Assessment of the Status of Seven Reptile Species in TOGO

by Matthew Harris
Assessment of the Status of Seven Reptile Species in TOGO.

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NB. The format for pagination includes a second page marked a in some parts of the report.
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The Commission of the European Community is gratefully acknowledged for providing support for much of the field work of the project and the Darwin Initiative of the UK for additional support for developing capacity building.

Note

The project has been delayed due to unforeseen circumstances including a car crash in Togo, and repeated sickness of the principle co-ordinator in addition to substantial communication difficulties.
1. **Introduction**

Togo has for some time had a sizeable export trade in animals collected from the wild. In recent years concern has been expressed in the CITES community that the trade in reptiles is based on inadequate knowledge of the abundance of these species in the wild and consequently of the impacts of such trade (Jenkins, 1997). Indeed, herpetology is recognised as a generally overlooked discipline and particularly in Africa there is a huge need for more herpetologists and more research into basic life history information on these species (Branch, 1998/9).

This project was conceived to collect information on seven species of reptile exported from Togo in significant numbers, two snakes, *Python regius* and *P. sebae*; three hingeback tortoises, *Kinixys belliana, K. erosa* and *K. homeana*; and two chameleon species, *Chameleo gracilis* and *Chameleo senegalensis*. In addition, with funding from the Darwin Initiative, the project aimed to develop capacity within Togo to undertake simple field assessments.

1.1 **Recent Trade History**

All of the focal species investigated in this study are included in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Species included in Appendix II must be subject to particularly strict regulation to ensure that they do not become eligible for inclusion in Appendix I, which prohibits commercial trade in wild specimens (Wijnstekers, 1994). This regulation under Appendix II requires that before export, an authority in the country of export must certify that the export will not be detrimental to the long-term survival of the species or affect the role of the species in the ecosystem. In effect the authority must certify that the harvest is sustainable as well as being subject to national laws and the specimens housed humanely. The Parties to CITES have recognised for many years that this non-detriment finding is not being adequately implemented and in 1984? CITES technical committee responsible for fauna, The Animals Committee instituted the Significant Trade Process (Resolution Conf. 8.9). Under this process the Committee reviews reported trade in all appendix II species and identifies species for which levels of trade may give cause for concern. The trade and biological information on these species is then reviewed in more detail. On the basis of these detailed reviews the Committee is then in a position to discuss with range States various management options for ameliorating the situation, where necessary.

Significant trade reviews were conducted on the three tortoise species and *Python sebae* in 1993, on *Chameleo gracilis* in 1996 and on *Chameleo senegalensis* in 1998 (WCMC, IUCN/SSC, TRAFFIC, 1993; IUCN/SSC, TRAFFIC, WCMC, 1996/98). As a result of these reviews it became clear that there was very little information on the abundance of the species in the wild, and the Committee recommended that such studies be undertaken and that Togo report on the biological basis for these exports. As a result, Togo instituted an export quota system, which reduced exports to some extent.

1.2 **Aim and Objectives**

The aim of this study was to work with the in Togo to collect further information on the status of and trade of the seven focal species to inform management decisions, and underpin management plans for the sustainable use and conservation of the species. Whilst collecting status information, the project also undertook to train six Togolese counterparts in reptile census and interview techniques.
Although, the current project concentrated on collecting information on the focal species reports that *Geochelone sulcata* occurs in the north of the country were to be investigated if possible.

Specific objectives included:

1) The collection of recent reports and literature sources to update information on the present range of the species in Togo, estimate the area of distribution and estimate the possible extent of range reduction, in light of reports of deforestation.

2) The estimation of population abundance, using established methodology, in different types of habitat and in areas subject to different levels of human impact, including comparison between non-exploited and exploited populations.

3) The collection of life history data, including information on habitat preferences, movements, food, nesting requirements and seasonality, and reproductive biology.

4) The investigation and documentation of aspects of exploitation, using interviews with CITES Authorities, trappers and literature research.

5) The examination to the extent possible of benefits to local communities derived from harvesting of reptiles and assess the incentives for trapping.

6) The identification of factors other than exploitation that affect or potentially affect the survival of wild populations and assess their importance relative to trade (e.g. deforestation).

7) The review of reptile farms.

8) The provision of recommendations concerning future management of reptiles, with regard to:

   i) whether the present export quota levels are acceptable; and

   ii) what measures would need to be implemented to ensure future sustainable exploitation, especially with regard to setting trapping and export quotas, future monitoring and management of captive breeding/ranching establishments.

2. **Survey Area and Methods**

2.1 **Introduction to Togo**

The West African State of Togo, 56,000 sq. km. in area is bounded on the north by Burkina-Faso, on the west by Ghana, on the east by Benin and on the south, for 50 km., by the Gulf of Guinea. Togo's human population numbers around 4 million and has been increasing at a rate of 3.1% annually. Almost half of the population is under 15 years and only 3% live beyond 65 years. Around 70% live in rural areas, although the urban population in the main cities Lome, Sokode, Kara, and Kpalime is growing at a rate of around 6%. The most recent estimates put annual per capita GDP at US $200. Administratively, Togo is divided into five regions, Maritime Region, Plateau Region, Central Region, Kara, and Savanes subdivided into 30 prefects and sub-prefects. The economy is largely based on agricultural produce (WRI, 1994).
The climate is tropical in the south and semi-arid in the north (22-35°C). In the South, the main rains fall from March-July and September – November. In the North the rains last from April to September. Annual rainfall averages 70 inches. The country is predominantly covered by bush savannah vegetation, with a small area of tropical broad-leaved rainforest in the south west of the country. In the extreme north, the bush savannah gives way to a relatively small area of grass savannah. However the country is traversed by a number of sizeable rivers, which support areas of gallery forest. Much of the natural vegetation has been cleared for agriculture.

Administration of the Wildlife Estate

The responsibility for the protection of wildlife and for protected areas falls to the Direction des Parcs Nationaux, des Réserves de Faune et de Chasse, i.e. the Department of National Parks, Faunal Reserves and Hunting. This is a department of the Ministère de l’Environnement et de la Protection Forestière, (The Environment and Forestry Protection Ministry). This department is divided into two divisions, the Division de la Conservation des Reserves de Faune et de l’Organisation des Activités Synergiques (Conservation of Fauna Reserves and Organisation of Synergistic Activities) and the Division des Parcs Nationaux (National Parks Division). Other relevant authorities include the Direction de la Protection et du Contrôle de l’Exploitation de la Flore (Department for the Protection and Control of Exploitation of Flora) and the Direction de l’Ecologie Générale et de la Réhabilitation du Milieu (Department of General Ecology and Rehabilitation of the Habitat).

Between 1939 and 1957, a total of 83 zones were designated Forêts Classées (Classified forests), representing some 9% of the territory of Togo. Following independence in 1960, the government created 3 National Parks and 10 Faunal Reserves (see Annex 1 for details).

2.2 Data Collection at Reptile Farms

Twelve establishments are registered to export reptiles, of which only four farms are active and overseen by the Wildlife Department. These four farms raise reptiles for the export trade and are situated in Lome (Togarim, Pajar, Fexas and Mare). They share approximately 95% of the export quota, whilst the other 8 establishments sharing the remaining 5% of the quota. Permits to export were granted to all establishments in about 1994 (see also de Buffrenil, 1995; Jenkins, 1997).

To collect information on growth rates of animals in captivity and other information, the four farms were visited once a week from 20th May 1999 to 25th June 1999, and then roughly once a month until December 1999, with a final visit made in June 2000.

During the initial visits, the number of specimens of each species held in the farms was estimated, and a representative sample of animals was marked, measured and set aside, although under the same conditions as other animals. The sample specimens were measured to define morphometric characteristics of each species, for comparison with data from free-living animals. The specimens were marked to allow the calculation of growth rate in younger animals, and to observe reproduction in captivity in adults. Ticks were also counted as an indicator of parasite burden, for comparison between captive and wild specimens. In total 314 P.regius; 20 P. sebae; 50 K. belliana; 50 K. homeana; 42 K. erosa; 33 C. senegalensis and 17 C. gracilis were marked. However, most of the marked animals escaped, were exported or died before any meaningful long-term data could be obtained.
2.3 Field Survey Methodology

To examine the sustainability of harvest, the density of each species was estimated and an index of abundance was derived to compare abundance in exploited and non-exploited areas. Mean relative abundance of the focal species, in different habitats was calculated by dividing the number of animals collected by the area searched and number of man search hours.

Area of Suitable Habitat

Information on the distribution of the focal species in Togo was collected from: historical sources; the work of Dr Bowsidjao; and this project. A current project funded by Cooperation Française and carried out in collaboration with the University of Benin Department of Botany, to map the vegetation cover of Togo, is due to be completed near the end of 2001.

Study Sites

To sample exploited and non-exploited areas in each of the seven main vegetation zones in Togo was not possible given the constraints of time and resources. Consequently the study focussed on the two most heavily exploited species, *Python regius* and *Kinixys belliana*, in the region where the vast majority of exploitation takes place, i.e. the extreme south of the country. However, all other focal species were searched for as well, and for comparison some sites were established in other areas of the country. Ideally, sites would have been placed in protected and non-protected areas in an attempt to assess whether the protected area status had any effect upon the reptiles’ population and population structure. However, none of the protected areas are situated in the southern quarter of the country where most of the reptile hunting takes place and the lack of resources for the management of national parks or faunal reserves means they are effectively paper parks, with the exception of the Fazao-Malfakassa reserve in the centre of the country.

Sample sites were generated at random and converted into latitude and longitude coordinates. In addition several sites were selected to reflect areas of exceptionally high exploitation, areas where surplus animals were released and areas with no exploitation, based on reports from hunters and reptile farmers.

Sites visited

The main quadrat sites are detailed below (Table 1.1). More detailed vegetation descriptions were made of the 9 most regularly surveyed sites (Table 1.2).
<table>
<thead>
<tr>
<th>Site</th>
<th>Surface area (m²)</th>
<th>Number of Visits</th>
<th>Main Sites</th>
<th>Hunted (H) or Non-hunted (NH)</th>
<th>Vegetation type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assahoun Fiagbe</td>
<td>25087</td>
<td>3</td>
<td>X</td>
<td>H</td>
<td>Bush savanna</td>
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<tr>
<td>NR2 Lilikope</td>
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<td>Agriculture</td>
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<tr>
<td>Kpotaive</td>
<td>24267</td>
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<td>X</td>
<td>NH</td>
<td>Palms / bush savanna</td>
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<tr>
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<td>19897</td>
<td>3</td>
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<td>NH</td>
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<td>Bombouaka</td>
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<td>Naki Est</td>
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<td>31300</td>
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<td>NH</td>
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</table>
### Table 1.2: The percentage surface area covered by different vegetation types for the nine main study sites

<table>
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<td>Pineapple</td>
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<td>Beans</td>
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<tr>
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<td>242</td>
<td>242</td>
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<td>242</td>
<td>242</td>
<td>242</td>
<td>242</td>
<td>242</td>
</tr>
</tbody>
</table>

Note: Figures are given as percentages of the surface area.
Abundance Estimates

As a group, reptiles are relatively difficult to study in the wild, especially in the sample sizes needed to make statistical analyses viable. Because tortoises and snakes are generally very cryptic and difficult to detect it is widely recognised that undertaking transect surveys is rarely productive. (Gorzula, 1997; Lawton, 1993).

Where possible, standard methods, were used to assess population size and population structure to detect differences between exploited and non-exploited areas. However, methodology depends upon the species concerned and the field situation. The actual technique for searching for animals depended upon the methods employed by the hunters, and is outlined in section XXX Trapping and Transport. The methods used to sample the species are outlined in the following paragraphs:

*Python regius* and *Kinixys belliana*. These two species, are known to occur in similar habitats and so were censused at the same time. Three hectare quadrats were searched intensively during the day by two hunters for sessions of three hours at a time and all animals detected were caught. Animals caught were weighed, marked, sexed, and in addition, a range of morphometric measurements were taken. Details of behaviour at time of capture, microhabitat of capture and any other relevant details were noted. Each quadrat was normally repeated twice within a week (though not normally within 24 hours), and for certain sites this cycle was repeated several times.

Though not specifically a mark-recapture study animals were marked to determine if any were recaptured and if so, to obtain growth and reproductive data. Pythons were marked by clipping ventral scales in a sequence, giving each animal a unique three-figure code. Tortoises were marked using a similar system, with notches being placed on the marginal scales of the carapace using a branding iron or knife.

During January and February, when hunters were not available to assist with the work, a transect system comparable to that described by Gorzula (1997) was used. Hunters were followed and the distance they covered estimated to give a transect length. The search width averaged 2 metres either side of the hunters in correspondence with Gorzula's study. The width of the strip covered by hunters was multiplied by the transect length and then by the number of hunters to give the total area searched. The number of animals caught was divided by the calculated search area to produce a density estimate. Distances were estimated with a GPS Garmin 300.

*Python sebae*. This species is reported to occur in association with linear features such as riverbanks or pond and lake shorelines, so transects aligned along these features were used. Despite searching during the day and night, with specialist *Python sebae* hunters and in known *Python sebae* sites, only one animal was ever encountered. So it was not possible to calculate a reliable abundance estimate for this species.

*Chamaeleon species*. Owing to their camouflage and slow-moving, secretive habits, chameleons are not easily found during the day, and so were searched for at night using torches (see section on Trapping and transport methods, below). A system of transects using the "Distance" method was used to estimate the abundance of these animals (see Brady and Griffiths 1999). In this method the horizontal distance of the specimen to the transect was calculated using a range finder. Initially, transects were placed in the quadrats used for the royal python study above. Two types of transect were used. Firstly, paths, roads and railway lines were followed and animals detected in the surrounding vegetation. Secondly, batches of four nylon cords, each 50 m long were placed 30 m apart in the area to be studied. Vegetation was not cut, and these cords were walked along by researchers to give an effective 200 m long transect in each area. The former
"path" method yielded plenty of sightings, though pre-established paths are not placed at random to the animals' distribution, thus violating one of the assumptions of the Distance method. The second "transect" method, with batches of transects placed at random, is more methodologically sound, but unfortunately revealed very few animals, and not enough to enable Distance method statistical analyses. In fact, only one such transect batch revealed any animals, but this particular sampling session is not thought to be valid for other reasons.

*Kinixys erosa* and *K. homeana*. Based on prior knowledge of the ecology of these species, combined with advice from the trapping community, it was known that surveying for these species would be problematic and it was expected that few specimens would be found. Dwight Lawson (pers. comm.) indicated that the cryptic colouration and secretive nature of these animals would rule out straightforward visual searching, and that drift fences and pitfall traps would be problematic as well. Ideally, radio-tracking would have been used to provide data on home range of individuals and allow estimation of density, but was beyond the scope of this project. Simple transects, with searchers walking in a line 10 m across for a measured distance, were used to estimate density, in the absence of any other viable method.

*Geochelone sulcata*. *Ad hoc* searching was used to detect this species.

Field survey teams consisted of the Principle Investigator, one or two members of the DFC, up to three university students and local hunters. The majority of field surveys were conducted between July 1999 and August 2000. The areas searched for each species are presented in Annex 2.

### 2.4 Interview Methods

In areas surveyed for live animals, villagers were interviewed about trends in reptile abundance and their use as food and for other purposes. Information was also sought on the socio-economic importance of reptile collection to determine whether trapping for the export trade provided a significant portion of the income of many rural families, or whether it is was viewed as a an opportune activity to top-up staple income derived from farming etc. A questionnaire was developed with the student collaborators on the project to collect this information in standard form. Local people were approached individually during fieldwork and the questions posed by one of the students in a native language. Though the questionnaire was designed and written in French, this is not the first language of many people in Togo, and it is common to find people in rural areas who speak little or no French. A copy of the questionnaire appears in Annex 3.
3. Survey Results

3.1 Ecology/ Life History of the Species

*Kinixys belliana*, Bell’s Hinged Tortoise

**Description:** The hingeback tortoises are so-named because as adults they have a unique hinge in the carapace that allows the rear of the shell to close protecting the hind feet and tail region. Juveniles do not have a hinge and so may be confused with other species. *K. belliana* is a medium sized tortoise (straight carapace length 12-17cm), which has either a smooth, convex or depressed carapace and a prominent hinge. The West African race is *K. belliana nogueyi*.

**Habitat and Distribution:** This species is widely distributed throughout sub-Saharan Africa. It is said to prefer savanna-type habitats, mainly grassland, moist savannah woodland and thicket or dry forest, and agricultural land. As habitat-types other than these are not extensive in Togo, this species is thought to range throughout the greater part of the country.

**Life History and use:** The species is active during the wet season, and may aestivate in burrows during the dry months (Broadley, 1989). The diet is very varied including vegetation, fruits, fungi and snails, millipedes and carrión. It has been recorded living up to 22 years in captivity. Breeding is relatively poorly known; the female excavates a burrow and lays 2-7 eggs (sometimes 10), and may lay eggs at 40-day intervals. Incubation takes 90-110 days (See Brach 1988) although Broadley (1989) maintains that incubation lasts about a year. This apparent discrepancy may be explained by the observation of Kingsley, (2000) that whilst artificially incubated eggs kept at 30 degrees C hatched after three to four months, longer incubation times are reported in the wild. Hatchlings are around 40mm in size. The species is eaten by man throughout its range and when encountered will be collected for sale to trappers or for food.

*Kinixys erosa*, Serrated Hinged Tortoise

**Description:** *K. erosa* is generally larger than *K. belliana*; the largest records from Zaire and Sierra Leone were of a male measuring 323mm and a females measuring 260mm (Broadley, 1989).

**Habitat and Distribution:** This species is distributed from Gambia east to Zaire and Uganda, and south to northern Angola and the northwestern shore of Lake Tanganyika (Broadley 1989). The CITES fauna database indicates that it is uncertain whether the species occurs in Togo, however, embl Heidelberg does include Togo in the area of distribution. The species apparently occurs in evergreen forest, especially marshy areas. The potential habitat in Togo for this species is not extensive and is restricted to the higher mountain areas around Badou and Kpalime, and also to gallery forest. Although not recorded in the wild during this project, the farms contained specimens of this species and records collected by Dr Bowsidjao (pers comm.) suggest the species does occur in Togo.

**Life History:** During the day the species hides under vegetation and is very cryptic. Individuals may be found living in streams where they can swim and dive for food (Broadley, 1989). There appears to be little information on the breeding biology of this species, but a captive specimen reportedly laid four eggs in Zaire in November.

*Kinixys homeana*, Home’s Hinged Tortoise

**Description:** This species is similar in size to *K. belliana*, the largest male and females being 211mm and 223mm respectively (Broadley, 1989). It is perhaps the most distinctive of the Hingebacks, with an almost 90% degree downward bend in the carapace (Kingsley, 1998).

**Habitat and Distribution:** The species has been recorded from Liberia to Zaire. The CITES fauna
database indicates that it is uncertain whether the species occurs in Togo, however, embl Heidelberg does include Togo in the area of distribution. It inhabits lowland evergreen forest and the potential habitat of these species in Togo is not extensive being restricted to the higher mountain areas around Badou and Kpalime, and also to gallery forest. Although not recorded in the wild during this project, the farms contained specimens of this species and records collected by Dr Bowsidjao (pers comm.) suggest the species does occur in Togo.

**Python regius, Royal or Ball Python**
**Description:** A generalist terrestrial species occurring in a variety of habitat types throughout West Africa. Known to be invasive in agricultural land, this species can be said to tolerate human presence. Adult size varies from 100-120cm max 180cm.
**Habitat and Distribution:** The species occurs in Central and Western Africa. It is found at the edges of forest lands.
**Life History:** The presence of thermosensitive labial pits indicates adaptation to taking warm-blooded prey and hunting probably occurs at night. The diet primarily includes rodents, although birds and lizards may also be taken. This species lays its eggs in burrows and is dependent on the availability of pre-existing burrows of other species. The first eggs were observed in the wild during this study on 1st of February 2000. Hatchlings were found in the wild from mid-April.

**Python sebae, African Python**
**Description:** This is Africa’s largest snake measuring 300-500cm max 560cm.
**Habitat and Distribution:** The species is found throughout sub-Saharan Africa. It can be found near water bodies throughout sub-Saharan Africa, particularly in open savannah regions, rocky regions and riverine scrub in Togo. It is more closely associated with aquatic habitats than *P. regius*, and is thought to be found in all marshland, and along borders of all rivers and lakes, natural or artificial.
**Life History:** Individuals are fond of water in which they may lie and hunt. Prey is ambushed and constricted usually at or after dusk. They can swallow very large prey, but are then vulnerable to attack by hyena and dogs. They are a valuable aid in agricultural areas in controlling rodent pests. They may fast for long periods (two and a half years has been recorded in captivity). They often lie and bask, particularly after feeding. They are generally more aggressive and unpredictable than the smaller *Python regius* and are less in demand as pets. The female lays 30-50 eggs (over 100 in very large females) in disused burrows of other species and coils round to protect and incubate them. The young hatch in 65-80 days and measure around 600mm. Sexual maturity is reached in 3-5 years at 200-300cm. In Togo this species is reported to lay from mid-January to the end of May/beginning of June, with incubation lasting 70-100 days.

**Chameleo gracilis, Graceful Chameleon**
**Description:** 12-16 inches in length.
**Habitat and Distribution:** Sub-Saharan and equatorial Africa. Dry and humid forest and savannah. This is an arboreal species and thus may potentially occur in all forest or wooded/scrub savannah areas in Togo. However, recent work in Madagascar has shown that chameleons may have very specific microhabitat requirements (Brady and Griffiths, 1999).
**Life History:** Reaches sexual maturity at 4-5 months, produces 1-2 clutches per year consisting of 20-40 eggs per clutch (Chameleon Journals, 2000). Chameleons forage almost exclusively on invertebrates, and using sight to detect prey are generally diurnal hunters.

**Chameleo senegalensis, Senegal Chameleon**
**Description:** Females to12 inches, males slightly smaller.
**Habitat and Distribution:** Equatorial Africa. Savannah and gallery forest. This is an arboreal species and thus may potentially occur in all forest or wooded/scrub savannah areas in Togo.
However, recent work in Madagascar has shown that Chameleons may have very specific microhabitat requirements (Brady and Griffiths, 1999).

Habitats:

**Life History:** Reaches sexual maturity at 5-6 months, produces two clutches per year consisting of up to 70 eggs (Chameleon Journals, 2000). Chameleons forage almost exclusively on invertebrates, and using sight to detect prey are generally diurnal hunters.

### 3.2 Results from Reptile Farms

The methods employed by the reptile farms to produce animals for the trade differs little from those described in de Buffrenil (1995), Jenkins (1997) and Hodoyali (1997) and so will not be described here. The main change in the reptile farms since these studies were carried out, and indeed during the course of this research, appears to be a reduction in captive breeding in favour of more ranching. There now appears to be very little captive breeding going on in any of the farms. For example, Toganim had developed a large annexe in the Kelegougan quarter of Lome, which acted as a repository for captive reptiles and held a large proportion of their breeding stock. However, the land on which this was built was sold and the animals released or integrated into Toganim’s other holding facilities.

Whilst it is uncertain whether previous reports of captive breeding conform strictly to CITES criteria for all species, *Python regius* have been regularly produced to F2 generations and beyond. All farms keep records of their production in the form of tables detailing, amongst other things, initial stock, reproduction statistics and disposal of animals produced. Jenkins recommended (1995) that farms needed to improve their record keeping with regard to records of stock, breeding statistics (egg production, clutch size, percentage fertility, hatchability, neonate mortalities etc.). This has been implemented to a certain extent, though the interpretation of this advice varies between the individual farms, as evidenced by the very different layouts of their record tables. A standard table would greatly facilitate the interpretation of reptile farms’ statistics by the wildlife management authority and by external observers.

**Data Collection from Farms**

It was recommended in 1997 that “The CITES Management Authorities of Benin and Togo should require python farms, to maintain accurate records of stock, breeding statistics (e.g. egg production, clutch size, percentage fertility, hatchability, neonate mortalities etc)” (Jenkins 1997). The records, supplied by the reptile farms to the Wildlife Department and the project were reviewed and indicate a mixture of over- and under-estimation of production. NB During interviews all reptile farm directors stated that some of the data are approximate, estimates or predictions.

The stock counts and clutch sizes reported by Pajar farm correspond with the numbers to be expected from the size of facilities (see Table 3.1). However, the total of 15,342 *P. regius* eggs laid would be expected to have produced more than the 1200 young recorded as ‘available’ (presumably for sale or release). Furthermore, the number of ‘Young and adults available’ seems to be underestimated for all species recorded. Data from Mare are consistent with its position as the smallest of the four farms and its export quota is correspondingly small (see Table 3.1). As a result, Mare sells many of its animals locally, mostly to the other reptile farms. The data from Fexas are the most detailed of all the records and show that the farm has grown since 1996, especially in the numbers of tortoises and chameleons, and ranching has also become gradually
more important with time. As the sexes of the animals listed under initial stock, i.e. animals maintained for captive breeding, are not specified, it is difficult to estimate the total number of females and hence the number of eggs per female. However, even if one assumes that all of the animals recorded are gravid females, this still gives a ratio of over 10 eggs produced per female for *P. regius*. Although this is within the range of clutch sizes recorded for the species, it seems unlikely to be the average clutch size for 450 females. Either the number of adults has been underestimated, or the number of hatchlings produced has been overestimated. Given the small amount of space available at Fexas farm for adult pythons, the latter seems more likely.

The numbers of *P. regius* witnessed in the Toganim premises support the records of the numbers of gravid females. The ratio of eggs per females seems to be over-estimated, given that data from clutch size counting by the project team gave a ratio of 7.41 eggs per female (see later) and that during another study, Bonnet et al (in prep), found a ratio of 7.6 eggs per female. However, the hatching rate of 90.5% corresponds with that recorded by the project and by the other farms. Thus Toganim should produce about 33690 hatchlings for sale, (once post-hatching mortality and numbers returned to the wild are removed from the calculations). However Toganim’s share of the annual export quota for pythons is about 15000 animals and by October 2000, after the main season for the export of these animals, Togo had already exported some 18825 mated pythons. Thus Toganim is either producing twice as many *P. regius* as required – or the figure for the production of young is greatly overestimated. Such a quantity of young was never observed at the farm and it is questionable if sufficient facilities were available.

Toganim recorded a total of 5073 eggs laid by all three species of *Kinixys*, assuming a conservative estimate of 2 eggs per female tortoise, this implies the presence of some 2537 females, not including the males needed to mate with those held captive permanently. The facilities to house this many adults and to incubate this many eggs were not observed during the project, again suggesting an overestimate the numbers of animals involved. Furthermore, 90% of tortoises produced were released suggesting gross overproduction. Some species, such as *K. homeana*, *K. erosa* and *G. sulcata* are restricted to limited areas of habitat in Togo, and it is not clear whether these young were released into an appropriate area.

**Discussion**

As evidenced by the anomalies recorded in the descriptions above, the tables provided by the reptile farms appear to lack accuracy, and no one table format provides all the information needed for careful management and stock taking. Although these tables may be produced to satisfy the requirements suggested by the Jenkin’s (1997) report, such data recording does not fulfil the spirit of the recommendations. To improve the regulation of these affairs, the Wildlife Department requires a standardised format. When the accuracy of these records is discussed, the farmers contend firstly that as there is a constant coming and going of animals throughout the year, it would be impossible for the Wildlife Department to verify the total figures for captive stock etc., and secondly that a large proportion of their stock is dispersed among their various holding stations (at least twelve in the case of Toganim), and so counting these animals would be beyond the resources of the Wildlife Department. It could be argued that it is in the interest of the reptile farms to overestimate their production, thereby justifying a high quota for the following year. This practice could be encouraged by the fact that the export quota for a given year is based on the previous year’s production. Certainly in most cases the estimates of young produced and of stock held seem to high, except in the case of Pajar farm, where there seems to be a gross underestimation.

*NB* During interview all reptile farm directors stated that some of the above data are approximate, estimations or are predictions.
Table 3.1. Selected data summaries for reptile farms - PAJAR Stocktable 1999.

<table>
<thead>
<tr>
<th></th>
<th>Hatchlings $\backslash$ female captivity</th>
<th>Hatchlings $\backslash$ female ranch</th>
<th>Ratio ranch $\backslash$ captivity</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>P. regius</em></td>
<td>5.33</td>
<td>6.59</td>
<td>1.24</td>
</tr>
<tr>
<td><em>P. sebae</em></td>
<td>15.36</td>
<td>36.57</td>
<td>2.38</td>
</tr>
<tr>
<td><em>K. belliana</em></td>
<td>1.65</td>
<td>1.51</td>
<td>0.92</td>
</tr>
<tr>
<td><em>K. homeana</em></td>
<td>1.15</td>
<td>1.34</td>
<td>1.17</td>
</tr>
<tr>
<td><em>K. erosa</em></td>
<td>1.12</td>
<td>1.25</td>
<td>1.12</td>
</tr>
</tbody>
</table>

Assessment of the Status of Seven Reptile Species in TOGO
<table>
<thead>
<tr>
<th>Females</th>
<th>Hatchlings</th>
<th>Return to Wild (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3.1 (Continued) - Trogania stock data as of June 30, 2020.

<table>
<thead>
<tr>
<th>K. gossa</th>
<th>225</th>
<th>37</th>
<th>48</th>
<th>225</th>
<th>37</th>
</tr>
</thead>
<tbody>
<tr>
<td>K. homomana</td>
<td>020</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>K. bellina</td>
<td>128</td>
<td>127</td>
<td>128</td>
<td>127</td>
<td>128</td>
</tr>
<tr>
<td>p. sealei</td>
<td>25</td>
<td>27</td>
<td>25</td>
<td>27</td>
<td>25</td>
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<tr>
<td>p. regius</td>
<td>48</td>
<td>48</td>
<td>48</td>
<td>48</td>
<td>48</td>
</tr>
</tbody>
</table>

Table 3.1 (Continued) - PAFAK stock table 1999
Table 3. Continued - MARE Stockables

<table>
<thead>
<tr>
<th>Breeders Provision</th>
<th>2000 - 2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>Females</td>
</tr>
<tr>
<td><strong>G. sulae</strong></td>
<td>150</td>
</tr>
<tr>
<td><strong>G. preilii</strong></td>
<td>2200</td>
</tr>
<tr>
<td><strong>G. sarakensis</strong></td>
<td>3800</td>
</tr>
<tr>
<td><strong>K. esus</strong></td>
<td>250</td>
</tr>
<tr>
<td><strong>K. homaeana</strong></td>
<td>900</td>
</tr>
<tr>
<td><strong>K. bhilliann</strong></td>
<td>860</td>
</tr>
<tr>
<td><strong>P. saeae</strong></td>
<td>254</td>
</tr>
<tr>
<td><strong>P. reclus</strong></td>
<td>5600</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Breeders Provision</th>
<th>2000 - 2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>Females</td>
</tr>
<tr>
<td><strong>G. sulae</strong></td>
<td>150</td>
</tr>
<tr>
<td><strong>G. preilii</strong></td>
<td>2200</td>
</tr>
<tr>
<td><strong>G. sarakensis</strong></td>
<td>3800</td>
</tr>
<tr>
<td><strong>K. esus</strong></td>
<td>250</td>
</tr>
<tr>
<td><strong>K. homaeana</strong></td>
<td>900</td>
</tr>
<tr>
<td><strong>K. bhilliann</strong></td>
<td>860</td>
</tr>
<tr>
<td><strong>P. saeae</strong></td>
<td>254</td>
</tr>
<tr>
<td><strong>P. reclus</strong></td>
<td>5600</td>
</tr>
</tbody>
</table>

**Notes:**
- Provision is calculated based on stock reserves.
- Males and Females are counted separately.
- The table includes data for various species, including G. sulae, G. preilii, G. sarakensis, K. esus, K. homaeana, K. bhilliann, P. saeae, and P. reclus.
- The table covers the years 2000 to 2001.
<table>
<thead>
<tr>
<th>Year</th>
<th>Stock level</th>
<th>Wild</th>
<th>% to return</th>
<th>% to wild</th>
<th>Mort.</th>
<th>% to stock</th>
<th>Sold</th>
<th>% to stock</th>
<th>Hatch.</th>
<th>% to hatch.</th>
<th>Spotted</th>
<th>% to spotted</th>
<th>% to find</th>
<th>Eggs</th>
<th>% to find</th>
<th>Hatch.</th>
<th>Eggs to find</th>
<th>Mort.</th>
<th>% to stock</th>
<th>Initial stock</th>
<th>Final stock</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>127</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
<td>0</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2018</td>
<td>123</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
</tr>
<tr>
<td>2017</td>
<td>120</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 3: Continued - FEXAS Stockhabes.
healthier siblings, thus reducing the weftiness of the return to wild program.

Heftiness is selected for sake with numerically the longest and heaviest (i.e., healthiest) being sold first. As a result, those animals released will contain a healthier and more robust stock. In contrast, a smaller proportion of small, weak, and deformed animals then in the population as a whole. These animals are less likely to survive than

counted and placed to order. The higher leeway for release is because demand can be more accurately estimated, and so these animals are

at least a year fatter and thus always easy to detect. The high percentage of offspring released may have been affected by the EL and US distribution and produce even lower than the previous years.

The high percentage of heftiness released probably reflects overproduction rather than any conscious conservation effort. Given that it has not been

$\begin{array}{|c|c|c|c|c|}
\hline
\text{Year} & \text{Initial} & \text{Number of} & \text{Number of} & \text{Heft Held} & \text{Year} \\
\hline
1637 & 8205 & 7996 & 6680 & 0 \times 0 & 0 \\
12 & 2000 & 2199 & 3734 & 88 & 65 \\
53 & 477 & 374 & 3304 & 26 & 52 \\
65 & 1516 & 556 & 3888 & 26 & 52 \\
28 & 384 & 360 & 370 & 20 & 39 \\
29 & 318 & 271 & 444 & 36 & 27 \\
\hline
\end{array}$

\section*{Table 2: Summary of stock data}

next, the following approximate summaries can be made about these data for any given year in the last two years:

The project is not in possession of stock tables from all four years for any one year, so the make, production and disposal for the years for which data

are not given have been estimated to yield results similar from one year to the

next, the following approximate summaries can be made about these data for any given year in the last two years:
Table 3.3 Showing reproductive cycles of focal species, according to Toganim, Pajar, Fexas and Mare

<table>
<thead>
<tr>
<th></th>
<th>1999/2000</th>
<th></th>
<th>20000</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>J</td>
<td>A</td>
<td>S</td>
<td>O</td>
<td>N</td>
<td>D</td>
<td>J</td>
<td>F</td>
<td>M</td>
<td>A</td>
</tr>
<tr>
<td>Pr</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>L</td>
<td>L</td>
<td>LH</td>
<td>H</td>
<td>H</td>
<td>H</td>
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<tr>
<td>Ps</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>LM</td>
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<td>HL</td>
<td>H</td>
<td>H</td>
<td>H</td>
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<td>Kb</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>ML</td>
<td>L</td>
<td>LH</td>
<td>L</td>
<td>L</td>
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<tr>
<td>Kh</td>
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<td>M</td>
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<td>L</td>
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<td>LM</td>
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<td>HL</td>
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<td>M</td>
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<td>BM</td>
<td></td>
<td>B</td>
<td>B</td>
<td>B</td>
<td>BL</td>
</tr>
</tbody>
</table>

**Key**
M = Mating
L = Egg-laying
H = Hatching
B = General breeding activity (i.e. mating, laying and hatching)

Table 3.4 Showing Clutch sizes according to reptile farmers quoted during interviews, September 2000 (Data of more than one source).

<table>
<thead>
<tr>
<th></th>
<th>Toganim</th>
<th>Pajar</th>
<th>Mare</th>
<th>Fexas</th>
</tr>
</thead>
<tbody>
<tr>
<td>P regius</td>
<td>8.21*</td>
<td>6.9*</td>
<td>9.79</td>
<td></td>
</tr>
<tr>
<td>P sebae</td>
<td>31.36*</td>
<td>37.7*</td>
<td>8.33</td>
<td></td>
</tr>
<tr>
<td>K belliana</td>
<td>3 – 6</td>
<td>1.6*</td>
<td>2 – 3</td>
<td>2 – 4, 1.66*</td>
</tr>
<tr>
<td>K homeana</td>
<td>3 – 6</td>
<td>1.42*</td>
<td>2 – 3</td>
<td>2 – 4, 1.73*</td>
</tr>
<tr>
<td>K erosa</td>
<td>3 – 6</td>
<td>1.33*</td>
<td>2 – 3</td>
<td>2 – 4, 1.83*</td>
</tr>
<tr>
<td>C senegalensis</td>
<td>40 – 60</td>
<td>30</td>
<td>40 – 45</td>
<td></td>
</tr>
<tr>
<td>C gracilis</td>
<td>40 – 60</td>
<td>50</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>G sulcata</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Indicates number of eggs divided by number of gravid females reported by each farm to obtain mean clutch size (Calculated from year 2000 data).

3.3 Reproduction of Python regius.

As Python regius is the most heavily exploited of the focal species, this species is the subject of the most detailed analysis. Accurate reproductive data for the focal species is necessary to estimate reproductive capacity and hence the likely sustainability of a known harvest. Reports to date present a conflicting range of values (Jenkins 1997, Gorzula, 1996).

Estimates of adult python density can be used to estimate gross annual production of wild pythons, and hence of the stock available for exploitation, provided the proportion of adults that are female (sex ratio), the proportion of females reproducing, the mean clutch size and hatching success rate can be calculated and extrapolated from sample areas to the country as a whole.

**Sex Ratio**

To determine the sex ration of Python regius in the wild, data are divided into two groups: The first comprised animals caught during random sampling and the second included those caught in areas chosen by reptile hunters, where they habitually find gravid females. The sex ratio in random sites was exactly 1:1 (75 males, 75 females with the sex of two further specimens not
being determined). In sites hunted for gravid females the sex ratio was 1:2.5 (40 males, 100 females with the sex of one juvenile not being determined). The first group is thought to more accurately reflect the prevailing sex ratio in the wild. In contrast, animals in the second group are caught in areas that the hunters specifically search for gravid females, so the sex ratio would be expected to be biased toward females. This implies that there are areas that females favour for egg-laying, and into which they migrate when gravid.

**Reproductive rate.**

An estimate of the proportion of females reproducing each year can be obtained by determining the ratio of breeding to non-breeding females during the reproductive season. Gravid females, and females that have recently laid eggs are easily distinguished from non-reproducing females by external examination. During the egg-laying season (February to April inclusive), the ratio of reproducing to non-reproducing females was 1:1.6 (N = 13) in random sites suggesting that not all females reproduce in a given year. In contrast, the ratio of reproducing to non-reproducing females was much higher 6.14:1 (N = 100) in the sites chosen by hunters to find gravid females, presumably because only gravid females seek out these sites due to the favourable conditions for egg laying.

**Age at first reproduction.**

Published literature suggests that females can first reproduce in the farm at 3-4 years of age or 90cm snout-vent length (svl) (Daoues and Gerard, 1997). In Benin reptile farmers consider that females reproduce successfully in their second year of life (Jenkins 1997). In the present study egg laying was recorded in the farms from January to March and hatching from March to June, the smallest reproducing females measured 103 cm svl (two females attained this length, laying 5 and 7 eggs respectively), but the ages of these females could not be determined. Two marked, farmed hatching *Python regius*, grew from 40 and 42 cm svl to 90 and 92 cm svl respectively between 20 May 1999 and 5 June 2000, during their first 15? months of life Unmarked hatchlings from the same year measured an average of 93.38 cm svl (N = 8) by June, with the largest reaching 101 cm svl. Thus during the first 15 months of life the 10 measured animals reached 92.9 cm svl, only 10 cm short of the smallest egg-laying females recorded at Toganim (103 cm svl). The longest juvenile measured in June? Was 101 cm svl, only 2 cm shorter at one year of age/ 15 months than the smallest egg-laying females. With yearlings almost reaching
reproductive length it seems feasible that some individuals are able to lay eggs during their second year as reported in Benin and certainly by 3 years of age, as suggested by Daoues and Gerard (1997). However, as with all reptiles, age at first reproduction, clutch size and reproductive interval are all dependent on body condition, which is determined by feeding rate and health. The situation in the wild may be different from that in captivity, with animals receiving veterinary treatment, and perhaps a more ample food supply. None of the juveniles from the reptile farms marked before release into the wild were recaptured, so growth rates in the wild could not be estimated.

**Clutch Size**

For *Python regius* egg clutches found in the wild, both hatched and unhatched, the mean clutch size was 8.00 eggs (n = 6). Clutches counted at WHICH? one of the reptile farms, averaged 7.44 eggs per clutch (N = 150 clutches; excluding “slugs”, or obviously infertile eggs). Average clutch sizes reported by reptile farmers were as follow: 8.22 eggs per clutch at Toganim, 6.94 eggs per clutch at Pajar and 5.65 eggs per clutch at Mare. The mean of these three estimates is 6.94 eggs per clutch... The recorded clutch size ranged from 4 eggs (N = 5) to a maximum of 15 eggs. This compares with a range of 3 to 16 eggs per clutch recorded in Daoues and Gerard 1997. Clutch size and female svl were significantly related (R² = 0.182, F = 29.13, P<0.00005).

**Hatching Rate.**

Hatching success in the wild has not been recorded in Togo. Hatching success reported by the reptile farms, averages at 92.2%, indicating that egg incubation is efficient. In addition, the current study monitored 1233 *Python regius* eggs across three of the farms and found a 94.76 % hatching success rate, a further 3.24 % were fertile but failed to hatch and the remaining 2 % of eggs were infertile. However, obviously infertile eggs are rejected even before incubation commenced and to estimate this percentage, 150 clutches were examined pre-incubation in March 2000. Seven eggs out of 1116 eggs were rejected (0.63%), if this pre-incubation rejection percentage is included in the calculation this still gives a hatching success of 94.13%. Thus according to data presented here the hatching success rate for *Python regius* in captivity lies between 92.20% and 94.13%.

**Reproductive Effort**

For animals caught in the wild, weight measurements showed that the mean proportion of post-partum body weight for egg clutch was 52.35%. This means that before laying, the egg clutch formed 34.67% of the total weight of the gravid female, not taking into account egg expansion during the period since laying (2 weeks). Even with this variable, egg clutch is roughly 50% of post-laying female body mass, and about one-third of the weight of the gravid female. Such a large relative investment requires considerable acquisition of nutritional resources and suggests that female pythons may not be able to reproduce each year.

**Implications of Reproductive Data for CITES Management Authorities.**

Although an explanation of basis for calculating annual export quotas in general is not readily available, the formula proposed by Jenkins (1997) is thought to be used in the case of *Python regius*.

*Assessment of the Status of Seven Reptile Species in TOGO* 20
This formula is:

\[ Q = (y \times n) - t - c \]

Where:

\( Q \) = export quota for each farm,
\( n \) = total number of reproductive females,
\( y \) = mean clutch size,
\( t \) = egg infertility and embryonic mortality factor,
\( c \) = compensation factor (20%) to be returned to nature.

The national annual export quota is then derived by adding the quota for each of the four farms, and rounding up to the nearest 500. In Togo, a small amount is also added to account for the unlicensed farms who occasionally have orders to export small numbers of animals.

Mean clutch size \( (y) \), is crucial for calculation of the quota, but its value has until now not been accurately determined. In fact, one of Jenkins' (1997) recommendations was that all of the biological parameters in the formula above were "...in urgent need of validation" and that they be determined with scientific research. According to the Jenkins 1997 report, the Management Authorities of Benin use a conservative estimate of 6 eggs per clutch with a 5% infertility/mortality rate. Apparently, Togo uses the lower estimate of 5 eggs per clutch in order to take account of infertility, and pre-and post-hatching mortality. The data above suggest that 7 eggs per clutch be a more accurate and slightly conservative estimate of clutch size, and that a conservative infertility, and pre-and post-hatching mortality factor be 10%.

Using these values, each female produces on average 6.3 hatchlings. For the purposes of the formula used above, this compares with 5 in the case of Togo and 5.7 for Benin.

3.4 Density Estimates

Locations of Focal species within Togo.

Information on the distribution of the focal species in Togo is sparse. Anecdotal information upon the habitat requirements of each species and information from interviews with reptile farmers, on distribution of hunting effort and known inhabited sites was collected throughout the project (see Table and Annex for Gazeteer).
<table>
<thead>
<tr>
<th>Records provided by Dr. Bowell from his thesis and from other research.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Species</strong></td>
</tr>
<tr>
<td>----------------------------------</td>
</tr>
<tr>
<td>Adenium</td>
</tr>
<tr>
<td>Koelreuteria</td>
</tr>
<tr>
<td>Nycteris</td>
</tr>
<tr>
<td>Rhoiptera</td>
</tr>
<tr>
<td>Schiewe</td>
</tr>
<tr>
<td>Teryxella</td>
</tr>
</tbody>
</table>

Table 3. Information on approximate locations of species distribution collected from sources within Togo during the project.
Population Density of focal species

Table 3.6 Repeat survey history for *Python regius* sites.

<table>
<thead>
<tr>
<th>Quadrat</th>
<th>SITE</th>
<th>Number of pythons encountered per sampling episode</th>
<th>N visits</th>
<th>Total snakes</th>
<th>Mean Snakes/visit</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Tsevie 51</td>
<td>5 10 6 4 6 4 5 0 0 9</td>
<td>9</td>
<td>40</td>
<td>4.44</td>
</tr>
<tr>
<td>X</td>
<td>NR 1</td>
<td>3 1 5 5 3 0 0 0 1</td>
<td>8</td>
<td>18</td>
<td>2.25</td>
</tr>
<tr>
<td>X</td>
<td>NR2</td>
<td>9 6 3 0 0 0 0 0</td>
<td>7</td>
<td>18</td>
<td>2.57</td>
</tr>
<tr>
<td>X</td>
<td>Vokpevidji</td>
<td>1 0 3 6 3 2 2</td>
<td>7</td>
<td>17</td>
<td>2.43</td>
</tr>
<tr>
<td>X</td>
<td>Kpotave</td>
<td>0 0 0 0 0 0 0</td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>X</td>
<td>Tokpli</td>
<td>1 3 0 1 2 1 0 0</td>
<td>8</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>X</td>
<td>Esse Nadje</td>
<td>0 1 0 0 1 0 0</td>
<td>7</td>
<td>2</td>
<td>0.29</td>
</tr>
<tr>
<td>X</td>
<td>Wli</td>
<td>0 1 0 0 0 2 0</td>
<td>7</td>
<td>3</td>
<td>0.43</td>
</tr>
<tr>
<td>X</td>
<td>Adangbe</td>
<td>2 1 0 0 0 1 0 1</td>
<td>8</td>
<td>5</td>
<td>0.63</td>
</tr>
<tr>
<td></td>
<td>Bomb m</td>
<td>0</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>Bombuaka</td>
<td>1 2 2 0</td>
<td>4</td>
<td>5</td>
<td>1.25</td>
</tr>
<tr>
<td>X</td>
<td>Naki est</td>
<td>1</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>X</td>
<td>Cinkasse</td>
<td>2 1 1</td>
<td>3</td>
<td>4</td>
<td>1.33</td>
</tr>
<tr>
<td>X</td>
<td>Yembour</td>
<td>2</td>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Abobo</td>
<td>2</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>Yokele</td>
<td>0 1 0</td>
<td>3</td>
<td>1</td>
<td>0.33</td>
</tr>
<tr>
<td>X</td>
<td>Assahoun</td>
<td>2 0 0</td>
<td>3</td>
<td>2</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td>Agbakope</td>
<td>8</td>
<td></td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kpevego</td>
<td>0</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lonvo</td>
<td>0</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kouve</td>
<td>4 3 7</td>
<td>3</td>
<td>14</td>
<td>4.67</td>
</tr>
<tr>
<td></td>
<td>Kovie</td>
<td>3</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lilikope</td>
<td>2</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fongbe</td>
<td>5</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gape</td>
<td>4 3</td>
<td></td>
<td>7</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>Agbelouve</td>
<td>2</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tsevie</td>
<td>8</td>
<td></td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Davie</td>
<td>15</td>
<td></td>
<td>15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N tsevie</td>
<td>12</td>
<td></td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Have</td>
<td>14</td>
<td></td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S tsevie</td>
<td>8</td>
<td></td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Douve</td>
<td>11</td>
<td></td>
<td>11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Koveto</td>
<td>14</td>
<td></td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vodje</td>
<td>8</td>
<td></td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Animabio</td>
<td>6</td>
<td></td>
<td>6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dalave</td>
<td>6</td>
<td></td>
<td>6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aveve</td>
<td>1 2 0</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

Assessment of the Status of Seven Reptile Species in TOGO 23
Main Harvest areas.

Names of main harvest areas are given in Table below, the longitude and latitude of these sites are available in the Annexes to the report. These do not indicate exhaustively the location of all harvest areas, nor do they represent an indication of the geographic range of the species. Rather, they represent general locations, usually the name of a village, where hunting mainly takes place.

Table 3.7 Main harvest areas for reptile species in Togo

<table>
<thead>
<tr>
<th></th>
<th>TOGANIM</th>
<th>PAJAR</th>
<th>MARE</th>
<th>FEXAS</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>P. regius</em></td>
<td>Tsévié, Davié, Gapié, Assahoun, Vogan, Gboto</td>
<td>Gapié, Vogan, Kouvé</td>
<td>Vokpeyidji</td>
<td>Gapé, Kolo, Lonvo, Adangbé</td>
</tr>
<tr>
<td><em>P. sebae</em></td>
<td>Lac Togo region, Vogan, Bas-Mono region</td>
<td>Hahotoé, Sévagan, Kovié</td>
<td></td>
<td>Kané</td>
</tr>
<tr>
<td><em>K. belliana</em></td>
<td>Tsévié, Kouvé</td>
<td>Kloto, Badou</td>
<td>Vokpeyidji, Kolo</td>
<td>Kati, Kolo</td>
</tr>
<tr>
<td><em>K. erosa</em></td>
<td>Kpalimé, Badou</td>
<td>Badou</td>
<td>Badou</td>
<td>Badou</td>
</tr>
<tr>
<td><em>K. homeana</em></td>
<td>Kpalimé, Badou</td>
<td>Badou</td>
<td>Badou</td>
<td>Kati</td>
</tr>
<tr>
<td><em>C. senegalensis</em></td>
<td>Anié, Atakpamé, Glei, Wahala, Notsé, Abégoulouvé</td>
<td>Lébé, Abégoulouvé</td>
<td>Kolo</td>
<td>Lilikope, Wahala</td>
</tr>
<tr>
<td><em>C. gracilis</em></td>
<td>Anié, Atakpamé, Glei, Wahala, Notsé, Abégoulouvé</td>
<td>Abégoulouvé</td>
<td>Bassar</td>
<td>Notsé, Kpalimé</td>
</tr>
<tr>
<td><em>G. sulcata</em></td>
<td>“North Togo”</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In general, *Python regius* are taken form the villages around the town of Tsévié, west to Assahoun and east to Tabligbo and Vogan. *Kinixys belliana* tend to be taken from roughly the same areas, with concentrations around Ahépé, whereas *K. erosa* and *K. homeana* tend to be taken almost exclusively from forest remnants around Kpalimé and Badou. Chamaeleon species are taken from a range of sites along the Route Nationale No. 1 which runs along the spine of the country, with hunting concentrated between Tsévié and Atakpamé along this road. *Python sebae* are taken mostly from areas around Lac Togo, plus near the larger rivers in the south (Sio, Haho and Mono).

This distribution of hunting effort does not necessarily represent the limits of distribution or areas of highest density for these species. Other factors to be taken into consideration include the accessibility of hunting areas, distance from the purchaser (i.e. the reptile farms in Lomé), presence of public transport, acceptance of collection by local people, prior knowledge of the existence of high populations of the target species, and the division of hunting zones among the hunters themselves. The four main reptile traders appear to have different source areas for most of their animals, which may help to spread out the impacts of harvesting. The only exception being for the two Kinixys species which have a localised distribution within Togo, namely *K. erosa* and *K. homeana*.

**Python regius** Densities

To investigate the effect of habitat type and reptile hunting on *Python regius* densities, data from the most regularly sampled areas in the south of the country were compared. The areas were
divided into those dominated by agricultural, and those dominated by palm and tree or bush savannah vegetation. Within each of the two predominant vegetation types, two sites were in reptile hunting areas and two outside hunting areas. The seasonal timing of sampling was the same for all sites included in this analysis. The mean density of the four sites is shown in Table 3.8. Sites were sampled during the same seasons Although sample sizes were relatively small and non-parametric statistics were used to account for the high proportion of zero values, a Kruskall Wallis ANOVA showed a significant difference in density of snakes encountered per hectare at the four sites. (see Table 3.8). Pair-wise comparisons were undertaken using the parametric Mann-Whitney U test. The densities of python found per hectare in non-hunted areas was significantly greater in the agricultural than in the bush areas (see Table 3.8). In contrast in the hunted areas, python densities were generally higher in the bush areas. However python densities were not significantly different between hunted and non-hunted bush areas. In the agricultural areas, the hunted areas had a significantly lower density of pythons than the non-hunted areas.

Studies of Python reticulatus in Indonesia, have found that the species is more common in human altered landscapes and this appears to be the case with Python regius. Alternatively, this apparent difference in density may be due to a sample bias, because it is easier to find python burrows in agricultural lands.

Table 3.8 Comparison of mean P. regius density (snakes/ hectare) in areas predominated by agriculture and bush vegetation respectively and hunted and non-hunted areas and results of statistical tests of the difference in density

<table>
<thead>
<tr>
<th>Area</th>
<th>Mean +</th>
<th>n</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bush non-hunted</td>
<td>0.451 + 0.159</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>Bush hunted</td>
<td>0.935 + 0.28</td>
<td>21</td>
<td>0.54</td>
</tr>
<tr>
<td>Agriculture non-hunted</td>
<td>1.665 +0.427</td>
<td>16</td>
<td>1.03</td>
</tr>
<tr>
<td>Agriculture hunted</td>
<td>0.306 + 0.116</td>
<td>14</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Areas</th>
<th>Statistic</th>
<th>DF/ n</th>
<th>Probability</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>Kruskal-Wallis</td>
<td>H= 9.797</td>
<td>(15,16,19)</td>
<td>P=0.0204</td>
</tr>
<tr>
<td>Agriculture hunted vs non-hunted</td>
<td>Mann-Whitney U</td>
<td>Z= -2.522</td>
<td>15,13</td>
<td>P=0.0117</td>
</tr>
<tr>
<td>Bush hunted vs non hunted</td>
<td>Mann-Whitney U</td>
<td>Z= -1.416</td>
<td>16,19</td>
<td>P=0.1569</td>
</tr>
<tr>
<td>Agriculture vs Bush hunted</td>
<td>Mann-Whitney U</td>
<td>Z= -2.006</td>
<td>13,19</td>
<td>P=0.0449</td>
</tr>
<tr>
<td>Agriculture vs Bush non-hunted</td>
<td>Mann-Whitney U</td>
<td>Z = -2.384</td>
<td>15,16</td>
<td>P=0.0171</td>
</tr>
</tbody>
</table>

*Kinixys belliana* Densities

Although 78 of the density samples were undertaken in habitat suitable for *Kinixys belliana*, specimens were only found on 18 of these sampling occasions and of these only three in non-
hunted habitats, consequently it was not possible to undertake any meaningful statistical comparisons of density in hunted vs nonhunted areas.

**Chameleon Densities**

Surveying took place on a total of 26 nights in July 1999, October and November 1999 and July 2000. A total of 35.295 Km were searched (equivalent one-sided transect length). Usually a different site was searched each night, though two sites, Tsevie 51 and NR2, were surveyed twice each. Of the two methodologies employed (formal rope transect and path transect) the formal rope transects were carried out on 12 nights, and the path transects on 19 nights. Thus on 5 of the nights, both methods were employed. Only one (8.3%) of the rope transects (at site NR2) yielded any chameleon observations, as opposed to 13 (68.4%) of the path transects, showing that the path transects were roughly 60 % more successful at detecting chameleons. Some of this bias may be due to the fact that path transects were generally at sites to which the chameleon hunters had brought the research team because they were known populated areas, whereas the formal rope transect sites were generally placed at random, and so less likely to fall in an inhabited zone. However, at 5 sites path transects were carried out adjacent to formal rope transects, and though two of these paths revealed chameleons, none of the rope transects did.

Of the 26 survey episodes, 14 were at non-hunted sites and 12 were at hunted sites. Of the non-hunted sites, ten produced a negative result and the remaining four revealed a total of 35 chameleons, whereas all of the hunted sites produced a positive result, revealing 133 chameleons. This result should again be treated cautiously, since the non-hunted sites were largely placed at random, (i.e. none of the randomly placed site fell in a zone that was hunted for chameleons), whereas the hunted sites, as described above, were known chameleon sites.

<table>
<thead>
<tr>
<th>Test</th>
<th>No. Transects</th>
<th>No. Obs.</th>
<th>Density (per Ha)</th>
<th>Lwr Conf. int</th>
<th>Upper Conf. int</th>
<th>Coefficient of variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Cs</td>
<td>14</td>
<td>146</td>
<td>4.049</td>
<td>1.819</td>
<td>9.012</td>
<td>0.386</td>
</tr>
<tr>
<td>All Cg</td>
<td>4</td>
<td>18</td>
<td>1.302</td>
<td>0.716</td>
<td>2.364</td>
<td>0.218</td>
</tr>
<tr>
<td>Hunted Cs</td>
<td>10</td>
<td>109</td>
<td>3.377</td>
<td>1.091</td>
<td>10.446</td>
<td>0.532</td>
</tr>
<tr>
<td>Non-hunted Cs</td>
<td>4</td>
<td>37</td>
<td>20.32</td>
<td>6.564</td>
<td>61.131</td>
<td>0.419</td>
</tr>
</tbody>
</table>

These estimates were calculated using DISTANCE software, with hazard-rate key function and hermite polynomial series expansion for the detection function model.

**C. senegalensis.**

The estimated mean perch height was 215.80 cm (+/- 93.35, n = 144) and the mean perpendicular distance form the observer was 567.14 cm (+/- 358.31, n = 146). The snout-vent length (SVL) is marginally smaller than the body; the ratio of body length to tail length in those specimens for which the tail was not obviously damaged (two specimens were excluded) was 0.989 (+/- 1.874, n = 144).
The size class distribution shows two main peaks, one represented by juvenile specimens found in October and November and another, much smaller, by adults in July. These sampling sessions took place at different sites and are so not directly comparable, however all sampling sites were in the same region and in the same broad vegetation type.

The difference in size between these two peaks could indicate survivorship from the juvenile to the adult generation, and suggests that young take one year to reach mature adult size. Though no direct data are available (no mating was observed, nor were gravid females found), we can assume from the above that adulthood is reached at 100mm SVL. Assuming that animals over 100mm SVL are adult, males outnumber females by more than 2 to 1 (M/F = 2.2). It could be that this is because females are generally smaller, and so relatively more of them are included in the below 100mm SVL ‘juvenile’ category. However, females above 100mm SVL are on average larger than the males, with mean female SVL = 130.7 +/- 8.56 mm (N = 10), whereas
mean males’ SVL = 117.0 +/- 11.09 mm (N = 22). If this is a true reflection of adult sizes, it corresponds with the situation often found among reptiles, with females showing increased reproductive capacity due to increased size. The peak for adults above this size is 28 % smaller than that for juveniles (below 100mm SVL), and though these peaks are not directly comparable because they are from different sites, this nonetheless indicates the scale of survivorship from the juvenile to adult stage. However, for October and November, adults make up only 4.67 % of the animals caught. There could be several explanations for this. Among them are that for some reason the sampling technique involved preferentially detected young specimens, though this is doubtful as adults are more visible. Alternatively, juveniles may roost in more exposed sites than adults and so be more visible. This is possible, as many of the animals found were perched high on grass stems. Intuitively, lighter animals should be able to perch higher up on grass stems as heavy animals would risk causing the stems to bend over and break. If this were indeed the case, then lighter animals such as juveniles would be able to perch higher up and so become more detectable, biasing their influence of the size-class distribution above. When a regression of Perch height on SVL is plotted, the result is significant (R^2 = 0.068, P = 0.0015), showing that perch height decreases as SVL increases. (See Figure below)

![Plot of SVL versus perch height in C senegalensis](image)

Finally, it is possible that adults do make up less than 5 % of the population in October/November. Chameleons produce large clutches (see species descriptions) and tend to be relatively short-lived, so which could account for the high ratio of juveniles to adults.

Juveniles are present in July for both years, suggesting that hatching starts before this month, though no females were obviously gravid in any of the July October or November sessions, suggesting that egg laying occurs between December and June. This seems logical, as this period coincides with the main rainy season, during which other reptiles are noted to lay their eggs in Togo.
Chamaeleo gracilis.

Owing to the scarcity of data, few analyses are available for this species. It was searched for at all of the same sites as C senegalensis, but only found at four of them. These were sites to which reptile hunters had specifically brought us to find this species, indicating that the species is relatively restricted in its distribution.

No juveniles were found, and only one male was caught out of 18 animals, precluding detection of sexual dimorphism with respect to size or perch height.

The mean of the perch height estimates was 578.33 cm (+/- 387.97, n = 18) and the mean perpendicular distance form the observer was 711.28 cm (+/- 187.95, n = 18). For the 17 specimens which were measured, the mean body (snout-vent) length was 126 cm (+/- 14.18), with the total length (snout-tip of tail) at 235.53 cm (+/- 38.50). The tail is marginally shorter than the body; the ratio of body length to tail length in those specimens for which the tail was not obviously damaged (two specimens were excluded) was 1.02 (+/- 0.078, n = 15).

None of the females were obviously gravid, suggesting that they do not lay around or soon after the end of November.

Size class distribution for C. gracilis

Size at adulthood is difficult to determine, given that no specimens were found mating, nor were gravid females found. It is probably safe to assume that all of the specimens found were adult, which raises the question as to why no non-adults were found.
Comparison of *C. senegalensis* with *C. gracilis*.

*C. senegalensis* is more common than *C. gracilis*, occurring at a wider range of sites and at a higher density overall.

Mean perch heights and distances from the observer show that *C. senegalensis* are found much closer to the ground, and much closer to the observer, in this case the path or road which formed the transect. This reflects the field observation that *C. gracilis* are generally found in trees whereas senegalensis are found in tall grasses, and that *C. senegalensis* appear to be found close to habitat edges, such as the tall grasses that occur along the sides of roads, whereas *C. gracilis* show no discernible pattern.

*Senegalensis* and *gracilis* are not always easy to tell apart, especially for juveniles or young female specimens. All *C. gracilis* have bright yellow/orange skin in between the scale rows on the throat plus black pigment on the inside of the mouth. Inflating their brightly coloured throat and opening the mouth to expose the contrasting black colour inside forms part of their threat display. *C. senegalensis* do not have these characteristics, and also have many more (and therefore, smaller) spines forming the dorsal crest. Adult males show exaggerated secondary sexual characteristics such as increased head size and increased nuchal and dorsal crest heights, and so are very distinctive. However, these techniques for distinguishing between the two species are subjective and it was hoped therefore to derive a morphometric method of distinguishing between the two species such as different body to tail length ratio. However, as SVL/tail length ratio is so similar in the two species (1.02 (+/− 0.078, n = 15), for *C. gracilis* and 0.989 (+/− 1.874, n = 144) for *C. senegalensis*), this cannot be used as a quick and easy method of distinguishing between species.

As so few chameleons were found at randomly placed sites, and that the vast majority of chameleons were found at sites that the hunters knew of, it seems that these animals’ distributions are patchy, and restricted to sub-habitat types that are found throughout the country. In casual observations and ad hoc interviews with local people, chameleons were present in all of the areas studied, including as far north as Dapaong in Sahelian habitat.