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A Survey of Reptiles and Amphibians That Can Be Found At Abuko Nature Reserve, The Gambia

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Gambia? Where's that? Africa? What do you want to go to Africa for? Why don't you go to Australia?" This was the common progression of questions that I received from my father every time the topic of this study tour came up. Of all the places I have dreamt of traveling to, Africa and Australia have always been at the top. When I heard of possible ecological research at Abuko Nature Reserve in The Gambia, West Africa, I could not pass it up. Although my father thought this was the wrong decision, I knew it was founded in many of my own interests. I have always been interested in large mammals, and once hoped to one day go to veterinary school and work in a zoo, although it seems that every opportunity that has come my way thus far has been for something a little smaller: reptiles and amphibians. For example, an internship that I had last summer at The Baltimore Zoo turned into an extensive research project on snakes. I had to use anole lizards in a behavioral ecology study that I did last year because in a lab setting it is cheaper and easier to get lizards than it is to get rats. And once again, the ecological

research that I was asked to carry out at Abuko Nature Reserve was an inventory of their reptiles and amphibians. This included a survey on Nile and Dwarf Crocodile populations. How could I complain? Here was a once-in-a-lifetime opportunity that I had to jump on, so I began looking for information on my topic.



This painting was located on the observation deck of the Education Center at Abuko Nature Reserve as a constant reminder of conserving the Earth.



Christina at the entrance to Abuko Nature Reserve.

Although The Gambia is the smallest country in Africa, with a total area of 11,147 square kilometers, it is the fourth most densely populated country on the continent. A population study in 1993 shows there being 97 people per square kilometer (Baldeh et al. 1997). The current population of 1.3 million people has put extreme pressure on the country's natural resources. They have largely destroyed the once vast and varied flora and fauna that lived there. According to a forestry inventory conducted in 1983, the amount of land covered by forest declined by 80% between 1968 and 1983 (Baldeh et al. 1997). The number of plant species driven to extinction because of human activity is unknown. In the past few decades The Gambia's people have played a major role in the destruction of about 30 animal species (Government of The Gambia, NBSP Country Report). Giant eland (*Tragelaphus (Taurotragus) derbianus*) and elephants (*Loxodonta africana*) once roamed the Gambian countryside. However, this is no more. There have not been any

Giant Eland sightings since 1903, nor any elephant sightings since 1913 when most likely a hunter, who was after its ivory, shot and killed this last elephant. Over the last century 13 species of large animals once indigenous to The Gambia, like these, have become extinct, and many others are threatened. The large animals most threatened today include hippopotami (*Hippopotamus amphibius*), the West African Manatee (*Trichechus senegalensis*), and all species of sea turtles (*Cheloniidae* and *Dermochelyidae*; Government of The Gambia, NBSP Country Report).

Only recently has anything been done to protect these already threatened and the soon-to-be threatened species. The first protected area in the country was Abuko Nature Reserve, which was originally set aside in 1916 as a water reservoir, and given reserve status in 1968. This is the smallest of the six protected areas in the country, with an area of 105 hectares out of the total of 39,768 hectares currently protected within the country. The government passed the Wildlife Conservation Act in 1977 to protect what remained of the wildlife. This Act authorized the Department of Parks and Wildlife Management to set up and develop protected areas, to prohibit the sales of most wild animals, to set limitations to what animals could be hunted, and to prohibit keeping most animals as pets (Government of The Gambia 1977). In 1978 the next established protected area in The Gambia was River Gambia National Park, followed by Niimi National Park in 1986, Kiang West National Park in 1987, Tanje Nature Reserve in 1993, and the most recent Baobolong Nature Reserve in the late 1990s (Barlow et al. 1997). Although nature reserves and national parks are very similar, the difference between the two is that national parks are under more protection in most countries. Figure 4.1 shows the locations of these protected areas of The Gambia. The total protected

area in the country is currently 3.4 % of the total land area. However, the Department of Parks and Wildlife Management would like to increase this area to 5% and include a wider variety of the Gambian habitats (Baldeh et al. 1997).

The Department of Parks and Wildlife Management established a Research and Development section in 1995 to evaluate and monitor the condition of the wildlife (Baldeh et al. 1997). Before this, researchers knew little based upon systematic recordings of the indigenous species. The majority of published lists of Gambian animal species contained information about the more abundant and larger animals that are easily spotted. Such animals were the objects of the local people's everyday activities, like hunting and fishing. Smaller species such as many of the reptiles, amphibians, and insects in the country were not on the list. Because Gambians did not eat these animals, they did not know much about their distribution or relative abundance. Many Gambians had little idea about the wildlife they were destroying as their population grew and they destroyed forests. The Gambian conservation laws can not protect animals and plants if their status is unknown. For that reason, one of the most important steps in current wildlife conservation efforts in The Gambia is to carry out studies such as inventories of the unknown species of flora and fauna on both protected and unprotected areas. This then also justifies the protection laws that the country does have.

Herpetology is the study of reptiles and amphibians. During my literature search for previous herpetological studies in The Gambia, I found only a few. Further, these few studies are very brief compared to the herpetological studies completed in other parts of the world. For example, in 1884 Rochebrune made the first recorded attempt to deal with the herpetofauna of Senegambia, but the first list of the herpetofauna



Figure 4.1 Protected Areas of The Gambia. Here you can see the locations of all the National Parks and Nature Reserves (Baldeh et al., 1997).

was not published until 1937 by Anderson. Anderson's list was very short and included many different unique species including two crocodiles, three turtles, eight lizards, 15 snakes, and four amphibians. Next, in 1981, Hakansson added another 21 species to the list for The Gambia based on research in surrounding areas. He added them to Anderson's list, but agreed that a more intensive study was needed (Pauwels et al. 1996). Yet another list was compiled in 1991 and included 40 species of amphibians and reptiles (Gruschwitz et al. 1991). Pauwels and Meirte added about a dozen new or rarely recorded species to the list in the two short visits they made to The Gambia. Their complete list contained 21 reptiles and 26 amphibians (Pauwels et al. 1996). The most recent, a field guide on West African amphibians, came out this year (Rodel 2000). Most of these studies were relatively short-term studies between two and six weeks. This brings up the problem of seasonality of the species. It is possible that other reptiles and amphibians that we do not know about inhabit The Gambia.

Other than conducting a survey of the reptiles and amphibians in the reserve, I was also asked to look at the populations of both Nile Crocodiles (*Crocodylus niloticus*), and Dwarf Crocodiles (*Osteolaemus tetraspis*). It is relatively easy to see Nile Crocodiles at Abuko Nature Reserve. On the other hand, Dwarf Crocodiles used to be abundant in the country but now they are no longer as visible. Dwarfs are the world's smallest crocodiles, and they usually do not emerge from hibernation until after the beginning of the rainy season. The only place in The Gambia where they may still exist is Abuko Nature Reserve. In order to help protect this threatened species, construction of pools took place in the reserve in 1989. These efforts seemed successful because the Dwarfs inhabited the pools and shortly after began breeding. Researchers believe that this was the first time they bred in the reserve since 1981 or 1982. The last time that a Dwarf Crocodile was reported in the reserve was in 1990 (Jones 1991). It is unknown if this species remains there. I feel that once proper research is completed, the Department of Parks and Wildlife Management will have a better idea of what wildlife remains, which species need to be protected, and what steps need to be taken towards conserving these animals.

Methodology

During my short time working at Abuko Nature Reserve (June 20- July 7, 2000), I had three areas that I was asked to explore. First, I was to conduct a

general inventory of the reptiles and amphibians that inhabit the nature reserve. Second, I was to estimate the number of Nile Crocodiles in the reserve. Third, I was to survey and see if Dwarf Crocodiles were still living there.



A Nile Crocodile, Crocodylus niloticus, resting at the pool's edge at Abuko Nature Reserve.

Photo by L.K. Barnett, DPWM

I studied at the reserve for a total of 15 days (8–9 hours per day), and four nights (3–4 hours per night). I used two techniques to make a species list of all the reptiles and amphibians I could find in the reserve. First, I walked through during different times of the day and night and kept a record of the species I observed: their location, abundance, and the general time. Second, I collected specimens using a type of trap called a terrestrial drift fence. The basic idea of a drift fence is to guide small terrestrial animals in a particular direction until they fall into a pitfall trap.

The workers at Abuko Nature Reserve helped me to construct these drift fences. The model we followed was from a design from O'Shea (O'Shea 1994). The first step we took in building a drift fence was to measure out the specific interval that we wanted as the distance between the buckets along the fence. In this instance I placed the buckets about four feet apart. The buckets were rectangular, about six inches wide by eight inches long by one foot deep, and made of heavy plastic. We marked the locations of the buckets, and then dug a hole into the ground deep enough for the buckets to be flush with ground level. Next, we dug a channel into the ground between the buried buckets. We buried one to two wooden stakes perpendicular to the ground between each of the buckets. After the buckets and wooden stakes were in place, we centered the fence over each buried pitfall trap and tightly tied them off to the wooden stakes. The fence material



The view of the crocodile pool from the Education Center at Abuko Nature Reserve.

was tightly woven plastic once used as rice sacks; it was stitched together into a single long sheet. Once the fence was as taut as possible, we filled the channel back up with dirt so that we covered the bottom of the fence with earth. We then filled the small areas between the corners of the buckets and the fence with dirt so that there were not any gaps for small animals to crawl through. The final product was a fence approximately 40 feet long and two and a half feet tall. When small frogs and lizards approach the fence they can not go over or under it, so they follow the fence

line and eventually fall into the buckets. The picture below shows a finished drift fence.

We built two fences, one in each of the different habitat areas of the reserve. We did this so that we could compare the animals we caught in each habitat. The first of the finished drift fences was in a habitat known as gallery forest. Abuko Nature Reserve has one of the few remaining examples of this type of environment in The Gambia. The structure of a gallery forest is similar to that of a rain forest, except that a gallery forest relies on surface water as its primary water source while rain forest relies on precipitation. A gallery forest is an evergreen forest with a closed canopy and open understorey (Gormant). The gallery forest fence was set up parallel to the main crocodile pool, so there was plenty of water and a decent amount of vegetation around this first drift fence. We made the fence in a straight line and punched holes in the bottom of the buckets to prevent them from filling up with water.

We built the second drift fence in an environment known as guinea savanna, a habitat that comprises a much larger proportion of the nature reserve. Characteristics of guinea savanna include open glades of grassland, distance from any source of surface water, and vegetation, depending on the season, that is usually very dry (Gormant). Unlike the first fence we made, the second fence zigzagged slightly to go around some of the vegetation. In addition, we did not put holes in the buckets because we wanted a small



Christina and some of the rangers at Abuko Reserve putting the finishing touches on one of the drift fences.

amount of water to stay in the buckets of this dry area if it rained. Figure 4.2 shows a map of Abuko Nature Reserve and the location of these two drift fences.

For the three weeks that I worked on the reserve I checked the buckets at the two fences every morning and some afternoons depending on the weather and the outcome of the morning's collections. I placed collected specimens in small glass jam jars, then took them back to the laboratory where I identified each organism to the best of my knowledge. I preserved at least one example of each species I recorded so it could be sent off to a lab in England for verification by someone more qualified than myself. I released the others back into the wild, preferably away from the capture site. In this way I tried to minimize the chance of recapturing the same specimens. Some of the species that I captured in large numbers and that I identified easily at the time of capture I immediately released in the same area, but as far away from the

fence as possible. Since I did not mark the specimens, there was no way for me to know if I captured an individual more than once. Because the study was not a population study, it was not too much of a concern if I recaptured the same individual more than once. Slowly we built two lists of species, one for each of the reserve's two environments. I also combined these lists in order to have a single running list of what species lived in the reserve.

Over a period of three nights I carried out the survey of the population estimation of the Nile Crocodile. At night one can see their eyes glow when they catch the beam of a flashlight, making them much easier to count than during the day. These counts were conducted once a week from the Education Center and the surrounding photo hide, footbridge, and pathway near the gallery forest drift fence. Figure 4.3 shows the location of these counts on the map of Abuko Nature Reserve. I took these counts about an hour and a half after sunset,

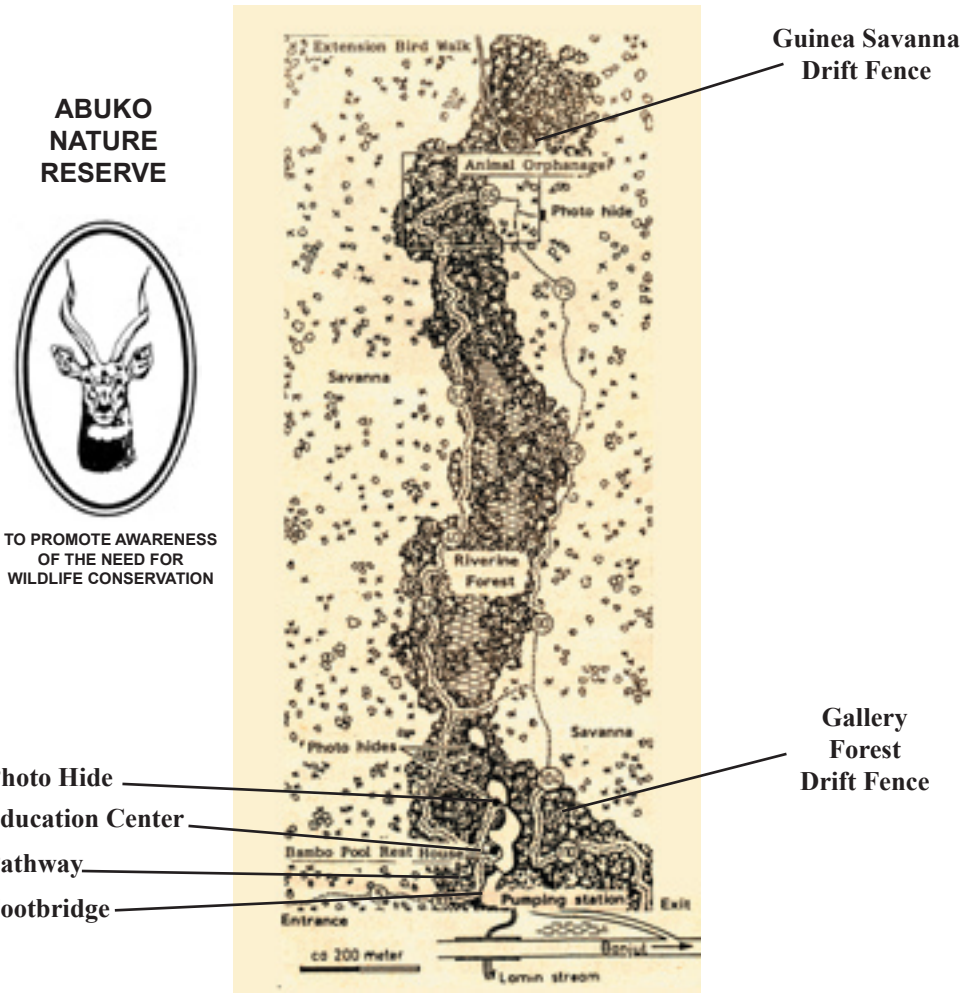


Figure 4.2 Map of Abuko Nature Reserve. Here you can see the locations of the Gallery Forest Drift Fence and the Guinea Savanna Drift Fence. The locations of the Nile Crocodile counts are also labeled on this map. These sites include the Education Center, Photo Hide, Footbridge, and the Pathway, which are all located near the Gallery Forest Drift Fence (map courtesy of Abuko Nature Reserve).

between 8:30 and 9:30 p.m. I conducted all the counts myself to reduce individual biases.

I also surveyed the area for Dwarf Crocodiles at night. The last report of these crocodiles was in their small pools in 1990. When I began working at Abuko the workers resurfaced the pools with cement. Once completed, they filled the pools with water. I surveyed these pools on four different nights to determine whether Dwarf Crocodiles still lived in the reserve. Based on my findings, the reserve management would decide whether to import breeding pairs from another West African country.

Results

I identified all of the specimens I collected to their species level. Over the entire time of the survey I collected a total of 553 specimens from the two different fences. This sample made up 16 different species of reptiles and amphibians. Of these 16 species, six I found only in the gallery forest and five I only found in the guinea savanna. I found the remaining five species in both environments. In addition, about 84% of the total specimens were collected in the gallery forest, while only about 16% were collected in the guinea savanna. Although both environments carried a similar number of species, as noted earlier, the abundance of specimens found was considerably

higher in the gallery forest. There is a significant difference between the abundance of species between the two habitats (based on a Chi-square test where $\chi^2 = 1.172 \times 10^{-81}$, Excel 98). This shows that the gallery forest, where reptiles and amphibians have more access to water, is more conducive to their life.

I observed 10 more species during my general walking survey of the reserve; therefore the overall survey of the reserve consisted of a total of 26 species. Of the 26 species I identified, I reported 11 for the first time in the reserve and four for the first time in the country. The four new species in the country included *Leptopelis bufonidis* (a species of tree frog), *Leptotyphlops narraratum* (a spotted blind snake), *Leptosiaphis nimbaense* (a species of skink), and *Lycophidium irraratum* (a species of house snake). The seven other species that made up the list of new species of the reserve included *Afrixalus fulvovuttataus* (a reed frog), *Bufo pentoni* (Penton's Toad), *Bufo xeros* (Savanna Toad), *Hemismus marmoratus* (Shovel-nosed Frog), *Kassina fusca* (Pale Running Frog), and *Leptopelis viridis* (Tree Frog). The comparison of the abundance of each species found in the two drift fences is in Figure 4.3. Table 4.1 shows the listing of all species observed during this study.

The most abundant species I found in this survey was the Shovel-nosed Frog, *Hemismus marmoratus*, which made up about 75% of the total collected

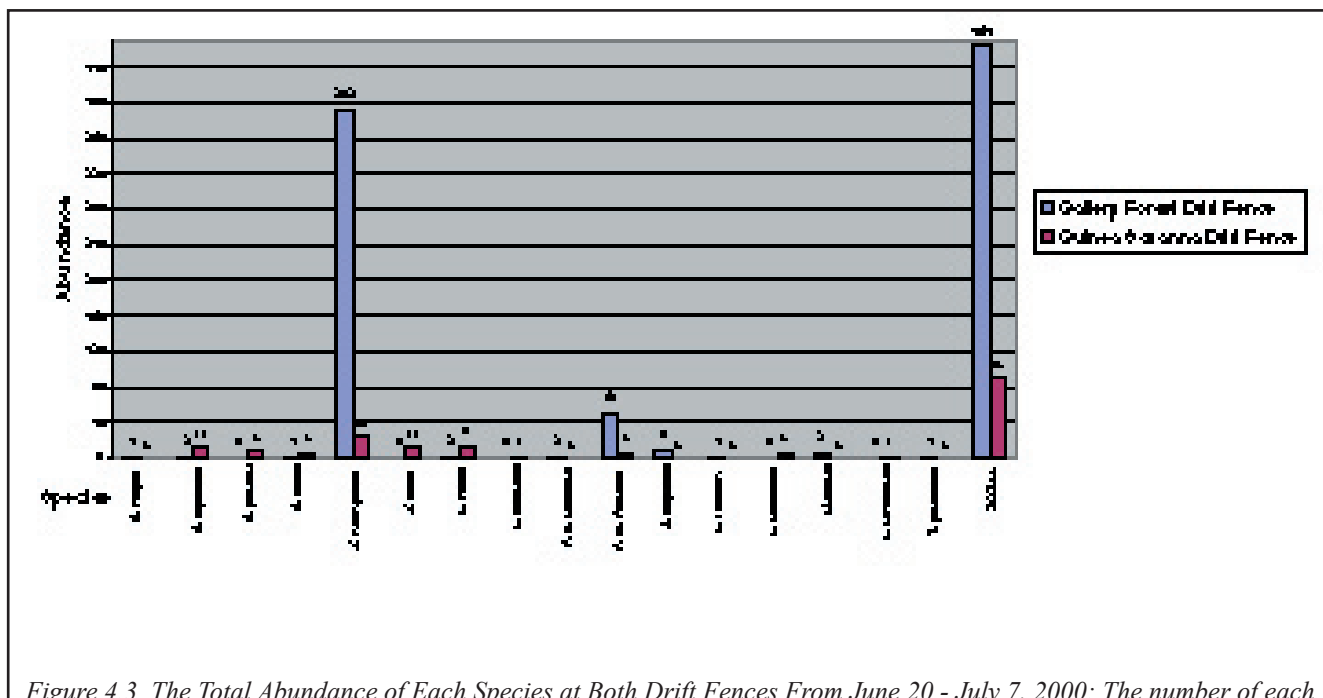


Figure 4.3 The Total Abundance of Each Species at Both Drift Fences From June 20 - July 7, 2000: The number of each species found at each drift fence can be seen in this figure. Note that the numbers above each bar represent the exact number of that species found in that particular environment.

FAMILY	ORDER	SCIENTIFIC NAME	COMMON NAME	NOTES
Amphibia				
	Anura			
		<i>Afrivalus vittiger</i>	Reed Frog	G *
		<i>Bufo regularis</i>	Common African Toad	B
		<i>Bufo pentoni</i>	Penton's Toad	S *
		<i>Bufo xeros</i>	Savanna Toad	B *
		<i>Hemisus marmoratus</i>	Shovel-nosed Frog	B *
		<i>Hoplobatrachus occipitalis</i>	Groove-crowned Bullfrog	
		<i>Kassina fusca</i>	Pale Running Frog	S *
		<i>Leptopelis veridis</i>	Tree Frog	B *
		<i>Leptopelis bufonidis</i>	Tree Frog	S **
		<i>Phrynobatrachus cf. latifrons</i>	Accra Puddle Frog	G *
		<i>Phrynobatrachus cf. francisci</i>	Puddle Frog	B
		<i>Silurana tropicalis</i>	Forest Clawed Toad	G
Reptilia				
	Crocodylia			
		<i>Crocodylus niloticus</i>	Nile Crocodile	
	Squamata			
		<i>Agama agama</i>	Agama	
		<i>Chamaeleo gracilis</i>	Graceful Chameleon	
		<i>Chamaeleo senegalensis</i>	Senegal Chameleon	
		<i>Leptosiaphis nimbaense</i>	Orange-flanked Skink	S **
		<i>Leptotyphlops narirostris</i>	Spotted Thread Snake	S **
		<i>Lycophidium irratatum</i>	African House Snake	G **
		<i>Mabuya affinis</i>	Brown-flanken Skink	G
		<i>Naja melanoleuca</i>	Black Cobra	
		<i>Psammophis elegans</i>	Slender African Beauty Snake	
		<i>Tarentola ephippiata</i>	Fig Tree Gecko	
		<i>Typhlops punctatus</i>	Spotted Blind Snake	
		<i>Varanus exanthematicus</i>	Bosc's Monitor	
		<i>Varanus n. niloticus</i>	Nile Monitor	

NOTES:

Single Asterisk (*) denotes specimens new to the reserve.

Double Asterisks (**) denotes specimens new to the country.

For a comparison of the two drift fences, G denotes those species that were only found in the Gallery Forest, S denoted those species that were found only in the Guinea Savanna, and B denotes those species that were found in both drift fences. Those without designated locations were found in the general survey of the Abuko Nature Reserve.

Table 4.1 A list of the herpetofauna recorded at Abuko Nature Reserve.



One of the new species found in The Gambia, *Leptopelis bufonidis*, a type of tree frog.

Photo by L.K. Barnett, DPWM

specimens. Surprisingly, my report of the shovel-nosed frog was the first for Abuko Nature Reserve, although it has been reported in other parts of the country. The next most abundant species was a puddle frog, *Phrynobatrachus cf. francisci*, which made up about 10% of the specimens. Despite the lack of previous research in this area, there may be other reasons why species that I found in such large numbers had no previous record in the reserve. One reason is that earlier studies were general surveys that concentrated on the larger animals that one would see as they walked through the reserve or forest area. Another reason is that my survey may have taken place at a different time of year than previous studies. The presence of reptiles and amphibians varies greatly according to season.

My estimate of the Nile Crocodile population in the reserve is as follows:

Although the largest number of Nile Crocodiles that I recorded was 17, I believe that the overall population could be larger. Due to constraints on my field of vision, it is possible that I could not count all of them. Nevertheless, overall I think that this is a decent

estimate. Some of the limitations I faced in completing this survey included loss of visibility because of dense vegetation, crocodiles being submerged in the water, and the angle in which the crocodile was facing in relation to me. Another problem with this survey was that I might have counted an individual crocodile more than once, or not at all on a given night. I took the counts from four different spots, and it is possible that an individual crocodile may have moved into or out of my view between the counts.

As for the survey of the pools which I thought Dwarf Crocodiles inhabited, I observed none in the four nights that I searched for them. I feel that it is possible that they are still present in the reserve, but due to the limited time available to me, I did not come across them. Also, since my survey took place at the end of the dry season and briefly into the wet season, it is possible that they were not out of hibernation yet. Finally, since the pools filled with water after being recently resurfaced, the crocodiles may have needed more time to make their way back and acclimate themselves. Table 4.2 shows a summary of this.

Conclusions

This was a unique opportunity for me to carry out field research for the first time, and what better place to do it than Africa. Although my attempts to find Dwarf Crocodiles were unsuccessful, and I had limited time to estimate the size of the Nile Crocodile population, I feel that my general survey of the reptiles and amphibians living in the reserve was very successful. The drift fences were an excellent way to capture a wide variety of small creatures that previously had not been recorded in the reserve, or even in the country. Like most other studies done in this area on reptiles and amphibians, mine was short. Given more time, I could have extended my research and been able to do a

Date	06/22/2000	07/03/2000	07/05/2000
Location			
Gallery Forest Drift Fence/Pathway	1	1	0
Education Center	8	9	11
Foot Bridge	1	3	1
Photo Hide	7	0	4
Night's Total	17	13	16

Table 4.2 Summary of Nile crocodile.

more complete survey of the reptiles and amphibians. I am also interested if others will find other species in the drift fences once the rainy season advances, and whether Dwarf Crocodiles still inhabit the reserve.

The data that I collected on the herpetofauna and the data collected by others of other animal families are being compiled. The Department of Parks and Wildlife Management will then publish the complete species list of the reserve. I am also completing an in-house field guide of the reptiles and amphibians for the workers at Abuko Nature Reserve. Along with this field guide an educational display on the reptiles and amphibians of the reserve will be mounted for their education center. I plan to present these two objectives to the management and research team at Abuko Nature Reserve. This opportunity has opened a new door for me and has made me more interested in further studying conservation ecology. Now when I tell people about this trip, the common question is, "Would you ever go back?" When I tell them yes, my protective father quickly butts in, "Why in the world do you want to go back?" for he still truly believes that I would have enjoyed Australia more.

Acknowledgements

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Christina helps with a Rock Python found in the park during her research. Too big for a drift fence!