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# *Pelusios castaneus* (Schweigger 1812) – West African Mud Turtle, Swamp Terrapin

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**Summary. – The West African Mud Turtle, *Pelusios castaneus* (Family Pelomedusidae), is an aquatic turtle of moderate size (carapace length to ca. 250–285 mm) indigenous primarily to savannah environments, but widely tolerant in terms of habitat requirements, and also able to penetrate into some forest and mangrove zones. It has rather variable coloration, but is recognizable by the pattern of fine, sinuous vermiculations on the head and the light plastron, unmarked except for angular figures around its periphery that may be either distinct or contiguous. In addition, the narrow, elliptical intergular scute and the very short pectorals are characteristic. Its field ecology has been studied extensively and quantitatively only in southern Nigeria, with such disparate features as home range, habitat selection, and food habits being analyzed. The species is omnivorous (but primarily carnivorous), with dietary composition shifting by season and by site, and also in relation to site pollution. The adult sex ratio is even. The species may potentially be a competitor of *P. niger* in the forest water bodies of southern Nigeria, and especially in the oil-polluted areas, due to an increased niche similarity between these species along the spatial and food niche axes. *Pelusios castaneus* is locally abundant, and its populations appear to be stable.**

**Distribution. – Angola, Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Congo (DRC), Congo (ROC), Equatorial Guinea (?), Gabon, Ghana, Guinea, Guinea-Bissau, Ivory Coast, Liberia, Mali (?), Niger, Nigeria, São Tomé and Príncipe (probable historic introduction), Senegal, Seychelles (extirpated; possible historic introduction), Sierra Leone, Togo. The species has a substantial but apparently disjunct distribution with three separate populations in western Africa, extending from Senegal to Angola.**

**Synonymy. – *Emys castanea* Schweigger 1812, *Pelusios castaneus, Chelys (Sternotherus) castaneus, Chelys castaneus, Sternotherus castaneus, Clemmys (Pelusios) castanea, Clemmys castanea, Sternothaerus castaneus, Sternothaerus nigricans castaneus, Sternothaerus nigricans castanea, Pelusios nigricans castaneus, Pelusios subniger castaneus, Pelusios castaneus, Pelusios castaneus castaneus, Sternothaerus leachianus* Bell 1825, *Sternotherus leachianus, Sternotherus derbianus* Gray 1844, *Sternothaerus derbianus, Pelusios derbianus, Pelusios castaneus derbianus.***

**Subspecies. – None recognized until recently, despite the wide range and the morphological variability of this species. However, several taxonomic combinations have been proposed. The taxon has previously been variously included as a subspecies of *Pelusios subniger* (Bonnaterre 1789) and *Pelusios nigricans* (Donndorff 1798). There is current controversy surrounding the taxonomic position of *Pelusios castaneus seychellensis* (Siebenrock 1906), considered to be a closely related but distinct species by Bour (1983) and Bour and Gerlach (2008), but as a historically introduced synonym of *P. castaneus* by Stuckas et al. (2013) and Kindler et al. (2016). Based on morphology, Bour (2013) recognized *P. c. seychellensis* as a possibly historically introduced distinct subspecies, and the TTWG (2014) and we continue to follow this taxonomy here, pending further analysis.**

**Status. – IUCN 2015 Red List Status: Not Listed (Least Concern, LC, assessed 1996); TFTSG Draft Red List: Least Concern (LC, assessed 2013); CITES: Not Listed.**

**Figure 1.** Adult male *Pelusios castaneus* from Togoville, Togo. Photo by Gabriel H. Segniagbeto.

**Taxonomy.** — *Pelusios castaneus* (Figs. 1 and 2) was described by Schweigger (1812) as *Emys castanea*, on the basis of a young individual, a shell of unknown origin, in the Paris Museum, that had already been mentioned by F.M. Daudin in 1801. Many authors from Daudin (1801) to Loveridge (1941) and Wermuth and Mertens (1961) confused this species with *Pelusios subniger* from East Africa. The nominal taxon was revalidated by Rendahl (1939) and Laurent (1956), but with the inclusion of other taxa, notably *P. castanoides* and *P. rhodesianus*, within this concept. *Emys castanea* was clearly demonstrated to be a senior subjective synonym of *Sternothaerus derbianus* Gray 1844 by Bour (1979). In order to definitely fix the identity of *P. castaneus*, a neotype was designated (Bour 2008), a juvenile registered as MNHN 2008.0303, with the restricted type locality the "vicinity of Koutchatcha (7°20' N, 1°18' E), a village close to the Amou River (ca. 30 km East of Gléï), Ogou Prefecture, Plateaux Region, Togo" (Fig. 3).

In the Seychelles Islands, a morphologically distinct and extinct endemic subspecies, *P. c. seychellensis* (Siebenrock 1906), is tentatively recognized as valid (Bour 1983; Bour and Gerlach 2008; Bour 2013; TTWG 2014), but Stuckas et al. (2013) and Kindler et al. (2016) considered it synonymous with *P. castaneus* based on mitochondrial DNA, and the relationship of these taxa needs further analysis. The Seychelles population may well have been introduced there during early historic times from an as yet unrecognized West African population (TTWG 2014); its mtDNA is most similar to specimens from the coastal region of Republic of Congo (Stuckas et al. 2013; Kindler et al. 2016).

According to Fritz et al. (2010), who studied both mitochondrial and nuclear DNA of the present species of Pelomedusidae (*Pelusios* and *Pelomedusa*), *P. castaneus* is most closely related to *P. chapini* Laurent 1965. Both species made a sister group of *P. adansonii* (Schweigger 1812) and *P. broadleyi* Bour 1983; this whole group itself is the sister group of a clade including *P. castanoides* and the pair *P. rhodesianus* Hewitt 1927 and *P. carinatus* Laurent 1956.

Kindler et al. (2016) documented phylogeographic structure of mtDNA within *P. castaneus*, identifying three separate evolutionarily significant units: one from coastal Republic of Congo (Brazzaville), one from eastern Cameroon, and a third from West Africa from Ivory Coast and Nigeria (and including São Tomé).

**Description.** — *Pelusios castaneus* is a moderate-sized species, with a carapace length (CL) reaching 220–250 mm or exceptionally up to 285 mm (Gramentz 1999). Although the largest individuals in wild populations are generally females (trend confirmed in studied populations in both Togo and Nigeria), the mean CL was similar between sexes in two populations of the Niger Delta in southern Nigeria (respectively, 152 ± 63 mm and 148 ± 69 mm (n = 326) in males, and 172 ± 61 mm and 155 ± 80 mm (n = 352) in

**Figure 2.** Adult female *Pelusios castaneus* from Togoville, Togo. Photo by Gabriel H. Segniagbeto.

**Figure 3.** Some noteable vouchers of *Pelusios castaneus*. **Top:** *Pelusios castaneus castaneus* juvenile, neotype MNHN 2008.0303, CL 73.2 mm, vicinity of Koutchatcha, 30 km E Glé̈, Ogou Prefecture, Plateaux Region, Togo. Photo by Roger Bour. **Middle:** *Pelusios castaneus castaneus* female, CL ca. 200 mm, Cacuaco, 10 km NE Luanda, Angola. Photo by Luis Ceriaco. **Bottom:** *Pelusios castaneus seychellensis* female, paralectotype ZMH R 00993, CL 133 mm, Mahé, Seychelles (Siebenrock 1909). Photo by Roger Bour.

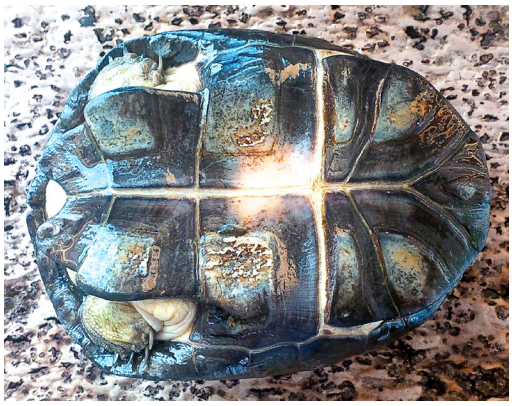

**Figure 4.** Two-year old *Pelusios castaneus* from Uyo, Akwa Ibom State, Nigeria. Very dark specimens are common in the forest zones. Photo by Luca Luiselli.

females; see Luiselli 1998), and in one population from Togoville, Togo (127 ± 26 mm in males (n = 34) versus 135 ± 37 mm (n = 46) in females; Segniagbeto et al., 2015).

The outline of the carapace is smoothly oval, although the shell may become almost straight-sided with age. Young specimens have a narrow median keel, but this disappears with growth. The shell becomes relatively flattened in old individuals. The first vertebral scute in adults typically shows curved sides, and its anterior border is about equal in length to the width of the first pair of marginal scutes. Vertebrals 2–4 are narrow, vertebral 2 becoming longer than wide when the carapace reaches a length of about 140 mm. The intergular scute is short and narrow, usually elliptical, with short posterolateral sides. The pectorals are short, both distally (the free margin being 50–65% of the humerals) and medially (one-half to one-ninth the length of the interhumeral seam). The femorals are wide, and there is a very strong femoro-anal constriction. The anal notch forms a deep acute angle in adults.

On the head, the parietal scales are of moderate size (4 to 5 large elements, one larger than the others); a supralabial (between the postocular and the masseteric) is present; and the five mental scales (in front of the barbels) are of moderate size, the median element being rounded. The maxillary beak terminates anteriorly in a small, shallow notch, and may or

**Figure 5.** Male *Pelusios castaneus* from Uyo, Akwa Ibom State, Nigeria. Photo by Luca Luiselli.

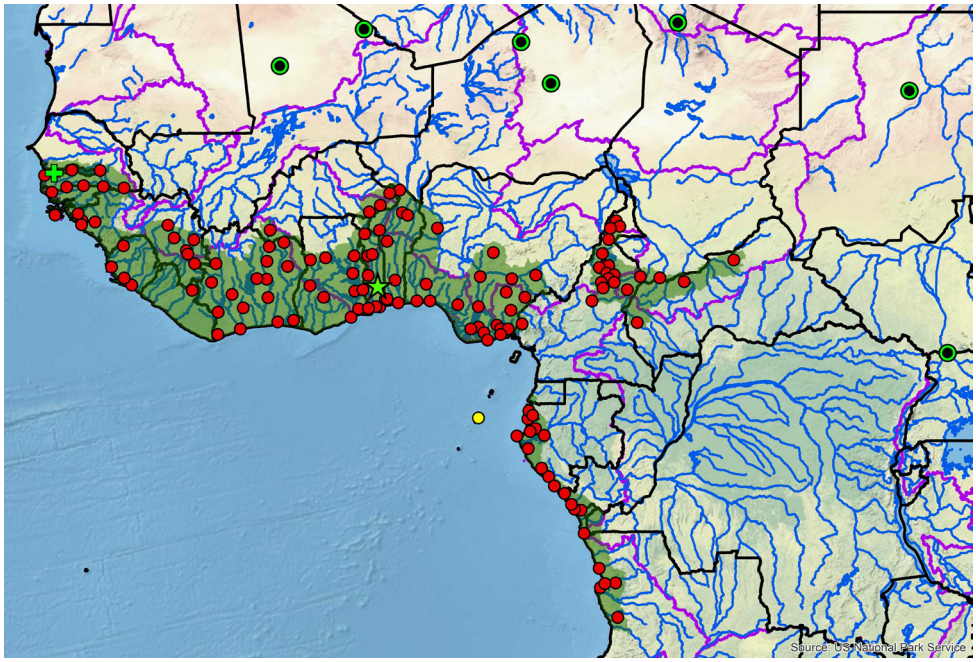


**Figure 6.** Distribution of *Pelusios castaneus* in western and central Africa. Purple lines = boundaries delimiting major watersheds (level 3 hydrologic unit compartments – HUCs); red dots = museum and literature occurrence records of native populations based on Iverson (1992), plus more recent and authors' data; yellow dot = introduced population; large green dots with black centers = Pleistocene and Holocene fossils referred to *P. castaneus*; green star = restricted type locality of *P. castaneus*; green cross = restricted type locality of synonymous *P. derbianus*; green shading = projected current distribution based on GIS-defined level 8 HUCs constructed around verified localities and then adding HUCs that connect known point localities in the same watershed or physiographic region, and similar habitats and elevations as verified HUCs (Buhlmann et al. 2009; TTWG 2014), and adjusted based on authors' subsequent data. The distributional discontinuity in the central Cameroon portion of the range is due to lack of records from the deep equatorial forests in this region, which have apparently served as an isolating mechanism for the three separate populations.

may not be bordered by a pair of inconspicuous, rounded cusps. The anterior face of the forelimb is covered by 2 or 3 rows of falciform, elongate, narrow scales. The neural series is complete, with eight bony elements, although neural 8 is, exceptionally, reduced. The single *P. c. seychellensis* examined has neurals 7 and 8 reduced and separated from the series. The suture between the mesoplastra is contained 2 or 3 times within the suture between the hyoplastra.

The carapace has a grayish tint, or it may be chestnut-brown to blackish, often with a lighter band along the costomarginal seam line. The plastron is yellow, rarely immaculate, more often marked with a peripheral design of angular brown or black figures that may form a distinctive continuous pattern similar to that characteristic of *P. sinuatus*. Some specimens from forest zones in Nigeria have very dark plastra (Fig. 4). The soft parts are brown, becoming yellowish or whitish-gray below the carapace overhang. The top and the sides of the head are gray-brown, reddish, or olive, ornamented with fine, sinuous, yellow vermiculations (Fig. 5). The three specimens attributed to *P. c. seychellensis* have a black shell; the plastron is also fully black, or with a narrow light figure along the medial seam.

Beside the Seychelles specimens, subspecies are not currently recognized, but certain characters seem to form a more or less regular cline from west to east across the range, and from savannah zones towards forested ones. These clinal changes include effacement of the maxillary cusps, darkening of the ornamentation on the top of the head, reduction of the sinuosity of the vermiculations, and development of the peripheral pigmentation of the plastron.

**Distribution.** — This species has a wide but disjunct distribution in western and central Africa (Fig. 6). Prior depictions of the species' distribution (e.g., Iverson 1992; Stuckas et al. 2013; TTWG 2014; Kindler et al. 2016) have shown it as one continuous widespread population, but our analysis of locality data for this account has revealed a high likelihood that the species actually occurs in three separate populations.

The large West African population occurs in southern Senegal (replaced by *P. adansonii* in the rest of this country), Gambia, Guinea, Guinea-Bissau, Liberia, Sierra Leone, Côte d'Ivoire (Ivory Coast), Ghana, Togo, Benin, possibly southern Mali, southern Burkina Faso, southern Niger, Nigeria, and extreme western Cameroon. The isolated population on São Tomé is most closely related to Ivory Coast animals (Kindler et al. 2016) and probably represents an historic introduction (see TTWG 2014).

The disjunct smaller northeast population occurs in northern and eastern Cameroon, southwestern Chad, and northern and western Central African Republic. It appears to be completely isolated from the other two populations of *P. castaneus*.

**Figure 7.** Typical *Pelusios castaneus* habitat: a perennial pond inside the Guinea savannah zone (surroundings of Kara, Togo). Photo by Fabio Petrozzi.

**Figure 8.** A view of the Imo River, with alternating gallery forest and deforested grassy areas on the banks. This is one of the typical habitats of *Pelusios castaneus* in the Niger Delta, Nigeria. Photo by Luca Luiselli.

**Figure 9.** Altered mangrove habitat in the surroundings of Port Harcourt, Niger Delta, southern Nigeria. In this type of habitat, *Pelusios castaneus* is locally abundant and commonly captured by fishermen. Photo by Fabio Petrozzi.

The disjunct southern coastal population occurs in Gabon, the Republic of Congo (Brazzaville), the Democratic Republic of Congo (Zaire), Cabinda, and northwestern Angola (Maran and Pauwels 2005; Maran 2006; Trape et al. 2012). It is restricted to a narrow band of coastal savannahs and is well isolated from the West African and northeast populations by the major equatorial rainforests in Cameroon. Whether the species occurs in southern coastal Equatorial Guinea is open to question, but we would expect it there.

The species has been introduced to and well established in Guadeloupe (Antilles, see Breuil 2002 for details of localities). It does not occur on the Cape Verde Islands as previously indicated by Iverson (1992), but as corrected by Stuckas et al. (2013) and corroborated by TTWG (2014). Fossil specimens referred to this species are also known from recent Pleistocene and Holocene sites from northern Mali, northern Niger, northern Chad, as well as Sudan and South Sudan (Lapparent de Broin 2000).

In Guinea-Bissau it occurs both on the mainland and throughout the Bijagos Archipelago (Auliya et al. 2012). In Ghana, *P. castaneus* has been collected in Kété Kratchi (Tornier 1901), in Buipe (Leaché 2005), in the Afram Plains in the Ekyiamenfrom area (Segniagbeto, unpubl. data), and in the Akati and Hotoe areas in the Volta region, close to the Togo border (Segniagbeto, unpubl. data), from where many specimens are collected for the international pet trade.

In Togo, the species occurs sympatrically with *Pelomedusa subrufa (sensu lato)*, the most widespread and abundant chelonian species (Segniagbeto et al. 2013, 2014, 2015a). *Pelusios castaneus* was first recorded from Togo by Tornier (1901) from Mango and Bismarkburg (now Adéle). The species was recorded by Segniagbeto et al. (2014) from the localities of Kundja Konkomba, Mango, Kelekougan, Agoegan, Agbanakin, Djagble, Dekpo, Sevagan, Adamé, and Togodo National Park. In addition, it has been collected frequently in the surroundings of Lomé, Togoville, Lake Togo, and Kara.

In Benin, it is common and widespread all over the southern and central marshlands. The species was recently collected in Adrala along the Mono River (Segniagbeto and Assou 2013), and it appears to be very common in Mono Valley and other wetlands around Lake Tohou and Lake Aheme (Segniagbeto, unpubl. data). This species is also heavily exported from Benin for the international pet trade (Ineich 2006).

In Niger, it has only been recorded in the southernmost region, from the large transborder W National Park along the border with Benin and Burkina Faso (Chirio 2009; Chirio, Eniang, Luiselli, Petrozzi, Segniagbeto, and Hema, unpubl. data).

In Nigeria, it is widespread throughout the central and southern territories, inhabiting essentially the Sudanese and Guinea savannah regions, but entering also the dense forest

region and the coastal mangrove zones (Akani et al. 1999; Luiselli and Politano 1999; Luiselli et al. 2000). It may be absent from the Sahel areas in the northern territories, but more detailed research is needed.

In Cameroon, this species has been collected in several localities in the northern territories, especially in the mountain savannahs of Adamaoua, in the Sudanese savannahs, and in the Mandara mountains (Chirio and LeBreton 2007). It has also been recorded occasionally from the dense forests (Korup, Campo, and Longji, see Nieden 1910; Monard 1951; Lawson 1993), but, according to Chirio and LeBreton (2007), these appear to be cases of misidentification with *P. chapini*.

In Gabon, it has been observed mainly in coastal localities in the provinces of Estuaire, Moyen-Ogooué, Nyanga, and Ogooué-Maritime (Bour 1983; Iverson 1992; Maran and Pauwels 2005; Maran 2006; Pauwels and Maran 2007). However, it is also common at a few slightly inland sites, such as Lambaréné (Maran 2006).

Along the Congo river, *P. castaneus* is limited to the lower watershed basin, being replaced by *P. chapini* above the cataracts. Its presence in Angola was recently confirmed by Luis Ceriaco (pers. comm.), who found several specimens near Cacuaco, 10 km northeast of Luanda.

Finally, the presence of this species or of a closely related taxon previously occurred in the Seychelles, probably on Mahé (see the CBFTT account on *P. seychellensis* by Bour and Gerlach 2008 and their distribution map, Fig. 3). The modalities of its historical arrival and possible settling on Mahé remain enigmatic (Bour 2013; TTWG 2014).

**Habitat and Ecology.** — Although most observations on habitat use by *P. castaneus* are anecdotal and/or descriptive without robust statistical design, it is clear that this species has wide habitat tolerances (Branch 2008). Indeed, it inhabits a wide variety of types of water bodies, generally within either grassy or lightly forested savannahs, or within gallery forests and mangroves (Akani et al. 1999; Luiselli and Politano 1999; Luiselli et al. 2000). It is difficult to define a particular type of habitat utilized by this species, as it is locally abundant in both rivers and streams, as well as in marshlands, lagoons, and lakes (Luiselli et al. 2000). For instance, it can be observed in both temporary and perennial ponds inside the Guinea savannah zone (for instance in central Togo, see Fig. 7), as well as in large rivers surrounded by gallery forest (for instance, in southern Nigeria, see Fig. 8), and along rivers crossing throughout altered mangrove forests (for instance, in southern Nigeria, see Fig. 9). In coastal Gabon, it is mainly confined to shallow aquatic ecosystems with dense or sparse vegetation banks (swamps, submerged shrub savannahs, lagoon banks) between the Atlantic Ocean and the extended equatorial forest (Maran and Pauwels 2005; Maran 2006).

The equatorial forest appears to be a barrier towards its colonization of most continental areas in Cameroon and Gabon (Maran and Pauwels 2005; Maran 2006), although this species is found in gallery forests and in the large submerged groves of the coastal plains of Ogooué-Maritime and Nyanga provinces (Maran 2006). It is an ombrophilous species fond of habitats with dense aquatic vegetation (Maran and Pauwels 2005). Considering that in Gabon and in Cameroon the species does not penetrate deeply into the extended tropical forest, its penetration into forested environments in Nigeria may depend on the heavy deforestation and pristine habitat alteration that has occurred in most of the southern regions of this country (especially in the Niger Delta) after the discovery of oil in 1958 and the consequent expansion of the petrochemical industry.

A similar penetration process from savannah to forests has been demonstrated for at least one other reptile species, i.e., the savannah cobra, *Naja nigricollis,* that has recently spread over the whole forested region of Nigeria, challenging the niche of the forest species, *Naja melanoleuca* (Luiselli 2001, 2002). A same pattern of forest colonization and niche expansion in Niger Delta is also likely occurring in two other sympatric chelonian species, i.e. *Kinixys nogueyi* (see Segniagbeto et al. 2015b) and *Pelomedusa subrufa (sensu lato)* (see Luiselli et al. 2015). In support of the penetration hypothesis, it should be stated that *P. castaneus* is still clearly less common in Cross River State (where the largest and most intact portions of Nigerian rainforest are found) than in the Niger Delta, where forest habitat alteration has been rampant for decades (Akani, Eniang, and Luiselli, unpubl. data).

Some authors have stated that the species inhabits primarily temporary water bodies, thus estivating in sand or moist mud during dry spells (Ernst and Barbour 1989; Branch 2008). However, in Benin, Ghana, Nigeria, and Togo it also frequently inhabits permanent water bodies, including large rivers, where it can reach high population densities (Luiselli, Akani, Eniang, Petrozzi, and Segniagbeto, unpubl. data). Indeed, it is a good swimmer, although it usually prefers shallow waters.

The only quantitative analyses on habitat use by *P. castaneus* came from Nigerian populations. In the Niger Delta of southern Nigeria, this species has been found in 12 out of 52 sites sampled for freshwater turtles (Luiselli et al. 2000), and logistic regression models revealed that its presence was significantly correlated only with the presence of mature dry forest on the banks (Luiselli et al. 2000). Moreover, in terms of the ecological correlates of its presence/absence, *P. castaneus* differed substantially from all other sympatric turtle species, apart from *P. niger,* which is often syntopic and whose presence was also significantly influenced by the presence of mature dry forest on the banks (Luiselli et al. 2000). However, the main habitat difference between these two species was that the probability of presence of *P. niger* was positively influenced also by the presence of mature

swamp/flooded forest on the banks, whereas this latter habitat type did not positively influence the probability of presence of *P. castaneus* (Luiselli et al. 2000).

The habitat use by *P. castaneus* in the Niger Delta of southern Nigeria also depended considerably on the pollution level of the water bodies. In relatively unpolluted areas, this species mainly inhabited main river tracts and marshlands surrounded by open grassy vegetation, avoiding forest ponds (Luiselli and Akani 2003). In areas polluted by oil spills, its habitat selection shifted remarkably, with most of the remaining individuals concentrated along the main river tract (Luiselli and Akani 2003). In addition, the spatial niche breadth tended to be significantly narrower in oil polluted areas than in unpolluted biotopes (Luiselli and Akani 2003).

The species occurs from sea level (e.g., coastal forests of the River Niger Delta in southern Nigeria: Luiselli et al. 2000) up to at least 1300 m a.s.l. (Yarimbang, Cameroon: Chirio and LeBreton 2007).

*Pelusios castaneus* is considered to be omnivorous (Ernst and Barbour 1989), but most comments on its diet are rather anecdotal. For instance, Broadley (1981) stated that it feeds essentially on large pulmonate snails and floating water lettuce. In Gabon, Maran and Pauwels (2005) and Maran (2006) observed the presence of several small stones, large amounts of plants, seeds, fish and aquatic invertebrates (insects, snails, shrimps, crabs, mollusks).

The diet of this species has been studied quantitatively only in the Niger Delta area of southern Nigeria. Luiselli (1998) found that two populations from Elem-Sangama (Rivers State) and Eket (Akwa-Ibom State) were both omnivorous, with algae and amphibians being consumed significantly more often in Eket and fish and aquatic plants in Elem-Sangama, with other consumed food items including invertebrates (Oligochaeta, Gastropoda, Crustacea, Insecta) and fruit and seeds. A second study in the same area (Luiselli et al. 2004), showed that there were remarkable dietary shifts in populations of this species between oil polluted and unpolluted water bodies. In the polluted area, the composition of the diet of *P. castaneus* consisted mainly of annelids (earthworms and leeches in 42% of individuals) and gastropods (57%), whereas in the unpolluted area it consisted mainly of crustaceans (in approximately 20% of individuals) and fish (in over 50% of individuals). In the unpolluted study area, the diet composition also shifted substantially between seasons, with a comparative preponderance of fish and anurans (both tadpoles and adults) during the wet season.

The feeding apparatus of *P. castaneus* has been studied in detail: it has a highly distensible esophagus that stores excess water sucked in during feeding until the prey is fixed by the jaws. This considerable distension is probably achieved by a combination of both active (hyoid branchial horn) and passive (water) components (Lemell et al. 2000). Studies on feeding kinematics have shown that the smaller and less agile the prey, the more this species enhances the suction component of its feeding patterns (Lemell and Weisgram 1996).

The species has been considered to be normally crepuscular or nocturnal (Ernst and Barbour 1989; Maran and Pauwels 2005). However, individuals can also be collected easily during the daytime in both Togo and Nigeria (Luiselli et al., unpubl. data). In Gabon, Maran (2006) observed that *P. castaneus* was active both day and night, with intense activity occurring just after dusk (around 1830 hrs) and declining markedly during the full moon.

The data available on the reproductive biology of *P. castaneus* in the field are scarce. The nesting period occurs during the dry season in the northern hemisphere, with egg-laying occurring between February and March in West Africa (Cansdale 1955), with eggs hatching by the wet season (June to July, see Cansdale 1955). In the southern hemisphere (e.g., in Gabon), egg-laying occurs between July and September (the dry season there), and hatchlings emerge between October and December (wet season: Maran 2006). Each female lays eggs at least twice a year (Maran 2006), with a clutch size range of 3–9 eggs and overall fecundity of 6–18 eggs annually (Cansdale 1955; Villiers 1958). In Tchengué, Port-Gentil, Gabon, a female measuring 131 mm CL and weighing 359 g, carried 9 oviductal eggs, 34–35 mm long and 19–22 mm wide, with a mass of 8 g each. The eggs are oblong, soft and characterized by a chalky uniformly white shell, and measure 36 x 21 mm in West Africa (Villiers 1958) and 33–37 mm (mean = 34.8 mm, n = 39) x 22–27 mm (mean = 24.6 mm) in Central Africa (Gabon: Maran and Pauwels 2005; Maran 2006). Egg mass was 8–15 g (mean = 11.8 g, n = 39) in Gabon (Maran and Pauwels 2005; Maran 2006). Hatchlings have a CL of 28–30 mm in West Africa (Villiers 1958), and 36–39 mm (mean = 37 mm, n = 26) in Central Africa (Gabon: Maran and Pauwels 2005; Maran 2006).

Selection of nesting sites was studied by radiotracking gravid females in the Niger Delta of southern Nigeria (Luiselli et al. 2006). Of the monitored females, 100% (n = 11) oviposited in sandy places with abundant vegetation along ponds and not along the river banks. The preferential selection of pond banks instead of river banks as nesting sites may be an anti-predator strategy (Luiselli et al. 2006). Most of the females oviposited less than 20 m from the water bodies at a non-polluted site, but at more than 50 m of distance at an oil-polluted site (Luiselli et al. 2006). In Gabon, the cavities excavated by females for laying eggs are about 10 cm deep, and usually placed near water (Maran 2006). According to Maran's (2006) observations in Gabon, it seems that juveniles often remain in the vicinity of their hatch site, staying hidden in dense vegetation and/or in residual water pools adjoining small streams.

Home ranges were studied in the Niger Delta of southern Nigeria by radiotracking 39 individuals for over 60 days each (Luiselli et al. 2006). Adult females had a mean home range of 2.6 ± 1.1 ha (S.D.), and males 2.4 ± 1.5 ha, with no significant sexual differences (Luiselli et al. 2006). However, the mean home ranges were significantly larger in an oil-polluted site than in a non-polluted site, in both males (from 2.9 ha to 1.6 ha) and females (from 3.3 to 1.7 ha), probably because the turtles needed more extensive movements to find suitable habitats to feed and survive (Luiselli et al. 2006).

Adult sex ratio (males: females) was close to 1:1 in three wild populations studied to date, i.e., in Elem Sangama (0.78:1) and Eket (1:1) in Nigeria (Luiselli 1998), and in Togoville (0.74:1) in Togo (Segniagbeto et al. 2015a). The percentage of young individuals appears to vary markedly among populations. For instance, the Togoville population consisted of more young specimens than the studied Nigerian populations (Segniagbeto et al. 2015a).

As a defensive display, *P. castaneus* does not bite or act aggressively, but retracts into its shell with its hinged plastron and exudes a yellowish, oily odoriferous secretion through its axillary and inguinal glands (Maran 2006).

Many wild individuals are externally parasitized by leeches in both Gabon (Maran 2006) and Nigeria (Luiselli et al., unpubl. data). Internal parasites include the helminths *Polystomoides bourgati,* found in turtles from Lomé, Togo (Combes and Kulo 1978), and *Hapalorhynchus tchalimi* from turtles in Djebba, Benin (Bourgat and Kulo 1987).

*Pelusios castaneus* may be a potential competitor of *P. niger* in the forest water bodies of southern Nigeria, given that they exhibit relatively similar habitat choices and dietary habits (Luiselli et al. 2000, 2004). The intensity of interspecific competition between these turtle species appears more intensified in oil-polluted sites due to a higher similarity in space use and food items (Luiselli and Akani 2003; Luiselli et al. 2004). Indeed, sophisticated statistical simulations (i.e., Monte Carlo permutations on dedicated null model algorithms) revealed there was a statistically significant increase in the similarity of habitat use in the polluted areas between these two *Pelusios* species, with increased potential for interspecific competition (Luiselli et al. 2006). However, the different body sizes (*P. niger* is a bigger species) may possibly minimize the intensity of their interspecific competition via differential use of food resource sizes (Luiselli et al. 2004).

**Population Status**. — *Pelusios castaneus* has a large geographic range. Nevertheless, progressive desertification of the Sahelian region may bring about the progressive elimination of certain northern populations, as evidenced already in some countries (i.e., Mali, Niger, Chad, and Sudan) from which the species has been recorded as fossils, but has since disappeared from its northern localities.

Local declines may have occurred in a few study cases that have been described in the Niger Delta of southern Nigeria. For instance, the species tends to be quickly extirpated from sites subjected to oil spillage (Luiselli and Akani 2003; Luiselli et al. 2006), but also in sites which were not subjected to heavy pollution but simply by human development and deforestation, such as along the Ethiope River in Delta State, where the species was captured several times in 1982 but not twenty years later (Lea et al. 2003).

However, there is no evidence that these population declines are in any way generalized. For instance, the numbers of traded *P. castaneus* individuals did not vary remarkably over time in nine markets of the Niger river Delta surveyed in 1996–2002 (41 visits) and again in 2011–12 (18 visits), thus suggesting a stable local population (Luiselli et al. 2013). In Togo, this species is intensively harvested for the pet trade (Segniagbeto et al. 2014b). Up to date, there is no assessment of status of the population of this species in order to provide data on the impact of this exploitation on the wild populations.

**Threats to Survival.** — This species is widespread in West Africa and locally abundant in several places of its range, but is regularly collected by humans for food (e.g., Branch 2008; Luiselli et al. 2013) and for traditional medicine (Segniagbeto et al. 2013). Also, it is often exported from Africa for sale to turtle hobbyists, with Ghana, Togo, and Benin being the main exporting countries (Ineich 2006; Segniagbeto 2009); although, it seems to be little sought after and does not fetch high prices. Apparently, there is no evidence that the international pet trade currently threatens wild populations of this species.

Climate change effects, including desertification, may constitute a significant threat for the northern populations of this species that inhabit remnant wetlands dispersed inside arid environments in the Sahelian savannah vegetation zone. In that region, *P. adansonii* is more adapted to the environment and could possibly emerge as a competitor there.

**Conservation Measures Taken**. — The species has been listed as Least Concern by the IUCN Red List since 1996 and is not included on the CITES Appendices. A recent 2013 draft assessment of its conservation status by the IUCN Tortoise and Freshwater Turtle Specialist Group reaffirmed its status as Least Concern.

At the present time, this species is not the focus of any direct conservation effort, and it doubtless occurs within a variety of protected areas within its wide range. Among the protected areas where this species has been recently observed (2010 to 2016), we note Banco, Comoé, and Tai National Parks in Côte d'Ivoire (Ivory Coast); Mole National Park in Ghana; Togodo, Oti-Keran, and Fazao-Malfakassa National Parks in Togo; W National Park in Benin, Burkina Faso, and Niger; Upper Orashi, Edumanom, Egbedi Creek, Taylor Creek, Nun River, and Stubbs Creek Forest Reserves, Yankari

Game Reserve, and Okomu, Kainji Lake, Gashaka-Gumti, and Cross River National Parks in Nigeria; Korup National Park in Cameroon; and Loango and Moukalaba-Doudou National Parks in Gabon (Maran and Pauwels 2005; Pauwels and Maran 2007; Segniagbeto et al. 2014b).

**Conservation Measures Proposed.** — Monitoring of export quantities of this species, especially from Ghana, Togo, and Benin, should be undertaken in order to better understand and possibly regulate the potential adverse effects of trade of wild populations. No other specific measures are recommended at this time.

**Captive Husbandry.** — This species does very well in captivity, where it can be kept at 27–31°C of water temperature and 28–32°C of air temperature. In captivity it feeds almost exclusively on animal food, including fish, crustaceans, insects, mollusks, and meat, but accepts pet pellets and also tender fruits like pears. In captivity, *P. castaneus* is much less sensitive to polluted water than *P. niger*.

**Current Research.** — Currently, *P. castaneus* is not the subject of any specifically dedicated ecology research projects. However, it is one of several target turtle and tortoise species of an ongoing long-term research project in southern Nigeria for 20 years, including mark-recapture protocols. This project has been carried out under the supervision of Luiselli and in collaboration with scientists at the Rivers State University of Science and Technology (mainly Godfrey C. Akani) and at the University of Uyo (mainly Edem A. Eniang). The Nigerian studies also involve monitoring of bushmeat markets in order to verify whether trade trends vary over the years (Luiselli et al. 2013; Akani et al. 2015). Luiselli, Petrozzi, and Segniagbeto have carried out ecological studies on *P. castaneus* in Togo since 2012, and the ethnozoology of these turtles is also being studied in Nigeria and Togo.

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