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THE BIRDS OF THE OUADI RIME - OUADI ACHIM FAUNAL RESERVE
A CONTRIBUTION TO THE STUDY OF THE CHADIAN AVIFAUNA

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INTRODUCTION

Although the Republic of Chad has been fairly well covered ornithologically during the last three decades (Malbrant 1952, Salvan 1967-69, Vielliard 1971-72), little attention has been focussed on the arid northern and central regions that constitute much of Chad. As Conservation Officer in the vast Ouadi Rimé - Ouadi Achim Faunal Reserve, I have been able to make almost continual observation of the bird life in Chad's north sahelian and saharan regions over the last eight years. The Ouadi Rimé reserve was created in 1969 for the protection of the country's sahelio-saharan fauna. It is 77950 km² in extent and covers three major habitat types in central Chad :

North-sahelian Wooded Steppe Characterised by rolling, fixed dunes with a fairly continuous cover of annual and perennial grasses and herbs together with well-dispersed tree cover.

Sub-desert Steppe Characterised by open sandy plains and some low dune-ranges with a patchy cover of mainly annual plants and trees restricted to water-collection and run-off areas.

Run-off Desert Characterised by a mosaic of flat sandy terrain, sandy ergs, sterile regs and occasional areas of fixed dune. Vegetation is sparse, mostly annuals, restricted to the wadis or present as ephemeral pastures following the brief and irregular downpours.

Geographically, the reserve is fairly featureless, and apart from a small area of volcanic out-croppings around Eléla there is no rocky country. Altitude varies from 180 m in the west to about 250 m in the east. A series of 1500 m high massifs (Ennedi, Maraoné, Kapka, Ouaddai) to the east gives rise to parallel wadis that dissect the reserve. With their associated flood plains, temporary pools and inundation zones these wadis greatly enhance the biological and topographical diversity of the reserve (Newby 1974). The prevalent climate is 'North-sahelian' or 'Sub-saharan' and is characterised by

- a cold season from December to February, with a temperatures range of 10-32°C ;
- a warmer transitional period in February and March (temperatures 16-36°C) ;
- a hot season from April to June (temperatures 22-45°C) ;

- a cooler, rainy season from July to September (temperatures 18-38°C) ; and
- a hot, humid transition period from October to November (temperatures 21-40°C).

Rainfall is more or less restricted to July, August, and September, with only the odd shower earlier or later. The reserve being so large, one value for mean annual rainfall would be misleading; representative figures are : for the North-sahelian Wooded Steppe (e.g. Abeché), mean annual rainfall 413 mm (range 105-980 mm); for Sub-desert Steppe (e.g. Arada), 205 mm (range 43-570 mm); and for Run-off Desert (e.g. Faya), 14 mm (range 0-73 mm).

A gazetteer is given in the Appendix. To facilitate cross-reference with French maps, French spelling has been used except for places which do not feature in current maps and in those cases I give anglicised spellings. Abbreviations are used in the text for some geographical features, as follows.

<i>Ouadi</i> (O.) or <i>Wadi</i>	a water-course that flows only during the rainy season
<i>Affluent wadi</i>	a wadi with distinct bed and banks
<i>Receptive wadi</i>	a wadi whose course is marked only by lines of vegetation
<i>Rahad</i> (R.)	a temporary pool, lake or marsh
<i>Goz</i> (G.)	a dune or series of dunes
<i>Erg</i>	a sand sea
<i>Reg</i>	a sterile stony or gravel plain
<i>Bir</i> (B.)	a shallow well or well-site

The annotated checklist which follows lists 267 species of bird recorded in the reserve between 1971 and 1978. Nomenclature and sequence are as in Vielliard (1971), and English names as in Mackworth-Praed & Grant (1970-73).

OSTRICH *Struthio camelus camelus* Ostriches occur throughout the reserve from the wooded steppe in the south to the featureless, open sub-saharan steppes of the north. Although adaptable, they nonetheless prefer open, dry, steppe-like habitats. They lay eggs in the coolest season, from October to February. Ostriches prefer fairly open ground on which to lay their large, off-white eggs, and seem to rely on a clear view of the surrounding country rather than on camouflage. When surprised, an incubating Ostrich invariably at first crouches over its nest, stretching its neck out along the ground; it flees only if the threat persists.

Of a dozen nest sites discovered, eight were in shallow depressions, barely concealed by low vegetation; two were on flat, grassy plains and two in fairly well concealed water run-off channels near

temporary pools, now dry. No nesting material is used. A rim of loose sand, gravel or adjacent pebbles is sometimes formed by the sitting bird. The eggs are laid over a period of several days and often several females use the same nest. Four of the twelve nests I found had no eggs, and the others had 6, 9, 11, 11, 17, 19, 22 and 31 eggs.

Males assume their highly distinctive and attractive breeding colouration in August and September, the bare skin on the head, neck and thighs becoming vivid scarlet. Young females, like domestic hens, may be erratic during their first laying-period. On several occasions, single, nestless eggs have been found cold and abandoned. Both sexes incubate. Tradition has it that the male covers by night and the female by day, their respectively dark and light colourations perhaps being cryptic. Ostriches are polygamous, a cock usually having two or three hen birds.

Ostrich chicks are strong and inquisitive; they closely follow the parent birds, accumulating into crèches. Growth is rapid and they probably become sexually mature during their third or fourth years.

Ostriches eat a large variety of vegetable and insect matter. The leaves, flowers, seed-pods and gum of the trees *Acacia raddiana*, *A. laeta*, *A. senegal*, *A. mellifera* and *A. ehrenbergiana* are all staples. Also eaten in quantity are the fruits of *Cordia sinensis*, the jujube *Ziziphus mauritania* and above all, the large and bitter fruits of the Desert Date *Balanites aegyptiaca*. The leaves, stems, tendrils and fruits of the following creepers are also eaten: *Cocculus pendulus*, *Leptadenia hastata*, *Coccinea grandis*, *Mormordica balsamina*. The parasites *Tapinanthus globiferus* and *T. acaciae* are favourites too.

Locusts, crickets, grasshoppers and beetles are eaten; I have even seen an Ostrich feeding on tadpoles from a shallow pool. Doubtless frogs and lizards are eaten if they can be caught. Plenty small stones are swallowed, as gastroliths. Ostriches can do without drinking water for up to ten months, their water requirements being satisfied by dietary plant and animal matter. A major source of water is the wild melon *Citrulus colocynthis*, which it eats in quantity, especially during the hot season. In fact, Ostriches' seasonal movements are often determined by the presence of the melon and other water-rich food items. During the hot season 50-60 birds are often brought together in an area of rich melon-growth. With the oncoming rainy season Ostriches move south, often into areas of early rainfall. In 1972 I saw 246 on the dunes bordering the wadi Haddat, where rain had recently fallen. That included 104 seen within an area of 20 km² east of Derbé.

Although widespread, Ostriches are no longer common. Hunting, both traditional and modern, has resulted in a startling decline. Traditionally Ostriches are hunted by the arabs on horseback with spears. The Haddat or smiths practice net-hunting, using nets woven of animal tendon-fibres. Ostriches are also caught with foot-traps set in the vicinity of the nest. Nest-robbing must also cause consider-

able losses to the population.

Being so well dispersed within the reserve, its numbers are difficult to judge; an estimate of 1000 seems fair.

AFRICAN LITTLE GREBE *Podiceps ruficollis capensis* A regular wet season visitor, to be found on all the deeper temporary pools, sometimes in large numbers. In early September 1977 there were about 120 on the lake west of Arada. Arriving during late July and early August (earliest 14 July 1974 on the O. Enne), the Little Grebe breeds on larger waters, usually building amongst floating Water Hyacinths *Ipomea aquatica*. 3-6 eggs are laid and hatch in September. By early October the majority of grebes have flown south.

EUROPEAN LITTLE BITTERN *Ixobrychus minutus minutus* A palaeartic migrant; one record, Bir Haraz, 19 September 1973. It may be commoner than the one record would suggest. As yet I have no records of the African Little Bittern, *I. m. payesii*.

DWARF BITTERN *Ixobrychus sturmii* A regular but uncommon wet season visitor. It favours dense waterside vegetation, especially semi-inundated thorn trees, which makes it difficult to observe. Its northern limit within the reserve seem to be the O. Haddat (about 14° 50'N), although it probably occurs further north to the east of the reserve. Earliest record, 3 August 1977, Abou Hadjer.

NIGHT HERON *Nycticorax n. nycticorax* First arrivals are in the second half of August, when flocks of adult and juveniles can be seen. It prefers well-wooded pools but during its passage rarely stays long in any one place. Earliest dates : 18 August 1976 at Bir Haraz and 21 August 1974 at Abou Hadjer. By mid September flocks peak at about 100.

SQUACCO HERON *Ardeola ralloides* To judge by the early arrival of Squacco Herons from the south, it would seem that both African and Palaeartic races occur. The species occurs north to 15°30'N as early as the end of July. Palaeartic migrants are very common on all moister habitats, with peaks over 200 during the second half of September and October. Earliest arrivals from the south : 24 July 1976, the Rahad el-Doot, and from the north : 29 August 1976, O. Heméra. The latest record of birds moving north was a flock of 12 over Arada on 17 May 1975.

CATTLE EGRET *Ardeola ibis ibis* A very common wet season visitor. Apart from the White-throated Bee-eater *Merops albicollis*, it is the earliest spring migrant, and arrival dates vary little. First dates at Arada were 14, 18, 18, 22, 6 and 14 June, respectively from 1972 to 1977.

Within the reserve Cattle Egrets breed as far north as 15°50'N, but during wet periods they can be seen well north of the 16th

parallel. Nesting colonies are usually in tall *Acacia albida* or *A. nilotica* trees. Breeding success seems to be quite low, with many eggs and pulli being pushed or blown from the nests. Most egrets leave in late September and October, but a few stay until December.

GREEN-BACKED HERON *Butorides striatus atricapillus* Present only during the wettest summers and even then secretive and very difficult to observe. They arrive during late August, rarely staying until the end of September. My observations of this species contradict Salvan's assertion (1967-69) as to its strictly sedentary nature.

GREAT WHITE EGRET *Egretta alba melanorhynchos* Only six records, between the 16th parallel at Bir Haraz and the wadi Zornam at 14°07'N. Earliest : 8 August 1974, Lidey; latest, one at Arada from 13 December 1977 to 7 January 1978.

LITTLE EGRET *Egretta garzetta* A common and regular Palaearctic migrant, arriving during late August and early September and leaving when the temporary pools and marshes dry up. My observations of Little Egrets as early as the third week in July (26 July) are of Palaearctic individuals which failed to emigrate, or of (breeding) residents. Earliest presumed Palaearctic bird : 20 August 1975, north-west of Oum Chalouba.

GREY HERON *Ardea cinerea cinerea* A common and regular passage migrant. Earliest arrivals are in late August but large passages occur, often at night, during the latter half of September and early October. Larger areas of water sometimes attract as many as 200 Grey Herons. Earliest : 16 August 1972, Lidey; latest departure : 8-10 May 1977, Arada.

BLACK-HEADED HERON *Ardea melanocephala* The southernmost wadis of the reserve are its northern limit in Central Chad. An uncommon wet season breeding visitor, colonies rarely exceeding two or three pairs. Earliest : 28 July 1974, O. Enne (nesting), and 8 August 1975, Arada (furthest north observed).

PURPLE HERON *Ardea p. purpurea* A common and regular visitor from the Palaearctic, arriving in large numbers during September, flying in flocks mixed with Grey Herons. Peaks at Arada during mid September are 150-200 birds. Earliest : 1 September 1973, at B. Haraz. Pre-nuptial passage northwards in the eastern part of the reserve, 7-12 April 1976.

WHITE STORK *Ciconia ciconia ciconia* A fairly common winter visitor to Chad but only a passage migrant through the reserve. Control of ringed storks shows that many Chadian birds come from central European and Balkan breeding populations. In early August 1975, 20-30 were seen on the inundated banks of the O. Lidey, which may have summered there. The earliest large-scale arrivals come in the second half of September; one extremely travel-worn bird was seen at B.

Haraz on 1 September 1973.

ABDIM'S STORK *Ciconia abdimii* A very common wet season visitor, arriving in mid June (13, 6, 15, 18 and 19 June, respectively from 1973 to 1977). Abdim's Storks nest in the same sort of places as Cattle Egrets and Sacred Ibises; often all three together in the same acacia or Desert Date tree *Balanites aegyptiaca*. Breeding success seems to be low at the northern limits of its range, which is about 15°30'N in the reserve.

The species' penetration of the sahel and sub-desert zones depends greatly on the availability of suitable feeding; they often reach the 16th parallel and occasionally go much further north. During September and early October enormous flocks, sometimes over 1500 birds, gather on larger waters. These flocks soar on convection currents almost out of sight. The social descent from high altitudes is remarkable, the birds turning and rolling to lose altitude as quickly as possible. Latest records usually mid October, and once 14 November, Arada.

SADDLE-BILLED STORK *Ephippiorhynchus senegalensis* Twice, both juveniles seen after very heavy storms, on 15 August 1975 and 7 August 1978, at Arada.

OPEN-BILLED STORK *Anastomus lamelligerus lamelligerus* Unexpectedly this bird is a regular wet season visitor to a few of the deeper and more regularly inundated pools on the wadis Kharma and Achim. The pools support an abundant mollusc fauna. At R. Lidey over 50 on 28 August 1974, and at R. Morfazzy a year later 43 were seen roosting in dead *Acacia nilotica* trees. Earliest : 10 August 1977, R. Sara.

MARABOU STORK *Leptoptilos crumeniferus* The Marabou is a common wet season visitor, found in varying numbers on marshes and large and small waters. Earliest : 24 June 1976 on the O. Enne.

WOOD IBIS *Ibis ibis* Very erratic visitor, common only in exceptionally heavy wet seasons. In early August 1977 there were 150 at Arada, but none remained by 15 August despite abundant food.

SACRED IBIS *Threskiornis aethiopica aethiopica* A common and widespread wet season visitor, less common at the northern extremes of its range than Cattle Egrets or Abdim's Storks. Arrival dates south of 15°N have been 21, 8, 18, 25, 4 and 9 July from 1972 to 1977, i.e. later than Cattle Egrets and Abdim's Storks. Sacred Ibises rarely occur until there is plenty standing water. It breeds within the reserve as far north as 15°30'N. As the larger pools dry up they leave for the south, and rarely occur in the reserve after October.

GLOSSY IBIS *Plegadis falcinellus falcinellus* A Palaearctic migrant, regular in the wet season. First arrivals are during the latter half of August and peak numbers of 300-400 occur between 15 and 30

September on larger stretches of water. Individuals seen in early August or even late July are probably Palaearctic birds that have not undertaken the pre-nuptial migration.

AFRICAN SPOONBILL *Platalea alba* A regular but scant visitor during the wet season, in groups of 5-20. They regularly visit two or three favoured expanses of water, shunning seemingly equally suitable pools in the area. Regular haunts within the reserve are the rahads Karnak, Lidey, al-Afee, Arada, and Abou Snett. Earliest : 28 July 1976 at Karnak; latest : 17 September 1973 at Arada.

EUROPEAN SPOONBILL *Platalea leucorodia leucorodia* Only one record (cf. Vielliard 1972) : two birds on the inundation zone of the wadi Achim at Bir Panda, 27 August 1974. Its large size and the relative lack of suitable feeding places make it difficult to overlook.

WHITE-FACED TREE-DUCK *Dendrocygna viduata* A regular early wet season visitor to most of the pools, marshes and wadis. As with the other African ducks, it is nowhere in the reserve as common as the commonest of the Palaearctic species (cf. Roux et al. 1978). I have records of it breeding during August on the wadis Enne and Zornam. Earliest : 12 July 1976 at Arada.

EGYPTIAN GOOSE *Alpochen aegyptiaca* A regular visitor to the reserve between July and October. It breeds on many of the quieter waters but never in large numbers. Abou Hadger, a regularly inundated pool of some 10 to 12 ha, usually harbours three or four pairs.

SPUR-WINGED GOOSE *Plectropterus gambensis* Erratic north of 15°N where it appears only during heavy rainy seasons. I have no breeding records of it from the reserve, but at similar latitudes further east I have found it nesting during August and September. It probably breeds in the wadi Zornam/Enne/Djedit complex in the south.

KNOB-BILLED GOOSE *Sarkidiornis melanota melanota* The commonest breeding duck, and I am virtually certain that this duck rears two broods on more permanent waters. Brood size is 8-12, and young and adults are adept at hiding under floating masses of Water Hyacinth to escape detection.

TEAL *Anas crecca crecca* An uncommon and late-arriving Palaearctic duck. I found 12, dead presumably from exhaustion, on 12 December 1974 in desert at Kossoma Trama. As with the other Palaearctic ducks, Teal seen commoner over the western half of the reserve (west of 19°00'E), but are more difficult to observe due to the relative lack of long-lasting wet season pools. Earliest : 30 September 1977, Ouadi Achim; arrival dates are usually much later.

CAPE WIGEON *Anas capensis* One record : four at Arada on 2 August 1977.

MARbled TEAL *Anas augustirostris* Salvan (1967-69) described this duck as rare, recorded from the Tibesti; Vielliard (1972) mentioned it from the Kanem. To these records I can add four : 27 August 1974, 7 at Bir Haraz; 12 September 1975, 3 at Lidey; 1 September 1976, 11 at Arada; and 17 September 1977, 4 at Arada. It would seem that, although rare, the Marbled Teal is a regular passage migrant.

PINTAIL *Anas acuta* A regular and fairly numerous visitor. Peak numbers at Arada during late October are about 100, but (as with the other late-arriving species of duck) accurate observations are impaired by the lack of suitable stop-over points.

GARGANEY *Anas querquedula* By far the commonest duck. On large waters, peak numbers may reach 2000 during late September. Some occur as early as the first week of August and it would be interesting to know their origin. At Arada, where half the lake is covered with Water Hyacinth, Garganey roost in the water-weeds.

SHOVELER *Anas clypeata* A regular visitor but not nearly as common as the Garganey or Pintail. Peak numbers rarely exceed 25-30. Earliest : 27 August 1974 at Bir Haraz, but most birds arrive in late September and October.

LAPPET-FACED VULTURE *Aegypius tracheliotus* Encountered throughout the reserve. It tends to move north during the rains, probably following nomadic animals. Breeding takes place during the colder months from November to February. Areas of sparse wooded steppe or dune seem to be the favourite breeding haunts. Nests are usually built in *Balanites aegyptiaca* trees, often (as Salvan observed) on top of nests of Buffalo-Weavers, Chestnut-bellied Glossy Starling or other vultures.

WHITE-HEADED VULTURE *Trigonoceps occipitalis* Less common than Rüppell's Vulture but nonetheless widespread and frequently met with. It is a cold season breeder, favouring *Acacia senegal*, *A. raddiana* and *Balanites aegyptiaca* trees for nesting sites. It is raptorial and I have seen it attack hares and jackals from flight and kill a young Dorcas Gazelle.

RÜPPELL'S VULTURE *Gyps r. ruppellii* Probably the commonest resident vulture although in pure desert it is encountered less than is the Lappet-faced Vulture. Rüppell's Vulture is fairly gregarious, even in its breeding habits, several nests often being in the same tree. Although various authors record that its clutch is only one egg, I have more than once found two young in a nest. It breeds in the cool season, but young are often still in the nest in March and April.

WHITE-BACKED VULTURE *Gyps bengalensis africanus* Scarce only during the wet season and south of 15°N. Presumably a non-breeding visitor.

EGYPTIAN VULTURE *Neophron p. percnopterus* Common and widespread, frequenting the most arid regions during the wet season. However, I have yet to find it breeding within the reserve. It seems much more dependent on water than the other vultures and it is common to see them drinking and washing their heads and necks in duck-like fashion at the edges of temporary pools. Palaearctic birds join the resident population during September and October.

COMMON VULTURE *Neophron monachus* A fairly uncommon visitor to the reserve, seen in any number only in the wet season. South of 15°N a few occur rarely in the colder months. I have no breeding records.

PALLID HARRIER *Circus macrourus* A common migrant from the Palaearctic, overwintering in the reserve, where it is commoner in the western half. It favours flat grassy terrain with diverse topography and vegetation. The depressions and other more inundatable areas west of the Goz Kerky are favoured and 4-6 per km² occur there on suitable terrain. Mice and jerboas seem to be the favourite prey. Crickets and locusts are also taken, and I have seen Pallid Harriers take Crested Larks and Dunn's Larks as well as large dung-beetles.

First arrivals are during October, and they depart by early April.

MARSH HARRIER *Circus a. aeruginosus* A regular passage migrant, not overwintering in the reserve. It arrives in late September, and hunts over water and waterside vegetation. Although I have seen them attack Garganey on several occasions, their favourite prey seems to be Black-winged Stilts.

HARRIER-HAWK *Polyboroides radiatus typus* A regular wet season visitor. Widespread, but prefers the more wooded areas of the reserve and especially the gallery forests of the affluent wadis. In this sort of habitat it can be seen as far north as the wadis Achim, Sofaya and Babanoosa (16th Parallel). It undoubtedly goes further north in the Ennedi. As Salvan observed, it preys much on weavers. Golden Sparrows also form a large part of its diet. Harrier-Hawks arrive in mid July and are rare after November.

BATALEUR EAGLE *Terathopius ecaudatus* Widespread but nowhere common. Resident. My only breeding record is of a pair that nests regularly in a large *Acacia nilotica* near Bir Haraz on the Ouadi Achim. A fledgling in early June was seen to be fed on a Spotted Thickknee. Sandgrouse, guinea-fowl, plovers, hares and small rodents are eaten, and I have even seen a Bataleur try to kill a full-grown female gazelle, and have heard that they do kill goats.

SHORT-TOED EAGLE *Circaetus gallicus* I have recorded this species only on migration (two or three records a year) although it is possible that it overwinters.

BROWN HARRIER-EAGLE *Circus cinereus* Two records, both at Arada, August 1974 and August 1977.

SHIKRA *Accipiter badius sphenurus* A widespread wet season visitor, but not common. I have often watched it hunt, and on successive days in August in the wadi Achim I saw one kill a Black-headed Plover and a Black-winged Stilt. Both were dragged underneath a thorn bush before being eaten. On another occasion I watched a pair of Shikras hawking locusts and grasshoppers from a perch, like bee-eaters. My only breeding record is of an adult and two newly-fledged young mist-netted on 21 September 1977, at Am Dagasham near Arada.

OVAMPO SPARROWHAWK *Accipiter ovampensis* Twice; at Arada on 9 August 1975 and at Djammous on 7 September 1976.

GABAR GOSHAWK *Melierax gabar* Not rare within the southern half of the reserve. There is an increase in the population during the wet season and a certain northward movement. A nest found in an *Acacia* at Abou Hadjer in April 1977 contained one whitish egg. On a later visit I found the nest abandoned and the egg cold.

CHANTING GOSHAWK *Melierax metabates metabates* Common and widespread south of 16°N. It appears to be sedentary, and is a cool-season breeder, favouring *Acacia albida* and *Balanites aegyptiaca* trees. A nest found in late February contained two half-fledged young. The food is varied and includes rodents, birds, reptiles and large insects.

GRASSHOPPER BUZZARD *Butastur rufipennis* A common visitor from July until late September. It favours wetter areas, especially temporarily inundated grassland. Congregations of over 100 can be seen on good habitat and at locust swarms. It seems also that frogs and tadpoles form a considerable part of the diet. I once saw a Grasshopper Buzzard robbing an Egyptian Goose's nest.

AUGUR BUZZARD *Buteo auguralis* Less common than the last species, with which it shares the same habits and habitats. Its northern limit is about latitude 15°30'N.

MARTIAL EAGLE *Polemaetus bellicosus* A fairly common wet season visitor to the reserve south of 15°N. The Martial Eagle prefers open wooded steppe, often perching in the tree-tops to survey the surrounding country.

BOOTED EAGLE *Hieraaetus p. pennatus* A regular but uncommon passage migrant from the Palaearctic. All my records have been of small groups of 2-3 in the first half of October.

AYRE'S EAGLE *Hieraaetus dubius* One, Calla Id (14°36'N), 12 December 1974, at what must be its northern limit in Chad.

TAWNY EAGLE *Aquila rapax raptor* A small but widespread resident population of the Tawny Eagle is augmented during the wet season by the arrival of individuals from the south. It is associated with human habitation. A pair regularly breed in a tall *Acacia raddiana* to the west of Arada. The breeding season is from late in rains until the middle of the cold.

The Tawny Eagle is a versatile and catholic feeder. During the wet season, aerial battles between eagles and kites for scraps of food are common, the kites usually winning. Tawny Eagles hunt chickens with fair success.

WAHLBERG'S EAGLE *Aquila wahlbergi* An erratic visitor to the reserve at all seasons. Further east, in the Kapka, Maraoné and Ouaddai Massifs it is common and breeds.

BLACK KITE *Milvus migrans* The African subspecies *Milvus migrans parasitus* is a wet season visitor only. First arrivals are during early July and the bulk of the population arrives in July or early August. Large arrivals often precede heavy storms from the south, when fronts several km long and comprising many hundreds of kites can be seen. Concentrations occur around shallow pools and especially on inundated grassland, where the kites feed on insects and amphibians. It is a scavenger and also an accomplished hunter. The spectacle of them successfully hunting bats as they leave their roosts is remarkable.

The European Black Kite *Milvus m. migrans* arrives during September and October. During the latter half of October, virtually all kites seen are of the Palaearctic subspecies, the African birds having quit the reserve during the latter half of September. The European birds do not overwinter but move south almost immediately.

BLACK-SHOULDERED KITE *Elanus c. caeruleus* Uncommon. I do not know whether it is resident; all my observations of it are from June to February. It feeds largely on grasshoppers, especially the large migratory locust. Elsewhere it is considered more of a rodent-eater (Morel, pers. comm.).

SWALLOW-TAILED KITE *Elanus riocourii* A regular inhabitant of the open dune and steppe south of 16°N. It breeds during the wet season when it is at the north of its range. A colony of 40-50 pairs was found in an isolated clump of thorn bushes *Acacia ehrenbergiana* 3-4 m high south of Bir Haraz, on 27 July 1975. On 24 August 1975 a pair was feeding two young at a nest built high in a *Maerua crassifolia* tree. That record, north of the Ouadi Sofaya (16°12'N), is the furthest north I have seen this species. Locusts and grasshoppers form the bulk of its diet, taken in the air or from the ground. But small rodents and lizards are almost certainly taken too.

OSPREY *Pandion h. haliaëtus* A regular but uncommon passage migrant. Earliest : 2 October 1977 at Abou Hadjer.

LANNER *Falco biarmicus abyssinicus* The Lanner is a common resident falcon in wooded areas, virtually absent from the open steppe. It seems strictly sedentary. They attack large prey and I have seen them take guinea-fowl, francolins and plovers. On 17 September 1973 I watched one hunting small waders on the pool at Bir Haraz, and next day I mist-netted it, together with the flock of 16 Little Stints and 3 Ringed Plovers it was chasing.

The Lanner is a cold season breeder. A pair at Arada build regularly in a leafy *Maerua crassifolia*. This pair was seen to bring Crested Larks, Long-tailed Doves and skinks to the single chick.

Salvan (1967-69) recorded *Falco b. tanypterus* and also *F. b. abyssinicus* in Chad; the birds seen in the reserve belong to the latter subspecies.

AFRICAN PEREGRINE FALCON *Falco peregrinus peregrinoides* Only a few observations, probably all vagrants from the rockier country to the east. The Palaearctic *F. p. minor* probably crosses the reserve on migration.

HOBBY *Falco subbuteo* Two records : Ouadi Achim, 12 October 1973, and Arada, 2 October 1977.

LESSER KESTREL *Falco naumanni* A common, gregarious, overwintering Palaearctic raptor. It arrives in October and leaves in March. It favours areas of receptive wadi and is commoner in the east than the west. It hawks insects and hovers in typical kestrel-like fashion over coarse grassland. Small birds and rodents are taken as well as locusts and grasshoppers, and Short-toed Larks are a favourite prey.

SOOTY FALCON *Falco concolor* I have a dozen records of this ashy-grey, cuckoo-like falcon, all in semi-desert country north of 16°N and east 18°E. Once a Sooty was seen to attack a Hoopoe-Lark, without success.

KESTREL *Falco tinnunculus* The African subspecies *F. t. rufescens* is sporadic over the grasslands south of 15°N. It is somewhat commoner west than east of 19°E. Kestrels north of 15°N in the wet and cold seasons probably all refer to the Palaearctic subspecies *F. t. tinnunculus* which evidently overwinters.

FOX KESTREL *Falco alopex* Fairly common over the eastern fringe of the reserve and north to 16°30'N. Further east it undoubtedly goes further to the north. Often near human habitation; an accomplished hunter of chickens.

SECRETARY-BIRD *Sagittarius serpentarius* An inhabitant of steppe and especially the inter-dunal depressions. Nowhere common, and it is very rare to see one north of 15°N except in the wet season. Then they prefer areas of tall grass around inundated pools and marshland. Their

diet is varied and, at least during the wet season, consists mainly of frogs and toads. I have only once seen one catch and eat a snake. Doubtless large insects and rodents are taken too.

Secretary-Birds will also tackle larger prey, including gazelles which I have seen attacked. That habit must be fairly widespread since one of the local arabic names is *sugr al-jiddyan* or "gazelle-hawk".

I have yet to record it breeding within the reserve but am certain that it does so.

CLAPPERTON'S FRANCOLIN *Francolinus c. clappertoni* Common in all the wadi systems south of 16°N. South of 14°30'N it occurs also in wooded steppe. Its northern limit is wadis Achim and Sofaya. Clapperton's Francolin breeds during the wet season, laying four to six eggs. At its northern limits it rarely leaves the dense shade of the wadis. It obtains all of its water from its food, which consists of seeds such as those of *Echinochloa colona*, *Panicum laetum*, *Brachiaria deflexa* and *Sporobolus helvolus*. A great deal of unidentified insect matter has also been found in their crops.

COMMON QUAIL *Coturnix c. coturnix* A common migrant from the Palaearctic. It overwinters wherever suitable vegetation exists, but mainly south of 15°N. First arrivals are in early October. During years when the rainfall permits a winter crop of millet in the wadi at Arada, the verdant fields provide an excellent habitat for the Quail until their return in March.

GUINEA-FOWL *Numida meleagris strasseni* Common in all the major wadi systems. The existence of large flocks in the wadi Achim throughout the year proves that these birds are able adequately to satisfy their water requirements without drinking. Guinea Fowl breed in the wettest months (August and September) and the young gather with adults in flocks in November. The food is seeds and small insects, especially ants and termites.

CORNCRAKE *Crex crex* This Palaearctic migrant has been observed only by Gillet in the Ennedi. I have one record, a bird seen over three days at the R. Lidey in September 1972. Probably commoner than the two records suggest.

BAILLON'S CRAKE *Porzana pusilla intermedia* A number of interesting species have been recorded by persistent mist-netting of several of the larger and more vegetated temporary wet season pools. Three Baillon's Crake were caught between 20 and 23 September 1977. Roux and Morel (1966) have already shown it to migrate to Africa from the Palaearctic.

SPOTTED CRAKE *Porzana porzana* I have several observations at close hand, but failed to net it despite making every effort. A Palaearctic

arctic migrant arriving during the second half of September.

LITTLE AFRICAN MOORHEN *Gallinula angulata* One caught and photographed at Arada on 20 September 1977 - an interesting record of a species which usually inhabits the permanent pools and marshlands of the sudanian zone.

MOORHEN *Gallinula chloropus* I have recorded both the African *G. c. meridionalis* and Palaearctic *G. c. chloropus* subspecies, but have not yet been able to confirm racial identifications with specimens. The former is present during the heaviest wet seasons and even then only exceptionally. In 1977, an extremely wet year, it was numerous on large waters such as Arada and Abou Hadger.

The Palaearctic race regularly arrives during the second half of September. It would seem that juveniles arrive separately and somewhat earlier than the bulk of the adults.

PURPLE GALLINULE *Porphyrio porphyrio madagascariensis* A pair at Arada between the 29 August and 25 September 1977. On 20 September one of the pair was mist-netted, photographed and released.

Its occurrence as far north as this is remarkable. But the fact that birds like this and the two moorhens do show up during the wet season, only goes to show their mobility and readiness to exploit suitable habitats, however transient.

DEMOISELLE CRANE *Anthropoides virgo* An erratic passage migrant to the reserve. Its presence as suggested by my records seems unrelated with the amount of suitable stop-over places.

Malbrant (1937) was the first to elucidate the cranes' African overwintering grounds in Chad. In 1973, I had occasion to watch this crane frequently, including a flock of over 100 feeding at dusk on grassland bordering the Rahad Lidey; on the pool at Arada they could be seen almost daily, with palaearctic herons.

In 1974, 1976 and 1977, only a dozen or so cranes were recorded. My observations suggest that this bird passes very quickly over the sahelian zone before reaching its winter quarters around the larger permanent lakes in the Bahr Salamat drainage area. Whilst on passage, its diet is like that of the other storks and cranes, i.e. grasshoppers, locusts, etc., taken on and around inundated grassland.

CROWNED CRANE *Balaearica pavonina pavonina* Widespread but uncommon. Arriving in July, it breeds as far north as the wadi Achim. Nests are usually built in tall Acacias and similar trees within the dense wadi habitat. Towards the end of the wet season this species may gather on and concentrate around the larger waters before moving southwards.

SUDAN BUSTARD *Otis arabs stieberi* This is the commonest and most widespread of the bustards within the reserve. During the wet season, it can be found deep into desert country. In the hotter months there is a general southwards shift in its distribution, its northern limit retracting south to around the 16th parallel. It will, however, exploit suitable habitat further north when available. It is during the hot season that the bustard associates most closely with wadis. Many hundreds can be seen along the wadis Kharma and Achim in May and June.

Eggs are laid during the wet season; young can be seen from September onwards and most are flying by December or early January.

The bustard's diet consists mainly of insect matter, grass-hoppers, crickets and locusts forming the bulk. Numerous beetles and Hemiptera are also eaten. Plant matter includes various seeds and the fruits of trees such as *Cordia sinensis*, *Grewia villosa* and *Salvadora persica*. Gum arabic from *Acacia* trees is also eaten in quantity and in some gum-growing regions bustards are considered pests.

All bustards, and especially the Sudan Bustard, have a predilection for coloured beads of all sizes. Over half of all bustard stomach contents examined contained beads; yellow and white seem to be the favourite colours and one individual (a female needless to say!) had 41 beads in her gizzard.

Chad, unlike other sahelian and north African countries, still maintains healthy bustard populations. Hunting does take place and nest robbing is frequent. One of the most astounding methods of catching adult bustards is to literally bury a child right next to a nest with eggs in it. One of the child's hands is free and lays under the eggs, in the sand. When the adult arrives and sits, the child tries to grab its feet and hangs on until help arrives.

DENHAM'S BUSTARD *Neotis denhami denhami* It arrives during July and August from the south-sahelian and sudanian zones. In the reserve, Denham's Bustard prefers rolling, grassy, *Acacia*-studded dune-land and is especially common east of the longitude 19°E. Its northern limit is around 16°N and it is most abundant between 14 and 15°N. Breeding takes place within the reserve and two eggs are laid in a shallow scrape partially shaded by an overhanging bough or a tussock of grass. Migration southwards begins in late September and October, the young departing later.

NUBIAN BUSTARD *Neotis nuba agaze* Widespread over all the more arid areas of the reserve between 15° and 17°N; not at all common, but probably as common as it should be. The most sedentary of the reserve's bustards.

Its food consists mainly of large insects, but ants, when available, are eaten in quantity. As with the other bustards, grass seeds and gum are consumed. I have not as yet found this species breeding

but suppose that its breeding season and habits are similar to those of the other bustards.

SENEGAL BUSTARD *Eupodotis s. senegalensis* Very common over a wide variety of habitats, and during the wet season it penetrates deep into desert country. One of the earliest breeders during the wet season. I have found eggs being incubated in late June.

BLACK-BELLIED BUSTARD *Eupodotis melanogaster* Rare, principally found in the south-west quarter of the reserve. Even during the wet season this species rarely moves north of 15°N.

CRESTED BUSTARD *Eupodotis ruficrista savilei* The Crested Bustard is more or less confined to the south-west quarter of the reserve, where in places it seems to be gregarious. It breeds during the wet season and a pair of young caught in late September were already able to fly short distances.

SPOTTED THICK-KNEE *Burhinus capensis maculosus* Of the three species of thick-knee recorded by Vielliard (1972) in Chad, I have found only *B. capensis* in the reserve. It is a very common inhabitant of wadis. Largely nocturnal, it can be seen by day under the shade of a bush or running from tree to tree.

The thick-knee is a hot season breeder. The nest is usually a simple scrape secreted in the shade of a low bush or shrub. Two eggs are laid and the young often hatch as the first rains bring a flush of green to the steppe and dunes. The breeding season seems to be fairly extended. A nest found on 7 August held eggs still being incubated; perhaps it was a second brood. The thick-knee would seem to be fairly sedentary, breeding right up to its northern limits, nearly 16°N.

SPUR-WINGED PLOVER *Vanellus spinosus* A regular wet-season visitor to the temporary pools and marshes south of 15°N. Morel (1972) reported that this species breeds in Senegal from January to August. I am fairly certain that it does not breed during its stay within the reserve.

BLACK-HEADED PLOVER *Vanellus t. tectus* Common in the inundation plain of both wadis and temporary pools. In the west of the reserve it occurs in lightly wooded habitat surrounding the inter-dunal depressions. The 16th parallel is its northern limit. Breeding takes place in the hot season; the nest is a scrape or spoor-mark and the clutch is three or four eggs.

SENEGAL WATTLED PLOVER *Vanellus s. senegallus* This bird is a regular but rare wet-season visitor to the southernmost wet-lands. I saw one at Arada in 1977, certainly at its northern limit in central Chad.

GREY PLOVER *Pluvialis squatorola* Seven on 21 September 1974 and 30+ on 1 October 1977, at Arada.

RINGED PLOVER *Charadrius hiaticula* A regular but not particularly common visitor. Peak numbers on large waters such as Arada or Lidey are 20-30.

LITTLE RINGED PLOVER *Charadrius dubius curonicus* To be seen commonly on all waters during September, preferring sandy beaches. Flocks of over 60 are not uncommon. Earliest : 17 August 1973, at Lidey.

KENTISH PLOVER *Charadrius a. alexandrinus* A rare but regular passage migrant. I have recorded it nine times in six years.

CURLEW *Numenius arquata* In small numbers every year, especially during late September and early October, always in ones or twos at the larger and muddier waters.

BAR-TAILED GODWIT *Limosa l. lapponica* Three : Lidey, 7 September 1973, Arada, 15 August 1975 and 21 September 1977.

BLACK-TAILED GODWIT *Limosa l. limosa* A regular and common visitor particularly to the western half. Earliest : 9 August 1977, at Arada, with considerable passage in mid and late September.

GREENSHANK *Tringa nebularia* One of the commonest of the reserve's Palaearctic waders. First arrivals are in mid August and passage is especially heavy in mid September. Earliest : Lidey, 6 August 1973. Heavy passage over Arada on the nights of 29-31 March 1976.

MARSH SANDPIPER *Tringa stagnatalis* Regular but uncommon, usually in groups of 4-5. Earliest : Arada, 10 August 1977.

WOOD SANDPIPER *Tringa glareola* Easily the commonest *Tringa*. Arriving in August and September, peak numbers exceed 1000 at Arada and Lidey. Earliest : 6 August 1977 at Arada, 9 August 1973 at Lidey.

GREEN SANDPIPER *Tringa ochropus* Common on all the larger pools, many small marshes and temporary, inundated grasslands. It likes shady places.

COMMON SANDPIPER *Tringa hypoleucos* The very early arrival dates of this species (late May, early June) make one wonder if they are not birds that have summered in Africa. But it is also an early arriver from the Palaearctic. Biggest numbers are seen during late August and early September, unlike other waders which peak towards mid to late September.

REDSHANK *Tringa totanus* One at Arada, 7 August 1977.

SPOTTED REDSHANK *Tringa erythropus* A regular but not common migrant from the Palearctic. Every year some 15-20 birds occur at Arada between late August and late September.

TEREK SANDPIPER *Tringa terek* Regular but rare. I have eight records : Morfazy 1 September 1972, Arada 25 August 1973, Arada 17 September 1973 (2), Lidey 29 September 1974, Arada 17 August 1975 (2), Lidey 12 September 1975, Arada 16 September 1977, Arada 20 September 1977 (2).

TURNSTONE *Arenaria interpres interpres* Three : Arada 26 August, Lidey 29 August and Arada 27 September, all 1973.

COMMON SNIPE *Gallinago g. gallinago* The Common Snipe arrives in September and October (earliest, 2 September) and is then fairly common throughout, but seems not to overwinter.

CURLEW SANDPIPER *Calidris ferruginea* A regular but rare passage migrant. Four records : Haraz 19 September 1973, Lidey 14 September 1974, Arada 29 August 1976 and 2 September 1977. Several species considered rare by myself and by Salvan (1967-69) but more common by Vielliard (1971-72) may migrate through western Chad in greater abundance than elsewhere.

LITTLE STINT *Calidris minuta* One of the commonest waders to the reserve. Little Stints can be seen in large and small flocks on all manner of waters, mud-flats, wadis and creeks. I have recorded it as early as 6 August but most arrive between 20 August and 20 September.

TEMMINCK'S STINT *Calidris temminckii* Not at all common in the east of the reserve but more numerous in the west.

SANDERLING *Calidris alba* A regular visitor in small numbers. All my records fall between 25 September and 15 October.

BROAD-BILLED SANDPIPER *Limicola f. falcinellus* I was able to watch this tame and distinctive wader, still in its breeding plumage, at Arada on 16-17 September 1977, my only observation of it.

RUFF *Philomachus pugnax* A common visitor to larger expanses of water, favouring submerged pasture for foraging. First arrivals are about 20 August and flocks of up to 400 occur by the second week of September. Their early arrival suggests that some may have summered in Africa; only a few of the earliest birds shows vestiges of breeding plumage.

BLACK-WINGED STILT *Himantopus h. himantopus* If there is enough standing water stilts can be seen as early as the end of June, but it is in August and September that they are commonest. They remain until the last of the larger waters dry up, leaving by early October. The usual northern limit is about 16°N, but migrants occur on pools deep into desert country.

AVOCET *Recurvirostra a. avosetta* A regular and fairly common wet-season visitor, arriving later than many other Palaearctic species (earliest, 15 August) and staying until the pools dry up. Most arrive after 20 September. On passage through the desert it exploits the tiniest of temporary pools.

PAINTED SNIPE *Rostratula b. benghalensis* Its penetration of the reserve depends wholly on the abundance and distribution of the rainfall and it is, at best, a regular visitor only to the southernmost wadis. In exceptionally wet years (like 1977) it occurs as far north as the wadi Fama (15°30'N) and is common on many temporary lakes and swamps. The largest concentrations are at the end of the wet-season, before they fly south. In late September 1977, 15-20 could be seen at Arada. I suspect that the Painted Snipe breeds within the reserve.

EGYPTIAN PLOVER *Pluvianus aegyptius* One record, in the exceptionally wet season of 1977. One arrived at Arada on 8 August, and was joined by three more a week later, staying until 27 September.

CREAM-COLOURED COURSER *Cursorius c. cursor* A common and widespread winter visitor to the northern half of the reserve. First arrivals are in October, and it leaves in late February and early March. Salvan suggested that it might breed in northern Chad; that is possible, but not probable south of 17°30'N.

PRATINCOLE *Glareola pratincola* The presence of pratincoles at Arada and Lidey early on in the wet-season points to the presence of an African race as well as the Palaearctic one (*G. p. pratincola*) which can be seen later on.

BLACK-WINGED PRATINCOLE *Glareola nordmanni* A regular passage migrant but much less common than the Pratincole. Sightings are usually of groups of 3-8 birds. Earliest: Wadi Babanoosa 24 August 1975.

GUN-BILLED TERN *Sterna n. nilotica* A regular visitor in small numbers. Earliest, 9 August; most birds arrive after 1 September. Peak numbers at Arada and Lidey are 25-30.

WHISKERED TERN *Sterna h. hybrida* Arrives around mid August. It perches more than its congeners, which prefer resting on the ground. Numbers on the larger waters may reach 150-200 during early September.

WHITE-WINGED BLACK TERN *Sterna leucoptera* By far the commonest of the terns; a passage migrant arriving in mid August and September, with numbers exceeding 500 at Arada and Lidey. Earliest : 29 July 1977 at Arada.

BLACK TERN *Sterna nigra nigra* Rare throughout Chad. I have nine records from the reserve.

CHESTNUT-BELLIED SANDGROUSE *Pterocles e. exustus* The commonest and most widespread sandgrouse. In the wet-season it occurs in the southernmost part of the reserve, especially in the early rainy season when there have been heavy rains south of the 15th parallel. Enormous bands of sandgrouse then come to drink in the early morning, often staying around until midday. As the wet-season progresses, they move northward until September when a second incursion is made to the south. After a heavy wet-season, they can be seen in small bands until December or January, but they have moved northward again by the hottest months. They do not breed in the reserve. Food consists mainly of small to medium-sized seeds but I have also seen them feeding on long trails of black ants.

LICHTENSTEIN'S SANDGROUSE *Pterocles l. lichtensteinii* The southern limit is about the line formed by the wadis Achmin and Oum Chalouba. This species prefers to drink in the small, shallow rain-filled interdunal pools common over the greater parts of the northern sub-desert steppe. At the beginning of the wet-season they will, however, drink on the larger wadis and especially at the pools of Haraz and Morfazy.

CORONATED SANDGROUSE *Pterocles c. coronatus* Somewhat rarer than the previous species, at least over the southern part of its range, but in other respects my remarks apply equally to both. None of the sandgrouse species is entirely sedentary here, and in the hottest months they move into the Tibesti and Erdi regions of northern Chad.

FOUR-BANDED SANDGROUSE *Pterocles quadricinctus* A wet-season visitor from the south, widespread but nowhere common, and usually met with in groups of 4-6. It is at its most conspicuous during the late afternoon, when it leaves cover to sun itself and feed exposed on soft sand. Its northern limit corresponds with the wadis Lidey and Achim. It appears not to breed within the reserve.