

ARTICLES

Results of a pilot survey of raptors in Dzanga-Sangha Special Reserve, Central African Republic

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Abstract

Raptor surveys were conducted in Dzanga-Sangha Special Reserve including Dzanga-Ndoki National Park, over a five-week period between 5 February and 15 March 2011. Raptors were surveyed through observations at vantage points and by conducting walking and river transects. The majority of raptors were observed opportunistically outside of formal surveys. Details of the 20 raptor species observed are presented. Using set abundance categories, our results suggest that two raptor species are “common”, with one to ten individuals seen in suitable habitat every day; African Harrier Hawk and Palm Nut Vulture. The majority of species were either “uncommon”, with only a few individuals recorded during the survey period, or “rare”, with only one or two records during the survey period. It is recognised that it is not possible to obtain an accurate figure of the density of every species of raptor in a tropical forest within a short time, due to the difficulties in effectively censusing forest birds with low population densities. There is much to be learnt about Dzanga-Sangha’s raptors, and further study would almost certainly uncover new and exciting knowledge.

Introduction

The Congo Basin is one of the poorest regions in the world but harbours one of the world’s most diverse forests. Unfortunately it is also a highly threatened ecosystem, with commercial logging, land clearance for subsistence ag-

riculture, and widespread civil strife causing habitat loss across the region (Blom 2001).

As large, predatory birds with extensive home ranges, birds of prey are extremely sensitive to habitat fragmentation (Thiollay 1988). Information on raptor abundance in tropical forests is sparse and even information on the life histories and behaviour of most rainforest raptor species are very poorly known, if at all (Thiollay 1985a,b, 1989). There are still few studies of the long-term dynamics of a complete raptor community, least of all in the tropics (Thiollay 2000).

Raptors tend to be highly sensitive to prey availability, vegetation structure, pollution, and human disturbance and thus are good indicators of environmental changes (Newton 1979). Further, specialist raptors in rainforests might be among the most sensitive raptors to habitat disturbance (Julien and Thiollay 1996). Since raptors offer themselves as effective barometers of the health of ecosystems, a sound understanding of the Congo Basin's forest raptors could help in conservation and management planning in the world's second largest tropical rainforest.

The primary aim of this survey was to increase knowledge of raptors in the Central African rainforests. Very little raptor research has been carried out previously in Dzanga-Sangha, so it was hoped that this short study would be a first step in gaining an understanding of the status of raptors in the area, and a knowledge base upon which future longer-term research could be based.

Materials and Methods

Study area

The Dzanga-Sangha Special Reserve (4 000 km²) is located in the rainforest in the south-western corner of the Central African Republic (CAR) (Figure 1). The two central parts of the reserve, the Dzanga and Ndoki Sectors, constitute the Dzanga-Ndoki National Park, which covers 1 200 km² (Blom 2001). This dense forest region has a very low human population with only one person per km² (Blom 2001) and is the traditional home of the BaAka people (Green and Carroll 1991).

Parts of Dzanga-Sangha were selectively logged in the 1970s and 1980s and, as a result, the forest structure is a mixture of primary and secondary forest (Remis 1997; Dowsett 2001). In several areas in Dzanga-Sangha, outside the

National Park, patches of savanna exist, mostly where human activities such as village clearing and slash and burn agriculture take place (Blom 2001). There are several different types of forest, including the mono-dominant *Gilbertiodendron dewevrei* forest (Dowsett 2001), known locally as “Malapa” forest, which grows on slopes along watercourses and has a sparse understorey (Fay 1989; Green and Carroll 1991). There is also a forest with a dense understorey of thick herbaceous growth but a discontinuous canopy, locally called “Ebuka” forest (Blom 2001).

Dzanga-Sangha contains many natural forest clearings along streams, called “bai” or “bais” (Dowsett 2001). These areas are swampy, containing short vegetation, and are important grazing areas for mammals such as African Forest Elephants and Bongo antelopes (Blom 2001; Green and Carroll 1991).

Over 700 species of birds have been recorded in the Central African Republic (Dowsett, 2001). At least 357 bird species have been recorded in Dzanga-Sangha (Dowsett, 2001), including 27 diurnal raptors, and six owl species (Dzanga-Sangha online bird list <http://www.dzanga-sangha.org/node/322>).

Survey methods

Birds of prey are notoriously difficult to survey in tropical forests, especially in tall, dense, large unbroken tracts of lowland forest (Thiollay 1989). They are particularly difficult to census accurately due to the lack of standardized methodology, low population densities, large territory sizes, and inconspicuous behaviour (Thiollay 1989; Robinson 1994), and methods employed to survey other bird species in tropical forests are not suitable for large, diurnal raptors (Lloyd 2004).

We carried out surveys of forest raptors in the heart of Dzanga-Sangha Special Reserve, including Dzanga-Ndoki National Park, over a five-week period between 5 February and 15 March 2011. Since no standard methodology for surveying raptors in tropical rainforest exists (Thiollay 1988, 1989), we incorporated methods from a variety of similar studies in African forests (Thiollay 1985b; Angehr et al. 2005; Buij 2008; Olmos and Turshak 2009), and further afield (Thiollay 1988, 2002; Robinson 1994).

The most common survey method employed was line transects carried out on foot (Thiollay 1985b; Robinson 1994; Thiollay 2002; Buij 2008). We walked

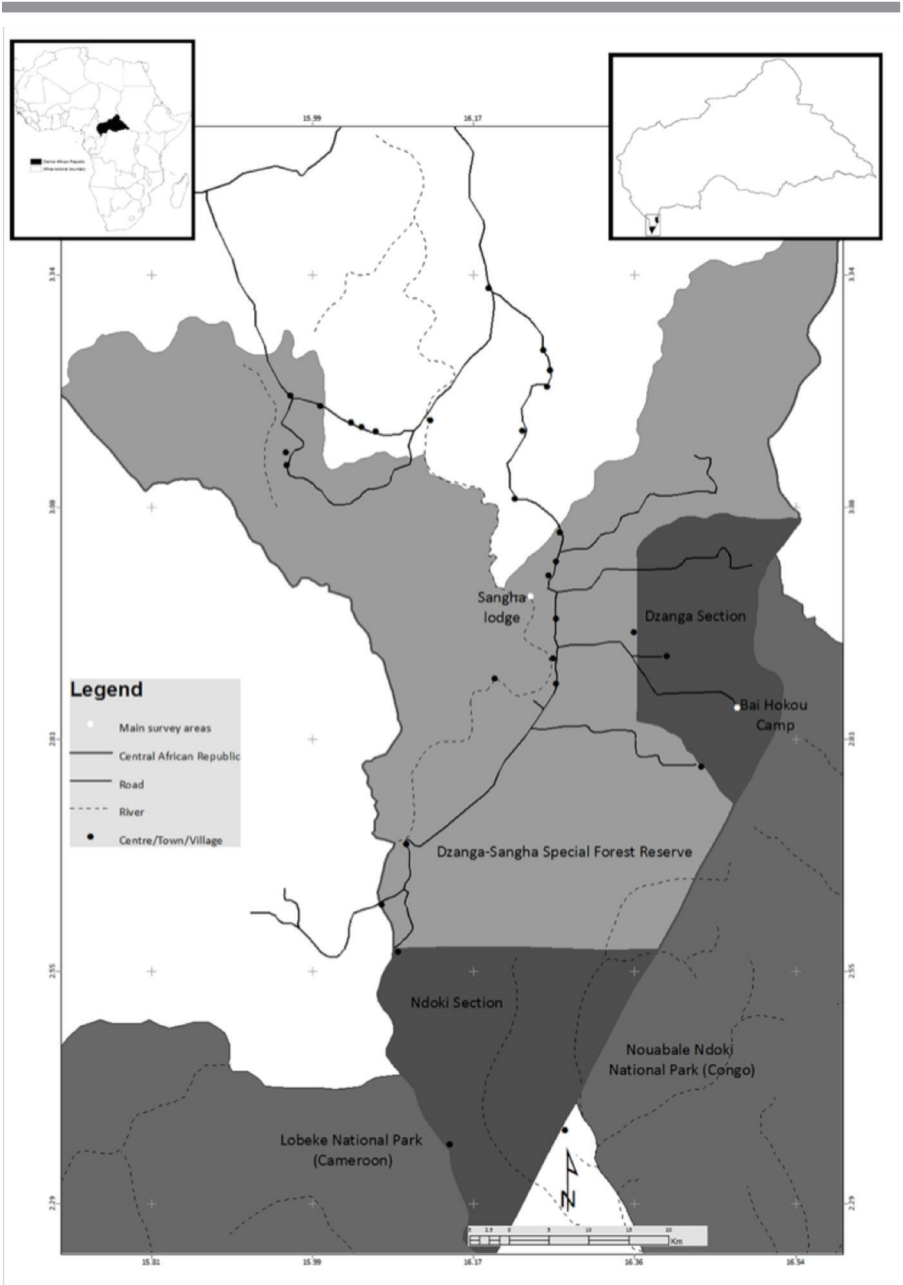


Figure 1. Map of Dzanga-Sangha Special Reserve.

transects through a range of habitats, using abandoned logging roads, paths used by local people, and major elephant trails. We were not permitted to cut new trails within the forest. Transects were usually 3 km in length and were walked at around 1 km per hour (following Thiollay 2002) with frequent visual scans of the surrounding habitat. Five minute pauses were made in areas with good visibility, to scan for soaring raptors or birds perched on forest edges (following Thiollay 1985b). We aimed to carry out each transect twice (morning and afternoon), in an opposite direction each time (following Thiollay 2002). We surveyed during all parts of the day to cover potentially different activity patterns by different species in the raptor community.

Bais often provided us with open areas to view the sky in otherwise unbroken dense rainforest. They also provided extensive areas of forest edge to scan for perched raptors. Near Bai Hokou forest camp, we walked transects through a number of bais, and the forest between them, in a “join the dots” fashion, similar to Thiollay (2002), pausing for 15 to 30 minutes in bais to scan the sky and forest edges (following Thiollay 1985b).

Some areas of forest through which line transects were carried out were extremely dense, making raptors in the canopy very difficult to see. In these instances we occasionally incorporated call-playback at points along some transects, using Chappuis (2000) *African Bird Sounds* CDs. Calls were played through a small speaker attached to a laptop computer for one minute followed by five minutes of “listening time”.

In dense rainforest, rivers provide a useful break in the canopy and an extensive area of forest edge where raptors may be seen perching, so they serve as useful survey routes (Robinson 1994; Buij 2008). We carried out river transects on the Sangha River, which were very similar in methodology and speed to the line transects on foot, but were carried out using a wooden dug-out paddle canoe, or pirogue.

Following Thiollay (1988), we carried out a series of vantage point watches from rare areas of elevation in the otherwise flat terrain, such as elevated stretches of river bank or the top of waterfalls. Vantage point watches were three hours in duration, during which time the surveyors made frequent scans of the top of the forest canopy for raptors breaking the surface, the sky, and forest edges.

We also carried out vantage point watches from the ground in large bais, following Thiollay (1988). Although not elevated, these large bais gave the best

view of the sky from otherwise closed-canopy forest. Some of the baies within the National Park have viewing platforms (miradors) which made useful elevated vantage points, giving us excellent raised positions.

Following Thiollay (1988), we also carried out watches within more open areas within the forest to attempt to locate raptors such as accipiters, which are mostly seen sitting amongst foliage in the forest understorey or making short flights between perches. Malapa forest was ideal for this, with its tall trees and more open understorey, making longer observation distances possible (Fay 1989).

Because of the presence of African Forest Elephants, and following advice from local researchers and National Park authorities, surveys of nocturnal raptors had to be limited to forest camp clearings using call-playback surveys of seven owl species. These were carried out between sunset and one hour after when many owl species come out to feed and begin to call.

In addition to all the methods listed above, we also recorded all casual sightings of raptors and six casual records were given to us by R and A Cassidy of Sangha Lodge, and were of raptors seen or heard by them during the survey period.

For each raptor seen or heard, we recorded the species, number seen, age, behaviour, location (a description and GPS location using a Garmin Etrex GPS), and habitat.

Results

We completed 118 hours of raptor surveys and identified 226 individuals in 198 separate records. Vantage point surveys were the most productive, but the majority of raptors were observed opportunistically outside of surveys (Table 1).

We walked or paddled a total of 103 km of transect, which represents the total distance travelled, rather than the total transect length, as many transects were repeated. Raptors showed a similar abundance inside compared to outside the National Park, when corrected for differences in distance surveyed (Table 2).

Table 1. Effectiveness of different survey methods for forest raptors.

Method	Number of raptors observed	Time spent (hr)	Individuals/hour
Opportunistic sightings	97		
Vantage point	85	46	1.8
Walking transect	38	61	0.6
River transect	6	11	0.5

Table 2. Raptor abundance inside and outside Dzanga-Ndoki National Park, CAR (using transect data).

Location	Number of raptors observed	Distance surveyed (km)	Individuals/km
Inside national park	13	28	0.46
Outside national park	31	75	0.41

We recorded 20 different species of raptor during our time in Dzanga-Sangha.

Because of the limitations and short duration of the survey, we decided to use broad categories describing the frequency of observation following Buij (2008):

- Common:** 1–10 seen in suitable habitat each day
- Frequent:** often seen but not every day
- Uncommon:** only a few records during the survey period or restricted to only one or two sites
- Rare:** only one or two records during the survey period

Two raptor species, Palm Nut Vulture *Gypohierax angolensis* and African Harrier Hawk *Polyboroides typus*, commonly occurred both inside and outside the park. All other species were more often recorded, or entirely recorded, either inside or outside the park (Table 3).

Table 3. Likelihood of observing 20 different species of raptor inside and outside Dzanga-Ndoki National Park, CAR.

Species	Likelihood of observation	
	Inside park	Outside park
Black Kite <i>Milvus migrans</i>	not recorded	common
African Fish Eagle <i>Haliaeetus vocifer</i>	rare	not recorded
Palm Nut Vulture <i>Gypohierax angolensis</i>	common	common
Bat Hawk <i>Macheiramphus alcinus</i>	rare	uncommon
African Harrier Hawk <i>Polyboroides typus</i>	common	common
Lizard Buzzard <i>Kaupifalco monogrammicus</i>	not recorded	frequent
African Cuckoo Hawk <i>Aviceda cuculoides</i>	not recorded	uncommon
Long-tailed Hawk <i>Urotriorchis macrourus</i>	rare	not recorded
Black Sparrowhawk <i>Accipiter melanoleucus</i>	not recorded	rare
African Goshawk <i>Accipiter tachiro toussenelii</i>	not recorded	uncommon
Cassin's Hawk Eagle <i>Aquila africana</i>	frequent	rare
Congo Serpent Eagle <i>Dryotriorchis spectabilis batesi</i>	rare	not recorded
African Crowned Eagle <i>Stephanoaetus coronatus</i>	frequent	uncommon
Grey Kestrel <i>Falco ardosiaceus</i>	not recorded	rare
African Wood Owl <i>Strix woodfordii</i>	frequent	frequent
Vermiculated Fishing Owl <i>Scotopelia bouvieri</i>	uncommon	rare
Fraser's Eagle Owl <i>Bubo poensis</i>	not recorded	uncommon
Akun Eagle Owl <i>Bubo leucostictus</i>	rare	not recorded
Sandy Scops Owl <i>Otus icterorhynchus holerythrus</i>	not recorded	rare
Red-chested Owlet <i>Glaucidium tephronotum</i>	rare	not recorded

By far the most common species was African Harrier Hawk with a total of 71 records.

Another seven species were reasonably common, with more than ten records each; Palm Nut Vulture *Gypohierax angolensis* (25 records), Black Kite *Milvus migrans* (21 records), African Crowned Eagle *Stephanoaetus coronatus* (18 records), African Wood Owl *Strix woodfordii* (16 records), Cassin's Hawk Eagle *Aquila africana* (16 records), Lizard Buzzard *Kaupifalco monogrammicus* (14 records), and Vermiculated Fishing Owl *Scotopelia bouvieri* (14 records).

Less common species, with six or less records, were African Cuckoo Hawk *Aviceda cuculoides* (six records), Bat Hawk *Macheiramphus alcinus* (six records), African Goshawk *Accipiter tachiro toussenelii* (four records), Fraser's Eagle Owl *Bubo poensis* (four records), Congo Serpent Eagle *Dryotriorchis spectabilis batesi* (three records), Long-tailed Hawk *Urotriorchis macrourus* (two records).

Six species were recorded only once; African Fish Eagle *Haliaeetus vocifer*, Akun Eagle Owl *Bubo leucostictus*, Black Sparrowhawk *Accipiter melanoleucus*, Grey Kestrel *Falco ardosiaceus*, Red-chested Owlet *Glaucidium tephronotum*, and Sandy Scops Owl *Otus icterorhynchus holerythrus*.

For the 13 species which were recorded on formal surveys, a simple measure of the frequency of encounter (individuals per hour) was made (Figure 2).

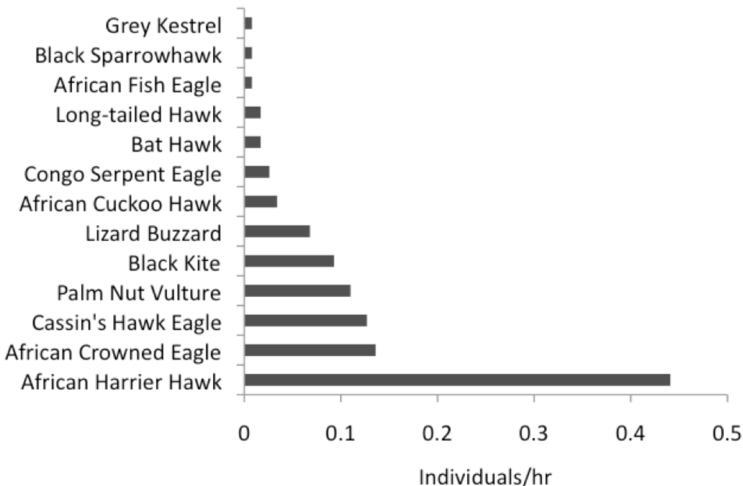


Figure 2. Species observed during formal surveys in Dzanga-Sangha Special Reserve and Dzanga-Ndoki National Park, CAR. Frequencies are based on 118 hrs of observation.

More detailed information about each of the 20 species observed is given below.

Black Kite *Milvus migrans*

Kites were seen regularly in flight over human habitation and farmbrush areas, being most common around the village of Bayanga. Of the 21 individuals recorded, the majority were seen near modified habitats and all but three were recorded outside the National Park. This species was not always identified to race, but those that were identified were African race birds.

African Fish Eagle *Haliaeetus vocifer*

A single adult was seen gliding high above Bai Hokou in the National Park on 26 February. This was the only record for this species. In Gabon, Buij (2008) observed African Fish Eagles in rivers and lagoons but, while this species is present within the Dzanga-Sangha area, they are seldom, if ever, seen along the Sangha River and tend to be more associated with bays (R. Cassidy, pers. comm.).

Palm Nut Vulture *Gypohierax angolensis*

This was a commonly seen species in more natural habitats such as rainforest and rainforest edge, with only one sighting in a modified habitat (a pair soaring high over Bayanga village). Single birds were regularly recorded flying up and down the river close to Sangha Lodge (presumably one or perhaps two individuals), or soaring high over the forest within the National Park and throughout the Special Reserve. Most records were of single birds, with a handful of pairs seen together. Only one immature bird was recorded near Mongambe forest camp in the National Park.

Bat Hawk *Macheiramphus alcinus*

Four out of the six sightings of this crepuscular species were seen at sunset, just after birds had left their daytime roosts in search of prey. Only one of the six records came from inside the National Park; the rest were recorded at or near Sangha Lodge. On 8 February a single bird was observed over Sangha Lodge at 05:57 heading back into the forest, presumably going to roost. On 13 March a single Bat Hawk was recorded flying low over the forest canopy near Sangha Lodge at 09:42, giving two very brief examples of display flight - very quickly flapping and quivering the wings while gliding over the tree tops. On nights when they were seen, their time of emergence tended to vary,

suggesting that they may alter the time that they leave their day roost and/or the area in which they hunt, rather than habitually following the same pattern each night.

African Harrier Hawk *Polyboroides typus*

This was by far the most common raptor encountered during the survey. Harrier Hawks were seen in every type of habitat, including dense rainforest, forest edges, bais, farmbush, rivers, and areas of human habitation, suggesting that they are raptors that have adapted to a range of habitats in this area. Individuals were almost always recorded in flight, except two occasions when a bird was seen perched in a tree. Immature birds were seen as frequently as adult birds, and pairs were seen often (on one occasion, three adults were seen flying together). We recorded birds conducting aerial displays on four occasions; single birds displaying three times on 11 February, 11 March and 12 March, and a pair displaying together on 14 March. In all cases, aerial displays were seen over areas of forest or forest edge, and consisted of fluttering wings, followed by swoops up and down (though not as pronounced as in the African Crowned Eagle) and frequent calling.

Lizard Buzzard *Kaupifalco monogrammicus*

This typical savanna-dwelling species was locally common within areas of farmbush and recently felled/burned areas within the Special Reserve, which presumably mimic savanna conditions in this part of Africa. This is in keeping with findings in nearby Gabon in a study by Buij (2008), where lizard buzzards were seen in areas of grassland and scrub within the forest, and Angehr et al. (2005) where a single bird was seen in a small area of savanna habitat. In our survey, all but one record were of single birds, mostly perched on dead trees or burnt stumps searching for prey. On 6 February a pair was observed soaring together over farmbush north of Bayanga village. This species was often heard calling.

African Cuckoo Hawk *Aviceda cuculoides*

This species was seen infrequently and was only observed within the Special Reserve, never within the National Park. It was sometimes recorded being quite vocal while in flight over the forest canopy, as also observed by Dowsett-Lemaire (2012). On 11 February a single bird was observed flying and calling repeatedly over forest edge and farmbush and a single bird was seen calling over the forest close to the National Park boundary on 8 March.

On 12 February a pair was observed displaying over the forest to the south of Sangha Lodge. On 6 February an immature bird was recorded mobbing an African Harrier Hawk over farmbrush and scattered trees.

Long-tailed Hawk *Urotriorchis macrourus*

Despite attempts to gain responses from Long-tailed Hawks through call-playback within the National Park, this species was only heard calling on two occasions, neither in response to call-playback. The first record was of an adult bird heard calling from the mirador at Dzanga Bai on 19 February late in the morning. The second record was of a single adult bird calling mid-morning on 3 March near Mongambe camp in the National Park.

Black Sparrowhawk *Accipiter melanoleucus*

One adult was seen gliding over the forest and river south-west of Sangha Lodge on 12 February. This was the only recorded sighting of this species during the survey. The only sighting of Black Sparrowhawk made previously in that area was a single bird seen by R. Cassidy across the river from Sangha Lodge in primary forest (pers. comm.).

African Goshawk *Accipiter tachiro toussenelii*

We obtained four records of this species. A single adult was observed perching in dense foliage on 8 February close to the Sangha Lodge access track, and single birds were heard calling early in the morning from Sangha Lodge on 19 and 28 February and 1 March by R. Cassidy, while we were in the National Park.

Cassin's Hawk Eagle *Aquila africana*

All but one of the 16 sightings of this species occurred inside the National Park. The only record from the Special Reserve was on 5 February as we boarded the plane in Bayanga and saw a single bird circling over the forest edge and farmbrush close to the end of the landing strip. All other sightings were either of pairs or single birds, mainly soaring over primary forest, often close to bays. On 24 February we witnessed an adult pair soaring over Bai Debwe, near Bai Hokou camp, before conducting a brief display involving talon grappling while being mobbed by a large flock of swifts. In Gabon, Buij (2008) saw two adults displaying above the forest canopy in October, describing the display as “a series of deep dives on closed wings interspersed with upward swoops on spread wings, accompanied by loud “keeyep” calls, and

circling with wings held in a deep V". Display such as this was not witnessed in Dzanga-Sangha, but, on 22 February we did witness an adult pair circling together and calling repeatedly, which might suggest territorial display.

Congo Serpent Eagle *Dryotriorchis spectabilis*

Congo Serpent Eagle was heard responding to call-playback twice, once close to Bai Hokou on 27 February and once at Bakulangu on 28 February, both within the National Park. The only visual sighting was of a single bird in flight over the forest on the edge of the Sangha River on the 11 March. A single Congo Serpent Eagle has been seen on several occasions perched on top of a tall dead tree on the far bank of the river across from Sangha Lodge (R. Cassidy, pers. comm.).

African Crowned Eagle *Stephanoaetus coronatus*

Of the 18 African Crowned Eagle sightings made, all were observed deep within the National Park over dense forest or bays. Though we did not observe them outside the National Park, they have been seen near Sangha Lodge (R. Cassidy, pers. comm.) and are therefore probably better categorised here as "uncommon". Pairs were seen more frequently than single individuals, and they were often detected from their distinctive call while in aerial display. These display flights tended to be observed around late morning or midday. On 24 February a pair was recorded displaying over Bai Debwe, near Bai Hokou, and on 26 February a single bird was seen displaying to another non-displaying bird directly over Bai Hokou camp. On 2 March a pair was recorded displaying frequently over, and around the edges of, Mongambe Bai over a two and a half hour period. Display usually consisted of birds (usually the slightly smaller male) swooping up and down, on closed wings with feet hanging down, before opening wings and swooping back up calling repeatedly. Interestingly, we were told African Crowned Eagles are frequently observed following a troop of habituated Agile Mangabeys (*Cercocebus agilis*), which live in the forest near Bai Hokou camp (A. Todd, pers. comm.) and local trackers reported to us that they had seen birds taking monkeys and also forest antelopes.

Grey Kestrel *Falco ardosiaceus*

One adult observed perching on a tall dead tree in farmbrush between Sangha Lodge and Bayanga village was the only record for this species. A further

watch of this area was undertaken to ascertain whether or not a pair might be breeding there, but this species was not observed again. This was an unexpected species in this area and it may be that Grey Kestrels are benefiting from the increase in savanna-like (farmbush) habitat within the Dzanga-Sangha Special Reserve, much in the same way as Lizard Buzzard seems to have done, though this is purely speculative being based on the sighting of a single individual. Thiollay (2000) found an increase in the number of Grey Kestrels in Lamto Reserve in Ivory Coast between the 1970s and the 1990s as forest habitat decreased and open savanna increased.

African Wood Owl *Strix woodfordii*

This was the most commonly recorded nocturnal raptor. It was regularly heard calling from two of the three forest camps we stayed at within the National Park and heard once across the river from Sangha Lodge. On 23, 27 and 28 February a single owl was seen hunting in Bai Hokou camp, and on two of those nights an owl was observed perched on various camp buildings, which is reported to be a fairly common sight (M. Stoerger, pers. comm.). African Wood Owls are often heard calling around the small villages surrounding Bayanga village in the evenings (L. Sarno, pers. comm.).

Vermiculated Fishing Owl *Scotopelia bouvieri*

This was the second most commonly heard owl, with 14 separate records from two locations. On 15 and 16 March a single bird was heard calling close to Dzanga Bai camp. All other records came from within Sangha Lodge camp, or from the forest just surrounding it. The only record of more than one bird calling was on 6 March when one bird could be heard calling from the forest edge close to Sangha Lodge camp, while the other bird sat calling on the roof of our accommodation.

Fraser's Eagle Owl *Bubo poensis*

This owl was only recorded on four occasions and all were at Sangha Lodge. On 8 February an adult was observed roosting close to the river's edge, within 100 m of the Sangha Lodge boundary; the other three records were of birds heard rather than seen. This species may well be under-recorded in the area surrounding Sangha Lodge because of the generator used each evening. R. Cassidy told us that birds are known to come into camp at night occasionally once the generator has been switched off. Interestingly, no Fraser's Eagle

Owls were heard from the camps in the National Park, where other owls seemed to be fairly common/obvious.

Akun Eagle Owl *Bubo leucostictus*

On 4 March a single bird was heard calling several times on the edge of Dzanga Bai camp in the National Park. This species has not been officially recorded in Dzanga-Sangha but is likely to occur in the region in suitable habitat (R. Cassidy, pers. comm.), so it may well be that this species of owl is under-recorded. This species is reported to be fairly common in adjacent Nouabalé-Ndoki National Park in Congo (Dowsett-Lemaire 2006).

Sandy Scops Owl *Otus icterorhynchus holerythrus*

A single bird was heard calling around 04:00 on 14 February within Sangha Lodge grounds by R. Cassidy.

Red-chested Owlet *Glaucidium tephronotum*

One bird called briefly on 23 February close to Bai Hokou camp in the National Park at around 22:00. This was the only record for this species and was heard before call-playback was attempted.

The following two species have been recorded in the park, but were not recorded during our surveys.

Chestnut-flanked Sparrowhawk *Accipiter castanilius* – Not recorded

This species is easily missed due to its habit of perching unobtrusively amongst foliage for long periods (Kemp and Kemp 1998). Though not recorded during this survey, Chestnut-flanked Sparrowhawk has been previously recorded by Green and Carroll (1991).

Red-thighed Sparrowhawk *Accipiter erythropus* – Not recorded

Red-thighed Sparrowhawk is also difficult to detect due to its habit of perching for long periods and its secretive nature, and detection rates are usually very low. Buij (2008), for example, only recorded this species twice in nine months of fieldwork in Gabon. As above, this species was recorded by Green and Carroll (1991) and would presumably be detected during a longer survey. R. Cassidy (pers. comm.) reported seeing Red-thighed Sparrowhawk at Sangha Lodge once in the last couple of years.

Other records of note

On 24 February, an unidentified *Aquila* eagle species was observed soaring high over forest and bai in the National Park. It was not observed well enough to identify to species level but was undoubtedly an *Aquila* eagle. Lesser Spotted Eagle *Aquila pomarina* is recorded on the Dzanga-Sangha bird list and would seem to be the most likely *Aquila* species in this case, and it was therefore probably a migrant bird (R. Cassidy, pers. comm.). Lesser Spotted Eagle has been recorded flying into Dzanga-Sangha from Congo in April/May (Dowsett-Lemaire and Dowsett 1998).

Discussion

Using the categories outlined in Buij (2008), our results suggest that two raptor species are “common” in Dzanga-Sangha, with one to ten individuals seen in suitable habitat every day; African Harrier Hawk and Palm Nut Vulture. The majority of species were either “uncommon”, with only a few individuals recorded during the survey period, or “rare”, with only one or two records during the survey period. However, that it is not possible to obtain an accurate figure of the density of every species of raptor in a tropical forest within a short time (Thiollay 1988), so a five-week survey can only give an indication of the relative abundances of the different raptor species present.

Because, in this habitat, conspicuous soaring species recorded at large distances are mixed with smaller, inconspicuous understorey species, detectable only at short distances, percentages cannot be representative of the actual relative densities (Thiollay 1984). It is likely that the density of the most secretive species is underestimated, while more conspicuous species are overestimated (Thiollay 1985b). Buij (2008) in a similar but longer-term survey in Gabon, states that Cassin’s Hawk Eagle, Long-tailed Hawk, African Goshawk, Chestnut-flanked Sparrowhawk, Red-thighed Sparrowhawk and perhaps Congo Serpent Eagle may be more common than observations suggest, and this is likely to be the case here too.

Despite these difficulties, there is much to be learnt about Dzanga-Sangha’s raptors, and further study would almost certainly uncover new and exciting knowledge. It is also vital in the long-term that more is learnt about the abundance, distribution and habitat requirements of tropical forest raptors. Most of the world’s tropical rainforests are now heavily exploited and are rapidly being turned into a variety of secondary habitats, and many forest birds

disappear when the pristine forest structure is disturbed (Thiollay 1985b). Dzanga-Sangha is currently protected, but its forests represent a significant income for the Central African Republic government, so this status cannot be guaranteed into the future (Blom 2001). A long-term study would help to inform decision-makers about the importance of this area, and could aid its conservation in years to come.

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References

- Angehr, G.R., Schmidt, B.K., Njie, F. and Gebhard, C. 2005. Significant records and annotated site lists from bird surveys in the Gamba Complex, Gabon. *Malimbus* 27: 53-76.
- Blom, A. 2001. Ecological and economic impacts of gorilla-based tourism in Dzanga-Sangha, Central African Republic. PhD thesis, Wageningen University. Pp. 1-164.
- Buij, R. 2008. The lowland raptor community of the Gamba Complex of Protected Areas, Gabon. *Malimbus* 30: 55-64.

- Chappuis, C. 2000. African Bird Sounds: Birds of North, West and Central Africa and Neighbouring Atlantic Islands. 15 CDs. Société d'Etudes Ornithologiques de France: Paris; British Library: London.
- Dowsett-Lemaire, F. 2006. Ecology, voice and territorial competition of two forest eagle owls, Fraser's Eagle Owl *Bubo poensis* and Akun Eagle Owl *B. leucostictus*. Bulletin of the African Bird Club 13: 147-156.
- Dowsett-Lemaire, F. 2012. Aspects of vocal behaviour, including seasonality of song, of diurnal forest raptors in the Guineo-Congolian region. Bulletin of the African Bird Club 19(2): 178-188.
- Dowsett-Lemaire, F. and Dowsett, R.J. 1998. Further additions to and deletions from the avifauna of Congo-Brazzaville. Malimbus 20: 15-32.
- Dowsett, R.J. 2001. Central African Republic (République Centrafricaine). In Fishpool, L.D.C. and Evans, M.I. (eds). Important bird areas in Africa and associated islands. Cambridge, UK: Pisces & BirdLife International: 169-176.
- Fay, J.M. 1989. Partial completion of a census of the lowland gorilla in southwestern Central African Republic. Mammalia 53: 203-215.
- Green, A.A. and Carroll, R.W. 1991. The avifauna of Dzanga-Ndoki National Park and Dzanga-Sangha Rainforest Reserve, Central African Republic. Malimbus 13: 49-66.
- Julien, M. and Thiollay, J-M. 1996. Effects of rain forest disturbance and fragmentation: comparative changes of the raptor community along natural and human-made gradients in French Guiana. Journal of Biogeography 23: 7-25.
- Kemp, A. and Kemp, M. 1998. Birds of prey of Africa and its islands. New Holland, London.
- Lloyd, H. 2004. Habitat and population estimates of some threatened lowland forest bird species in Tambopata, south-east Peru. Bird Conservation International 14: 261-277.
- Newton, I. 1979. Population ecology of raptors. Academic Press: London.
- Olmos, F. and Turshak, L.G. 2009. A survey of birds in Omo Forest Reserve, south western Nigeria. Bulletin of the African Bird Club 16(2): 184-196.
- Remis, M.J. 1997. Western lowland gorillas as seasonal frugivores: Use of variable resources. American Journal of Primatology 43: 87-109.
- Robinson, S.K. 1994. Habitat selection and foraging ecology of raptors in Amazonian Peru. Biotropica 26(4): 443-458.

- Thiollay, J-M. 1984. Raptor community structure of a primary rainforest in French Guiana and effect of human hunting pressure. *Journal of Raptor Research* 18(4): 117-122.
- Thiollay, J-M. 1985a. Falconiforms of tropical rain forest: a review. In: Newton, I. and Chancellor, R.D. (eds). *Conservation studies on raptors*. Cambridge ICBP Technical Publication no.5: Cambridge. pp 155-165.
- Thiollay, J-M. 1985b. Composition of falconiform communities along successional gradients from primary rainforest to secondary habitats. In: Newton, I. and Chancellor, R.D. (eds). *Conservation studies on raptors*. Cambridge ICBP Technical Publication no.5: Cambridge. pp 181-190.
- Thiollay, J-M. 1988. Forest Fragmentation and the Conservation of Raptors: A Survey on the Island of Java. *Biological Conservation* 14: 229-250.
- Thiollay, J-M. 1989. Censusing of diurnal raptors in a primary rain forest: comparative methods and species detectability. *Journal of Raptor Research* 23(3): 72-84.
- Thiollay, J-M. 2000. Stability and long-term changes in a West African raptor community. In: Chancellor, R.D. and Meyburg, B-U (eds), *Raptors at Risk*. World working Group on Birds of Prey and Owls. Hancock House: Berlin. pp 15-25.
- Thiollay, J-M. 2002. Avian diversity and distribution in French Guiana: patterns across a large forest landscape. *Journal of Tropical Ecology* 18: 471-498.