common prey was Blue-cheeked Bee-eater *Merops superciliosus* followed by European Bee-eater *M. apiaster*, Hoopoe *Upupa epops* and Golden Oriole *Oriolus oriolus*.

Baha El Din (1984), besides migrant passerine Birds like *Oenanthe sp.*, Bluethroat *Luscinia svecica*, Redstart *Phoenicurus phoenicurus*, *Sylvia sp.*, and *Phylloscopus sp.*, reported much larger preys such as Green-backed Heron *Butorides striatus*, Black-headed Gull *Larus ridibundus* and even White-eyed Gull *Larus leucophthalmus*. This last species, bigger than the Sooty, seems unrealistic as a prey.

In the Negev Desert, the majority of identified preys is also migrant birds but mainly aerial feeder birds such as Swallow *Hirundo rustica*, Swift *Apus apus* and European Bee-eater *Merops*

Figure 2: Prey of Sooty Falcon in Oman (Walter, 1979).



apiaster (Frumkin 1991).

The data gathered on the breeding biology of Sooty Falcon in Saudi Arabia are comparable to the observations reported from similar habitats (Clapham 1964; Walter 1979) but different of those reported from desert habitat (Frumkin 1991)

Table 3: Clutch size of the Sooty Falcon in the different parts of its breeding range.

Study Areas	Number of Nests with				Mean	Source
	1 egg	2 eggs	3 eggs	4 eggs		
Negev Desert		2	7		2.78	Frumkin, 1991
Libyan Desert			1			Booth, 1961
Oman	1	8	14	1	2.62	Walter, 1979
West Red Sea	2		4	1	2.57	Clapham, 1964
East Red Sea	7	39	35		2.35	This study & Gaucher <i>et al.</i> ,1988

Because these data have been collected at different years and from different populations, it is no possible to compare them statistically. However, it seems that the birds nesting in the desert (Frumkin 1991) have slightly larger clutches than the birds nesting on the islands.

The average clutch we recorded, was smaller than the average clutches reported from other populations breeding in the similar habitat: Islands in Gulf of Oman (Walter 1979) and Dahlak Archipelago in the Red Sea (Clampham 1964). The reason for this is that our results have been

calculated from three years data, including one year with significantly lower production of eggs (see above). The average number of eggs per clutch in our study area during the two years without severe climatic circumstances is 2.52, a number which matches more closely with those of obtained by Clapham (1964) and Walter (1979).

The differences of breeding performances noticed between the two first and the third year could be related to adverse climatic conditions i.e. very strong storms that occurred in July or August 1991 and flooded partially the islets, when the Sooties started laying. Unfortunately, no precise weather data are available. The usual hatching dates were recorded from nests above the flood line, the late clutches could be the replacement clutches.

The breeding success (number of fledging on the number of eggs) with an average of 87.4% can be considered as very high for a raptor (Newton 1979). In Oman, Walter (1979) reported a similar breeding success of 87.1% as fifty-four chicks fledged out of sixty-two eggs. In Israel, (Frumkin 1991) although the observed mean clutch size is the highest of the other study areas (see Table 1), the number of fledglings is the lowest with only two fledglings per nest. The breeding success calculated from a sample (Frumkin & Pinshow 1983) is 62.5% with only five chicks fledging from eight eggs.

The very high breeding success and the relatively high nest density suggests that prey availability is not a limiting factor for the Sooty populations nesting on the islands (Clapham 1964; Walter 1979). In our case, this is supported by the fact that many preys are caught and not eaten and also by the fact that we never found starving chicks, usually observed when preys are lacking (Newton 1979) (see Table 2).

In our study area, the high prey availability is probably related to the islets location on a point where the Asir mountains near to the Red Sea funnelling the flow of migrant birds on the seashore. This hypothesis is supported by the fact that similar islands situated south of the study area do not harbor any important breeding colony.

At this natural funnel, the barrenness of the local environment and the high summer temperatures make the vegetated islands very attractive to palearctic migrant birds. Part of these migrants are very vulnerable and become easy prey when they attempt to cross the sea to reach the vegetated cover of the islets.

A ground survey indicated that such high nest density is encountered only on the islets situated less than 5 km from the shoreline probably because the further islands do not attract so many migrants and so can sustain a lesser number of breeding pairs.

Data from our three years observations suggest that only severe climatic incidents linked with local sea level variations could have a significant influence on the breeding results of the Sooty Falcon.

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APPENDIX

SOOTY FALCON PREY COLLECTED IN 1989-90-91

Marsh Warbler	<i>Acrocephalus palustris</i>	161
Whitethroat	<i>Sylvia communis</i>	50
Rufous Warbler	<i>Cercotrichas galactotes</i>	36
Red-backed Shrike	<i>Lanius collurio</i>	33
Isabelline Wheatear	<i>Oenanthe isabellina</i>	32
Quail	<i>Coturnix coturnix</i>	21
Swallow	<i>Hirundo rustica</i>	20
Great Reed Warbler	<i>Acrocephalus arundinaceus</i>	20
River Warbler	<i>Locustella fluviatilis</i>	19
Swift	<i>Apus apus</i>	15
European Bee-eater	<i>Merops apiaster</i>	14
Wryneck	<i>Jynx torquilla</i>	12
Basrah Reed Warbler	<i>Acrocephalus (arundinaceus) griseldis</i>	11
Reed Warbler	<i>Acrocephalus scirpaceus</i>	11
Willow Warbler	<i>Phylloscopus trochilus</i>	11

Hoopoe	<i>Upupa epops</i>	10
Olivaceous Warbler	<i>Hippolais pallida</i>	10
Garden Warbler	<i>Sylvia borin</i>	10
Wheatear	<i>Oenanthe oenanthe</i>	9
Upcher's Warbler	<i>Hippolais languida</i>	8
Black-crowned Lark	<i>Eremopterix nigriceps</i>	7
Lesser-Grey Shrike	<i>Lanius minor</i>	7
Blue-checked Bee-eater	<i>Merops superciliosus</i>	6
Tree Pipit	<i>Anthus trivialis</i>	6
White-throated Robin	<i>Irania gutturalis</i>	6
Common Sandpiper	<i>Tringa hypoleucos</i>	5
Woodchat Shrike	<i>Lanius senator</i>	5
Bluethroat	<i>Luscinia svecica</i>	5
Stonechat	<i>Saxicola torquata</i>	4
Spotted Crake	<i>Porzana porzana</i>	4
Laughing Dove	<i>Streptopelia senegalensis</i>	3
Turtle Dove	<i>Streptopelia turtur</i>	3
Cuckoo	<i>Cuculus canorus</i>	3
Hoopoe Lark	<i>Alaemon alaudipes</i>	3
Spotted Flycatcher	<i>Muscicapa striata</i>	3
Thrush Nightingale	<i>Luscinia luscinia</i>	3
Redstart	<i>Phoenicurus phoenicurus</i>	3
Barred Warbler	<i>Sylvia nisoria</i>	3
African Reed Warbler	<i>Acrocephalus basticalus</i>	3
Namaqua Dove	<i>Oena capensis</i>	2
Sand Martin	<i>Riparia riparia</i>	2
Short-toed Lark	<i>Calandrella brachydactyla</i>	2
Blue-headed Wagtail	<i>Motacilla flava</i>	2
Desert Wheatear	<i>Oenanthe deserti</i>	2
Blackap	<i>Sylvia atricapilla</i>	2
Orphean Warbler	<i>Sylvia hortensis</i>	2
Little Crake	<i>Porzana parva</i>	1
Redshank	<i>Tringa totanus</i>	1
Greater Sandplover	<i>Charadrius leschenaultii</i>	1
Kentish Plover	<i>Charadrius alexandrinus</i>	1
Pratincole	<i>Glaucopis pratensis</i>	1
Alpine Swift	<i>Apus melba</i>	1
Water Pipit	<i>Anthus spinoletta</i>	1
Masked Shrike	<i>Lanius nubicus</i>	1
Great Grey Shrike	<i>Lanius excubitor</i>	1
Isabelline Shrike	<i>Lanius isabellina</i>	1
Nightingale	<i>Luscinia megarhynchos</i>	1
Whinchat	<i>Saxicola rubetra</i>	1
Rock Thrush	<i>Monticola saxatilis</i>	1
Savi's Warbler	<i>Locustella luscinioides</i>	1
Lesser Whitethroat	<i>Sylvia curruca</i>	1
Ortolan Bunting	<i>Emberiza hortulana</i>	1
Golden Oriole	<i>Oriolus oriolus</i>	1
Unidentified		4