

# **Liberian Greenbul expedition 2013**

## **Final report**

December 2013



**Ben Phalan  
Lincoln D. C. Fishpool  
Emmanuel M. Loqueh  
Trokon Grimes  
Flomo P. Molubah  
Michael Garbo**



Funded by the African Bird Club and RSPB

# **Liberian Greenbul expedition 2013**

## **Final report**

December 2013

### **Ben Phalan**

Conservation Science Group, Department of Zoology, University of Cambridge, Cambridge CB2 3EJ, UK [btp22@cam.ac.uk](mailto:btp22@cam.ac.uk)

### **Lincoln D. C. Fishpool**

BirdLife International, Wellbrook Court, Girton Road, Cambridge CB3 0NA, UK  
[lincoln.fishpool@birdlife.org](mailto:lincoln.fishpool@birdlife.org)

### **Emmanuel M. Loqueh**

SCNL, Tubman Boulevard, Congo Town, CARE Compound, PO Box 2628, Monrovia, Liberia  
[emmanuelloqueh@yahoo.com](mailto:emmanuelloqueh@yahoo.com)

### **Trokon Grimes**

Forestry Development Authority, Zwedru office, Zwedru, Grand Gedeh County, Liberia  
[trokongrimes@yahoo.com](mailto:trokongrimes@yahoo.com)

### **Flomo P. Molubah**

Golden Veroleum (Liberia) Inc., R. Fole Sherman Law Building, 17th Street & Cheeseman Ave, Sinkor, Monrovia, Liberia [flomo.molubah@veroleum.com](mailto:flomo.molubah@veroleum.com)

### **Michael Garbo**

SCNL, Tubman Boulevard, Congo Town, CARE Compound, PO Box 2628, Monrovia, Liberia  
[scnlliberia@yahoo.com](mailto:scnlliberia@yahoo.com)

*Please cite as: Phalan B, Fishpool LDC, Loqueh EM, Grimes T, Molubah FP and Garbo M (2013) Liberian Greenbul expedition 2013: Final report. Unpublished report to African Bird Club and RSPB. Cambridge, United Kingdom.*

*All photos by Ben Phalan, and [can be re-used with attribution](#) (Creative Commons license)*

## Summary

The Liberian Greenbul *Phyllastrephus leucolepis* is listed as Critically Endangered, but nothing is known of it since it was first observed and collected in the Cavalla Forest in the early 1980s. We spent one month (7 February to 8 March 2013) searching in the area where the type specimen was collected, but we were unable to locate any Liberian Greenbuls. Extensive areas of suitable forest habitat remain in the area, albeit disturbed by selective logging, plantations of exotic tree species, hunting and small-scale agriculture and mining. Our failure to locate the species underscores the importance of efforts to clarify its taxonomic status, which are now underway using genetic material from the type specimen and blood collected by us from other *Phyllastrephus* greenbuls. One possibility is that the Liberian Greenbul is not a valid species, but an aberrant juvenile plumage form of Icterine Greenbul *P. icterinus*. Regardless of the outcome of this taxonomic question, our expedition found evidence that the Cavalla Forest supports at least twenty bird and mammal species of global conservation concern, including apparently healthy populations of large hornbills, White-breasted Guineafowl *Agelastes meleagrides* and other Upper Guinea endemics. The area merits better protection on that basis alone. Its remaining areas of closed-canopy high forest are threatened in particular by logging, and whether the area will continue to support its current levels of biodiversity will depend on whether logging and other threats can be controlled. The Liberian Greenbul is the subject of considerable local interest and pride, which if handled sensitively, and if local livelihood needs are addressed, could help to provide a basis for future conservation efforts.

## Acronyms and abbreviations

CITES	Convention on International Trade in Endangered Species
DNA	Deoxyribonucleic acid, the molecule that encodes genetic information
FDA	Forestry Development Authority, the state body responsible for forests and conservation
GIZ	‘Gesellschaft für Internationale Zusammenarbeit’: German state body for overseas development
GPS	Geographic positioning system
GTZ	‘Gesellschaft für Technische Zusammenarbeit’, now merged into GIZ
h	hour(s)
IBA	Important Bird Area
IUCN	International Union for the Conservation of Nature, the body responsible for the global Red List
km	kilometre(s)
m	metre(s)
µL	microlitre(s)
NGO	Non-governmental organisation
PUP	Private Use Permit, a form of logging licence
RSPB	Royal Society for the Protection of Birds, the BirdLife partner in the United Kingdom
SCNL	Society for the Conservation of Nature in Liberia, the BirdLife affiliate in Liberia
t	tonne(s)

## Introduction

The Liberian (or White-winged) Greenbul *Phyllastrephus leucolepis* is perhaps the most enigmatic bird species in West Africa. It is known only from its original description by Wulf Gatter (1985) who collected the single specimen now lodged at the museum in Bonn. It is listed as Critically Endangered on the global Red List (BirdLife International 2013a) but it has never been seen since Gatter's observations of it between 1981 and 1984. Since that time, Liberia suffered fifteen years of civil war, which made it too dangerous for further searches to be carried out. The area where it occurs, near Zwedru in Grand Gedeh County, is classified as an Important Bird Area, one of only nine currently recognised in Liberia (Robertson 2001). Liberian Greenbul was recently identified as a high priority for international work by the RSPB, and is one of 45 Critically Endangered bird species globally 'requiring intensive searches' (BirdLife International 2008).

We are aware of only one expedition since 1984 to look for the species, organised by Flomo Molubah and Michael Garbo from the BirdLife national affiliate organisation – Society for the Conservation of Nature of Liberia – in 2010, with financial support from RSPB (Molubah & Garbo 2010). This expedition did not locate any Liberian Greenbuls, but it did succeed in finding the precise area where Gatter worked, and in identifying local people who claimed to have worked as his field assistants in the 1980s. This information provided an invaluable starting point for our expedition.

There are several possible reasons for the lack of success by the 2010 expedition. The surveys were carried out during the wet season (early July), whereas most of Gatter's nine observations of the species (each of 1-2 individuals) were made during the dry season: in October (2), November (1), December (2), January (2) and February (2). The species might therefore be, perhaps, more readily detected in the dry season. The 2010 surveys incorporated only five days in the field, and because the organisers lacked a four-wheel drive vehicle and camping equipment, they were unable to get into the forest early in the morning. Gatter spent many months in the area but only accumulated nine observations during more than 500 days in the field, suggesting that the species occurs at very low densities. However, he was mostly not searching specifically for this species, but making observations of birds largely in his own time alongside his research work for the German Forestry Mission. He also mist-netted some 5000 birds, but never caught a Liberian Greenbul in a net. Furthermore, the area where his observations were made was selectively logged during the war, and so searches in neighbouring areas of primary forest, rather than in the collection locality, might be more likely to succeed.

A further brief visit to the same area was made by Tom Ewert (year unknown, but probably during 2007–2009). He did not have local guides and thus did not manage to get into the forests, so was only able to make some observations along roads, from which he observed several hornbills and two turaco species (W. Gatter in litt.). Wulf Gatter himself has made several visits to Liberia in recent years, but has not returned to the Zwedru area because of concerns about security.

The IUCN funded a Liberian NGO, the Society for Environmental Conservation, to carry out a €25,000, two-year awareness-raising and 'alternative livelihood' project in the area, apparently starting in 2008 (there was information at the following website, which is now unfortunately unavailable: [http://www.iucn.nl/funded\\_projects/campaign\\_against\\_the\\_destruction\\_of\\_greenbul\\_habitat\\_and\\_promotion\\_of\\_alternative\\_livelihoods\\_1/](http://www.iucn.nl/funded_projects/campaign_against_the_destruction_of_greenbul_habitat_and_promotion_of_alternative_livelihoods_1/)). This project aimed to raise local awareness of the Liberian Greenbul, and find ways of reducing threats to its habitat. If there was any continuation of the

alternative livelihood activities promoted by this project, they were not visible or reported to us during our visit. The only trace of this project that we were able to observe was that locals remembered being given Liberian Greenbul t-shirts.

### **Taxonomic status of the Liberian Greenbul**

The Liberian Greenbul was described as a distinct species from the Icterine Greenbul *Phyllastrephus icterinus* (the species which it most closely resembles) on the basis of differences in plumage, behaviour and microhabitat. Gatter (1985) made nine observations of the species between 1981 and 1984, at least two of which involved two individuals, and collected a single specimen on 16 January 1984. The specimen was deposited at the Museum Alexander Koenig in Bonn, with inventory number ZFMK 84.221. The species is widely accepted as a valid taxon (e.g., Borrow & Demey 2004; Del Hoyo et al. 2005; BirdLife International 2013a).

However, there have been calls for more detailed investigation of the taxonomic status of this species. Del Hoyo et al. (2005, p. 215) note: “Status unclear; relationship with *P. icterinus*, to which it is identical except for whitish spots on wings, requires investigation.” BirdLife International highlighted the need to: “Review its taxonomic status to establish conclusively whether it is a good species or merely an aberrant form of Icterine Greenbul” (BirdLife International 2013a). The multiple hypotheses that need to be considered are as follows:

1. Liberian Greenbul is a valid species.
2. Liberian Greenbul is an aberrant plumage form of Icterine Greenbul, in which the whitish spots in the wings have been produced either by a genetic mutation or disturbance during feather growth.
3. Liberian Greenbul is a hybrid between other species of greenbuls (e.g., Icterine and Spotted Greenbul *Ixonotus guttatus*).

The evidence in favour, as described by Gatter (1985), of recognising Liberian Greenbul as a species distinct from Icterine Greenbul, which is evidently its closest relative, is as follows:

- Most obviously, Liberian Greenbul has prominent whitish tips to its primaries, greater and primary coverts, alula, and two largest tertials, whereas in Icterine Greenbul these feathers lack any contrasting markings.
- There are other, subtle differences in plumage coloration of the type specimen compared to a series of 48 Liberian specimens of Icterine Greenbul, including: tail feathers (paler than in Icterine), wing (distinctly browner, more rust coloured and less olive green than that of Icterine), outer webs of primary (less green and more brownish than those of Icterine) and inner webs of flight feathers (very dark brown, rather than blackish in Icterine).
- Liberian Greenbuls behaved differently to Icterine Greenbuls, often raising and quivering their wings to display their pale wing-spots;
- Liberian Greenbul appeared to use a different microhabitat than Icterine: the latter foraging mainly on thinner branches and foliage, while Liberian Greenbul was observed mainly on larger branches close to the trunk;
- At least two of the observations were of two individuals, and Gatter concluded that he had observed at least four individuals in all. Liberian Greenbuls were observed at two sites around 2

km apart. It would be easier to credit the idea of a plumage abnormality if there was only a single individual observed at a single site.

There are a number of arguments against recognising Liberian Greenbul as a species distinct from Icterine Greenbul. Amongst these is its unaccountably restricted range. No other *Phyllastrephus* has such a restricted distribution, and there are no obvious geological or altitudinal features, such as an isolated inselberg, to explain why it should be found only in this one small part of the lowland forests of Liberia. Unexplained distribution patterns are found in other West African birds as well, although none is as restricted in its range as the Liberian Greenbul. Species such as the Gola Malimbe *Malimbus ballmanni* and Black-headed Rufous Warbler *Bathmocercus cerviniventris* are found at only a few sites (where they can be locally common), and are absent from many apparently suitable areas in between. Knowledge of the West African avifauna is still far from complete, and several new bird species with sparse and localised distributions were discovered in the 1960s, 1970s and 1980s: Nimba Flycatcher *Melaenornis annamarulae*, Gola Malimbe and Yellow-footed Honeyguide *Melignomon eisentrauti* (Forbes-Watson 1970; Field 1979; Colston 1981; Louette 1981). The distributions of these species remain rather poorly known in detail, but in each case they have been shown to be more widely distributed than initially thought: for example, Nimba Flycatcher has recently been found to occur as far east as Ghana (Demey & Hester 2008). There have not, in contrast, been any other claims of Liberian Greenbul from elsewhere in West Africa, despite increased survey effort in recent decades in all countries in the region.

Another argument against is the close ecological overlap between Liberian and Icterine Greenbul. It seems unlikely that a second, new *Phyllastrephus* species would occur not only in the same habitat (sympatry) but even in the same flocks (syntopy) as its congener, without showing any differences in size or structure. There are, as Gatter (1985) noted, other African greenbul genera with multiple, very similar, sympatric species, such as *Andropadus*, but these show fairly clear ecological segregation. In almost all cases of congeneric syntopy, such as that between *Phyllastrephus icterinus* and *P. xavieri*, or *P. debilis* and *P. fischeri*, there are clear differences in size. *Phyllastrephus* greenbuls are also typically common members of the avifauna where they occur, and are often relatively conspicuous (at least vocally) even in the case of species with restricted ranges. For example, Grey-headed Greenbul *Phyllastrephus poliocephalus* is restricted to the montane forests of Nigeria and Cameroon, but is said to be 'common to very common in suitable habitat' (BirdLife International 2013b). Moreover, it might be expected that a bird of the forest mid-stratum, with behaviour that involves drawing attention to itself, would not be particularly hard to find. The extreme local scarcity as well as the highly restricted range of the Liberian Greenbul is thus hard to explain.

Gatter (1985) discusses and rejects the second hypothesis, that Liberian Greenbul is merely an aberrant form of Icterine Greenbul. He notes that there were no irregularities in the plumage of the type specimen that might indicate it to be an abnormal individual, although this is somewhat difficult to assess because the type specimen was damaged by ants (a result of the interval between it being shot and retrieved from where it had fallen). The pale markings in the wing were relatively distinct, and there was no trace of dark markings within them, and no trace of pale markings within the dark parts of the feathers. Gatter discusses a number of possible causes of plumage aberration. He rejects the possibility that the pale spots were the result of a disturbance during feather development, because the markings were regular and restricted to specific feather tracts. He rules out the possibility that they were attributable to growth bars, on the basis that the markings were evenly distributed, restricted to parts of the wing, and present in feathers that had grown over a long period of time. Moreover, one

would not expect to see the same patterns in different individuals in different areas and different years. The possibility of a genetic mutation or polymorphism is also rejected on the basis of the behavioural differences noted between Liberian and Icterine Greenbuls.

Against these arguments, no other *Phyllastrephus* greenbuls have pale wing spots or bars, despite the size of the genus. The presence of similar markings across multiple feathers could be explained if the birds were juveniles, which grow all of their flight feathers together. The fact that all observations were of 1–2 individuals during relatively short periods (October–early December 1981, February 1983 and January 1984), and only observed at a single location in any one year, is consistent with the possibility of a disturbance during the development of juvenile plumage within a single brood in each of those years.

The third hypothesis, a hybrid origin for the Liberian Greenbul, seems intrinsically unlikely. There is a greenbul with spotted wings and wing-raising behaviour, which could explain the main differences from Icterine Greenbul, but the Spotted Greenbul is not even in the same genus. Inter-species hybrids are known in greenbuls, and have been proposed as an explanation for sporadic records of a mystery greenbul of doubtful validity in Southeast Asia, Blue-wattled Bulbul *Pycnonotus nieuwenhuisii* (Williams 2002), but we are not aware of any cases of inter-generic hybridisation.

On the basis of both plumage and behavioural differences – nothing is said about its voice while its measurements fall comfortably within those of Icterine – Gatter felt sufficiently confident to accept the first hypothesis, that Liberian Greenbul is a valid species. We feel that this was the safest conclusion on the basis of the limited evidence available at the time. It would be better to mistakenly assume that the species is genuine than to mistakenly disregard it without further detailed investigation (to avoid making a similar mistake to that of Romeo; Collar 1998). Our first priority, therefore, was to collect what information we could about the current conservation status of the Liberian Greenbul and the habitats of the area in which it was found.

## **Aims**

The primary aim of the expedition was to locate the Liberian Greenbul, and if successful, to collect information on its basic ecology, voice, habitat preferences, local conservation status and phylogenetic relationships with other taxa. Given the chances of failure in the primary aim, the expedition also had two secondary aims: to build local capacity, and to collect ancillary information relevant to the Liberian Greenbul and other species of conservation importance. In support of these secondary aims, we aimed to meet the following objectives:

- Improve the ability of local partners to identify birds and record systematic data;
- Improve knowledge of the avifauna of a rarely-visited and poorly-known Important Bird Area;
- Gain a better understanding of current threats to forest habitat in the type locality from deforestation and forest degradation;
- Make proposals for a better definition of the Zwedru IBA, whose boundaries are currently undefined;
- Obtain genetic samples from local populations of Icterine and other greenbuls, to be used to help establish the phylogenetic relationships of Liberian Greenbul (building on other recent work on greenbul phylogeny: Moyle & Marks 2006; Johansson *et al.* 2007).

## Study area

The type locality of the Liberian Greenbul was described by Gatter (1985) as being in one of the forest plots of a forestry research project near the Cavalla River, 20 km northwest of Zwedru in Grand Gedeh County, Liberia. The ‘Naturwaldforschung Südostliberia’ (Exploration of natural forests in Southeast Liberia) project was a research collaboration between the Liberian forest administration and the German association for technical cooperation GTZ (now GIZ). Detailed forest research was carried out in several forest plots as part of the project, and it was here that the Liberian Greenbul was discovered and collected. The collection location of the type was noted as 6° 12’ N, 8° 11’ W.

Using data provided by Gatter (1997), Robertson (2001) defined the ‘Zwedru’ Important Bird Area because of its importance for the Liberian Greenbul and other globally threatened and biome-restricted bird species. However, the forest is known locally as the Cavalla Forest, while Zwedru refers only to the nearby town. A more accurate name for the IBA, taking account of local usage, would be ‘Cavalla Forest’ (not to be confused with the ‘Cavally and Goin-Débé Forest Reserves’ IBA in Côte d’Ivoire). The ‘Cavalla Forest’ as far as we could ascertain refers to all of the forest areas from the Franzay Forest (Figure 1) westwards to the western boundary of Grand Gedeh County, and northwards to the Cavalla River (Figure 2).

Figure 1 shows the area in which we searched for the Liberian Greenbul in 2013, together with the locations of campsites, roads, and local settlements. The north of the study area is bounded by the Cavalla River, which forms the border between Liberia and Côte d’Ivoire.

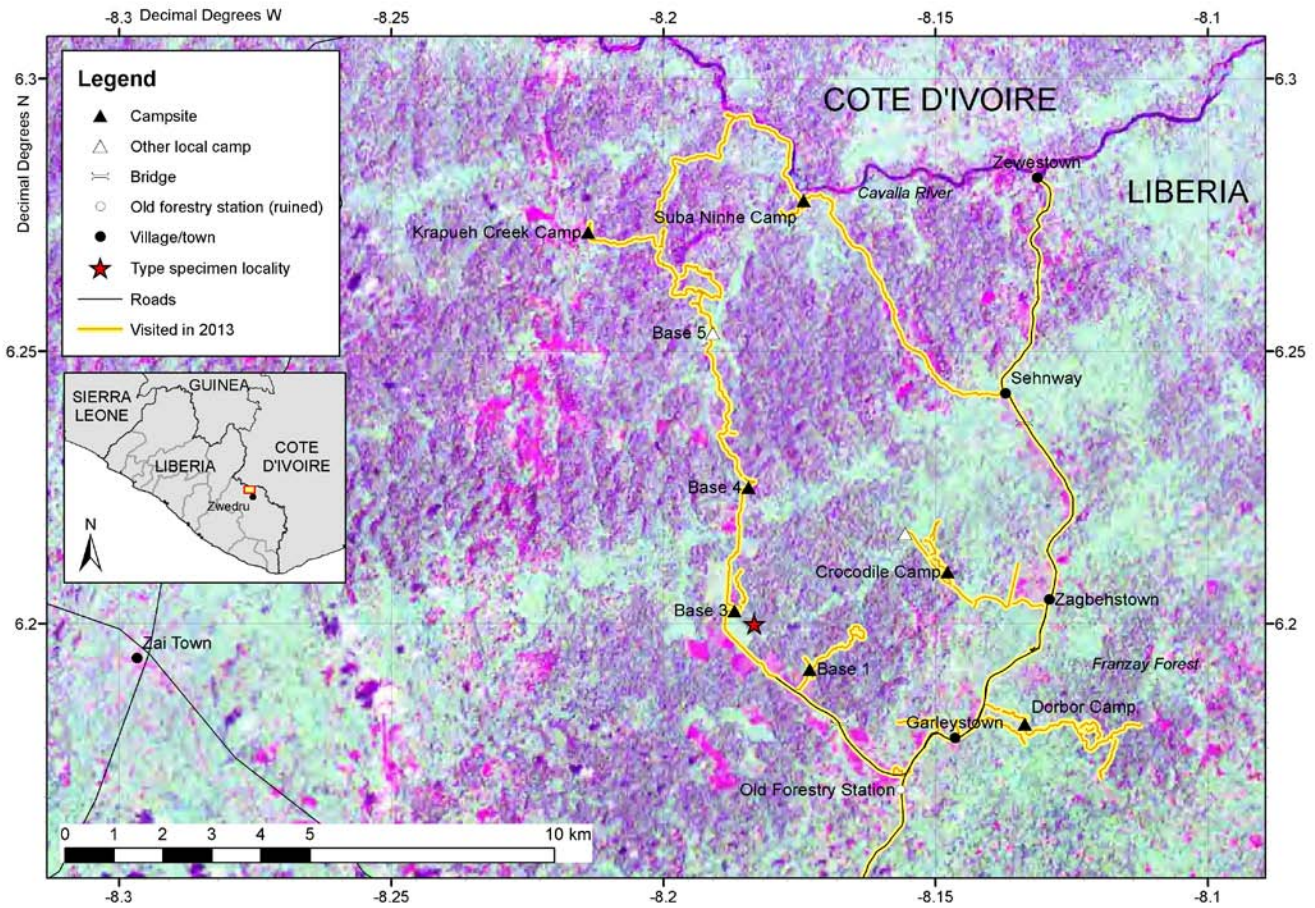
## Methods

The expedition team was made up of Ben Phalan (University of Cambridge), Lincoln Fishpool (BirdLife International), Emmanuel Loqueh (SCNL), Trokon Grimes (FDA) and was assisted and supported by the leaders of the 2010 expedition, Flomo Molubah (now at Golden Veroleum Liberia) and Michael Garbo (SCNL). During the time we spent in the field (7 February to 8 March), we hired a number of local people as guides, porters, cook and security guards. Further details on the expedition members, itinerary, gazetteer, and other aspects are provided in Appendices A–G.

Our initial plan called for identifying the extent of forest cover close to the type locality, and systematically visiting 1 km grid squares in the area which were entirely or largely forested. This provisional plan proved impractical for a number of reasons. It was difficult to define forest using the available satellite imagery. We were constrained to camp at sites with a reliable water supply, which at the end of the dry season were relatively scarce. And a more pragmatic approach to identifying potential habitat for the Liberian Greenbul was consultation with local people and the use of local guides to take us to forested areas.

Our principal survey method was to walk through the forest, using hunting trails, and stopping to observe mixed species flocks when they were encountered. We also used playback of Icterine Greenbul, and tested whether using playback of Shining Drongo *Dicrurus atripennis* and Red-chested Owlet *Glaucidium tephronotum* might help to attract mixed bird parties that could include Liberian Greenbuls. Where we could locate ant swarms, and pools used by forest birds for drinking and bathing, we spent time observing birds at these.





**Figure 1.** Map of the study area in Grand Gedeh County, Liberia, with the approximate location at which the type specimen of Liberian Greenbul was collected in 1984 (red star), and areas visited by us in 2013 (yellow). The background is Landsat imagery (bands 3, 4, 5) at 28.5 m resolution, from around the year 1990 (Tucker et al. 2004). Dull purple is forest, bright pink is suggestive of some form of disturbance such as plantation establishment, and pale green may be farmland and/or more open vegetation such as swamps and young secondary forest. Place names are transcribed by us from the reports of local informants, as place names on published maps do not correspond to local usage.

A daily list of all bird species encountered was maintained, together with a GPS track of the route walked (yellow tracks in Figure 1). We recorded GPS locations for all observations of species of global conservation concern.

Mist nets were deployed primarily to capture Icterine Greenbuls for the collection of blood samples. We found that freshly-cut *Raphia* palm rachises made very effective mist-net poles. Mist nets were checked at intervals no greater than 45 minutes, and each bird was weighed, had its wing length measured, and checked for primary moult. Blood was taken from a vein in the wing, using a fine needle and a capillary tube, and preserved in 99% ethanol. Blood samples were limited to an absolute maximum of 200  $\mu$ L (usually much less), and following sampling, a cotton pad was applied with pressure to prevent further bleeding. Birds were kept for five minutes and checked for any signs of further bleeding before being released. Alcohol gel was used to clean the bird's skin before and after sampling, and to clean our hands afterwards.

No specific permits are required for mist-netting or blood-sampling of non-CITES listed species in Liberia, but the nature of this work was set out in a letter to the FDA, and approval was received in the form of an official letter, and during a meeting with the interim Managing Director of FDA, Harrison Karnwea. We also received official approval for our expedition from the District Superintendent's office in Zwedru.

## **Results**

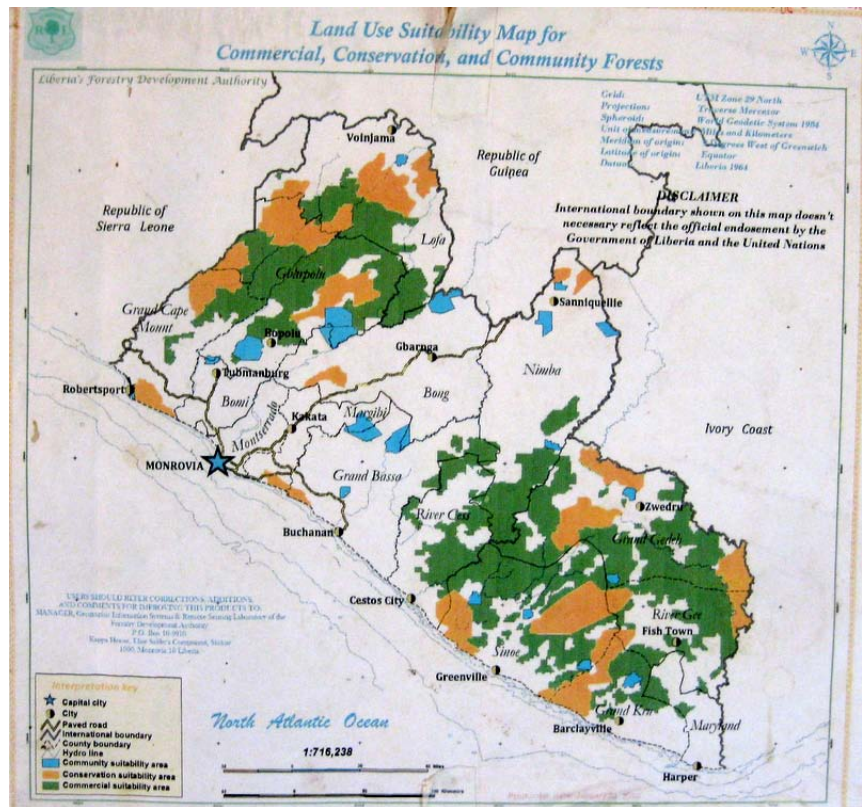
A summary of the main results is provided here. More detailed information on birds, including a complete species checklist, selected observations, breeding records, measurements, moult, sound recordings and photos is given in Appendices H–M.

**Habitat.** It was difficult to judge the extent or condition of forests in the Zwedru area from available satellite imagery, because of the lack of any ground-truthing data to help interpret the images. On the ground, there was considerable variation in forest condition. Along the unpaved road to Garleystown and on to the Cavalla River at Zewestown, there were areas of heavily disturbed forest, clearings with farms (cassava, plantain, bananas, pineapple and cocoa), plantations of exotic teak and *Gmelina* trees, and occasional charcoal pits (see Appendix M for photos). There appeared, however, to be little agriculture more than a few hundred metres from the road. Away from the road, the landscape was a patchwork of selectively logged and mature secondary forest, *Raphia* swamps along watercourses, secondary thickets and some patches of closed-canopy forest. We visited forest close to the Cavalla River, around 8 km west of Zewestown, where we were told the logging companies had never reached. There was also near-primary forest in the 'Franzay Forest', north-east of Garleystown. Satellite imagery from around 1990 and 2000 shows that considerable areas of forest remained at that time, and our observations on the ground suggested that most of the forest cover shown in those images for the places we visited is still extant.

**Threats.** The most immediate threat to the area is commercial logging. Large areas of the Cavalla Forest had recently been surveyed for valuable timber trees, and had been subject to a Private Use Permit (PUP) until those permits were suspended in January 2013 by the president, Ellen Johnson Sirleaf. We were informed by the Cavalla District Commissioner, Alfred M. Dorlue, that a Community Forest management committee had been set up. This is chaired by Harrison Dweh in Zwedru, and has ten representatives from the community. Its primary aim, as far as we could determine, was to open up the Cavalla Forest to logging. Areas of the Cavalla Forest have been zoned by the FDA for conservation and community management (Figure 2), and have also been identified as a Proposed Protected Area (unpublished map by Global Witness, 2012, for which we have no further details) but there was no evidence that these designations have yet been taken up locally by FDA or others as the basis for on-the-ground management or improved protection.

Hunting is an important threat to larger-bodied vertebrates, and hunting by locals is augmented by incursions of Ivorian hunters from across the Cavalla River. Charcoal burning and agriculture seemed to be of relatively restricted extent for the time being. However, Grand Gedeh County has one of the fastest population growth rates in Liberia (its population has more than doubled since 1984; LISGIS 2008) and these threats seem likely to increase in the future.

**Figure 2.** Land use suitability map developed by FDA (undated) and photographed on the wall of the FDA office in Zwedru. The Cavalla Forest comprises the orange area (suitable for conservation) and blue area (suitable for community management) northwest of Zwedru. There was no evidence on the ground that the area identified as suitable for conservation is receiving any protection, and it was unclear to us whether the area covered by the Community Forest management committee corresponds to the blue area or whether it now includes some or all of the orange area too.



**Liberian Greenbul.** We did not have any confirmed sightings of birds resembling the Liberian Greenbul. One member of the team, together with a local guide, saw a bird which he strongly believed to be a Liberian Greenbul on 24 February, in the Franzay Forest at 6.18161° N, 8.12230° W. He described it as ‘looking just like the picture in the book’ with pale spots on the back and wings, and what he felt was the most convincing feature: a ‘spread’ tail rather than a small tail. However, as the observer had virtually no experience of identifying forest birds prior to this expedition, and could not consistently identify other common species, this evidence was not sufficient to confirm the presence of Liberian Greenbul. We spent several days in the area of his sighting, which was good quality closed-canopy forest with species including Green-tailed Bristlebill *Bleda eximius*, Yellow-bearded Greenbul *Criniger olivaceus* and Shining Drongo. Several members of the local community in Garleystown claimed to be familiar with the Liberian Greenbul, but proved unable to identify the calls of common forest birds, or to describe the basic habitat preferences of common species from their field guide illustrations, so again, these reports were not convincing.

**Behaviour of Icterine Greenbul.** A key piece of the evidence for the distinctiveness of Liberian Greenbul as a species was the behaviour observed by Gatter, which can be loosely translated as ‘jumping around with open and trembling wings’ (Gatter 1985). On several occasions, BP and LDCF observed Icterine Greenbuls rapidly and repeatedly extending and raising one or both wings while moving around in the mid-canopy layers. This behaviour was most evident and pronounced in birds excited by playback of calls of conspecifics, but was also seen to occur unprompted by playback. Wing-raising or wing-flicking behaviour has been observed in this species elsewhere (LDCF, pers. obs.) and has been observed in most members of the genus (F. Dowsett-Lemaire in litt.), but it seemed to take on particular significance in this context because it suggested to us that the behaviour is not a

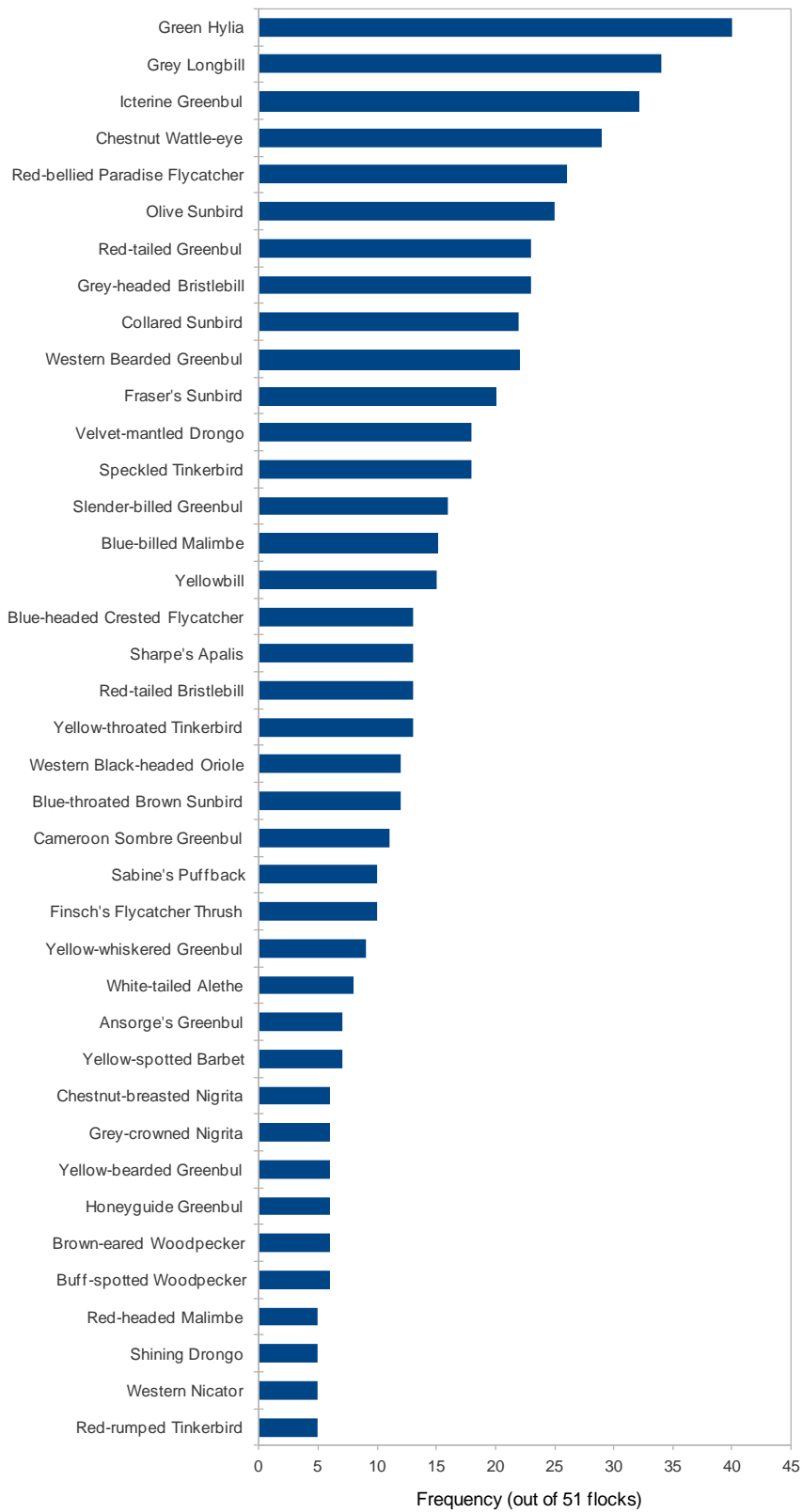
diagnostic feature separating Liberian Greenbul from Icterine Greenbul. However, W. Gatter (in litt.) comments that the behaviour he observed by Liberian Greenbuls was ‘not at all comparable’ with the wing-flicking sometimes seen in Icterine Greenbul, nor with that of Spotted Greenbul, and was instead similar to the ‘movements with half opened wings we see in the two *Trochocercus* Flycatchers *nitens* and *nigromitratus*’. Based on this, he concludes that the behaviour ‘represents from my side still a key piece for distinctiveness differing from that you describe as having seen.’

**Observations of mixed bird flocks.** We encountered 51 mixed bird parties, containing in total at least 92 species (Figure 3). The most frequent members of these parties were Green Hylia *Hylia prasina*, Grey Longbill *Macrosphenus concolor*, Icterine Greenbul and Chestnut Wattle-eye *Dyaphorophya castanea*. Most of the species mentioned by Gatter as occurring in mixed flocks with Liberian Greenbul were present in a large percentage of the bird parties we observed, including Icterine Greenbul (67%), Western Bearded Greenbul *Criniger barbatus* (46%), Fraser’s Sunbird *Deleornis fraseri* (42%) and Blue-billed Malimbe *Malimbus nitens* (31%). However, we did not observe any Gola Malimbés or bush-shrikes (both also mentioned by Gatter) in mixed bird parties: perhaps an indication of a decline in habitat quality since the early 1980s. W. Gatter (in litt.) comments that the composition of the parties we observed suggests ‘a high influence of Secondary Forest/ and older Farmbush Bird Societies’, which might indicate that the forests have become less dense and are now more disturbed because of logging activities since the time when his observations were made (see also pp. 66-70 of Gatter 1997).

**Other birds.** We observed 186 bird species altogether in the Cavalla Forest and Zwedru area (see Appendix I). Gatter (1997) reported at least 347 species from the two quarter-degree grid cells encompassing the area in which we were working (total calculated by us based on his text, see Appendix I). His longer list is explained both by the inclusion of many birds of open habitats and wetlands such as rice paddies (while we were working exclusively in and near forest) and the fact that he lived and worked in the area for more than three years. We added at least eight species to those recorded by Gatter, including Lanner Falcon *Falco biarmicus*, Laughing Dove *Streptopelia senegalensis* and Plain-backed Pipit *Anthus leucophrys* (all observed in Zwedru, and all species which have likely benefited from deforestation and the expansion of human settlements), and Brown Nightjar *Caprimulgus binotatus*, Yellow-footed Honeyguide, White-throated Greenbul *Phyllastrephus albigularis*, Black-capped Apalis *Apalis nigriceps* and Grey-throated Flycatcher *Myioparus griseigularis* (all forest species, and mostly unobtrusive birds, easily missed unless the calls are known).

**Birds of conservation concern.** We observed 11 species of global conservation concern, including five Vulnerable species (White-breasted Guineafowl *Agelastes meleagrides*, Timneh Parrot *Psittacus timneh*, Brown-cheeked Hornbill *Bycanistes cylindricus*, Yellow-casqued Hornbill *Ceratogymna elata* and Yellow-bearded Greenbul), five Near Threatened species (Crowned Eagle *Stephanoaetus coronatus*, Green-tailed Bristlebill, Rufous-winged Illadopsis *Illadopsis rufescens*, Copper-tailed Starling *Lamprolornis cupreocauda* and Red-fronted Antpecker *Parmoptila rubrifrons*) and one Data Deficient species (Yellow-footed Honeyguide). For further details, see Appendix H.

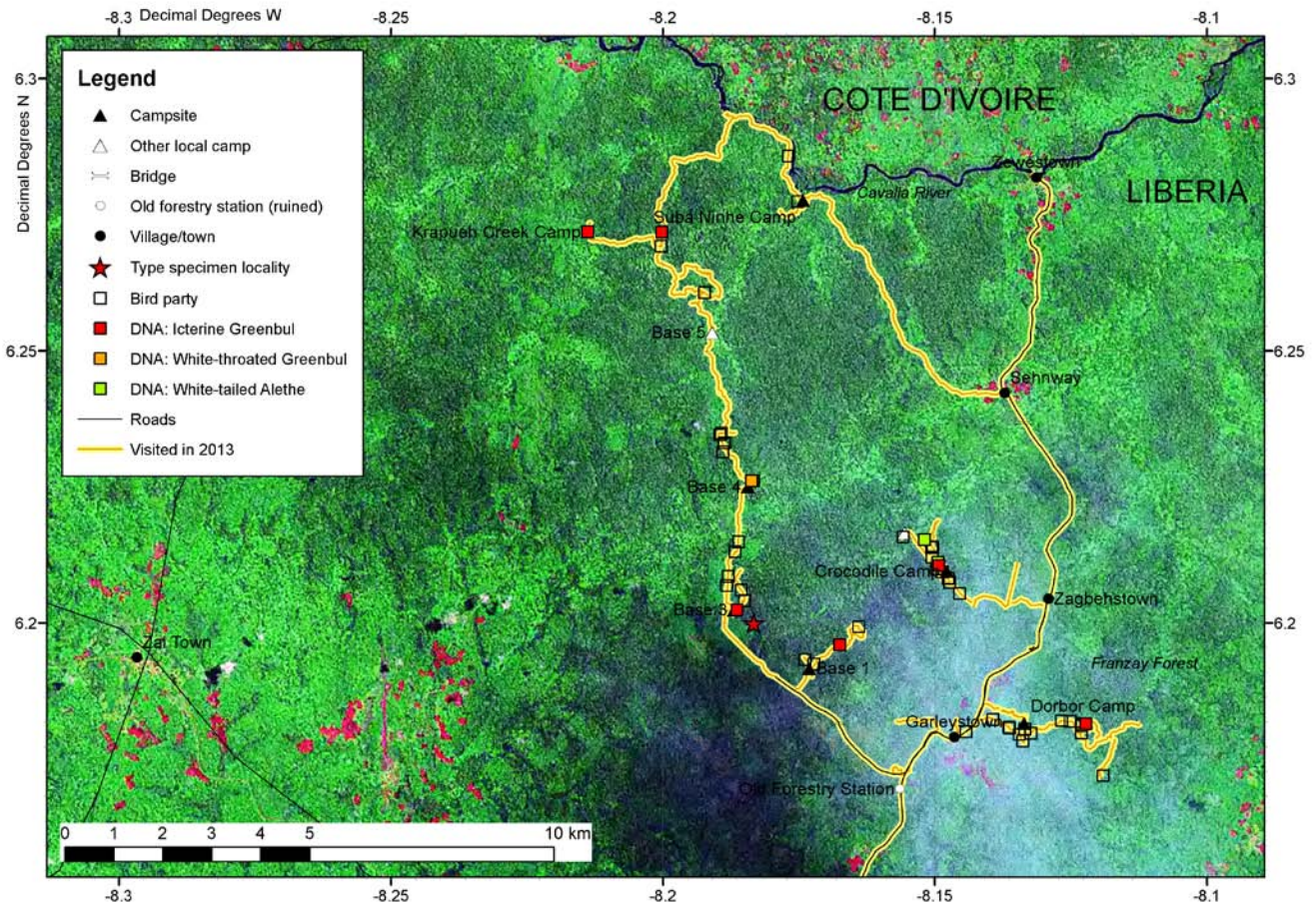
**Mammals (and reptile) of conservation concern.** We observed feeding signs of Chimpanzee *Pan troglodytes* (Endangered), and our local guide reported having seen a Zebra Duiker *Cephalophus zebra* (Vulnerable) in the Franzay Forest while we were there. According to descriptions by locals, a further seven mammals of global conservation concern were present, including two Endangered species (Western Red Colobus *Procolobus badius* and Pygmy Hippopotamus *Choeropsis liberiensis*), three



**Figure 3.** Frequency of species which occurred in at least 5 out of 51 mixed bird parties observed in the Cavalla Forest between 8 February and 7 March 2013.

Vulnerable species (Sooty Mangabey *Cercocebus atys*, Western Black-and-white Colobus *Colobus polykomos* and Jentink's Duiker *Cephalophus jentinki*) and two Near Threatened species (Leopard *Panthera pardus*, 'last seen in 2008' and Bongo *Tragelaphus eurycerus*). African Elephant *Loxodonta africana* was reported not to occur. Our 'Crocodile Camp' was so-named because the water source there – a small pool in a dry streambed – contained a hole which locals told us belonged to a West African Dwarf Crocodile *Osteolaemus tetraspis* (Vulnerable), although unfortunately we never saw the animal itself.

**Mist-netting and blood sampling.** We caught a total of 97 birds of 23 species, with a total effort of 3855 net-metre-hours involving up to seven 12 m mist-nets and one 9 m mist-net. These birds included 23 Icterine Greenbuls, most of which were attracted using playback. Of these Icterine Greenbuls, 17 were blood-sampled for DNA analysis (locations shown in Figure 4). We also blood-sampled one White-throated Greenbul and two White-tailed Alethes *Alethe diademata* (the latter species to provide an outgroup for genetic analysis). Genetic analysis will focus initially on the CO1 and cytochrome b genes and will be carried out by Martin Collinson at the University of Aberdeen. We took samples of feathers from a Green-tailed Bristlebill and two Red-fronted Antpeckers, in case those are of interest for future DNA analyses. For further details of species caught in mist nets, see Appendix K. Use of playback of Icterine Greenbul was effective in attracting that species and perhaps also other flocking species associating with them, but only when nets were placed in locations near where Icterines had been observed. Playback of Shining Drongo did not seem to attract bird parties, and playback of Red-chested Owlet attracted the attention only of Green Hylas.



**Figure 4.** Map of the locations where bird parties were observed (open squares) and where DNA samples were collected (coloured squares) in 2013. The background is a composite of Landsat imagery (bands 70, 40, 20) from between December 1999 and March 2002, with darker green indicating forest, and pink indicating land which has been cleared for farming or settlements.

## Discussion

Although we could not confirm the presence of Liberian Greenbul in the Cavalla Forest, this cannot be taken as definitive evidence of its absence. Large areas of forest habitat remain, forest birds can be difficult to detect, and other species probably occur which we did not locate during the expedition. Other than the Liberian Greenbul, the most notable ‘miss’ is the Gola Malimbe, which was reported to be ‘locally common’ in the 1980s in this part of south-eastern Liberia (Gatter & Gardner 1993). Given the large areas of forest that remain in the area, it seems highly unlikely that the Gola Malimbe should have been extirpated completely, although its numbers may have been reduced because of logging. Many of the birds we captured in mist-nets, of a variety of species, were undergoing primary moult. If Gola Malimbés and Liberian Greenbuls were also moulting, they might perhaps have been less vocal, less active and thus difficult to observe.

It would be premature to come to a conclusion about the taxonomic status of the Liberian Greenbul until the genetic analysis of DNA from the type specimen and that from the Icterine and White-throated Greenbuls sampled during this expedition. However, our observations of wing-raising behaviour in Icterine Greenbuls undermine one of the key pieces of evidence for the distinctiveness of Liberian Greenbul. With regards to the plumage differences, Hein van Grouw, an authority on plumage aberrations in birds, has commented (personal communication, 2013) that the pale spots in the wings of the Liberian Greenbul specimen could potentially be explained by a disturbance such as a dietary deficiency during feather growth in juvenile birds, so explaining why they occur equally in the same position across multiple feathers. Such phenomena are known to affect wing but not, for example, tail, feathers (although the latter can be affected by fault bars).

## Conclusions

Irrespective of the status of the Liberian Greenbul, the Cavalla Forest is worthy of conservation for its other biodiversity. We found 11 bird species of global conservation concern, and local reports indicated the presence of at least 9 mammal species and one reptile of global conservation concern. There are extensive areas of forest, including closed-canopy high forest with large trees. Populations of some species appeared to be healthy. Large hornbills were abundant, despite evidence of hunting pressure, and judging by the number of times we encountered them, there is a good population of White-breasted Guineafowl. There were 2–4 territories of Crowned Eagle in the areas we visited, and likely more in parts of the forest we did not get to. The Cavalla Forest would thus continue to meet the criteria for an Important Bird Area and as a national conservation priority, even without the Liberian Greenbul. Whether it will continue to support its current levels of biodiversity, however, will depend on whether threats from logging, hunting, charcoal burning and forest clearance can be controlled.

## Recommendations

1. Carry out genetic analysis to ascertain the relationship between Liberian Greenbul and Icterine Greenbul.

*Status: a skin flake from the type specimen has been received from Bonn, and at the time of writing (September 2013) sequencing of the CO1 gene from this and the blood samples we collected in 2013 is underway by Martin Collinson at Aberdeen University.*

2. Lobby for protection of the Cavalla Forest, and alternatives to logging. The area has been identified



as a proposed protected area, but local people and even local FDA staff appear to be unaware of this. Instead, there is still enthusiasm for logging the area despite the freeze on PUPs.

*Status: at present there appears to be little local awareness of the proposed protected area. SCNL and FDA could work together to raise the profile of biodiversity conservation in discussions about the future of the Cavalla Forest.*

3. Support local alternatives to logging, hunting, charcoal and agricultural expansion. When we met with local people in Garleystown, their number one request was for assistance in creating employment for their young people. If it is to help reduce pressure on forests, alternative livelihood support would need to be part of a co-ordinated conservation programme for the area, with long-term financial and personnel commitment.

*Status: at present, the capacity to implement such a programme does not exist. For such a programme to be effective at reducing threats to forest biodiversity, it would need secure funding, dedicated staff and long-term institutional commitment.*

4. Seek to increase capacity within SCNL to enable them to develop an effective IBA programme. In addition to needing greater ornithological field skills, the organisation currently lacks an IBA programme coordinator and associated resources. SCNL is therefore not in a position to run a coherent programme of work for the conservation and monitoring of its IBA network.

*Status: extra resources should soon become available for additional site-based conservation activities, particularly at Lofa-Mano (=Gola) IBA. These may enable SCNL to develop its IBA programme more generally. If not, this should become a fund-raising priority for SCNL and BirdLife.*

5. With additional IBA capacity, SCNL should consider building on contacts made and goodwill generated as a result of this expedition to make follow-up visits and pursue contacts with the Community Forest Management Committee to discuss the possibility of setting aside part of the Cavalla Forest for conservation.

*Status: although further large-scale exploitation of timber seems to remain a high priority in the minds of local people, there is also appreciable local awareness of and, indeed, pride in Liberian Greenbul. Taxonomic status aside, this may help provide the starting point for conservation action.*

6. Explore biodiversity offset possibilities. A number of large-scale mining and agricultural developments are currently underway in Liberia, including concessions for iron ore, gold, diamonds and palm oil. As part of the environmental mitigation for those projects, some companies are developing offset programmes. Provided that the mitigation hierarchy is properly adhered to (with offsets a last resort following on-site avoidance, minimisation and rehabilitation of impacts), securing protection of the Cavalla Forest might be an option that some of these companies could consider for part of their offset programme. Any such offset would need to follow internationally agreed guidelines and be carried out with the support and agreement of local communities.

*Status: as of now, this is an idea that may be worthy of further consideration, but has not been taken forward to any company as a formal proposal.*

## Acknowledgments

We thank Alice Ward-Francis and Robert Sheldon (RSPB) and Alan Williams and Keith Betton (African Bird Club) for their assistance with securing funds for the expedition. This expedition could not have happened without the generous support of the ABC and RSPB. We thank Wulf Gatter for providing maps and other information, and for comments on a draft. We are grateful to Harrison Karnwea and other staff of the FDA for their support, and to Golden Veroleum Liberia for permitting Flomo Molubah to join the expedition. We thank the District Superintendent and FDA in Zwedru, and Albert Schenk and other staff (and drivers) at the SCNL/BirdLife offices in Monrovia. We are grateful to Hannah Rowland for blood-sampling kit and advice, to Jamie Gundry for advice on cameras and lenses and the loan of a camera backpack, RSPB for the use of a SPOT locator, and to Graham Prescott for the loan of a microphone. We thank Françoise Dowsett-Lemaire and Robert Dowsett for commenting on the identification of sound recordings, and on a draft. We thank Till Töpfer at the Alexander Koenig Museum in Bonn for providing a skin sample from the type specimen of the Liberian Greenbul, Nigel Collar for helping to arrange this, and Martin Collinson for carrying out the genetic work. BP is supported by a Junior Research Fellowship at King's College Cambridge.

## References

- BirdLife International. (2008) *Critically Endangered Birds: a Global Audit*. BirdLife International, Cambridge, UK.
- BirdLife International. (2013a) Species factsheet: *Phyllastrephus leucolepis*, <http://www.birdlife.org>
- BirdLife International. (2013b) Species factsheet: *Phyllastrephus poliocephalus*, <http://www.birdlife.org>
- Borrow, N. & Demey, R. (2004) *Birds of Western Africa*. Christopher Helm, London.
- Collar, N.J. (1998) Extinction by assumption; or, the Romeo Error on Cebu. *Oryx* **32**: 239–244.
- Colston, P.R. (1981) A newly described species of *Melignomon* (Indicatoridae) from Liberia, West Africa. *Bulletin of The British Ornithologists' Club* **101**: 289–291.
- Del Hoyo, J., Elliot, A. & Christie, D. (2005) *Handbook of the Birds of the World, Vol. 10: Cuckoo-Shrikes to Thrushes*. Lynx Edicions.
- Demey, R. & Hester, A. (2008) First records of Nimba Flycatcher *Melaenornis annamarulae* for Ghana. *Bulletin of the African Bird Club* **15**: 95–96.
- Field, G.D. (1979) A new species of *Malimbus* sighted in Sierra Leone and a review of the genus. *Malimbus* **1**: 2–13.
- Forbes-Watson, A.D. (1970) A new species of *Melaenornis* (Muscicapinae) from Liberia. *Bulletin of British Ornithologists' Club* **90**: 145–149.
- Gatter, W. (1985) Ein neuer bülbül aus Westafrika (Aves, Pycnonotidae). *Journal of Ornithology* **126**: 155–161.

- Gatter, W. (1997) *Birds of Liberia*. Yale University Press, New Haven.
- Gatter, W. & Gardner, R. (1993) The biology of the Gola Malimbe *Malimbus ballmanni* Wolters 1974. *Bird Conservation International* **3**: 87–103.
- Ginn H. & Melville D. (1983) *Moult in birds*. British Trust for Ornithology, Thetford.
- Johansson, U.S., Fjeldså, J., Lokugalappatti, L.G.S. & Bowie, R.C.K. (2007) A Nuclear DNA phylogeny and proposed taxonomic revision of African greenbul (Aves, Passeriformes, Pycnonotidae). *Zoologica Scripta* **36**: 417–427.
- LISGIS. (2008) *2008 National Population and Housing Census: Preliminary Results*. Liberia Institute of Statistics and Geo-Information Services, Monrovia, Liberia.
- Louette, M. (1981) A new species of honeyguide from West Africa (Aves, Indicatoridae). *Revue de Zoologie Africaine* **95**: 131–135.
- Molubah, F.P. & Garbo, M. (2010) *Liberian Greenbul – Phyllastrephus leucolepis: Survey Report*. Society for the Conservation of Nature of Liberia, Monrovia, Liberia.
- Moyle, R.G. & Marks, B.D. (2006) Phylogenetic relationships of the bulbuls (Aves: Pycnonotidae) based on mitochondrial and nuclear DNA sequence data. *Molecular Phylogenetics and Evolution* **40**: 687–695.
- Robertson, P. (2001) Liberia. *Important Bird Areas in Africa and Associated Islands: Priority Sites for Conservation* (eds L.D.C. Fishpool & M.I. Evans), pp. 473–480. Pisces Publications and BirdLife International, Newbury and Cambridge, UK.
- Tucker, C.J., Grant, D.M. & Dykstra, J.D. (2004) NASA's global orthorectified Landsat data set. *Photogrammetric Engineering and Remote Sensing* **70**: 313–322.
- Williams, R.S.R. (2002) The rediscovery and doubtful validity of the Blue-wattled Bulbul *Pycnonotus nieuwenhuisii*. *Forktail* **18**: 107–110.

## APPENDICES

### Appendix A: Expedition members

Ben Phalan (BP)	31 Jan – 10 Mar	University of Cambridge
Lincoln D. C. Fishpool (LDCF)	31 Jan – 19 Feb	BirdLife International
Emmanuel M. Loqueh (EML)	1 Feb – 10 Mar	SCNL
Trokon Grimes (TG)	1 Feb – 8 Mar	FDA
Flomo P. Molubah (FPM)	5 Feb – 12 Feb	Golden Veroleum Liberia
Michael Garbo (MG)		SCNL (Monrovia): logistical coordination
Amos ‘Dweh’ Dorbor Patient (Zagbehstown)		principal local guide
A.B. (Zagbehstown)		local cook
Jeff ‘Glepley’ Gblah		local security man/guide
Emmanuel Boakai		local security man
		driver

### Appendix B: Itinerary

- 31 January: flight from London to Monrovia (BP and LDCF). Meeting with MG at SCNL office.
- 1 February: meeting with Harrison Karnwea, interim Managing Director of FDA.
- 2 February: shopping for supplies.
- 3 February: day off, visit to Marshall including boat trip into mangroves.
- 4 February: delayed departure waiting for vehicle paperwork; shopping.
- 5 February: to Robertsfield Airport to collect FPM, via Monserrado and ‘Firestone’ rubber plantation.
- 6 February: drive from Monrovia to Zwedru, leaving 07:30. Car trouble so arrive 22:00.
- 7 February: meetings with acting District Superintendent (Olaska Barh representing Peter Solo, who was absent) and regional FDA office (Alexander Akoy); to Garleystown; camp at Crocodile Camp.
- 8 February: whole day between Crocodile Camp and ‘Gahnway’ hunting base.
- 9 February: whole day north of Crocodile Camp.
- 10 February: mist-netting; whole day near Crocodile Camp.
- 11 February: mist-netting in morning; whole day near and west of Crocodile Camp.
- 12 February: mist-netting north of Crocodile Camp. FPM left to return to Greenville.
- 13 February: morning around Crocodile Camp, then walked back to the road and Garleystown; drove to the Cavalla River (Zewestown, where met Major Mitchell, Washington Zelleh and Lt. Col. Thomas Kahn from the Bureau of Immigration. Camped at the edge of the village after the BoI painstakingly transcribed every detail of our passports and visas.
- 14 February: morning walk near Cavalla River, then packed up to drive to Garleystown, leaving Zewestown at 10:30. Stopped at several streams along the way to check for Black-headed Rufous Warbler using playback. Drove through Garleystown to the ‘Tuzon Road’ and reached ‘Base 3’, where we camped, before 15:00.
- 15 February: whole day north of ‘Base 3’, into good forest north of ‘Base 4’.
- 16 February: morning east of ‘Base 3’, mist-netting in afternoon near ‘Base 3’.
- 17 February: mist-netting in early morning near ‘Base 3’; packed up and walked back to Tuzon Road, getting back to Garleystown by 10:30. Drive to Monrovia, arriving 20:30.

- 18 February: seminar given to staff and students at University of Liberia, Fendell Campus (BP).  
 19 February: flight from Monrovia to London (LDCF).  
 20 February: car repairs, shopping.  
 21 February: drive from Monrovia to Garleystown, leaving 07:00 and arriving 17:15. Camped at Garleystown school.  
 22 February: meeting with Garleystown people, we provided drinks and received their blessing in a ceremony with white chalk. Attempted to locate Gatter's study plots. Visit to Zwedru in afternoon: car stuck in creek for two hours attempting to bypass bridge under repair.  
 23 February: whole day into Franzay Forest to the northeast of Garleystown.  
 24 February: again walked from Garleystown into Franzay Forest.  
 25 February: moved camp from Garleystown to Dorbor Camp. Afternoon in Franzay Forest, setting nets at location where yesterday EML and Dweh saw what they believe was a Liberian Greenbul. Observed birds at pool in dry stream bed near Dorbor Camp (18:00–18:40).  
 26 February: mist-netting and observations in Franzay Forest.  
 27 February: mist-netting and observations in Franzay Forest.  
 28 February: moved camp to 'Base 4'. Observations en route and near Base 4.  
 1 March: most of day north of Base 4.  
 2 March: trek northwards to Krapueh Creek Camp, where camped (BP accompanied by Dweh). EML and TG remained at Base 4 camp.  
 3 March: mist-netting, observations between Krapueh Creek and Cavalla River, where camped (Suba Ninhe Camp; BP accompanied by Dweh).  
 4 March: walked to Sehnoway, took motorbike back to Garleystown, where stayed overnight to meet district commissioner the next day (BP accompanied by Dweh).  
 5 March: met district commissioner; BP and Dweh returned to Base 4 before 15:00; mistnetting.  
 6 March: mist-netting; moved camp to Base 1, getting there 14:15. Mist-netting.  
 7 March: mist-netting; observations north of Base 1.  
 8 March: packed up and returned to Monrovia via Zwedru and Ganta.

### Appendix C: Gazetteer

6.1917° N, 8.1731° W	'Base 1' (hunters' campsite)
6.2024° N, 8.1869° W	'Base 3' (hunters' campsite)
6.2251° N, 8.1844° W	'Base 4' (hunters' campsite)
6.2534° N, 8.1909° W	'Base 5' (former hunters' campsite)
6.2095° N, 8.1478° W	Crocodile Camp, known to locals as 'Tupleh Tuzon' (campsite)
6.1816° N, 8.1336° W	Dorbor Camp (campsite)
6.2166° N, 8.1556° W	'Gahnway Base' (hunters' campsite)
6.1790° N, 8.1465° W	Garleystown (village)
6.1695° N, 8.1565° W	old forestry station (present when Gatter worked in the area)
6.2718° N, 8.2139° W	Krapueh Creek campsite
6.2423° N, 8.1372° W	Sehnoway (village)
6.2777° N, 8.1743° W	Suba Ninhe (=Rocky Creek) campsite
6.1901° N, 8.1794° W	Tuzon Road (logging road navigable by car to this point)
6.2045° N, 8.1291° W	Zagbehstown (village)
6.2819° N, 8.1314° W	Zewestown (village at Côte d'Ivoire border)

## Appendix D: Weather

Largely dry during the expedition period. No rain in the Garleystown area between 7 and 17 February. According to local reports, it rained on 19 February (while we were in Monrovia). There were only a few rain showers, mostly of around an hour's duration: 22 February at 08:00, 26 February at 05:00, 28 February at 02:00 and 7 March at 01:00.

## Appendix E: Budget

US dollars were the usual currency in Liberia for all but minor expenses. Expenditure was calculated on the basis of the actual exchange rate when money was changed, which was £0.63 = US\$1.

---

<b>Summary of expenditure</b>	
Visas	£138.68
Flights	£1,564.39
Contribution to vehicle purchase by SCNL	£4,527.50
Equipment (from UK)	£366.76
Equipment (in Liberia)	£194.21
Food	£527.19
Honoraria/per diems to Liberian expedition members	£529.34
Driver	£308.26
Local guides, porters, cook and security	£342.52
Accommodation	£650.78
Fuel	£551.23
Repairs/maintenance	£123.69
Miscellaneous/other	£129.14
<b>Total</b>	<b>£9,953.69</b>

---

<b>Summary of funding sources</b>	
African Bird Club award	£1,980.00
RSPB	£6,500.00
King's College Cambridge	£439.61
Personal contributions	£1,034.08
<b>Total</b>	<b>£9,953.69</b>

---

## Appendix F: Legacy

Efforts were made to ensure that the expedition left a legacy of value with the SCNL. In terms of financial value, we contributed over £4,500 (\$7,000) to SCNL which went towards the purchase of the Nissan 4×4 vehicle used during the expedition. We left the SCNL with a stock of camping gear and other equipment with a total value close to £600 (~\$900), of which the most valuable items were two 3-man tents and a minidisc player with speaker for playback and recording of bird sounds. LDCF and BP

also made personal gifts of field equipment (binoculars, field guide and headtorch) to expedition members, which are not included in this figure.



*The purchase of this Nissan 4×4 was part-funded by the expedition*

## **Appendix G: Environmental impact**

We calculated the main direct components of the expedition's carbon footprint in tonnes of CO<sub>2</sub> equivalent as: two return flights London–Monrovia (4.61 t); approximately 200 gallons of diesel (including a few gallons of kerosene) consumed with the assumption that each gallon produces 12 kg CO<sub>2</sub> (2.40 t); a guesstimate of 5 kg of firewood used per day, for 25 nights in the field (0.23 t CO<sub>2</sub>). This gave an approximate carbon footprint of 7.24 t CO<sub>2</sub>. This was offset out of personal funds through a donation of £108.60 to the World Land Trust at <http://www.carbonbalanced.org> (not counted in the budget summary above).

We took measures to limit other environmental impacts. Whilst working for us as guides or security men, locals were not permitted to hunt. We did not buy bushmeat. We bought two kerosene stoves with the aim of avoiding firewood use, but this proved impractical given what local people are used to, and we ended up using a combination of kerosene stove and wood fire for cooking. The stoves did, however, reduce our consumption of firewood. It might be worth bringing fuel-efficient wood-burning stoves on a future expedition. We burned most of our rubbish, and buried metal tins after they had been put in the fire to remove traces of food that could attract animals. Used batteries were taken back to the UK for recycling.

## Appendix H: Observations of species on the Global Red List

- Crowned Eagle *Stephanoaetus coronatus*. **NEAR THREATENED**. Heard singing above forest on 12 February (13:00), 13 February (13:00), 2 March (11:45) and 3 March (14:45): all of these observations were separated by at least a kilometre, and indicate the presence of 2–4 territories.
- White-breasted Guineafowl *Agelastes meleagrides*. **VULNERABLE**. Groups, including a flock of around eight birds, observed in three well-separated locations, on 11 February, 2 March and 7 March.
- Timneh Parrot *Psittacus timneh*. **VULNERABLE**. Seen or heard almost daily singly or in small numbers, flying over in early morning or late evening. Largest count was a total of ten flying southeast over Garleystown on morning of 22 February (largest single group 4). Locals reported that a trapper from Zwedru had paid periodic visits, using a decoy bird (probably a Senegal Parrot) to trap 40 or 50 Timneh Parrots at a time, and taking them across the border to Côte d'Ivoire. Away from the Cavalla Forest, one for sale in the street in Monrovia on 18 February.
- Brown-cheeked Hornbill *Bycanistes cylindricus*. **VULNERABLE**. Heard on 5 or 6 days.
- Yellow-casqued Hornbill *Ceratogymna elata*. **VULNERABLE**. Seen or heard on most days. Perhaps a little less common than *C. atrata*, although it was often difficult to distinguish calls of the two species.
- Yellow-footed Honeyguide *Melignomon eisentrauti*. **DATA DEFICIENT**. One heard singing near Crocodile Camp on 10 February.
- Green-tailed Bristlebill *Bleda eximius*. **NEAR THREATENED**. Not vocal and probably overlooked. Two mist-netted (in Franzay Forest and near Base 1), and one seen coming to small pool near Dorbor Camp in evening of 25 February. Only heard singing on one occasion: near Base 1 on 6 March.
- Yellow-bearded Greenbul *Criniger olivaceus*. **VULNERABLE**. Observed in six bird parties in less-disturbed areas of closed-canopy forest. Two mist-netted in Franzay Forest on 27 February.
- Rufous-winged Illadopsis *Illadopsis rufescens*. **NEAR THREATENED**. Heard (and seen with the aid of playback) on five days, in closed-canopy but also in quite disturbed forest.
- Copper-tailed Starling *Lamprotornis cupreocauda*. **NEAR THREATENED**. The most frequently observed starling, present in small numbers throughout the Cavalla Forest.
- Red-fronted Antpecker *Parmoptila rubrifrons*. **NEAR THREATENED**. A pair mist-netted at Base 3 on 16 February, and one seen with a mixed flock near Base 1 on 7 March.



## Appendix I: Checklist of birds of the Cavalla Forest and Zwedru area

Checklist of birds of the Cavalla Forest and Zwedru area, based on Gatter (1997) and our observations in 2013. The ‘Zwedru’ column includes species mapped in the quarter-degree grid cell that includes Zwedru, and species which are not mapped but which are mentioned in the text as occurring at Zwedru or Tuzon. The ‘Cavalla’ column includes species mapped in the quarter-degree grid cell immediately north of the Zwedru grid cell. The 2013 column includes species recorded during our expedition in 2013. A further species, Yellow-throated Cuckoo *Chrysococcyx flavigularis*, was recorded by Gatter north of Zwedru, but outside the two grid cells considered here. Global Red List status is given in the RL column, and **Upper Guinea endemics** are highlighted in **bold**. Occurrence is indicated by 1, with ‘V’ referring to vagrants, and ‘?’ referring to some uncertainty about either the identification, or to species which are not mapped and where the text is unclear whether they occur near Zwedru, but which are widespread and thus may occur. The total number of species recorded by Gatter in the Zwedru and Cavalla grid cells combined was 347 (358 if ‘?’ species are included).

Species	RL	Zwedru	Cavalla	2013
Great Cormorant <i>Phalacrocorax carbo</i>		V		
Long-tailed Cormorant <i>Phalacrocorax africanus</i>		1		1
Pink-backed Pelican <i>Pelecanus rufescens</i>		V		
Little Bittern <i>Ixobrychus minutus</i>		1		
Dwarf Bittern <i>Ixobrychus sturmii</i>		1		
White-crested Tiger Heron <i>Tigriornis leucolopha</i>		1	1	
Black-crowned Night Heron <i>Nycticorax nycticorax</i>		1		
White-backed Night Heron <i>Gorsachius leuconotus</i>		1		
Squacco Heron <i>Ardeola ralloides</i>		1		
Cattle Egret <i>Bubulcus ibis</i>		1		1
Green-backed Heron <i>Butorides striata</i>		1	1	
Little Egret <i>Egretta garzetta</i>		1		
Western Reef Egret <i>Egretta gularis</i>		1		
Intermediate Egret <i>Egretta intermedia</i>		1		
Purple Heron <i>Ardea purpurea</i>		1		
Grey Heron <i>Ardea cinerea</i>		1		
Black-headed Heron <i>Ardea melanocephala</i>		1		
Goliath Heron <i>Ardea goliath</i>		V		

Species	RL	Zwedru	Cavalla	2013
Hamerkop <i>Scopus umbretta</i>		V		
Woolly-necked Stork <i>Ciconia episcopus</i>		1	1	1
Hadada Ibis <i>Bostrychia hagedash</i>			1	1
Olive Ibis <i>Bostrychia olivacea</i>		1	1	
Spot-breasted Ibis <i>Bostrychia rara</i>		1		1
Spur-winged Goose <i>Plectropterus gambensis</i>		1		
Hartlaub's Duck <i>Pteronetta hartlaubii</i>		1	1	1
Pintail <i>Anas acuta</i>		V		
Garganey <i>Anas querquedula</i>		1		
Northern Shoveler <i>Anas clypeata</i>		V		
African Cuckoo Hawk <i>Aviceda cuculoides</i>		1	1	
Honey Buzzard <i>Pernis apivorus</i>		1		
Bat Hawk <i>Macheiramphus alcinus</i>		1	1	1
Black-shouldered Kite <i>Elanus caeruleus</i>		1		
Yellow-billed Kite <i>Milvus migrans</i>		?	?	1
African Fish Eagle <i>Haliaeetus vocifer</i>			1	
Palm-nut Vulture <i>Gypohierax angolensis</i>		1	1	1
Congo Serpent Eagle <i>Dryotriorchis spectabilis</i>		1	1	
African Harrier Hawk <i>Polyboroides typus</i>		1	1	1
Eurasian Marsh Harrier <i>Circus aeruginosus</i>		1		
Pallid Harrier <i>Circus macrourus</i>	NT	V		
Montagu's Harrier <i>Circus pygargus</i>		1		
Black Sparrowhawk <i>Accipiter melanoleucus</i>		1	1	1
Red-thighed Sparrowhawk <i>Accipiter erythropus</i>		1	1	
African Goshawk <i>Accipiter tachiro</i>		1	1	1
Shikra <i>Accipiter badius</i>		1		
Long-tailed Hawk <i>Urotriorchis macrourus</i>		1	1	1
Grasshopper Buzzard <i>Butastur rufipennis</i>		V		

Species	RL	Zwedru	Cavalla	2013
Lizard Buzzard <i>Kaupifalco monogrammicus</i>		1		1
Red-necked Buzzard <i>Buteo auguralis</i>		1	1	1
Ayres's Hawk Eagle <i>Hieraaetus ayresii</i>		1		
Long-crested Eagle <i>Lophaetus occipitalis</i>		?	?	
Cassin's Hawk Eagle <i>Spizaetus africanus</i>		1		1
Crowned Eagle <i>Stephanoaetus coronatus</i>	NT	1	1	1
Lesser Kestrel <i>Falco naumanni</i>		V		
Common Kestrel <i>Falco tinnunculus</i>		1		
Fox Kestrel <i>Falco alopex</i>		V		
African Hobby <i>Falco cuvierii</i>		1		
Lanner Falcon <i>Falco biarmicus</i>				1
Peregrine Falcon <i>Falco peregrinus</i>		1		
Latham's Forest Francolin <i>Francolinus lathamii</i>		1	1	1
Ahanta Francolin <i>Francolinus achantensis</i>		1	1	
Common Quail <i>Coturnix coturnix</i>		1		
Blue Quail <i>Coturnix chinensis</i>		1		
<b>White-breasted Guineafowl <i>Agelastes meleagrides</i></b>	VU	1	1	1
Crested Guineafowl <i>Guttera pucherani</i>		1	1	1
Nkulengu Rail <i>Himantornis haematopus</i>		1		1
White-spotted Flufftail <i>Sarothrura pulchra</i>		1	1	1
Grey-throated Rail <i>Canirallus oculeus</i>		1	1	
African Crake <i>Crex egregia</i>		1		
Black Crake <i>Amaurornis flavirostra</i>		1		
Little Crake <i>Porzana parva</i>		V		
Spotted Crake <i>Porzana porzana</i>		1		
Allen's Gallinule <i>Porphyrio alleni</i>		1		
Common Moorhen <i>Gallinula chloropus</i>		1		
African Finfoot <i>Podica senegalensis</i>		1	1	1

Species	RL	Zwedru	Cavalla	2013
African Jacana <i>Actophilornis africanus</i>		1		
Greater Painted Snipe <i>Rostratula benghalensis</i>		1		
Black-winged Stilt <i>Himantopus himantopus</i>		1		
Senegal Thick-knee <i>Burhinus senegalensis</i>		1		
Collared Pratincole <i>Glareola pratincola</i>		1		
Rock Pratincole <i>Glareola nuchalis</i>			1	1
Little Ringed Plover <i>Charadrius dubius</i>		1		
Common Ringed Plover <i>Charadrius hiaticula</i>		?		
Forbes's Plover <i>Charadrius forbesi</i>		1		
Caspian Plover <i>Charadrius asiaticus</i>		?		
American Golden Plover <i>Pluvialis dominica</i>		?		
African Wattled Lapwing <i>Vanellus senegallus</i>		1		
White-headed Lapwing <i>Vanellus albiceps</i>		1	1	
Common Snipe <i>Gallinago gallinago</i>		1		
Great Snipe <i>Gallinago media</i>	NT	1		
Jack Snipe <i>Lymnocyptes minimus</i>		1		
Green Sandpiper <i>Tringa ochropus</i>		1		
Wood Sandpiper <i>Tringa glareola</i>		1		
Common Sandpiper <i>Actitis hypoleucos</i>		?	?	
Little Stint <i>Calidris minuta</i>		1		
Temminck's Stint <i>Calidris temminckii</i>		1		
Pectoral Sandpiper <i>Calidris melanotos</i>		1		
Dunlin <i>Calidris alpina</i>		1		
Ruff <i>Philomachus pugnax</i>		1		
Grey Phalarope <i>Phalaropus fulicarius</i>		V		
African Skimmer <i>Rynchops flavirostris</i>	NT		1	
Afep Pigeon <i>Columba unicincta</i>		1	1	1
Western Bronze-naped Pigeon <i>Columba iriditorques</i>		1	1	1

Species	RL	Zwedru	Cavalla	2013
Laughing Dove <i>Streptopelia senegalensis</i>				1
Red-eyed Dove <i>Streptopelia semitorquata</i>		1		1
Blue-spotted Wood Dove <i>Turtur afer</i>		1	1	1
Tambourine Dove <i>Turtur tympanistria</i>		1	1	1
Blue-headed Wood Dove <i>Turtur brehmeri</i>		1	1	1
African Green Pigeon <i>Treron calvus</i>		1	1	1
<b>Timneh Parrot <i>Psittacus timneh</i></b>	<b>VU</b>	<b>1</b>	<b>1</b>	<b>1</b>
Red-fronted Parrot <i>Poicephalus gulielmi</i>		1	1	
Yellow-billed Turaco <i>Tauraco macrorhynchus</i>		1	1	1
Great Blue Turaco <i>Corythaeola cristata</i>		1	1	1
Levaillant's Cuckoo <i>Clamator levaillantii</i>		1		
Thick-billed Cuckoo <i>Pachycoccyx audeberti</i>			1	
Red-chested Cuckoo <i>Cuculus solitarius</i>		1	1	1
Black Cuckoo <i>Cuculus clamosus</i>			?	1
Dusky Long-tailed Cuckoo <i>Cercococcyx mechowi</i>		1	1	
Olive Long-tailed Cuckoo <i>Cercococcyx olivinus</i>		1	1	1
African Emerald Cuckoo <i>Chrysococcyx cupreus</i>		1	1	1
Klaas's Cuckoo <i>Chrysococcyx klaas</i>		1	1	1
Didric Cuckoo <i>Chrysococcyx caprius</i>		1	1	
Yellowbill <i>Ceuthmochares aereus</i>		1	1	1
Black Coucal <i>Centropus grillii</i>		1		
Black-throated Coucal <i>Centropus leucogaster</i>		1	1	1
Senegal Coucal <i>Centropus senegalensis</i>		1	1	1
Barn Owl <i>Tyto alba</i>		1		
Sandy Scops Owl <i>Otus icterorhynchus</i>		1	1	
Maned Owl <i>Jubula lettii</i>	DD		1	
Fraser's Eagle Owl <i>Bubo poensis</i>		1	1	1
Shelley's Eagle Owl <i>Bubo shelleyi</i>	NT	1	1	

Species	RL	Zwedru	Cavalla	2013
Akun Eagle Owl <i>Bubo leucostictus</i>		1	1	
Pel's Fishing Owl <i>Scotopelia peli</i>			1	
<b>Rufous Fishing Owl <i>Scotopelia ussheri</i></b>	<b>VU</b>	<b>1</b>	<b>1</b>	
Red-chested Owlet <i>Glaucidium tephronotum</i>		1		1
African Barred Owlet <i>Glaucidium capense</i>		1	1	
African Wood Owl <i>Strix woodfordii</i>		1	1	1
Short-eared Owl <i>Asio flammeus</i>		1		
Brown Nightjar <i>Caprimulgus binotatus</i>				1
European Nightjar <i>Caprimulgus europaeus</i>		V		
Plain Nightjar <i>Caprimulgus inornatus</i>		1		
Long-tailed Nightjar <i>Caprimulgus climacurus</i>		1	1	
Standard-winged Nightjar <i>Macrodipteryx longipennis</i>		1		
Mottled Spinetail <i>Telacanthura ussheri</i>		1		
Black Spinetail <i>Telacanthura melanopygia</i>		1	1	
Sabine's Spinetail <i>Rhaphidura sabini</i>		1	1	1
Cassin's Spinetail <i>Neafrapus cassini</i>		1	1	
African Palm Swift <i>Cypsiurus parvus</i>		1		
European Swift <i>Apus apus</i>		1	1	1
Little Swift <i>Apus affinis</i>		V		1
Narina's Trogon <i>Apaloderma narina</i>		1	1	1
Shining-blue Kingfisher <i>Alcedo quadribrachys</i>		1	1	1
Malachite Kingfisher <i>Alcedo cristata</i>		1	1	
White-bellied Kingfisher <i>Alcedo leucogaster</i>		1	1	1
African Dwarf Kingfisher <i>Ceyx lecontei</i>		1	1	1
African Pygmy Kingfisher <i>Ceyx pictus</i>		1	1	
Chocolate-backed Kingfisher <i>Halcyon badia</i>		1	1	1
Grey-headed Kingfisher <i>Halcyon leucocephala</i>		1	1	
Blue-breasted Kingfisher <i>Halcyon malimbica</i>		1	1	1

Species	RL	Zwedru	Cavalla	2013
Woodland Kingfisher <i>Halcyon senegalensis</i>		1	1	1
Giant Kingfisher <i>Megaceryle maxima</i>		1	1	1
Blue-moustached Bee-eater <i>Merops mentalis</i>	NT	1	1	
Black Bee-eater <i>Merops gularis</i>		1	1	1
Little Bee-eater <i>Merops pusillus</i>		V		
White-throated Bee-eater <i>Merops albicollis</i>		1	1	1
Abyssinian Roller <i>Coracias abyssinicus</i>		1		
Rufous-crowned Roller <i>Coracias naevius</i>		V		
Broad-billed Roller <i>Eurystomus glaucurus</i>		1	1	
Blue-throated Roller <i>Eurystomus gularis</i>		1	1	1
White-headed Wood Hoopoe <i>Phoeniculus bollei</i>		1	1	
Forest Wood Hoopoe <i>Phoeniculus castaneiceps</i>		1	1	1
White-crested Hornbill <i>Tropicranus albocristatus</i>		1	1	1
Black Dwarf Hornbill <i>Tockus hartlaubi</i>		1	1	1
Red-billed Dwarf Hornbill <i>Tockus camurus</i>		1	1	1
African Pied Hornbill <i>Tockus fasciatus</i>		1	1	1
Piping Hornbill <i>Bycanistes fistulator</i>		1	1	1
<b>Brown-cheeked Hornbill <i>Bycanistes cylindricus</i></b>	<b>VU</b>	<b>1</b>	<b>1</b>	<b>1</b>
Black-casqued Hornbill <i>Ceratogymna atrata</i>		1	1	1
Yellow-casqued Hornbill <i>Ceratogymna elata</i>	VU	1	1	1
Naked-faced Barbet <i>Gymnobucco calvus</i>		1	1	
Bristle-nosed Barbet <i>Gymnobucco peli</i>		1	1	1
Yellow-spotted Barbet <i>Buccanodon duchaillui</i>		1	1	1
Speckled Tinkerbird <i>Pogoniulus scolopaceus</i>		1	1	1
Yellow-rumped Tinkerbird <i>Pogoniulus bilineatus</i>		1		
Yellow-throated Tinkerbird <i>Pogoniulus subsulphureus</i>		1	1	1
Red-rumped Tinkerbird <i>Pogoniulus atroflavus</i>		1	1	1
Hairy-breasted Barbet <i>Tricholaema hirsuta</i>		1	1	1

Species	RL	Zwedru	Cavalla	2013
Yellow-billed Barbet <i>Trachylaemus purpuratus</i>		1	1	1
Cassin's Honeybird <i>Prodotiscus insignis</i>		1		1
Yellow-footed Honeyguide <i>Melignomon eisentrauti</i>	DD			1
Spotted Honeyguide <i>Indicator maculatus</i>		1	1	
Lesser Honeyguide <i>Indicator minor</i>		1	1	
Willcocks's Honeyguide <i>Indicator willcocksii</i>		1		1
Lyre-tailed Honeyguide <i>Melichneutes robustus</i>		1	1	
African Piculet <i>Sasia africana</i>		1		1
Little Green Woodpecker <i>Campethera maculosa</i>		1	1	1
Buff-spotted Woodpecker <i>Campethera nivosus</i>		1	1	1
Brown-eared Woodpecker <i>Campethera caroli</i>		1	1	1
Gabon Woodpecker <i>Dendropicos gabonensis</i>		1		1
Fire-bellied Woodpecker <i>Thripias pyrrhogaster</i>		1	1	1
Rufous-sided Broadbill <i>Smithornis rufolateralis</i>		1	1	1
African Pitta <i>Pitta angolensis</i>		1	1	
Square-tailed Saw-wing <i>Psalidoprocne nitens</i>		1	1	
Fanti Saw-wing <i>Psalidoprocne obscura</i>		1		
Grey-rumped Swallow <i>Pseudhirundo griseopyga</i>		1		
Rufous-chested Swallow <i>Hirundo semirufa</i>		1	1	
Preuss's Cliff Swallow <i>Hirundo preussi</i>			1	
Rock Martin <i>Hirundo fuligula</i>			1	
White-throated Blue Swallow <i>Hirundo nigrita</i>		1	1	1
Barn Swallow <i>Hirundo rustica</i>		1	1	
House Martin <i>Delichon urbicum</i>		1		
Yellow Wagtail <i>Motacilla flava</i>		?	?	
Mountain Wagtail <i>Motacilla clara</i>			1	
African Pied Wagtail <i>Motacilla aguimp</i>			1	1
Richard's Pipit <i>Anthus richardi</i>		1		



Species	RL	Zwedru	Cavalla	2013
Long-billed Pipit <i>Anthus similis</i>			1	
Plain-backed Pipit <i>Anthus leucophrys</i>				1
Tree Pipit <i>Anthus trivialis</i>		1		
Red-throated Pipit <i>Anthus cervinus</i>		1		
Purple-throated Cuckoo-shrike <i>Campephaga quiscalina</i>		1	1	
<b>Western Wattled Cuckoo-shrike <i>Lobotos lobatus</i></b>	<b>VU</b>		<b>1</b>	
Blue Cuckoo-shrike <i>Coracina azurea</i>		1	1	1
Little Greenbul <i>Andropadus virens</i>		1	1	1
Little Grey Greenbul <i>Andropadus gracilis</i>		1	1	1
Ansorge's Greenbul <i>Andropadus ansorgei</i>		1	1	1
Cameroon Sombre Greenbul <i>Andropadus curvirostris</i>		1	1	1
Slender-billed Greenbul <i>Andropadus gracilirostris</i>		1	1	1
Yellow-whiskered Greenbul <i>Andropadus latirostris</i>		1	1	1
Golden Greenbul <i>Calyptocichla serina</i>		1	1	1
Honeyguide Greenbul <i>Baeopogon indicator</i>		1	1	1
Spotted Greenbul <i>Ixonotus guttatus</i>		1	1	1
Simple Greenbul <i>Chlorocichla simplex</i>		1		
Swamp Palm Bulbul <i>Thescelocichla leucopleura</i>		1	1	1
Icterine Greenbul <i>Phyllastrephus icterinus</i>		1	1	1
<b>Liberian Greenbul <i>Phyllastrephus leucolepis</i></b>	<b>CR</b>	<b>1</b>		
White-throated Greenbul <i>Phyllastrephus albigularis</i>				1
Red-tailed Bristlebill <i>Bleda syndactylus</i>		1	1	1
<b>Green-tailed Bristlebill <i>Bleda eximius</i></b>	<b>NT</b>	<b>1</b>	<b>1</b>	<b>1</b>
Grey-headed Bristlebill <i>Bleda canicapillus</i>		1	1	1
Western Bearded Greenbul <i>Criniger barbatus</i>		1	1	1
Red-tailed Greenbul <i>Criniger calurus</i>		1	1	1

Species	RL	Zwedru	Cavalla	2013
<b>Yellow-bearded Greenbul</b> <i>Criniger olivaceus</i>	<b>VU</b>	<b>1</b>	<b>1</b>	<b>1</b>
Common Bulbul <i>Pycnonotus barbatus</i>		1	?	1
Western Nicator <i>Nicator chloris</i>		1	1	1
White-tailed Ant Thrush <i>Neocossyphus poensis</i>		1	1	1
Finsch's Flycatcher Thrush <i>Stizorhina finschi</i>		1	1	1
Grey Ground Thrush <i>Zoothera princei</i>		1		
White-tailed Alethe <i>Alethe diademata</i>		1		1
Brown-chested Alethe <i>Alethe poliocephala</i>		1	1	1
Forest Robin <i>Stiphrornis erythrothorax</i>		1	1	1
Lowland Akalat <i>Sheppardia cyornithopsis</i>			1	
Common Nightingale <i>Luscinia megarhynchos</i>		1		
Snowy-crowned Robin-Chat <i>Cossypha niveicapilla</i>		1		
Forest Scrub Robin <i>Erythropygia leucosticta</i>		1	1	1
Whinchat <i>Saxicola rubetra</i>		?	?	
<b>Black-headed Rufous Warbler</b> <i>Bathmocercus cerviniventris</i>	<b>NT</b>	<b>1</b>	<b>1</b>	
Sedge Warbler <i>Acrocephalus schoenobaenus</i>		1		
Eurasian Reed Warbler <i>Acrocephalus scirpaceus</i>		?	?	
Great Reed Warbler <i>Acrocephalus arundinaceus</i>		1		
Icterine Warbler <i>Hippolais icterina</i>		1		
Melodious Warbler <i>Hippolais polyglotta</i>		1	?	
Rufous-crowned Eremomela <i>Eremomela badiceps</i>		1	1	1
Green Crombec <i>Sylvietta virens</i>		1	1	1
Lemon-bellied Crombec <i>Sylvietta denti</i>		1	1	1
Grey Longbill <i>Macrosphenus concolor</i>		1	1	1
Kemp's Longbill <i>Macrosphenus kempii</i>		1	1	1
Willow Warbler <i>Phylloscopus trochilus</i>		?	?	
Wood Warbler <i>Phylloscopus sibilatrix</i>		1	?	1

Species	RL	Zwedru	Cavalla	2013
Violet-backed Hyliota <i>Hyliota violacea</i>		1	1	1
Green Hylia <i>Hylia prasina</i>		1	1	1
Whistling Cisticola <i>Cisticola lateralis</i>		1	1	
Tawny-flanked Prinia <i>Prinia subflava</i>		1	1	1
Black-capped Apalis <i>Apalis nigriceps</i>				1
<b>Sharpe's Apalis <i>Apalis sharpii</i></b>		<b>1</b>	<b>1</b>	<b>1</b>
Grey-backed Camaroptera <i>Camaroptera brachyura</i>		1	1	1
Yellow-browed Camaroptera <i>Camaroptera superciliaris</i>		1	1	1
Olive-green Camaroptera <i>Camaroptera chloronota</i>		1	1	1
Fraser's Forest Flycatcher <i>Fraseria ocreata</i>		1	1	1
White-browed Forest Flycatcher <i>Fraseria cinerascens</i>		1	1	1
Spotted Flycatcher <i>Muscicapa striata</i>		1		
Olivaceous Flycatcher <i>Muscicapa olivascens</i>		1	1	
Cassin's Flycatcher <i>Muscicapa cassini</i>		1	1	
Little Grey Flycatcher <i>Muscicapa epulata</i>		1	1	
Ashy Flycatcher <i>Muscicapa caerulescens</i>		1		
Dusky Blue Flycatcher <i>Muscicapa comitata</i>		1	1	1
Ussher's Flycatcher <i>Muscicapa ussheri</i>		1	1	1
Grey-throated Flycatcher <i>Myioparus griseigularis</i>				1
Shrike Flycatcher <i>Megabyas flammulatus</i>		1	1	
Black-and-white Flycatcher <i>Bias musicus</i>		1		
Bioko Batis <i>Batis poensis</i>		1	1	1
Yellow-bellied Wattle-eye <i>Dyaphorophya concreta</i>		1	1	
Red-cheeked Wattle-eye <i>Dyaphorophya blissetti</i>		1	1	
Chestnut Wattle-eye <i>Dyaphorophya castanea</i>		1	1	1
Chestnut-capped Flycatcher <i>Erythrocercus mcallii</i>		1	1	1

Species	RL	Zwedru	Cavalla	2013
Dusky Crested Flycatcher <i>Elminia nigromitrata</i>		1	1	
Blue-headed Crested Flycatcher <i>Trochocercus nitens</i>		1	1	1
African Paradise Flycatcher <i>Terpsiphone viridis</i>			1	
Red-bellied Paradise Flycatcher <i>Terpsiphone rufiventer</i>		1	1	1
Brown Illadopsis <i>Illadopsis fulvescens</i>		1	1	1
Pale-breasted Illadopsis <i>Illadopsis rufipennis</i>		1	1	1
Blackcap Illadopsis <i>Illadopsis cleaveri</i>		1	1	1
<b>Rufous-winged Illadopsis <i>Illadopsis rufescens</i></b>	<b>NT</b>	<b>1</b>	<b>1</b>	<b>1</b>
Puvel's Illadopsis <i>Illadopsis puveli</i>		1	1	1
<b>Yellow-headed Picathartes <i>Picathartes gymnocephalus</i></b>	<b>VU</b>		<b>1</b>	
Dusky Tit <i>Parus funereus</i>		1		
Tit-hylia <i>Pholidornis rushiae</i>		1		1
Fraser's Sunbird <i>Deleornis fraseri</i>		1	1	1
Brown Sunbird <i>Anthreptes gabonicus</i>		1	1	1
Green (Yellow-chinned) Sunbird <i>Anthreptes rectirostris</i>		1	1	1
Collared Sunbird <i>Anthreptes collaris</i>		1	1	1
Little Green Sunbird <i>Nectarinia seimundi</i>		1	1	
Bates's Sunbird <i>Nectarinia batesi</i>		1		
Olive Sunbird <i>Nectarinia olivacea</i>		1	1	1
Green-headed Sunbird <i>Nectarinia verticalis</i>		1		
Blue-throated Brown Sunbird <i>Nectarinia cyanolaema</i>		1	1	1
Buff-throated Sunbird <i>Nectarinia adelberti</i>		1	1	1
Variable Sunbird <i>Nectarinia venusta</i>			1	
Olive-bellied Sunbird <i>Nectarinia chloropygia</i>		1	1	1
Tiny Sunbird <i>Nectarinia minulla</i>		1	1	1
Johanna's Sunbird <i>Nectarinia johannae</i>		1	1	1

Species	RL	Zwedru	Cavalla	2013
Superb Sunbird <i>Nectarinia superba</i>		1	1	1
Western Black-headed Oriole <i>Oriolus brachyrhynchus</i>		1	1	1
Black-winged Oriole <i>Oriolus nigripennis</i>		1		1
Common Fiscal <i>Lanius collaris</i>		1		1
Woodchat Shrike <i>Lanius senator</i>		1	?	
Sabine's Puffback <i>Dryoscopus sabini</i>		1	1	1
Sooty Boubou <i>Laniarius leucorhynchus</i>		1		1
Many-coloured Bush Shrike <i>Malaconotus multicolor</i>		1	1	
Fiery-breasted Bush Shrike <i>Malaconotus cruentus</i>		1		
Lagden's Bush Shrike <i>Malaconotus lagdeni</i>	NT		1	
Red-billed Helmet Shrike <i>Prionops caniceps</i>		1	1	1
Shining Drongo <i>Dicrurus atripennis</i>		1	1	1
Velvet-mantled Drongo <i>Dicrurus modestus</i>		1	1	1
Pied Crow <i>Corvus albus</i>		1		1
Narrow-tailed Starling <i>Poeoptera lugubris</i>		1		
Forest Chestnut-winged Starling <i>Onychognathus fulgidus</i>		1	1	1
<b>Copper-tailed Starling <i>Lamprotornis cupreocauda</i></b>	<b>NT</b>	<b>1</b>	<b>1</b>	<b>1</b>
Splendid Starling <i>Lamprotornis splendidus</i>		1	1	1
Violet-backed Starling <i>Cinnyricinclus leucogaster</i>		1		
Northern Grey-headed Sparrow <i>Passer griseus</i>		1	1	1
Black-necked Weaver <i>Ploceus nigricollis</i>		1	1	1
Vieillot's Black Weaver <i>Ploceus nigerrimus</i>		1	1	
Village Weaver <i>Ploceus cucullatus</i>		1		
Yellow-mantled Weaver <i>Ploceus tricolor</i>		1	1	1
Maxwell's Black Weaver <i>Ploceus albinucha</i>		1	1	1
Preuss's Golden-backed Weaver <i>Ploceus preussi</i>		1		1

Species	RL	Zwedru	Cavalla	2013
Blue-billed Malimbe <i>Malimbus nitens</i>		1	1	1
Crested Malimbe <i>Malimbus malimbicus</i>		1	1	1
Red-vented Malimbe <i>Malimbus scutatus</i>		1	1	1
<b>Gola Malimbe <i>Malimbus ballmanni</i></b>	<b>EN</b>	<b>1</b>	<b>1</b>	
Red-headed Malimbe <i>Malimbus rubricollis</i>		1	1	1
Red-headed Quelea <i>Quelea erythrops</i>		1		
Black-winged Bishop <i>Euplectes hordeaceus</i>		1	1	
Yellow-mantled Widowbird <i>Euplectes macroura</i>		1		
Red-collared Widowbird <i>Euplectes ardens</i>		1		
<b>Red-fronted Antpecker <i>Parmoptila rubrifrons</i></b>	<b>NT</b>	<b>1</b>	<b>1</b>	<b>1</b>
Grey-crowned Nigrita <i>Nigrita canicapillus</i>		1	1	1
Chestnut-breasted Nigrita <i>Nigrita bicolor</i>		1	1	1
White-breasted Nigrita <i>Nigrita fusconotus</i>		1	1	1
Crimson Seedcracker <i>Pyrenestes sanguineus</i>		1	1	
Western Bluebill <i>Spermophaga haematina</i>		1	1	1
Green Twinspot <i>Mandingoa nitidula</i>		1		
Orange-cheeked Waxbill <i>Estrilda melpoda</i>		1	1	
Bronze Mannikin <i>Spermestes cucullata</i>		1		
Black-and-white Mannikin <i>Spermestes bicolor</i>		1	1	1
Magpie Mannikin <i>Spermestes fringilloides</i>		1	1	
Pin-tailed Whydah <i>Vidua macroura</i>		1	1	
Total (excluding ‘?’ species)		329	222	186
Total (including ‘?’ species)		339	234	186

## Appendix J: Notes on selected species of interest, and breeding records.

For scientific names, see Appendix I. For sound recordings, see Appendix L.

Woolly-necked Stork. One over Zwedru on 7 February.

Hadada Ibis. Two singles at Cavalla River, and another two going to roost in a riverside tree, 3 March.

Spot-breasted Ibis. Heard on several occasions shortly after dark, or before dawn.

Hartlaub's Duck. One on Krapueh Creek, and two going to roost on dead tree next to Cavalla River, 3 March.

Bat Hawk. One flying above Cavalla River at 18:40, 3 March.

Long-tailed Hawk. One perched by roadside 3 km south of Garleystown, 8 March.

Lanner Falcon. One circling over Zwedru on 7 February.

Crested Guineafowl. Feathers found regularly (in dust baths and where hunters had killed birds). Two seen on 4 March near Cavalla River. Away from the Cavalla Forest, one (dead) for sale by roadside on 17 February, at 6.4705° N, 8.6821° W.

Laughing Dove. Seen in Zwedru on 7 February.

African Green Pigeon. Largest group was 21 at Garleystown, 22 February.

Great Blue Turaco. Seen or heard daily. Flock of eight on 28 February.

Red-chested Cuckoo. Heard on 2 and 4 March, not far from Cavalla River.

Black Cuckoo. Heard on 9 and 27 February, and 3 March.

Red-chested Owlet. One heard (and seen, with playback) on nights of 25–27 February near Dorbor Camp.

Brown Nightjar. Singing for brief periods before dawn and after dusk near Base 3 (15–17 February) and Base 4 (1 and 5 March) – where two were seen chasing each other through a clearing at 19:06 on 5 March. Very few records from Liberia, and no previous observations from the Cavalla Forest.

Unidentified swift *Apus* sp. A group of several dozen all-dark swifts was seen over the Cavalla River on 3 March. Visual resemblance to European Swift, but calls did not sound like that species, and were transcribed as 'srrriiw'. A poor quality sound recording was made of another call (a fast 'sri-sri-sri-sri') from the same birds (see Appendix L).

Forest Wood Hoopoe. A group observed in a mixed flock on 14 February.

Black Dwarf Hornbill. Seen in three places, including degraded forest adjacent to Garleystown village, and with a mixed flock in Franzay Forest.

Black-casqued Hornbill. Seen or heard almost daily. On some days, the calls and wingbeats of this and Yellow-casqued Hornbill could be heard virtually all the time.

Cassin's Honeybird. One seen in tall tree on 15 February. Other honeyguides, apparently with fine bills and therefore possibly this species, on 14 and 23 February.

Willcocks's Honeyguide. One singing on 16 February.

African Piculet. One seen near Crocodile Camp on 8 February. A very poor photograph was obtained. Tiny high-pitched calls and tapping on Marantaceae stems, possibly by this species (but not seen), near Base 4 on 28 February and 6 March.

Plain-backed Pipit. One seen on open ground in the town of Zwedru on 7 February.

White-throated Greenbul. Found in at least three different locations in Cavalla Forest, including one caught in a mist-net.

Brown-chested Alethe. One caught in mist net on 6 March near Base 1.

Forest Scrub Robin. One heard (and recorded) near Base 3 on 16 March.

Lemon-bellied Crombec. Seen near Garleystown on 23 February.

Wood Warbler. Seen on five days between 13 February and 5 March, including observations of birds singing. Mostly in tall trees in open-canopy logged forest.

Black-capped Apalis. Heard singing on 15 and 16 February and 1 March. It was not possible to get a recording. In Liberia, not previously found south of northern Nimba County.

Grey-throated Flycatcher. Quite frequent: seen or heard on ten days. In Liberia, previously only recorded from the Mt Nimba area, but probably overlooked in the past because of its unobtrusive habits and subtle song. Good recordings were obtained.

Bioko Batis. Heard on 16 February, 1 March and 5 March in Cavalla Forest.

Puvel's Illadopsis. Heard in secondary vegetation near Garleystown.

Western Black-headed Oriole. By far the commoner of the two oriole species, and the only species seen or heard in forest proper.

Black-winged Oriole. Not found in forest. Its distinctive sharp 'hioc' call, sometimes repeated monotonously for long periods, was heard only from tall trees in farmbush or clearings near to Garleystown and other villages.

Sooty Boubou. Heard (and briefly seen) on four days near Garleystown and Dorbor Camp in secondary habitats, e.g. *Chromolaena* thickets. Reacted angrily to playback but still reluctant to show.

Shining Drongo. Surprisingly infrequent. Observed in only five out of 51 bird parties. Comparing our observations with Gatter's description of this species as a 'common resident', present locally at densities of 10–20 pairs/km<sup>2</sup> (albeit it is not clear that this description refers specifically to the Zwedru/Cavalla Forest area) this species appears to have declined markedly since the 1980s.

Pied Crow. Three near Garleystown, 23 February. Judging by the map for this species in Gatter (1997) this species was uncommon in the area in the 1980s.

Splendid Starling. One seen on 23 February near Garleystown.

Preuss's (Golden-backed) Weaver. Observed on 16 February.

### ***Breeding records***

Latham's Forest Francolin. Female with two or three small but mobile young, Cavalla Forest, 16 February.

African Green Pigeon. Adult with nest material (twig), St. Paul River, 5 February.

Speckled Tinkerbird. One inside nest hole, Cavalla Forest, 12 February.

Gabon Woodpecker. Excavating nest hole in tree, Cavalla Forest, 15 February.

Preuss's Cliff Swallow. Around 50 birds at a colony with c. 30 nests under construction, under bridge over the St. Paul River at 6.23037 N, 10.52350 W, 5 February.

White-throated Blue Swallow. Pair collecting mud at St. Paul River, 5 February.

Fraser's Forest Flycatcher. Nest-building within a few tens of metres of White-browed Forest Flycatcher pair also noted on 14 February (see below).

White-browed Forest Flycatcher. Pair nest-building in old log over water at the Cavalla River, Zewestown, 14 February.

Dusky-blue Flycatcher. Nest building with dried piece of *Raphia* lamina, Cavalla Forest, 13 February.

Red-bellied Paradise Flycatcher. Nest with two large young (a few days from fledging) c. 1.5 m off ground in understorey sapling, near Garleystown, 22 February.

Collared Sunbird. Nest-building, Cavalla Forest, 15 February. Another bird sitting on a nest (on eggs?), near Garleystown, 22 February.

Velvet-mantled Drongo. Nest-building in top of small tree, Cavalla Forest, 22 February.

Forest Chestnut-winged Starling. Pair nest-building in massive fern in broken tree top, Cavalla Forest,



1 March.

Yellow-mantled Weaver. Nest-building in same tree as Forest Chestnut-winged Starlings, Cavalla Forest, 5 March.

Village Weaver. Nest-building, Robertsfield Airport, 31 January.

Black-necked Weaver. Nest-building, Zwedru, 7 February.

Red-vented Malimbe. Nest in an oil palm (no birds present, but identifiable by long entrance tube), Garleystown, 22 February.

Crested Malimbe. Seen at nest in climbing rattan palm, Cavalla Forest, 9 February.

## Appendix K: Measurements, weights and primary moult scores of birds from mist-netting

For scientific names, see Appendix I. All measurements were taken by BP. Wing length was measured using the maximum flattened chord method, and is enclosed in square brackets if taken on an incompletely-grown wing. Moult scores follow Ginn and Melville (1983). A dash '-' means we did not check for primary moult, and a single '0' means no primary moult. Otherwise, we assigned a code to each primary feather, starting from the innermost primary, as follows:

- 0 an old feather
- 1 old feather missing or new feather completely in pin
- 2 new feather just emerging from sheath, up to one third grown
- 3 new feather between one and two thirds grown
- 4 new feather more than two thirds grown, but waxy sheath still at its base
- 5 new feather fully-grown with no trace of sheath at its base

In one White-bellied and one African Dwarf Kingfisher, only nine primaries were counted (the unaccounted-for primary is indicated with a '?' in the table). There was evidence of arrested moult in at least two of the White-bellied Kingfishers.

Date	Location	Lat.	Lon.	Species	Wing (mm)	Mass (g)	Primary moult	Notes
10 Feb	nets1	6.2105	-8.1492	Forest Robin	68	14.4	-	
10 Feb	nets1	6.2105	-8.1492	White-tailed Alethe	98	32.0	-	
10 Feb	nets1	6.2105	-8.1492	Red-bellied Paradise Flycatcher	81	15.8	-	
10 Feb	nets1	6.2105	-8.1492	Forest Robin	63	14.0	-	Tail half grown
10 Feb	nets1	6.2105	-8.1492	Olive Sunbird	55	8.6	-	Female
10 Feb	nets2	6.2112	-8.1495	Rufous-sided Broadbill	63	19.9	-	Juvenile
10 Feb	nets2	6.2112	-8.1495	Icterine Greenbul	69	16.1	-	
10 Feb	nets2	6.2112	-8.1495	Icterine Greenbul	81	19.1	-	
11 Feb	nets1	6.2105	-8.1492	Forest Robin	68	14.3	-	
11 Feb	nets2	6.2112	-8.1495	White-tailed Alethe	92	31.7	-	
11 Feb	nets2	6.2112	-8.1495	White-tailed Alethe	98	33.0	-	
11 Feb	nets1or2	6.21	-8.149	Yellow-whiskered Greenbul	78	24.4	4542000000	
11 Feb	nets1	6.2105	-8.1492	Olive Sunbird	61	11.0	5555553000	Male (pectoral tufts)
12 Feb	nets3	6.2153	-8.152	Forest Robin	66	14.2	0	
12 Feb	nets3	6.2153	-8.152	Yellow-whiskered Greenbul	74	24.7	0	
12 Feb	nets3	6.2153	-8.152	Yellow-whiskered Greenbul	87	28.9	1100000000	
12 Feb	nets3	6.2153	-8.152	White-tailed Alethe	97	33.8	0	
12 Feb	nets3	6.2153	-8.152	Green Hylia	66	13.8	0	
12 Feb	nets3	6.2153	-8.152	Green Hylia	67	13.6	0	
16 Feb	nets B, Base 3	6.2035	-8.1852	Red-bellied Paradise Flycatcher	77	17.3	0	

Date	Location	Lat.	Lon.	Species	Wing (mm)	Mass (g)	Primary moult	Notes
16 Feb	net D, Base 3	6.2024	-8.1869	Yellow-whiskered Greenbul	83	23.5	0	
16 Feb	net D, Base 3	6.2024	-8.1869	Red-fronted Antpecker	53	10.3	0	Female
16 Feb	nets B, Base 3	6.2035	-8.1852	Olive Sunbird	55	8.7	0	Female
16 Feb	nets B, Base 3	6.2035	-8.1852	Red-bellied Paradise Flycatcher	77	14.9	0	Tail projection: 10 mm
16 Feb	net D, Base 3	6.2024	-8.1869	Red-fronted Antpecker	54	9.7	0	Male
16 Feb	net D, Base 3	6.2024	-8.1869	Yellow-whiskered Greenbul	85	26.5	5541000000	
16 Feb	net D, Base 3	6.2024	-8.1869	Yellow-whiskered Greenbul	79	21.2	4000000000	
17 Feb	net A, Base 3	6.2024	-8.1864	Icterine Greenbul	83	17.6	0	Male?
17 Feb	net A, Base 3	6.2024	-8.1864	Icterine Greenbul	73	16.1	0	Female?
17 Feb	net A, Base 3	6.2024	-8.1864	White-tailed Ant-thrush	109	52.8	0	
17 Feb	net A, Base 3	6.2024	-8.1864	White-tailed Ant-thrush	107	51.2	0	
25 Feb	Franzay Forest	6.1815	-8.1222	Green-tailed Bristlebill	-	-	0	
25 Feb	Franzay Forest	6.1815	-8.1222	Olive Sunbird	-	-	0	Male (pectoral tufts)
25 Feb	Franzay Forest	6.1815	-8.1222	White-bellied Kingfisher	-	-	0	
25 Feb	Franzay Forest	6.1815	-8.1222	Grey-headed Bristlebill	-	-	4000000000	
25 Feb	Franzay Forest	6.1815	-8.1222	Icterine Greenbul	-	-	5554100000	
26 Feb	Franzay Forest	6.1815	-8.1222	Chestnut-breasted Nigrita	57	9.0	5500000000	
26 Feb	Franzay Forest	6.1815	-8.1222	White-bellied Kingfisher	56	13.7	?055500550	
26 Feb	Franzay Forest	6.1815	-8.1222	White-bellied Kingfisher	56	16.1	0	
26 Feb	Franzay Forest	6.1815	-8.1222	Olive Sunbird	58	9.0	555410000	Male (pectoral tufts)
26 Feb	Franzay Forest	6.1815	-8.1222	Yellow-whiskered Greenbul	90	29.2	5531000000	
26 Feb	Franzay Forest	6.1815	-8.1222	White-tailed Alethe	91	31.4	0	

Date	Location	Lat.	Lon.	Species	Wing (mm)	Mass (g)	Primary moult	Notes
26 Feb	Franzay Forest	6.1815	-8.1222	Olive Sunbird	62	9.7	0	Male (pectoral tufts)
26 Feb	Franzay Forest	6.1815	-8.1222	Olive Sunbird	54	8.3	5555200000	Female
26 Feb	Franzay Forest	6.1815	-8.1222	White-bellied Kingfisher	57	13.9	5500555000	
26 Feb	Franzay Forest	6.1815	-8.1222	Red-bellied Paradise Flycatcher	77	16.4	0	Tail projection: 5 mm
26 Feb	Franzay Forest	6.1815	-8.1222	African Dwarf Kingfisher	44	9.5	?555000000	
26 Feb	Franzay Forest	6.1815	-8.1222	Olive Sunbird	60	10.4	0	Male (pectoral tufts)
26 Feb	Franzay Forest	6.1815	-8.1222	Olive Sunbird	57	9.7	0	Male (pectoral tufts)
26 Feb	Franzay Forest	6.1815	-8.1222	Yellow-whiskered Greenbul	84	28.9	5554100000	
26 Feb	Franzay Forest	6.1815	-8.1222	Western Bearded Greenbul	104	48.0	5541000000	
26 Feb	Franzay Forest	6.1815	-8.1222	Western Bearded Greenbul	108	48.5	5555520000	
27 Feb	Franzay Forest	6.1815	-8.1222	Pale-breasted Illadopsis	69	20.4	0	
27 Feb	Franzay Forest	6.1815	-8.1222	Pale-breasted Illadopsis	75	23.5	5540000000	
27 Feb	Franzay Forest	6.1815	-8.1222	Pale-breasted Illadopsis	71	22.7	0	
27 Feb	Franzay Forest	6.1815	-8.1222	Red-tailed Bristlebill	112	53.7	5542000000	
27 Feb	Franzay Forest	6.1815	-8.1222	Icterine Greenbul	78	18.0	0	
27 Feb	Franzay Forest	6.1815	-8.1222	Icterine Greenbul	83	20.2	5554100000	
27 Feb	Franzay Forest	6.1815	-8.1222	Yellow-bearded Greenbul	91	28.6	5542000000	
27 Feb	Franzay Forest	6.1815	-8.1222	Green Hylia	54	9.8	0	Juvenile
27 Feb	Franzay Forest	6.1815	-8.1222	Icterine Greenbul	79	20.2	5530000000	
27 Feb	Franzay Forest	6.1815	-8.1222	Red-tailed Greenbul	99	35.5	0	
27 Feb	Franzay Forest	6.1815	-8.1222	Icterine Greenbul	68	16.0	0	Juvenile
27 Feb	Franzay Forest	6.1815	-8.1222	Icterine Greenbul	78	21.4	5554000000	

Date	Location	Lat.	Lon.	Species	Wing (mm)	Mass (g)	Primary moult	Notes
27 Feb	Franzay Forest	6.1815	-8.1222	Yellow-bearded Greenbul	88	24.5	0	
27 Feb	Franzay Forest	6.1815	-8.1222	Western Bearded Greenbul	104	43.4	5554000000	
27 Feb	Franzay Forest	6.1815	-8.1222	Icterine Greenbul	74	17.6	4200000000	
27 Feb	Franzay Forest	6.1815	-8.1222	Icterine Greenbul	71	15.8	0	
27 Feb	Franzay Forest	6.1815	-8.1222	Icterine Greenbul	81	18.9	5553000000	
27 Feb	Franzay Forest	6.1815	-8.1222	Icterine Greenbul	81	19.1	5554200000	
2 Mar	Krapueh Creek	6.2718	-8.2139	Olive Sunbird	[52]	-	5555541000	Moulting: short tail, incomplete wing
2 Mar	Krapueh Creek	6.2718	-8.2139	Icterine Greenbul	80	-	0	
3 Mar	Krapueh Creek	6.2718	-8.2139	Forest Robin	65	-	0	
3 Mar	Krapueh Creek	6.2718	-8.2139	Forest Robin	64	-	0	
3 Mar	Krapueh Creek	6.2718	-8.2139	Western Bluebill	[72]	-	5541000000	
3 Mar	Mining Creek	6.2718	-8.2002	Icterine Greenbul	80	-	0	
3 Mar	Mining Creek	6.2718	-8.2002	Icterine Greenbul	80	-	5552000000	
5 Mar	Base 4	6.22608	-8.18375	Red-bellied Paradise Flycatcher	79	15.9	0	Tail projection <10 mm
5 Mar	Base 4	6.22608	-8.18375	Red-bellied Paradise Flycatcher	77	15.6	0	Tail projection ~10 mm
6 Mar	Base 4	6.22608	-8.18375	White-throated Greenbul	87	26.0	5555555540	
6 Mar	Base 4	6.22608	-8.18375	Forest Robin	68	15.5	0	
6 Mar	Base 4	6.22608	-8.18375	Olive Sunbird	59	9.0	0	Male (pectoral tufts)
6 Mar	Base 4	6.22608	-8.18375	Olive Sunbird	55	7.9	0	Female/juvenile
6 Mar	Base 4	6.22608	-8.18375	Forest Robin	60	14.5	5300000000	
6 Mar	Base 1 water	6.1925	-8.1723	Yellow-whiskered Greenbul	[79]	24.4	5554100000	
6 Mar	Base 1 water	6.1925	-8.1723	Brown-chested Alethe	92	32.8	0	
6 Mar	Base 1 water	6.1925	-8.1723	White-bellied Kingfisher	55	16.0	0	
7 Mar	Base 1 forest	6.1933	-8.1739	Green-tailed Bristlebill	112	50.8	0	

Date	Location	Lat.	Lon.	Species	Wing (mm)	Mass (g)	Primary moult	Notes
7 Mar	north of Base 1	6.19601	-8.16748	Olive Sunbird	60	9.8	5555555540	Male
7 Mar	north of Base 1	6.19601	-8.16748	Icterine Greenbul	78	18.7	5530000000	
7 Mar	north of Base 1	6.19601	-8.16748	Icterine Greenbul	80	22.5	5552000000	
7 Mar	north of Base 1	6.19601	-8.16748	Icterine Greenbul	73	18.8	0	Female: brood patch
7 Mar	north of Base 1	6.19601	-8.16748	White-tailed Alethe	94	30.6	0	

*In addition, a Yellow-whiskered Greenbul escaped from the net before it could be extracted, and three Icterine Greenbuls were released at the net because a storm was imminent.*

## Appendix L: Sound recordings

Sound recordings were made using an Edirol R-09 digital recorder and Sennheiser ME-66 microphone. Recordings were made in WAV format and converted to MP3 so that they could be uploaded to Xeno-Canto as digital vouchers. An asterisk (\*) denotes species for which, at the time they were added, this was the only recording on Xeno-Canto.

- \*Latham's Forest Francolin *Francolinus lathamii*. <http://www.xeno-canto.org/144139>
- \*Fraser's Eagle Owl *Bubo poensis*. <http://www.xeno-canto.org/127309>
- Red-chested Owlet *Glaucidium tephronotum*. <http://www.xeno-canto.org/144138>
- \*Brown Nightjar *Caprimulgus binotatus*. <http://www.xeno-canto.org/127307>
- Unidentified swift species *Apus* sp. <http://www.xeno-canto.org/144550>
- \*Shining-blue Kingfisher *Alcedo quadibrachys*. <http://www.xeno-canto.org/144127>
- Yellow-throated Tinkerbird *Pogoniulus subsulphureus*. <http://www.xeno-canto.org/144142>
- Little Greenbul *Andropadus virens*. <http://www.xeno-canto.org/144140>
- Little Grey Greenbul *Andropadus gracilis*. <http://www.xeno-canto.org/144132>
- Yellow-whiskered Greenbul *Andropadus latirostris*. <http://www.xeno-canto.org/144141>
- Western Bearded Greenbul *Criniger barbatus*. <http://www.xeno-canto.org/127312>
- \*Yellow-bearded Greenbul *Criniger olivaceus*. <http://www.xeno-canto.org/127314>
- \*Forest Scrub Robin *Cercotrichas leucosticta*. <http://www.xeno-canto.org/144130>
- Tawny-flanked Prinia *Prinia subflava*. <http://www.xeno-canto.org/144133>
- Fraser's Forest Flycatcher *Fraseria ocreata*. <http://www.xeno-canto.org/144126>
- \*Dusky-blue Flycatcher *Muscicapa comitata*. <http://www.xeno-canto.org/127315>
- Grey-throated Flycatcher *Myioparus griseigularis*. <http://www.xeno-canto.org/144135> and <http://www.xeno-canto.org/144137>
- Rufous-winged Illadopsis *Illadopsis rufescens*. <http://www.xeno-canto.org/144128>
- Green (Yellow-chinned) Sunbird *Anthreptes rectirostris*. <http://www.xeno-canto.org/144134>
- \*Tiny Sunbird *Nectarinia minulla*. <http://www.xeno-canto.org/144143>
- Western Black-headed Oriole *Oriolus brachyrhynchus*. <http://www.xeno-canto.org/139719>
- Velvet-mantled Drongo *Dicrurus modestus*. <http://www.xeno-canto.org/144125>

**Appendix M: Photos**



*Garleystown*



*Disturbed forest along road near Garleystown*



*Forest clearance for crops along road*



*Charcoal pit north of Zagbehstown*



*Gmelina plantation near Sehway*



*Banana/plantain farm at Zagbehstown*





*Lincoln Fishpool in good forest*



*Emmanuel Loqueh, Flomo Molubah, Trokon Grimes*



*Crocodile Camp*



*Cavalla River near Zewestown: well-wooded banks*



*Hunter with Campbell's Monkey Cercopithecus campbelli near Base 4*



*Used shotgun cartridge, cut with two 'wings' indicating that it was used to kill a bird (most likely a hornbill)*



*Rufous-winged Illadopsis (NT)*



*Green-tailed Bristlebill (NT)*



*Female Red-fronted Antpecker (NT)*



*Male Red-fronted Antpecker (NT)*



*White-breasted Guineafowl (VU)*



*Yellow-bearded Greenbul (VU)*



*Black Dwarf Hornbill*



*Blue-throated Roller*



*Red-chested Owlet*



*White-tailed Alethe*



*Nest and chick of Red-bellied Paradise Flycatcher*



*Olive Sunbird*



*Rufous-sided Broadbill (juvenile)*



*Forest Robin*



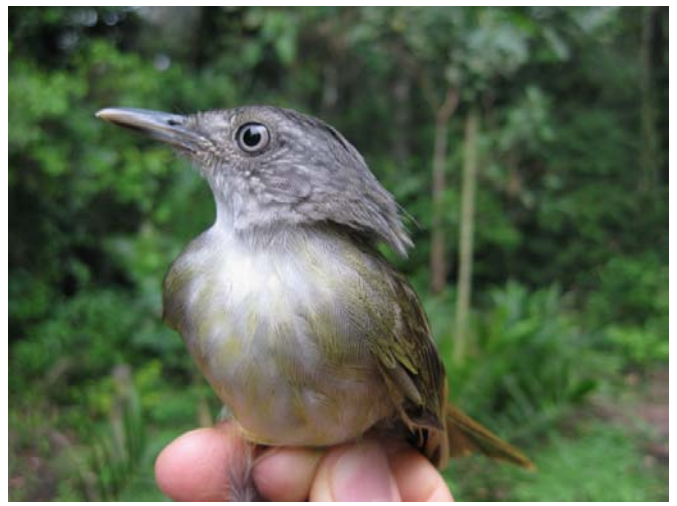
*White-bellied Kingfisher*



*African Dwarf Kingfisher*



*Brown-chested Alethe*



*White-throated Greenbul*