

Monitoring birds, reptiles and butterflies in the St Katherine Protectorate, Egypt

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ABSTRACT

Fifty-two bird species were recorded during transect and point count surveys of wadis in the St Katherine Protectorate in the mountainous southern region of the Sinai, Egypt. Two species are new to Egypt: Rock Nuthatch (*Sitta neumeyer*) and Rock Sparrow (*Petronia petronia*). There were several other notable species: migrants such as Arabian Warbler (*Sylvia leucomelaena*) and Upcher's warbler (*Hippolais languida*); and residents such as Verreaux's Eagle (*Aquila verreauxi*), Hume's Tawny Owl (*Strix butleri*) and Striated Scops Owl (*Otus brucei*).

Estimates of bird density and descriptions of each wadi are given. Species diversity of wadis within the Ring dyke geological feature bounding the central mountain plateau was not significantly different from wadis outside. Species composition and numbers of individuals varied according to the distribution of water sources, natural trees and Bedouin gardens especially in fruit. These features appear to be particularly important as staging posts for migrants. Numbers of some birds increased around tourist areas.

Observations of seven species of reptile and ten species of butterfly including endemics are also presented. Recorded numbers of all groups depended heavily on the time of day.

INTRODUCTION

Egypt has a 'hyper-arid' desert climate with little vegetation, and biodiversity is relatively low compared to other ecosystems. This does not mean that biodiversity is unimportant, and within Egypt there are areas of high diversity. Situated where Asia and North Africa meet, the Sinai Peninsula is one of the two most biologically diverse areas of Egypt. The fauna and flora are concentrated into highly heterogeneous patches, principally where rainfall run-off and snow melt from mountains is channelled through ephemeral river and stream valleys known as wadis. The peninsula divides into three parts: the northern sand dunes; a central, north-draining limestone plateau; and a set of high igneous mountains to the south (Evenari 1985). Highly specialised isolated environments promote the evolution of endemism, and many endemic or near-endemic plant and animal species occur in the Sinai mountains. Although the endemics do not include birds, there are some regionally interesting species, such as Tristram's Grackle (*Onychognathus tristramii*) and the Sinai Rosefinch (*Carpodacus synoicus synoicus*) among about fifty resident breeding birds (Goodman *et al*, 1989).

Culturally and historically the mountains of the southern part of the peninsula are famous for Mount Sinai (2286 m: its Arabic name, Gebel Musa, is used here) and associated religious sites, especially the Monastery of St Katherine, and the neighbouring Mount St Katherine (Gebel Katrin 2642 m). The Jebaliya Bedouin have traditionally inhabited the mountains around St Katherine, maintaining fruit tree gardens and olive groves in suitable basins in the wadi floors around St Katherine (Hobbs 1996, Zalut & Gilbert 2007).

In 1996 the South Sinai mountains area was given protection as the St Katherine Protectorate. All hunting was banned, although many of the larger charismatic fauna of the

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region such as the Sinai leopard (*Panthera pardus jarvisi*) had already been hunted to extinction, and others such as the Nubian Ibex (*Capra ibex nubiana*) were already rare. Current threats include overgrazing, especially on palatable species of endemic plants, and the mixed blessing of tourism, which increases the value of preserving the region's wildlife, but risks damaging it from increased disturbance and water consumption (Hobbs 1996).

Few biological records have been collected from the Protectorate on a systematic basis and there is little detailed information on where species occur and if there are differences in the faunas between wadi systems and altitudes. To improve knowledge, and to assist the rangers of the St Katherine Protectorate with their monitoring programme, preliminary surveys of birds were carried out *ad hoc* in 1996-2001 and systematically in 2002. In 2005, a UK-based charity (Operation Wallacea) together with Egyptian colleagues and the St Katherine Protectorate started a long-term monitoring programme by recruiting 49 British (self-funded) matched with 40 Egyptian undergraduates (funded by the British Council), 23 rangers from Protected Areas around Egypt (funded by the BioMAP project of the EEAA, Cairo) and a number of local Bedouin experts. These teams conducted eight weeks of biological recording guided by local Bedouin in 18 different wadi systems.

METHODS

In the preliminary surveys of 1996-2001, birds were identified *ad hoc* by H.G. during time spent in St Katherine and trekking in wadis while collecting plants and insects. In 2002 a bird census was carried out over a 14-day period between August 24th and September 6th. Led by S.de K., a team of five people walked slowly and quietly along the length of a number of wadis (in the Ring Dyke, Feiran and °Ain Hodra), listening for bird calls, and observing and identifying birds with binoculars (using Porter *et al.* 2004). Records were made of the species, number of individuals in the group, sex of individuals, time of sighting, whether they were flying, perching or foraging, and whether they were in/outside the Bedouin gardens. The surveys were carried out both in the early morning (0600 - 0900 h) and evening (1600 - 1930 h) when the birds were most active. In addition, five local Bedouin were asked a series of questions to help understand how and why the population and diversity of the avian fauna in the area may have changed through time. They were shown pictures of species expected to occur here, and the species seen, and then asked a series of questions concerning the abundance past and present, and the basic ecology and behaviour of each species.

All other data were gathered between June 25th and Sept 4th 2005 by teams led by K.M. All times are local time (GMT + 2). The following wadis were surveyed (Fig 1): twelve wadis within the Ring Dyke that forms the boundary to the central granite mountains of the St Katherine Protectorate; a further four in the lower-altitude sandy desert east of the ring dyke towards the Gulf of Aqaba; the granitic Wadi Isla draining south-westwards from near Gebel Katrin; and the fruit and date palm gardens of Wadi Feiran to the north-west of St Katherine.

Transects of generally 1 to 2 km (see Table 1) were walked along each wadi starting as close to 0600 h as possible at a pace of 1 km per hour, initially recording the time and GPS position of the group when birds were observed. Large inaccuracies in GPS position readings were sometimes found, probably due to signal reflection off of the steep, rocky wadi walls. In an attempt to compensate, the group's position was instead recorded every ten minutes and the position of a bird was related to the position fix at the nearest time to its observation. Ten-minute readings should have plotted the route of the transect itself so that inaccurate points could later be easily identified and adjusted when the data were plotted on a GIS map.



Figure 1: Areas of south central Sinai Peninsula surveyed

The estimated distance from the observer to the bird and its bearing from the direction of travel were recorded. After 1000 h very few birds were active and only incidental observations of species were made. In garden and oasis locations (Ain Hodra and Wadi Feiran) where either the extent of the habitat or access was restricted, point counts and species lists were made. Some extra bird counts were done in the vicinity of the monastery (Wadi el Deir).

The full schedule of treks is given in Table 1. Birds were identified from experience and from various field guides: the names follow Snow *et al.* (1998). Although the main focus was on birds, we also recorded reptiles and butterflies on an *ad hoc* basis. The eight reptile species to be monitored in the St Katherine Protectorate were selected by Baha El Din & Baha El Din (2000), and identified using a photographic key developed from Baha El Din (2001). Ten key butterfly species (Table 2) were chosen as targets for the surveys on a variety of grounds: importance, abundance and ease of identification. They were identified from Larsen (1990).

Site descriptions

Wadi Isla (1200 – 560 m a.s.l). (**Area 1**) The 20-km length of the wadi descends through boulder fields to a wide sand and gravel dry river bed flanked by cliffs and sections constricted by harder rocks into canyons. Largely uninhabited, some small simple fields have been built up above the sand of the wadi bed that are watered via long lengths of hose pipe from a network of deep wells at intervals along the bed of the wadi. Where there were springs between the rocks there were a few trees, mainly acacia or palms or areas of sedge. These were most

extensive where Wadi Muagid, a steep rocky tributary, joined Wadi Isla at approximately 700 m altitude.

One set of wadis (**Area 2**) were all within the Ring Dyke, local to St Katherine, and were either surveyed within a day from the field base (wadis Arba'ain, Talah, Itlah and Nabq el Hawa) one overnight camp (Wadi Ferah, Safsafa and Gebel Musa) or two overnight camps (Wadi Gebel system).

Table 1: Schedule of the Operation Wallacea expeditions in south Sinai in 2005. A 'cluster' is a term for a flock of birds (ranging from 1 for single birds, to large numbers in some cases)

Schedule

<i>Date</i>	<i>Wadi</i>	<i>Area</i>	<i>Length (m)</i>	<i>Point Counts</i>	<i>Time (h)</i>	<i>No. of clusters seen</i>
30th June	Isla	area1	5000		5	31
30th June	Isla	area1	2000		1.5	25
2nd July	Isla	area1	1000		1.5	5
1st July	Moagid	area1	1000		1.5	5
1st July	Moagid	area1	1000		4	9
2nd Aug	Arbaein	area2		1		0
18th July	Dir	area2		1		11
18th July	Dir	area2		1		20
7-9th Aug	Gebel	area2		1		35
28th July	Safsafa	area2		1		14
20th July	Tenya	area2		1		0
21st July	Abu Tuita	area2	1000		1	9
8th July	Arbaein	area2	2000		4	35
22nd July	Farsh Romana	area2	1000		1	18
27th July	Ferah	area2	1200		1.5	9
9th Aug	Itlah	area2	1000		1	26
9th Aug	Itlah	area2	400		1.5	9
6th July	Itlah	area2	2500		5	14
6th July	Itlah	area2	600		1	14
26th July	Naqb Howa	area2	600		2	5
5th July	Safsafa	area2	1500		4	21
20th July	Shagg	area2	2000		2	26
29th July	Sheikh	area2	2300		2.5	10
19th July	Tala	area2	2000		2	35
12th July	Tala	area2	2000		0.5	9
21st July	Tenya	area2	1000		1	18
6th Aug	Hodra	area3		1	1	49
5th Aug	Hodra	area3		1	0.5	22
5th Aug	Hodra	area3		1	1	24
14th July	Hodra	area3		1	1	19
15th July	Matamir	area3		1		1
15th July	Matamir	area3		1		1
4th Aug	Hammam	area3	3000		3	9
5th Aug	Hodra	area3	1500		2	51
14th July	Hodra	area3	1500		1	11
11th Aug	Feiran	area4	1000		1	20
12th Aug	Feiran	area4		1	1.5	24
11th Aug	Feiran	area4		1	1.5	35

19th Aug	Sheikh Awad	area5	2000	1.5	25
18th Aug	Sheikh Awad	area5	2000	2	38
18th Aug	Sheikh Awad	area5	2000	5.	17

(a) total number of point-count clusters	255
(b) total number of line-transect clusters	495
(c) total time in transects	54.5
(d) clusters per hour in transects	9.08
(e) Hectares per hour surveyed in transects	8.09
(f) equivalent time in point counts (= c * a/b)	28.08
(g) equivalent area surveyed in point counts (= e * f)	227.18

Table 2: Targetted species of reptile and butterfly for recording. The reptiles were chosen by Baha El Din & Baha El Din (2000) as monitoring indicators for St Katherine. The butterflies were chosen on the basis of importance, abundance and ease of identification.

Reptiles	Geckonidae	<i>Ptyodactylus hasselquistii</i>		
		<i>Ptyodactylus guttatus</i>		
	Agamidae	<i>Pseudotrapelus sinaitus</i>	Blue Agama	
		<i>Laudakia stellio</i>	Sinai Agama	
		<i>Uromastyx aegyptia</i>	Egyptian	
		<i>Uromastyx ornata</i>		
	Lacertidae	<i>Acanthodactylus boskianus</i>		
		<i>Mesalina guttulata</i>		
Butterflies	Lycaenidae	<i>Zizeria karsandra</i>	Mediterranean Grass Blue	
		<i>Pseudophilotes sinaicus</i>	Sinai Baton Blue	
		<i>Freyeria trochylus</i>	Grass Jewel	
		Nymphalidae	<i>Melitaea deserticola</i>	Desert Fritillary
		Satyridae	<i>Pseudotergumia pisidice</i>	Desert Grayling
			<i>Satyrium jebelia</i>	Sinai Hairstreak
		Pieridae	<i>Pontia daplidice</i>	Bath White
			<i>Colotis phisadia</i>	Blue-spotted Arab
			<i>Colotis (Madais) fausta</i>	Salmon Arab
		Hesperidae	<i>Carcharodes alcaea</i>	Mallow Skipper

Gebel Musa (Mount Sinai) and Safsafa - Elijah's Basin and El Loza (2200- 2000 m a.s.l.). A series of granite basins running north over approximately 2.5 km from Elijah's Basin between the granite slabs and domes of Safsafa (2168 m). A large farsh (open area) with basic campsite facilities and two large cypress trees below the summit of Gebel Musa, Elijah's Basin is most visited by tourists descending Gebel Musa via the Steps of Repentance. A narrow trail connects Elijah's Basin with El Loza and a series of smaller basins via passes over boulders. Relatively well vegetated with a naturally occurring dwarf montane vegetation, some basins have fenced areas to exclude domestic but not wild grazing animals, or have been historically cultivated by monks living in hermitages on the Safsafa massif who planted or maintained tree species such as almond (*Prunus dulcis*) and fig (*Ficus* sp).

Wadi Shrayj and Ferah (1700-1900 m a.s.l.). The boulder field of Wadi Shrayj rises steeply from small gardens under the north side of Safsafa to the less rocky gravel and stone basin of Wadi Ferah. There are a few walled gardens in pans before the wadi opens out into a sparsely vegetated valley that descends into Wadi Arba'ain at the Bedouin village.

Wadi Arba'ain (1700-1770 m a.s.l.). Wadi Arba'ain rises gradually south from Suez Canal University's Research Centre at the edge of the town of St Katherine for approximately 3 km through red-granite boulder fields, ending at the garden of Deir El Arbaein, where on one side the Pilgrim's trail goes up Gebel Musa, and on the other side the monks' path winds up the black basalt of Gebel Katerina. Wadi Arba'ain receives fairly heavy camel traffic from

Bedouin trading on the mountain. A Bedouin village at the end of the wadi maintains one of the monastery's largest gardens: the olive grove of the convent of Deir El Arba'ain, or the Garden of the Forty Martyrs. There are two smaller gardens of olive (*Olea europaea*), fig, cypress trees (*Cupressus*) and poplar (*Populus* sp) in basins lower down the wadi. Steep scree slopes of large boulders and slabs on either side of the wadi channel the annual snow melt from the surrounding steep mountainsides down the wadi every spring, replenishing wells and ground water.

Wadi Tala (1520-1670 m a.s.l.). Wadi Tala is a U-shaped rocky wadi running north-south for approximately 2.5 km west of St Katherine. Connected to the north via a short gorge to Wadi Itlah, the scree slopes of the flanking high cliffs widen out into extensive areas of barren slab at the bases of which on the wadi floor are two large areas of walled garden, one planted with olive trees belonging to the Monastery. At the southern head of the wadi are smaller Bedouin gardens. Most bird records came from overlooking the monastery garden from the slabs above.

Wadi Itlah (1400-1520 m a.s.l.). A narrower and longer defile than Wadi Tala, running north-west south-east for approximately 4 km. Scree slopes of extensive boulder fields drop down to the dry bed of the wadi. Where water collects, small Bedouin fruit gardens have been created with some smallholdings, goats, sheep and donkeys particularly in the southern reach of the wadi where the floor opens out. More natural vegetation and trees such as Carob (*Ceratonia siliqua*) and Date Palm (*Phoenix dactylifera*) grow in pockets between boulders.

The Wadi Gebel wadi system (1800-2000 m a.s.l.). (Wadis Tubug / Shagg, Zawatein, Tenya, Abu Twaita, and Farsh Rumana: see Zalat & Gilbert 1998). These are high-altitude wadis on a massif formed by the high peaks of, among others, Gebel Abbas Basha (2363 m) Gebel Umm Loz (2176 m) and Gebel Bab (2228 m) to the west of Gebel Musa and the town of St Katherine. They were surveyed over three days. Ascending to the massif up the pass of Abu Geefa from the town, the higher rainfall and lower temperatures support Bedouin fruit gardens wherever enough soil and water is able to collect on open ground. Wadi Tubug and Shagg are fairly narrow granite ravines with gardens or rocky pans of natural vegetation, but beyond the pass at the head of wadi Zawatein, wadis Tenya and Abu Twaita are much longer, more open and exposed with some basaltic rocks from the surrounding basalt and granite hills and larger areas of walled garden. Trekking westwards over the massif from Abu Twaita there was a steep descent down to the Blue Pool (Galt el-Azraq) and back out again to the south through the narrow and well-vegetated wadi Talla to the large open area and gardens of Farsh el-Rumana. From here St Katherine was regained via Wadi Gebel.

Nabq el-Hawa (1520-1550 m a.s.l.). A long wadi at the end of the Plain of el-Raha that leads out of the mountains north from St Katherine, down to Sheikh Awad. Only the rocky head of the wadi where it descends from the village of Abu Seila was surveyed.

Wadi Sheikh (1460-1500 m a.s.l.). Lower than the mountain wadis of Arba'ain, Talah and Ferrah, Wadi Sheikh is a wider, less mountainous gravel plain that lies to the east of Gebel Musa and carries the road into St Katherine.

Ain Hodra (600 m a.s.l.) (**Area 3**). The oasis of Ain Hodra towards the head of Wadi Hodra lies in the eastern Sinai, to the north-east of the road to Dahab. Surrounded by steep cliffs, a large area of date palms and fruit trees is tended by Bedouin as a series of gardens. Several also act as campsites for tourists on Bedouin safaris. Beyond the gardens the wadi opens out into a wide dry riverbed of sand flanked by steep cliffs of sandstone or metamorphic rock and narrow canyons.

Abu Matamir (800 m a.s.l.). To the south of the road to Dahab on the eastern side of the peninsula, Abu Matamir is on the edge of an area of sandstone outcrops at the end of a wide sandy plain flanked by low metamorphic rock hills to the east. To the south east a wadi of metamorphic rocks connects to the Gebel Barq area.

Wadi Hamman & Gebel Barq (700 -570 m a.s.l.). Further south from Abu Matamir, Gebel Barq is a sandstone outcrop area surrounded by wide sand and gravel plains. Further south again from Gebel Barq, Wadi Hamman drops down through metamorphic and igneous rocks to form a wide dry river bed similar to the mid reaches of Wadi Isla but with a higher occurrence of acacia trees. As with Wadi Isla a series of large deep wells has been dug into the water table.

Wadi Feiran (700-750 m a.s.l) (**Area 5**). This is the most densely populated of the wadis visited. Large areas of date palm and fruit gardens have been planted in the wadi floor between cliffs of metamorphic and sandstone rock. In places the cliffs of the wadi are fringed by deep lacustrine deposits of compacted sand in the lees of the wadi which contain many caves. Most observations were made in the small el-Bragga fruit tree garden in a large area of palms and small holdings in the Markaz Feiran area of the wadi and in the much larger orchard of Feiran Garden slightly higher in the Wadi further to the east.

Sheikh Awad (1120 -1140 m a.s.l.) (**Area 5**). Just outside the Ring Dyke at the northern end of Nabq el-Hawa, Sheikh Awad is an area of mixed sandstone and metamorphic rock with large exposures of slab, shallow wadis of sand and gravel basins and areas of garden. The Protectorate have encouraged local enterprise by building an ecolodge for tourist groups.

Analysis of density and diversity

Too few sightings were available for Line Transect methods to be used on individual species (the commonest species, the White-crowned Black Wheater, was seen 118 times, but many of these were not during line transects). The point counts had no distances recorded, and hence could not be used to estimate densities. Thus we adopted an *ad hoc* method of combining the datasets to allow density estimation using reasonable numbers of observations. This was done by working out the “area equivalent” for each of the point counts, taking into account the length of time spent at each point and assuming that the overall number of birds seen reflects the same rates of recording as in the line transects. This allowed an ‘observed density’ to be calculated for each species from the number seen and the area sampled (the actual area of the line transects [assuming a transect width of 100 m], plus the ‘apparent area’ of the point counts). The assumption may not have been valid because the point counts were done in areas (such as gardens and oases) where bird density was expected to be greater. As a result, the estimated densities refer to ‘normal’ parts of wadis, rather than small patches where birds concentrate.

The ‘apparent density’ does not take into account the reduction in observability with distance from the observer, the whole basis of the Line Transect method. Therefore we worked out the overall density of birds (of all species lumped together) from just the line transects using Distance5 (Thomas et al., 2005), and compared this to the overall apparent density by our rough method that included the point counts. We then adjusted the observed densities of each species using the same ratio, to arrive at the approximate densities presented here.

We calculated Simpson’s Index of Diversity (1-D) (see Lande 1996) to estimate diversities.

RESULTS

Records of casual observations and the more systematic surveys of 2002 are presented in Table 3. Forty-one species of bird were recorded during the 2002 census: the species and number of individuals recorded in each wadi system are presented in Appendix 1.

Thirty-five species of bird were recorded during the 2005 expedition (Table 4), plus a few extra in casual observations. The species and number of individuals recorded in each wadi system during each visit is given in Appendix 2 (which combines transect and point-count data

together). No species was seen in all 17 wadis. The White-crowned Black Wheatear was the most frequently recorded and widespread species followed by the Rock Martin. Twenty-two resident breeding species and thirteen migrants/unknown status species were recorded.

Table 3: Bird species recorded *ad hoc* during numerous visits, and during a systematic survey in 2002.

Common name	Latin name	Previous observations	Status in 2002 survey	2002 survey observations	Bedouin comments
* = information provided by Bedouin that conflicts with available literature information about distributions					
*Little Owl	<i>Athene noctua</i>		absent	not recorded	present in winter; feeds on mice [not recorded from south Sinai except once at Dahab in 1984]
*White-tailed Eagle	<i>Haliaeetus albicilla</i>		absent	not recorded	migratory; found on the mountain peaks apart from in summer and autumn, when they move to the wadis and gardens, eg Wadi Gebel and Telah [recorded from Egypt as a former breeding resident; an irregular winter visitor, last seen in 1954, but never from Sinai]
White Pelican	<i>Pelecanus onocrotalus</i>		absent	not recorded	migratory; found in Ain El Hodra; die after coming down for a wash and a drink of water
White Stork	<i>Ciconia ciconia</i>		Very rare	one individual found dead in Wadi Tarfa	migratory; present Sept - Dec; seen flying in large flocks for 3 h duration; they carry ectoparasites which weaken them and can cause death; have been found in Ain El Khodra, Gebel and St Katherine after having come down to drink for a period of two weeks, after which they die; when they see the gardens of St Katherine they feed on worms and fish in the pools and also on the vegetation
Black Stork	<i>Ciconia nigra</i>		Very rare	one individual found dead in Wadi Tarfa	migratory; seen passing overhead; Ain El Khodra and St Katherine
Black Kite	<i>Milvus migrans</i>		absent	not recorded	feeds on Chukar and Sand Partridge
Red Kite	<i>Milvus milvus</i>		absent	not recorded	feeds on Chukar and Sand Partridge
Lammergeier	<i>Gypaetus albicilla</i>		absent	not recorded	migratory; commonly seen soaring; found around mountain tops, especially around Wadi Gebel; feeds on Sand Partridges and young goats; present last year [2001] in summer and autumn; can still be seen every month or two
Egyptian Vulture	<i>Neophron percnopterus</i>	Wadi Feiran (May 1997)	absent	not recorded	builds nests in caves on mountain sides; in groups of 4-11; feeds on young goats and insects; found in Wadi Telah, Gebel, El Galt al Azraq and Lamasridi, but absent from Wadi Arba'ein
Long-legged Buzzard	<i>Buteo rufinus</i>	Wadi Gebel (Aug 1995) and Wadi Mila'aqa in Isla (Aug 1996)		Flying over St Katherine	
Marsh Harrier	<i>Circus aeruginosus</i>		Very rare (1 female)	one individual recorded in Wadi Sa'al, flying low over plain in early morning	
Hen Harrier	<i>Circus cyaneus</i>		absent	not recorded	feeds on Sand Partridge
Pallid Harrier	<i>Circus macrourus</i>		absent	not recorded	feeds on Sand Partridge
Montagu's Harrier	<i>Circus pygargus</i>		absent	not recorded	feeds on Sand Partridge
Steppe Buzzard	<i>Buteo buteo vulpinus</i>	one found dead in Wadi Gebel (Aug 2001)	Very rare	one individual recorded in Wadi Feiran, perched on a post in an extensive garden	present in late-summer and autumn; found in St Katherine and Wadi Gebel; feed on Sand Partridges and Chukars (dark type)
Imperial Eagle	<i>Aquila heliaca</i>		absent	not recorded	migratory
Verreaux's Eagle	<i>Aquila verreauxii</i>		absent	not recorded	used to be present in summer and autumn in Wadi Arba'ein, but absent for two years; scavengers, feeding on carrion

Meakin et al.: Birds, reptiles and butterflies of St Katherine

Bonelli's Eagle	<i>Hieraaetus fasciatus</i>		absent	not recorded	present throughout the year; found in the high mountains around St Katherine, Gebel Bab, Tarbosh, Madsus, Um Shomar and Wadi Gebel
Lesser Kestrel	<i>Falco naumanni</i>		Very rare	one individual recorded in Wadi Feiran	migratory; found on mountain tops in El Galt El Azraq, Gebel Bab, Wadi Za'atar and St Katherine; in summer, feed on Sand Partridge, small birds, grackles and pigeons; absent for the last 7-8 years
Red Footed Falcon	<i>Falco vespertinus</i>		absent	not recorded	found in high mountains, descending to St Katherine; feeds on small birds
Kestrel	<i>Falco tinnunculus</i>	possibly a Barbary Falcon, Wadi Feiran (May 1997)			
Sooty Falcon	<i>Falco concolor</i>		absent	not recorded	migratory, present in Wadi Gebel Apr - Nov; juveniles used to be present; feeds on Sand Partridges and Chukars in gardens
Lanner Falcon	<i>Falco biarmicus</i>	Ras Mohamed (Aug 2001)	absent	not recorded	migratory; present in May and June; found near water; feeds on small birds
Chukar	<i>Alectoris chukar</i>	present everywhere in the high mountain wadis; also Gebel Serbal (May 1997)	Common	found on the steep rocky slopes of the narrow Wadis around St Katherine; the distinctive call is frequently heard as individuals communicate within their small groups	breeding resident; found on the mountains in all wadis except Ain El Khodra; build their nests under worm seed plants [?] by digging in the ground between rocks; feed on olives and fruits, storing them in winter; lay their eggs on marsh [<i>Juncus</i> ?] in numbers of 12-40 eggs
Sand Partridge	<i>Ammoperdix heyi</i>	Wadi Itlah (Aug 2001)	absent	not recorded	breeding resident; present in all wadis, mountains, gardens and houses throughout the year; builds the nest from plants; feeds on camel dung and plant seeds; vary in colour among wadis
Green Sandpiper	<i>Tringa ochropus</i>		Very rare	migratory: only seen on one occasion in Wadi Feiran	
Rock Dove	<i>Colomba livia</i>	Wadi Tobouq (Aug 1995) & on the side of Gebel Serbal (May 1996)	Very common	fairly widespread, found in flocks of up to 50 individuals; often seen perched on rock faces	
Laughing Dove	<i>Streptopelia senegalensis</i>	common throughout	Common	generally found in gardens in small groups (2-4 individuals); very abundant in Wadi Ain El Hodra, where many date palms are cultivated	breeding resident; found in all wadis throughout the year, especially Wadi Talah and St Katherine; present in groups, and make their nests on carob and olive trees or inside human houses; feed on olives and pomegranate seeds off the ground
Common Cuckoo	<i>Cuculus canorus</i>		Very rare	only seen on one occasion in the early morning at El Galt Al Azraq	
Hume's Tawny Owl	<i>Strix butleri</i>	heard in Wadi Gebel (Aug 1995)	Status unknown	individuals can be heard calling after dusk at the end of Wadi Arba'ein, beneath Mt Sinai.	breeding resident; present throughout the year in Wadi Gebel, Telah, El Talah and Ain El Hodra; build nests from plants and feed on insects
Common Swift	<i>Apus apus</i>		absent	not recorded	feed on insects
European Bee-eater	<i>Merops apiaster</i>		Rare	seen in two wadis only, El Galt Al Azraq and Feiran: in gardens perched on trees, searching for prey	migratory; feeds on insects, particularly wild bees; build their nests from twigs; live in small groups of between 4 and 9; present from spring until the end of summer; found in Wadi Arba'ein, Gebel and St Katherine
Hoopoe	<i>Upupa epops</i>	Wadi Tobouq (Aug 1995)	Rare	solitary at ground level in gardens; more common in Wadi Feiran than elsewhere (total 5)	breeding resident; live in all wadis throughout the year; feed on earthworms, and build their nests from twigs
Desert Lark	<i>Ammomanes deserti</i>	common in high wadis; also Serbal (May 1997), Zeituna & Wadi Remham (Aug 1996)	Fairly common	found throughout the area outside gardens on rocks and rubble; solitary or in pairs	

Meakin et al.: Birds, reptiles and butterflies of St Katherine

African Rock Martin	<i>Ptyonoprogne fuligula</i>	common in the high mountains and also Feiran/Serbal	Very common	frequently seen flying in characteristic fashion throughout the area; very conspicuous	
Grey Wagtail	<i>Motacilla cinerea</i>		absent	not recorded	migratory
White Wagtail	<i>Motacilla alba</i>		absent	not recorded	migratory; present in St Katherine in winter, appearing after the Grey Wagtail; feeds on insects
Rufous Bush Robin	<i>Cercotrichas galactotes</i>		absent	not recorded	present in all wadis at the end of summer after the migration of the Sinai Rosefinch in Oct; feeds on worms found in fruits, especially grapes and pomegranates
Yellow-vented Bulbul	<i>Pycnonotus xanthopygos</i>	Wadi Rim on Serbal (May 1997); Wadi Tobouq (Aug 2001)	Common	fairly widespread; predominantly found in gardens foraging in trees; are habituated and super-abundant in the gardens of Wadi Ain El Hodra	breeding resident; build their nests in palms, and are present in all the gardens throughout the year; feed on white beans
Blackstart	<i>Cercomela melanura</i>	May 1997 and Aug 2004 in Feiran, Wadi Aleyat & Wadi Rim on Gebel Serbal	Rare	only found in the gardens of Wadi Feiran, El Haswa and Ain El Hodra; solitary or in pairs (total 7)	breeding resident; present throughout the year in Wadi El Talah, Telah, Gebel and Ain El Khodra; feed on fruits especially figs and grapes
Finsch's Wheatear	<i>Oenanthe finschii</i>	Wadi Isla near canyon (31 Aug 1996)			
Mourning Wheatear	<i>Oenanthe lugens</i>	seen 5 times in the high mountains in August	Very rare	one individual seen in Wadi Tarfa	present
Hooded Wheatear	<i>Oenanthe monacha</i>	Wadi Gebel & Itlah (Aug 1995 & 2004)	absent	not recorded	found in St Katherine, but when the White-crowned Black Wheatear is found in the same place, they compete together
White-crowned Black Wheatear	<i>Oenanthe leucopyga</i>	common everywhere	Very common	widespread throughout the area; the species has both black-headed and white-headed morphs; it is as yet unknown how this dimorphism relates to the sex of the individuals; are found throughout the wadis and in St Katherine town itself	breeding resident in wadis and around houses; feed on insects; build their nests in three stages: small smooth stones are placed in front of the nest to prevent snakes from entering; the nest is covered with small stones; and finally layered with twigs
Scrub Warbler	<i>Scotocerca inquieta</i>	reasonably common in the high mountains	Fairly common	found on rocks at ground level throughout the wadi system; easily identified due to their raised elongate tail	present throughout the year and found in all areas; feed on insects
European Reed Warbler	<i>Acrocephalus scirpaceus</i>		Very rare	one individual seen foraging in a small bush in a garden in Wadi Feiran	
Olivaceous Warbler	<i>Hippolais pallida</i>		Very rare	only one individual found foraging in a garden bush in Wadi Ain El Hodra	
Olive-tree Warbler	<i>Hippolais olivetorum</i>	7 records along Isla and in the high mountains in August			
Icterine Warbler	<i>Hippolais icterina</i>		Very rare	one individual seen in Wadi Tarfa	migratory; present in summer; found in gardens, feeding on ants and other insects
Spectacled Warbler	<i>Sylvia conspicillata</i>		absent	not recorded	very rare, and much depleted in numbers; present from April to November; build nest from plants; found in Wadi Tenia and El Galt Al Azraq; feeds on insects
Menetries' Warbler	<i>Sylvia mystacea</i>		absent	not recorded	present in August and September
Desert Warbler	<i>Sylvia nana</i>		absent	not recorded	found in Wadi Gebel; feeds on pomegranates
Garden Warbler	<i>Sylvia borin</i>	between Zeituna and Wadi Remhan (Aug 1996)			

Meakin et al.: Birds, reptiles and butterflies of St Katherine

Arabian Warbler	<i>Sylvia leucomelaena</i>		Rare	seen in gardens of Wadi Gebel and El Galt Al Azraq, solitary or in small groups (total 4)	lives in Wadi Gebel, Arba'ein and St Katherine; eats figs, grapes and pomegranates
Orphean Warbler	<i>Sylvia hortensis</i>	Wadi Itlah (Aug 2001)	Fairly common	found in trees in gardens of wadis around St Katherine (total 17)	present throughout the year; feeds on pomegranates and olives in wadi Telah, Gebel and El Talah; build their nests from twigs
Lesser Whitethroat	<i>Sylvia curruca</i>	Wadi Moagid in Isla (Aug 1996)	Fairly common	similar distribution as the Orphean Warbler; often found foraging on trees of gardens in groups of mixed warbler species; Orphean and Lesser Whitethroat are the most common warblers in the area (total 12)	used to be abundant, but absent for 3-4 years; present in summer; feeds on figs, pomegranate and grapes
Blackcap	<i>Sylvia atricapilla</i>		Very rare	a single pair was seen in a garden in Wadi Tobouq	
Green Warbler	<i>Phylloscopus nitidus</i>		Very rare	only seen foraging in small trees in the gardens of Wadi Gebel and Tobouq	present in spring; feeds on grapes
?recorded as Chiffchaff, but too early in migration	<i>Phylloscopus</i>	Wadi Gebel & Wadi Remhan at Deir Antoush (Aug 1996)	Very rare	single sightings in the gardens of both Wadi Neshil and Feiran	present in summer until Aug-Sept; feeds on pomegranates; build nests from herbs; found in Wadi Tenia, Arba'ein and St Katherine; more prevalent in recent years
Rock Nuthatch	<i>Sitta neumayer</i>	Safsafa (Elijah's basin) (Aug 2004)			
Spotted Flycatcher	<i>Muscicapa striata</i>		Fairly common	solitary individuals seen perched on the bare outer branches of trees in gardens (total 10)	one interviewee saw one in autumn
Collared Flycatcher	<i>Ficedula albicollis</i>		absent	not recorded	found in Wadi Enshiel, on black rocks, and in Wadi Arba'ein; builds nest from twigs; feeds on seeds, grapes and citrus; live in pairs and groups of 4 to 10 individuals
Palestine Sunbird	<i>Nectarinia osea</i>	Wadi Aleyat in Feiran (May 1997), otherwise around St Katherine & in Wadi Isla in August	Rare	seen foraging in bushes and small trees; only the female was seen during the study (total 4)	migratory; build nests near together in the garden olive trees; live in pairs but only one appears [at any one time?]; feeds on fruits in autumn; males are few in number; very rare, but present in Wadi Arba'ein and St Katherine
Golden Oriole	<i>Oriolus oriolus</i>	Wadi Mila'aqa at bottom of Wadi Isla (Aug 1996)	absent	not recorded	present in autumn
Red-backed Shrike	<i>Lanius collurio</i>	2 in Wadi Tobouq (Aug), otherwise 4 times in Wadi Isla (Aug)	Fairly common	found in the gardens, generally perched on the outer branches of trees; highly concentrated in Wadi Gebel (total 21)	found throughout the year; feeds on insects; weak flight; build nest from small twigs; found in the gardens of Wadi Gebel, Talah, Arba'ein and St Katherine; singly or in pairs
Great Grey Shrike	<i>Lanius excubitor</i>	seen regularly in the high mountains and Wadi Remhan in August	Very rare	solitary individuals seen in Wadi Gebel and El Galt Al Azraq (total 3)	migratory, present in late summer and autumn; feeds on insects and pomegranates
Woodchat Shrike	<i>Lanius senator</i>	Wadi Feiran (Aug 2004)	Very rare	solitary individuals seen in Wadi Tarfa and Feiran (total 2)	one interviewee saw one in autumn
Masked Shrike	<i>Lanius nubius</i>	Wadi Tellah (Aug 1996) and 2 seen in Isla at Wadi Zelliga & Mila'aqa (Aug 1996)	Very rare	individuals seen in El Galt Al Azraq and Wadi Feiran (total 3)	found in Wadi Arba'ein; singly or in pairs
Brown-necked Raven	<i>Corvus ruficollis</i>	Wadi Feiran & Gebel Serbal (May 1997) and Wadi Gebel (Aug 1995)	Rare	seen in flight at moderate heights in El Galt Al Azraq, Ain El Hodra and Feiran (total 5)	resident, especially common last year [2001]; feed on rubbish; have decreased in the last few years, perhaps due to the decrease in the quantity of rubbish; build their nests from small stones and rubbish in caves in the higher mountains; live in all wadis except Wadi Arba'ein; occur outside the gardens

Meakin et al.: Birds, reptiles and butterflies of St Katherine

Fan-tailed Raven	<i>Corvus rhipidurus</i>	Wadi Feiran (Aug 2004)	absent	not recorded	found in Wadi Arba'ein; builds nest from twigs; live in pairs, but collect in large groups of 40-50 to feed
Tristram's Grackle	<i>Onychognathus tristramii</i>	common in the high mountains; also seen in Feiran/Serbal (May 1997) and Isla (Aug 1996)	Common	found throughout the area in small groups, outside the gardens on steep, rocky wadi slopes and around the boundaries of gardens (total 30)	resident; occur in three sizes; build their nests in the same manner as the White-crowned Black Wheatear; live in Wadi Gebel, Zawateen, Arba'ein and St Katherine, but are not present in Ain El Hodra; found near camels, feeding on insects that live on the skin; also feeds on plants like maize, fig and pomegranate; occur in groups of 2-20
Pale Rock Sparrow?	<i>Carpospiza brachydactyla</i>	6 records in the high mountains in August; identity uncertain			
Rock Sparrow	<i>Petronia petronia</i>		Very rare	one pair seen on low rocks in Wadi Talah	
Trumpeter Finch	<i>Bucanetes githagineus</i>		Rare	seen in the gardens of both El Galt Al Azraq and Feiran; seen only in small numbers on the ground (total 6)	migratory; build nests in red granite rocks using small twigs; live in all wadis containing grapes and figs; arrives in March, and leaves in Oct before the temperature decreases
Sinai Rosefinch	<i>Carpodacus synoicus</i>	reasonably common in the high mountains, and also Serbal (May 1997) and Isla (Aug 1996)	Very common	found throughout the wadi gardens and rocky cliffs in medium-sized, mixed-sex groups	same as Trumpeter Finch
House Bunting	<i>Emberiza striolata</i>		absent	not recorded	absent for the last 8 years; was present in groups of 5-9 in Wadi Gebel; feeds on insects and figs
Cinereous Bunting	<i>Emberiza cinerecea</i>		absent	not recorded	present in autumn; found in gardens on pomegranate trees
Ortolan Bunting	<i>Emberiza hortulana</i>		absent	not recorded	one interviewee saw one in autumn
Cretzschmar's Bunting	<i>Emberiza caesia</i>		absent	not recorded	found on pomegranate trees
Black-headed Bunting	<i>Emberiza melanocephala</i>		Very rare	only a single individual seen in a garden of Wadi El Haswa	

Table 4: Estimated densities of bird species in the five wadi systems

Species	density per km ²				
	Isla	Ring Dyke	Eastern Sinai	Feiran	Sheikh Awad
Rock Dove	2.1	27.6	21.2	0.0	0.0
Rock Martin	5.3	21.2	7.6	3.0	6.8
Laughing Dove	1.1	7.5	19.2	4.9	4.1
White-crowned Black Wheatear	4.4	13.7	5.4	2.5	2.9
Yellow-vented Bulbul	0.9	4.1	4.1	9.7	2.3
Chukar	1.8	16.2	0.0	0.0	0.0
Sinai Rosefinch	0.8	15.9	0.0	0.0	0.0
Blackstart	4.0	2.8	5.4	3.1	1.1
Desert Lark	1.6	8.0	0.8	0.0	0.8
Tristam's Grackle	1.4	8.0	0.0	0.9	0.0
Sand Partridge	4.5	0.0	0.0	0.0	5.6
House Sparrow	0.0	0.0	7.7	0.0	0.4
Scrub Warbler	0.9	4.0	0.6	0.3	0.6
Palestine Sunbird	0.0	3.7	0.0	0.6	0.0
Orphean Warbler	0.0	1.0	0.6	0.0	1.9
Hoopoe	0.0	1.2	0.0	0.5	0.0
Chiffchaff	0.0	0.0	0.0	0.8	0.3
Domestic Pigeon	0.0	0.6	0.0	0.0	0.6

Reed Warbler	0.0	0.0	0.0	1.1	0.0
Trumpeter Finch	0.0	0.0	0.8	0.0	0.0
Hooded Wheatear	0.0	0.3	0.0	0.0	0.3
Brown-necked Raven	0.5	0.0	0.0	0.0	0.0
Olivaceous Warbler	0.0	0.3	0.2	0.0	0.0
Olive-tree Warbler	0.0	0.2	0.2	0.0	0.2
Fan-tailed Raven	0.0	0.3	0.0	0.0	0.0
Great Spotted Cuckoo	0.2	0.0	0.0	0.0	0.2
Lesser Grey Shrike	0.0	0.0	0.0	0.0	0.3
Sooty Falcon	0.0	0.0	0.3	0.0	0.0
Upcher's Warbler	0.0	0.0	0.2	0.0	0.2
Bee-eater	0.0	0.0	0.0	0.2	0.0
Kestrel	0.0	0.0	0.0	0.0	0.2
Lesser Whitethroat	0.0	0.0	0.0	0.2	0.0
Scops Owl	0.0	0.0	0.0	0.0	0.2
all birds	29.7	132.3	73.6	30.5	30.9

Birds became active an hour after sunrise at 0505 h. Fifty-one percent of all bird observations were made between 0600 and 0800, with a smaller late-afternoon peak in activity between 1700 and 1900 (sunset at 1856 h) (Fig 2). Some wadis were almost certainly under-recorded because of late starts: Abu Twaita, Wadi Shagg, Ferah, Elijah's basin and the first survey of Wadi Itlah all started after 0800 h, and as a result many of the birds of these wadis have probably been missed.

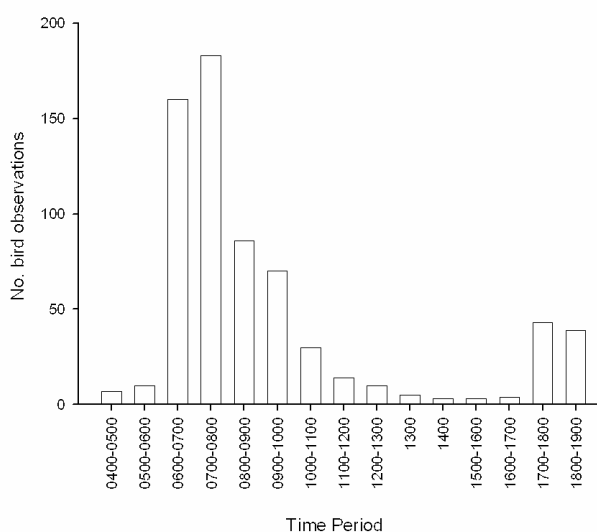


Figure 2: The diel pattern of bird observations during surveys in South Sinai.

Species accounts

Storks (*Ciconiidae*)

Single dead individuals of both the Black Stork (*Ciconia nigra*) and the White Stork (*Ciconia ciconia*) were found in Wadi Tarfa in 2002.

Birds of prey (*Accipitriformes*, *Falconiformes*)

Very few birds of prey were seen. Two Black Eagles (*Aquila verreauxii*), an adult and a juvenile, were photographed in Wadi Arba ein in June 2005 by Tim Hurst. This is an important record, because Black Eagles used to be recorded regularly in the area (see Discussion). Two

Short-toed Eagles (*Circaetus gallicus*) were seen rising on thermals above cliffs at the southern end of Wadi Zawatein on the 22nd July, 2005. The remains of an eagle or buzzard (*Buteo*) species were found in the middle section of Wadi Isla near the wings of a White Stork (*Ciconia ciconia*). Both were probably shot overhead whilst on migration.

One female Marsh Harrier (*Circus aeruginosus*) was recorded in Wadi Sa'al, flying low over the plain in the early morning (2002). A Buzzard (*Buteo buteo*) was recorded in Wadi Feiran, perched on a post in an extensive garden. A Long-legged Buzzard (*Buteo rufinus*) was observed flying over the Environmental Research Centre in 2002. Three observations of Sooty Falcons (*Falco concolor*) were made: one bird circling above a narrow canyon in the lower reaches of Wadi Isla (below 700 m) in the early afternoon, one circling a possible nest site above one of the sandstone outcrops of Abu Matamir in the mid-morning, and a further three circling cliffs above Wadi Hodra in the early evening. A tame Kestrel (*Falco tinnunculus*) reared from a foundling but living wild was also frequently seen at Sheikh Awad. A single Lesser Kestrel (*Falco naumanni*) was recorded in 2002 in Wadi Feiran.

Partridges (Phasianidae) and Sand Grouse (Pteroclididae)

The Chukar (*Alectoris chukar*) is a characteristic bird of the high mountains and was seen in groups on Safsafa, the slopes of Gebel Musa, in the Wadi Gebal wadis and in Wadi Talah. They were seen regularly in Wadi Arba'ain in the late afternoon and a couple were seen in the upper reaches of Wadi Isla. Below an altitude of approximately 1200 m they were replaced by Sand Partridge (*Ammoperdix heyi*): the maximum number (20) of Sand Partridge were recorded in Sheikh Awad.

Several birds of an unidentified species of Sand Grouse were heard during a night walk of the gravel plain at Gebel Barqa.

Waders (Charadriiformes)

A single individual of the Green Sandpiper (*Tringa ochropus*) was seen Wadi Feiran in 2002.

Doves (Columbidae)

Laughing Doves (*Streptopelia senegalensis*, also known as Palm Doves) were most numerous in gardens with fruit and palm trees. A maximum of 24 individuals was recorded in the low-altitude Ain Hodra oasis but the species occurred in gardens all the way up to the basin of Elijah on Gebel Musa. Rock Doves (*Columba livia*) were most abundant in wadis with tall cliffs and gardens or wells, such as Wadi Itlah, Tala, Arba'ain, Isla and Ain Hodra. One hundred birds were counted in Wadi El Deir, with a maximum flock size seen at one time of 50 birds over the monastery. Flocks of free-flying feral or domestic pigeons kept by the Bedouin for food were under-recorded on the surveys, but approximately 100 birds were regularly seen mixing with individuals with pure rock-dove plumage around the town of St Katherine, with lower numbers of domestic pigeons in the nearby village of Abu Seila and around the inhabited areas of Wadi Feiran. Most feral pigeons stayed close to human habitation: the furthest away from a village were two seen among a flock of Rock Dove feeding around camel dung where camels are kept on the open ground beyond the monastery at the head of the trail to Gebel Musa.

Cuckoos (Cuculidae)

Single Great Spotted Cuckoos (*Clamator glandarius*) were seen in an acacia tree at the mouth of Wadi Isla in the early morning on the 2nd July and on the 19th August in Sheikh Awad. One common Cuckoo (*Cuculus canorus*) was seen flying in Wadi El Galt Al Azraq in 2002.

Owls (Strigiformes)

In 2002, the voices of two individuals of Hume's Tawny Owl (*Strix butleri*) were recorded after dusk at the end of Wadi Arba'ain, beneath Mt. Sinai. The recorded sounds were then played back and the birds approached the speaker and answered the playbacks from the speaker. A possible Hume's Tawny Owl was seen flying through floodlights opposite the field base at St Katherine and an owl call was heard at night at Ain Hodra. Because of the uncertainty of these records, they have not been included in the expedition species list.

While mist-netting for bats at Sheikh Awad in 2005, Christian Dietz caught an individual of the Striated Scops Owl (*Otus brucei*).

Bee-eaters (Meropidae)

Bee-eaters (*Merops apiaster*) come to feed occasionally at the beehives near the St Katherine Research Centre. One individual was seen in Wadi Gebel and two individuals were observed in Wadi Ain el Hodra in 2002. Bee-eaters had been seen in June 2005 before the start of the expedition and were seen again briefly by Rebecca Guenther in late July. A Bee-eater was heard as it flew over Feiran Garden on the 12th August by Hosni Helmy Aly Asran.

Hoopoe (Upupidae)

In 2002 Hoopoes (*Upupa epops*) were seen individually in wadis Tarfa and Razana, and three birds together were observed in Wadi Feiran. Hoopoes were seen singly in Wadi Arba'ain, Wadi el Deir (by the monastery walls) and Farsh Rumana (Wadi Gebel area). These are likely to have been the same bird or one a local wide-ranging pair. Two Hoopoes were frequently seen around El Bragga garden in Wadi Feiran and a further three in Feiran Garden.

Larks (Alaudidae)

The Desert Lark (*Ammomanes deserti*) was the only species of bird seen in the open sandy desert at the camp at Abu Matamir. It can be found throughout the area outside gardens on rocks and rubble, either solitary or in pairs. Seven individuals came in to feed on seeds in camel dung.

Rock Martins (Hirundidae)

Rock Martins (*Ptyonoprogne fuligula*) were often one of the first species seen in a morning, patrolling cliff faces along the wadi, feeding high over open areas, or making low passes along the wadi floor. Very seldom landing, they were only observed to perch briefly on a ledge on a building in St Katherine between feeding forays. Rock Martins were also seen making drinking passes over small open reservoir tanks in gardens at Ain Hodra, Wadi Feiran and Mr Ramadan's garden in Wadi Arba'ain.

Bulbuls (Pycnonotidae)

Yellow-vented Bulbuls (*Pycnonotus xanthopygos*) are predominantly found in gardens foraging in trees. They are habituated and very abundant in the gardens of Wadi Ain El Hodra. Yellow-vented Bulbuls were the species most common where there were palm trees and a good water supply up to approximately 1900 m at Farsh Rumana.

Wheatears, Blackstart (Turdidae)

The distinctive black-and-white markings and habit of perching on top of rocks made the White-crowned Black Wheatear (*Oenanthe leucopyga*) one of the most easily recognisable of birds. The highest number (14) was recorded over the length of Wadi Isla, the longest wadi surveyed (over four days and a total combined transect length of 10 km). White-crowned Black Wheatears and Desert Larks (*Ammomanes deserti*) were the passerines most likely to occur in sparsely vegetated rocky areas.

The wide and open Wadi El Sheikh within the Ring Dyke was the only location where White-crowned Black Wheatears were not recorded, but it probably does occur towards the

rockier sides of the wadi. Two individual wheatears were recorded in the lower-altitude and more exposed desert of Abu Matamir, the only location where Rock Martins (*Ptyonoprogne fuligula*) were not recorded. However these wheatears were not recorded on the sandy plain surrounding the sandstone outcrops of Abu Matamir itself, but further to the east in a metamorphic rock wadi with rocks and occasional acacia trees.

The largest number of White-crowned Black Wheatears seen at one time in Wadi Isla was four birds, which came together to mob a Burton's Carpet Viper (*Echis coloratus*) hiding under vegetation on the wall of the wadi. One bird started calling, flying and attempting to hover in front of the snake, indicating where it was: it was joined by the others, who also drew attention to the location of the snake by hopping around perches, calling near where it was, but they also harried each other and dispersed as we approached to attempt to identify the snake. Whether White-crowned Black Wheatears had a white crown (male or female) or an all black head (only immatures?) was not consistently recorded, but white-crowned and black-headed birds were more often seen in pairs or in close succession than two white-headed birds.

Three female Hooded Wheatears (*Oenanthe monacha*) were observed. One quite tame female flew in front of the group where the trail to the summit of Gebel Musa meets the trail to Elijah's Basin. Another female was seen at Sheikh Awad and also in Wadi Zawatein (in the Wadi Gebel area). There was an unconfirmed sighting of a male Hooded Wheatear from Abu Twaita (Wadi Gebel Area). A single Mourning Wheatear (*Oenanthe lugens*) was observed in Wadi Tarfa in 2002.

Uncommon birds at altitude within the Ring Dyke, Blackstarts (*Cercomela melanura*) were much more numerous at lower altitudes. Twelve were seen over the length of Wadi Isla, and 5-10 birds (depending on how many times individuals were recounted) in the oasis at Ain Hodra. Blackstarts were also frequently observed in the gardens in Wadi Feiran.

Scrub warbler (Cisticolidae)

Scrub Warblers (*Scotocerca inquieta*) were more frequent in the wadis around St Katherine and on Safsafa, moving through patches of vegetation in basins as very vocal feeding groups. This small bird was often heard before it was seen. Scrub Warblers occurred at lower altitudes along Wadi Isla and Wadi Hamman, but were uncommon in Wadi Feiran and absent from the more open areas of sandy desert and the oasis at Ain Hodra.

Hippolais warblers

The first Olivaceous Warbler (*Hippolais pallida*) was recorded in Wadi Itlah on July 6 in 2002, and again in a different area of Wadi Itlah on the 9th August with an Orphean Warbler. An Olive-tree Warbler (*Hippolais olivetorum*) was seen in an acacia tree on the 4th August, 2002 in a wadi above Wadi Hamman. In 2005, during the final early morning survey of El Bragga Garden on the 13th August, an Upcher's Warbler (*Hippolais languida*) was seen with a unidentified *Phylloscopus* in a *Ziziphus spina-christi* tree on the edge of the garden. Intermediate in size and colouration between the smaller lighter-coloured Olivaceous and darker more heavily built Olive-tree Warbler, the bird was observed for approximately 20 min, moving and feeding around the tree. Its identity was confirmed by its characteristic circular bobbing motion and flicking of a more elongate tail than the other two species, exhibited every time it landed on a new perch (cf. Porter et.al. 2004). One Olivaceous Warbler and one Orphean Warbler were seen on different days in a large *Ziziphus spina-christi* tree during the second visit to Ain Hodra on the 5th and 6th August. The largest number of migrant warblers were seen in Wadi Feiran between the 11th and 13th August.

Sylvia Warblers

Orphean Warblers (*Sylvia hortensis*) were the most frequently observed migrant warbler (Table 4). They were first seen in a group of four foraging among rocks and rushes (*Juncus* sp)

in an untended area of the Garden of the Forty Martyrs in Wadi Arba'ain on the 2nd August. The Lesser Whitethroat (*Sylvia curruca*) was frequently observed in 2002. Two Blackcaps (*Sylvia atricapilla*) were observed in Wadi Tabouk and three Arabian warblers (*Sylvia leucomelaena*) were spotted in Wadi Gebel in 2002. Arabian Warblers are rare in Egypt, but the observer (SdK) is very familiar with the species, and has no doubt over the identification. Up to six Orphean warblers, an Olive-tree Warbler and a *Phylloscopus* warbler were seen during the final week of the expedition at Sheikh Awad between the 18th and 19th August, 2005.

Acrocephalus warblers

Seven Reed Warblers (*Acrocephalus scirpaceus*) and a Lesser Whitethroat were seen during a one hour late afternoon count (2005) of birds in a *Ziziphus spina-christi* tree in Feiran Garden (Hosni Helmy Aly Asran). A Reed Warbler was also mist-netted at El Bragga.

Phylloscopus warblers

A maximum of six unidentified *Phylloscopus* species were seen frequently in El Bragga garden and a further two in Feiran Garden. Two Green Warblers (*Phylloscopus nitidus*) were observed foraging in small trees in the gardens of Wadi Gebel. In 2002 Lesser Whitethroats were regularly observed in mixed species groups with Orphean Warblers.

Flycatchers (Muscicapidae)

A total of 10 Spotted Flycatchers (*Muscicapa striata*) were observed in several wadis during 2002.

Nuthatches (Sittidae)

One Rock Nuthatch (*Sitta neumeyer*) was seen by H.G. in Elijah's Basin in August 2004. This species is new to Egypt. The observer is familiar with nuthatches in the UK, and made the following notes: "striped head, black, grey & white; whitish front, buffish u-t coverts, black tail, pale grey back. Call two-tone wistful pee-you followed by tuneful twitter. Largish tit size.". There is little doubt over the identification.

Sunbirds (Nectarinidae)

As nectar feeders, Palestine Sunbirds (*Nectarinia osea*) were seen in gardens with fruit trees, but were more common at altitude. A male and a female were frequently seen visiting flower beds and hibiscus plants at the field centre. None were seen at Ain Hodra, but a possible 11 were seen in Wadi Tubug / Shagg. This number is probably too high as these birds are very active, and what was probably seen was one feeding group of about 5 birds commuting back and forth along the transect between gardens.

Shrikes (Laniidae)

A Masked Shrike (*Lanius dubius*) was seen occasionally by Christian Dietz in El Bragga Garden in Wadi Feiran in 2005. Two Masked Shrikes were seen in Wadi el Haswa and one in Wadi El Galt Al Azraq in 2002. Red-backed Shrikes (*Lanius collurio*) were regularly observed in 2002 with 15 individuals on one morning in Wadi Gebel. The Woodchat Shrike (*Lanius senator*) was observed in Wadis Tarfa and Feiran and the Great Grey Shrike (*Lanius excubitor*) was seen hunting in Wadi Gebel. A Lesser Grey Shrike (*Lanius minor*) was seen during the final week of the 2005 expedition at Sheikh Awad between the 18th and 19th August.

Ravens (Corvidae)

Three Brown-necked Ravens (*Corvus ruficollis*) were seen circling cliffs above Wadi Muagid (Wadi Isla) and two more Ravens (possibly Fan-tailed, *Corvus rhipidurus*) at Wadi Sheikh. A

further two ravens were seen flying away over sand dunes when disturbed as the group were being driven into the Gebel Barq area, but unfortunately the species could not be identified. In 2002, Brown-necked Ravens were observed in Wadi El Galt Al Azraq, Wadi Feiran and three individuals in Ain El Hodra.

Tristram's Grackle (Sturnidae)

During the bird count of the farsh beyond the monastery on the 30th July 2005, a maximum of 15 Tristram's Grackle (*Onychognathus tristramii*) were seen together in cypress trees in a garden. In comparison a total of six were seen in the El Bragga garden (campsite) in Wadi Feiran. In other wadis Grackles were seen in twos and threes in association with trees, flying down wadis, perched on cliff walls or grooming camels (Wadi Tenya).

Finches (Fringillidae, Sparrows (Passeridae) and Buntings (Emberizidae)

Sinai Rosefinch (*Carpodacus synoicus*) was commonly seen in Wadi el Deir. Nine females were seen in an open area just beyond the monastery walls at the start of the trail to Gebel Musa. On a follow-up one-hr count started at 0645 on the 30th July 2005, the maximum of five Sinai Rosefinch were seen, including one male. 400 m away, seven females were seen, whilst a group of observers walking the wadi from the junction with the St Katherine road to the car park (approximately 700 m) saw none.

Flocks of Sinai Rosefinch were observed coming in to feed on the seeds in fresh camel dung and food left behind from the large number of tourists and their camels traveling down the mountain every morning after sunrise. Four to eight (1 male) were seen on Safsafa/ Elijah's Basin.

Sinai Rosefinches including at least one male were regularly seen during casual walks in Wadi Arba'ain, and twenty-six (two males) were seen during a transect walk of the Wadi on the 8th of July 2005, eight in the Garden of the Forty Martyrs. Seventeen were seen in the Garden of the Forty Martyrs on the 2nd August, feeding on a ripe fig tree. Sinai Rosefinches were also relatively common in the Wadi Gebel area. Fourteen were seen during the morning transect in Wadi Tenya, and eight from Wadi Shagg/ Wadi Tubug.

Beyond the Ring Dyke, a flock of six females was seen at the garden of Moyat Zalaqa at the head of Wadi Isla (approx. 1200 m altitude). A further three were seen lower down but none below 800 m.

Away from the high mountains only a maximum of three Trumpeter Finches (*Bucanetes githagineus*) were seen visiting a leak from a reservoir tank at Ain Hodra. They were seen every morning, but nowhere else on the expedition. No species of finch were seen at Abu Matamir, Wadi Hammam or Wadi Feiran. In 2002 two Trumpeter Finches were seen and heard in Wadi El Galt Al Azraq, and four birds were seen in Wadi Feiran. Like the Trumpeter Finch, House Sparrows (*Passer domesticus*) were not seen at altitude but in association with water and human habitation at Ain Hodra (maximum of 9) and six at Sheikh Awad. None were seen in Wadi Feiran, despite the numbers of people living there.

Two Rock Sparrows (*Petronia petronia*) were seen on low-lying rocks in Wadi Talah in 2002. The male had the distinctive yellow throat spot. This is a newly recorded species for the Sinai and Egypt, but it may have been overlooked. The yellow spot on the chest is diagnostic. One Black-headed Bunting (*Emberiza melanocephala*) was observed in Wadi El Haswa in 2002.

Bird densities

The density estimate from the raw data (Table 5) is about 40% higher than the estimate from Distance5. This is because of the relationship between group size, detectability and distance (which is allowed for in the Distance program). We therefore adjusted downwards all estimates by the same proportion (see Methods), giving the adjusted densities of Tables 4 and 5. The

three commonest species (the doves and the Rock Martin) may have inflated density estimates because the same individuals may have been repeatedly recorded as they flew back and forth along the wadis. Densities of migrants too are clearly very variable according to the time of the census relative to the phenology of migration.

Table 5: Birds seen in south Sinai during Operation Wallacea expeditions in summer 2005

Species		Status	No. of sites rec.	-- Number of groups --						group size	density per km ²	Adj density ²	
				Isla	RingDyke	E Sinai	Feiran	Sheikh Awad	O t a				
Rock Dove	<i>Columba livia</i>	R	11	3	39	30				72	4.4	71.4	50.9
Rock Martin	<i>Hirundo fuligula</i>	R	16	14	56	20	8	18	116	2.3	61.5	43.9	
Laughing Dove	<i>Streptopelia senegalensis</i>	R	9	3	20	51	13	11	98	2.3	51.7	36.9	
White-crowned Black Wheatear	<i>Oenanthe leucopyga</i>	R	16	18	56	22	10	12	118	1.5	40.6	28.9	
Yellow-vented Bulbul	<i>Pycnonotus xanthopygos</i>	R	8	2	9	9	21	5	46	2.8	29.7	21.2	
Chukar	<i>Alectoris chukar</i>	R	9	1	9				10	11.1	25.2	17.9	
Sinai Rosefinch	<i>Carpodacus synoicus</i>	R	9	2	40				42	2.5	23.5	16.7	
Blackstart	<i>Cercomela melanura</i>	R	10	14	10	19	11	4	58	1.8	23.1	16.5	
Desert Lark	<i>Ammomanes deserti</i>	R	12	6	31	3		3	43	1.6	15.6	11.2	
Tristram's Grackle	<i>Onychognathus tristramii</i>	R	7	3	17		2		22	2.9	14.5	10.3	
Sand Partridge	<i>Ammoperdix heyi</i>	R	2	4				5	9	6.9	14.1	10.0	
House Sparrow	<i>Passer domesticus</i>	R	2			19		1	20	2.5	11.3	8.1	
Scrub Warbler	<i>Scotocerca inquieta</i>	R	10	3	14	2	1	2	22	1.8	8.8	6.3	
Palestine Sunbird	<i>Nectarinia osea</i>	R	7		18		3		21	1.3	6.1	4.4	
Orphean Warbler	<i>Sylvia hortensis</i>	M	5		3	2		6	11	2.0	5.0	3.6	
Hoopoe	<i>Upupa epops</i>	R	3		5		2		7	1.4	2.3	1.6	
Chiffchaff ¹	<i>Phylloscopus collybita</i>	M	1				3	1	4	1.8	1.6	1.1	
Domestic Pigeon	<i>Columba livia</i>	R	3		1			1	2	3.5	1.6	1.1	
Reed Warbler	<i>Acrocephalus palustris</i>	M	1				1		1	7.0	1.6	1.1	
Trumpeter Finch	<i>Bucanetes githagineus</i>	R	1			5			5	1.0	1.1	0.8	
Hooded Wheatear	<i>Oenanthe monacha</i>	R	3		2			2	4	1.0	0.9	0.6	
Brown-necked Raven	<i>Corvus ruficollis</i>	R	1	1					1	3.0	0.7	0.5	
Olivaceous Warbler	<i>Hippolais pallida</i>	M	2		2	1			3	1.0	0.7	0.5	
Olive-tree Warbler	<i>Hippolais olivetorum</i>	M	2		1	1		1	3	1.0	0.7	0.5	
Fan-tailed Raven	<i>Corvus rhipidurus</i>	R	1		1				1	2.0	0.5	0.3	
Great Spotted Cuckoo	<i>Clamator glandarius</i>	M	2	1				1	2	1.0	0.5	0.3	
Lesser Grey Shrike	<i>Lanius minor</i>	M	1					2	2	1.0	0.5	0.3	
Sooty Falcon	<i>Falco concolor</i>	R	3			1			1	2.0	0.5	0.3	

Upcher's Warbler	<i>Hippolais languida</i>	M	1	1	1	2	1.0	0.5	0.3			
Bee-eater	<i>Merops apiaster</i>	M	1		1	1	1.0	0.2	0.2			
Kestrel	<i>Falco tinnunculus</i>	R	1			1	1.0	0.2	0.2			
Lesser Whitethroat	<i>Sylvia curruca</i>	M	1		1	1	1.0	0.2	0.2			
Striated Scops Owl	<i>Otus brucei</i>	R	1			1	1.0	0.2	0.2			
Masked Shrike	<i>Lanius nubicus</i>	M	1		1							
Black Eagle	<i>Aquila verreauxii</i>	R	1	2								
Short-toed Eagle	<i>Circaetus gallicus</i>	M	1	2								
Grand Total				75	334	186	77	78	750	2.4	416.5	297.0
transect distance (km)				10	21.1	6	1	6	44.1			
No. of point counts				0	6	5	1	2	14			

1. possibly misidentified (Baha El Din, pers.comm.)
2. adjusted according to the technique outlined in the Methods

Bird species richness and diversity

The modal number of species per survey in 2005 was seven. Over a 1-km transect, the most species-rich wadi was Farsh Rumana with ten species. Seventeen bird species in all were recorded over the total surveyed length of Wadi Isla (approximately 10 km) in the course of four separate transects of varying length. Species richness increased in August with the arrival of migrants and birds gathering to feed on ripe fruit trees. Nine of thirteen species recorded over 1.4 km in Wadi Itlah on the 9th August were feeding together in one ripe fig tree, whereas previously only eight species were recorded over 3.1 km when Itlah was surveyed in early July. Twelve species were recorded over a 2-km transect at Sheikh Awad on the 18th August.

Human impact also increased species richness. During one hour of stationary observations 11 species were seen in the heavily used Farsh beyond the monastery in Wadi el Deir. Ten species were seen during a survey of the Garden of Forty Martyrs in Wadi Arba'ain in August 2005. In contrast, low numbers of species were seen in more open desert (e.g. three species at Abu Matamir) or if a route moved away from areas of vegetation (e.g. three species down from eight on Safsafa during the late July survey).

Simpson's diversity index (1-D) was calculated for each survey of 2005, and an average taken where there were repeat surveys of the same wadi. Farsh Rumana in the Wadi Gebel system was the single most-diverse wadi (Simpson index = 0.91): 28 individuals of ten species were seen during one hour's slow walk. Abu Matamir was the least diverse wadi (0.51), with only ten individuals of three species seen over one and a half days. Based on transect data only, the least diverse wadi was Wadi el Deir (Simpson index = 0.55), where 27 individuals of six species were seen. The average diversity was very similar inside (0.77 ± 0.1) and outside (0.78 ± 0.08) the Ring Dyke. There was no tendency for bird diversity to increase with altitude ($r^2 = 0.066$, $n = 43$ transects, n.s.).

Reptiles

Fifty-five records of seven species of reptile were made from 21 locations during 2005 (Table 6). Most observations were made between 1000 and 1100 h, after which time it was generally too hot for surveying. The maximum number of reptile species seen in any one location or wadi was four. *Acanthodactylus boskianus* was the most frequently recorded species (44% of observations), followed by *Pseudotrapelus sinaitus* (24%). There was some altitudinal separation in the ranges of these species: 46% of *A. boskianus* records came from Wadi Isla and 83% of all records below 1500 m altitude, whereas 93% of *P. sinaitus* records came from within the Ring Dyke area, above 1500 m altitude (apart from one record from Sheikh Awad).

A. boskianus appeared to prefer more open sand and gravel beds of wadi floors with scattered large rocks and vegetation. *P. sinaitus* preferred much more rocky terrain, with large boulders offering crevices in which to hide. A male and a female were observed together on Safsafa on the same boulder, the male displaying on the top, the female at the mouth of a crevice at the bottom that may have been their burrow.

Laudakia stellio was the species next most frequently seen (15% of observations); it showed the same altitudinal distribution pattern and habitat preference as *P. sinaitus*. The highest numbers of *Laudakia* and *Pseudotrapelus* were seen in the Wadi Gebel system. Juveniles of *Mesalina guttata* were encountered more often than adults, scurrying across open slabs of rock to reach narrow slits in the rock – including under people’s shoes. *M. guttata* was the only species seen below 700 m in Wadi Hodra, in an area of sand and small rocks beneath the wadi wall. *M. guttata* was also incidentally recorded at the mouth of Wadi Arba’ein after the expedition had ended.

Geckos were only seen in the shelter of boulders. It was difficult to combine searching boulder spaces with the bird and butterfly surveys, and geckos were the most under-recorded group of species during transects. *Ptyodactylus hasselquistii* could not be separated from *P. guttatus* with confidence, and there was also confusion with the recently described endemic *P. mindiae*: as a consequence, sighting records have been lumped together. Identifications by Sherif Baha El Din from photographs demonstrated that both *P. hasselquistii* and *P. mindiae* occurred at the Suez Canal Environmental Research Centre in St Katherine, and both *P. hasselquistii* and *P. guttatus* occurred at Wadi Hamman.

Only one individual of *Uromastyx* (unidentified) was seen at high altitude out in the open in the Wadi Gebel area, but much more evidence of these species was seen at lower altitudes, mostly burrows. Burrows were dug into sand under a rock shelf or into a gap between two plates of soft rock and were often near to an *Acacia* tree. The Bedouin staff was familiar with trapping these animals outside of their burrows and two *U. ornata* were caught: one at Gebel Barq and one among the rocks above El Bragga Garden, Wadi Feiran. Burrows were also seen in Wadi Hamman and in a metamorphic rock wadi near Abu Matamir, where there was a well-used trail from the burrow, up the slope across a sand dune, to an area of scattered droppings in the lee of a sandstone rock outcrop with deep clefts and lots of small-reptile and rodent tracks. Tracks in sand also revealed lot of nocturnal reptile activity in the metamorphic rock hills and sand dunes between Abu Matamir and the road to Dahab.

An experienced animal trapper Mr Rashid El Rafaei was engaged for the last week of the expedition in August. Mr Rafaei trapped a Pale Agama *Trapelus pallida* and an unidentified snake, possibly a Racer, in Wadi Arba’ein. An Egyptian sand snake “*Psammophis aegyptius*” was also seen at the white canyon on the route to Ein Hodra.

A Burton’s Carpet Viper (*Echis coloratus*) was seen being mobbed by White-crowned Black Wheatears in Wadi Isla during the early morning. The snake was moving down a crevice on a rock face covered by a fig tree. A second Burton’s Carpet Viper was killed in the camp on the sand at Gebel Barq. A burrow was found a short distance away and fresh tracks indicated the presence of another individual.

Table 6: Reptile Records

Date		<i>Acanthodactylus boskianus</i>	<i>Pseudotrapelus sinaitus</i>	<i>Laudakia stellio</i>	<i>Mesalina guttulata</i>	<i>Uromastyx ornata</i>	<i>Gecko sp.</i>	<i>Echis coloratus</i>
30/06/2005	Isla	5						1
01/07/2005	Isla (Muagid)	6						
02/07/2005	Isla (Mouth)	1						
05/07/2005	El-Loza basin (Safsafa)	4	7	2				
05/07/2005	Gebel Musa West		2					
06/07/2005	Itlah		1					
08/07/2005	Arba'ain		1	1				
12/07/2005	Talah			1	2			
14/07/2005	Ein Hodra				1			
15/07/2005	Abu Matamir				2			
20/07/2005	Wadi Shagg / Tubug			1				
21/07/2005	Abu Twaita & route to Blue Pool	1	2				1	
26/07/2005	Nabq el Hawa		1		1			
27/07/2005	Ferah		1	1				
29/07/2005	Wadi el Sheikh	5						
04/08/2005	Wadi El Hamam	3					3	
03/08/2005	Gebel Barq					1	1	1
08/08/2005	Wadi Gebel area (Christian Dietz)		20	8		1 (unident sp)		
11/08/2005	El Bragga Garden, Wadi Feiran			1		1	1	
18/08/2005	Sheikh Awad	1	1	1			1	
28/07/2005	Pilgrim trail Gebel Musa			1				
Jul -Aug	Field Centre, St. Katherine		2	1	1		2	
Total No. individuals		26	36	17	6	3	7	2

Butterflies

Seventy-three records of ten species of butterfly were made from ten wadis (Table 7), nine of which were within the Ring Dyke: three species were recorded from Wadi Isla. Four of the target species were not seen: the Sinai Baton Blue (*Pseudophilotes sinaicus*), the Sinai Hairstreak (*Satyrium jebelia*), the Mediterranean Grass Blue (*Zizeria karsandra*), and the Blue-spotted Arab (*Colotis phisadia*). The Sinai Baton Blue and Sinai Hairstreak were probably not seen because they are spring-flying high-altitude species, and were at the end of their flight period. The Mallow Skipper (*Carcharodes alceae*) was only seen visiting plants around the Research Centre in St Katherine.

Five non-target species were seen in addition: Clouded Yellow (*Colias croceus*), Small White (*Pieris rapae*), Mediterranean Tiger Blue (*Tarucus rosaceus*), Long-tailed Blue (*Lampides boeticus*) and the Plain Tiger (*Danaus chrysippus*). Most of these were seen around the gardens of Wadi Itlah on the 6th July, when Sabrine Rashed, the St Katherine Protectorate butterfly expert, joined the surveys (seven species were recorded in total that day). Most butterflies were seen between 0900 and 1100.

Members of the Pieridae were the most common. The Salmon Arab (*Colotis fausta*) was the most frequently recorded species (22% of records), but was only seen in Wadi Isla and Wadi Itlah. Species of *Pontia* and the Desert Grayling (*Pseudotergumia pisidice*) were the next most frequently observed species (21% of records each). The most common *Pontia* was the Bath White (*Pontia daplidice*) but according to Sabrine Rashed, other species were present also in the area: all *Pontia* records have therefore been lumped together. *Pontia* were seen at eight of the ten survey locations, and the Desert Grayling at five. The tiny Grass Jewel

(*Freyeria trochylus*) was the next most frequently seen, but only from Wadi Itlah, Tala and Arba'ain. The remaining species were all seen either once or singly at a couple of locations.

Table 7: Butterfly records

Date		<i>Colotis fausta</i>	<i>Colotis croceus</i>	<i>Pontia</i> sp	<i>Pieris rapae</i>	<i>Pseudotergumia pisidice</i>	<i>Freyeria trochylus</i>	<i>Tarucu rosaceus</i>	<i>Lampides boeticus</i>	<i>Melitaea deserticola</i>	<i>Danaus chrysippus</i>
30/06/2005	Isla	10		3		2					
01/07/2005	Isla	2		4		4					
	(Muagid)										
05/07/2005	El Loza			4							1
06/07/2005	Wadi Itlah	4	2		8	3	20	3	1		
08/07/2005	Arba'ain			1			6				1
12/07/2005	Wadi Tala			1			8				
20/07/2005	Wadi Shagg / Tubug		1	5		4			1	1	1
21/07/2005	Abu Twaita			1							
27/07/2005	Wadi Ferah			1							
29/07/05	Wadi Sheikh					3					
	Total no. individuals	16	3	20	8	16	34	3	2	1	3

DISCUSSION

During these expeditions, many records of birds from a variety of wadis were added to the databases of St Katherine Protectorate, contributing to mapping the region's biodiversity. Two new species for Egypt, the Rock Sparrow (*Petronia petronia*) and the Rock Nuthatch (*Sitta neumeyer*) were observed. This former species is not mentioned in Goodman *et al.* (1997), but it is considered not uncommon in northern Israel and may reach Eilat (Shirihai 1996). Twenty-two resident breeding birds out of a possible total of 50 were recorded. The data includes significant records of resident species: Black Eagle, Striated Scops Owl and Hume's Tawny Owl. They also included rare migrants: Great Spotted Cuckoo and Upcher's Warbler. The last species is an eastern Mediterranean and Middle-Eastern species rejected from the Egyptian list by Goodman *et al.* (1989), but there are four recent Sinai records of Upcher's Warbler (Snow *et al.*, 1998), so it is not unknown.

Most notable for their absence were the birds of prey. Only six species were recorded with certainty (excluding the hand-reared Kestrel at Sheikh Awad and the owl records) and none of these species were recorded regularly. The two Short-toed Eagles seen in Wadi Zawatein are most likely to have been early migrants although they may breed in the Sinai (Goodman *et al.* 1989). Sherif Baha El Din identified the two Black Eagles from a photograph, and the presence of a juvenile may constitute a breeding record: these birds must range widely because they were not seen again. Two adults and a fledgling were previously seen in Wadi Arba'ain in 1978 (Goodman *et al.* 1989). The last known definite records for the St Katherine Protectorate were in the early 1980s in autumn (Baha El Din & Baha El Din 2000), although Shirihai (1996) states that one to three birds were regularly seen there and were assumed to be breeding. The main prey of Black Eagles are usually hyrax, and these are not common in St Katherine.

The most striking observation made by the Bedouin in 2002 was the decline in the large birds of prey in the area. They recall a great diversity and abundance of large predatory species, such as vultures, that used to soar high above the mountains only a few years previously. The decline of these species has been dramatic. The apparent degradation of the entire ecosystem, probably related to a ten-year period of low rainfall and overgrazing, has

clearly taken its toll on the higher trophic levels. We suggest that a reduction in productivity of the whole ecosystem has reduced the level of nutrition available to all trophic levels, reducing abundance and diversity throughout.

Brown-necked and Fan-tailed Ravens were also much rarer than expected. Prey did not appear to be a limiting factor, reptiles and carrion from livestock were easily available. From the remains of a shot bird of prey and white stork found in Wadi Isla there is still persecution in places and species may take a long time to re-colonise. Fan-tailed Ravens are known to have depended on the town dump, which has now been cleaned up and is no longer a regular source of food.

There have been claims that Hooded, Mourning (*Oenanthe lugens*) and Desert Wheatears (*Oenanthe deserti*) are common residents along with the White-crowned Black Wheatear. However, except for two positively identified female Hooded Wheatears and one Mourning Wheatear, only the White-crowned Black Wheatear was common; the latter is known to occur at high densities in rugged granitic country (Goodman *et al.* 1989). The low number or absence of the other species is puzzling. Snow & Perrins (1998) show the Desert Wheatear as having a north-Sinai distribution outside the survey area. There is a possibility that some male Hooded and Mourning Wheatears were overlooked and misrecorded as White-crowned Black Wheatears, but this is unlikely. Goodman *et al.* (1989) note that the Mourning Wheatear may undergo considerable altitudinal movements and dispersal during the non-breeding season, but we surveyed a range of altitudes without finding it.

From one season of surveys at the hottest time of year when bird behaviour changes after the breeding season, it is not possible to tell whether species are in decline. At all altitudes bird diversity within the wadis was very patchily distributed between gardens and small areas of natural vegetation interspersed with hostile areas of desert, through which only one or two bird species may occasionally pass (Desert Larks, Sooty Falcon, Ravens).

There were some apparent altitudinal changes in species composition and abundance. The smallest species (Palestine Sunbirds, Scrub Warblers) appeared to prefer the patchy but relatively high density of vegetation and fruit trees in and around Bedouin gardens within the Ring Dyke. Palestine Sunbirds are a Middle Eastern species relatively new to the Sinai: they were recorded for the first time in Sinai in 1979 and as breeding in 1984 (Snow *et al.*, 1998). Sinai Rosefinch and Tristram's Grackle also only tended to occur at higher altitudes and were most numerous around gardens, areas of human disturbance and livestock. A bird of ravines and cliffs but dependent on vegetation for food, Tristram's Grackle has been extending its range, tracking the development of agriculture and settlements, and becoming increasingly tame (Snow *et al.*, 1998). In contrast, House Sparrows and Trumpeter Finch were limited to the low-altitude sites around Ain Hodra. Sinai Rosefinch remain at 1000-1500 m in mild winters, but disperse to lower altitudes when it gets colder (Snow *et al.*, 1998). No information has been found that could indicate why so few adult males were seen.

At the start of August the bird diversity of wadis was augmented by migrants, including the rare Orphean and Olive-tree warblers, on passage from their breeding range in the Middle East and Eastern Mediterranean to wintering grounds in sub-Saharan Africa. Migrants occurred in scattered trees of *Acacia* or *Ziziphus* at all altitudes but were most frequent in the gardens at Wadi Feiran. This is in part due to a good cover of suitable trees and in part due to surveying Wadi Feiran in mid-August when migration would have been fully underway. Olivaceous warblers are an abundant breeding species of semi-desert and the Nile Valley (Snow *et al.*, 1998) and the July record of one in Wadi Ithlah may represent a resident individual.

With the exception of White-crowned Black Wheatear, Desert Lark and Rock Martin (three of the most common birds), the majority of the birds seen all showed some dependence on the presence of trees. Occasional trees of *Acacia* and *Ziziphus spina-christi* are probably particularly important as "stepping stones" of food across the desert for many of the migrants.

Outside of the Bedouin gardens, there are very few trees, and within a wide radius of villages many trees that would naturally have been growing between rock crevices have been lost to fuelwood (Hobbs 1996).

Tending gardens is a centuries-old but declining tradition among the Jebaliya, as young people shift towards working in the tourism sector (Hobbs 1996). Coupled with increased human demand for water, there are also problems in re-establishing the native vegetation caused by free-roaming or feral livestock. If the fruit trees that are so valuable to birds are no longer watered and tended, then there is a risk of the disappearance of many bird species because there are few wild trees to compensate for their loss.

Loss of genetic purity of Rock Doves by inter-breeding and the spread of feral domestic birds with different plumage variants has been a largely neglected problem in ornithology and it is now impossible in many countries to distinguish wholly wild colonies (Snow *et al.*, 1998). Although still common in Egypt, wild Rock Doves will interbreed with escaped domestic birds: mixed flocks of wild and feral pigeons were seen in Wadi el Deir, Wadi Feiran and Nabq el Hawa. Since they are largely sedentary, feral birds should spread into the wild population only slowly. The occurrence of unnatural plumage variants and feral domestic birds in the St Katherine and Wadi Feiran area is well worth monitoring carefully, especially while there is still the prospect of controlling the small numbers of feral birds, and thereby maintaining what will possibly become a rare example of a genetically pure population. In Syria, so much interbreeding has occurred that wild Rock Doves no longer appear to exist (Snow *et al.*, 1998) and the last isolated wild populations in the UK on the west of Scotland and Ireland are being diluted by birds showing Feral Pigeon characteristics (Wingfield Gibbons *et al.* 1993).

Butterflies and reptiles were recorded in a much more *ad hoc* manner than the birds, partly because they were becoming active late in the morning when surveys of birds had finished, and personnel were preparing to move to another site. Butterflies were often locally quite abundant around gardens, but it was difficult to stop to give these areas full attention at the possible expense of further bird and reptile records. There was no time to chase active fast-flying butterflies, or catch species such as Pierids for accurate identification.

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Appendix 1: Number of individuals of each bird species recorded during each survey.

English Name	Latin Name	05/07/05	28/07/05	28/07/05	06/07/05	12/07/05	19/07/05	06/07/05	09/08/05	08/07/05	02/08/05
		Gebel Musa / Safsafa	Safsafa	Elijah's basin	Wadi Tala	Wadi Tala	Wadi Tala	Wadi Itlah	Wadi Itlah	Wadi Arba'ein	Wadi Arba'ein garden of 40 martyrs
Chuckar	<i>Alectoris chukar</i>	6									
Rock Dove	<i>Columba livia</i>	4		1	8	8	20		1	11	25
Laughing Dove	<i>Streptopelia senegalensis</i>	1				4	2	6	13	6	8
Hoopoe	<i>Upupa epops Ammomanes</i>									1	
Desert Lark	<i>deserti Ptyonoprogne</i>	4		2	2	2	2	3	2	3	3
Rock Martin	<i>fuligula Cercomela</i>	5	1	2	3		6	1	7	4	2
Blackstart	<i>melanura</i>			1				1	1		
Hooded Wheatear	<i>Oenanthe monacha</i>			1							
White crowned	<i>Oenanthe</i>										
Black Wheatear	<i>leucopygia</i>	6	1	3	4	2	12	2	6	8	10
Scrub Warbler	<i>Scotocera inquieta</i>	6		4	3				1		
Olivaceous Warbler	<i>Hippolais pallida</i>							1	1		
Orphean Warbler	<i>Sylvia hortensis</i>								1		4
Palestine Sunbird	<i>Nectarinia osea</i>				1		4	1	1	2	1
Yellow-vented Bulbul	<i>Pycnonotus xanthopygos</i>							4	3	1	2
Tristram's Grackle	<i>Onychognathus tristranii</i>				2		4	5	2		3
Sinai Rosefinch	<i>Carpodacus synoicus</i>	6	4	8					8	26	17
	Total number of individuals	38	6	22	23	16	54	20	47	62	75
	Total number of species	8	3	8	7	4	8	8	13	9	10

Meakin et al.: Birds, reptiles and butterflies of St Katherine

English Name	Latin Name	Date									
		14/07/05	14/07/05	05/08/05	05/08/05	05/08/05	05/08/05	05/08/05	05/08/05	06/08/05	06/08/05
		Ain Hodra Oasis	Wadi Hodra	Ain Hodra	Ain Hodra point count mid camp	Ain Hodra edge camp	Ain Hodra transect	Wadi Hodra PM	Ain Hodra garden	Ain Hodra mid camp	Ain Hodra edge camp
Sooty Falcon	<i>Falco concolor</i>							3			
Rock Dove	<i>Columba livia</i>	6	18	26	5	8	10	11	4	14	1
Laughing Dove	<i>Streptopelia senegalensis</i>	8	6	24	6	2	13	11	10	9	8
Desert Lark	<i>Ammomanes deserti</i>						1				
Rock Martin	<i>Ptyonoprogne fuligula</i>	2	7	1			5	8	4		2
Blackstart	<i>Cercomela melanura</i>	10		8	1	2	2		3	1	
White-crowned Black Wheatear	<i>Oenanthe leucopyga</i>	3	5	3	6	1	3	2		1	
Olivaceous Warbler	<i>Hippolais pallida</i>						1				1
Orphean Warbler	<i>Sylvia hortensis</i>								1		
Yellow-vented Bulbul	<i>Pycnonotus xanthopygos</i>	4		1		1			1	2	
House Sparrow	<i>Passer domesticus</i>	9	5	4	3		7	3	9		
Trumpeter Finch	<i>Bucanetes githagineus</i>	1			3		1			1	
Total individuals		43	41	67	24	14	43	38	32	28	12
Total number of species		8	5	7	6	5	9	6	7	6	4

English Name	Latin Name	Date									
		20/07/05	20/07/05	21/07/05	21/07/05	22/07/05	26/07/05	27/07/05	29/07/05	29/06 - 2/07	
		Wadi Shagg / Zawateen	Wadi Tenya eve transect	Wadi Tenya am	Abu Tweta	Farsh Romana	Nabq el Hawa	Wadi Ferah	Wadi Sheikh	Wadi Isla	
Short-toed Eagle	<i>Ciraetus gallicus</i>	2									
Sooty Falcon	<i>Falco concolor</i>									1	
Chukar	<i>Alectoris chukar</i>	1			4	3				2	
Sand Partridge	<i>Ammoperdix heyi</i>									4	
Rock Dove	<i>Columba livia</i>		3			4		1	3	22	
Laughing Dove	<i>Streptopelia senegalensis</i>	1								3	
Great Spotted Cuckoo	<i>Clamator glandarius</i>									1	
Hoopoe	<i>Upupa epops</i>					1					
Desert Lark	<i>Ammomanes deserti</i>	3	1	3		1	2		5	7	
Rock Martin	<i>Ptyonoprogne fuligula</i>	25	2	4	16	2	1	1	5	19	
Blackstart	<i>Cercomela melanura</i>			1	1					12	
Hooded Wheatear	<i>Oenanthe monacha</i>				1						
White-crowned Black Wheatear	<i>Oenanthe leucopyga</i>	6	2	9	3	5	2	3		14	
Scrub Warbler	<i>Scotocera inquieta</i>					2	2	2		4	
Palestine Sunbird	<i>Nectarinia osea</i>	11		2						1	
Yellow-vented Bulbul	<i>Pycnonotus xanthopygos</i>					4				1	
Tristram's Grackle	<i>Onychognathus tristramii</i>		3			3				2	
Brown-necked Raven	<i>Corvus ruficollis</i>									3	
Fan-tailed Raven	<i>Corvus rhipidurus</i>								2		
Sinai Rosefinch	<i>Carpodacus synoicus</i>	8	3	14		3		8	2	9	
Trumpeter Finch	<i>Bucanetes githagineus</i>									1	
Total number of individuals		55	14	33	25	28	7	15	17	106	
Total number of species		7	7	6	5	10	4	5	5	17	

Meakin et al.: Birds, reptiles and butterflies of St Katherine

English Name	Latin Name	15/07/05	04/08/05	11/08/05	11/08/05	12/08/05	12/08/05	13/08/05	18/08/05	18/08/05	19/08/2005
		Abu Matamir	Wadi Hammam	El Bragga garden, Feiran	Wadi Feiran pm transect	Feiran garden	Feiran garden pm point count	El Bragga garden Feiran	Sheikh h Awad am transect	Sheikh Awad pm transect	Sheikh Awad am transect
Sooty Falcon	<i>Falco concolor</i>	1									
Kestrel	<i>Falco tinniculus</i>										1
Sand Partridge	<i>Ammoperdix heyi</i>								29		26
Rock Dove	<i>Columba livia</i>							10			
Feral pigeon	<i>Columba livia</i>								5		
Laughing Dove	<i>Streptopelia senegalensis</i>			5	3	15		2	10	11	9
Great Spotted Cuckoo	<i>Clamator glandarius</i>										1
Straited Scops Owl	<i>Otus brucei</i>								1 (netted)		
Bee-eater spp	<i>Merops spp</i>					1					
Hoopoe	<i>Upupa epops</i>				2	3		1			
Desert Lark	<i>Ammomanes deserti</i>	7							6		1
Rock Martin	<i>Ptyonoprogne fuligula</i>		1	2	6	22		1	11	5	8
Blackstart	<i>Cercomela melanura</i>		6	3	4	11	1		4	2	
Hooded Wheatear	<i>Oenanthe monacha</i>								2		
White-crowned Black Wheatear	<i>Oenanthe leucopyga</i>	2	4	3	1	9		2	7	5	6
Scrub Warbler	<i>Scotocera inquieta</i>		3		1				2		
Reed Warbler	<i>Acrocephalus palustris</i>						7				
Olive-tree Warbler	<i>Hippolais olivetorum</i>		1							1	
Upcher's Warbler	<i>Hippolais languida</i>							1			
Lesser Whitethroat	<i>Sylvia curruca</i>						1				
Orphean Warbler	<i>Sylvia hortensis</i>		2					3	5	1	6
Chiffchaff ¹	<i>Phylloscopus collybita</i>			2		2	2	6		1	
Palestine Sunbird	<i>Nectarinia osea</i>					2	1	2			
Yellow-vented Bulbul	<i>Pycnonotus xanthopygos</i>			11	14	20	9	7	11	2	5
Tristram's Grackle	<i>Onychognathus tristramii</i>			6		1					
Lesser Grey Shrike	<i>Lanius minor</i>								1		1
Masked shrike	<i>Lanius nubicus</i>							1			
House sparrow	<i>Passer domesticus</i>										6
	Total number of individuals	10	17	32	31	86	21	36	93	28	70
	Total number of species	3	6	7	7	10	6	11	12	8	11

1. possibly misidentified (Baha El Din, pers.comm.)

English Name	Latin name	18/07/2005	30/07/05	30/07/05
		Wadi el Deir Farsh beyond Monastery	Wadi el Deir: Farsh beyond Monastery (max bird count)	Wadi el Deir (main road to coach park)
Chukar	<i>Alectoris chukar</i>		2	
Rock Dove	<i>Columba livia</i>	100	50	18
Feral Pigeon	<i>Columba livia</i>		2	
Laughing Dove	<i>Streptopelia senegalensis</i>	3	6	1
Hoopoe	<i>Upupa epops</i>		1	
Desert Lark	<i>Ammomanes deserti</i>		2	2
Rock Martin	<i>Ptyonoprogne fuligula</i>		1	1
White-crowned Black Wheatear	<i>Oenanthe leucopyga</i>	3	5	2
Scrub Warbler	<i>Scotocera inquieta</i>		3	3
Reed Warbler	<i>Acrocephalus palustris</i>			
Tristram's Grackle	<i>Onychognathus tristramii</i>	2	15	
Sinai Rosefinch	<i>Carpodacus synoicus</i>	9	5	
	Total number of individuals	117	92	27
	Total number of species	4	11	6

الملخص العربي

تقييم ومتابعة الطيور والزواحف والفراشات في محمية سانت كاترين - جمهورية مصر العربية

كاثي ميكن¹ - سالفينو دي كورت² - هيلري جلبرت³ - فرانسيس جلبرت^{3,4} - سامي زلط^{3,5} - لوجين محيي⁵ - سوزان إبراهيم⁵ - جون جريفين⁴ - طلاب اوباريشين واليسيا صيف 2005م⁶

1. جامعة ليدز - المملكة المتحدة - إنجلترا
2. جامعة كورنيل - الولايات المتحدة الأمريكية
3. مشروع البيوماب - وزارة الدولة لشئون البيئة - مصر
4. قسم البيولوجي - جامعة نوتنجهام - المملكة المتحدة
5. قسم علم الحيوان - جامعة قناة السويس - مصر
6. هيئة أوباريشين واليسيا - المملكة المتحدة

تم تسجيل 52 نوع من الطيور في محمية سانت كاترين خلال صيف عام 2005م، وذلك باستخدام تقنية الترانسيكت (المشاهدة على طول خط مستقيم) أو عن طريق المشاهدة خلال نقاط محددة في الوديان المختلفة.

تم تسجيل نوعين من الطيور لأول مرة في مصر وهما: كاسر الجوز وعصفور الصخرة. كان هناك عدة أنواع أخرى من الطيور المهاجرة مثل الطائر المغرد العربي وطائر أبشر المغرد؛ وطيور مقيمة مثل العقاب الأسود، بومة بتلر وبومة الأشجار المخططة. تم تقدير كثافة الطيور والصفات المورفولوجية لكل الوديان التي تم دراستها.

لوحظ تنوع الطيور داخل الوديان المختلفة داخل الحلقة الصخرية الدائرية التي تُحيط بمنطقة سانت كاترين، ولم يكن الاختلاف معنوياً عن الوديان التي تقع خارج تلك الحلقة. تفاوتت طبيعة الأنواع وأعداد الأفراد تبعاً لتوزيع مصادر الماء، حيث ازدادت الكثافة بين الأشجار وحدائق البدو خصوصاً أشجار الفاكهة.

هذه العوامل تبدو هامة كمناطق راحة ونقاط إنطلاق للطيور المهاجرة. أوضحت النتائج أن أعداد بعض الطيور قد تزايدت في الوديان القريبة من المناطق الساحلية. شوهد سبعة أنواع من الزواحف وعشرة أنواع من الفراشات متضمناً أنواعاً متوطنة للبيئة المصرية. زادت كثافة الأعداد المسجلة لكل المجموعات خلال فترات محددة من اليوم.