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Communal nesting of *Caiman crocodilus* (Linneaus, 1758) (Crocodylia: Alligatoridae) in lower Amazon river floodplain, Brazil

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The Spectacled Caiman (*Caiman crocodilus* [Linnaeus, 1758]) is a comparatively abundant species of the Crocodylia order and exhibits a high plasticity in habitat use (Brazaitis et al., 1996; Aguilera et al., 2008). With a wide distribution extending from the Amazon Basin northwards into Mexico (Ross, 1998), the Spectacled Caiman is able to live in a variety of different water bodies and often coexist with other crocodilian species (Rebêlo and Lugli, 2001). Such a wide range of habitats may also extend the knowledge on the reproductive ecology of the species. Knowledge on reproductive strategies is crucial to understand successful reproduction of a species (Whittier and Limpus, 1996). A behaviour not often found in crocodilians is communal nesting or communal oviposition, which can be described as non-accidental oviposition of eggs in a nest cavity shared by two or more individuals of the same species (Espinoza and Lobo, 1996). This behavior was described in Teiidae lizards (*Kentropyx calcarata;* Magnusson and Lima, 1984) and neotropical crocodilians, including *Caiman latirostris* in Argentina (Larriera, 2002) and *Melanosuchus niger* in Ecuador (Villamarín-Jurado and Suárez, 2007). Interspecific interactions in shared nest cavities were also reported between *Crocodilus acutus* and the neotropical lizard *Iguana iguana* (Dugan et al., 1981), and between *Melanosuchus niger* and *Podocnemis unifilis* (Maffei and Da Silveira, 2013). This behavior could occur because of a rareness of appropriate nesting areas (Rand, 1967), provoking sharing of or competition for the few available habitats. Communal nesting of crocodilians in the Amazon flooded Forest (várzea) has not yet been studied and published within the scientific literature. We herein report on communal nesting of females of *Caiman crocodilus* in the Lower Amazon River, in Pará State of Brazil (Figure 1).

Nests of *C. crocodilus* were found along the banks of a small channel (six meters in width) in November 2012, during the dry season in the floodplain forest of the Amazon River, located near Santarém city, Pará state, Brazil. It is expected that females compete for nest sites in this habitat, where we observed a density of 8 nest/km in some parts of the channel. During the reproductive season 105 nests were found, among which two were located about five meters from each other and at seven meters from the channel (water body) that had completely dried out. The first nest contained no eggs, but two females were found close to it; the first female was recorded one meter away from the nest, with a snout vent length (SVL) of 66 cm and a weight of 6 kg, while the second female was recorded two meters from the nest, with a SVL of 78 cm and a weight of 10 kg. In the second nest we recorded 43 eggs (Figure 2c) with a third female found 1.5 m away, which measured 78 cm SVL and weighed 10 kg (Figure 2a, b). The female had an injury in the left lower lateral region nearly half way between the hind and fore limbs, with bite marks and abundant insect larvae (Figure 2d). All females were hidden under tree branches, supposedly to avoid predation (Da Silveira et al., 2010).

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Figure 1. Localization of the communal nesting place of *Caiman crocodilus* in Água Preta community, Lower Amazon River, Brazil.

The eggs of the second nest were organized in two incubation cavities arranged vertically above the same base. All the upper eggs were broken and of an advanced decomposed stage (N= 12), and were not measured.

Because there were only 11 intact eggs in the lower cavity, it was not possible to determine if there was more than one group of eggs with different sizes or a separate egg-laying period. The average number of eggs for *C. crocodilus* varies from 22 to 28 eggs. The average number of eggs recorded in the study area in 2012 was 22 (unpublished data; Table 1). We believe that during the periodical absence of a large female the recorded third individual laid her eggs on top of the formed nest. The original female (owner of the first posture) then returned, provoked the injury to the new female and damaged the newly laid eggs.

Table 1. Average clutch size ± SD (range) of *C. crocodilus* in different neotropical areas

Local, Year (N)	Clutch size	Source
Cururu Lake, Amazon River. 2001 (N= 60)	25 ±5.6 (14-38)	Campos, 2003
Literature review	24.4	Thorbjarnarson, 1996
Llanos, Venezuela. 1973, 1974 (N= 30)	28.6 ±0.91* (17-38)	Staton and Dixon, 1977
Floodplain, Lower Amazon River. 2011, 2012 (N= 193)	22.12 ±6.19 (11-38)	Unpublished data

SD = Standard Deviation; *SE = Standard Error

Figure 2. A and B) *C. crocodilus* females in the area of the communal nest, under branches and thorns, exhibiting parental care, C) viable eggs from the communal nest, and D) injured female captured near the nest.

Evidence of nest sharing by the females included: (a) the number of eggs (intact and broken) found in the nest was above the maximum clutch size recorded in nests of the same species in different habitats; (b) the presence of three females guarding the two nest sites; (c) two incubation cavities within a single nest.

The presence of three females could be considered a coincidental phenomenon simply because one or two of the females could have been passing through the area. However, the high number of eggs in the nest renders this unlikely. The wounded female and the broken eggs represent a possible aggressive intraspecific interaction, suggesting that the nest sharing did not occur in a harmonic and consensual way, implying competition. A high density of nests was previously identified in crocodilians (Platt and Thorbjarnarson, 2000; Seijas and Chavez, 2002), yet the the occurrence of communal nesting may be caused by intraspecific competition for nesting sites as a result of limited nesting areas (Graves and Duvall, 1995). Another reason is the intraspecific brood care *farming out* – where a female exploits the parental effort of others when mixing the offspring with conspecifics, avoiding *fitness* reduction and mitigating the energetic costs of parental care when faced with inadequate conditions (Yanagisawa, 1985). Parental care can cause nutritional stress due to higher energy costs in females and increased susceptibility to predation (Da Silveira et al., 2010). In the Lower Amazon Várzea during the reproductive period, it is common to find females with low body mass close to their nests in areas where the water body is completely dried out.

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