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SHORT NOTE

**People's perceptions of crocodiles in Nigeria**

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22 Throughout Africa, feelings towards crocodiles vary according to the danger or fear experienced by  
23 communities living alongside them. Crocodile conservation programs must therefore be based on  
24 reliable assessments of cultural attitudes towards these reptiles. In this study, we interviewed a  
25 random sample of 300 persons in six states in southern Nigeria to determine their perception of  
26 crocodiles. Our results revealed that most respondents were very familiar with crocodiles, animals  
27 being regularly sighted but only in small numbers. Most interviewees were aware of just two  
28 crocodile types, consistently describing the dwarf crocodile (*Osteolaemus tetraspis*) and the West  
29 African Nile crocodile (*Crocodylus [niloticus] suchus*); only a minority of respondents reporting  
30 they were aware of the West African slender-snouted crocodile (*Mecistops cataphractus*).

31 *Keywords:* *Crocodylus*; *Osteolaemus*; *Mecistops*; Local Ecological Knowledge; conservation; West Africa

32

33 In most tropical regions, crocodiles and other reptiles are important as food and traditional  
34 medicine, as well as for clothing or ornaments (Alves et al., 2006, 2008, 2009, 2013). Wherever  
35 crocodilians occur alongside humans, peoples' attitudes towards these animals may vary from  
36 indifference to antagonism. Crocodiles can provide direct benefits through their sustainable use,  
37 especially via the skin trade (Webb et al. 1987). But, local communities may be convinced to  
38 protect these large predators because they are thought to play an important role in maintaining the  
39 productivity and diversity of wetland ecosystems (van der Ploeg et al. 2011). Cultural and intrinsic  
40 values for protecting crocodiles can also be strong motivational reasons to be used when developing  
41 crocodile management plans (Pooley, 2016). In West Africa, crocodilians alongside snakes and  
42 chelonians, are also central to many cultural beliefs (Ben-Amos, 1976; Fretey et al., 2007).  
43 However, depending on the level of conflict between crocodiles and humans, attitudes towards the  
44 conservation of these reptiles may differ, as shown in rural communities in Benin experiencing  
45 distinct levels of human-crocodile conflict (Kpéra et al., 2014).

46

47 Rural peoples living in close proximity to crocodiles West Africa often revere and protect them  
48 from harm. In some countries, this is due to their belief that, just as water is essential to crocodiles,  
49 crocodiles are crucial for water, since this would permanently disappear if they were not there  
50 (Kpéra, 2003; Kpéra et al., 2004). Although there are records of the folklore surrounding crocodiles  
51 in West Africa (Kpéra et al., 2014), our knowledge of the nature of the relationship between human

52 communities and crocodiles is still fragmentary (e.g. Anadu & Oates, 1982; Powell, 1993, 1995;  
53 Akani et al., 1999; Pooley, 2016). Although knowledge of the ecology of crocodiles in West Africa  
54 (Shirley et al., 2009, 2018), and primarily in Nigeria is growing (Luiselli et al., 1999a, 1999b,  
55 2012), there are few studies assessing people's perception of the presence and abundance, or their  
56 value as a source of food or income. This information, as Kpéra et al. (2004) have shown, can be  
57 used to improve the management of these species e.g. in turning traditional uses of crocodiles for  
58 medicines into a sustainable industry in Benin.

59  
60 Although in-depth interviews involving intensive individual interviews with a small number of  
61 respondents are ideal, here we use shorter interviews applied to a large number of people to  
62 determine attitudes and knowledge of crocodilians in southern Nigeria. These interview campaigns  
63 were used to gather indirect data of conservation and biological interest (Huntington, 1997).

64  
65 Between March and May 2014, we interviewed different people in seven states in southern Nigeria  
66 (Oyo, Edo, Delta, Bayelsa, Rivers, Akwa-Ibom and Cross River). These states are characterized by  
67 a network of rivers, streams and water basins (mostly within the Niger Delta region), most of them  
68 inhabited by crocodiles (e.g., Luiselli et al., 2012). The banks of rivers and streams are lined by  
69 gallery forests in the freshwater tracts and by mangroves in the brackish water expanses. There are  
70 extensive agricultural areas and large urban centres in the region (the largest city being Port  
71 Harcourt), and the overall human population is well over 10 million people (e.g., Luiselli et al.,  
72 2012). Based on previous visits in which we collected data on the presence of crocodiles in their  
73 surroundings, we selected a sample of villages and towns in each state to interview people (see  
74 below for the details). In these localities, we applied semi-structured face-to-face interviews,  
75 consisting of eight questions as follows:

- 76 1) Have you ever seen a crocodile in Nigeria?
- 77 2) Where did you see crocodiles in Nigeria?

- 78 3) When was the last time you saw a crocodile in Nigeria?
- 79 4) How many crocodiles did you see?
- 80 5) In what condition did you see the crocodiles?
- 81 6) How many types of crocodiles do you know?
- 82 7) Do you know any community or area where crocodiles exist but are not hunted or killed?
- 83 8) Do you know any community or area where crocodiles exist but are hunted or killed?

84 Interviewees were selected by randomly picking persons in marketplaces, canteens, restaurants,  
85 roadsides, hairdressing salons, food shops, and other gathering places. This random selection  
86 procedure consisted in stopping the first person met after a given time period (in minutes), with the  
87 time interval randomly generated by a Random Number Generator. Local scientists applied all  
88 interviews in the local language. Interviewed persons were informed of the aims of the project  
89 beforehand and were asked for their verbal consent before proceeding. No minors (<18 years) were  
90 approached. All interviews followed the ethical recommendations of the British Sociological  
91 Association. Each interview lasted about 15 minutes on average.

92 During each interview, we noted the interviewees' gender (male or female) and age (18 to 25 years,  
93 26-50 years,  $\geq 51$  years) but not their names to ensure anonymity (St. John 2010; Nuno et al. 2014;  
94 Luiselli et al. 2017). To avoid non-independence of data, we did not question persons of the same  
95 family or those living in the same house, even if they were not relatives (see also Hema et al.,  
96 2017). A total of 300 people (241 men; 59 women) were interviewed.

97 Frequency differences between types of answers were analysed using a  $\chi^2$  test, performed by Past  
98 3.0 statistical software, with alpha set at 5%. All analyses were done with the software "Past 3.2  
99 version".

100 *Question 1.* Valid cases were 299, with 277 'yes' and 22 'no' as answers. There was a statistically  
101 significant difference between the frequencies of the two answers ( $\chi^2=217.47$ ,  $df = 1$ ,  $P < 0.0001$ ).

102 *Question 2.* The different answers provided by interviewees are summarized in Fig S1. In this case,  
103 275 valid cases were retained for analysis. There was a significantly uneven distribution of the  
104 various answers ( $\chi^2=109.16$ ,  $df = 4$ ,  $P < 0.0001$ ), with the majority of answers being 'wild' and  
105 "park/zoo". Interestingly, a relatively low percentage of people (7.7%) answered 'market' (Fig.  
106 S1a).

107 *Question 3.* A total of 255 valid cases were retained for this question. There was a significantly  
108 uneven distribution of the various answers ( $\chi^2=144.88$ ,  $df = 4$ ,  $P < 0.0001$ ; Fig. S1b), with a greater  
109 majority of answers being '1-5' years.

110 *Question 4.* A total of 269 valid answers were retained for this question, providing a statistically  
111 uneven distribution of answers ( $\chi^2=547.6$ ,  $df = 4$ ,  $P < 0.0001$ ; Fig. S1c). Almost three quarters of  
112 people interviewed have seen less than five crocodiles (Fig. S1c), with no significant frequency  
113 differences among the surveyed states of Nigeria ( $\chi^2=4.6$ ,  $df = 6$ ,  $P = n.s.$ ).

114 *Question 5.* Out of 267 valid cases retained for analysis, 94.4% of respondents mentioned that they  
115 saw crocodiles 'alive', 2.6% 'dead', and 3.0% as 'skin'.

116 *Question 6.* In total, 249 valid cases were retained. Most interviewees answered that they have seen  
117 two types of crocodiles (Fig. S1d), and consistently described the dwarf crocodile (*Osteolaemus*  
118 *tetraspis*), locally known as alligator in Pidgin English, and the West African Nile crocodile  
119 (*Crocodylus [niloticus] suchus*). Conversely, a small proportion of respondents (< 5%) reported that  
120 they are aware of the West African slender-snouted crocodile (*Mecistops cataphractus*), whereas  
121 the fourth type of "crocodile" mentioned is the forest monitor lizard (*Varanus ornatus*); because of  
122 its swimming attitudes, this animal is sometimes considered a crocodile.

123 *Question 7.* Out of a total of 144 valid cases, 86 people answered 'no' and 50 answered 'yes'. The  
124 location of traditional veneration areas for crocodiles was, according to respondents of our  
125 questionnaires, quite widespread, with areas in the south-west (Edo State), south-east (Cross River  
126 State) as well as in northern areas of the country (Borno State) (Figure 1).

127 *Question 8.* Out of a total of 115 valid cases, a large majority of people (n = 79) people answered  
128 `no` and only 36 answered `yes` (Figure 2).

129

130 Our interviews revealed that most people were familiar with crocodiles, with wild and park/zoo  
131 animals being the usually observed individuals. Interestingly, as the majority of respondents  
132 claimed to have seen crocodiles in recent years and in the wild, this suggests that crocodiles are still  
133 frequently encountered by people in southern Nigeria. However, pooling the outcomes of question  
134 4) with the results for question 3, it becomes evident that in recent years most interviewees saw  
135 crocodiles, but in small numbers, suggesting that crocodiles are still widespread but relatively rare  
136 in southern Nigeria.

137

138 Most respondents claimed that they saw live crocodiles not dead specimens. Although the term  
139 alive could refer to living animals in different situations not just in the wild (many crocodiles are  
140 traded alive in bushmeat markets, see Fig. 3), it is likely that some specimens reported alive by our  
141 interviewees were just ready to be killed, and in any case not going to be released to the wild. Most  
142 crocodiles observed were *O. tetraspis* and *C. [niloticus] suchus* but our results indirectly indicate  
143 that *M. cataphractus* is extremely rare. The perception that our interviewees had of the three  
144 crocodile species mirrors available field data collected during the last twenty years in southern  
145 Nigeria. *M. cataphractus* is very rare in the whole of West Africa with very few records for Nigeria  
146 (Shirley et al., 2009; Shirley et al., 2018), whereas *O. tetraspis* and *C. [niloticus] suchus* are still  
147 widespread and locally abundant, especially in the remote wetlands of the Niger Delta region  
148 (Luiselli et al., 2012). In the Niger Delta area, Luiselli et al. (2012) collected 94 records of *C.*  
149 *[niloticus] suchus* and 344 records of *O. tetraspis*. The findings of our interviews reinforce the  
150 value of “Local Ecological Knowledge” (LEK, sensu Padmanaba et al., 2013; Turvey et al., 2015)  
151 as reliable when contrasted with scientific data collected in the field (Luiselli et al., 2018).

152 Our study has also shown that traditional veneration of crocodiles is not exceptional in Nigeria, an  
153 attribute that can be used to guide potential conservation programs, as in our parts of the world (e.g.  
154 Philippines, van der Ploeg et al. 2011).

155

156 We observed that relatively few persons were able to answer with a precise locality where  
157 crocodiles are hunted or venerated. We think that this relatively low percent of people depended on  
158 that, once arriving to a market for being sold, the provenance of a crocodile is not a matter of  
159 interest for customers, thus many people did not ask where the animal were hunted and therefore it  
160 remains unknown to them where exactly human communities still hunt for wild crocodiles. Overall,  
161 the distribution of answers would indicate that hunting areas for crocodiles are still quite  
162 widespread, with areas in south-west (Edo State), south-east (Cross River State) as well as in  
163 northern areas of the country (Borno State) (Figure 2). It must be noted that there was a wide  
164 overlap between areas cited in Figure 1 and Figure 2, thus showing that veneration and hunting may  
165 coexist at fine spatial scales. Therefore, for conservation planning, it is necessary to have a fine-  
166 scale knowledge of the traditions and culture of local communities if we want to make efficiently  
167 the management of the local crocodile populations, and further studies on the cultural attitudes of  
168 humans towards crocodiles are strongly needed in this region of West Africa. In particular, since a  
169 suite of different variables influences behaviour (attitudes, perceptions, norms, perceived control  
170 etc., Marchini & McDonald, 2012), a fuller study of factors influencing human behaviour should be  
171 studied if we want to efficiently manage the crocodile populations in the whole region.

172

173 From a geographical point of view, our data suggest that the Rivers State is the most important for  
174 crocodile protection and long-term survival since interviews from this area not only generated a  
175 high number of localities in which at least two species (*C. [niloticus] suchus* and *O. tetraspis*,  
176 possibly also *M. cataphractus*) were found but also several sites that included “traditional



177 protection”. Conversely, Borno State appears as the area where crocodiles are most hunted and  
178 therefore of special conservation concern for crocodiles.

179

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185 followed the ethical standards accepted by the British Sociological Association and did not involve  
186 any minors.

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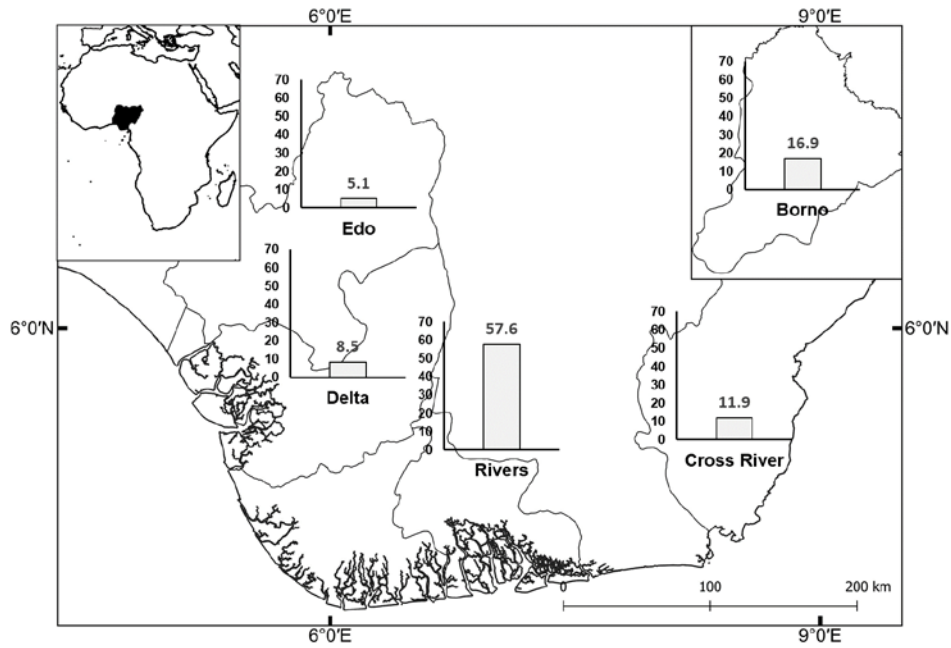
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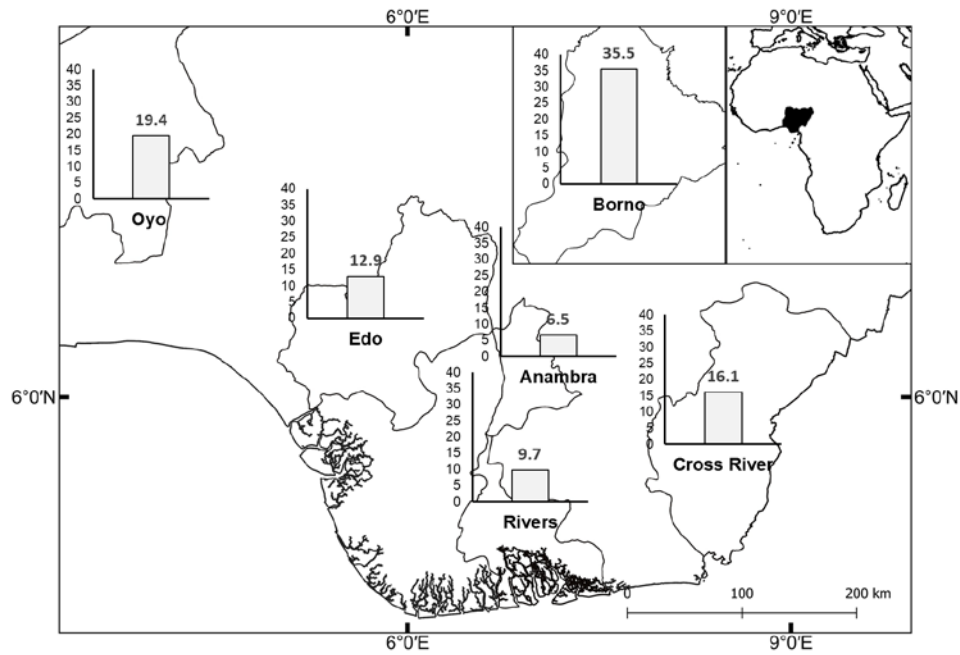
269 **Figure 1.** Map of Nigeria showing, by State, the valid percentages of answers on the question: “Do  
270 you know any community or area where crocodiles exist but are not hunted or killed?” Valid  
271 percent would indicate the percentage calculated, for a given answer, only to the people who gave  
272 an answer (thus excluding the “no answer” cases).



273

274

275 **Figure 2.** Map of Nigeria showing, by State, the valid percentages of answers on the question: “Do  
276 you know any community or area where crocodiles exist but are hunted or killed?” Valid percent  
277 would indicate the percentage calculated, for a given answer, only to the people who gave an  
278 answer (thus excluding the “no answer” cases).



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281

282 **Figure 3.** Dwarf crocodile (*Osteolaemus tetraspis*) still alive while being sold at Edumanom  
283 market, Bayelsa State (Nigeria).



284