Herpetological survey of the Haute Dodo and Cavally forests, western Ivory Coast, Part II: Trapping results and reptiles

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Zusammenfassung

Herpetologische Untersuchungen in den Haute Dodo und Cavally Wäldern, westliche Elfenbeinküste, Teil II: Fallenfänge und Reptilien.

Wir untersuchten die Herpetofauna zweier Wälder in der westlichen Elfenbeinküste, namentlich den Haute Dodo und den Cavally Wald. Insgesamt wiesen wir 24 Reptilienarten nach: acht Echsen-, 13 Schlangen-, zwei Krokodil- und eine Schildkrötenart. Wir errechneten aufgrund des Sammelaufwandes und -erfolgs, dass der Artenreichtum der Region nur teilweise, höchstens zu 61,5 %, erfasst wurde. Einfache, selbstgebaute Trichterfallen entlang von Fangzäunen waren signifikant effektiver im Fang von Amphibien und Reptilien, als an gleicher Stelle installierte Eimerfallen. Die Fangraten waren stark negativ mit dem Abstand zum letzten Regen korreliert. Grosse Schlangen (> 500 mm Gesamtlänge) wurden nur von Hand oder mit Trichterfallen gefangen.

Viele der nachgewiesenen Reptilienarten sind in Westafrika weit verbreitet. Allerdings konnten wir auch einige für den oberguineischen Waldblock endemische Arten nachweisen: zum Beispiel *Cophoscincopus durus, Mabuya polytropis paucisquamis* und *Polemon acanthias.* Bemerkenswerte Reptilienfunde beinhalten den dritten Nachweis von *Cophoscincopus durus* für die Elfenbeinküste, und den zweiten Nachweis für die Elfenbeinküste sowie das insgesamt dritte und vierte bekannte Exemplar des Skinks *Mabuya polytropis paucisquamis*. Bei *Typhlops liberiensis, Polemon acanthias* und *Hapsidrophys lineatus* fingen wir die größten bekannten Exemplare.

Die für die kurze Erfassungsperiode relativ hohe Anzahl an Reptilienarten belegt das hohe Potential der beiden Wälder für den Erhalt der regionalen Artenvielfalt. Allerdings sind beide Wälder durch nicht nachhaltige forstliche Nutzung stark gestört. Dies zeigt sich auch in den Nachweisen verschiedener, normalerweise nicht in geschlossenen Regenwäldern anzutreffender Arten (z.B. *Agama agama* und *Mabuya affinis*).

Schlagwörter: Reptilia, Amphibia; faunistische Erfassung; Fallenmethoden; Biologie; Westafrika, Elfenbeinküste, Cavally Wald, Haute Dodo Wald.

Abstract

The herpetofauna of two forests in western Ivory Coast, namely the Haute Dodo and Cavally forests, were investigated. In total 24 reptile species were recorded, including eight lizards, 13 snakes, two crocodilians, and a chelonian. The recorded diversity probably underestimates that for the region, and it was calculated that the presence of no more than 61.5 % of the reptile fauna in the region was confirmed. The use of simple hand-made funnel traps in conjunction with drift fences were significantly more successful in capturing reptiles and amphibians than pitfall traps. Capture rates were strongly negatively correlated with the interval since rainfall. Large snakes (> 500 mm total length) were only collected by hand or in funnel traps.

Many of the recorded species are widespread in West Africa, although some are endemic to the Upper Guinea forest block, e.g. *Cophoscincopus durus, Mabuya polytropis paucisquamis*, and *Polemon acanthias.* Notable reptile discoveries included: the third record for Ivory Coast of *Cophoscincopus durus* and the second record for Ivory Coast and third and fourth known specimens of the skink *Mabuya polytropis paucisquamis*. The largest documented specimens of *Typhlops liberiensis, Polemon acanthias* and *Hapsidrophys lineatus* were also recorded.

The relatively high reptile diversity documented in both forests during the survey clearly demonstrated that they still retain high conservation potential. However, both forests already suffered considerably by non-sustainable forest management. This already resulted in the presence

of populations of several species not normally found in closed canopy rain forests (e.g. *Agama agama* and *Mabuya affinis*).

Key Words: Reptilia, Amphibia; species survey; trapping methods; biology; West Africa, Ivory Coast, Cavally forest, Haute Dodo forest.

1 Introduction

About 80 % of the Upper Guinea forests in Ivory Coast have been destroyed during the last 20 years (ROMPAY 1993, PARREN & DEGRAAF 1995, CHATELAIN et al. 1996) and there is increasing awareness that the relatively small pockets of forest habitats currently conserved may be unable to maintain the long-term viability of the fauna and flora (LAURANCE & LAURANCE 1999, GASCON et al. 1999, DELIMA & GASCON 1999). Following a Conservation Priority Setting Workshop in Ghana (BAKARR et al. 2001a) two poorly-known forests of western Ivory Coast were selected by Conservation International (Washington D.C.) for surveys under their Rapid Assessment Program. It was hoped that the two forest reserves would serve as viable corridors to allow the movement of species between the Taï National Park in western Ivory Coast and adjacent forest reserves in Liberia. The Forêt Classé de Haute Dodo (HD) is situated south of Taï National Park (TNP) whilst the Forêt Classé de Cavally (CA) lies northwest of this largest protected forest area in West Africa. Field work was conducted in HD from March 15-22, in CA from March 23-30. Geographic position and habitat characterization for the localities investigated are summarized in the first paper in this series, which also documented the rich amphibian fauna revealed during the herpetofaunal survey (RÖDEL & BRANCH 2002). This second part of the series discusses the overall trapping success and gives details of the reptile fauna.

2 Methods

2.1 Sampling methods and sampling effort

Specimens were mainly located opportunistically, during visual surveys of all habitats by up to four people. Surveys were undertaken during the day and during the evening. Search techniques included visual scanning of terrain and refuge examination (e.g. lifting rocks and logs, peeling away bark, scraping through leaf litter).

To supplement opportunistic collecting, habitats were also sampled using arrays of funnel and pitfall traps placed along drift fences. Trap lines were set in different microhabitat types. Drift fences consisted of lengths of plastic shade cloth or black plastic sheeting 0.5 m high and stapled vertically onto wooden stakes. An apron left at the base was covered with soil and leaf litter to direct specimens intercepted during their normal movements along the fence towards the traps.

Pitfall traps comprised plastic water buckets (275 mm deep, 285 mm top internal diameter, 220 mm bottom internal diameter) sunk with their rims flush to the ground level and positioned so that the drift fences ran centrally across the mouth of each trap. One pitfall trap was set at each end of a drift fence with the remaining traps spaced between at regular intervals. Holes in the base of the buckets allowed drainage.

Cylindrical funnel traps were made from fine steel wire mosquito mesh, shaped by hand and with stapled seams. Measurements were roughly 60 × 25 cm, with funnel entrances narrowing to approximately 30 mm diameter. Traps had funnel openings at one or both ends. The flexible mosquito mesh allowed the funnel entrance to be distorted to a quarter round profile so that the sides fitted flush with the ground and with the drift fence wall. Traps were covered with light vegetation to hide them and

to provide cover for captured specimens. They were checked every morning and during the day if a survey team was working in the region. Captive specimens were removed by simply opening a stapled seam, after which it was re-stapled shut. Specimens not retained as voucher specimens were released in the vicinity of capture, but 10 m from the trap line. The lengths and orientation of trap arrays were tailored to local conditions, and were set for variable periods (see below). A trap-day is defined as one trap in use for a 24-hour period.

Some voucher specimens were collected, anesthetized and killed in a chlorbutanol solution and thereafter preserved in 70 % ethanol. Reptile vouchers were deposited in the collections of the Port Elizabeth Museum (PEM), South Africa. Tissue samples (liver) of all species were preserved in 95 % ethanol and are stored in PEM. A list of all recorded species with remarks on African distribution and habitat selection is provided in the Appendix. A detailed description of both reserves and a characterization of all habitats investigated is given in the first part of this series (abbreviations: HD = Haute Dodo, CA = Cavally, numbers refer to site characterization in RÖDEL & BRANCH 2002).

Species / Art	Number / Anzahl
Silurana tropicalis	15
Phrynobatrachus liberiensis	11
Phrynobatrachus alleni	10
Arthroleptis spp.	8
Phrynobatrachus plicatus	7
Bufo togoensis	4
Phrynobatrachus villiersi	4
Bufo maculatus	3
Leptopelis hyloides	2
Cardioglossa leucomystax	1
Ptychadena longirostris	1
Ptychadena bibroni	1
Phrynobatrachus guineensis	1
Amnirana albolabris	1
Geotrypetes seraphini	1
Total	**70**

Tab. 1. Amphibians caught in trap arrays at Haute Dodo and Cavally. *Arthroleptis* could only be determined to species level while calling (two species involved, compare RÖDEL & BRANCH 2002).

In den Fallenanlagen des Haute Dodo und Cavally gefangene Amphibienarten. Nicht rufende *Arthroleptis* konnten nicht auf Artebene bestimmt werden (zwei Arten, vergleiche RÖDEL & BRANCH 2002).

2.2 Trap sites

Haute Dodo: Two trap arrays were set for six days each beside a small forest stream 0.5 km from camp (see localities in RÖDEL & BRANCH 2002). HD1 comprised a V-shaped array with 10 m arms set in low-lying, closed-canopy forest alongside the stream. Three

pitfall traps were set at the end of the arms (sharing a middle bucket), with two funnel traps on each side of each arm. After heavy rain the central pitfall trap was inundated due to the poor drainage and proximity to the local water table. Total trap days: 18 pitfall, 48 funnel. HD2 comprised a T-shape array with 10 m arms; arm 1 was set in secondary undergrowth running parallel to, and 3 m from the stream; arm 2 ran through secondary undergrowth up a slope running away from the stream; arm 3 also ran parallel to the stream, but beneath closed canopy small trees. Five pitfall traps were set at the end of the arms, with two each side of the junction of the arms; three funnel traps were placed along each arm, with two on one side and one on the other. Total trap days: 30 pitfall, 54 funnel. HD3 was single line drift fence (150 m) with pitfall traps (17) spaced equally only the fence. Total trap days: 85 pitfall.

Cavally: Two trap arrays were set. CA1 was set for four days 0.5 km from camp beside a small river in secondary undergrowth. It comprised a single line array (20 m) with four funnel traps set along each side. Total trap days: 32 funnel. A larger array (CA2) was set for three days 5 km from camp in dry, closed canopy forest. It comprised a single line array (150 m) with 20 pitfall traps set at approximately 7 m apart, with 17 funnel traps set approximately 20 m apart on each side. Total trap days: 60 pitfall, 51 funnel.

Species / Art	Number / Anzahl
Cophoscincopus durus	11
Mabuya affinis	7
Mabuya polytropis paucisquamis	2
Polemon acanthias	1
Hapsidrophys lineatus	1
Boiga pulverulenta	1
Total	**23**

Tab. 2. Reptiles caught in trap arrays at Haute Dodo and Cavally.
In den Fallenanlagen von Haute Dodo und Cavally gefangene Reptilienarten.

3 Results

3.1 Trapping

Trapping success was variable, depending upon both climatic factors and the relative efficacy of pit-fall and funnel traps. A total of 70 amphibians (Tab. 1) and 23 reptiles (Tab. 2) were collected in the traps. With few exceptions most species captured in the trap arrays were of terrestrial habits. However, one arboreal snake (*Boiga pulverulenta*) and an amplectant pair of arboreal frogs (*Leptopelis hyloides*) were also collected in funnel traps. Due to their location beside a forest stream the main trap arrays at HD collected large series of the aquatic *Silurana tropicalis* or semi-aquatic species (*Cophoscincopus durus*), all of which were collected on nights immediately following heavy rain.

The efficacy (specimens caught per trap day) of funnel traps in catching reptiles or amphibians (87 specimens in 185 trap days; 0.47 specimens per trap days) far surpassed that of pitfall traps (6 specimens in 193 trap days; 0.03 specimens per trap days). This was true for both sites (funnel traps, HD: 0.53, CA: 0.36; pitfall traps, HD: 0.04, CA: 0.02) as well as for arrays that comprised only pitfall traps (HD3), mixed arrays, or arrays comprising only funnel traps (CA1). There was also a strong negative correlation between the number of amphibians and reptiles caught in funnel traps and the period since rainfall (Spearman Rank correlation, $r_s = -1.00$, $p < 0.001$; not tested for pitfall traps due to small sample size). More specimens were caught on the first night following heavy rain than on all other nights put together (Fig. 1). Large snakes (> 500 mm TL) were only collected by hand or in funnel traps.

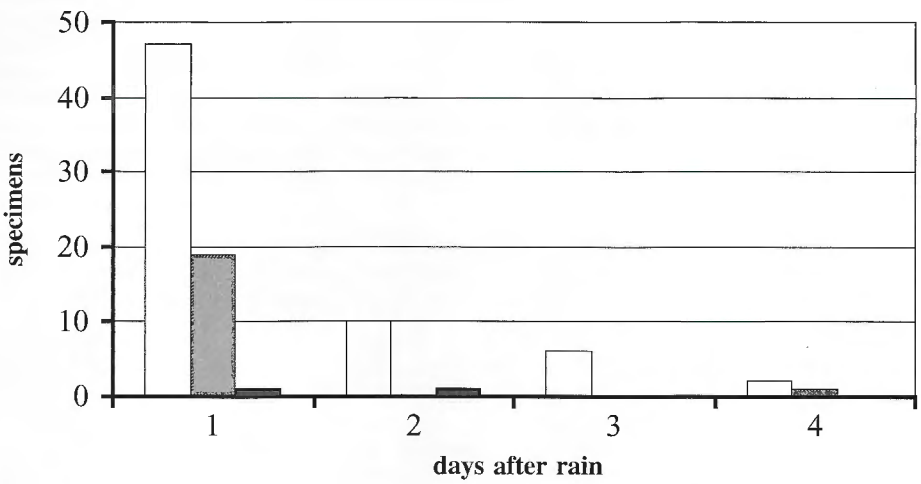

Fig. 1. Effect of rainfall on trap success (only funnel traps, 185 trap days). White bars: frogs; grey bars: skinks; black bars: snakes.

Einfluss von Regenfällen auf den Fangerfolg (nur Trichterfallenfänge berücksichtigt, 185 Fallentage). Weiße Balken: Frösche; graue Balken: Skinke; schwarze Balken: Schlangen.

In total 58 man-hours were spent searching in CA and 73 man-hours in HD. The latter site had greater habitat diversity and search time was approximately the same for different habitat types at the two sites. Species accumulation curves show how many new reptile species were added each day (Fig. 2). Because we had no real quantitative data available, we used the Jack-knife 1 estimator, based on presence/absence data for all habitats (program: BiodivPro from the Natural History Museum London). Due to the relatively low numbers of reptiles collected (24 species) the data

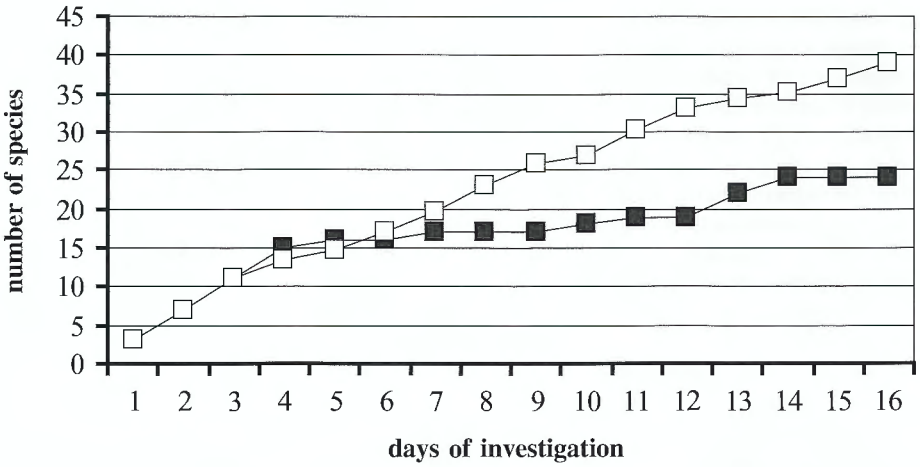

Fig. 2. Daily species accumulation curve (black squares) and estimated species richness (white squares; Jack-knife 1 estimator) for reptiles from Haute Dodo and Cavally forests.

Artenakkumulationskurve (schwarze Quadrate) und geschätzter Artenreichtum (weiße Quadrate, Jack-knife 1 Schätzstatistik) der im Haute Dodo und Cavally Wald gefangenen Reptilien.

for both forest reserves was pooled. It was assumed that sampling effort was the same for each habitat. On this basis it was calculated that approximately 39 reptile species lived in the forest reserves (Fig. 2). The 24 recorded species therefore represent only 61.5 % of the calculated fauna. However, the slope of this curve is still very steep and do not enter a plateau phase, thus indicating much higher species numbers. It is therefore evident that even the calculated reptile diversity underestimates the true reptile species richness in the region.

3.2 Species accounts

Below we give a short description of habitats and biology for the reptile species recorded by us. Species names are followed by a list of localities from which they were recorded (see RÖDEL & BRANCH 2002) and collection numbers of voucher specimens deposited in the Port Elisabeth Museum (PEM). HD numbers refer to localities in Haute Dodo forest, CA numbers to those in Cavally forest. When necessary, taxonomic comments are given under 'remarks'.

Chamaeleo gracilis HALLOWELL, 1842.

Localities: HD22, CA1. Voucher specimen: PEM R2304, an adult collected in degraded forest near the border of Haute Dodo. A further specimen was observed in vegetation along a seepage area with open canopy in Cavally. It is widespread in West Africa in farmbush and forested savanna (e.g. DUNGER 1967, BARBAULT 1975b, CISSÉ & KARNS 1978, RÖDEL et al. 1997).

Agama agama (LINNÉ, 1758).

Localites: HDCamp, CACamp, CA2, CA15, CA16. Voucher specimen: PEM R2302, a subadult collected running on discarded logs around the Haute Dodo camp.

Others were seen in forest clearings in both Haute Dodo and Cavally, although the species was much more common at the former. Five eggs with half-developed embryos were found in an earth embankment bordering a forest clearing at Cavally.

Hemidactylus fasciatus GRAY, 1842.

Localites: CA5-CA6. Voucher specimen: PEM R5298, a large female banded gecko with a partially regenerated tail (70 + 55 mm) was collected sheltering under loose bark on a tree trunk 1.2 m above the ground at Cavally. It was non-gravid. The stomach contained a large grasshopper. *H. fasciatus* is a forest dweller that might range into the savanna region by making use of gallery forests (e.g. BOOTH 1956, DUNGER, 1968, BARBAULT 1975a, RÖDEL et al. 1997).

Hemidactylus muriceus BOCAGE, 1873.

Localities: HD7, HD23, CA8-CA11. Voucher specimens: PEM R2305, 2306, 2309; three females (SVL 48-50 mm) were collected at Haute Dodo and Cavally; two active, gravid females were found at low heights, one during the day (10:00) on low vegetation (< 20 cm above ground) on a forest trail and another on the forest floor at night. A non-gravid female was active at night 1.5 m above ground in foliage. In contrast to the nocturnal and arboreal *H. fasciatus*, *H. muriceus* is partial diurnal and forage in fine foliage. Taxonomic confusion concerning the *H. muriceus-longicephalus-echinus* complex is unresolved.

Mabuya affinis (GRAY, 1838).

Localities: HDCamp, HD5, HD8, HD10, HD14, CACamp, CA1, CA2, CA5-CA6, CA9. Voucher specimens: PEM R1476-77, 5300. The commonest lizard at both sites, and numerous specimens were observed during the day on fallen trees and on the ground along old logging roads. Others were caught in funnel traps in secondary undergrowth beside streams. BARBAULT (1974), RÖDEL et al. (1997), GRAMENTZ (2000) and AKANI & LUISELLI (2001) have noted similar habits from other parts in West Africa.

Mabuya polytropis paucisquamis HOOGMOED, 1978.

Localites: CA13-CA14. Voucher specimens: PEM R4436, 4438; two adults collected in a trap array in dry, closed-canopy forest at Cavally. These are the second records for Ivory Coast (compare SCHNEIDER 1983), and only the fourth known records for the taxon (Fig. 3). An additional specimen (PEM R5462) is known from Taï National Park. The taxonomic status of this Upper Guinea endemic (HOOGMOED 1974, 1978), which may deserve specific status, is under further study.

Cophoscincopus durus (COPE, 1862).

Localities: HD4, HD5, HD8. Voucher specimens: PEM R1297-99, 1471-75, 2303; a series of adults collected at Haute Dodo. A further eight specimens were captured and released, or observed. Most specimens were caught in funnel traps set in closed canopy forest alongside streams. On two occasions multiple specimens were captured in the same trap (2, 2, and 3 specimens). Two specimens were collected sleeping at night on streamside marginal vegetation; two were observed foraging among rocks in a vegetated seepage zone; another specimen was captured in a rock crack where a small stream flowed over bedrock. It initially tried to escape by diving into water and swimming under cover. This is only the third time the species has been recorded in Ivory Coast; the others were from the nearby Taï National Park (BÖHME et al. 2000) and the Man region (JOGER 1981).

Fig. 3. *Mabuya polytropis paucisquamis* from Cavally forest.
M. polytropis paucisquamis aus dem Cavally Wald.

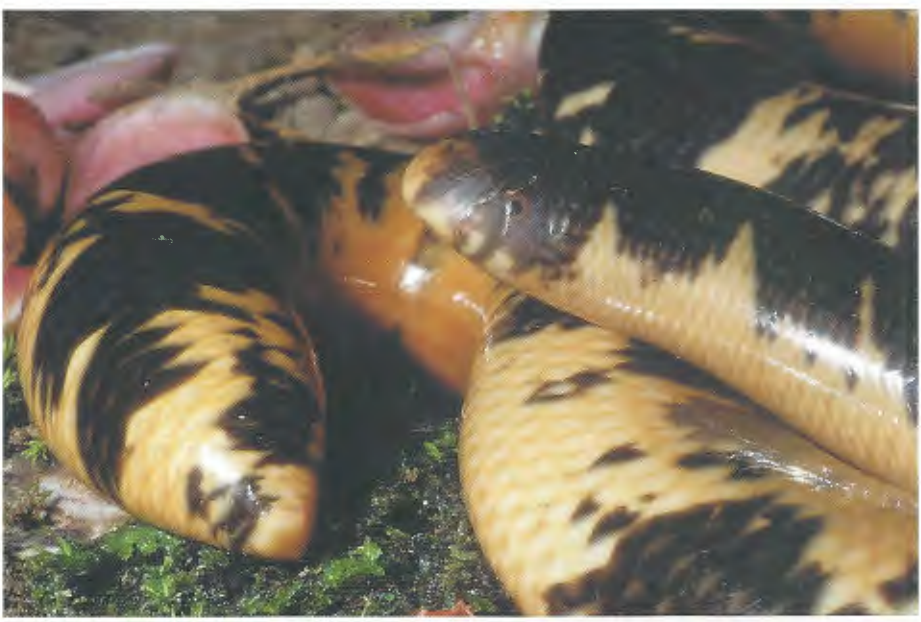

Fig. 4. *Typhlops liberiensis* from Haute Dodo forest.
T. liberiensis aus dem Haute Dodo Wald.

Varanus ornatus (DAUDIN, 1803).

Locality: HD6. A young adult observed in a small swamp formed beside a logging road in partially disturbed forest in Haute Dodo.

Typhlops liberiensis (HALLOWELL, 1848).

Locality: HDCamp. Voucher specimens: PEM R1478, 2301; a subadult (264 + 5 mm) and a very large female (766 + 13 mm, Fig. 4), both collected whilst crawling in the Haute Dodo camp in the early evening. Both have 26 midbody scale rows and immaculate ventrums. The large female laid a single egg (32 × 17 mm; embryonic plaque visible) two days after capture. Dissection revealed no further eggs in the oviducts, although it is probable that the female laid other eggs prior to capture. The specimen is the largest recorded for the species (previous maximum 720 mm: ROUX-ESTÈVE 1974), or for the *T. punctatus* complex.

Remarks: There remains confusion concerning the taxonomic status of blind snakes of the *T. punctatus* complex. As MCDIARMID et al. (1999) have noted this results, in part, from the confused treatment in MEIRTE's (1992) keys to African snakes. Both ROUX-ESTÈVE (1974) and HAHN (1980) recognized only a single species, *T. punctatus*, with three subspecies, *T. p. punctatus, T. p. liberiensis* and *T. p . congestus*. Although morphological differentiation between the taxa is minor they generally inhabit different habitats; savannah (*punctatus*) and forest (*congestus* and *liberiensis*). However, both *liberiensis* and *punctatus* have been recorded from secondary forests in the forest zone of Taï National Park (RÖDEL & MAHSBERG 2000), and gallery forests in the savanna zone, Comoé National Park (RÖDEL et al. 1995, 1999). SCHMIDT (1919) first recognized *T. congestus* as a distinct species, and this has been followed by SPAWLS et al. (2001). Due to their immaculate ventral coloration and forest habitat, and pending further analysis including gene sequencing, we prefer to treat the Haute Dodo specimens as *T. liberiensis.*

Fig. 5. *Bothrophthalmus lineatus* from Cavally forest.

B. lineatus aus dem Cavally Wald.

Python sebae (GMELIN, 1788).

Localities: HD17, HD18. A large female (4-5 m) was killed by a cocoa farmer in a small plantation at the edge of the Haute Dodo forest reserve. It was skinned and the meat and fat kept for eating and medicinal use.

Polemon acanthias (REINHARDT, 1860).

Locality: HD4. Voucher specimen: PEM R1479; an adult female (581 + 39 = 620 mm TL) collected in a funnel trap in closed-canopy forest adjacent to a small stream. The stomach was empty. The specimen appears to be a new record size for this Upper Guinea endemic species. CHIPPAUX (1999) records a previous maximum size of 589 mm TL.

Bothrophthalmus lineatus (PETERS, 1863).

Locality: CA11. Voucher specimen: PEM R4435; a large female (736 + 110 mm = 846 mm TL; 103 g, Fig. 5) collected whilst it was swimming in the River Dibo at mid-day. It is of the typical brightly-striped phase. The stomach contained a large rodent (*Malacomys* cf. *longipes*, 35 g); the relative prey mass (prey mass/snake mass) was 34 % of the snake's mass.

Grayia smithii (LEACH, 1818).

Locality: CA2. Voucher specimen: PEM R4434; a large female (683 + 273 mm = 956 mm TL) was drowned in a fish net set overnight in a small tributary of the River Dibo. The stomach was empty.

Boiga pulverulenta (FISCHER, 1856).

Localites: CA13-CA14. Voucher specimen: PEM R4437; a juvenile specimen (465 + 111 mm = 576 mm TL) was collected in a funnel trap on the ground in closed canopy forest. The stomach was empty.

Hapsidophrys lineatus FISCHER, 1856.

Locality: HD5. Voucher specimen: PEM R2307; a very large female (901 + 360 = 1261 mm TL, Fig. 6) collected in a funnel trap in low vegetation in a small clearing alongside a small stream. The trap also contained a number of frogs (*Silurana tropicalis*) which may have tempted the snake to enter the trap. The stomach, however, was empty. CHIPPAUX (1999) records a previous maximum size of 1225 mm.

Rhamnophis aethiopissa GÜNTHER, 1862.

Locality: HD19. No specimens were collected during the survey but photographs were taken of two specimens crossing forest roads during the Haute Dodo survey.

Thelotornis kirtlandii (HALLOWELL, 1844).

Locality: HD24. Voucher specimen: PEM R2308; a young male (610 + 373 mm, Fig. 7) collected whilst crossing a forest road at Haute Dodo. The stomach was empty.

Natriciteres variegata (PETERS, 1861).

Locality: HD3. Voucher specimen: PEM R1296; an adult male (238 + 87 mm) collected at Haute Dodo on a logging road in the morning. The stomach was empty.

Naja melanoleuca (HALLOWELL, 1857).

Localities: HD3, HD21. No specimens were collected, but large, hooded black snakes probably referable to this species were observed crossing forest roads in Haute Dodo.

Causus maculatus (HALLOWELL, 1842).

Locality: HD3. Voucher specimen: PEM R1295; a hatchling (113 + 10 mm) was collected crossing a forest road during late morning in Haute Dodo. It had an obvious umbilical scar and the stomach was empty.

Atheris chlorechis (PEL, 1851).

Locality: CA1. Voucher specimen: PEM R5297; a large female (393 + 79 mm) was found basking on a low bush beside a logging track and small forest stream. The stomach was empty.

Osteolaemus tetraspis COPE, 1861.

Localites: HD6, HD17. A single adult was spotted lying on vegetation in a swamp next to a logging road in Haute Dodo. The track of another specimen was observed in the same general area. Vulnerable by over-exploitation in the bushmeat trade (AKANI et al. 1998).

Crocodylus cataphractus CUVIER, 1825.

Locality: River Dibo. No large crocodiles were observed in the permanent water bodies during the survey. However, the slender-snouted crocodile was reported by local people to be present. Vulnerable and often persecuted due to its danger to people and livestock. It is also exploited in the bushmeat trade (SPAWLS et al. 2001).

Kinixys erosa (SCHWEIGGER, 1812).

Locality: HD20. No tortoises were observed during the surveys, but one young specimen caught outside the Haute Dodo reserve was brought for sale to the camp. *K. erosa* is mostly active at night (SCHMIDT 1919) and it has been reported to swim and dive for food (BROADLEY 1989). Vulnerable and over-exploited for bushmeat (LAWSON 2000).

4 Discussion

4.1 Trapping Results

Comparative studies on the efficacy of pitfall versus funnel traps for surveying African herpetofauna are unavailable. In North American woodlands BURY & CORN (1987) found pitfall traps more effective than funnel traps for capturing all forest non-volant vertebrates other than snakes. However, their funnel traps were much smaller (12-15 cm diameter) than those employed during this survey. HOBBS et al. (1994) assessed various designs of pitfall trap arrays for catching Australian reptiles in arid *Spinifex* grassland, and noted that the most effective design comprised a simple straight line drift fence with pitfall buckets placed approximately 7 m apart. Pitfall arrays used during a survey of herpetofauna of Monts Doudou, Gabon (BURGER et al. 2002) were effective in catching amphibians, but caught almost no reptiles. A total of 263 amphibians and only one reptile (a small tortoise) were captured in 726 trap-days. Moreover, the exceptional amphibian capture rate resulted from only two frog species

Fig. 6. *Hapsidrophys lineatus* from Haute Dodo forest.
H. lineatus aus dem Haute Dodo Wald.

(*Silurana epitropicalis,* 138 specimens; *Hemisus perreti,* 53 specimens) which together accounted for 73 % of the captures.

4.2 Reptile diversity

The reptile fauna of Haute Dodo and Cavally were similar, with a diverse snake fauna but depauperate lizard fauna. However, as the reptile fauna was probably undersampled during the current survey, no attempt is made here to repeat the detailed comparative analysis given previously for amphibians (RÖDEL & BRANCH 2002). The snake faunas for both sites (HD: 9 species, CA: 4 species) were undersampled and are certainly much larger than confirmed during the current survey. Adjacent areas have some of the richest and most diverse ophidian faunas in Africa. Of 40 snakes recorded from Taï National Park (RÖDEL & MAHSBERG 2000, ERNST & RÖDEL 2002), 22 were found in primary forest, and 18 could be considered farmbush species. Even richer snake faunas have been recorded from Mt. Nimba (52 species, ANGEL et al. 1954b, INEICH 2002) and Ziama Forest (42 species, BÖHME 1999) in Guinea. Other rich snake faunas in West and Central Africa include: 45 species from Dinamika, Congo Republic (TRAPE 1985); 44 species in Comoé National Park, Ivory Coast (RÖDEL et al. 1995, 1999); and 54 species from Korup National Park, Cameroon (LAWSON 1993).

Both HD and CA had relatively depauperate lizard faunas, with only six species recorded from each site (eight species in total). Although the sites were again relatively undersampled, the lizard fauna of the West African rain forests is known to be of very

Fig. 7. *Thelotornis kirtlandii* from Haute Dodo forest.
T. kirtlandii aus dem Haute Dodo Wald.

low diversity (BÖHME 1994, RÖDEL et al. 1997). BÖHME (1994, 1999) recorded only 11 species from Ziama, and an equally impoverished fauna is known from Mt. Nimba (15 species, ANGEL et al. 1954a, INEICH 2002, BÖHME et al. 2000). Whilst LAWSON (1993) noted affinities between the snake faunas of Korup, Cameroon and the Upper Guinea forests, little such relationship occurs between the lizard faunas. Most lizards have relatively wide distributions within the region (e.g. *Chamaeleo gracilis, Agama agama, Hemidactylus fasciatus, H. muriceus, Mabuya affinis, Varanus ornatus*). The only lizards that are endemic to the Upper Guinea forests were the water skink *Cophoscincopus durus* and the western subspecies of the forest skink, *Mabuya polytropis paucisquamis* (HOOGMOED 1978), which probably deserves specific recognition (BRANCH & RÖDEL unpubl. data). An unusual, and unexplained feature of the Upper Guinea forests is the absence of forest chameleons, which have speciated extensively in forest isolates elsewhere (e.g. Cameroon and Tanzania).

Based on known reptile faunas from adjacent regions (Ziama: BÖHME 1999; Mt Nimba: ANGEL et al. 1954a, b; INEICH 2002; Taï National Park: RÖDEL & MAHSBERG 2000) a fauna of more than 60 reptile species, including more than 40 snake species, should occur in the western forests of Ivory Coast.

4.3 Conservation implications

Although the survey was much too short to compile a comprehensive species list for reptiles, the records presented in this paper and the very rich amphibian diversity

(RÖDEL & BRANCH 2002) clearly indicates the high value of both forests for preserving regional diversity. However, a more complete assessment of the reptile assemblages of both HD and CA requires more research.

A number of threatened reptiles were recorded. The two crocodilian species (*Crocodylus cataphractus* and *Osteolaemus tetraspis*) recorded from Haute Dodo or Cavally are currently listed as Vulnerable in the IUCN Red List 2001 (HILTON-TAYLOR 2001). These species and four others (*Chamaeleo gracilis, Varanus ornatus, Python sebae* and *Kinixys erosa*) are include in CITES appendices and their international trade is monitored or regulated. Sightings of chelonians and crocodilians were rare, and local villagers reported hunting them for food. LAWSON (2000) documented the extent of exploitation of the forest tortoises *Kinixys erosa* and *K. homeana* in Cameroon, and the dwarf crocodile *Osteolaemus tetraspis* is similarly threatened by overexploitation throughout West Africa (AKANI et al. 1998).

However, to preserve the potentially high diversity of HD and CA the highest priority is to stop or strictly control ongoing logging activities. The construction and placement of logging roads within the forest reserves, particularly that of Cavally which was being logged immediately before and after the survey, showed no evidence of concern for future erosion control or for avoidance of sensitive habitats. Numerous dirt roads gave access to almost all parts of the forest and careless handling of logged trees had resulted in a huge number of open areas with altered microclimate. The past and current logging activities in both HD and CA forest reserves have caused erosion and silting of natural water courses, which in the hillier terrain of CA could have significant impacts on aquatic systems. We regard the presence of several non-forest species within the forests, both amphibians and reptiles, as a result of this unsustainable forest management (RÖDEL & BRANCH 2002, this paper).

It is now well-established that access to previously inaccessible forest by logging roads leads to numerous secondary impacts, including a massive increase in the illegal and unsustainable harvesting of forest resources, especially bushmeat (see BAKARR et al. 2001b, and references therein). It also allows easy access for the establishment of small illegal cocoa plantations in the bush clearings generated by logging activities. Both of these major impacts were already very evident in both reserves. If the natural biodiversity of these reserves, including both the herpetofauna and other faunal groups, is to be preserved it is essential that stricter control of access to and impacts on the reserves be initiated. Logged areas need to be given sufficient time to recover, and better logging practices should be strictly enforced. To achieve these goals the awarding of logging concessions and control of logging activities need to be improved considerably.

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Taxa	Haute Dodo*	Cavally*	Distribution			Habitat		
			SSA	WA	UG	F	S	FB
Reptilia – Sauria								
Agamidae								
Agama agama	4	3	+	–	–	–	+	+
Chamaeleonidae								
Chamaeleo gracilis	1	1	+	–	–	–	+	+
Gekkonidae								
Hemidactylus fasciatus	0	1	+	–	–	+	–	–
H. muriceus	2	1	+	–	–	+	–	–
Scincidae								
Mabuya affinis	7	7	–	+	–	+	–	+
M. polytropis paucisquamis	0	2	–	–	+	+	–	–
Cophoscincopus durus	5	0	–	+	–	+	–	–
Varanidae								
Varanus ornatus	1	0	+	–	–	+	–	–
Reptilia – Serpentes								
Typhlopidae								
Typhlops liberiensis	1	0	–	–	+	+	–	+
Boidae								
Python sebae	2	0	+	–	–	+	+	+
Atractaspidae								
Polemon acanthias	1	0	+	–	–	+	–	–
Colubridae								
Bothrophthalmus lineatus	0	1	+	–	–	+	–	–
Grayia smithii	0	1	+	–	–	+	+	+
Boiga pulverulenta	0	1	+	–	–	+	–	–
Hapsidrophys lineatus	1	0	+	–	–	+	–	–
Rhamnophis aethiopissa	1	0	+	–	–	+	–	+
Thelotornis kirtlandii	1	0	+	–	–	+	–	+
Natriciteres variegata	1	0	+	–	–	+	+	+
Elapidae								
Naja melanoleuca	2	0	+	–	–	+	–	+
Viperidae								
Causus maculatus	1	0	+	–	–	+	+	+
Atheris chlorechis	0	1	–	+	–	+	–	–
Crocodylidae								
Osteolaemus tetraspis	2	0	+	–	–	+	–	–
Crocodylus cataphractus	0	1	+	–	–	+	–	–
Testudinidae								
Kinixys erosa	1	0	+	–	–	+	–	–

Appendix 1. Presence, distributions, and habitat associations of the reptiles of the Haute Dodo and Cavally forests (based on literature data and own records, compare text). SSA = Sub-Saharan Africa, WA = West Africa, UP = Upper Guinea; F = forest, S = savanna, FB = farmbush, * number of records per forest.

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