

Cyclanorbis elegans (Gray 1869) – Nubian Flapshell Turtle

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SUMMARY. – The Nubian Flapshell Turtle, *Cyclanorbis elegans* (Family Trionychidae), is a large softshell turtle (total carapace length up to 700 mm) from north central Africa. It is the largest and least ossified member of the flapshell subfamily Cyclanorbinae. This highly aquatic species occurs in large rivers of the Sahelo-Sudanese belt from the Mole River in northern Ghana to the Sobat River of South Sudan. The flesh and cartilaginous portions of the shell are known to be consumed in Ghana and South Sudan; however, the species is likely hunted for food throughout its range. In South Sudan, turtle eggs are collected by pastoralists who bring their cattle to feed on the “toic” grasslands that form when the floodwaters of the Nile recede. Records of this species are rare and it is in need of immediate conservation attention.

DISTRIBUTION. – Benin, Cameroon, Central African Republic, Chad, Ethiopia (probably), Ghana, Nigeria, South Sudan, Sudan, Togo. Large river systems of the Sudanian and Guinea savannah including the Volta River drainage in Ghana and northern Togo, the Niger River, and the White Nile basin of South Sudan and Sudan.

SYNONYMY. – *Baikiea elegans* Gray 1869, *Cyclanorbis elegans*, *Cyclanosteus elegans*, *Tetrathyrba baikii* Gray 1865 (partim), *Cyclanorbis oligotylus* Siebenrock 1902.

SUBSPECIES. – No subspecies recognized.

STATUS. – IUCN 2015 Red List: Near Threatened (NT, assessed 1996), TFTSG Draft Red List: Critically Endangered (CR, assessed 2013); CITES: Not Listed.

Taxonomy. – The complex taxonomic history of the genus *Cyclanorbis* was clarified by Loveridge and Williams (1957) and Webb (1975). *Cyclanorbis elegans* was first described as *Baikiea elegans* by Gray (1869) based on five

syntypes: BMNH 1946.1.22.15, 1947.3.6.26, 1947.3.6.27, 1947.3.6.28 and 1947.3.6.29 that include four skulls of adult turtles and a juvenile in alcohol. The locality for these specimens, collected by W. Balfour Baikie, was



Figure 1. Adult male *Cyclanorbis elegans* in captivity. Photo by Maurice Rodrigues.



Figure 2. Adult male *Cyclanorbis elegans* in captivity. Photo by Maurice Rodrigues.

initially given simply as “West Africa”, but was later restricted to the Niger River by Webb (1975) based on the route of Baikie’s travels (e.g., Baikie 1856). The many early names proposed for specimens of *Cyclanorbis* was based on Gray’s (and others’) use of plastral callosities as diagnostic characters (e.g., Gray 1865a). Over time, the number of museum specimens increased and examination of a reasonably complete ontogenetic series revealed that the number of callosities increased with age (Gray 1865b; Siebenrock 1906).

Cyclanorbis elegans is distinguished from its congener *C. senegalensis* by its larger size and the presence of two, or less commonly, four plastral callosities in adults, whereas the smaller *C. senegalensis* has up to nine callosities. Given that the adult specimens described as *B. elegans* by Gray (1869) were represented by skulls, they lacked the salient diagnostic characteristics (e.g., color, plastral callosities) for the genus. Boulenger (1889) re-assigned the adult skulls of *B. elegans* to *Cyclanorbis senegalensis* and restricted *B.*



Figure 3. Adult male *Cyclanorbis elegans* in captivity. Photo by Maurice Rodrigues.

elegans to the juvenile specimen. Consequently, Siebenrock (1902) described *Cyclanorbis oligotylus* based on a large shell with two plastral callosities collected in “Nubia”. Werner (1908, 1924) followed this taxonomic arrangement for the larger of the two *Cyclanorbis* species he collected from Bari fishermen in Mongalla, South Sudan, and for a large shell collected by Morley Wenyon in “Nasser, Upper

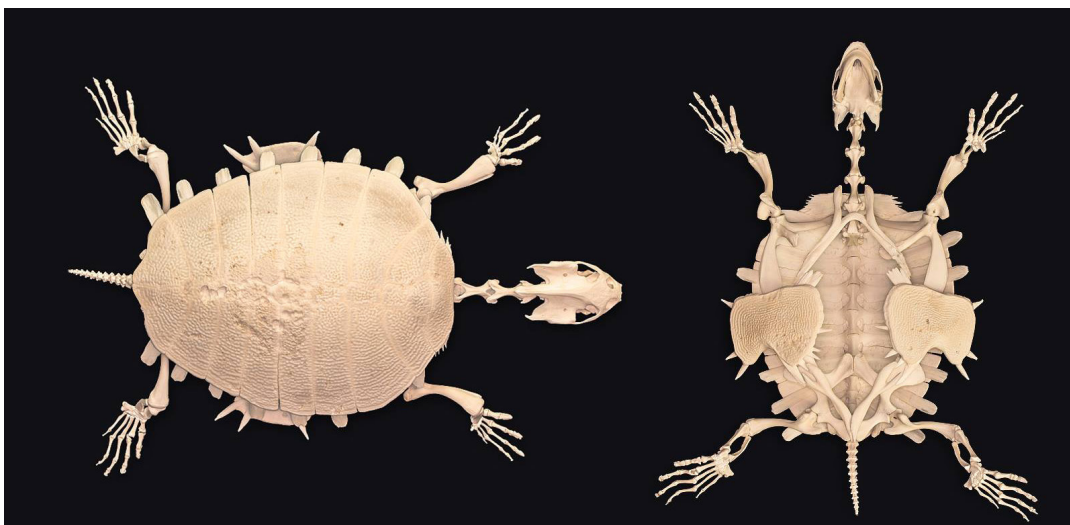


Figure 4. Skeleton of adult *Cyclanorbis elegans*, collection of T. Diagne. Photo by Jay Villemarette.

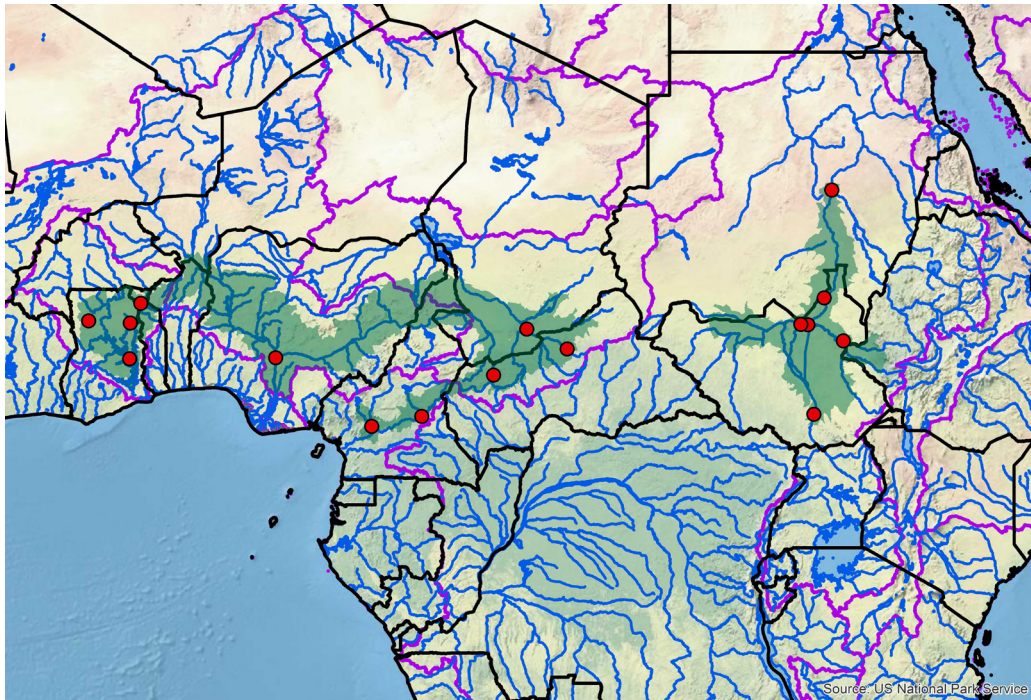


Figure 5. Distribution of *Cyclanorbis elegans* in sub-Saharan Africa. Purple lines = boundaries delimiting major watersheds (level 3 hydrologic unit compartments – HUCs); red dots = museum and literature occurrence records based on Iverson (1992) plus more recent data, and the authors' personal data; green shading = projected historic native 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.

Sobat" in what is now South Sudan. Phylogenetic analyses based on morphological and molecular characters confirm that the two extant species of *Cyclanorbis* are each other's closest relative and distinct from other African and Asian flapshell turtles (Meylan 1987; Engstrom et al. 2004; Le et al. 2014).

Description. — Loveridge and Williams (1957) provided a comprehensive description of hatchling and adult *C. elegans* based on specimens in London and Vienna. Hatchlings have a projecting fleshy proboscis; the distance from the tip of the proboscis to the orbit is greater than the orbital diameter. Nostrils have a papilla-like process projecting from the median wall. The upper lips meet medially to form a flat arch. The forelimbs have 4 crescent-shaped skinfolds on their upper surface and another small weal-like thickening on the lateral aspect. The hindlimbs have a crescent-shaped fold under the heel, posterior to the base of the fifth toe. The tail in males extends beyond the rim of the carapace, in females it is shorter, and in hatchlings it is rudimentary.

In hatchlings, the carapace has a moderate vertebral keel and numerous small tubercles arranged in longitudinal rows that converge anteriorly (see Gray 1869, pl. 15). The leathery margin is not extensive posteriorly, scarcely extending beyond the tail. The plastron of hatchlings is smooth, without callosities. The first callosities to appear are the hyo-hyoplastral and the last to form, if at all,

are the xiphiplastral callosities. Loveridge and Williams (1957) observed that young *C. elegans* (CL = 170 mm) from the Chari River showed no evidence of plastral callosities. The femoral flaps permit concealment of the hind limbs; however a caudal flap is absent in hatchlings (Loveridge and Williams 1957) and poorly developed in adults (Gramentz 2008).

The bones comprising the carapacial disk are distinctly granulated. The prenuchal bone is absent, and the nuchal bone is not notched laterally, but with multiple digitations



Figure 6. Habitat of *Cyclanorbis elegans*: the Nile River near Mongalla, South Sudan, near where Werner (1908) obtained *C. elegans* shells from Bari fishermen. Photo by Tracy Baker.



Figure 7. Interview with fishermen in Bor, South Sudan, drawing two softshells: the larger one on the right is *Trionyx triunguis*, the smaller one on the left is *Cyclanorbis*. The difference between species is indicated by the shape of the carapace, the size of the turtle, and the ratio of the bony shield to total carapace length. Photo by Tracy Baker.

underlying the first pleurals, between which are two neurals. All of the large specimens collected by Werner had 6–8 neurals (Siebenrock 1906); however, 14 specimens examined by Meylan (1987) varied in neural numbers and arrangement: 21% had 7 neurals, 43% had 8, and 36% had 9 neurals. Long continuous rows of neurals or many isolated neurals are found in both *Cyclanorbis* species (e.g., Hughes 1979); however, *C. senegalensis* tends to have more isolated neurals than *C. elegans* (Meylan 1987). There are 8 pairs of pleurals; the eighth pair is always in contact medially. Depressions for articulation of the ilia are absent on the ventral side of the eighth pleurals (Meylan et al. 1990).

While the carapace offers some problems in diagnosis for the genus, the arrangement of plastral bones and their superficial callosities are distinct between *C. senegalensis* and *C. elegans* (see Siebenrock 1902, figs. 16–17). The epiplastra are widely separated and the anterior branch is longer than the posterior. The entoplastron forms an acute angle. The hyo–hypoplastra fuse shortly after hatching to form a compound bone whose anterior border is straight or somewhat concave, but never convex. The posterior borders of the hyo–hypoplastra are very deeply notched. In young specimens, the processes of the plastron are relatively exposed, but as ossification of the hyo–hypoplastra progresses they become increasingly concealed (Hughes 1979). The prongs of the anteromedial process are indistinct. The medial process is relatively short and only slightly projecting. The posteromedial processes of the hyo–hypoplastra have three prongs which are inserted into the two anterior prongs of the xiphiplastron. The rodlike xiphiplastron are broader anteriorly and not in contact with one another. Adult specimens have 2–4 callosities, granulated on the outer surface like the carapace; usually two on the hyo–hypoplastra only, covering most of these bones but widely separated medially; occasionally there are small callosities on the xiphiplastron (e.g., Siebenrock 1902, fig. 17).

Excellent illustrations and a detailed description of an adult *C. elegans* skull (BM 65.5.9.22 = 1947.3.6.28) are presented by Loveridge and Williams (1957). The distance between the anterior premaxilla and the anterior orbit is greater than the long diameter of orbit. The height of the orbit is about 1.3 to 1.5 times the interorbital width, which is less than the width of the naris. A single premaxilla is present and does not separate the maxillae underneath the naris. The maxillary triturating surfaces meet behind the premaxilla, their inward extensions closing or partly closing over the intermaxillary foramen. More dorsal flanges of the maxillae meet medially behind the triturating surfaces, ventral to the vomer, for a distance greater or less than the palatal length of the premaxilla. The vomer is slender and in contact with the prefrontals. The interchoanal portion of the vomer is moderately long. The choanae are only slightly narrowed by inward extensions of the triturating surfaces of the maxillae. The postorbital arch is more than half the long diameter of the orbit. The orbit is entered by the jugal, which is narrowly in contact with the parietal. The squamosal crests are long, sharp, straight, or incurved. The pterygoids meet the opisthotic, greatly restricting the postotic fenestra. Hughes (1979) identified the lower jaw of *C. elegans* by its wide triturating surface, narrow symphyseal notch, and distinct post-coronoid foramen leading into the Meckelian fossa.

The carapace of hatchlings is dark olive brown with large irregular blotches of yellow, the periphery sometimes with a few, scattered, somewhat smaller, roundish, yellow spots (see Gray 1869, pl. 15). The carapace of adults is light brown to olive green with light green spots near the edges. The plastron of hatchlings is yellowish with a dark central area and profusely spotted towards the edges. The fleshy underside of the disk is edged or spotted with yellow. The plastron of adults is light yellow and may have dark blotches. The description by Gramentz (2008) of the plastron as being pink is likely the result of vascular “blushing” often observed in trionychids.

The head and neck of hatchlings are gray brown above. In his original description of *C. elegans*, Gray (1869) described the hatchling as having small spots on the crown, but the lateral spots were larger and unequal-sized. The chin and throat are anteriorly vermiculated, whereas the neck is yellow and immaculate. The limbs are uniform or mottled with yellow. The head of adults is dark brown with light green vermiculations. The temporal region is olive green, but the neck is lighter, speckled and spotted with yellow. The underside of the throat and neck is uniformly yellow.

The maximum carapace length recorded so far for *C. elegans* was a 676 mm male in the collection of W.P. McCord (Gramentz 2008). The series of bony carapacial disks collected in Mongalla by Werner ranged from 223 to 490 mm

(mean = 438 mm; n = 9) (Siebenrock 1906). Given that the 676 mm male had a bony disk of only 478 mm, Gramentz (2008) suggested that carapace length in this species might exceed 700 mm. Meylan et al. (1990) reported a bony disk of 520 mm for a fossilized *C. elegans* from Koobi Fora deposits near Lake Turkana, Kenya. The mass of the large male in McCord's collection was 20.4 kg, whereas a smaller female weighed only 11.3 kg (Gramentz 2008).

In adult specimens, the sex can be distinguished by observing the length and shape of the tail. For males, the tail is visible beyond the rim of the carapace in ventral view and is wide and blunt, while that of the female is tapered and concealed beneath the caudal flap (Gramentz 2008). In *Cycloderma frenatum*, the carapace of males is narrow relative to that of females (Peters 1882); this appears to also hold true for *C. elegans*, as the calculated ratios of carapace width to carapace length for the male and female specimens from McCord's collection are 1:1.43 and 1:1.28, respectively (data from Gramentz 2008).

Distribution. — *Cyclanorbis elegans* has a wide but disjunct distribution. It is known from the White Volta drainage in Ghana and northern Togo, in central Nigeria, southern Chad, and the White Nile basin of South Sudan and Sudan (Iverson 1992; Gramentz 2008). Constructing an accurate range map is confounded by museum specimens that lack precise labeling. For instance, one specimen of *C. elegans*, deposited in the Zoological Museum of Berlin (ZMB 16011), is labelled as coming from Togo, and Tornier (1901) and Loveridge and Williams (1957) referred to specimens from Kete Krachi, Togo (ZMB 16012) and Jendi (Yendi), Togo. However, these localities are now in Ghana as a result of post-colonial changes to political boundaries (Gramentz 2008; Segniagbeto et al. 2014). At the time the Kete Krachi specimen was collected, the village was located on the eastern banks of the White Volta River near the confluence with the Oti River; however, this area was subsequently flooded in the mid-1960s when Lake Volta formed behind the Akosombo Dam (Gramentz 2008). Kete Krachi was relocated farther north on the shores of the lake, but it is not known if *C. elegans* still inhabits the lake. The species is known to occur at Sansanné-Mango (10°21'N, 0°28'E), upstream from Lake Volta, in the Oti River, Togo (Segniagbeto et al. 2014).

Occurrence of this species in intervening or headwater countries, such as Benin or Ethiopia, is likely but not certain. Gramentz (2008) questioned the record(s) from Cameroon (Chirio and LeBreton 2007). However, examination of photographic materials (provided by L. Chirio at the TFTSG Red List workshop in Lomé, Togo, August 2013) revealed that these specimens were clearly *C. elegans*.

Fossil material of this species has been recorded from the Pleistocene Omo beds to the north of Lake Turkana and from the Pliocene beds of Lothagam Hill and Koobi Fora in

the Lake Turkana basin (Meylan et al. 1990). The presence of these remains in northern Kenya suggests the historic distribution for *C. elegans* was greater due to hydrologic connections that are mirrored in the ichthyofauna of Lake Turkana (Meylan et al. 1990).

Habitat and Ecology. — There is no accurate or quantitative field study on the ecology of this species. It is generally assumed that *C. elegans* inhabits large rivers of the Sudanian savannah (Gramentz 2008). Nonetheless, there are also records for the Guinea savannah region, for instance, in Mole National Park and Kete Krachi (Ghana), along the Oti River (Togo), and around Lokoja (Nigeria), so it is possible that the species has a wider ecological tolerance than presently known (Branch 2008).

Skeletal remains of both *Cyclanorbis* species have been collected from the same locations (Siebenrock 1906; Werner 1924; Hughes 1979); therefore, they are assumed to occur sympatrically. Pritchard (2001) hypothesized that when gross sympatry occurs in softshell turtles, direct competition between species may be reduced by divergence in adult size or feeding specializations. The broad crushing surface of its mandible suggests that *C. elegans* is adapted to eat hard-bodied animals, but this remains to be confirmed by field observation. It is unknown whether behavioral divergence between *Cyclanorbis* species facilitates the utilization of different microhabitats or feeding niches.

There are no published data on reproduction in *C. elegans*. The nesting season for turtles that inhabit the Sudd wetlands in South Sudan is likely to occur towards the end of the dry season (December to March) when upland areas are available. Timing of nesting is likely similar to *C. senegalensis*. A gravid female *C. senegalensis* was collected by Werner at Duem, Sudan on 12 April (Siebenrock 1906). Hatching and emergence from the nest may coincide with the beginning of the rainy season (April to November) when the uplands adjacent to the river are flooded by rising waters. Determining basic reproductive data (clutch size, egg size, clutch frequency) is critical to our understanding of the life history of this species and should be a priority for both *in-situ* and *ex-situ* conservation programs.

Population Status. — Quantitative data on any populations are lacking. Despite survey work across West Africa, no live animals have been observed in recent times and fewer than 5 specimens have been recorded in the last 20 years. This suggests that the species is exceedingly rare, although no direct evidence for a declining status is yet available. With such few records any decline would be hard to quantify.

Girgis (1961) stated that *C. oligotylus* (a junior synonym of *C. elegans*) was "rather rare" in the vicinity of Khartoum, Sudan, but relatively common in southern Sudan (now South Sudan). Suitable habitat remains largely intact in the vast wetlands of South Sudan, and hunting pressure on chelonians

is relatively low (Baker, pers. obs.). No specimens, live or dead, have been observed from the eastern portion of the range (i.e., White Nile and its tributaries) in recent years. However, ongoing conflict in the region has limited access to these rivers for additional survey work.

Threats to Survival. — Riverine turtles, like *C. elegans*, face similar pressures of extensive habitat destruction by sand mining, damming, channelization, and pollution (Moll and Moll 2004). While the habitat of *C. elegans* has been mostly untouched by industrial development, planned hydrologic interventions upstream from the Sudd wetlands of South Sudan could have drastic consequences for *C. elegans* and other species that rely on the natural function of this flood-pulse ecosystem (Rebelo et al. 2012).

Human consumption of large softshell turtles is widespread and poses a serious threat to *C. elegans* (Luiselli 2009). Bari fishermen in South Sudan consume the flesh of both *Cyclanorbis* species, including the cartilaginous portions of the shell (Siebenrock 1906). About half of the museum specimens utilized in a description of skeletal morphology had been harvested and butchered (Meylan 1987). Similarly, fragmentary remains of a hyo-hyoplastral bone collected from a village midden in Ghana showed evidence of cutting (Hughes 1979). In South Sudan, turtle eggs are opportunistically collected by pastoralists who bring their cattle to feed on the “*toic*” grasslands that form when the floodwaters of the Nile recede (Baker, unpubl. data). Eggs of large softshells (e.g., *Trionyx triunguis*) are consumed in southern Nigeria (Luiselli et al., unpubl. data). Thus, it is likely that the same applies to Nigerian populations of *C. elegans*. Collection for the pet trade is not considered a threat to the species, as it has not been recently reported to have been exported from Togo, Ghana, or Benin, which are the main export countries of reptiles for West Africa (examination of CITES dataset).

Conservation Measures Taken. — *Cyclanorbis elegans* is not protected or regulated under international legislation. It is currently listed on the IUCN Red List as Near Threatened based on a 1996 assessment, and by the IUCN Tortoise and Freshwater Turtle Specialist Group as Critically Endangered based on a 2013 draft assessment performed at a Red Listing workshop in Lomé, Togo. It is not listed by CITES.

Some protection for this species may be afforded by its occurrence in National Parks and other protected areas within its range. Hughes (1979) found the remains of this species near the Mole River in Mole National Park (Ghana); however, it is not known with certainty to occur in this or other secure protected areas in Ghana. Keran National Park (Togo) protects a portion of the Oti River downstream from Mango. Manda National Park (Chad) borders the Chari River downstream from Sarh (formerly Fort Archambault). Historic records from Mongalla, South Sudan, are adjacent to Bandingilo National Park which

includes two sections of the Bahr el Jebel (White Nile) and associated wetlands. The Sudd wetlands of South Sudan were designated as a Ramsar wetland site of international importance in 2006.

Conservation Measures Proposed. — The long-term survival of *C. elegans* is contingent on understanding and protecting the habitat of this critically endangered species and preventing its extinction by overexploitation for consumption. Surveys of its distribution, population status, reproductive ecology, and population trends are urgently required, including descriptions and evaluations of exploitation and other observed and potential threats. Conservation measures, possibly including establishment of additional protected areas and measures to manage targeted capture and reduce bycatch in fisheries, are likely needed. Further, given the rarity of this species, *ex-situ* conservation (i.e., assurance colonies for conservation breeding) should be established.

Captive Husbandry. — In captivity, *C. elegans* readily consumes fish, mice, and trout chow. Animals tend to bury themselves in sandy substrates in shallow water, and when provided with live fish, demonstrate their effectiveness as ambush feeders.

Current Research. — Patrick Baker interviewed fishermen familiar with this species in South Sudan as part of a broader natural resources inventory in Jonglei state. Tomas Diagne (African Chelonian Institute) is engaged in surveys in West Africa (Benin and Nigeria). He has trained local members of conservation associations (Nature Tropicale ONG & NIOMR) in field surveys and identification techniques in order to identify remaining wild populations. Luca Luiselli, Fabio Petrozzi, Godfrey C. Akani, and Gabriel H. Segniabeto are investigating the status and distribution of this species in Togo and Nigeria, under the support of conservation organizations such as the Mohamed bin Zayed Species Conservation Fund.

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