

Assessing the Impact of Human Hunting Activities on Populations of Forest Tortoises (Genus *Kinixys*) in the Niger Delta, Nigeria. Linnaeus Fund Research Report

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The Niger Delta (southern Nigeria, West Africa) is one of the major wetlands of Africa, and is particularly important because it is the main oil producing area in Africa and thus is now rapidly being developed with devastating consequences for its unique wildlife (Powell, 1993, 1994, 1996, 1997; Politano, 1998; Akani et al., 1999). The Niger Delta region is characterized by a remarkable chelonian diversity (Luiselli et al., 2000a), and is especially important in the chelonian conservation perspective because of the concurrent presence of three nearly sympatric species of tortoises of the genus *Kinixys*: *K. belliana nogueyi*, *K. erosa*, and *K. homeana* (Akani et al., 1999; Luiselli et al., 2000a). These species are in absolute need of protection in southern Nigeria, where large areas of their pristine habitats are disappearing due to agriculture and oil industry development (Politano, 1998; Akani et al., 1999), and they are subjected to strong subsistence hunting pressure by local people and for traditional magic "ju-ju" practices (Akani et al., 1998; Luiselli and Politano, 1998; Luiselli et al., 2000a). The main protein source of Niger Delta tribes is wildlife, which is normally captured by traditional hunting practices (Akani et al., 1998). Wildlife is traded in local bushmeat markets, which are found along the main roads and in the riverine villages (Ojonugwa, 1986).

The coexistence in the wild of three *Kinixys* species has rarely been reported, because these species are normally characterized by very different ecological and habitat requirements (Ernst and Barbour, 1989). Their coexistence in the Niger Delta region is, other than important for conservation implications, a good opportunity to study aspects of their comparative ecology and niche separation. Previous work has permitted the collection of data on the ecological distribution and habitat requirements of *Kinixys* species in the Niger Delta (Luiselli and Politano, 1998; Akani et al., 1999; Luiselli et al., 2000a), as well as on snakes (Luiselli and Angelici, 2000; Luiselli et al., 1998, 2000b, 2001) and crocodiles (Luiselli et al., 1999).

Detailed statistical studies of the distribution of the three *Kinixys* species in the Niger Delta are presented in Luiselli et al. (2000a). This paper provides enough basic information on the habitat requirements and the distribution of the studied species to be used for a general conservation program. *Kinixys belliana nogueyi* is the rarest of the three

species, and was found only in a few sites between the upper Orashi and upper Sambreiro River courses with open forest patches, clearings, and bushy edges. *Kinixys homeana* is the most common and widespread of the three species, and its presence was statistically linked to the presence of secondary swamp forest, secondary dry forest, and mangrove formations along river banks (Luiselli et al., 2000a). *Kinixys erosa* is less common than *K. homeana*, and its presence was statistically linked to the presence of secondary swamp forest (Luiselli et al., 2000a). *Kinixys homeana* and *K. erosa* were similar in terms of habitat requirements, and their distributions overlapped widely. However, *K. homeana* was more easily found than *K. erosa* in nearly every site where the two species were sympatric (Luiselli and Politano, 1998).

Conservation is a sophisticated and problematic matter of concern in tropical Africa, where the need for developing effective conservation strategies for critically threatened faunas needs to pass through a detailed knowledge not only of the natural history of the studied organisms (Greene, 1993, 1994), but also of the cultural traditions of the local human communities inhabiting the regions deserving conservation (Eltringham, 1984). In particular, it is necessary to know 1) the local cultural protection that some species could benefit from, such as traditional medicine or animistic taboos and religious beliefs (Eltringham, 1984; Politano, 1998; Oduro, 1999), and 2) the main economic benefit that local people derive from the target species to be conserved.

Aims of the research project summarized in this report were: 1) to investigate the local cultural and ethnological views of tortoise utilization in the Niger Delta; 2) to monitor and quantify the numbers, sex ratio, age classes, and seasonal frequency of occurrence of the three *Kinixys* species in the bushmeat markets of local tribes in the eastern Niger Delta region; 3) to compare the numbers of tortoises traded in local markets with the numbers exported for the international trade; and 4) to obtain ecological information on the free-ranging populations of these three *Kinixys* species based on the examination of bushmeat market specimens.

Methods. — A pilot study was conducted in 1996–99 and the main study in 2000, focusing on the eastern side of the Niger Delta in Bayelsa and Rivers states. A detailed description of the study area is presented in Akani et al. (1999), and in Luiselli et al. (2000a).

I reviewed all the available ethnologic information on the relationships between humans and *Kinixys* tortoises in the Niger Delta, and also obtained much original information by interviewing people at every study site and by distributing a questionnaire to persons of different ethnic groups (Igbo, Ijaw, Ogoni, Efik, Ibibio, Yoruba, Hausa, Tivi, etc.). Details of the interview procedures are presented elsewhere (Akani and Luiselli, 2001).

We (I and/or my associates) visited all the bushmeat markets situated along the courses of the Sambreiro (= Sombreiro) and Orashi rivers, and those in the vicinities of the following urban centers: Yenagoa, Sagbama, Port Harcourt, Peterside, Bonny, Obrikom, Oguta, Ahoada, Abonnema, and Degema. We attempted to maintain a con-

stant survey effort throughout the research period, so that the hunting activities of local tribes were monitored during both the dry and the wet seasons. Nevertheless, some minor sampling bias is likely, because we were unable to maintain an identical monthly effort throughout the study period.

To collect natural history data, every tortoise recorded from the bushmeat markets was examined as to species, sex, age, carapace length and height, plastron length, body weight, and dissected (if the specimen was already dead at the time of examination) for any food item in the stomach, and for assessing clutch size and reproductive condition (if they were adult females). Specimens that were still alive at the time of examination were bought and their fecal pellets collected, and then set free in the nearest forest location where the presence of that species was known. Moreover, the sellers (who were usually also the hunters) were interviewed to learn more about the habitat of capture of the traded specimens. The presence of other types of animals in the markets was also recorded to determine the relative importance of *Kinixys* tortoises for the dietary culture of the human tribes of the Niger Delta area. This data could be crucial to better understand which type of food could be recommended as an alternative to *Kinixys* tortoises.

Data coming from bushmeat market surveys were compared with field data on free-ranging specimens that were measured, marked, and released. Fecal analysis was also performed on free-ranging specimens.

Data on the international trade of *Kinixys* species, used for comparisons with the effects of human hunting at a local level, were generated from IUCN studies.

Results and Discussion.—The ethnological interview data showed that the three species of *Kinixys* are exploited in 89% of 38 surveyed village sites. Tortoises are considered a delicacy by most people, their shell is used as a music instrument, they are maintained as pets, and also used for traditional medicine. Nevertheless, some villages (11% of 38) provide traditional protection through ethnologic veneration of these species. The few places where tortoises are venerated could be used to develop effective conservation programs for these species (e.g., a *Kinixys*-oriented mosaic of protected areas).

However, even in villages where tortoises are provided with traditional protection, their survival may still be threatened by rapidly evolving social and cultural change in the Niger Delta. Indeed, in recent years most of the villages have partially lost their original mono-ethnic composition, and people from different tribes with different cultural traditions have immigrated. Although positive from a socio-economic point of view (De Montclos, 1994), it is detrimental for the conservation of tortoises. In fact, tortoises may be subjected to exploitation by immigrant people with different traditions from those of the original tribe inhabiting a site, even in places where tortoises have traditionally been venerated.

The number of *Kinixys* recorded in bushmeat markets is given in Table 1. In total, 189 tortoises were observed, mostly *K. homeana* (75.1%), followed by *K. erosa* (21.2%) and *K. b. nogueyi* (3.7%). The abundance of the three species

Table 1. *Kinixys* species offtake at surveyed bushmeat markets in the Niger Delta, Nigeria, primarily during 2000 but with some data also from 1996–99.

Month	<i>K. homeana</i>	<i>K. erosa</i>	<i>K. b. nogueyi</i>
January	4	-	-
February	1	1	-
March	7	3	-
April	32	7	2
May	39	11	1
June	17	6	1
July	15	4	-
August	7	3	1
September	10	2	2
October	3	1	-
November	4	1	-
December	3	1	-
Totals	142	40	7

in the trade parallels the apparent abundance patterns of the same species in the wild (Luiselli et al., 2000a). The great majority of the specimens were traded during the wet season (April to September), possibly as a consequence of their increased activity in the wild during the wet months. A similar pattern was observed by Lawson (2000) in southwestern Cameroon, where more tortoises (*K. erosa* and *K. homeana*) were harvested during the rainy season.

The sex ratio (male:female) of adult specimens traded was not significantly skewed from equality in any species (*K. homeana* = 1.13:1, $n = 128$; *K. erosa* = 1.26:1, $n = 34$; *K. b. nogueyi* = 2:1, $n = 6$). The proportion of juveniles in the total sample was 9.8% in *K. homeana*, 15% in *K. erosa*, and 14.2% in *K. b. nogueyi*.

The distribution of the plastron lengths for the traded specimens of the three species is presented in Fig. 1. The modal plastron lengths of *K. homeana* ranged from 110 to < 200 mm, whereas bigger specimens were very rare. On the other hand, *K. erosa* was often much bigger, as confirmed by the presence of several specimens > 200 mm.

I examined stomach and fecal contents of 128 *K. homeana*, 25 *K. erosa*, and 6 *K. belliana nogueyi*, including both market and free-living specimens. The food items found in these animals are listed in Table 2. For *K. belliana*, samples were obtained only during the wet season, possibly

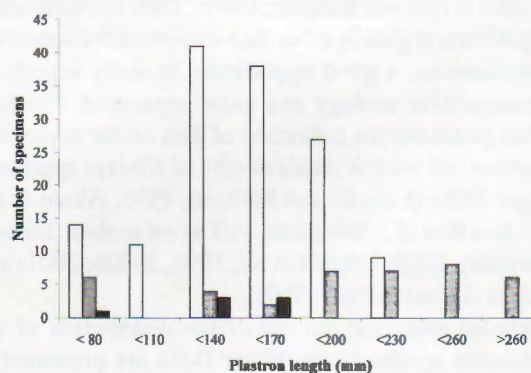


Figure 1. Size distribution for specimens of three species of tortoises recorded in bushmeat markets in the Niger Delta, Nigeria, primarily during 2000 but with some data also from 1996–99. *Kinixys homeana* (open bars), $n = 142$; *K. erosa* (gray shaded bars), $n = 40$; *K. belliana nogueyi* (black bars), $n = 7$.

because it aestivates during the dry months (Luiselli et al., 2000a). The taxonomic composition of the diets of the three species was apparently similar, and all of them were omnivorous, with a preponderance of invertebrates (arthropods and gastropoda). The high frequency of occurrence of fungi as food of all three species is also noteworthy. All species of *Kinixys* have been reported to be omnivorous, feeding on fungi, plants, and invertebrates (Villiers, 1958; Blackwell, 1968; Bertram, 1979), but the only detailed dietary data have been provided for *K. spekii* (Hailey, 1997, 1998; Hailey et al., 1997, 1998).

IUCN trade data for 1990–98 recorded ca. 20,000 *K. homeana* exported from Togo, 7000 from Ghana, and less than 500 from Cameroon, with ca. 3000 *K. erosa* exported from Ghana, 1500 from Togo, and less than 200 from Cameroon. No international exports of *Kinixys* from Nigeria were recorded by IUCN during these years, nor is export of wildlife for commercial purposes permitted from Nigeria (CITES Notification No. 1998/36). Illegal international trade from Nigeria, if occurring at all, is probably very limited (Akani et al., unpubl. data).

Although the absolute numbers of tortoises traded at the local scale of the eastern Niger Delta were much less than those exported from Ghana and Togo, nevertheless they almost equalled the exported amounts from Cameroon, despite the time interval being much shorter in our case (1996–2000) than in Cameroon's case (1990–98). Moreover, since we surveyed markets of only a few villages in a very limited area, our harvest rates are extremely conservative. A projection of total domestic Nigerian tortoise offtake will no doubt exceed by far the total exports from Ghana, Togo, and Cameroon during the same timespan (Luiselli, in

prep.). Moreover, all tortoises traded in local markets in Nigeria are wild caught, as no tortoise farms exist.

The market price of tortoises varied substantially from area to area. In Cross River State where large forests are still present and where tortoises are more abundant (Luiselli et al., unpubl. data), the price of a single specimen sold by the original collector ranged between 70 and 150 Naira (approximately \$US 0.58 to 1.25) depending on size, and at least 300 to 400 Naira if sold by middlemen who bought the animals from collectors. In the eastern Niger Delta, where tortoises are much more rare, the price of a specimen sold by collectors ranged between 300 and 600 Naira, whereas the price by middlemen in urban markets was 600 to over 1000 Naira. These prices are still very low in comparison with the average price for softshell turtles, *Trionyx triunguis* (3000–7000 Naira if directly sold by the collectors), or other reptiles including *Python sebae* (at least 1500 Naira, if only meat of a small specimen is sold), *Osteolaemus tetraspis* (1800–2000 Naira, only meat), and *Varanus niloticus ornatus* (1600–2000 Naira, only meat).

Based on the above data, domestic local trade in Nigeria should be considered a very serious threat for *Kinixys* tortoises, possibly of a higher magnitude than the levels of international trade in surrounding countries. It is the main threatening factor (together with forest habitat loss) for free-ranging *Kinixys* populations of Nigeria. In this regard, it seems evident that for Niger Delta *Kinixys*, the local exploitation rates exceed by far any sustainable harvest, as in other forest vertebrates that are consumed by people (Payne, 1992; Noss, 1995), including Cameroonian *Kinixys* (Lawson, 2000).

In conclusion, this study provided data which are consistent with those of Lawson (2000) in southwestern Cameroon, and indicate that *Kinixys* tortoises in Nigeria receive very little (if any) benefit from the mechanisms currently in place to monitor and curtail their international trade. In a country like Nigeria, where international trade is negligible, these tortoises are heavily harvested for subsistence, and are declining and threatened virtually everywhere. Thus, conservation planning is mandatory, and should be adopted within a very short time. The problem is how to convince the local people, often affected by desperately poor economic conditions, to avoid eating tortoises.

At the present time, I conclude that the establishment of functional protected areas is the only conservation strategy for tortoises that may work in southern Nigeria, but the presence of rangers monitoring the areas to be protected seems absolutely necessary to avoid illegal hunting. Indeed, I observed several tortoises captured by people inside the boundaries of the Upper Orashi Forest Reserve and Taylor Creek Forest Reserve, two officially protected areas at the federal government level. Last but not least, I agree with Lawson (2000) that international conservation institutions should address domestic bushmeat consumption of chelonians in Afrotropical regions as the first conservation measure for these animals, even more than their international trade. In fact, at least in Nigeria, the preservation of remnant forest areas may be effective in saving several other threat-

Table 2. Frequency of occurrence of dietary items found in stomach and fecal contents of 128 *Kinixys homeana*, 25 *K. erosa*, and 6 *K. belliana nogueyi*, including both market and free-living specimens in the Niger Delta, Nigeria, based on collection time during the dry or wet season. Numbers indicate the numbers of turtles containing a given food type, not the numbers of food items.

Food Item	<i>K. homeana</i>		<i>K. erosa</i>		<i>K. b. nogueyi</i>
	Dry	Wet	Dry	Wet	Wet
Plant matter	13	9	3	6	4
Fruits and berries	8	6	-	-	2
Seeds	1	2	-	1	-
Fungi	3	3	3	4	2
Oligochaeta	9	2	1	1	1
Gastropoda	12	7	3	3	1
Bivalvia	-	1	-	-	-
Crustacea	-	-	-	-	1
Isopoda	7	7	-	1	-
Chilopoda	5	5	1	-	-
Miriapoda	1	1	-	-	-
Araneidae	3	-	-	1	1
Scorpiones	2	-	-	-	-
Arthropoda ind.	2	5	2	-	-
Coleoptera adults	5	1	-	1	-
Coleoptera larvae	5	-	-	-	-
Lepidoptera larvae	2	-	-	1	-
Orthoptera	1	-	-	-	-
Dermaptera	-	4	-	-	-
Formicidae	-	1	-	1	-
Termites	3	4	-	-	-
Poultry (scavenging)	-	1	-	-	-
Empty stomach	17	15	3	1	-

ened vertebrates (e.g., guenons, apes, ungulates, snakes, etc.), but will not impede people from continuing to exploit the tortoise resource, at least if other control initiatives are not taken. I also suggest that chelonian conservationists initiate a large-scale monitoring program of the exploitation rates of these tortoises country-by-country in Africa and elsewhere, in such a way as to build a large body of data as currently available for Asian turtles and their trade (van Dijk et al., 2000).

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LITERATURE CITED

- AKANI, G.C. AND LUISELLI, L. 2001. A survey of the cultural attitude of people towards reptiles in the Niger Delta, Nigeria: implications for conservation. *Herpetological Bulletin* 75:19-24.
- AKANI, G.C., LUISELLI, L., ANGELICI, F.M., AND POLITANO, E. 1998. Bushmen and herpetofauna: notes on amphibians and reptiles traded in bush-meat markets of local people in the Niger Delta (Port Harcourt, Rivers State, Nigeria). *Anthropozoologica* 27:21-26.
- AKANI, G.C., LUISELLI, L., AND POLITANO, E. 1999. Ecological and conservation considerations on the reptile fauna of the eastern Niger Delta (Nigeria). *Herpetozoa* 11(3/4):141-153.
- BERTRAM, B.C.R. 1979. Home range of a hinge-back tortoise in the Serengeti. *African Journal of Ecology* 17:241-244.
- BLACKWELL, K. 1968. *Kinixys* species eating giant land snail. *British Journal of Herpetology* 4:42.
- ELTRINGHAM, S.K. 1984. *Wildlife Resources and Economic Development*. Chichester: John Wiley and Sons.
- ERNST, C.H. AND BARBOUR, R.W. 1989. *Turtles of the World*. Washington, DC: Smithsonian Institution Press, 313 pp.
- DE MONTCLOS, M.-A. 1994. *Le Nigeria*. Paris: Kurthala.
- GREENE, H.W. 1993. What's good about good natural history. *Herpetological Natural History* 1:1-3.
- GREENE, H.W. 1994. Systematics and natural history, foundations for understanding and conserving biodiversity. *American Zoologist* 34:48-56.
- HAILEY, A. 1997. Digestive efficiency and gut morphology of omnivorous and herbivorous African tortoises. *Canadian Journal of Zoology* 75(5):787-794.
- HAILEY, A. 1998. The specific dynamic action of the omnivorous tortoise *Kinixys spekii* in relation to diet, feeding pattern, and gut passage. *Physiological Zoology* 71:57-66.
- HAILEY, A., COULSON, I.M., AND CHIDAVANZI, R.L. 1997. Fungus eating by the African tortoise *Kinixys spekii*. *Journal of Tropical Ecology* 13:469-474.
- HAILEY, A., CHIDAVANZI, R.L., AND LOVERIDGE, J.P. 1998. Diet mixing in the omnivorous tortoise *Kinixys spekii*. *Functional Ecology* 12:373-385.
- LAWSON, D.P. 2000. Local harvest of hingeback tortoises, *Kinixys erosa* and *K. homeana*, in southwestern Cameroon. *Chelonian Conservation and Biology* 3(4):722-729.
- LUISELLI, L. AND ANGELICI, F.M. 2000. Ecological relationships in two Afrotropical cobra species (*Najamelanoleuca* and *Najasnigricollis*). *Canadian Journal of Zoology* 78:191-198.
- LUISELLI, L., AND POLITANO, E. 1998. Update of distribution, status, and habitats of crocodiles and chelonians in the eastern Niger Delta (Port Harcourt Region of Nigeria), with a planning for conservation and management. Milan: AGIP Petroleum Reports, 60 pp.
- LUISELLI, L., AKANI, G.C., AND CAPIZZI, D. 1998. Food resource partitioning of a community of snakes in a swamp rainforest of south-eastern Nigeria. *Journal of Zoology, London* 246:125-133.
- LUISELLI, L., AKANI, G.C., AND CAPIZZI, D. 1999. Is there any interspecific competition between dwarf crocodiles (*Osteolaemus tetraspis*) and Nile monitors (*Varanus niloticus ornatus*) in the swamps of central Africa? A study from south-eastern Nigeria. *Journal of Zoology, London* 247:127-131.
- LUISELLI, L., POLITANO, E., AND ANGELICI, F.M. 2000a. Ecological correlates of the distribution of terrestrial and freshwater chelonians in the Niger Delta, Nigeria: a biodiversity assessment with conservation implications. *Revue d'Ecologie (Terre et Vie)* 55:3-23.
- LUISELLI, L., ANGELICI, P.M., AND AKANI, G.C. 2000b. Large elapids and arboreality: the ecology of Jameson's green mamba (*Dendroaspis jamesoni*) in an Afrotropical forested region. *Contributions to Zoology* 69:147-155.
- LUISELLI, L., ANGELICI, F.M., AND AKANI, G.C. 2001. Food habits of *Python sebae* in suburban and natural habitats. *African Journal of Ecology* 39:116-118.
- ODURO, W. 1999. Ghana - Attack a threat to crocodile conservation. *Crocodile Specialist Group Newsletter* 18(2):3-4.
- OJONUGWA, O.S. 1986. A survey of wildlife in bushmeat markets in Rivers and Imo State, Nigeria. B.Sc. Thesis, Rivers State University of Science and Technology, Port Harcourt.
- NOSS, A.J. 1995. Duikers, cables, and nets: a cultural ecology of hunting in a Central African forest. Ph.D. Thesis, University of Gainesville, Florida.
- PAYNE, J.C. 1992. A field study of techniques for estimating densities of duikers in Korup National Park, Cameroon. Master's Thesis, University of Gainesville, Florida.
- POLITANO, E. (Ed.). 1998. A study of the fauna of the Niger Delta and environmental impact assessment of the construction of two natural gas pipelines in the Rivers State. Port Harcourt: T.S.K.J. - Aquater Reports.
- POWELL, C.R. 1993. Sites and species of conservation interest in the central axis of the Niger Delta. Abuja: National Resources Conservation Council.
- POWELL, C.R. 1994. Wildlife species known/suspected in the Upper Orashi Forest Reserve. Yenagoa: RISOPALM Lowland Oilpalm Project.
- POWELL, C.R. 1996. Wildlife study I. Port Harcourt: Shell Petroleum Developmental Co.
- POWELL, C.B. 1997. Discoveries and priorities for mammals in the freshwater forests of the Niger Delta. *Oryx* 31:83-185.
- VAN DIJK, P.P., STUART, B.L., AND RHODIN, A.G.J. (Eds.). 2000. *Asian Turtle Trade: Proceedings of a Workshop on Conservation and Trade of Freshwater Turtles and Tortoises in Asia*. Chelonian Research Monographs 2:1-164.
- VILLIERS, A. 1958. Tortues et crocodiles de l'Afrique noire Française. *Institut Français d'Afrique Noire, Initiations Africaines* 15:1-354.

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