

A survey of the potential distribution of the threatened tortoise *Centrochelys sulcata* populations in Burkina Faso (West Africa)

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Abstract: The African spurred tortoise (*Centrochelys sulcata*) is a threatened species, especially in West Africa, where it shows a scattered distribution. In Burkina Faso, the species distribution is unknown and we documented the current distribution and potential habitat characteristics. We found evidence of the species in a few sites in the northern and eastern part of the country, whereas some records from the southern part of Burkina Faso were considered unreliable. Multiple specimens were recorded only in four localities, mainly in the Sahel ecological zone. Annual rainfall was negatively related to the observed number of tortoises per site, and indeed these tortoises were found in the Sahel and adjacent ecoregions where rainfall is lower than other regions in Burkina Faso whereas latitude and numbers of tortoise individuals observed in each site were positively related. In a sample of 12 measured specimens, the males were significantly larger than females. Although the present surveys demonstrated that *C. sulcata* is present in Burkina Faso, we can not conclusively determine whether they are native or originated from escaped or introduced animals.

Key words: African spurred tortoise, Burkina Faso, distribution, Sahel, West Africa.

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Introduction

The African spurred tortoise (*Centrochelys sulcata*) was originally described by Miller (1779) from "India orientali" (in error), but is instead native to the southern edge of the Sahara Desert and the Sahel, a transitional eco-region of semi-arid grasslands, savannas, and thorn shrublands

found in the countries of Burkina Faso, Chad, Eritrea, Ethiopia, Mali, Mauritania, Nigeria, Senegal, Sudan (Trape *et al.* 2012), and the southern Arabian peninsula (southern Yemen, may be Saudi Arabia, Gasperetti *et al.* 1993). *C. sulcata* is the largest species of continental tortoises and the third largest species of tortoise in the world after the Galapagos tortoise

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(*Chelonioideis nigra* complex) and Aldabra Giant Tortoise (*Aldabrachelys gigantea*).

Despite apparently having a wide distribution across the dry savannahs of sub-Saharan Africa, the species' distribution is poorly known but surely fragmented due to historical reasons (progressive desertification that caused extinction of the species in some countries), habitat loss due to agriculture, overgrazing and hunting (Trape *et al.* 2012). All populations are reported to be declining, due in large part to competition for food with domestic livestock (Branch 2008); it appears to be on the verge of extirpation in Nigeria (Petrozzi *et al.* 2015), and is possibly the first conspicuous reptile species that has gone extinct in Cameroon, at least if we follow Chirio & LeBreton's (2007) opinion. In West Africa, there do not appear to be any locations where this species is still abundant; most records are the result of very occasional encounters by field scientists. The species has probably always been characterized by low population density, as it was reported to be rare in the 1960s in Sudan by Cloudsley-Thompson (1970). Although considered Vulnerable (A1 cd) by the IUCN until recently (2012), the taxon specialist group (IUCN/SSC Tortoise and Freshwater Turtles Specialist Group workshop, Lomé, Togo, Aug. 2013) is in the process of changing the status to Endangered because of extensive habitat loss across much of its range.

Unfortunately, the effective management of the extant West African populations of *C. sulcata* is heavily compromised by a plethora of reasons, including the instable social and political issues of the region, as well as, the very little data available on the species' natural history and ecology. Indeed, apart from some data on morphometrics (Hirth & Latif 1981; Lambert 1993), and general biology (e.g., Devaux 2004; Lambert 1993, 1995), no data useful for planning management strategies (e.g., demography, habitat use, etc.) are available apart from data on captive reproduction (e.g., Cloudsley-Thompson 1970; Gasperetti *et al.* 1993; Lambert 1999). However, it is known that adults typically weigh 45 - 91 kg, but specimens heavier than 100 kg have been reported (Ernst & Barbour 1989). Their diet consists of many types of grasses and forbs, and is reported to be high in fiber and very low in protein (Ernst & Barbour 1989; Gasperetti *et al.* 1993).

The status of the African spurred tortoise in Burkina Faso is totally unknown due to a lack of field research. Indeed, although it was presumed to occur in Burkina Faso considering the overall

distribution of the species (Trape *et al.* 2012), there are no reliable records for the country in the literature (Chirio 2009) apart a note in a non-technical book (Vetter 2005).

This paper aims to report on the local distribution and associated ecological data for *C. sulcata* in Burkina Faso. Although results presented here are preliminary and based in part on indirect evidence (i.e. interviews), they serve as a foundation for further investigation on the status and potential threats to the species. In particular, we not only provide some distribution data for these tortoises in Burkina Faso, but also report analyses on the relationships between their distribution and climatic (rainfall) and geographical (latitude) characteristics of their presence sites, and include the first morphometric data on the totally unknown populations from Burkina Faso.

Materials and methods

There are no precise locality data for the African spurred tortoise in Burkina Faso in the peer-reviewed literature (e.g. see Iverson 1992; The Reptile Database 2014; Trape *et al.* 2012). Therefore, to obtain accurate distribution data we conducted both field surveys and reviewed all the potential sources of available information. Reliable unpublished databases of scientific and conservation institutions in Burkina Faso were queried and relevant people at National Parks and Nature Reserves were interviewed. Thus, all the available information at: (i) Centre National de Recherche Scientifique et Technique (CNRST), (ii) Office National des Aires Protégées, (iii) Direction de la Faune et des Chasses, (iv) Parc National d'Arly, (v) Parc Nationale de W (a transboundary protected area occurring in Burkina Faso, Benin and Niger), (vi) Nazinga Game Reserve, was consulted. All faunal datasets were updated to June 2014. Tortoise presence in a given area was confirmed (and therefore reported as such in this paper) only after inspection of photographic materials or carefully circumstantiated observations by more than one searchers (either scientists, park staff or rangers).

Field surveys were conducted in suitable areas in every year in the period 1997 - 2014 (e.g. see Hema & Belemsogbo 2012; Hema *et al.* 2010a, 2010b, 2010c, 2013), and a total of 1180 days were spent in the field (Table 1). These long-term surveys were conducted throughout several of the potential areas of occurrence of *C. sulcata* in

Burkina Faso, by randomly walking across transects laid in the potential dry savanna habitat types for this species (Branch 2008). To maximize the probability of encountering tortoises, the field surveys were especially concentrated in protected areas that are known to (i) be characterized by the most pristine habitat characteristics, and (ii) house most of the large savanna wildlife in Burkina Faso (elephants, lions, etc.), such as Arly and W National Parks or Comoé-Léraba Forest Reserve (Table 1). Although these field surveys were focused primarily on large mammals (e.g., Hema & Belemsogbo 2012), we recorded tortoise sightings and collected additional data when possible. Sex was determined by observing the plastron concavity pattern, while curved carapace length and curved carapace width of the observed individuals were recorded to the nearest cm as was possible. Although we focus mainly on tortoise records from the field, we could not conclude that all tortoises were from free-ranging populations. Indeed, as this species is frequently kept captive by Sahel and Northern Soudan people, individual tortoises often are released when they become too large to be kept in captivity. In this regard, the very low number of individuals observed at each locality does not allow a rigorous interpretation of the native status of these potential/presumed populations.

Table 1. Synopsis of the field effort spent by researchers in the various territories of Burkina Faso in order to locate tortoises.

Region	Years of study	Number of field days
Arly and W National Parks	1999, 2013	10
Ouagadougou	1999 - 2015	500
Deux Balé National Park	2003, 2012	60
Nazinga Game Ranch	2006 - 2015	360
Comoé-Léraba Forest Reserve	1997 - 2013	250
Total		1180

Tortoise locations were geo-referenced using Google Earth software. Since the distribution of *C. sulcata* has been considered to be limited by rainfall (Branch 2008; Trape *et al.* 2012), we matched locations of tortoises to annual rainfall (mm) data (Lodoun *et al.* 2013).

In adjacent countries, only single individuals are typically observed (Petrozzi *et al.* 2015). Therefore, we hypothesized that higher sample sizes in single localities in Burkina Faso should

roughly correspond to naturally abundant populations. Hence, we explored by Pearson's correlation coefficient, for each presence site, the relationships between sample sizes of tortoises (dependent variable) and (i) annual rainfall and (ii) latitude (independent variables). Obviously, our hypothesis that sample size is correlated to "natural" abundance may be somewhat un-precise due to detection issues, given that records were incidental to mammal surveys, that abundance is presumed to be very low, and that records could not be assumed to be native (i.e. we can not exclude a bias related to release site selection). However, (1) our field surveys were conducted for such a long-term that the eventual detection issues due to their mammal-focused scope should be minimized, and (2) there was no relation between apparent abundance (sample size per site) and density of humans (Petrozzi *et al.* unpublished report), thus reinforcing our assumption that higher sample sizes did really correspond to higher "natural" abundance. However, there is the possibility that persons releasing an oversized pet would decide to release it at a site far away from humans and in what they think is suitable habitat.

Given that morphometrics of *C. sulcata* populations from Burkina Faso are totally unknown, we analyzed, by Pearson's correlation coefficient, the relationships between curved carapace length and curved carapace width of the recorded specimens. Shape (shell dome) is often different between sexes in tortoises, and shape difference would greatly influence curved shell measurements. Intersexual differences in body size (curved carapace length) were assessed by two-tailed Student t-test. All analyses were conducted at the 95 % confidence level using PAST statistical software.

Results

Recorded specimens

The records for *C. sulcata* in Burkina Faso, including both field observations, captive specimens and interview data, are presented in Fig. (1) Overall, we observed individuals, or examined photographs, of 28 tortoises from 7 distinct localities (Table 2). Five tortoises came from localities which we considered to represent unsuitable habitat for the species' (see below). The remaining 23 specimens came mostly (60.9 %) from sites with about 300 mm of annual rainfall, and no specimen came from sites with > 600 mm of annual rainfall (Table 2).

Multiple specimens were recorded only in four

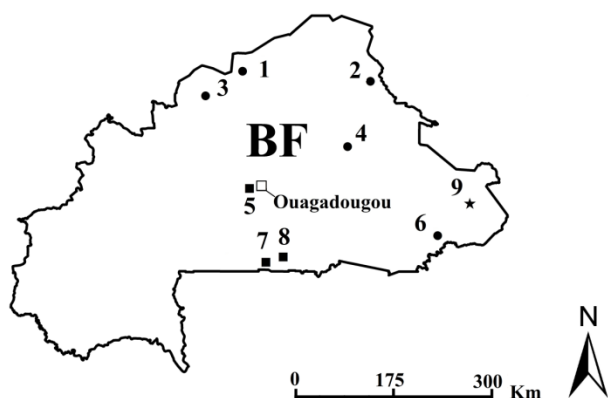


Fig. 1. Map of Burkina Faso, showing the potential localities of presence for *Centrocelys sulcata*. Symbols: filled circles = reliable localities; filled squares = unreliable localities; white stars = literature data; 1 = Baraboulé, 2 = Katchirga, 3 = Ouahigouya (7 km north), 4 = Bogandé, 5 = Bazoulé, 6 = Arly, 7 = Nazinga Game Reserve, 8 = Po, 9 = Diapaga.

localities, two of them situated in the extreme north of the country within the Sahel zone, and two at the far east of the country, close to the border with Mali and Niger (Table 2). The presence of autochthonous populations of the African spurred tortoise in these latter four locations (and possibly surrounding sites) appears to be very likely as evidenced by: (i) more than one specimen recorded at each site; (ii) the presence of free-ranging juveniles in the observed sample in one of these localities (Fig. 2); and (iii) many interviews with local people congruently confirming the occurrence, since long time, of wild individuals of this tortoise.

Interview data

Three out of seven identified localities (Bazoulé, Po, and Nazinga Game Reserve; Table 2) were considered erroneous because (i) the local habitat does not appear to be suitable for the African spurred tortoise, and/or (ii) there was clear disagreement among interviewees about the provenance of the reported specimens. However, in the three supposedly unreliable localities, a few captive specimens of unknown origin were observed during the surveys (Table 2). In addition, intensive field surveys at Nazinga Game reserve (Table 1) did not produce records or evidence of occurrence.

All interviewees at Arly National Park (park managers and rangers) agreed that African spurred tortoises do occur there, although they are

not easily encountered. The descriptions of ecological features associated with these tortoises (burrowing habits; apparent low densities) were consistent among interviewees, and were in agreement with available literature (e.g., Branch 2008; Devaux 2000; Ernst & Barbour 1989). Thus, it was concluded that *C. sulcata* naturally occurs in Arly National Park. Fougérol & Touzet (2003) also demonstrated the presence of *C. sulcata* at Arly on the basis of three individuals. Fougérol & Touzet (2003) also reported that African spurred tortoises are present in Diapaga (province de la Tapoa, SE of Burkina), where local cultures venerate them as holy animals and do not eat them. Interestingly, Arly National Park is not far (about 100 Km linear distance) from either the Burkina side of the W National Park or the closest free-ranging populations that occur in the Niger side of the W National Park (Chirio & Dulieu 2007), and it shares the same type of habitat. Nonetheless, no reliable records of *C. sulcata* on the Burkina side of the W National Park were obtained during the present surveys, and this reinforces / supports suggestions by Chirio & Dulieu (2007) and Chirio (2009) that the species is not found in the Burkina sector of the Park.

Based on the absence of field records during our long-term field researches (Table 1), it is concluded that *C. sulcata* is surely absent from Comoé-Leraba National Reserve in South-Western Burkina Faso, and from Deux Bale National Park in the Central-West Burkina Faso. In both these protected areas, characterized by relatively dense tree coverage, there are abundant populations of the tortoise *Kinixys nogueyi*, another species considered threatened (Vulnerable) at the continental scale (Segniagbeto *et al.* 2014). During the surveys, no specimens of *C. sulcata*, either free-ranging or captive, were observed in the Ouagadougou and in the Plateaux Central regions, and no indirect sign of their presence was recorded. However, interviews with elders indicated that up to 50 years ago, it was not uncommon for villagers to keep these tortoises as pets, and for the children to play with them. The interviewees were unable to remember where those tortoises were captured.

Relationships between localities of tortoise records and their climatic-geographic characteristics

Assuming that the number of observed individuals per site (Table 2) was a proxy of their

Table 2. List of localities for African spurred tortoises recorded in Burkina Faso during the present surveys. Asterisk would indicate unreliable records due to (i) unsuitable local habitat, and (ii) clear disagreement among interviewees in terms of whether the reported specimens were native or not. Coordinates are not reported for conservation reasons, but are available on request from authors.

Site	Year	Numbers observed	Males	Females	Juvenile	Veg zone	Rainfall
Baraboulé	2011-2013	8	1	3	4	Sahel	300
Katchirga	2010-2012	6	4	2	0	Sahel	300
Ouahigouya (7 km north)	2014	5	3	2	0	northern Soudanian	600
Bogandé	2011-2013	4	2	2	0	northern Soudanian	600
Bazoulé*	2013	2				northern Soudanian	600
Arly (Parc Nationaux)	2013					northern Soudanian	600
Nazinga Game reserve*	2014	2				northern Soudanian	600
Po*	2013	1				EstMouhoun	900

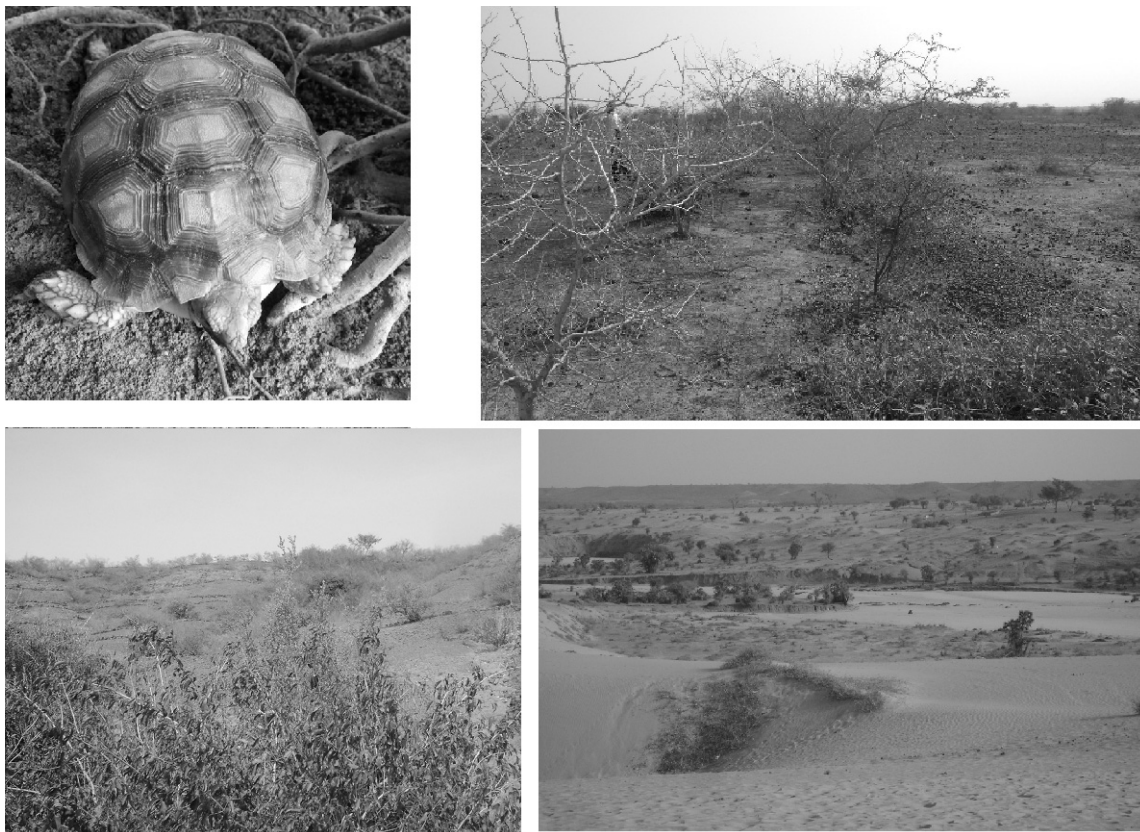


Fig. 2. Juvenile *Centrochelys sulcata* from Baraboulé, Northern Burkina Faso, and three views of typical dry savanna habitats in the Sahel region in northern Burkina Faso.

relative abundance (Petrozzi *et al.* 2015, see above), there was a significantly negative relationship between (log) annual rainfall and (log) sample size per site ($r = -0.849$, $n = 7$, $P = 0.014$; Fig. 3). There was a statistically significant positive linear relationship between latitude and number of

tortoise records in each site ($r = 0.962$, $n = 7$, $P = 0.0089$; Fig. 4).

Morphometrics

A total of 12 individuals (7 males and 5 females) were measured. Curved carapace length

and curved carapace width were positively correlated ($r = 0.977$, $n = 12$, $P < 0.05$), thus only carapace length was used for assessing intersexual size dimorphism. Despite the small sample size ($n = 12$), males ($x = 78.4 \pm 12.1$ cm, range 73 - 97 cm, $n = 7$) were significantly larger than females ($x = 55.2 \pm 5.7$ cm, range 49 - 64 cm, $n = 5$) in terms of curved carapace length ($t = 39.4$, $df = 10$, $P < 0.001$).

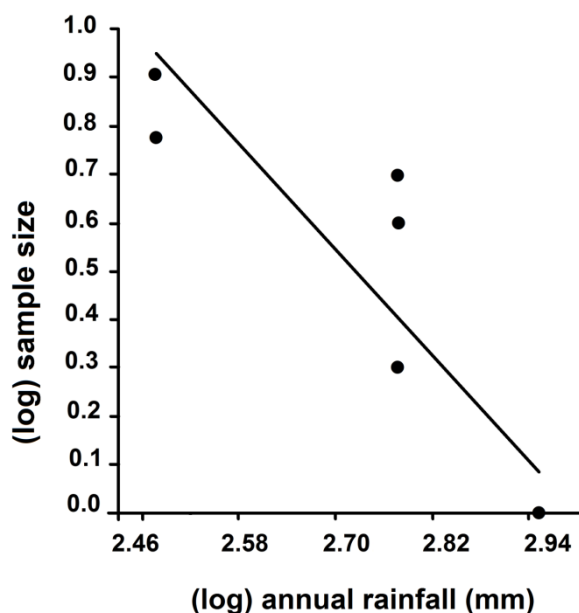


Fig. 3. Relationships between annual rainfall (mm) and observed sample size of tortoises at each site in Burkina Faso 95 %. For statistical details, see the text.

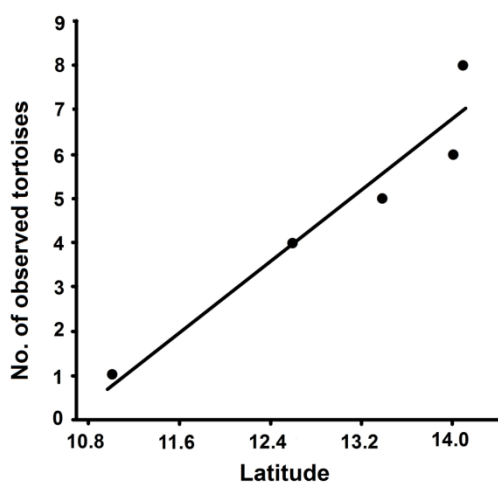


Fig. 4. Relationships between latitude of presence sites and number of tortoise individuals observed in each site. For the statistical details, see the text.

Discussion

Overall, the present surveys led us to conclude that:

- (1) some populations of *C. sulcata* certainly do occur in the wild in Burkina Faso (in the northernmost and far eastern sides of the country);
- (2) they appear confined to sites with low rainfall (usually about 300 mm per year, and certainly not more than 600 mm per year);
- (3) their populations are characterized by male-larger sexual size dimorphism, that is in good agreement with available data from conspecifics in Mali (Lambert 1993).

The species seems to be Critically Endangered in the country, due to the extremely scattered distribution, less than five populations potentially occurring, and minimal size of the populations (sensu IUCN 2014; www.iucnredlist.org, adjusted for national sub-populations as in <http://goo.gl/jJGiDd>). Probably, only the extreme north of Burkina (Sahel ecological zone) may still support some relatively thriving / viable populations of this species, whereas in the East the populations seem very scarce. Tortoise populations are under immediate threat of hunting, as the interviewed people claimed that they do consume these animals as food. However, it should also be noticed that the proportion of Burkina Faso political territory that is mostly suitable for African spurred tortoises (i.e. areas with about 300 mm of annual rainfall) may be increasing (between 1950 - 59 and the present time) due to the ongoing climate change (Thiombiano & Kampmann 2010). So, although it is very unlikely that these tortoises may naturally recolonize territories of their range eventually lost, this fact looks positive for eventual reintroduction and management programs.

Obviously, properly devised management programs are urgently needed for Burkina Faso tortoises, but there have been no efforts by any governmental conservation agency. We suggest that in-situ captive breeding farms (with individuals of known genetic origin) may be useful in order to re-introduce the juveniles into appropriate remote areas where human intervention is minimal. Eventual releases of captive-bred tortoises should be done preferably in the extreme north of the country, where the relative abundance of this species seems to be higher than in the rest of Burkina Faso. Nonetheless, captive breeding facilities need substantial investment and competent husbandry skills, that may not be

available at the local level of Burkina Faso. Plus, headstarting and re-introduction of juvenile tortoises is far from a proven technique, and made even more challenging by the harsh unforgiving environment. Adequate consideration should be given to improved protection of wild animals that already reside in these areas. Anyway, to our knowledge, the only management program targeted at Burkina Faso populations of *C. sulcata* suggested that was devised by Fougeirol & Touzet (2003) in an unpublished report to the Programme Régional Parc - W / ECOPAS (Ecosystèmes Protégés en Afrique Soudano-Sahélienne). These authors suggested that management of free-ranging tortoise populations could not be done without an eco-tourism campaign that may benefit also the local human population. Nonetheless, nothing has been done up to now in this regard, and this recommendation should be revived. In addition, further field research should be urgently done, especially in the dry and remote savanna sites that represent the potential habitats for this species (Fig. 2), to increase our knowledge on the distribution, abundance in the field, and basic biology of *C. sulcata* in Burkina Faso.

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References

- Branch, B. 2008. *Tortoises Terrapins and Turtles of Africa*. New Holland Publishing, Cape Town.
- Chirio, L. 2009. Inventaire des reptiles de la Région de la Réserve de Biosphère Transfrontalière du W (Niger/Bénin/Burkina Faso: Afrique de l'Ouest). *Bulletin de la Société Herpétologique de France* **132**: 13-41.
- Chirio, L. & D. Dulieu. 2007. *Inventaire Provisoire des Reptiles de la Zone du Parc Régional du W*. Programme Régional Parc W / ECOPAS 9 ACP ROC 13, Ouagadougou.
- Chirio, L. & M. Le Breton. 2007. *Atlas des Reptiles du Cameroun*. MNHN & IRD, Paris.
- Cloudsley-Thompson, J. 1970. On the biology of the desert tortoise *Testudo sulcata* in Sudan. *Journal of Zoology (London)* **160**: 17-33.
- Devaux, B. 2000. La tortue qui pleure - The crying tortoise *Geochelone sulcata* (Miller, 1779). *Chelonii* **1**: 1-87.
- Devaux, B. 2004. *Centrochelys sulcata*, the tortoise that weeps. *Reptilia (GB)* **37**: 20-26.
- Ernst, C. H. & R. W. Barbour. 1989. *Turtles of the World*. Smithsonian Institution Press, Washington D.C.
- Fougeirol, L. & D. Touzet. 2003. *Valorisation écotouristique des reptiles dans le Parc Régional du W*. Technical Report to the Programme Régional Parc - W (ECOPAS), Ouagadougou.
- Gasperetti, J., A. F. Stimson, J. D. Miller, J. P. Ross & P. R. Gasperetti. 1993. Turtles of Arabia. *Fauna of Saudi Arabia* **13**: 170-367.
- Hema, M. E. & U. Belemsobgo. 2012. *Rapport d'inventaire de faunerealisé du 23 au 27 Février 2012 dans les Forêts Classées des deux Balé et de Dibon*. Université de Ouagadougou, Ouagadougou, 65 pp.
- Hema, M. E., R. F. W. Barnes & W. Guenda. 2010a. Distribution of savannah elephants (*Loxodonta africana africana* Blumenbach 1797) within Nazinga game ranch, southern Burkina Faso. *African Journal of Ecology* **49**: 141-149.
- Hema, M. E., R. F. W. Barnes & W. Guenda. 2010b. The seasonal distribution of savanna elephants (*Loxodonta africana africana* Blumenbach 1797) in Nazinga Game Ranch, southern Burkina Faso. *Pachyderm* **48**: 33-40.
- Hema, M. E., Y. Ouattara & M. Karama. 2010c. *Recensements pédestres des grands mammifères diurnes de la Forêt Classée Réserve Partielle de Faune Comoé-Léraba*. Rapport spécial AGEREF-CL, Banfora, Burkina Faso.
- Hema, M. E., R. F. W. Barnes & W. Guenda. 2013. Elephants or Excrement? Comparison of the Power of Two Survey Methods for Elephants in West African Savanna. *Environmental Pollution* **2**: 14-26.
- Hirth, H. & E. M. A. Latif 1981. Morphometrics of the spurred tortoise, *Geochelone sulcata*, in the Sudan. *Journal of Herpetology* **15**: 120-121.
- Iverson, J. B. 1992. *A Revised Checklist with Distribution Maps of the Turtles of the World*. Privately published.
- Lambert, M. R. K. 1993. On growth, sexual dimorphism, and the general ecology of the African spurred tortoise, *Geochelone sulcata* in Mali. *Chelonian Conservation and Biology* **1**: 37-46.
- Lambert, M. R. K. 1995. On general biology and utilization of the African spurred tortoise, *Geochelone*

- lone sulcata* in Mali, West Africa. International Congress of Chelonian Conservation Proceedings. SOPTOM, Gonfaron, pp. 112-114.
- Lambert, M. R. K. 1999. On conservation of the Sahelian giant tortoise, *Geochelone sulcata*. *Proceedings of the Ordinary General Meeting of the Societas Europaea Herpetologica*. pp. 255-261.
- Lodoun, T., A. Giannini, P. S. Traoré, L. Somé, M. Sanon, M. Vaksman & J. M. Rasolodimby. 2013. Changes in seasonal descriptors of precipitations in Burkina Faso associated with late 20th century drought and recovery in West Africa. *Environmental Development* **5**: 96-108.
- Miller, L. 1779. *Icones Animalium et Plantarum*. Letterpress, London.
- Petrozzi, F., L. Luiselli & E. A. Eniang. 2015. Supplementary distribution data of *Centrochelys sulcata* (Miller, 1779) in northern Nigeria (West Africa). *Herpetozoa* **28**: 92-94.
- Segniagbeto, G. H., E. A. Eniang, F. Petrozzi, L. Vignoli, D. Dendi, G. C. Akani & L. Luiselli. 2014. Aspects of the ecology of the tortoise *Kinixys nogueyi* (Lataste, 1886) in Togo and Nigeria (West Africa). *Tropical Zoology*. <http://dx.doi.org/10.1080/03946975.2014.992616>.
- The Reptile Database. 2014: *Centrochelys sulcata* (Miller, 1779). Available at <www.reptile-database.org>. Last accessed 12 December 2014.
- Thiombiano, A. & D. Kampmann. 2010. *Atlas de la biodiversité de l'Afrique de l'Ouest. Tome II. Burkina Faso*. Ouagadougou and Frankfurt/Main.
- Trape, J. F., L. Chirio & S. Trape. 2012. *Lézards, crocodiles et tortues d'Afrique occidentale et du Sahara*. IRD Editions, Paris.
- Vetter, H. 2005. *Leopard- and African spurred tortoise*. Edition Chimaira, Frankfurt/Main.

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