



Trip Report: Aquatic biodiversity survey of the lower Cuito and Cuando river systems in Angola.



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Executive Summary

The Southern Africa Regional Environmental Program (SAREP) has a strategic goal to improve the conservation and sustainable use of biological resources of the Cubango- Okavango River Basin. This report fulfils one of the initial steps in helping to mitigate a critical threat to biodiversity within the system, i.e.; Poor Knowledge of the Status, Extent and Factors Regulating Biodiversity within the Basin (Indirect Threat) (SAREP, 2012), providing information on some of the aquatic faunal diversity of the Cubango-Okavango basin within Angola.

This report provides a summary of the initial findings of the survey as well as general field conditions and observations. This survey is the second of its kind organised by the Southern African Regional Environmental Programme (SAREP) and the first survey took place in May 2012. The results of this initial survey were documented by Brooks (2012). The surveys are a collaborative venture between SAREP and the Angolan Ministry of Environment's (MINAMB) Institute of Biodiversity and the Angolan Ministry of Agriculture's National Institute of Fish Research (INIP). The survey was organised by Dr Chris Brooks of SAREP and Dr Paula Coelho, Director of MINAMB's biodiversity directorate. The survey was undertaken by specialists from the following organizations with the assistance of Angolan counterparts from the stated Ministries;

Professor **Roger Bills & Nkosinathi Mazungula** (Fish) - Southern African Institute of Aquatic Biodiversity (SAIAB). Grahamstown, South Africa.

Werner Conradie (Herpetofauna) - Port Elizabeth Museum, Bayworld. South Africa.

Timothy Harris - Royal Botanic Gardens Kew. London, UK & **Frances Murray-Hudson** (Plants) - Peter Smith University of Botswana Herbarium (PSUB), Okavango Research Institute (ORI). Maun, Botswana.

Dr Sven Bourquin & Vincent Shacks (Crocodiles) - Okavango Crocodile Monitoring Programme. Maun, Botswana

Mark Paxton (Birds)

Logistical Crew

Simon Byron - Beagle Expeditions. Maun, Botswana

The survey took place from the 13th April - 1st May, 2013. The survey was broken up into two legs, the first of which included the lower Cuito river channel and the second included the terrestrial environments around Jamba village as well as the Cuando river channel. These surveys were carried out to improve the baseline knowledge of species and ecological health of the newly proclaimed protected areas in the south-eastern corner of the country. The protected areas between Mavinga and Luengue-Luiana cover 46 000 and 22 600 square kilometers respectively. This data will be used in the formulation of any management plans for these national parks and will provide valuable baseline monitoring data for the future. General findings of the survey indicated that these surveyed areas have been negatively affected by the long term civil war in this region. Large herbivore populations have been heavily effected by poaching and those animals that remain continue to be very wary and shy of any humans. Habitat change in the region seems to be increasing as more people move to larger villages and towns and the demand for food increases. The threat of landmines remains a challenge in these parts and demining organisations continue to carry out clearing activities in these parts. The sheer isolation of the villages in this southern portion of Angola currently hinders development of the area, but there is every indication that the construction of new tar roads is in progress and taking place rapidly in the region.

Introduction

On the 14th of November 2011, Steve Johnson, the Director of the Southern Africa Regional Environmental Program (SAREP) signed a Memorandum of Understanding (MoU) with the Angolan Minister of Environment (MINAMB), Maria de Fatima Monteiro Jardim and the National Director for Biodiversity within the Ministry of Environment, Paula Francisco Coelho. The signing of the MoU completed the procedural requirements for SAREP and MINAMB to collaborate and work together in planning for the Aquatic Biodiversity Survey.

The need for the biodiversity survey was prioritised within the MoU as the second objective, after the strengthening of cooperation between the parties. Justification for such a high level of prioritisation is clear when addressing the Angolan National Action Plan (NAP) for the Cubango-Okavango, which states under objective 4 the need, “To develop a better knowledge and understanding about the basin ecosystems, through biodiversity monitoring, environmental management and staff training programs” and under target 11 further defines the activity as; “Basin biodiversity known and protected thanks to the implementation of scientific research and biodiversity monitoring actions and staff training”. The poor status of knowledge on the nature and extent of biodiversity within the Angolan portion of the basin is well recorded, attributing to its high level of concern with the Preliminary Biodiversity Threat Assessment for the Cubango-Okavango basin². Undertaking the aquatic survey thereby helps to mitigate this identified threat and contribute to the expressed needs of the Angolan Government.

The first biodiversity survey of the upper Angolan catchment indicated the distinct differences between various river systems within the catchment. These differences call for unique management and monitoring protocols which will hopefully protect natural resources whilst still allowing for the sustainable development of this region. Various threats to local biodiversity were highlighted in this survey and it is only through these types of detailed surveys that accurate progress and biodiversity change can be measured in a region.

The second survey aimed to focus on the mid- lower reaches of the main river systems which form the Okavango catchment. The specific river systems which were targetted were the Cuito (Okavango catchment) and Cuando (Linyanti/ Zambezi catchment). The intention of this survey was to also survey some of the terrestrial environments of the newly designated national parks in the south-eastern corner of Angola. The team focussed on the aquatic environments of the large river systems as well as the rain-fed, isolated fresh water pans in the region. Some of these pans had

dried up in the southern sections but many of them still held water from the summer rainfall. Both dry and water filled pans provided an interesting assemblage of species.

Methods

Survey Timing

The timing of the biodiversity expeditions hinge on a number of varying factors which all need to be weighed up before a survey such as this can be carried out. These factors range from logistical planning factors, the issuing of travel visa's, species activities, access to sites, weather conditions and specialist availability. The first aquatic biodiversity survey was carried out in May 2012, and while this survey allowed for the collection of dry season species and lower water levels, it did provide it's own restrictions in terms of the collection of reptile, amphibian and dragonfly species. The timing of this survey took these factors into consideration and attempted to provide better survey conditions for herpetofauna and dragonflies. The constraints on carrying out an April survey would be the high water levels in the river channels which would make fish and crocodile capture difficult.

Survey Sites

The intention of this biodiversity survey was to carry out baseline species identification and status information of the lower Cuito river and the newly proclaimed protected areas in the South Eastern corner of the country. The survey sites were selected opportunistically according to travel times and travel conditions on any particular day. All of the sites were selected according to the availability of optimal survey sites for all of the specialists. For each of the survey sites, it was also important to have an adequate base camp with good shade, solid ground, access to fresh water and in an area with no risk of landmines. The trip was broken up into two different legs, the first leg was a survey of the lower Cuito river between the villages of Rito in the north and Dirico in the south. The crew also spent two nights on the Cubango river near the village of Calai and carried out survey work at these points too. The survey sites are indicated in the map below and have been numbered consecutively according to the date of each survey. The second leg of the trip was Cuando river survey including some of the terrestrial and fresh water pan environments in the Luiana area.

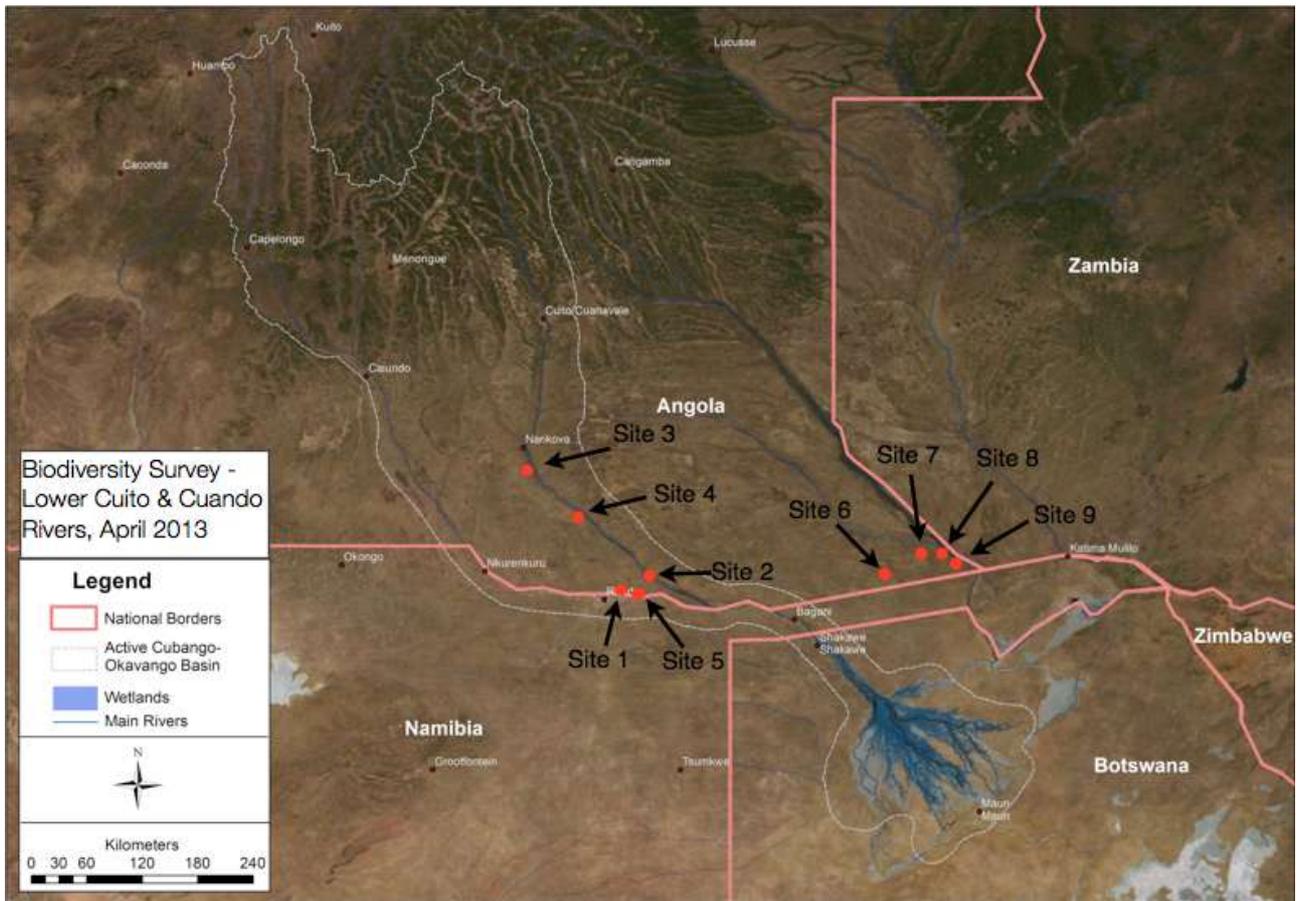


Figure 1. Camping and main survey sites along the Cuito and Cuando rivers.

Sites 1 - 5 make up the lower Cuito leg of the trip and sites 6-9 make up the Cuando leg of the trip. The first leg took place from the 13th April- 24th April and the second leg took place from the 25th April- 1st May, 2013.

Lower Cuito River Survey

The Cuito river is permanent and deep flowing channel with clear, open channels. The surrounding channel habitat includes Phragmites reeds and channel fringing emergents. The meandering nature of the river occasionally cuts into mainland which then provides a mixed woodland habitat on the fringe of the main river channel. Small interspersed palm islands (*Phoenix reclinata*) can also be found dotted in the adjacent floodplains of the river. The lower Cuito river is mainly fed from the upstream catchments of the Cuito and Longa river systems, but a number of smaller tributaries recharge this lower section of the river downstream of the Longa-Cuito junction. These smaller tributaries generally feed from the eastern bank of the Cuito where a gentle escarpment can be found. These feeder channels appear to be seasonal and recharged by rainfall in the lower catchment of this system. The lower Cuito is also characterised by a number of rocky rapids which have been formed by protruding rocky outcrops that run across this river channel. These rapids

create partial barriers along the river and offer a unique aquatic habitat for many species. Where these rapids were accessible, they formed focus points for our species surveys.



Figure 2. Rapids at Mpupa on the lower Cuito River.

The Cuito river spills water into adjacent floodplains after the summer rains. These floodplains are extensive in some parts and increase the size of this aquatic habitat dramatically. Access into these floodplains is extremely difficult as it is too vegetated and shallow for a motor boat and access on



foot is not safe due to crocodiles and hippo in the area.

Figure 3. Seasonal floodplains adjacent to the main river channel

Lower Cuando River Survey

The lower Cuando river is a fairly narrow, slow flowing river lined by *Phragmites* reeds and channel fringing emergents. This river “valley” system appears to be a very wide floodplain (up to

5km wide at some points) that is made up of a number of narrow flowing streams which are likely to vary in strength and depth as the water levels increase and decrease. The sediment load of this river is very likely to play a major part in the flow dynamics of these smaller channels. Access onto the main channel is only possible at a few specific sites where the river channel cuts into the mainland on western bank. The Cuando river is fed mainly by the Luiana river system, who's catchment is in the central part of Angola. A smaller catchment area on the Zambian side feeds into the Cuando near the village of Luiana. From this point onwards, the Cuando travels as a single river channel through this very wide floodplain system.

Sampled Taxa

The survey followed a very similar protocol to the first biodiversity survey carried out in May 2012. The intention of this survey was to focus collections on the river channels of the Cuito and Cuando systems with a view to understanding the baseline ecology of these rivers and thereby gauging the health of the Okavango catchment and the surrounding protected areas. The taxa covered in this survey would not only give us very detailed species lists and additional natural history data on lesser known species, but would also allow the future managers of these areas to gauge the ecological health at this present time. The timing of these surveys are essential in that they will provide the earliest post-war, ecological baseline information for these areas. This survey also provides an added benefit of being carried out on the boundaries and within the newly declared national parks of southern Angola.

The sampled taxa also represent a strong group of indicator species which will allow practitioners to assess the general ecological health of the region. This type of data is also essential to future monitoring systems which will one day provide the opportunity for long term comparative data. The taxa sampled during this survey include:

Dragonflies and Damselflies

Birds

Crocodiles (*Crocodylus niloticus*)

Fish

Herpetofauna (including amphibians, snakes, lizards, gecko's and skinks)

Plants

Results

Fish

Professor Roger Bills - South African Institute of Aquatic Biodiversity (SAIAB)

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Objectives

The May 2013 survey is the second visit to the Okavango system in Angola under the coordination of the Southern Africa Regional Environmental Program's (SAREP). The major goal of the surveys is to expand the geographical coverage of baseline biological inventories for the region in order to aid with resource use planning.

The survey was a collaborative effort between SAREP and the Angolan Ministry of Environment's Institute of Biodiversity and the Ministry of Agriculture's National Institute of Fish Research. The fish survey was undertaken by specialists from the following organizations with the assistance of Angolan counterparts from the stated Ministries:

Roger Bills & Nkosinathi Mazungula (fishes) - The Southern African Institute for Aquatic Biodiversity (SAIAB), Grahamstown, SA; and

Francisco Almeida & Manuel Domingos, Instituto Nacional de Investigacao Pesqueira (INIP), Luanda, Angola.

Sample Area and Sample Sites

The northern rivers of the Okavango system in Angola are long, north-south draining rivers of which the major tributaries are the Cubango, Longa-Cuito and Cuando. The Angola highlands represent a poorly known part of the Okavango system and a potentially fascinating region as the environment is very different from that of the lower altitude and gradient system in Namibia and Botswana. In physical character the western Okavango tributaries are similar to many streams in the upper Zambezi in north-western Zambia.

During this current survey we have explored limited areas of the lower Cuito and lower Kwando rivers in southern Angola close to the Caprivi Strip of Namibia. Sample sites were chosen largely on the basis of logistics e.g. accessibility and our ability to easily sample multiple environments.



Figure 4. Fish sampling sites (**Top Left**) Cuito River, Mpupa. (**Top Right**) Cuito overflow channel, Mpupa. (**Middle Left**) Margins of Cuito river, near Rito. (**Middle Right**) Margins of Cuito River (crocodile proof barrier put in place by herders). (**Bottom Left**) Boafe lagoon, near Jamba. (**Bottom Right**) Cuando river, near Jamba.

Findings and Comments

Our overall impressions during this second expedition were that the fish fauna of the lower Cuito and Kwando Rivers were more similar to the southerly areas of the system than those sampled in 2012. Species collected in the lower the Cuito and Kwando were mostly well known, described species. The rocky and headwater specialists from the upper Cubango collections of 2012 were, for the most part, missing and floodplain specialists from several families dominated catches. There were a few species of particular interest and notes on these follow.

Obvious differences in the faunas of the two regions are the massive increase in poeciliid topminnows and the decrease in cyprinids and mormyrids in the lower systems. There was overall greater diversity in most groups in the upper river although in many instances species numbers were extremely low. Certain families e.g. kneriids, mastacembelids were absent from our lower river collections and many species e.g. *Barbus* were absent from the lower river. Some absences from catches are probably attributable to sampling techniques and efforts as species are widespread within the system e.g. *Mormyrus*, some *Barbus* spp.

Bar-coding. At present we have not sent the 2013 materials off for bar-coding (CO1 gene) as we did for the 2012 collections. The samples are being prepared now and should be completed by the end of 2013 and compared with upper river samples. The interest here is to see if there is any genetic structuring in fish population in the greater Okavango system that would indicate barriers to fish movements.

Poeciliids. There were fewer species of topminnows in the lower rivers but considerably higher numbers and they dominated most collections. Of special taxonomic interest was the *Aplocheilichthys* cf. *johnstoni* species with the broad horizontal pigment band. This is not present in the Okavango in Namibia or Botswana and was abundant in the upper rivers last year.



Figure 5. *Aplocheilichthys* cf. *johnstoni* 'broad-band'

Citharines – Distichodontidae. There may be additional species collected in the lower river – colour patterns seem to indicate this although it is also possible that there are specific sexual patterns. Bar-coding will hopefully tease this issue out and confirm the number of species present. Overall diversity and abundance was similar to the upper river.



Figure 6. (Left) *Hemigrammocharax* cf. *machadoi* showing a variation in pigmentation. (Right) Probably two different species of *Nannocharax* cf. *macropterus* collected near Mpupa.

Yellowfishes. Collected last year in the upper river and at two sites in 2013 at Rito and Mpupa camps. *Labeobarbus codringtoni* occur from the Okavango across to the Kafue and are rare in museum collections. The recent Angolan collections are valuable specimens and will help, with bar-coding, to determine if they are in fact the same species across the upper-Zambezi region.



Figure 7. Labeobarbus codringtoni caught on the Cuito river near Rito.

Sucker-mouth and squeaker catfishes. The identification of all the Synodontis species continues to be a challenge. In general mochokid diversity was lower with fewer Chiloglanis but almost the same species and numbers of Synodontis. The strikingly patterned species of the upper river were present but rare. Bar-coding will be conducted on all species sampled in an attempt to determine species numbers and identities. Further sampling of these species is essential to sort out their taxonomy.



Figure 8. *Synodontis* species collected during the survey.

Artisanal fisheries. As we were focused on biodiversity surveys, time did not allow us to search out fishermen. Fishing activity was rarely observed but reports indicated that fishermen were active in floodplain lagoons during our expedition. Evidence of artisanal fishing methods were present in villages but indicated that these were low-intensity and seasonal activities. However, these rivers have low conductivities and outside of flood periods are relatively small, single channel river systems and thus are of limited productivity. It is likely that with increased pressure on fisheries resources due to population growth and easier access to rivers, over-fishing will occur in the future. This could be exacerbated by varied habitat degradation and pollution. We suggest a dedicated programme is needed to examine the current fishery and to develop a long-term fisheries management plan and that ideally this should be trans-boundary in scope.

Herpetofauna

Werner Conradie - Port Elizabeth Museum (Bayworld), South Africa.

The herpetological survey was undertaken by Werner Conradie, based at Port Elizabeth Museum (Bayworld), South Africa. Field assistance was provided by Sven Bourquin (SAREP). Opportunistic specimens were also collected by other members of the survey, particularly during the fish surveys (especially Roger Bills and Nkosinathi Mazungula (SAIAB)). Two standard Y-shape traplines were employed, but most collections were made by active searching. Amphibian call surveys were done using a Nagra ARES-ML digital recording device and a Sony F-V4T Microphone. The following literature was consulted to compile historical records for the study area: Monrad (1937), Branch & McCartney (1998) and Conradie (2012a). Collections of specimens have been deposited in Port Elizabeth Museum (South Africa) and South African Aquatic Biodiversity Institute (South Africa) and a representative collection will be returned to Angola.

A total of 55 species of amphibians and reptiles have been recorded from the study area to date. During the April 2013 survey 12 new amphibian and 17 new reptile records were added to the study area.

Cuito River Basin

In total 30 species of amphibians and reptiles were associated with the Cuito river basin catchments to the west of the study area.

Cuando River Basin

In total 40 species of amphibians and reptiles were associated with the Cuito river basin catchments to the west of the study area

Important Discoveries

Although relatively few reptiles were collected, the survey revealed a number of exciting discoveries, including:

1st record of *Acontias kgalagadi* [= *Typhlosaurus lineatus*] for Angola. According to Broadley (1986) only *A. jappi*, sister species to *A. kgalagadi*, occurs north of the Cubango-Okavango and the Zambezi River. This is thus the first record north of the Cubango-Okavango River and might be more widespread in the south-eastern sandier Angola.

2nd record of *Naja mossambica* for Angola, the only other record is from Maconjo (Broadley 1974). Bill Branch (pers comm.) collected another specimen in south-western Angola in December 2012. This species is expected to be more widely distributed in southern Angola.

2nd record for *Limnophis bangweolicus*, the other record is 700 km north to Calundo (Moxico Province). Its sister species, *Limnophis bicolor*, is more widespread in western, central and northern Angola.

2nd record of the Okavango Hinged Terrapin (*Pelusios bechuanicus*) for Angola. The only other record for Angola is from Chonga River, Moxico Province (Laurent 1964), 700 km to the north.

3rd record for *Meroles* (= *Ichnotropis*) *squamulosa* from Angola. The phylogenetic relationship among *Meroles* and *Ichnotropis* is underway and may represent many undescribed lineages.

3rd record for *Typhloacontias rohani*. The type locality of this species is Lwankundu River, an western tributary of the Kwando River. The only other record for Angola is from Chimporo (Monrad, 1937). Haacke (1997) reports this species to be common in north-eastern Namibia, the Caprivi Strip, northern Botswana and western Zimbabwe.

The following 16 species are new for the study area: *Acontias jappi*, *Limnophis bangweolicus*, *Natriciteres olivacea*, *Psammophis subtaeniatus*, *Python natalensis*, *Zygaspis quadrifrons*, *Varanus niloticus*, *Afroablepharus wahlbergi*, *Mochlus sundevalli*, *Trachylepis varia*, *Chondrodactylus turneri*, *Lygodactylus angolensis*, *Meroles squamulosa*, *Pelusios bechuanicus*, *Pelomedusa subrufra* and *Stigmochelys pardalis*.



Figure 9. (**Top left**) *Striped Swamp Snake* (*Limnophis bangweolicus*); (**Top right**) *Olive Marsh Snake* (*Natriciteres olivacea*); (**Bottom left**) *Leopard Tortoise* (*Stigmochelys pardalis*); (**Bottom right**) *Kalahari Round-headed Worm Lizard* (*Zygaspis quadrifrons*)



Figure 10. *Top Left:* Kalahari Burrowing Skink (*Typhlacontias rohani*); *Top Right:* Striped Blind Legless Skink (*Acontias kgalagadi*); *Bottom Left:* Okavango Mud Terrapin (*Pelusios bechuanicus*)

Amphibian activity was reduced. Most species had already bred, although some individuals were still present. Winter breeding species were abundant. The following exciting discoveries were made:

Lemaire’s Toad (*Amietophrynus lemairii*) is a very unusual toad that is adapted to living in flood plains. It is restricted to Angola, the Caprivi Strip (Namibia), the Okavango delta (Botswana) and floodplains in Zambia and Democratic Republic of the Congo. The life history (breeding, call and tadpoles) of this species was previously unknown. During the current survey we collected natural history data and are in the process of preparing this for publication.

Unusual examples of a Grass Frog (*Ptychadnea* sp) and a Puddle Frog (*Phrynobatrachus* sp.) were collected. DNA samples have been sent for barcoding to access their taxonomic affinities.

The following 12 amphibians are new records for the study area: *Amietophrynus gutturalis*, *Amietophrynus lemairii*, *Amietophrynus poweri*, *Phrynobatrachus mababiensis*, *Phrynobatrachus* cf. *parvulus*, *Ptychadena guibei*, *Ptychadena oxyrhynchus*, *Ptychadena* cf. *schillukorum*, *Ptychadena taenioscelis*, *Xenopus muelleri*, *Xenopus petersii*, *Tomopterna cryptotis*.



Figure 11. *Top Left:* Lemaire's Toad (*Amietophrynus lemairii*); *Top Right:* Unidentified Grass Frog (*Ptychadena* sp.); *Bottom Left:* Unidentified Puddle Frog (*Phrynobatrachus* sp.)

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Crocodiles (*Crocodylus niloticus*)

Vincent Shacks - Okavango Crocodile Monitoring Programme

Dr Sven Bourquin - Okavango Crocodile Monitoring Programme

A 16ft aluminum boat with a 30HP motor was used for this survey work. Both diurnal and nocturnal surveys were carried out along the Cuito river. The purpose of the diurnal surveys was to evaluate the habitat and its suitability for crocodiles. Nocturnal surveys are used to carry out live capture of crocodiles by using a powerful electric spotlight. Due to a reflective layer in the eye, the tapetum lucidum, crocodilian eyes reflect any bright light shone into them and exposed crocodiles can be located for distances in excess of 100 m, depending on a number of factors such as vegetation density, the strength of the spotlight and the relative position of the crocodile.

Nocturnal spotlight and capture surveys are usually conducted between 20h00 and 04h00 using a trained team of three - four boat crew including one trained observer with at least one year's intensive spotlighting experience at the front of the boat. The boat is steered along the middle of the river at an average speed of 8 - 10 km.hr⁻¹ with the spotlight beam traversing an arc of 180^o, illuminating river banks, the water-vegetation ecotone, and the main river channel surface.

When eye shine (i.e. a crocodile) is observed, the crocodile is approached slowly and quietly and captured when possible, using the size-dependent techniques. All of the crocodiles caught are given individual identification numbers and are taken through a series of morphometric measurement procedures. These measurements include snout - vent length (SVL), total length (TL), neck circumference (NC) and base of tail circumference (BTC) and head measurements including head length (HL), head width (HW) and head depth (HD). Scute clippings (tissue) are taken for DNA analysis and each of the scutes clipped form a permanent marking system for the crocodile. This marking system is permanent and allows researchers to get excellent comparative data of individuals, should these animals be recaptured in the future.

Damage to our outboard motor restricted the team from using the boat on the Cuando river. General observations from the river bank were however carried out by all of the team members.

Results.

Cuito River - A total of 10 crocodile were caught over 3 night surveys with an additional 9 sightings of crocodiles which were not caught. Water levels in April were very high and this generally increases the amount of useable habitat by crocodiles. Under these flooded condi

tions, most adult crocodiles will move away from the main channel into the warmer seasonal water of the floodplains as well as concentrating in deeper adjacent water bodies like lagoons. Activity on the main channel is thus limited and the encounter rate with large crocodiles was restricted. Only one adult crocodile was encountered in the main channel, while another two large adults were spotted opportunistically on foot while walking around a large lagoon next to the main land.

Cuito River

Angola

Crocodile Survey
April 2013

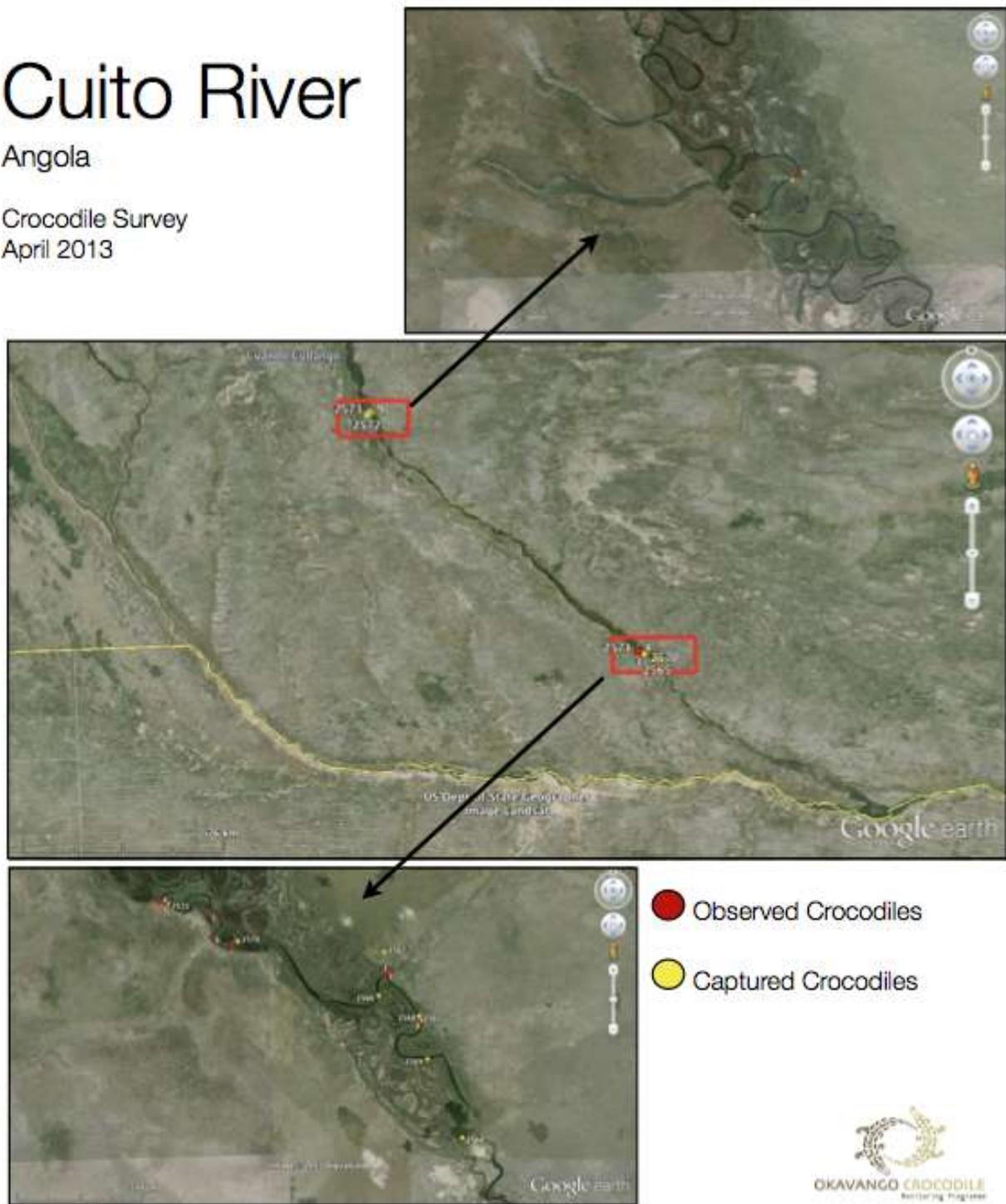


Figure 12. Cuito River crocodile capture and sightings map.

The average size of the captured crocodiles was 87cm total length, with the largest crocodile being 112cm total length. Tissue was collected from 8 of the captured individuals and will be used for

DNA analysis. All of the individuals were in very good health apart from a 2013 hatchling who had been bitten by what appeared to be a tiger fish.

Nesting Habitat - Habitat along the Cuito river seems to suggest that the southern portion of the Cuito from Rito to the junction at Dirico, provides excellent crocodile nesting habitat. This was confirmed by the density of yearling and juvenile crocodiles which were caught along this stretch. A single hatchling, presumed to be from the 2013 nesting season, was found drifting in the middle of the main channel. This behaviour is typical of a hatchling which has recently left the nesting creche area and is now dispersing further downstream using the river current.



Figure 13. Raised sand banks and thick stands of *Phragmites* reed beds provide excellent nesting habitat for crocodiles.

Quando River - At our first camping site on the Cuando river system, the team discovered a side channel of the Cuando which was approximately 30m wide, very deep and lined with *Phragmites* reeds. In this channel approximately 15-20 adult crocodiles were found feeding on a hippo carcass in the water. This feeding opportunity obviously lead to the large concentration of adults in the area, but this provided a good opportunity to see that a healthy adult population was present in this system.

Nesting Habitat - Initial observations indicate that the habitat along the Cuando river is very favourable for crocodile nesting.

Conclusions.

The timing of the survey was unfortunately not an ideal period for crocodile surveying along the main channel as the river water levels were too high. This obviously drops the encounter rate with large adults. We were however, very encouraged to find hatchlings, yearlings and juveniles this high up in the catchment area of the Okavango. The presence of these young crocodiles confirms that adult crocodiles are in fact nesting this high up in the catchment which is very positive from a population ecology perspective. Our work in the Okavango Delta suggests that nest numbers have decreased dramatically over the last 20 years due to human disturbances and unsustainable egg collections by farmers. This entire system will benefit greatly from the added recruitment of young crocodiles from further upstream. The habitat along the Cuito appears very favourable for nesting but this would need to be confirmed by carrying out nesting surveys between September - January.

Interviews with local residents suggested very intense crocodile human conflict in the region, with crocodiles being killed when ever an opportunity presented itself. There was also an indication from a community member that crocodile eggs, when found, were eaten by people. The post war land use changes in the region are a concern for crocodiles as large tracts of riverside vegetation are cleared for the plantation of casava, maize and sorghum. This type of land clearing is very intensive along the southern portion of the Cuito system and is likely to increase dramatically once the new tar road is complete and people start moving into the large riverside villages.

Botanical Report

Timothy Harris - *Royal Botanic Gardens Kew, London, UK*

Frances Murray-Hudson - *Peter Smith University of Botswana Herbarium (PSUB), Okavango Research Institute (ORI), Maun Botswana.*

There is no published Flora for Angola yet. The most comprehensive botanical reference source is currently 'Plants of Angola' (Figueiredo & Smith 2008). Prior to this there was the incomplete [Conspectus Florae Angolensis](#) (CFA) which was begun in the 1937, work stopped on it in 1970s. This geographical region of Angola has yet to be described botanically. The flora of the region is poorly represented in herbaria due to under collecting. Therefore most specimens collected on this trip will probably add to either distribution information for species, or be a first record for that species in that locale.

The botanical objective of the mission was to collect as many specimens in flower and/or fruit as possible. The specimens need these characteristics to ease identification.

No CITES listed species were to be collected. The Angolan government had issued permits for general collection. A young Angolan government representative accompanied the expedition. Botanically, the expedition was seen to be a chance to take a 'snap shot' of the flora of the region. April is considered to be late summer - early winter. The summer rains in the study area were below average (see map below). In general terms the veld was drying rapidly.

Figure 14. *Rainfall anomaly for 21 Jan – 20 March 2013. From SADC website: Food Security Early Warning System. Agromet Update 2012/2013 Agricultural Season. Dated 17th April 2013.*

To quote from the SADC website section National Agromet Summaries, Angola: "Recent satellite images of vegetation suggest an improvement in vegetation conditions since last month, compared to average conditions. The major crop producing areas in the central parts of the country show near normal vegetation conditions. In the southern areas however, both vegetation images and satellite rainfall estimates suggest dry conditions which could affect crop and pasture conditions in those parts of the country. Many parts of Angola experienced a severe drought last season." (Italics are mine)

Indeed we found that many of the under-storey herbs and grasses were past their prime, being too dry and brittle to collect. Most woody species had flowered and fruited. In general there was often evidence of human impact on the flora. Many areas showed evidence of recent burning or repeated burning in the past, hardwood felling and clearing for arable agriculture. The area is relatively sparsely populated but the livelihoods of people there is almost entirely dependent on their environment. Consequently fields are established where the soil is suitable, trees are felled for timber which is used for house construction, to fence fields, and for uses such as sleds, racks for drying grain, furniture, tools and implements.

Many areas of the mixed miombo woodland visited appeared to have been impacted by commercial logging in the past. For example: few *Pterocarpus angolensis* trees with substantial girth were observed. However not many substantial stumps were seen either. The largest trees seen were often softer woods such as *Albizia* sp. and these were primarily components of the riverine fringes.

This SAREP funded biodiversity assessment expedition sampled in three historically proclaimed protected areas: Coutadas publicas de Luenge, Mucusso and Luiana. These have, until recently, been inaccessible due to the prolonged civil war and the after math: the legacy of which is hundreds of square kilometers of land mines, placed by the various warring factions. De-mining is in progress but is a dangerous, slow, laborious process often dependent on donated funds.

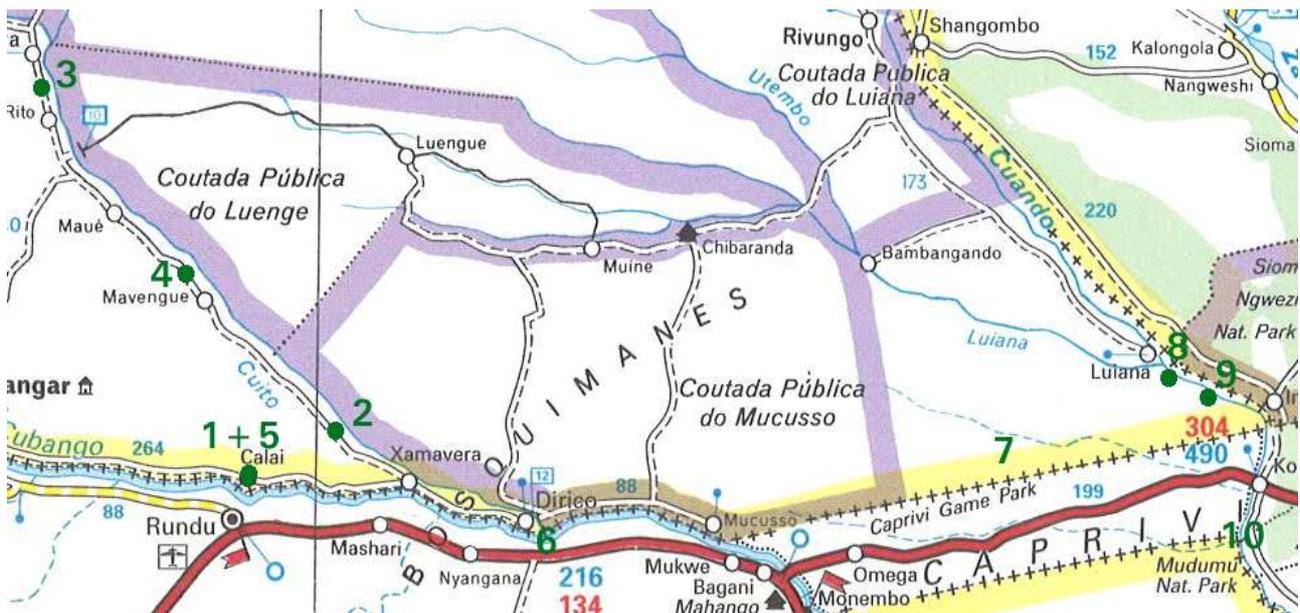


Figure 15. Map showing locations of all campsites April-May 2013. Sampling sites indicated by green dot.

The flora was sampled most intensively along four rivers in two systems: the Cubango and the Cuito, which feeds into the Cubango, becoming the Okavango when it enters Namibia. The Luiana River drains into the Cuando (called the Kwando in Namibia and Botswana). The Luiana has a vast floodplain and the water was rising, making access to that habitat difficult. The last sample sites on the fourth river, the Cuando, were south of the junction with the Luiana River.

Figure 16. Drying plants in camp

The expedition was an overland camping trip, fully equipped before departure with some restocking en route. Using the roads infrastructure in Namibia to drive into Angola whose internal roads in this area are still bush tracks of unpredictable quality. The design of sites for sampling near protected areas and along the river systems had been agreed prior to departure.

The logistics of the expedition were ably handled by Simon Byron of Beagle Expeditions. He had done much preparatory work on possible routes and sampling areas. He was also diligent in adapting to travelling conditions; none of us knew what conditions were like so predicting how far we would be able to travel was impossible. We all participated in decisions about when, where and how long to stop or camp for. The team interacted meaningfully with each other, there was a good deal of mutual co-operation. Since I agree with the philosophy that "a population of a species is only as good as its habitat" the health status of the study area must consider all components of the ecosystem. So it was important that for example, the fish experts brought us, the botanists, samples of aquatic plants caught in their nets and traps. These plants were obviously important components of fish habitat.

Findings

More than 350 species were collected on the entire expedition. In most cases four specimens were collected of each of these species.

A full list with of species together with collection locality description will be provided later.

It is intended that all the specimens will be identified at RBG Kew. Kew will retain one of each specimen and the duplicates will be distributed to:

PSUB at Okavango Research Institute (ORI), University of Botswana

LUIC, ex-Centro Nacional de Investigação Científica (CNIC) in Luanda, Angola

WIND, National Botanical Research Institute (NBRI) in Windhoek, Namibia.

The major collecting sites are described in general terms below. A complete list of all species collected will be provided after the determination of identification has been carried out by Kew.

Site 1 & 5

Calai

13th and 24th April

Two single nights were spent on the banks of the Cubango. The sites are heavily disturbed by human use, livestock grazing etc. Here the river was high just receding after the peak, the floodplain is wide.

Site 2

Mpupa rapids

Figure 17. *Mpupa rapids campsite*

16th to 18th April 2013, 3 nights.

Three habitats close to the campsite were sampled: **S17 30' 46.8" E20 03' 39"**

Water in the drift was flowing at approximately 2mtrs per second, and the water was less than 40cms deep. The substrate was sandy soil on rock. The area was surrounded by mixed woodland, species included:

Combretum imberbe, Ziziphus mucronata, Peltophorum africanum, Croton gratissimus, Combretum sp. Terminalia sericea, Diospyros lycioides, Rhus sp. Phoenix reclinata (at water's edge)

Grasses included: Cymbopogon sp. Stipagrostis sp. Eragrostis rigidior, Panicum sp. (cf. P maximum), Eragrostis superba, Pogonarthria sp. Melinis sp. Eriocaulon spp.,

Cyperaceae included: Scleria spp., Fimbristylis spp., and Cyperus spp.

Herbs included: Waltheria indica, Hibiscus spp., Albuca sp., Sida sp., Nidorella sp., Nymphaea sp., Jasminum sp. and Scrophulariaceae

S17 30' 45.8" E20 03' 38"

Drier woodland. Soils red brown with iron stained 'blobs' of stone in it. The habitat was very reminiscent of southern Botswana near Kanye. Predominant woodland species here were: Peltophorum africanum dominant with Combretum imberbe, Croton gratissimus and Combretum

spp. being equally second dominant. Other woody species included: *Guibourtia coleosperma*, *Bauhinia* sp., *Boscia* sp., *Ziziphus mucronata*, *Baphia massaiensis*, occasional *Commiphora* sp. and very occasional *Acacia mellifera* as small trees.

Herbs included: *Indigofera* spp. *Waltheria indica*, *Acrotome inflata*, *Convolvulus* sp., *Ocimum* sp. and *Vernonia* sp.

Grasses included: *Digitaria* spp. *Eragrostis* spp. and *Dactyloctenium* sp. cf. *D. giganteum*.

S17 30' 30.9" E20 03' 57.9"

Campsite at Mpupa rapids. Fast flowing, deep river about 60 to 100mtrs wide.

Riparian /Island vegetation

The site is parallel to the river, a bank which is bounded by arable fields of sorghum. There are remains of stone walls and the area has obviously been used for many years as a settlement. The Chief's compound less than 200m away and comprises of buildings constructed during some geological prospecting-mining company's activities. The people here complained of elephants destroying their crops and no assistance or advice about dealing with the problem. They also noted that there is far more diverse wildlife on the north bank.

Woody species included: *Phoenix* sp. cf. *P. reclinata*, *Ficus* spp. incl. *F. capreifolia*, *Syzygium* sp. cf. *S. guineense*, *Piliostigma thonningii*, *Ricinus* sp., *Diospyros lycioides*, *Berchemia discolor* (as a shrub), *Bauhinia* sp., *Rhus* sp. *Gymnosporia* sp., a woody *Apocynaceae*, *Peltophorum africanum*, *Morella serrata*, *Albizia* sp. (cf. *A. versicolor*) and *Ziziphus mucronata*.

Grass species include: *Pennisetum macrourum*, *Oryza* sp., *Sporobolus* sp., *Cynodon dactylon*, *Imperata cylindrica*, *Digitaria* sp., *Setaria verticillata* and *Melinis repens*.

Other species include: *Leonotis* sp., *Persicaria* sp., *Achyranthes* sp., *Jasminum fluminense*, *Bidens* sp., *Sida* sp. (cf. *S. cordifolia*), *Crotalaria* spp., *Cyperaceae* spp., *Indigoferae* spp., *Hibiscus* spp. (4 of them at least), *Commelina* sp., *Aeschynomene* sp., *Convovulaceae*, *Striga* sp., *Tagetes minuta*, *Acanthospermum hispidum*, *Vernonia* spp.

On the far side of the river (north bank) the landscape is visibly much more wooded. Swathes of *Terminalia sericea* were growing in the sandy stretch of river bank. Clumps of *Phoenix reclinata* grew near the water, on firmer soil. *Pterocarpus angolensis* and *Baikiaea plurijuga* were also discernible with naked eye. With binoculars other species became visible: *Garcinia livingstonei*, *Combretum zeyheri*, *Diospyros lycioides*, *Piliostigma thonningii*, *Peltophorum africanum*, *Syzygium guineense* and the distinctive winter shapes of many *Schinziophyton rautanenii* (Mongongo in Setswana) on the hard, dry slopes.

A short botanical collecting trip was made by boat to the north bank (upstream of the area described above). This was an 'island' of lush Phoenix growth in the deep mud of a steep bank surrounded by mixed Acacia woodland. Elephants were very close by their dung full of Mongongo seeds.

Site 3

North of Rito, on the Cuito River.

19th to 21st April 2013, 3 nights.

S16 37' 22.6" E19 03' 12"

Location on the transition between woodland/grassland:

Miombo woodland mixed. Smaller trees around the camp have had recent burn, there was some re-growth. The woodland gave way to open floodplain: grassland becoming sedges with occasional loose tree island. The burning may be from the floodplain, if like in Okavango delta people burn old grass to encourage flush of new growth to attract the wildlife. However, here one suspects animals will be killed for food or trade as opposed to tourism/hunting. Cattle were seen being herded, another possible explanation for the burning of grassland.

The water level was about 40cms lower than recent high. The high would have inundated some of the grassland. There were depressions with pockets of sedges, and rises which support woody species like *Terminalia sericea*.

At the campsite, where the river is distinct, the water was flowing within well-defined banks and was clear to a depth of about 1.5mtrs. The woodland on the ridge is on pinker coloured sand compared to the white sand of the floodplain which had a layer of black decomposing vegetative matter.

Hyena spoor were seen on the dry sandy ridge road and hippo spoor seen in the black mud of floodplain. The road to Rito is being upgraded with calcrete, eventually to be tarred according to the local police who checked in on our camp. Shots were heard one night some distance from camp. Many places along the road are being cleared for settlement and arable fields, we saw mealies and sorghum.

A general species list was not compiled here as time was taken with collecting.

Site 4

22nd and 23rd April 2013 for 2 nights.

Camp was on the pale gray, harder soils of river bank in an area of mixed Acacia woodland. The campsite looked out over *Phragmites australis* and *Chrysopogon nigritanus* reed beds. This floodplain was some 500m across, with the north bank being a distinct ridge. Guess that the water rises another 60cms, but not over the bank at this point, but rising and falling through the reed beds.

There was a small settlement some 100m away with San people staying there. The elder from this group was interviewed by another team member. A few cattle were seen.

Tree species were dominated by *Combretum imberbe* (away from camp) followed by *Acacia hebeclada* and *A. erioloba* as the next dominant. Other species included: *Terminalia sericea* (away from camp/the river), *Ziziphus mucronata*, *Acacia fleckii*, *Piliostigma thonningii* and *Schinziophyton rautanenii*.

Shrubby species were: *Grewia* sp., *Dichrostachys cinerea*, *Gymnosporia* sp., *Diospyros lycioides* and *Euclea* sp.

The dominant grass species on the harder soil was *Cynodon dactylon*, while away from the river a tall, reddish grass species (cf. *Cymbopogon* sp.) was widespread. Other grass species included *Heteropogon contortus*, *Aristida* sp., and *Digitaria* sp.

Site 8

27th to 29th April 2013 for 3 nights

Figure 18. *Campsite was on Kwando River near junction with the Luiana River.*

We were taken to a campsite selected by community members in Buafe. Interesting, socially/historically as the site was an old abandoned UNITA training headquarters. There were many signs of cultivation: papaya trees, preparations for a vegetable garden, mealies stalks drying, Euphorbia hedge planted, Amaranthus, sisal and weedy species such as *Setaria verticillata* and *Bidens* sp.

There were dogs roaming and cockerels were heard. There was also a lot of building rubble, old metal parts of machinery etc. The local people complained of elephant activity and, although there were still green papaya fruit on the trees, there was evidence further away from the river of elephant activity. Elephants were seen and heard at night. A huge heap of earth near the campsite appeared to be burial of an elephant carcass.

Hippo could be heard each night. One night there was a continuous sound of animals walking and or eating in the reed beds on the far side of the river which may have been elephant, hippo and/or buffalo. Their activity perhaps indicates the significance of the reed beds to the wildlife. At the campsite the river was deep, swiftly flowing, and about 15m wide. The opposite side of the river was a wall of *Phragmites australis*.

Away from the campsite there is a large grassy flood plain where the water is starting to rise. On higher ground there was mixed woodland. The larger established trees around the campsite include *Albizia* sp. cf. *A. versicolor*, *Terminalia sericea*, *Kigelia africana*, *Acacia erioloba*, *A. nigrescens*, *Philenoptera* sp. and good specimens of *Diospyros mespiliformis*. Herbs include: *Ocimum* sp., *Leonotis nepetifolia* and *Jasminum fluminense*.

On the road again we would pass through areas that had recently been burned.

Figure 19. *Recently burnt habitats*

Site 9

30th April to 1st May for two nights.

On track heading south-east along the Kwando. At place called "Mamashota" which seems to be a side channel of the Kwando river. Evidence of elephants (in a mud wallow hole), Buffalo and Kudu. There were no signs of fires although the horizon was coloured with smoke. Leaf litter on the ground and dead grass hamper were all taken to be signs of less disturbance to the habitat. Three

snakes were caught by the herpetologists near this site, a record number for the trip. The water in the river was rising and seeping into the floodplain.

Woody species included: *Combretum hereoense*, *C. psidioides*, *C. imberbe*, *Acacia erioloba*, *A. nigrescens*, *A. sieberiana*, *Terminalia sericea*, *Philenoptera* sp. and one small *Berchemia* sp. tree, at the water's edge, which had been much used by elephants, *Peltophorum africanum*, *Commiphora* sp. (only one specimen was seen and it had been killed by elephants uprooting it), *Kigelia africana*, *Dichrostachys cinerea*, *Diospyros lycioides* and *Flueggea virosa*.

Herbs included *Hibiscus* sp., *Ocimum* sp., *Leonotis nepetifolia* and *Heliotropium* sp.

Grasses included: *Setaria verticillata*, *Cynodon dactylon* and *Eragrostis superba*.

Conclusion

The botanical team was pleased with what we were able to achieve and we are eagerly awaiting confirmation/corrections to field names. The logistics in the field of handling an accumulating amount of specimens presented its own logistical challenges. The dry weather on this survey certainly facilitated the drying of specimens. Any future collecting trips in the rainy season would require serious consideration of the number of presses and additional drying papers, this in turn would have space implications in vehicles. We are pleased to have been part of this survey team. We enjoyed the working environment and look forward to any future possible involvement with similar surveys

Other observations

The expedition saw that the Angolan government is visibly developing the rural areas, roads are being up graded, some with calcrete and others are to be tarred. There were basic primary schools in even the smallest settlements, in the bigger communities new, modern, facilities are being constructed. The impression is certainly one of progress towards better education, health, administration and access to these remoter rural areas.

I (FMH) feel that the opportunity to maintain (or create) viable protected areas that benefit the local communities as well as the national economy, is now and should not be missed. The current economic pressures on the resident people are strong, driving them to do what they can with the natural resource to survive. If, for example, areas were allocated for tourism development and the people immediately began to benefit from employment they would have less cause to clear land for marginal fields. The involvement of local people, in all stages of future land use, is essential and critical. As soon as the plants and animals are seen to be attracting tourists and their money the environment is seen to have value and people have a vested interest in protecting their asset. The next few years of land use will dictate the viability of future natural resource opportunities such as tourism including commercial hunting, photographic safaris etc.

If the Angolan government, locally and nationally, is able to respond to the opportunity immediately, they will protect the land for generations to come. The natural environment as it exists today will generate income from the flora and fauna. The wildlife populations may be able to build up. This time will create breathing space, in which to strategically plan how to handle other, future, land use proposals such as farming or mining.

If there is indecision or protracted debate the land will be cleared more, burned more, livestock will be brought in, roads and improved access will mean more people move into the area increasing demand for land, people will eke out a marginal living from the environment without vision to the future.

Birds

Mark Paxton

Bird observations were made from the vehicle while travelling along the Cuito River between camping areas and in the vicinity of the camps where we stopped. It would have been impractical to have carried out a pentad-like survey as this would have required more frequent stops and impeded our mode of travel.

A total of 183 birds were counted during the Cuito River survey.

At each of the camps mist nets were erected and the following birds were ringed:

Chirping Cisticola. 5x (3x Adults and 2x Sub-adults)
Tawny-flanked Prinia. 1x Adult
Common Waxbill. 1x Adult
Village Weaver. 8x (3x Adult Males, 3x Adult Females and 2x Sub-adults)
Luapula's Cisticola. 3x (1x Adult and 2x Sub-adults)
Little Rush-warbler. 1x Adult
Fan-tailed Widowbird. 9x (1x Adult male, 2x adult Female and 6x Sub-adults)
Eurasian Reed Warbler. 1x Adult

Interesting observations and opinions:

Sharp-tailed Starlings in mixed large groups with Juveniles were amazingly common throughout the area travelled along the Cuito River, and were the more common Starlings seen. In nearby Namibia with similar vegetation types however, they are regarded as extremely rarely seen and very seldom associated with the river, but found more in the woodland areas.

The Black Scimitarbill seen in this area, showed similar characteristics to the “Common Scimitarbill” in the Shamvura area in Namibia along the Okavango River. This indicates either that Black Scimitarbill occurs in that area, making it an important new bird for the Southern African Sub-region, or there is some hybridization between Black and Common Scimitarbill.

The floodplains along the river were exceptionally low in bird life numbers and diversity, and this is not due to human interference. The grass and other vegetation species here were also completely different than in the neighbouring Okavango River where bird life in similar floodplains was much richer. It appears that the Cuito River only rises a metre or so during floods and is essentially stagnant and nutrient poor which may ultimately account for the poor bird numbers and diversity.

Although there is very little human disturbance factor at present, indications are that this may change radically in the near future. Previously deserted villages are being resurrected with newer Government sponsored buildings, new and sophisticated roads are being built and people are being encouraged into these areas as can be seen by the Government sponsored newly ploughed fields of sorghum.

There is an unpopulated Conservation/Protected area on the Eastern banks of the Cuito River where as expected, evidence of particularly Elephant and other forms of wildlife are abundant. Nevertheless, evidence of Reedbuck, Kudu, Sitatunga, Steenbuck and even Elephant was also noted on the populated Western side of the river which was unexpected and encouraging. In the river there were even some Hippo, Crocodile, Water Mongoose and Spotted-necked Otter although not in any significant concentrations.

Dragonflies and Damselflies

A late cancellation by the dragonfly specialist meant that the team had to collectively contribute to the collection of dragonfly and damselfly specimens on this trip. Specimens were collected at most of the survey sites and processed accordingly. These specimens are currently being identified by the specialist and a detailed species report and list will be produced from this.

General observations

Cuito

Access - While this region had drastically less mine fields than the villages west of the Cubango, the threat of land mines was still a factor on this survey. The main road that runs on the western bank of the Cuito is a single bush track that is not maintained or cleared. The surface is generally solid with a few sections of thick sand. The only serious water crossing we encountered was near the village of Maue, we detoured around the crossing on the way north and then did the river crossing on the way south.

Construction on a new tar road is currently taking place on the western side of the Cuito river. Discussions with community members seemed to indicate that the road will run from the border with Namibia to Nankova. This improved access is very likely to stimulate growth in the region and lead to an increase in the village populations. The road is currently a fair distance from the river banks and runs mostly through the thick Miombo habitat.

Villages - The villages along the western bank of the Cuito seem relatively well populated with the presence of basic facilities such as schools and clinics being fairly common. Government vehicles appeared to be very active throughout this region, travelling on the bush track between Nankova and Calai. Most of the land on the outskirts of the villages has been ploughed and planted with various crops such as maize, kasava and sorghum. The obvious lack of material goods from commercial stores meant that litter in and around the village settlements was not excessive. This is likely to change once the tar road has been complete and access into the area is improved.

Cuito River resource use - While the use of traditional dug out canoe's (Mokoro's) was apparent, the use of water crafts did not seem to be very popular. This seems to suggest that not many people make use of the river environment for fishing or collecting resources. Most of the natural resources used did seem to be from the drier habitats including logs from the miombo forests, grass from the surrounding grassland and mud from the high lying ground. This pattern of resource use seems to suggest more of a reliance on the terrestrial resources than on the natural resources occurring near the river. No other motor boats were encountered on the Cuito at any stage of the trip. Cattle numbers increased around larger villages. All of the cattle had permanent herders with them and it was clear that fixed watering points were used by these cattle as the herders have built a number of croc proof fences alongside the river where the cattle could drink safely without the risk of being attacked by a crocodile. These fences were built from acacia thorn bushes placed around a shallow bank of the main channel.

Cuando

Access - The team entered this region through the Buabuata border post which can only be accessed through a poorly used dirt track heading north from Bagani in the Caprivi strip. The road is a winding bush track with very thick sand and thick Miombo forests. Vehicle access along this route is extremely difficult and slow. This track remains poor all the way to Jamba village, from where the track is solid and often used by the military and game scouts. The track from Jamba village to the Cuando river is very scenic with a more diverse assemblage of habitats. Natural fresh water pans are scattered across this region and provide a good source of drinking water to the surrounding wildlife. Wildlife tracks around these fresh water pans were extensive, including tracks of predators such as Lion, Hyena and Leopard.

Villages - Jamba and Boafe are the largest villages in this region and are home to many people. These villages and the region in general has a strong military and game guard presence with regular patrols taking place along the vehicle track from the border to Jamba. A number of smaller outlying farming villages are scattered in between the two large villages of Jamba and Boafe. These villagers live in and around their ploughing fields in order to protect the crops from elephant and hippo.

Cuando river - Once again, there seemed to be very little use of the river resources along the Cuando river. There were no signs of fishing activity, resource collection or water crafts of any sort. This seems to suggest that the community members are not heavily reliant of fish or other natural resources from the river.

Observed threats to biodiversity

The most pressing threat to the local biodiversity would be the dramatic **change in land use** on the western bank of the Cuito river channel. The eastern bank of the Cuito and the western bank of the Cuando all fall within the larger protected national parks of this region. The Cuito western bank is currently being transformed into ploughing fields for maize and sorghum using slash and burn techniques. These fields are situated close to the river channel to make use of the most productive soils and also to have good access to the permanent water source.

Poaching along the western bank of the Cuito was rife and gunshots were heard during the night while camping along this stretch of the river. Our team managed to spend some time with one of the hunting crew and it appeared that the hunters were using large caliber rifles for shooting large herbivores, more especially antelope species such as Kudu and where possible Buffalo. The hunters also appeared to be collecting various wildlife products for sale at traditional markets. We were shown a live Pangolin (*Smutsia temminckii*) which would apparently fetch R4000 at a market in Rundu (Namibia). It is very likely that a large amount of other wildlife products are collected along this isolated stretch of wilderness to provide products for a growing **traditional medicine** market.

Human wildlife conflict in the region was rife. Most of this conflict is based around the destruction of crops by elephant. Villagers would regularly use weapons such a rifles and shotguns on elephants who are raiding crops. Communities living close to the water, such the small community living on Mpupa island, complained of crocodiles regularly attacking their cattle near the river. Where possible, all problem animals are killed when encountered.

Most of the habitats surveyed also indicated a recent and **regular history of burning** which has negatively affected the number of reptiles and small mammals in these environments.

Way forward

The Southern African Regional Environmental Programme (SAREP) in association with MINAMB and INIP have currently carried out two biodiversity surveys within the larger Okavango basin area. The last survey included some survey points within the newly protected areas in the South Eastern corner of Angola and along the Cuando river system. The surveys to date have lead to the description of numerous new species and updated species distributions. The timing of the last two expeditions have been largely dependent on many logistical issues rather than a selection of the ideal survey times. Nevertheless, species collections have been good and the results of these surveys have probably provided the best information on all of the collected species for this area to date.

It is hoped that a third survey will take place either in the late summer months of 2014 or the early summer month of November 2014. This period is seen as ideal for most of the species experts. A third survey would likely follow the same survey sites of the first survey (April 2012) in order to resurvey certain biodiversity “hotspot” sites and collect more samples of new species. Having worked this area before, the logistical planning of this survey is likely to be more streamlined allowing the specialists to work specific sites for longer periods.