

A SURVEY OF DIURNAL RAPTORS IN THE WET-DRY TROPICS, NORTHERN AUSTRALIA

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The relative abundance of diurnal raptors in the Australian wet-dry tropics during the early dry season (winter) was measured during a twelve day, 3 024 kilometres road transect survey from northern Western Australia to northern Queensland in 2006. The results are compared with base-line data obtained during the nation-wide 'Birds of Prey Watch' scheme conducted 15–20 years earlier. Raptor densities in zones in the Top End of the Northern Territory were higher by a factor of between two and seven compared with those reported previously for the corresponding season. The tussock grasslands of the Barkly Tableland are identified as a wintering or concentration area for raptors, perhaps of similar importance to the Mitchell Grass Downs of central Queensland.

INTRODUCTION

This paper reports the results of a dedicated raptor survey conducted during a road transect from west to east across the wet-dry tropics of northern Australia in 2006. The purpose of the project was to sample the relative abundance of raptors in the continent's wet-dry tropics during the early dry season (winter), and to compare the results with those obtained in the nation-wide 'Birds of Prey Watch' (BOP Watch) scheme conducted from 1986 to 1990 (Baker-Gabb and Steele 1999).

Australian diurnal raptors, with some exceptions, are relatively conspicuous species that can be readily detected while driving along roads at normal speeds. For this reason vehicle-based surveys may be considered suitable for the broadscale measurement of relative abundance in the majority of raptor species, particularly in open (i.e. non-forested) environments (e.g. Baker-Gabb and Steele 1999; Gosper 2007).

SURVEY ROUTE

The survey was conducted between Wyndham, in the east Kimberley of Western Australia, and the Newcastle Range, east of Georgetown in Queensland's eastern Gulf Region. The route passed through Kununurra, Timber Creek, Katherine, Daly Waters, Cape Crawford, 'Brunette Downs', 'Alexandria', Camooweal, Mt Isa, Cloncurry, (south of) Normanton and Croydon. Apart from two sectors, Wyndham to Kununurra and the Ranken Stock Route on the Barkly Tableland, the route followed highways (sealed roads). The survey was carried out during the second (return) 'leg' of a trip from Atherton to Wyndham. The first 'leg' differed from the survey route in that it followed the Barkly and Stuart Highways along the southern and western edges of the Barkly Tableland (i.e. via Barkly Homestead and Elliot), and included a side trip north from Katherine to Darwin via the Kakadu and Arnhem Highways.

The region traversed lies between 14° and 21° S, and 128° and 144° E. In general terms the landscape is flat, climate is wet-dry tropical to semi-arid and the vegetation open woodland and grassland (Table 1). Although it was early dry season, the effects were evident of a late wet season caused by the passage

of tropical cyclones 'Larry' and 'Monica' across northern Australia in late March and late April 2006 respectively. Most watercourses still carried surface water and grasslands retained a good coverage of herbage.

In 2006 there was a sharp contrast in rainfall patterns across the continent. Northern Australia, including all areas traversed in the survey (together with inland Western Australia), received above to well above average precipitation associated with a heavy and extended monsoon. The south-east of the continent was in drought and experienced its second driest year on record, continuing the long-term rainfall deficiencies in many regions, some of which had persisted for more than five years (Bureau of Meteorology 2007).

METHODS

Survey methods adopted were those used for the nation-wide 'BOP Watch' scheme (Baker-Gabb and Steele 1999). Raptors were counted over 12 consecutive days from 17 to 28 June 2006, during which a distance of 3024 kilometres was travelled. Vehicle speeds averaged 80–85 kilometres per hour on highways, less than 60 kilometres per hour in built up areas and 45–50 kilometres per hour on unsealed roads. All travel was in daylight hours between 0900 hours and 1800 hours local time. Conditions were warm and dry throughout with no rain. Only one fire was encountered (near Timber Creek).

There were three observers in the vehicle. Raptors were counted while driving only (i.e. unaided vision from a moving vehicle). Individuals that could not be identified (usually at limit of vision) were not scored. Brown Goshawks *Accipiter fasciatus* and Collared Sparrowhawks *A. cirrocephalus* could not be separated in some situations, and such individuals are included in the results as a separate grouping. A GPS was used to monitor position, with date, time, location (by one degree block) and distance travelled in each sector of the trip recorded. Counts of raptors in built up areas associated with towns (eight towns with a population > 200) were also recorded as a sub-set of totals. Records were also kept of raptors seen during stops (and of less common species during the first leg of the trip) but these are not included in survey statistics.

TABLE 1

General descriptions of the biogeographical zones traversed during the study (after Baker-Gabb and Steele 1999).

Zone	General Description
Derby	Tropical climate; savanna of mixed open woodland and grassland
Lake Argyle	Tropical monsoon climate; grassland with scattered trees
Katherine	Tropical monsoon climate; open woodland with grass understorey
Wallhollow	Tropical climate; low open woodland with grass understorey
Barkly	Semi-arid tropical climate; grassland with some low open woodland
Boulia	Semi-arid climate; grass downs and open low woodland
Burketown	Tropical monsoon climate; woodland and grassland
Croydon	Tropical monsoon climate; woodland and grassland

TABLE 2

Count totals and overall recording rate (in terms of birds / 100 km) of diurnal raptors observed during a 3 024 km transect by vehicle across northern Australia in June 2006.

Species	Count total	Raptors / 100 km
Black-shouldered Kite <i>Elanus axillaris</i>	5	0.17
Square-tailed Kite <i>Lophoictinia isura</i>	1	0.03
Black-breasted Buzzard <i>Hamirostra melanosternon</i>	8	0.26
Black Kite <i>Milvus migrans</i>	605	20.01
Whistling Kite <i>Haliastur sphenurus</i>	182	6.02
White-bellied Sea-Eagle <i>Haliaeetus leucogaster</i>	2	0.07
Spotted Harrier <i>Circus assimilis</i>	7	0.23
Brown Goshawk <i>Accipiter fasciatus</i>	5	0.17
Collared Sparrowhawk <i>A. cirrhocephalus</i>	3	0.10
<i>Accipiter</i> sp. (Goshawk / Sparrowhawk)	3	0.10
Wedge-tailed Eagle <i>Aquila audax</i>	29	0.96
Brown Falcon <i>Falco berigora</i>	152	5.03
Australian Hobby <i>F. longipennis</i>	6	0.20
Grey Falcon <i>F. hypoleucos</i>	2	0.07
Nankeen Kestrel <i>F. cenchroides</i>	165	5.45

For the purposes of data collection and analysis the broad biogeographical zones used by Baker-Gabb and Steele (1999) are also used here. The survey route traversed eight of these zones (Tables 1 and 3), although it passed through only the extreme eastern and northern sections of the Derby and Boulia zones respectively.

RESULTS

A total of 1175 raptors of 14 species was recorded over a distance of 3024 kilometres (Table 2). A further five species were recorded during stops: Brahminy Kite *Haliastur indus* and Grey Goshawk *A. novaehollandiae* – Derby; Peregrine Falcon *Falco peregrinus* – Lake Argyle; Swamp Harrier *Circus approximans* – Katherine and Black Falcon *F. subniger* – Barkly.

The overall recording rate (all species combined) for the duration of the survey was 38.9 birds per 100 kilometres. In two biogeographic zones, Derby and Barkly, scores of greater than 65 birds per 100 kilometres were obtained, approximately double that recorded in the other six zones (Table 3).

Five species, Black Kite *Milvus migrans*, Whistling Kite *Haliastur sphenurus*, Wedge-tailed Eagle *Aquila audax*, Brown Falcon *F. berigora* and Nankeen Kestrel *F. cenchroides*, comprised 96 per cent of all raptors counted (Table 2). Excluding the Nankeen Kestrel, which was not detected in Katherine, these were the only species recorded from all zones (Fig. 1).

Black Kites were the most abundant raptors in all zones except Barkly, and comprised just over half (51%) of all raptors counted (Table 2). Scores in the range of 15 – 21 birds per 100 kilometres were obtained in all zones except Derby (49.0 birds / 100 km) and Barkly (4.8 birds / 100 km) (Fig. 1).

Whistling Kites comprised 15 per cent of raptors counted. Recording rates (range 2.6 to 9.1 birds / 100 km) were lowest in the more arid zones of Barkly, Wallhollow and Boulia (Fig. 1).

The Wedge-tailed Eagle was widely distributed at low densities. A mean recording rate of slightly less than 1.0 bird per 100 kilometres (range 0.25 birds / 100 km in Lake Argyle to 1.99 birds / 100 km in Derby) was obtained (Fig. 1).

TABLE 3

Summary of raptor recording rates (all species combined) by biogeographical zone during June 2006, together with comparative values obtained during the 'Bird of Prey Watch' scheme (Baker-Gabb and Steele 1999).

Biogeographical Zone*	Distance (km)	Raptors (species)	Raptors (total)	Raptors (per 100 km)	Raptors (per 100 km / winter 1986-90*)
Derby	251	10	166	66.14	15.3
Lake Argyle	401	9	110	27.43	11.3
Katherine	450	5	143	31.78	14.2
Wallhollow	665	10	201	30.23	11.8
Barkly	417	10	282	67.63	9.4
Boulia	221	7	67	30.32	33.3
Burketown	274	6	96	35.04	42.8
Croydon	345	7	110	31.88	23.7
Total	3024		1175		

*after Baker-Gabb and Steele 1999

Brown Falcons comprised 13 per cent of raptors, with an overall score of 5.0 birds per 100 kilometres. However, more than half was observed in just one zone, Barkly, where falcons were encountered at a rate of greater than 19 birds per 100 kilometres (Fig.1) and were the second most plentiful bird of prey present.

Nankeen Kestrels comprised 14 per cent of raptors overall but were recorded infrequently (mostly < 1.0 bird / 100 km) in all areas except Barkly where it was the most numerous raptor (Fig. 1). In this zone, where much of the survey route followed the Ranken Stock Route (between its intersections with the Tablelands and Barkly Highways), and then the Barkly Highway to the Northern Territory – Queensland border, kestrels were encountered at a rate of 36.9 birds per 100 kilometres.

Recording rates for all other species were less than 0.5 birds per 100 kilometres (Table 2). Of these, the Black-breasted Buzzard *Hamirostra melanosternon* was the most frequently observed, being recorded at six locations during the survey proper, and at an additional nine sites at other times during the trip. All locations were in the Northern Territory.

Four raptor species, Black-breasted Buzzard, Black Kite, Whistling Kite and Wedge-tailed Eagle, were noted feeding on road-killed animals.

DISCUSSION

The number of species detected (14) falls within the range of species' totals (13–20) reported for the relevant zones during the five-year 'BOP Watch' (Baker-Gabb and Steel 1999). If additional species recorded during stops are included, the total is 19. Given that this was a 'one-off' project that sampled one month in one season only, the range of species recorded is within expectations.

Relative abundance scores for the two most abundant raptors, Black Kite and Whistling Kite, were higher over most (or all) zones compared with the corresponding winter scores obtained during the 'BOP Watch'. The distribution of Black

Kites was consistent with their known association with human habitation, particularly in the tropics, where they are less common away from towns (Marchant and Higgins 1993). Kites were widely distributed but tended to be concentrated around settlements, with a score of greater than 300 birds per 100 kilometres obtained in town areas en route.

This survey establishes the importance, at least in some years, of the Barkly Tableland for wintering Nankeen Kestrels and Brown Falcons. On the 417 kilometres sector through Barkly (via one degree blocks 18 / 135, 18 / 136, 19 / 136, 19 / 137 and 20 / 137), 154 Kestrels and 81 Falcons were counted. The resultant recording rates of 36.9 birds per 100 kilometres and 19.4 birds per 100 kilometres for kestrels and falcons respectively (Fig. 1) contrasts with the winter rates of less than 1.0 bird per 100 kilometres reported for both species during the 'BOP Watch'. Extrapolation of these figures suggests that their populations on the Tableland at the time of the survey would have numbered in the thousands.

Kestrels are known to be partially migratory, with northward movements in winter. In addition to more or less regular seasonal movements, nomadic (random) movements into areas of unpredictable, high food availability (e.g. associated with locust or mouse outbreaks) also occur (Olsen and Olsen 1987). Brown Falcons in arid and semi-arid zones also demonstrate population shifts northward in winter, and may show short-term influxes in response to availability of food (Marchant and Higgins 1993; Olsen 1995). It seems probable that both species were concentrated in the largely treeless grasslands of the Barkly Tableland. Plausibly, this was in response to an abundance of prey, linked to the effects of the late wet season.

Black-breasted Buzzards were recorded in all Top End zones traversed. An overall recording rate for these zones of slightly above 0.4 birds per 100 kilometres was higher than autumn - winter scores obtained during the 'BOP Watch'. It provides further evidence of a suspected northward shift in part of the population in winter (cf. Marchant and Higgins 1993; Olsen 1995; Barrett *et al.* 2003).

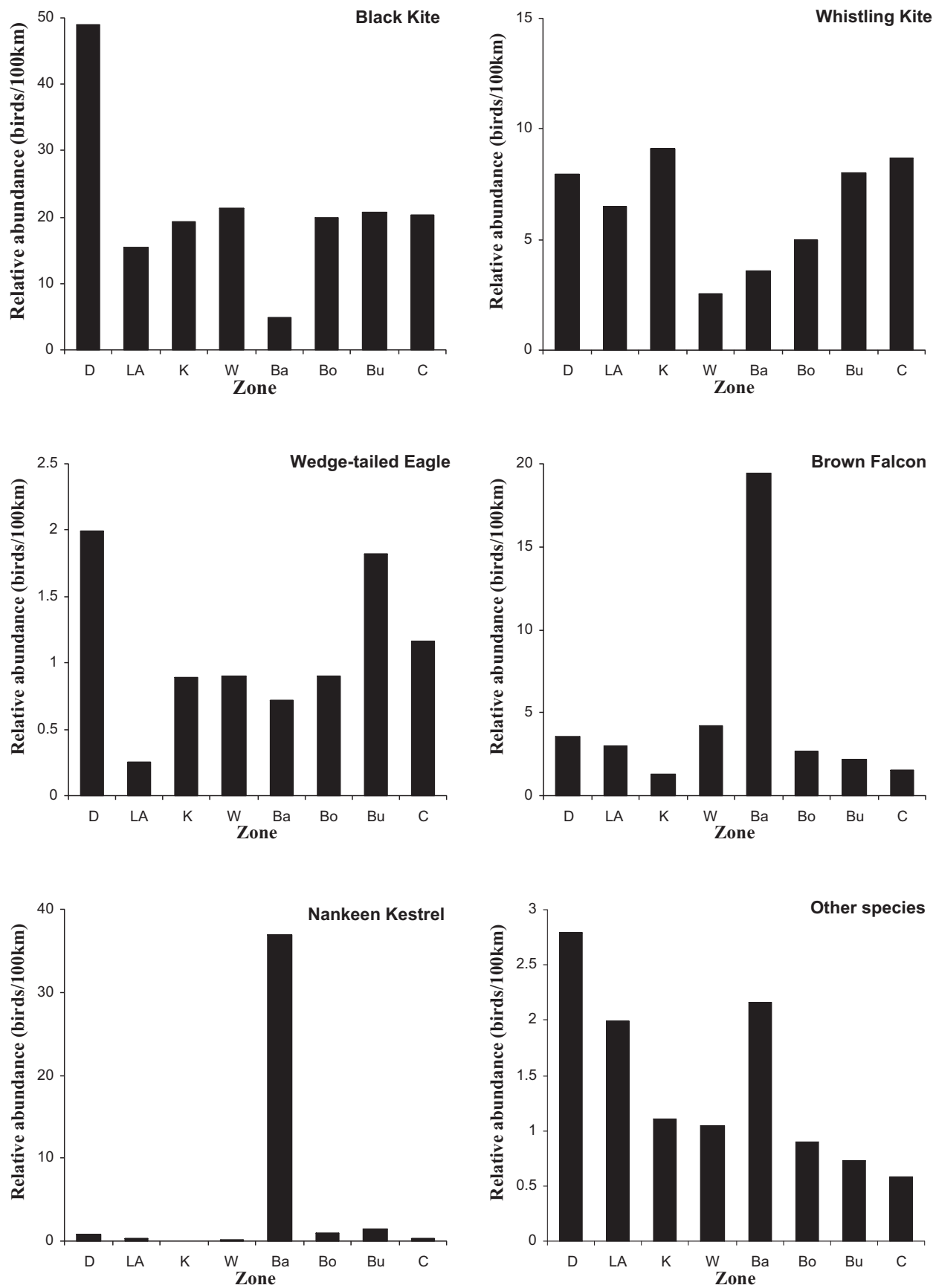


Figure 1. Relative abundance (birds / 100 km) of diurnal raptors in eight biogeographic zones in northern Australia. Zone codes: D = Derby; LA = Lake Argyle; K = Katherine; W = Wallhollow; Ba = Barkly; Bo = Bouli; Bu = Burketown; C = Croydon.

Recording rates for all other species were within or marginally higher than the ranges of 'BOP Watch' winter scores. Small numbers of Spotted Harriers *Circus assimilis* were recorded from the grasslands of Barkly and Wallhollow, although none was recorded during winter surveys of these zones during the 'BOP Watch'. On the other hand no Black Falcons were recorded whilst travelling but were twice observed during stops on the Barkly Tableland. During the 'BOP Watch' this species was reported at low frequencies (< 0.1 birds / 100 km) in winter in Barkly. No Little Eagles *Hieraaetus morphnoides* were detected during the survey proper, with a single bird only recorded at Attack Creek (19 / 134 – Ammaroo) for the entire trip. Some elements of the population are thought to move to northern Australia in the winter dry season (Marchant and Higgins 1993; Olsen 1995; Barrett *et al.* 2003), and during the 'BOP Watch' it was reported in low densities (0.1 – 0.25 birds / 100 km) in autumn-winter in most of the zones traversed.

The behaviour of Brown Goshawks and Collared Sparrowhawks makes them difficult to locate from a moving vehicle, even in open country (Olsen 1995; pers. obs.), and few were detected. However, when stops were made at bores and watercourses, notably on the Barkly Tableland, individuals of one species or the other were flushed from fringing shrubbery or trees sufficiently often to indicate that the survey results are likely to underestimate their abundance.

Although overall recording rates (all raptors) obtained in the zones in the Queensland Gulf Region (Burketown, Croydon and Boulia) were similar to winter rates reported during the 'BOP Watch' for these zones, values for zones across the Northern Territory were higher by a factor of two to seven (Table 3). Scores obtained in Derby and Barkly (66.1 and 67.6 birds / 100 km respectively) were well in excess of the highest rates of 48.8 birds per 100 kilometres (Burketown / autumn) and 44.8 birds per 100 kilometres (Darwin / winter) derived from 'BOP Watch' data (Baker-Gabb and Steele 1999). These exceptional scores may be an artefact of the short duration of the survey, and its coincidence with atypical seasonal conditions and an associated temporary increase in food availability. The influence on raptor movements of the severe, multi-year drought conditions affecting the south-eastern third of the Australian continent is unknown, but may also have been a factor contributing to increased concentrations of some species in the Top End in June 2006.

Baseline data gathered some 15–20 years earlier during the 'BOP Watch' found that the greatest density of raptors occurred in the north of Australia from April to July. The 'snapshot' of raptor relative abundance provided here is consistent with that finding. Recording rates provide evidence of stable raptor numbers, with concentrations in some zones, notably in the Top End of the Northern Territory, even being greater than previously reported. The survey also shows the tussock grasslands of the Barkly Tableland form a wintering or concentration area for raptors, perhaps of similar importance to the Mitchell Grass Downs of central Queensland identified by Baker-Gabb and Steele (1999). Longer-term studies are needed to properly evaluate the significance of the Barkly Region for raptor populations.

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