

Order FALCONIFORMES

Small to very large diurnal birds of prey. The terms 'diurnal birds of prey' and 'raptor' are used broadly to cover the convergent group of predatory and sometimes scavenging birds, much as 'seabirds' is used for the convergent assemblage of many sorts of marine birds, but not all are diurnal. About 280 species in 70 genera. Three families: Accipitridae, Sagittariidae and Falconidae. Monotypic Sagittariidae (Secretarybird *Sagittarius serpentarius*) extralimital in sub-Saharan Africa (Ethiopian region); other two cosmopolitan, except Antarctica, and represented in HANZAB region by 25 breeding species and one confirmed accidental (24 breeding and one accidental in Aust.; two breeding species and one non-breeding visitor in NZ). Traditionally (e.g. Amadon & Bull 1988; Peters) all diurnal birds of prey have been placed in a single order of four families (three above plus American Vultures Cathartidae). However, general uncertainty about the relationships of the higher taxa and recent studies of DNA-hybridization (Sibley *et al.* 1988; Sibley & Ahlquist 1990; Sibley & Monroe 1990) have led to the removal of the Cathartidae either into a separate order (Cathartiformes) or into a sub-family of the storks Ciconiidae, to which they are most closely related. Other arrangements of the higher taxa have been to put the Accipitridae into one order, with or without the genus *Pandion*, and the Falconidae into another or to put *Pandion* into its own monotypic family (BWP). Here we treat the Accipitridae, including *Pandion*, and the Falconidae as the two families of one Order. The Order may be of Gondwanan origin (Kemp & Crowe 1990).

As a whole, diurnal birds of prey have rather drab plumage in shades of brown, rufous, grey, white and black; patterns on underwings are sometimes important for identifying birds in flight. Field identification often depends more on general characters or jizz (structure, proportions, attitudes of wings in flight, and actions in flight) than on characteristics of plumage. These general characters are hard to describe succinctly and space does not allow us to discuss them exhaustively. Experience in the field with careful instruction from knowledgeable observers is really the only way to acquire skill in identification. However, Porter *et al.* (1986), though dealing specifically with European raptors, give useful information on fundamental differences between the various groups into which Accipitridae and Falconidae are divided.

Silhouettes and attitudes in flight being so important for identification, we have modified the section on Field Identification by adding a section on flight, in which these matters are described. It is as well to define standard terms for the sorts of flight that these birds use. Emarginations of inner and outer webs of primaries, leaves gaps between the feathers and gives a slotted or fingered appearance to wings; obvious and prominent in many Accipitridae, less so in Falconidae. **Gliding**: coasting forward on stiff wings without or between wing-beats; wings flexed according to angle of descent. **Soaring**: maintenance of height above ground or rising and circling up on stiff, fully spread wings and tail. **Hovering**: active flapping into wind to maintain position in relation to the ground. **Poising** (wind-hanging or kiting): facing into wind to maintain position but without flapping. **Stooping**: steep or shallow dive with wings folded close to the body; sometimes at great speed. The term **dihedral** (having two plane faces) describes the V-shaped attitude of the wings when raised above the plane of the body; qualified by **strong**, **medium** and **slight** to denote the degree to which the wings are raised to form a smaller or larger angle between their planes ($>15^\circ$, $5-15^\circ$, $0-5^\circ$ respectively); **modified dihedral** is when the innerwings are raised above the plane of the body but outerwing flat for the most part.

Members of the Order readily recognized by hooked, sharply pointed beaks with waxy membrane or cere at base through which nostrils open, strong powerful feet and sharp curved claws, otherwise found only in owls (Strigiformes), which resemble this order only by convergence. Palate imperfectly desmognathous with palatine processes of maxillae separated for much of their length and so grading into schizognathous type as found in some forms. Basipterygoid processes, absent in all except *Sagittarius*. Generally 14 cervical vertebrae but 15 in Falconidae and *Pandion*, 17 in some vultures (*Gyps*). Often no paired foramina or notches on sternum or else only one of pair. Holorhinal, nares impervious. Two carotids. Caeca, reduced except in *Pandion*. Crop, nearly always well developed; gizzard, poorly developed; fur, feathers, scales, insect chitin and many bones remain in crop and are later regurgitated as a compact pellet. Highly acid stomach for digesting all but chitinous or keratinous parts of prey. Syrinx, tracheo-bronchial. Ambians muscle present. Muscle formula, typically A (BXY in *Sagittarius*). No biceps slip; expensor secundariorum only in *Falco* and a few others. Ten functional primaries, eleventh vestigial or lacking; 11-25 secondaries; diastataxic. Tail with 12-14 rectrices. Feathers with aftershaft, except *Pandion*. Underdown present in varying amount; patches of powder-down in *Elanus*, *Circus*, *Gypaetus* and some others. Oil-gland, well developed, feathered except in *Microhierax*. Eyes, large with high density of cones in retina, giving high resolution; wide field of binocular vision. Hearing, acute. Sense of smell, poor; do not detect prey or carrion by smell, even in Old World vultures (cf. New World vultures [Cathartidae]).

Male nearly always smaller than, or same size as, female; thus different from most other birds; dimorphism greatest in bird-catching *Accipiter* and *Falco*. This reversed sexual dimorphism in size discussed by Reynolds (1972), Amadon (1975), Mendelsohn (1986a,b), Olsen & Olsen (1987), Pleasants & Pleasants (1988, 1989), Montgomerie & Lundberg (1989), J. Olsen (1989, 1990), P. Olsen (1991), Ydenberg & Forbes (1991) and Brown & Amadon¹ and others. Habits normally diurnal but sometimes crepuscular; a few nocturnal (e.g. Letter-winged Kite *Elanus scriptus*). Comfort behaviour includes bathing in water and dust; most adopt a characteristic posture for drying and sunning.

Raptors occur in all land faunas and a variety of climatic zones and habitats. Communities of raptors richest in Tropics and Subtropics and poorest in high latitudes. Patterns of movements vary: resident, migratory or dispersive; juveniles dispersive. In A'asia, small and medium-sized species breeding at high latitudes or altitudes or feeding on seasonally fluctuating prey tend to undertake seasonal movements, which are often towards coast, north (some to New Guinea) or to lower latitudes (Baker-Gabb & Fitzherbert 1989).

In A'asia, local threats to populations include illegal shooting, trapping and poisoning for supposed or real damage to livestock or poultry, or simply because they kill other birds. Egg-collecting, while illegal, is also a threat to some species. Some species have been or are used in falconry, an illegal activity in Aust. Secondary poisoning from pesticides is still a problem. Deforestation and other habitat degradation are the major threats. In consequence, some species are probably declining. Three endemic species are threatened: Square-tailed Kite *Lophoictinia isura*, Red Goshawk *Erythrotriorchis radiatus* and Grey Falcon *Falco hypoleucos* (Brouwer & Garnett 1990).

Further information on behaviour and biology of raptors in Newton (1979), Newton *et al.* (1990) and BWP.

(1) Because this reference and two others are so often used throughout the species accounts for the birds of prey, they are given in the texts without date and not listed in the references; they are Brown & Amadon (1968), Cupper & Cupper (1981) and Hollands (1984). For full details of these references, see the Introduction under Simplified References.

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Family ACCIPITRIDAE vultures, hawks, eagles and Osprey

Superficially diverse assemblage of small hawks to very large eagles and vultures; 200–225 species in more than 60 genera. Eighteen species, including five endemics, breed in Aust. and one is accidental; one species breeds NZ. Remarkably uniform as regards morphology. There is little agreement on subdivisions; up to 15 tribes or sub-families have been proposed by different authors (e.g. Wolters 1976; Amadon & Bull 1988; Kemp & Crowe 1990; Sibley & Monroe 1990; Holdaway 1991), some perhaps consisting of convergently similar species. Here we do not use formal subdivisions and arrange the species essentially in the same order as Peters and Amadon & Bull (1988). However, because the taxonomic affinities of three rather enigmatic endemic Aust. monotypic genera (*Erythrotriorchis*, *Hamirostra* and *Lophoictinia*) are uncertain they are extracted and placed at the end, followed by the somewhat aberrant and specialized *Pandion*, which others have regarded as forming a monotypic family. The following are useful groupings (sometimes considered sub-families):

(1) Honey-buzzards (*Pernis*) and cuckoo-hawks: 14 species in 5–7 genera; one species of *Aviceda* breeds in Aust. Small to medium-sized, without bony brow-ridges; with small weak feet; some crested; densely feathered lores or specialized bills. Plumage often boldly patterned or barred.

(2) Small (white-tailed) kites *Elanus* and others: six species in 3–4 genera; two endemic species of *Elanus* breed in Aust., one of which, Letter-winged Kite *E. scriptus*, fully nocturnal, uniquely so among raptors. Predominantly grey-and-white plumage; characterized by hovering with wings raised in strong dihedral; wings, long and pointed. *Elanus* are specialist predators of rodents. Inside of eggshell, buff, like *Pandion* and Falconidae (cf. green in other Accipitridae).

(3) Large kites (*Milvus*, *Haliastur*) and sea-eagles (*Haliaeetus*): 23 species in ten genera; four species in three genera breed in Aust.: one species of *Milvus*; two species of *Haliastur*, one of which endemic; and one species of *Haliaeetus*. Characterized by easy lazy soaring flight with tilting and twisting of tail, small feet; often of scavenging and piratical habits. The sea-eagles are larger than kites; soar on straighter wings, raised in moderate or strong dihedral, sometimes flat; and generally more predatory and aquatic than kites; tails, graduated or wedge-shaped.

(4) Harriers *Circus* and allies: 17 species in three genera; two species of *Circus* breed in Aust., one of which also breeds NZ. Spotted Harriers *C. assimilis* nest in trees, uniquely so for harriers. Characterized by owl-like facial ruff, large asymmetrical ears, slim body, long narrow wings, long tail and long legs. Fly buoyantly on raised wings, low over land or water; hunt by low-quartering in open country with wing often in strong dihedral. Only group in which polygyny common (Baker-Gabb 1982). For further discussion of this group, see Nieboer (1973), Baker-Gabb (1982, 1984).

(5) Goshawks and sparrowhawks: 53 species in five genera (see [7], Aust. endemic hawks, below); mostly in *Accipiter* (c. 40 species), which is the largest genus in the Family (see Wattel 1973). Three species of *Accipiter* breed in Aust.; another 19–20 species in New Guinea, Oceania and Wallacea. Typically in wooded lands; hunt from perches or by flying stealthily and dextrously through trees when hunting. Fierce expression caused by heavy brow-ridges; broad wings, rounded at tips; tail, long; legs and toes, long. For further discussion see Wattel (1973), Newton (1986).

(6) Buzzards (*Buteo*), hawks, eagles and allies: 91 species in 21 genera; two species in two genera (*Aquila*, *Hieraaetus*) breed in Aust. (both occurring New Guinea); another, Gurney's Eagle *Aquila gurneyi*, an accidental visitor from New Guinea. The most diverse group of the Family; predatory, soaring raptors with broad wings, bluntly rounded at end. Booted eagles and some other species have feathered tarsi.

(7) Aust. endemic hawks: three species in three monotypic genera in Aust.; perhaps related to other species that are extralimital in the A'sian zoogeographical region (*Henicopermis*, *Megatriorchis*); see Debus & Czechura (1989), Olsen & Olsen (1989), Debus (1991a), Schodde (in press). In general, affinities are quite uncertain (Kemp & Crowe 1990; Holdaway 1991); the resemblance of appearance and habits to typical kites, buzzards or goshawks may be a matter of convergence. Aust. species characterized by much rufous in plumage, especially in juvenile, and strongly patterned underwings.

(8) Osprey: monotypic, cosmopolitan; breeds Aust., not NZ. In several respects differs from rest of Family and stands out in appearance by the contrast of generally brownish upperparts and white head and underparts, distinctive silhouette, flight on long bowed wings, strictly aquatic and maritime habitat and diet predominantly of fish; dives into water to catch prey. Highly specialized and many characters adaptations to habitat and diet: dense plumage to avoid wetting, large feathered oil-gland, no aftershafts on feathers of head and underparts, closeable nostrils, long caecal sacs on intestine (as in other fish-eating birds), powerful feet with rough spicules on soles, long curved claws, reversible outer toe, bony ridges over tendons behind tarsus. Inside of eggshell, ochre, as in *Elanus* kites.

Two other groups, not represented in Aust. or NZ:

(9) Old-World vultures: 14 species in about eight genera. Perhaps the most distinct group in the Family.

(10) Snake-eagles (*Circaetus*) and allies: 14 species in five genera.

Some of the more salient characters shown by most members of the Family are as follows. Size of body varies from small and slender in small hawks to bulky and robust in eagles. Males are generally smaller than females, especially in *Accipiter*, but the reasons for such dimorphism, reversed from what is typical of birds in general, are a matter of debate (see Introduction to Order). Wings, broad, and shape correlated with mode of life and manner of hunting: short and rounded in *Accipiter* for dashing through woodland after prey; long broad and rounded in many other species that do much soaring; hardly ever pointed as in falcons. Similarly, tail varies: from long and square in some bird-catching hawks, kites and harriers, to enhance dexterity in pursuit of prey; to shorter, forked or wedge-shaped in others. Bills always with upper mandible curved down over shorter lower mandible: from slender in honey-buzzards to strong in goshawks and high and powerful in large eagles; not used to kill prey, which is always done by feet and claws, nor in defence and aggression. Long muscular tongue. Nostrils, opening in the cere, may be round, oval, elongated, or slit-like. Lores covered with hair-like feathers except in *Pernis*, which has small stiff scale-like feathers extending to base of bill as protection against attacks of insects. Often well-developed bony ridge over eye. Length and thickness of tarsi, and size and shape of feet and claws, also correlated with type of diet and predatory habits; tarsi and toes tend to be long with sharp claws in bird-hunters; legs long but toes shorter, with curved claws, in reptile-eaters; stout with heavy claws in species that take heavy prey on the ground: usually used for grasping and killing prey and in defence and aggression. Stance, upright or nearly horizontal; some species walk rapidly on flat ground and may even run and chase prey on ground. Right ovary and oviduct well developed, unlike most other birds. Squirt out droppings (cf. Falconidae) (Kemp & Crowe 1990; Newton *et al.* 1990).

Plumages vary greatly; no common features throughout Family but may be similarities within different groups, e.g. harriers, white-tailed kites and many accipiters. Brightest colours are rufous and chestnut; never reds, blues, greens, or yellows. Bare parts and iris often brightly coloured. Some groups tend to have white patches on rump; patterns on underwings, important for identifying soaring birds, often striking, even in otherwise uniformly plumaged species. Most predatory species have white triangular spot on upper nape, concealed unless feathers raised or disarrayed (Hafner & Hafner 1977); significance of this doubtful though it may serve as an appeasement signal. Some with elongation of feathers on head and neck, to form ruff-like or full plume-like crest, often differing in colour from rest of upperparts, often only ornamentation. Little difference in plumage between sexes, though females of some species more strongly patterned than males; considerable individual variation; pale and dark morphs occur, especially among eagles. Bare parts may be brightly coloured (e.g. red) and iris often strikingly yellow, orange, or red (cf. mostly brown in Falconidae). Single annual moult, often starting earlier in females than in males; complete in smaller species; primaries shed outwards, secondaries inwards

starting at two centres (s1 and s5); in larger species, full cycle often not completed within a year and birds in continuous moult, though may be halted during migration or breeding. Young, downy, semi-altricial and nidicolous; first down thick, silky and filamentous, rising from same papillae as later juvenile feathers; soon outgrown by long fluffy, usually white or grey second down, also originating from same papillae and covering whole body. Juveniles of smaller species often reach adult plumage by beginning of second year; those of larger species in third or later years after one or more immature plumages, gradually approaching adult plumage.

Almost world-wide distribution, except Antarctica; only one species in NZ. Found in all sorts of habitat from mountains and open moorlands to lowland forests, from deserts and arid lands to wetlands, both fresh and saline; occur along coasts but never going far to sea into truly marine conditions, where role of predators taken by groups in other Orders (Procellariiformes, Pelecaniformes, Charadriiformes); some species even found in urban environments. Many or most species in n. hemisphere migratory, at least in part; often concentrating in spectacular numbers at narrow sea-crossings or along narrow flyways; most migrating species make much use of soaring in thermals to gain height and gliding from one to another without use of flapping flight, but species of *Circus* feed *en route* and so sustain themselves fly low with flapping. In Aust., movements are poorly known; migration occurs in few species (e.g. *Milvus migrans*, *Circus approximans*, *Lophoictinia isura*); spectacular visible migration on a narrow front has not been noted. Letter-winged Kite *Elanus scriptus* is a species that erupts dramatically at the time of plagues of rodents, but many other species are attracted in large numbers to swarms of locusts, plagues of mice or to fire-fronts. Scavenging kites and vultures are useful in cleaning up man-made mess, perhaps more so in the past than now, and many species play some part in countering plagues of rodents and insects.

Most accipitrids are wholly predatory; some are wholly carrion-eaters; others both. Almost any prey taken: mammals, birds, reptiles, amphibia, fish and various invertebrates such as snails, grasshoppers, locusts and termites. Some species are highly specialized in diet, e.g. snail-eating kites, honey-buzzards. A very few even have a largely vegetable diet (Palm-nut Vulture *Gypohierax angolensis* in Africa). For the most part, hunting and catching methods are by pursuit in flight or by pouncing from a perch; white-tailed kites hover in very characteristic style and harriers quarter low above vegetation or water, both then dropping on prey on the ground. Hunting and feeding is typically diurnal but some (e.g. Bat-Hawk *Machaerhamphus* and *Elanus scriptus*) are crepuscular or nocturnal. Birds are plucked and eaten piecemeal, except very small ones, which may be swallowed whole; mammals are skinned and also torn in pieces but small rodents may be swallowed whole; indigestible matter (fur, feathers, chitin, etc.) regurgitated as pellets.

Displays commonly consist of stereotyped aerial manoeuvres such as undulating dives, slow flapping flight and lowering of legs, and ritualized attack and defence (cf. Falconidae) (Barnard & Simmons 1986; BWP). Outside breeding season, usually solitary except for scavenging species. Probably usually occupy rather large home-range and may maintain exclusive feeding territory within it. On migration in n. hemisphere often notably gregarious or loosely so. Most roost solitarily or in loose pairs in trees or on cliffs and similar high places; some, particularly harriers, roost on the ground, communally. See Newton (1976) for review of dispersion in diurnal birds of prey generally. Also typically solitary breeders, sometimes at traditional sites or in two or three traditional places in a territory, normally making a new nest each year. *Elanus scriptus* is exceptional because it is more or less gregarious throughout the year and breeds colonially or loosely so. Pairs are usually conspicuous at start of breeding season, defending vicinity of nest against conspecifics, other raptors and corvids; defence often done by female, which unlike males seem to stay near nests for entire breeding cycle. Pair-bond, typically monogamous, usually only for the season but in some species may be prolonged and even life-long. Polygyny occurs in some harriers. Activity over nesting territory often conspicuous: soaring or High-circling, singly or in pairs sometimes calling, which may develop into Flight-play in which birds grip each other's feet and spin downwards (Talon-presentation or -grappling and Cartwheeling); also Sky-dances when one of pair plunges and swoops in shallow or deep undulations, often calling and with wings partly closed and still (pothook type) or swinging to and fro (pendulum type) (Brown 1976; Brown & Amadon); Slow-flapping also part of aerial activity. Food-passing by males to females characteristic in many species; mostly during incubation and period of daytime brooding when male brings all food to female; also occurs as part of courtship well before laying. Copulation near or on nest or elsewhere in nesting territory, in some never or rarely on nest; may start well before laying and so probably also part of courtship. Some species bring sprays of green leaves to nest throughout or for part of nesting cycle; function not fully explained but probably for lining of nest, which may have some antiseptic properties, or for camouflage, or may have some social significance. Calls rather unspecialized; mostly loud harsh grating chattering, yelping, yapping, screaming, whistling, whining, or mewing; often resonant and tremulous. Often loaf during day for long periods on favoured perches in characteristic attitudes, e.g. with head drawn into shoulders or jutting forwards; some vultures squat on tarsi on ground or even lie down fully. Spend much time preening; allopreening reported in *Haliaeetus*, *Aquila*, *Lophoictinia*, *Hamirostra* and others. Commonly bathe and drink but some species seem not to drink, even in captivity. Dust- or sand-bathing also reported but incidence in Family as a whole not studied. Shield young in nest from sun or rain by standing and spreading wings; individually may also spread wings partly or fully on favoured perches probably for drying or sunning. Pant, gasp and gular-flutter to dissipate heat. Scratch head direct. Comfort movements (head-scratching, body-shaking) sometimes performed in flight. Some vultures, fish-eagles and *Hamirostra* use stones as tools to break open bones or eggs (Boswall 1977; Aumann 1990; Debus 1991b; Pepper-Edwards & Notley 1991).

Breeding season protracted, especially in large species and in warm latitudes. Nests placed in many situations in trees, on cliffs and even buildings, but on ground in thick cover in most harriers; usually rather or entirely inaccessible. Build own nest of sticks and branches; sometimes all sorts of rubbish in nests of typical kites, vultures and Osprey. Lining of fresh grass or green leaves in some; commonly decorated with sprays of green leaves. Nests of large species often huge by traditional use of same site. Building by both sexes, or entirely by female in *Circus*; material carried in bill or feet. Eggs usually broadly oval, mat, dull white or very faintly bluish and streaked and mottled with brown and red. Clutch-size, small to medium: invariably one in some large species (vultures, snake-eagles); 1–2 in some eagles; 1–3 in typical kites, some fish-eagles, eagles and typical buzzards; 2–6 in white-tailed kites, harriers, accipiters and some typical buzzards. Laying interval: 2 days in small species to 5 days in large. Generally single-brooded because full nesting cycle too long to allow more than one in time suitable for nesting; second broods occur only occasionally in species with a cycle of less than 6 months; yet *Elanus scriptus* apparently breeds almost continuously during plagues of rodents and may lay in second or later nests before young have fledged from first attempt. Clutches may be replaced if lost when fresh but period of replacement short (as early as c. 2 weeks in small species; 29 days in *Haliaeetus*). Nesting cycle of some large tropical eagles lasts longer than 12 months and, if successful, birds breed only every other year. Incubation period 4–8 weeks, depending on size of species, and to some extent on genus (e.g. 35–38 days in *Haliaeetus*, 42–44 days in *Haliaeetus vocifer*, 42–45 days in species of *Aquila* of similar or less weight than *Haliaeetus*, up to 47 days in *Circaetus*). Typically incubation starts with first egg and hatching asynchronous. Incubation mostly or entirely by female but male may cover eggs while she is away. Females have single median brood-patch; males often with none. Eggshells eaten by female or dropped out of nest or carried away. Female alone broods and actively feeds chicks, bill to bill. Usually male brings food for female and young but female may start to hunt again in latter part of nestling period. However, male known to brood young and even feed them in a few species, successfully rearing young when female died. Duties shared equally by sexes only in *Pernis*, snail kites and typical vultures and possibly others. Nestling period long, 4–31 weeks; the larger the species, the longer; difficult to determine accurately because young often clamber outside nest and stay away from it for several days before first flight. Smaller males tend to fledge sooner than larger females. In broods of two or more, youngest chick sometimes dies, being unable to compete for food with older and stronger siblings; may die through starvation, exposure or by being injured or thrown out of nest by siblings, which may eat them if they die in nest. In some eagles, second chick of two never survives even in favourable conditions but dies early in nestling period. In species with broods of two, fighting between siblings often fierce (Cain-and-Abel conflict), the larger persecuting the smaller, even when food plentiful. The adaptive significance of this behaviour much discussed and has led to theories on ecological significance of clutch- and brood-size, mortality in nest and evolutionary processes of its development (Brown *et al.* 1977; Gargett 1978; Simmons 1988; Brown & Amadon). Young of all species depend on parents for some time after fledging but, being difficult to observe and determine exactly, the length of the period is poorly known; certainly varies considerably depending on size and diet, from perhaps 2–3 weeks in small accipiters to a similar number of months in some large eagles and vultures. Age of first breeding 1–2 years in small accipiters and in harriers, 2–3 years in typical kites and buzzards, perhaps 4–9 in large eagles.

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Milvus migrans Black Kite

COLOUR PLATES FACING PAGES 104, 105 & 136

Falco migrans Boddaert, 1783, *Table des planches enluminées d'histoire naturelle de M. d'Aubenton*. Utrecht: 28; based on 'Le Milan noir' of Daubenton, 1765–81, *Planches enlum.*: Pl. 472 — France *apud* Hartert, 1914, *Vög. pal. Fauna* 2: 1166–75.

Milvus is Latin for 'kite'; specifically as a notorious and often obvious migrant.

OTHER ENGLISH NAMES Fork-tailed or Allied Kite, Kimberley Hawk, Kite-Hawk. In England formerly Black or Fork-tailed Gled, Glead or Glida; Pariah Kite (India); Yellow-billed Kite (Africa).

Black Kite has for long been the name internationally for this very widespread and common species.

POLYTYPIC Subspecies *affinis* Gould, 1838, Aust., Indonesia, PNG. Extralimitally, six subspecies: nominate *migrans*, Europe to Urals, Levant; *lineatus* (Gray, 1831), Asia (Urals to Japan); *formosanus* Kuroda, 1920, Taiwan and Hainan; *govinda* Sykes, 1832, Pakistan to Malay Pen.; *aegyptius* (Gmelin, 1788), Egypt and e. Africa; *parasitus* (Daudin, 1800), sub-Saharan Africa.

FIELD IDENTIFICATION Length 45–55; wingspan 120–140 cm; weight: male 570 g, female 600 g. Medium-sized dark-brown raptor, similar in size and shape to Square-tailed Kite *Lophoictinia isura* and similar in size to Whistling Kite *Haliastur sphenurus*. Wings, long, with outerwing roughly same width as innerwing, set well forward on slim body; long distinctly forked tail. When perched, wing-tips fall level with tip of tail. Gregarious, often in large flocks. Sexes alike. No seasonal variation. Juvenile separable.

Flight Persistently **soar** and **glide** on flat or slightly arched wings (innerwings held level or with carpals slightly raised above level of back, outerwings drooped, tips of primaries sometimes curled up) (Fig. 1a,b); when **soaring**, wings may be briefly held in slight dihedral when gaining height (Fig. 1a). Flight buoyant and manoeuvrable, with angle and attitude of wings and body constantly changing, and tail constantly twisted; head often pointed downward, combining with slightly arched wings to give hunched look; adept at side-slipping. When **soaring**, whole wing gently angled forward, with carpals pressed forward, outerwing directed slightly backwards and trailing-edge slightly to distinctly S-curved;



Fig. 1a Soaring and gliding



Fig. 1b Soaring and gliding

well-spread tail looks triangular, with nearly straight end and sharply pointed corners. When **gliding** fast, carpals well forward, level with bill, and primaries strongly swept back; folded tail looks

long and narrow, with straight or slightly concave sides, deeply forked at tip. In active flight, actions loose, with deep elastic wing-beats accompanied by some movement of body interspersed with glides; much more agile than Whistling Kite.

Description Adult Head and neck, grey to medium brown, densely streaked dark brown and shading to paler grey on forehead, cheeks, chin and throat; varying darker brown stripe from in front of eye to rear ear-coverts. Upperbody, dark brown. Tail, medium brown, finely barred darker. Inner wing-coverts, dark brown, with paler greyish to buff or reddish-brown diagonal band across central innerwing, contrasting with blackish remiges, primary coverts and greater secondary coverts. Underbody, medium to dark reddish-brown, finely streaked dark brown. Undertail, dull silvery-grey, with numerous fine dark bars; dark tips of outermost rectrices show as noticeable dark corners to tail. Under wing-coverts, medium to dark reddish-brown, as underbody, with slightly darker, blackish carpal patch (median primary coverts) and narrow border to lining (median secondary coverts); secondaries, dark brown, very slightly darker than coverts, with indistinct fine dark barring; usually distinct pale silvery-grey patch on inner primaries and bases of outer primaries, finely barred darker, contrasting with blackish wing-tip, darker secondaries and coverts. Bill, black; cere, yellow. Iris, dark brown. Legs and feet, yellow. **Juvenile** Plumage somewhat paler than adult, with pattern more distinct and contrasting. Head and neck, dark brown, densely streaked cream to buffish cream, making whole head appear pale, with dark eye-stripe more prominent. Upperbody and upper wing-coverts, dark brown tipped cream to buffish cream, appearing boldly spotted and making band across coverts appear much paler and more pronounced; pale tips of greater coverts show as thin pale line down centre of wing; thin pale trailing-edges to wing and tail. Foreneck, breast and upper belly, dark brown, densely streaked cream to buff, contrasting with paler head and merging into uniform buff-brown of lower belly, vent and under tail-coverts; under wing-coverts darker than underbody (cf. adult); cream to buff tips of greater coverts form diffuse pale line along rear edge of lining; typically, pale patch on inner and bases of outer primaries paler than on adult; thin pale trailing-edge stands out when backlit. Undertail, pale at base, distinctly darker over terminal third, with creamy tip, conspicuous when backlit. Bill, black. Cere, grey to greyish yellow. Iris, dark brown. Legs and feet, dull yellow or greyish yellow.

Similar species Ought not to be confused with other Aust. raptors by reason of distinctly forked tail, which is continually jerked, twisted, and opened and shut during characteristic buoyant manoeuvrable flight with constant subtle flexing of wings; generally dark plumage and lack of striking underwing-pattern. For distinctions from **Square-tailed Kite**, q.v. **Dark-morph Little Eagle** can be difficult to distinguish at distance but in general is stockier and more compact; bigger head; slightly shorter, broader, less deeply fingered wings, held straighter and with more parallel edges when soaring; slightly shorter unforked tail; spread tail, rounded (not straight) at tip; closed tail, square-cut, not forked, at tip. Very different flight: much steadier; in head-on silhouette, wings held stiff and level or with outerwing slightly lowered and tips of primaries curled up. Contrasting pale panel on inner primaries combines with pale diagonal band across inner wing-coverts to form pale broken M across upperwing; also show pale grey-brown scapular-patch on either side of dark back, and diffuse grey-brown U-shaped band at base of tail not shown by Black Kite; when backlit, inner few primaries translucent, forming pale wedge in outerwing, also not shown by Black Kite. When perched, appearance more robust; tarsi, fully feathered; short occipital crest; wing-tips fall well short of square-ended tail-tip (on Black,

nearly reach tip of forked tail). Flight call distinctive: loud rapid excited *tu-tu-tu...*

Gregarious kite, often in large flocks round towns, rubbish dumps, abattoirs, roads in n. and inland Aust.; solitary birds occasional in s. coastal areas. In many different habitats in open or lightly timbered country; may favour riverine areas; usually avoid forest. Roost communally in trees. Sunbathe on ground. Upright posture when perched; when on ground, body horizontal with tail held off ground; gait, a shuffling walk and pouncing run after insects. Typically scavenge; take fish from surface of water and insects in flight; gather to forage at fire-fronts. Voice a variety of high-pitched peevish squeals, mews and whinnies. Somewhat similar to Whistling Kite though Black Kite differs in that initial syllables of call do not descend strongly, and staccato does not ascend (S.J.S. Debus).

HABITAT In and over wooded lands, open country and urban areas of tropical and temperate Aust., mainly in n. and central districts; in all rainfall zones but not in waterless deserts. Altitudinal limits in Aust. unknown; up to 3300 m asl in western Palaearctic (BWP), but in Aust. many coastal and subcoastal highlands densely wooded and unsuitable. Congregate round settlements and human activity; at rubbish tips, abattoirs, cattle yards, piggeries, shearing sheds, roadsides, camps (Aust. Atlas), and sites where prey freshly disturbed or exposed (fire-fronts, ploughed ground) (Sontner 1981; Garnett & Bredl 1985). Cultivated and grazing land favoured, especially cane fields in Tropics (Hollands). Away from settlement in arid lands, mainly open woodland (e.g. eucalypt, pine *Callitris*, *Casuarina*), acacia scrub (e.g. Mulga *Acacia aneura*), and trees fringing watercourses and wetlands; hunt over nearby open plains or sandhills, in grassland, saltbush or bluebush country, or open shrubland (Cox & Pedler 1977; Allan 1978; Wyndham 1978; Badman 1979; Henle 1989); do not penetrate true desert away from surface water (Wilson 1974). In Tropics, less common away from towns, but occasionally numerous in grassland and dry open woodland, especially during fires (Garnett & Bredl 1985). Dense unbroken vegetation of all kinds avoided. Hunt over fresh open wetlands, particularly where water levels unstable and fish dying (Sontner 1981); take carrion from shores and live fish from surface of open water (Klapste 1983). During irruptions into s. districts, use habitats of similar structure to those inland; particularly open grassland, farmland with scattered trees, and low dry woodland (Copper & Copper).

Nest in trees, in open or remnant woodland near hunting grounds; in arid lands, usually beside watercourses. Soar effortlessly to great heights (maximum 1800 m); use thermals and updraughts from cliffs and banks for lift (Liddy 1959; Hobbs 1986); also patrol wetlands and open country at lower levels down to 10 m (Klapste 1983). Often on ground; observed sunbathing and dust-bathing on ploughed ground, and on short grass of sports fields and golf courses (Sontner 1987). Roost in trees.

Associated with human settlement and activity, in some regions to extent that it is rare in unmodified habitats. Clearing, agriculture, introduction of grazing stock, establishment of watering points in arid zone, and annual burning in tropics have been beneficial.

DISTRIBUTION AND POPULATION Widespread in Europe, Africa, Asia and Aust. Absent from New World. Breed Iberian Pen. and nw. Africa, through central Europe, Mediterranean basin and w. USSR; throughout Asia from Middle East and Urals, N to 60–65°N, to Sea of Okhotsk and Pacific Ocean; absent w. China and se. Asia (except Wallacea), s. two-thirds of Africa, S of Sahara from Mauritania E to Red Sea and S to C.

Province. African and s. and e. Asian populations augmented by n. migrants (Brown *et al.* 1982; BWP). In A'asia, mainly n., central and e. Aust. and New Guinea. Not recorded NZ.

Aust. Mostly E of line from about Broome to Port Augusta; less common, Pilbara and sw. WA. Vagrant to coastal NSW, Vic. and se. SA. **Qld** Abundant to common throughout, from Gulf of Carpentaria and C. York Pen. to ne. and central coast and all inland regions (Aust. Atlas; Qld Bird Reps); rare SE (Roberts 1979; Hughes & Hughes 1984); vagrant Thursday I. (Draffan *et al.* 1983). **NSW** Moderately common W of Great Dividing Ra., especially in N; small resident population in SW (Hobbs 1961; Sonter 1981); vagrant to coast (Aust. Atlas; NSW Bird Reps; Whiter 1989). **Vic.** Rare to very uncommon throughout (Wheeler 1967; Vic. Atlas), except NW (Baker-Gabb 1984; Campbell 1986; Vic. Atlas). **Tas.** Vagrant, all singles: Launceston, 9 Feb. 1965 (Fletcher 1966); Western Junction, 'late in 1965' (Milledge 1966); Rawleen near Sorell, 1966 (Tas. Bird Rep. 1); Tods Corner, 20–21 Sept. 1978; Mienna, 25–26 Sept. 1978 (Tas. Bird Rep. 1978); Pioneer, 14 Feb. 1980 (Aust. Atlas). **SA** Widespread in W, NW and NE (Cox & Pedler 1977; Badman 1979; Close & Jaensch 1984; Aust. Atlas), S to c. 32°S (Taylor 1987; Aust. Atlas); irregular visitor to Murray R., Adelaide Plains and e. Eyre Pen. (Glover 1952; Condon 1969; SA Bird Rep. 1976); uncommon elsewhere in s. and coastal regions. **WA** Uncommon in SW; regular to Pilbara and NW (Moriarty 1972; Serventy & Whittell 1976; Fletcher 1980; Howard 1986) and common from Kimberley Division to NT border (Serventy 1953; Officer 1974; Serventy & Whittell 1976; Ford 1978; Aust. Atlas); scattered records Great Sandy, Gibson and Great Victoria Deserts (Aust. Atlas); few Nullarbor records (Brooker *et al.* 1979; Congreve 1982; Congreve & Congreve 1985; Aust. Atlas); one record in SW before irruption of 1951–52 (Masters & Milhinch 1974) but regularly recorded since (Aust. Atlas). **NT** Generally common but uncommon Tanami Desert (Gibson 1986) and edge of Simpson Desert (Wilson 1974; Gibson & Cole 1988); said to be 'scarce on north coast away from towns' (Storr 1977) but not confirmed by recent survey work.

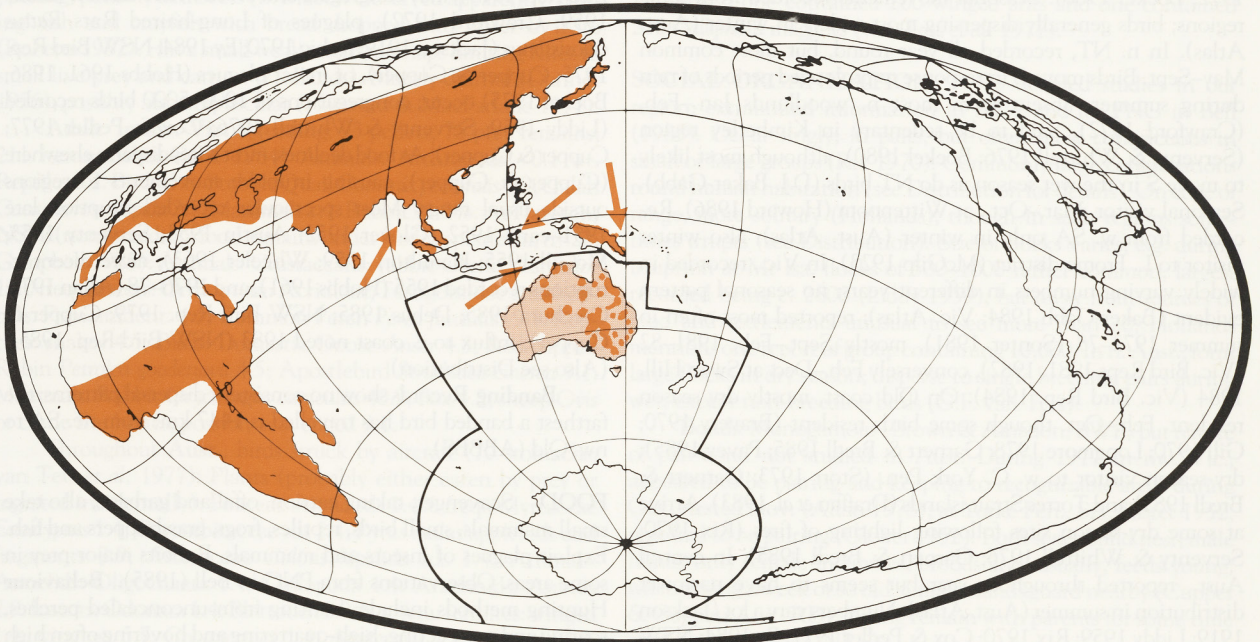
Breeding Scattered records throughout range, with main concentrations in n., ne. and mid-n. SA and w., sw., central

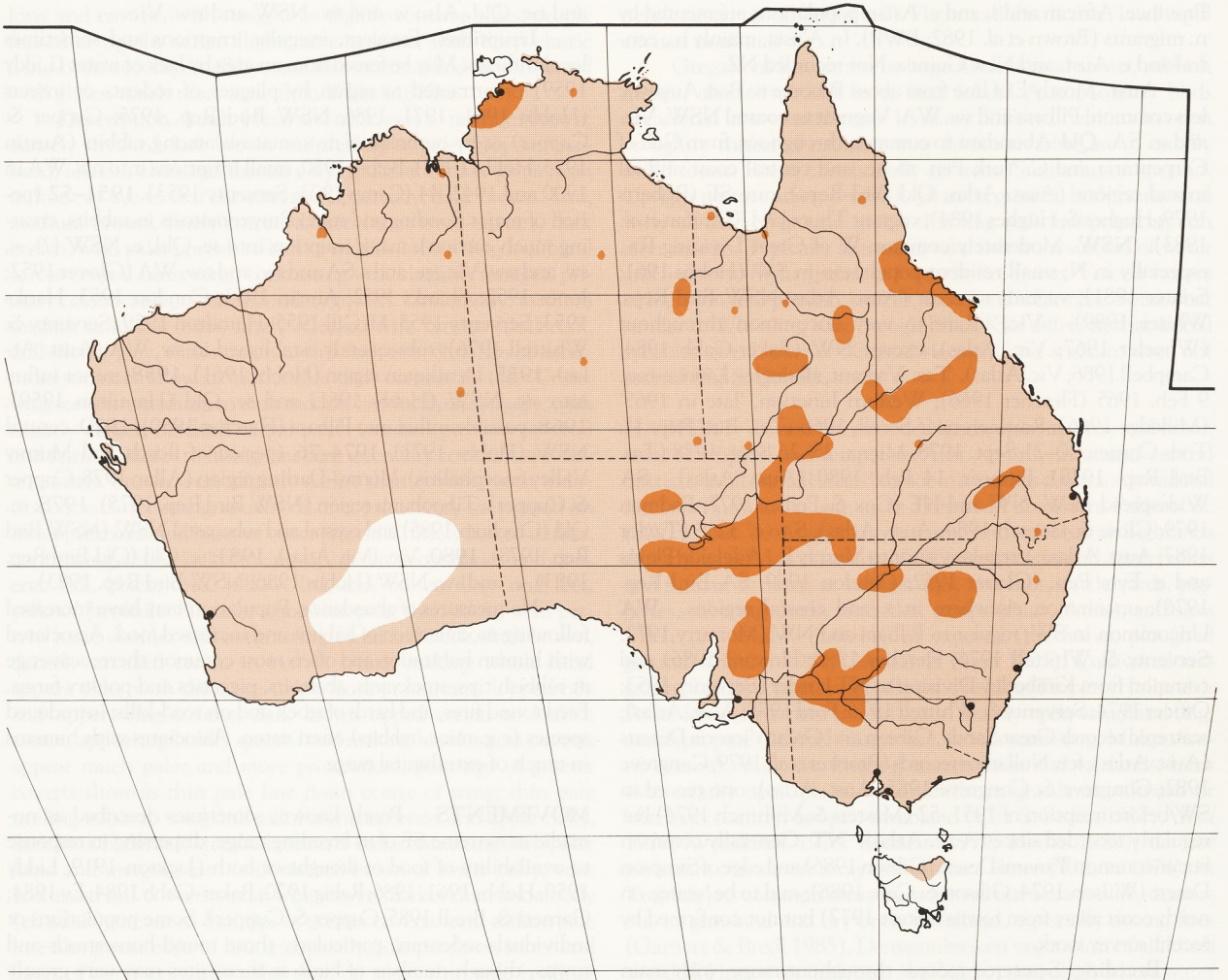
and ne. Qld. Also w. and sw. NSW and nw. Vic.

Irruptions Frequent, irregular irruptions and sometimes local influxes. May be forced from an area by lack of water (Liddy 1959) or attracted to region by plagues of rodents or insects (Hobbs 1961, 1971, 1986; NSW Bird Rep. 1975; Cupper & Cupper) or by outbreak of myxomatosis among rabbits (Austin 1953; Hobbs 1986). Before 1950, small irruptions into nw. WA in 1900 and 1942–44 (Carter 1903; Serventy 1953). **1951–52** (period of major flooding and start of myxomatosis in rabbits, creating much carrion): major irruption into se. Qld, e. NSW (?), s., sw. and nw. Vic., se. and s. SA and sw. and nw. WA (Glover 1952; Jones 1952; Shanks 1952; Austin 1953; Condon 1953; Hanks 1953; Serventy 1953; McGill 1955; Hamilton 1959; Serventy & Whittell 1976); subsequently established in sw. WA (Aust. Atlas). **1955:** Deniliquin region (Hobbs 1961). **1958:** minor influx into sw. NSW (Hobbs 1961) and se. Qld (Hamilton 1959). **1968:** possible influx into Pilbara (Fletcher 1980). **1970:** central NSW (Hobbs 1971). **1974–76** (period of floods and Murray Valley encephalitis): Murray–Darling region (Allan 1978; Cupper & Cupper); Tiboooburra region (NSW Bird Rep. 1975). **1978:** se. Qld (Czechura 1985) and coastal and subcoastal NSW (NSW Bird Rep. 1978). **1980:** Vic. (Vic. Atlas). **1983:** se. Qld (Qld Bird Rep. 1983), e. and sw. NSW (Hobbs 1986; NSW Bird Rep. 1983).

No measures of abundance. Population may have increased following modification of habitat and increased food. Associated with human habitation and often most common there: scavange at rubbish tips, stockyards, abattoirs, piggeries and poultry farms. Feed round fires, and herds of stock and on road-kills; introduced species (e.g. mice, rabbits) often eaten. Associates with humans in much of extralimital range.

MOVEMENTS Poorly known; sometimes described as nomadic at extreme SE of its breeding range, dispersing in response to availability of food or drought or both (Jackson 1919; Liddy 1959; Hobbs 1961, 1986; Rabig 1970; Baker-Gabb 1984; Ey 1984; Garnett & Bredl 1985; Cupper & Cupper). Some populations or individuals sedentary, particularly those round homesteads and towns, though numbers of birds at these sites may vary greatly (Liddy 1959; Hobbs 1961; Bravery 1970; Gill 1970; Crawford





1972; Boekel 1980). Seasonal movements recorded from some regions; birds generally dispersing most widely in winter (Aust. Atlas). In n. NT, recorded all year round, but most common May–Sept. Birds move S in response to prolonged periods of rain during summer; absent from most n. woodlands Jan.–Feb. (Crawford 1972). Said to be sedentary in Kimberley region (Serventy & Whittell 1976; Boekel 1980), although most likely to move S in the wet season as do NT birds (D.J. Baker-Gabb). Seasonal visitor, Mar.–Oct., at Wittenoom (Howard 1986). Recorded from w. SA only in winter (Aust. Atlas); also winter visitor to L. Frome district (McGilp 1923). In Vic., recorded in widely varying numbers in different years; no seasonal pattern evident (Baker-Gabb 1984; Vic. Atlas); reported most often in summer 1972–78 (Sonter 1981), mostly Sept.–Feb. 1981–82 (Vic. Bird Reps 1981, 1982), conversely Feb.–Dec. at Swan Hill, 1984 (Vic. Bird Rep. 1984). On Qld coast, mostly dry season resident, Feb.–Oct. though some birds resident (Bravery 1970; Gill 1970; Longmore 1978; Garnett & Bredl 1985; Pavey 1985); dry-season visitor to w. C. York Pen. (Storr 1973; Garnett & Bredl 1985) and Torres Strait islands (Draffan *et al.* 1983). Arrive at some dry-season sites following lighting of fires (Rix 1970; Serventy & Whittell 1976; Garnett & Bredl 1985). In central Aust., reported throughout year but seems to have narrower distribution in summer (Aust. Atlas). Numbers vary a lot (Jackson 1919; Liddy 1959; Rix 1970; Cox & Pedler 1977; Ey 1984; NSW

Bird Rep. 1975); may congregate and breed where carrion (Liddy 1959; Crawford 1972), plagues of Long-haired Rats *Rattus villosissimus* (Jackson 1919; Rabig 1970; Ey 1984; NSW Bird Rep. 1975; Cupper & Cupper), or insect plagues (Hobbs 1961, 1986; Boekel 1975) occur; congregations of 1000–5000 birds recorded (Liddy 1959; Serventy & Whittell 1976; Cox & Pedler 1977; Cupper & Cupper). As food declines, most Kites disperse elsewhere (Cupper & Cupper), causing irruptive movements to regions outside usual range. Most spectacular recorded irruption late 1951–early 1952 (Glover 1952; Austin 1953; Serventy 1953; McGill 1955; Hamilton 1959; Wheeler 1963); more recent irruptions recorded 1955 (Hobbs 1961), and 1976–78 (Allan 1978; Czechura 1985; Debus 1985; NSW Bird Rep. 1979; Cupper & Cupper); influx to e. coast noted 1983 (NSW Bird Rep. 1985). (Also see Distribution).

Banding Records show no consistent dispersal patterns; the farthest a banded bird has travelled is 1447 km, from ne. SA to nw. Qld (ABBBS).

FOOD Scavenger, taking carrion, offal and garbage; also take small mammals, small birds, reptiles, frogs, grasshoppers and fish. Exploit plagues of insects and mammals. Rabbits major prey in some areas. Observations from PNG in Bell (1985). **Behaviour** Hunting methods include: hunting from unconcealed perches, soaring and prospecting, high-quartering and hovering often high

against sun (Hollands), and low quartering like a harrier (Diamond 1972). Congregate in large numbers to scavenge at abattoirs, piggeries, garbage dumps, sewage ponds (Hamilton 1959; Liddy 1959; Rix 1970; Serventy & Whittell 1976; Storr 1977, 1980; Boekel 1980; Percival 1984). Gather at carcasses and discarded remains and offal from road-kills and hunters (Berney 1905; McGilp 1921; MacGillivray 1929; Allan 1978; Storr 1980; Sonter 1981; Veerman 1985; Cupper & Cupper; Hollands). Exploit plagues of rabbits (Hobbs 1986), Long-Haired Rats *Rattus villosissimus* (Dunnet 1956; Rabig 1970; NSW Bird Rep. 1975; Hollands), House Mice *Mus musculus* (Hayward & MacFarlane 1971; Hobbs 1971), Plague Locust *Chortoicetes terminifera* (Storr 1977; Boekel 1980; Hobbs 1986; Hollands), Yellow-winged Locust *Gastrimargus musicus* (D.J. Baker-Gabb), grasshoppers (McGilp 1921; Hobbs 1961; Storr 1980), and cicada *Macrotristis angularis* (Hobbs 1986). Attend fires that flush insects or other prey (Shilling 1948; Diamond 1972; Serventy & Whittell 1976; Storr 1977, 1980; Boekel 1980; Garnett & Bredl 1985; Cupper & Cupper; Hollands; Vic. Atlas; D.J. Baker-Gabb), willy-willies (Serventy & Whittell 1976), farm machinery (Sonter 1981), herded cattle (Boekel 1980; Storr 1980), and other animals including a family of Emus *Dromaius novaehollandiae* (Veerman 1985). Will search ground after fire for burnt prey (Diamond 1972). When catching fish, stoop to take fish at the surface, talons barely breaking water (Klapste 1983; Hollands); circled about 10 m over water, swinging through 180° and descending steeply to about 20 cm above water and snatched for fish, which were always caught and carried in one foot; also stooped from perch (Roberts 1982; Fell 1987). Observed taking dying fish from shallow pools in drought, avoiding dead fish (Liddy 1959), although fish carrion taken elsewhere (Sonter 1981; Watling 1983). Fish eaten at perches in trees; occasionally in flight (Liddy 1959; Roberts 1982; Klapste 1983; Fell 1987). Insects taken on wing (McGilp 1921, 1934; Hobbs 1961, 1986; Boekel 1975; Hall & Rogers 1980), caught in talons and passed to bill (Hobbs 1961, 1986). Rob both conspecifics and other birds (McGilp 1934; Percival 1984; Cupper & Cupper; Hollands); will steal food from Whistling Kites on wing (D.J. Baker-Gabb); group of Black Kites with three Whistling Kites walking round on bare ground and pecking, possibly at insects (B. Mace). Observed apparently 'baiting' fish and crayfish with bread dropped into water by Kite (Roberts 1982). Have small weak talons, perhaps limiting Kites to small live prey and carrion (Hollands). Mainly diurnal (Dunnet 1956), possibly also crepuscular (Hayward & MacFarlane 1971).

Adult In nw. Vic. (breeding; 93 pellets, 75 prey remains, 211 items; Baker-Gabb 1984) Animals: Arthropods <0.1 wt. Reptiles 0.2. Birds: 3.6: Stubble Quail *Coturnix pectoralis* 0.9; Galah *Cacatua roseicapilla* 2.7. Mammals 1.1: Rabbit 91.3%. At **Dareton**, NSW (non-breeding; food remains under feeding platform; n=22; Campbell 1985): Animals: Crustaceans: yabbie *Cherax destructor* 18.0 freq. Insects: Orthoptera: Acrididae/Tettigoniidae grasshoppers. Fish: unident. 4.5; Common Perch *Perca fluviatilis* 9.1. Reptiles: snakes 4.5. Birds: Domestic Goose *Anser* 4.5; Red-capped Robin *Petroica goodenovii* 4.5; Apostlebird *Struthidea cinerea* 9.1. Mammals: Rabbit *Oryctolagus cuniculus* 40.9; Fox 4.5; sheep *Ovis* or cattle *Bos* bones, possibly scavenged 9.1.

Throughout **Aust.**, birds struck by aircraft (70 stomachs; van Tets *et al.* 1977): Plants (probably either eaten by prey or ingested incidentally): Poaceae *Avena* sds 1.4% freq.; Myrtaceae *Eucalyptus* 1.4; Curcubitaceae sds 1.4; *Pyrus malus* apple: sds and fragments 2.9; Asteraceae *Calotis hipidula* sds 1.4. Animals: Annelids: Oligochaeta 1.4; Chilopoda 1.4. Arachnids: Aranea 2.9. Insects: Odonata 1.4; Blattodea 2.9; Isoptera: termites: winged 1.4; wingless 5.7; *Coptotermes* 1.4; *Amitermes* 1.4; mantids 2.9;

Orthoptera: Tettigoniidae 4.3; Gryllidae 10.0: *Teleogryllus commodus* 4.3; Acrididae 28.6; Phthiraptera: Mallophaga 1.4; Hemiptera: Pentatomidae 2.9; Coleoptera 18.6: Carabidae ad. 5.7; *Blackburnium* 1.4; Scarabaeidae ad. 5.7; Dynastinae 2.9; Elateridae ad. 2.9, larvae 1.4; Curculionidae 1.4; Diptera: Muscidae maggots 1.7; *Calliphora* maggots 1.4; Stratiomyidae 1.4; *Rutilla* larvae 1.4; Lepidoptera: caterpillars 8.6; Spingidae 1.4; Noctuidae 4.3: ads 10.0; Hymenoptera: Ichneumonidae 1.4; Apoidea 2.9; Formicidae: winged ants 10.0: *Oecophylla virescens* 4.3; wingless ants 25.7; *Camponotus* 1.4; *Rhytidoponera* 1.4; *Iridomyrmex* 12.9. Reptiles: lizards 11.4; agamids 5.7; skinks 1.4; snakes 1.4. Birds 2.9: shell of chicken egg 1.4; Zebra Finch *Poephila guttata* 1.4. Mammals: dunnart *Sminthopsis* 1.4; Rodents: Long-haired Rat *Rattus villosissimus* 1.4. Waste: offal 45.7; cooked meat 5.7; raw meat 18.6; beef 1.7; fat 28.5; bone fragments 11.4; tooth chip 1.4, wool 1.4; bread 1.7; paper 4.3; plastic 1.4; charcoal 2.9. Birds struck by aircraft, **Townsville, Qld** (ten stomachs; Lavery 1969): Animals: Insects: Orthoptera: *Gastrimargus musicus*; *Oedaleus australis*; mole cricket *Gryllotalpa*; *Locustamigratoria*; Neuroptera lacewings; Mantodea; Coleoptera: *Cybister*. Amphibians: frogs: *Limnodynastes ornatus*; *Hyla caerulea*; *H. inermis*; *Cyclorana albobuttatus*; *Bufo marinus*.

Other records Animals: Crustaceans: Soldier Crabs *Mictyris longicarpus* (Estbergs 1987). Insects: grubs (McGilp 1934); Orthoptera (Carter 1903; McGilp 1934; Liddy 1959; Hall & Rogers 1980; Cupper & Cupper); Hemiptera: cicadas (NSW Bird Rep. 1983). Fish (Sonter 1981; Fell 1987; Cupper & Cupper; Hollands): Common Perch *Perca fluviatilis* (Klapste 1983). Reptiles: unident. (Cupper & Cupper; Hollands); snakes: Death Adder (40 cm long, Cupper & Cupper). Birds: eggs, nestlings (Hardy 1985; Hollands); Stubble Quail (Sonter 1981). Mammals: small mammals (Cupper & Cupper); Rabbit (Rhodes 1944; Allan 1978; Cupper & Cupper; Veerman 1985; Hollands); rodents (McGilp 1934): native rats (Cupper & Cupper); House Mouse (Sonter 1981; Cupper & Cupper). Carrion: cattle (MacGillivray 1929; Liddy 1959; Veerman 1985); kangaroo (Liddy 1959; Czechura 1971; Veerman 1985); sheep (Cameron 1932); mice (Hayward & MacFarlane 1971); snake (Liddy 1959); fish (Sonter 1981).

Intake One individual contained 100 wingless termites *Amitermes*, one contained 200 winged ants and one contained 200 *Calliphora* maggots (van Tets *et al.* 1977).

SOCIAL ORGANIZATION No detailed studies in our region; extralimital information in BWP and for PNG in Bell (1985). Occur singly, in pairs, but often most conspicuous in small or large groups (Rix 1970). Commonly large congregations round human habitation (see Distribution for details). On edge of range, more solitary (Hollands), though in such regions sometimes irrupts (see Distribution). Size of flocks varies, e.g. during irruption at Mt Isa, flocks of 500–1000 rather common, largest recorded being c. 2800 (Liddy 1959), but away from sources of food and settlements unusual to see more than 20; Hollands mentions one report of group containing 10,000. In n. Aust., form large flocks in dry season; disperse to single breeding pairs during wet, except non-breeding birds (G.F. van Tets).

Bonds Monogamous (Brown & Amadon; BWP) but nature of pair-bond not studied in Aust. During 1977 in nw. Vic., appeared to be pairing and keeping to recognizable areas during Oct., nested Nov. (Allan 1978); at Yorke Pen., SA, Easter 1952, reported to be pairing (Glover 1952). Both sexes build nest; male hunts; only female incubates, broods and, usually, feeds young; when young a week or so old, female stands guard nearby (Cupper & Cupper; Aust. RD). Young remain with parents for some time after fledging (Aust. NRS).

Breeding dispersion Breed in single pairs (Aust. RD) though occasionally tend to form loose colonies (Baker-Gabb 1984); said not to defend nesting territories (Hollands) though this is disputed; spend much time near nest and in nest-tree in weeks before laying (D.J. Baker-Gabb). In Kimberley, nests sometimes as close as 250 m (Aumann 1991). In nw. Vic., four nests found in area 12 x 6 km, two closest nests 5 km apart but not all nests may have been located (Allan 1978); 47 active nests found in slightly less than 20 km of Strzelecki Creek floodplain (3 km wide at most) (Mace 1981); up to six active nests found in small stand of Coolibahs *Eucalyptus microtheca* round waterhole (Hollands); round Mildura, Vic., breeding density of 335 ha/pair with distance of 1.2 km (0.2–4.4; 40) between nests (Baker-Gabb 1984). Nests more widely spaced on edge of range (e.g. Vic.), than farther inland (Hollands).

Roosting Communal roosts are used both diurnally and nocturnally, usually in trees, but in absence of trees may roost communally on ground (D.J. Baker-Gabb; J. Estbergs). During breeding season, little information. Anecdotal details on communal roosting include: 'thousands' in trees along a creek (Cupper & Cupper); 500+ in trees at Palliot Ck, sw. Qld (Schradler 1981); 100–150 in a few dead trees near Ivanhoe HS for several evenings (Aumann 1991); up to 15 in flooded eucalyptus (Henle 1989); near Ipswich slaughter yards, main roosting trees in gently sloping paddock facing W alongside a road (Hamilton 1959); flock of at least 200 feeding daily at abattoirs and roosting in gums along nearby river (Glover 1952). Arrived at dusk, though on a particularly hot day arrived mid-afternoon (Cupper & Cupper); went to roost about sunset (Henle 1989); roosted at dusk and still there at first light (Hollands); roosting trees filled towards evening (Hamilton 1959). Sonter (1987) recorded mixed congregations of Whistling and Black Kites of up to 250 birds loafing during early- to mid-morning on posts, mounds of earth, and protruding sticks, some remaining inactive or preening for up to 2 h. May rest in standing or squatting position on ground, occasionally sunning or dusting themselves (Sonter 1987).

SOCIAL BEHAVIOUR No detailed studies in HANZAB area; extralimital data summarized in BWP. Information supplied by M.G. Brooker. At nest, adults wary of human intruders (Cupper & Cupper; D.J. Baker-Gabb). When disturbed may remain near nest, particularly as season progresses; usually circle c. 100 m or so away or perch in nearby tree (Allan 1978); may desert (Hollands). Pairs spend a lot of time near nest and in nest-tree just before laying eggs; also use nest as feeding platform (D.J. Baker-Gabb). Often gather into small compact groups at low altitudes and soar to high altitudes (Liddy 1959; Hamilton 1959). Sometimes Whistling Kites associate with flocks (Liddy 1959; Allan 1978; Sonter 1987; Hollands) and occasionally Brown Falcons (Liddy 1959). **Comfort behaviour** **SUNNING**: lie on side with lower wing folded and upper wing fully spread and tail fanned, exposing spread wing and fluffed-out dorsal surface to sun; alternate body and exposed wing from time to time (Sonter 1987; D.J. Baker-Gabb; G.F. van Tets). **DUSTING**: vigorously shuffle and kick in loose soil, stretching wing into motion to act as a fan for spreading dust over body (Sonter 1987).

Aerial activity Pair observed soaring at slow to moderate speed, one bird pursuing c. 1 m behind and 5 m above leading bird, which called occasionally; display lasted c. 10 min, then leading bird made gliding descent to nest-tree; second bird followed in spiralling descent to nest-tree, calling about ten times with head and neck dropped and shoulders hunched; spiralling display observed several times. Four Kites observed soaring together for 2 min, diving at each other and rolling to present

talons. Adults soaring over nest observed to tip sideways and give a threat call as in chasing a conspecific (D.J. Baker-Gabb).

Agonistic behaviour Fight over food (Rix 1970). Will attack and strike intruders at nest-tree (D.J. Baker-Gabb). As numbers of birds increased during irruption, fights with much calling became common; up to five birds involved and some fights resulted in loss of wing feathers; Kites with paper attached to them usually attacked by conspecifics; on one occasion, Kite emerged from whirlwind with long strip of toilet paper draped over neck, under wings, and trailing behind; promptly chased with much calling by several other Kites (Liddy 1959). Female with young will swoop at intruders, emitting shrill staccato call (Hobbs 1987; Cupper & Cupper; Aust. NRS).

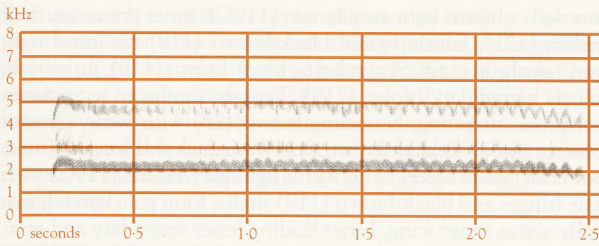
Sexual behaviour **Greeting** Brooding female utters a few loud quavering whistles when she sees male approach with prey (Cupper & Cupper). During courting, one of pair on nest may give thin whistling call; Kites also observed giving advertising or territorial calls on or near nests; where two or more Kites present, calling bird adopted horizontal posture with wings slightly spread; silent birds were in normal posture (Baker-Gabb 1989; D.J. Baker-Gabb). **Courtship feeding** When male brings food to nest, sometimes passes it from talons to bill before transferring it to mate (Cupper & Cupper). **Allopreening** Pair observed allopreening at nest-site, walking and shuffling about for 20 min (D.J. Baker-Gabb). **Copulation** Female took up horizontal posture on branches high in canopy; male glided in, landed on her back for 3 s, then flew off; female roused and remained perched there for c. 20 min (D.J. Baker-Gabb).

Relations within family group Female tears off sections of food brought by male to feed to young (Aust. RD). As chicks develop, female stops brooding during day, although in hot weather shades them with her body and outstretched wings (Cupper & Cupper). Chicks show no aggression toward each other (Cupper & Cupper); rather than defecating over edge of nest, young lower their heads, raise their rear-ends and eject 'howitzer-like' from nest (Cupper & Cupper). Young, when nearing fledging, crouch flat and still in nest if alarmed (Hollands).

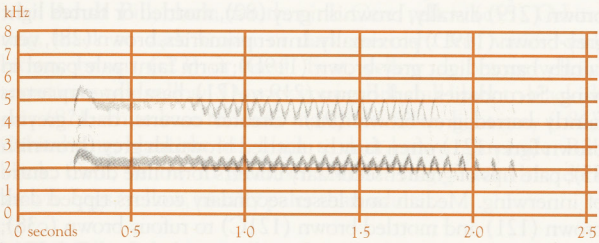
VOICE Little information and no detailed studies in our region; extralimital studies summarized in BWP. Vocal, particularly when squabbling over food; do not call when soaring in flock (Liddy 1959). Give many calls (Price-Jones 1983); described as hoarse querulous whistles and weak quavering squeals (Hollands); also hisses (Price-Jones 1983) and twitters (Morris 1976). Individual and sexual differences not known. Regional variation not known. Calls similar to those of Whistling Kite, though more subdued and less vigorous.

Adult WHISTLE: hoarse and querulous whistle (Hollands) with much variation; described as *see-ee-ee...* or *see-i-i-i...*; the first syllable a whistle; see sonagrams A, B and C, the last closely resembling characteristic whistling call of Whistling Kite, though of a more tremulous quality, not descending so vigorously and staccato notes not ascending so vigorously as in Whistling Kite (S.J.S. Debus). Given in flight, when defending territory or nest, when stooping at intruders at nest; sometimes harsher *scree-i-i-i* in nest defence (D.J. Baker-Gabb); possibly territorial or courtship call or both (Baker-Gabb 1989; D.J. Baker-Gabb). **Other calls** Hisses (Price-Jones 1983). Twittering calls when stressed (Morris 1976). Adult gave repeated *kreit-kit-kit-kit* three times, when observer climbed to nest with young (D.J. Baker-Gabb).

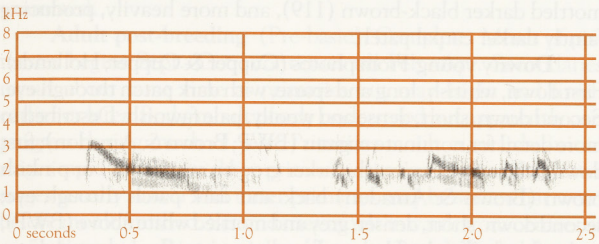
Young **Cheep**: sonagram D shows *cheep* of 1-day-old chick. Young in second down persistently give weak shrill repetitive cry, a feeble caricature of adult call, if left alone; call much less when nearing fledging (Hollands).



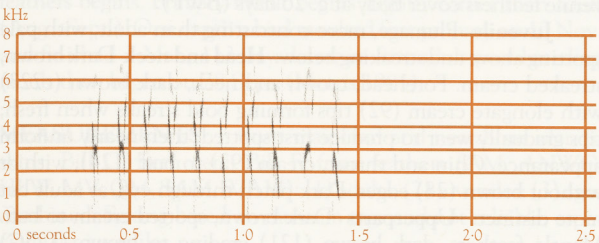
A D. Stewart; Palparara Stn, Qld, Aug. 1990; private tape, Dig. 10



B D. Stewart; Palparara Stn, Qld, Aug. 1990; private tape, Dig. 10



C R. Swaby; Kakadu NP, NT, July 1987; B1006



D D. Stewart; Palparara Stn, Qld, Aug. 1990; X146

BREEDING No detailed long-term Aust. studies; based on standard references, Aust. NRS. Extralimital information in BWP. Breed in simple pairs, solitarily.

Season In s. Aust., well defined, usually July–Jan.; occasionally in autumn (Baker-Gabb 1984). In n. (tropical) and central Aust., no definite season, breeding recorded all months. In s. Aust.: laying, July–Nov.; fledging, Oct.–Jan. (Aust. NRS). In n. Aust.: breeding recorded all months; laying, Feb.–May and July–Oct.; young, Apr.–Aug. and Oct.–Dec. (Le Souëf 1903; Lavery et al. 1968; Aumann 1991; North; Aust. NRS). In central Aust.: usually breed Aug.–Dec. following spring rains though may breed throughout year if conditions suitable, nesting whenever food adequate (Cupper & Cupper; Hollands; Aust. NRS).

Site In fork or on horizontal branch of live tree, usually eucalypt or casuarina, often near water (Aust. NRS). Nest height dependent on trees in area: in central Aust., 2–10 m high; up to 30 m along Murray and Darling Rs (Cupper & Cupper).



MEASUREMENTS (m): nest height, 6.9 (2.9; 2.5–20; 121); tree height, 12.2 (7.6; 5–30; 16); height of vegetation over nest, 3.0 (1.9; 0.2–10; 105); distance to edge of tree, 1.5 (0.5; 0.8–2.1; 9) (Aust. NRS). Frequently refurbish old nest of conspecifics, other raptors, corvids, or other species, e.g. Chestnut-crowned Babbler *Pomatostomus ruficeps* (Serventy & Whittell 1976; Allan 1978; Aust. NRS; D.J. Baker-Gabb). Same site used twice in one season (North; Aust. NRS). Distance between nests of conspecifics depends on habitat, nests clustered round waterholes, widely spaced where trees abundant (Hollands) (see Social Organization).

Nest, Materials Large, untidy platform or bowl of small and large sticks, sometimes unlined, or lined with wool, fur, bark, dried fungus, dung, refuse including silvery lining of wine cask, occasionally grass, leaves (never green; McGilp 1923), old caterpillar nests (Hobbs 1987; Brown & Amadon; Cupper & Cupper; Hollands). **MEASUREMENTS**: outside dimensions, 75 cm across, 60 cm thick (Serventy & Whittell 1976); 50–60 cm in diameter, occasionally larger (Cupper & Cupper). When using old nest, scratch out egg-cavity and reline it; no other repairs made (McGilp 1923); sticks added to old nest (Aust. NRS). Building mostly by male (Meyburg 1967); one bird brings material, other constructs (North).

Eggs Oval to rounded oval, almost globular; close-grained, dull, not glossy; dull white, more or less spotted, blotched, streaked or hair-lined with umber or reddish-brown, varying from small, dark, distinct to large, pale, blurred, scattered or concentrated at one end. **MEASUREMENTS**: 52 (2; 49.8–54.6; 9) x 42 (1; 39.9–43.4; Le Souëf 1903); 53 (4; 46.5–56.1; 7) x 42 (2; 38.9–43.9; North); 52.2 (44.5–56.2; 22) x 40.8 (37.8–44.0; Brown & Amadon). **WEIGHT**: extraliminally (Germany) 52 g.

Clutch-size Affected by prevailing conditions. During plagues of Long-haired Rats, clutches mostly 3–4; two eggs during less favourable conditions after plague (C/3 x 5, C/2 x 18, C/1 x 2) (Cupper & Cupper). From Aust. NRS, data for acceptably complete clutches, 2.3 (C/3 x 4, C/2 x 9). In nw. Vic., 2.4 (1–3) in 30 nests during two seasons (Baker-Gabb 1984). Replacement clutches laid; within 20 days of loss (North). Pairs successfully fledging young in Feb., again with eggs in mid-Sept. (North); similar record (Baker-Gabb 1984).

Laying For one nest of C/3, laying interval of 2 days indicated, eggs hatched 2 days apart. Extraliminally, Germany: laying interval (C/2) at least 24 h (Meyburg 1971).

Incubation **INCUBATION PERIOD**: for E1 and E2, c. 31 days; E3, 30 days 17 h ± 1 day (Hobbs 1987; Aust. NRS). Extraliminally, Germany: incubation period 25–34 days, may depend on size of egg, position in laying sequence, and clutch-size; incubation began before laying of second egg, incubation at least 34 days, hatching took 38 h (Meyburg 1971); incubation period 25–26 days for E4 of four-egg clutch (Link 1969); Japan: laying interval 3 days (n=6) and 2 days (n=1), incubation period 33 ± 1 days for E2 of three-egg clutch (Haneda & Koizumi 1965).

Young Altricial, nidicolous. At hatching, covered in fine grey down with long wispy tufts on crown, replaced by white down within days (Hollands). No further Aust. information on growth, development. **Parental care, Role of sexes** Female broods when young small, may shade large young during hot weather; male brings food to nest and may occasionally feed young (Cupper & Cupper). Young fed bill to bill, piecemeal (Aust. NRS); able to feed self from 33–35 days (Brown & Amadon). Young eject faeces from cup of nest, not over edge (Cupper & Cupper). **NESTLING PERIOD:** one young fledged at 44 days; two young still in nest at 36 and 39 days (Aust. NRS; Hobbs 1987); 37–44 days (n=3; Baker-Gabb 1984); 38 and 41 days (Cupper & Cupper); 60 days (Serventy & Whittell 1976) appears to be overestimate.

Fledging to maturity Young may leave nest and perch nearby before being able to fly, may return to, and be fed in, nest after fledging (Cupper & Cupper; Aust. NRS). May remain in nesting area for two weeks (Brown & Amadon). Independent 40–50 days after fledging (BWP).

Success From four nests with clutch-size determined: 11 eggs laid, nine young hatched (82%), seven fledged (64%) (Aust. NRS). Average 1.5 young per clutch; 0.9 per territorial pair for two seasons, nw. Vic. (Baker-Gabb 1984). Nests destroyed by storms (Aust. NRS). Young abandoned in nest to die of starvation if food supply diminishes, e.g. population of rats declines (Cupper & Cupper). No further information. Nestlings taken by Black-breasted Buzzard *Hamirostra melanosternon* (Cupper & Cupper; Hollands).

PLUMAGES Prepared by D.J. James. Subspecies *affinis*.

Adult Attained by post-juvenile moult probably near end of first year. Somewhat varying; darkest birds generally dark brown, palest more rufous-brown; females may average slightly paler, more rufous-brown. **Head and neck** Mostly brown with dark streaks and pale face. Forehead, chin, throat and lores, whitish; feathers have black-brown (119) shaft-streaks and varying buffish wash at tip. Crown and neck, light brown (123A) (becoming duller light brown [223D] with wear), thinly streaked black-brown (119). Varying blackish patch extends from ear-coverts, over eye to in front of eye. Paler individuals have edges of feathers tinged rufous-brown at tip. **Upperparts** Mostly blackish to dark brown. Feathers of mantle, slightly to much darker than hindneck, light brown (c39) grading to white at base and often to brown (28) along edges, with narrow black-brown (119) shaft-streaks. Rest of upperparts, black-brown (119), fading to dark brown (121) with wear, with varying, slightly paler fringes; shafts, blackish. On paler individuals, rump and upper tail-coverts, tinged rufous-brown at tip. **Underparts** Varying; dark brown, streaked blackish; feathers with white plumulaceous bases. Feathers of breast and flanks, dark brown (c121) with black-brown (119) shaft-streaks, latter bordered narrowly to broadly with brown (37) to light brown (123A), distally or along length. Rest of underparts, similar but with light brown (123A) to rufous-brown (136) tinge giving generally lighter appearance. Palest birds appear more rufous-brown, streaked dark brown; pale borders to shaft-streaks broader, richer rufous-brown (38) particularly on belly, thighs and under tail-coverts. **Uppertail** Dark brown (119A) when fresh, to brown (28) when worn; slightly darker distally with dark brown (221) to black-brown (119) barring, which is complete but not bold; distal bars may merge to form broader subterminal band, especially on outer rectrices. **Undertail** Brownish grey (80) to grey-brown (91) with dark-brown (219) barring, more distinct than above; pale tip. **Upperwing** Outer five primaries, black-brown (119) over distal half; bases, dark brown (219), grading to brown (28) at edge of inner web, and faintly

mottled or barred light grey-brown (119C). Inner primaries, dark brown (121), faintly barred black-brown (119) on inner web, very faintly on outer. Secondaries, black-brown (119); inner web, faintly barred dark-brown (219). Tertiaries, similar to secondaries but prone to fading, becoming brown (28) with wear. Greater coverts and alula, dark brown (121). Median and longest (most posterior) lesser secondary coverts, light grey-brown (119C) with pale fringes and black-brown (119) shafts; form pale band diagonally across inner wing. Inner leading lesser secondary and marginal coverts, dark brown (119A) with black-brown (119) shafts and thin pale fringes. **Underwing** Outer five primaries, dark brown (219) distally, brownish grey (80), mottled or barred light grey-brown (119D) proximally. Inner primaries, brown (28), very faintly barred light grey-brown (119D); form faint pale panel in wing. Secondaries, dark brown (219 to 121), basal three-quarters faintly barred grey-brown (91). Greater coverts, dark greyish brown (grey 121) often faintly mottled brownish grey (brownish 85); pale tips of greater secondary coverts form line down centre of innerwing. Median and lesser secondary coverts tipped dark brown (121) and mottled brown (121C) to rufous-brown (c38); shafts, black-brown (119); median coverts, slightly darker than lesser coverts. Lesser and median primary coverts, similar but mottled darker black-brown (119), and more heavily, producing faintly darker carpal patch.

Downy young From photos (Cupper & Cupper; Hollands). First down, whitish, long and sparse, with dark patch through eye. Second down, short, dense and woolly, pale fawnish. Described in more detail for nominate *migrans* (BWP; Brown & Amadon); first down, white to cream with darker grey-brown (BWP) or pinkish brown (Brown & Amadon) back and dark patch through eye; second down, short, denser, grey and mottled white above (BWP), and rufous-buff to buff below. In nominate *migrans*, second down appears at c. 5 days, primary quills at c. 11 days, and growing juvenile feathers cover body at c. 26 days (BWP).

Juvenile Plumage, more contrasting than adult, with pale spotting above and streaking below. **Head and neck** Dark brown, streaked cream. Forehead, crown and neck, dark brown (c223) with elongate cream (92) tips forming bold streaks when fresh; tips gradually wear to produce first spotted, then nearly uniform appearance. Chin and throat, cream (92) to buff (124), with or without brown (28) edges. Dark patch through eye, as adult but more distinct. **Upperparts** Dark brown, spotted cream to buff. Mantle feathers, dark brown (121) grading to brown (123C) distally, with cream (92) tips and black-brown (119) shaft-streaks. Rest of upperparts, dark brown (121) with cream (92) to light brown (123A) tips; rump and upper tail-coverts do not contrast appreciably with back (cf. nominate *migrans*; Sylven 1977). **Underparts** Dark brown, broadly streaked paler; white plumulaceous bases. Feathers of breast and flanks, dark brown (c121A), with broad cream (92) to buff (124) central streaks over distal half, bisected by black-brown (119) shaft. Belly, similar but slightly paler brown with less clearly defined pale streaks. Vent, thighs and under tail-coverts, brown (121C) to light brown (123A), with buff (124) to cream tips and mottling. **Tail** Similar to adult but with fairly broad (c. 10 mm) buff (124) to cream (92) tip; barring perhaps slightly crisper on average. **Upperwing** Remiges similar to adult but tipped buff (124) grading to cream (92) distally, forming trailing-edge from p4 inwards. Greater coverts and alula, similar to adult but tipped buff (124) to cream (92), forming 'chain' of spots along wing. Leading lesser secondary coverts, dark brown (119A) with thin buff (124) tips; rest of secondary coverts, dark brown (119A) proximally, grading to broad cream (92) or buff (124) distally and to brown (121C) along edges, forming spotted band across innerwing. **Underwing**

Remiges much as adult except for pale creamy trailing-edge and slightly stronger contrast between inner primaries and secondaries (slightly paler window in wing) but much affected by individual variation. Greater coverts, similar to adult but broadly tipped light grey-brown (119D) producing more distinct pale line along centre of wing. Median and lesser coverts, as adult except median coverts (sometimes?) with pale tips producing second pale line along wing.

BARE PARTS Subspecies *affinis*; from photos (Cupper & Copper; Hollands; Aust. RD) and museum labels.

Adult Bill, black; mouth, pink. Cere, yellow (c55). Orbital ring, black to dark brown or dark greenish. Iris, varies, dark brown, brown (c23) or hazel. Feet, yellow or orange-yellow, sometimes pale yellow. **Downy young** Bill, dull black to blackish grey (82); white base to lower mandible. Cere, light grey (c86). Orbital ring, blackish. Iris, black to dark brown. **Juvenile** Bill, black. Cere, yellow to greenish. Orbital ring, black. Iris, dark brown. Legs, yellow, usually paler than adult.

MOULTS Subspecies *affinis*. Based on skins from Aust. (AM, ANWC, HLW, MV, SAM, WAM); about 80 dated specimens examined.

Adult post-breeding (Pre-basic). Complete. Moulting of primaries begins Sept.–Oct., continues till Feb.–Apr. Secondaries moult about same time as primaries but may begin and finish earlier or later. Body-moult poorly understood but apparently can progress during much of year. Primaries moult outwards; initial stages rapid with up to three primaries growing at once, but latter stages usually slower and inner primaries may be somewhat worn before moult finished. Secondaries moult inwards from centres at c. s5, s8 and s1. **Post-juvenile** (First pre-basic). Probably complete but body-moult can be well advanced before moult of flight-feathers begins. Primary-moult begins slightly earlier than adult (Aug.–Sept.). One captive bird moulted first primary on 10 Nov. and finished 3 Mar., 113 days later; its first adult post-breeding moult then began on 28 Sept. (Morris 1981).

MEASUREMENTS Aust. mainland and nearshore islands, skins; Bill C, from cere; Bill F, from feathers (AM, ANWC, HLW, MV, QM, SAM, WAM): (1) adults; (2) juveniles; (3) ages combined. Sexing based on museum tags and not reliable, especially for juveniles.

	MALES	FEMALES	
WING	(1) 404 (14.5; 375–420; 31) (2) 397 (10.3; 386–417; 7)	419 (9.18; 401–432; 12) 395 (9.19; 383–415; 9)	** ns
8TH P	(1) 304 (13.3; 272–324; 30) (2) 300 (10.6; 290–316; 6)	318 (8.05; 306–330; 10) 301 (10.4; 287–322; 9)	* ns
TAIL	(1) 260 (13.9; 221–286; 26) (2) 239 (13.7; 214–259; 7)	261 (15.3; 230–288; 12) 240 (7.12; 228–252; 9)	ns ns
BILL C	(1) 23.0 (1.07; 20.5–25.1; 32) (2) 22.5 (1.77; 20.8–25.7; 9)	23.7 (1.26; 21.6–25.5; 11) 23.4 (1.11; 21.0–24.5; 9)	ns ns
BILL F	(1) 31.1 (1.17; 29.1–33.3; 32) (2) 30.5 (1.67; 28.1–33.1; 9)	32.3 (1.33; 30.7–34.5; 12) 31.7 (1.57; 27.5–33.0; 10)	ns ns
TARSUS	(3) 48.5 (2.25; 44.0–51.6; 14)	49.6 (2.21; 46.5–53.7; 18)	ns
TOE	(1) 33.5 (1.73; 30.1–36.1; 12) (2) 33.1, 34.3	34.0; 36.2 32.5, 34.3, 36.3	ns ns

Differences between age-groups not tested because samples small.

WEIGHTS Aust. mainland and nearshore islands, skins (museum labels; AM, ANWC, HLW, MV, SAM, WAM): adult

males: 554 (47.7; 500–640; 10); adult females: 626 (48.6; 560–671; 6); juvenile female: 690; differences between sexes not significant in these small samples.

Live birds banded in NT, 1976–82 (ABBBS), sexes combined since not separable in field except on size: adults: 567 (83.8; 360–775; 96); juveniles: 568 (85.4; 480–750; 15); age not known: 602 (77.9; 440–840; 68); differences not significant.

STRUCTURE Wing, long, fairly even in width; emargination of outer primaries produces six moderately long primary-fingers. Eleven primaries; p7 longest, p10 117–131 mm shorter, p9 32–48, p8 1–6, p6 6–20; p5 52–92, p4 114–142, p3 145–170, p2 164–190, p1 180–210, p11 minute. Emargination of outer web on p9 180–200 mm, p8 160–185, p7 130–155 p6 70–125; emargination of inner web on p10 100–130, p9 130–150; p8 140–155, p7 115–145, p6 70–115. Ten to eleven secondaries and three tertials; longest tertial falls between p3 and p5 on folded wing. Tail, moderately forked (less so in juveniles; Sylven 1977); 12 rectrices; t1 24–66 shorter than t6. Bill, moderate; nostrils diagonally elliptical. Tarsus, short; feathered on upper fore-edge; scales, scutellate on front of tarsus and top of toes, reticulate elsewhere. Outer toe without claw c. 71% of middle, inner c. 65%, hind c. 51%.

AGEING When worn and or in late stages of first pre-basic moult, juveniles best recognized by pale tips to outer greater primary coverts.

GEOGRAPHICAL VARIATION Within Aust., none described; limited series of skins suggests birds from W may average slightly paler, more rufous. Throughout Old World 6–7 subspecies recognized (e.g. Peters; Vaurie 1965), forming two groups: ‘yellow-billed kites’ (subspecies *aegyptius*, *parasitus*) of Africa, and ‘black-billed kites’, comprising remainder throughout much of Old World. Geographical variation complicated by marked individual variation of complex plumage-patterns. Subspecies *affinis* (described above) of New Guinea and Aust., geographically isolated from rest; smallest subspecies (Brown & Amadon). Nominate *migrans* of Europe, Middle East and n. Africa, slightly larger (Brown & Amadon) but plumage differs only slightly; adult has broader dark streaks on crown and throat, less prominent eye-patch and slightly more prominent ‘window’ in underwing; juvenile has broader cream streaks below, which originate nearer base of feather but are less sharply defined. Subspecies *lineatus* of Asia is largest form; adult has darker and browner head, paler buff belly and very prominent windows in underwing; juvenile has darker brown crown and much broader streaks on browner breast (BWP; Brown & Amadon; Vaurie 1965). Subspecies *govinda* of India, E to Indo-China, larger than *migrans*, smaller than *lineatus*, and somewhat intermediate in plumage; adult head feathers more rufous-brown with broader dark streaks than *affinis*, similar to *migrans*, and with clearer ‘window’ than either; juvenile, broadly streaked buff (124) below with pale, not dark, shafts on more uniform brown ground, and with fairly prominent white barring in ‘window’ (Vaurie 1965; Brown & Amadon; BWP). Subspecies *parasitus* of s. Africa, larger than *affinis*, slightly smaller than *migrans*; adult has yellow bill, darker brown head and paler body, washed rufous above, and rufous-brown to dark cinnamon below, with very faint window; juvenile only narrowly streaked cream below (Urban *et al.* 1986). Subspecies *aegyptius* of n. Africa, larger than *affinis* and *parasitus*, with more deeply forked tail; adult has yellow bill, dark-brown head, more rufous underparts (like *parasitus* but darker) and rufous-brown, more boldly barred tail (BWP; Brown & Amadon).

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Volume 2, Plate 5

Whistling Kite *Haliastur sphenurus* (page 71)
1 Adult, dark; 2 Adult, intermediate; 3 Adult, light; 4 Juvenile

Black Kite *Milvus migrans* (page 53)
5 Adult, pale; 6 Adult, dark; 7 Juvenile

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Volume 2, Plate 6

Whistling Kite *Haliastur sphenurus* (page 71)
1 Adult; 2 Juvenile, fresh; 3 Juvenile, worn

Little Eagle *Hieraetus morphnoides* (page 180)
4 Adult; 5 Juvenile

Black Kite *Milvus migrans* (page 53)
6 Adult; 7 Juvenile

Brahminy Kite *Haliastur indus* (page 63)
8 Adult; 9 Juvenile; 10 Immature



Volume 2, Plate 7

Whistling Kite *Haliastur sphenurus* (page 71)
 1 Adult; 2 Juvenile

Brahminy Kite *Haliastur indus* (page 63)
 3 Adult; 4 Juvenile; 5 First immature

Black Kite *Milvus migrans* (page 53)
 6 Adult; 7 Juvenile

Little Eagle *Hieraaetus morphnoides* (page 180)
 8 Adult, dark morph; 9 Adult, dark morph, darkest birds; 10 Adult, light morph; 11 Juvenile, dark morph; 12 Juvenile, light morph