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1 SHORT NOTE

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

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19

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

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

30

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

44

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

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

57

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

62

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

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

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

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

90 During each interview, we noted the interviewees' gender (male or female) and age (18 to 25 years,
91 26-50 years, ≥ 51 years) but not their names to ensure anonymity (St. John 2010; Nuno et al. 2014;
92 Luiselli et al. 2017). To avoid non-independence of data, we did not question persons of the same
93 family or those living in the same house, even if they were not relatives (see also Hema et al.,
94 2017). A total of 300 people (241 men; 59 women) were interviewed.

95 Frequency differences between types of answers were analysed using a χ^2 test, performed by Past
96 3.0 statistical software, with alpha set at 5%. All analyses were done with the software "Past 3.2
97 version".

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

100 *Question 2.* The different answers provided by interviewees are summarized in Fig S1. In this case,
101 275 valid cases were retained for analysis. There was a significantly uneven distribution of the
102 various answers ($\chi^2=109.16$, $df = 4$, $P < 0.0001$), with the majority of answers being 'wild' and
103 "park/zoo". Interestingly, a relatively low percentage of people (7.7%) answered 'market' (Fig.
104 S1a).

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

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

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

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

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

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

127

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

135

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

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

153

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

170

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

175 protection". Conversely, Borno State appears as the area where crocodiles are most hunted and
176 therefore of special conservation concern for crocodiles.

177

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

185

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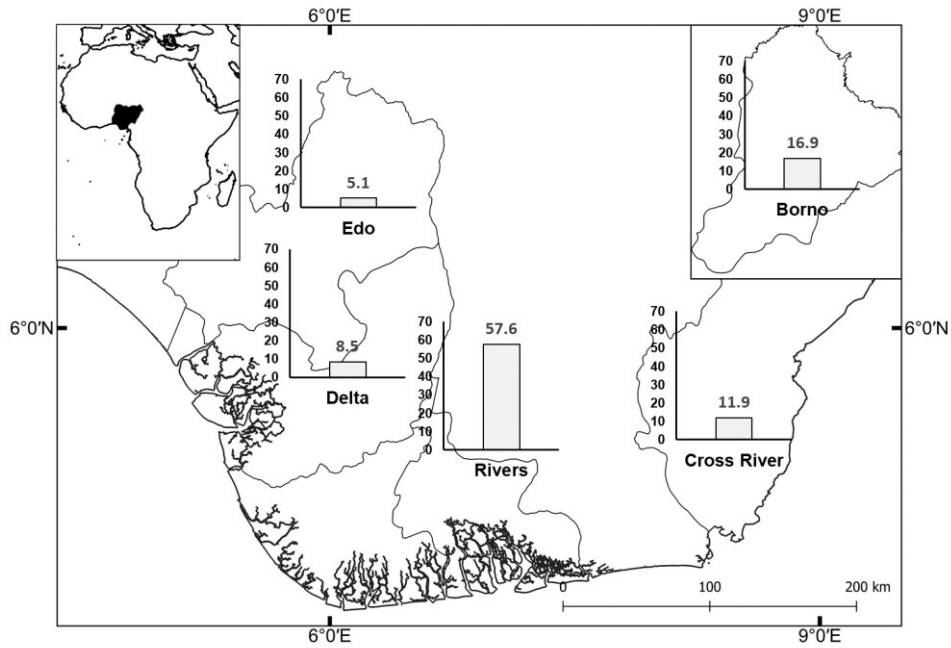
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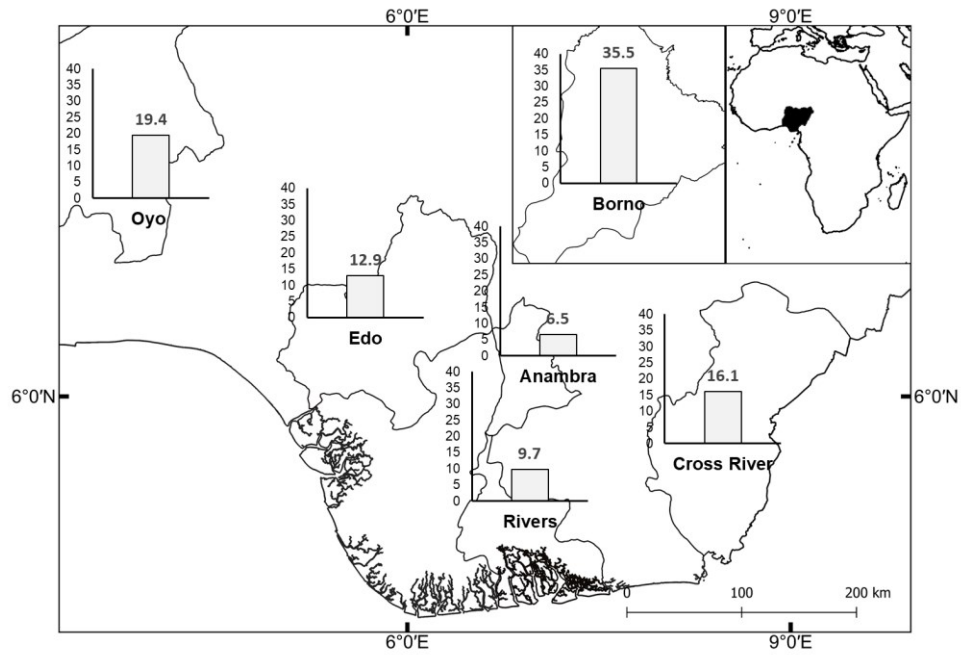
267 **Figure 1.** Map of Nigeria showing, by State, the valid percentages of answers on the question: “Do
268 you know any community or area where crocodiles exist but are not hunted or killed?” Valid
269 percent would indicate the percentage calculated, for a given answer, only to the people who gave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



271

272

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



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



282