PRESENT KNOWLEDGE ON THE WEST AFRICAN SLENDER-SNOUTED CROCODILE, *Crocodylus cataphractus* CUVIER 1824 AND THE WEST AFRICAN DWARF CROCODILE *Osteolaemus tetraspis*, COPE 1861

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INTRODUCTION

Very little has been published on the three crocodile species occurring in west Africa. This is particularly true for the two species endemic to west Africa, the west African long-snouted or slender-snouted crocodile (*Crocodylus cataphractus*, Cuvier 1824) and the west African stumpy, broad-fronted or dwarf crocodile (*Osteolaemus tetraspis*, Cope 1861). By contrast, for the Nile crocodile (*C. niloticus*, Laurenti, 1766), which ranges over the whole of tropical Africa, there is much information available from east and southern Africa. This lack of information on the west African crocodile populations results from a number of factors:

- the very secluded habitat of the forest dwellers *C. cataphractus* and *O. tetraspis*, which severely restricts field investigations;
- the evolution of national parks and the development of wildlife management has been comparatively slow in west African countries. This has been particularly the case in the forest zones;
- The belly skin of the west African forest crocodiles is less valuable for commercial exploitation, this reduces the interest of the skin industry;
- The size of west African crocodiles is less spectacular and their population density is lower, so reducing their show effect in reserves and on farms.

In essence this chapter tries to give a short overview on our present understanding of the biology and ecology of *C. cataphractus* and *O. tetraspis*, gathered by researchers both on field investigations in west Africa and in captive-breeding in zoos on several continents.

SPECIES PRESENTATION

The 3 species of crocodiles occurring in west Africa belong to 2 genera: The genus *Crocodylus* represented by two species and the genus *Osteolaemus* represented only by one.

Based on exact description of these species, given by Villiers (1958), the basic distingishing characteristics of these crocodiles are shown in Table 2.

Table 1. Species of west African crocodiles.

Scientific name	*Crocodylus niloticus* Laurenti 1766	*Crocodylus cataphractus* Cuvier 1824	*Osteolaemus tetraspis* Cope 1861
English name	Nile crocodile	Slender-snouted crocodile	Dwarf crocodile
French name	Crocodile du Nil cuirassé	Crocodile à nûque large	Crocodile à front
German name	Nil-krokodil	Panzer-krokodil	Stumpf-krokodil
Dioula name	Bamba gbèman	Bamba da Jan	Bamba fiman

Table 2.

Species	*Crocodylus niloticus*	*Crocodylus cataphractus*	*Osteolaemus tetraspis*
snout length	1-2/3 - 2X > basal width	2-2/3 - 3-1/3 X > basal width	about = basal width
dental format	18-19 / 15	17-18 / 15	16-17 / 14-15
nuchal scales	2 transverse series 1st 4 scales 2nd 2 scales	2 transverse series 1st 2 scales 2nd 2 scales	3 transverse series 1st 2 big scales 2nd 2 big scales 3rd 2 very small scales
coloration	back: bright olive/ bronze or dark green; belly: pale yellowish	back: dark olive; belly: bright yellowish with dark patches	back: black with yellowish patches on tail & jaw; belly: pale yellowish with many blackish patches
Maximum length	4-5 m*	3-4 m	1.8 m

* in west Africa

SYSTEMATICS AND EVOLUTION

The crocodiles were first classified in a the order Crocodilia by Gmelin in 1788. In 1766 Laurenti established the species *C. niloticus*. In 1824 Cuvier became the first to distinguish a second species in Africa, *C. cataphractus*. It was only in 1861 that the species *O. tetraspis* was established by Cope. Another crocodile from Zaire was described by Schmidt (1919) as *Osteoblepharon osborni*. Inger (1948) later annulled this new genus and described this crocodile as *Osteolaemus osborni*, but since Wermuth and Mertens (1961) it has been regarded as a subspecies of *O. tetraspis*, called *O. tetraspis osborni*.

The systematic classification of the three west African crocodile species is shown in Table 3.

Table 3.

Phylum	Chordata
Sub-Phylum	Vertebrata
Class	Reptilia
Order	Crocodilia
Suborder	Eusuchia
Family	Crocodylidae
Subfamily	Crocodylinae
1st Genus	*Crocodylus*
1st Species	- *niloticus*
2nd Species	- *cataphractus*
2nd Genus	*Osteolaemus*
2nd Species	- *tetraspis*

According to a theory of Greer (1970), all Recent crocodilians derive from a hypothetical ancestor which built its nest by digging a hole in the ground. From this ancestor some crocodilians evolved in such a way that they started to construct mound nests on the surface of the ground by heaping up dead leaves and rotting vegetation. In terms of their pattern of nest construction the two forest species of west African crocodiles belong to this branch of evolution, whereas the Nile crocodile remained in the principal line, continuing to construct their nests under the earth.

GEOGRAPHICAL DISTRIBUTION

In contrast to *C. niloticus*, which is found all over tropical Africa and Madagascar, the range of the two other species is limited to the equatorial forest zones, centered in the tropical rain forest around the Gulf of Guinea and the River Congo. Passing through the deciduous forest coming to the gallery forests in the Guinean and Sudanese savanna, they are found more and more rarely. Table 4 shows the countries and river systems from west to east where their presence has been documented.

Table 4.

Country	*Crocodylus cataphractus*	*Osteolaemus tetraspis*
Senegal and Gambia	Saloum delta, River Gambia and its tributaries Senegal-, Falémé- and Casamance rivers and their tributaries (Pooley 1982)	Saloum delta, River Gambia and its tributaries (Villiers 1956a, b, 1958, 1959, Pooley 1982)
Guinea Bissau	no information available	no information available
Guinea	tributaries to River Niger Kourai, Sankarani and Boa rivers (Waitkuwait 1986)	Kourai, Sankarani, Boa Bafing, Mafou rivers (Waitkuwait 1986)
Sierra Leone	Moa and Morro rivers (Waitkuwait 1986)	River Jong at Magburaka (IUCN 1979)
Liberia	Mano, Loffa, St. Paul, Mani, Cess, Sangwin and Douabé rivers (Waitkuwait 1986)	Mani, Loffa, St.Paul, Mani Cess, Sangwin and Douabé rivers (Waitkuwait 1986)
Mali	Baoulé, Bagoé, Kankélaba rivers (Waitkuwait 1986)	Baoulé, Bagoé, Kankélaba rivers (Waitkuwait 1986)
Ivory Coast	Baoulé, Bagoé, Sassandra, Bafing, Nzo, Lobo, Cavalla, Hana, Meno, Néka, Tabou, Dodo, Néro, San Pedro, Bandama, Maraoué, Badénou Solomougou, Nzi, Boubo, Go Comoé, Iringou, Kongo, Kolonkoko, Agnéby, Bia and Tanoé rivers; Grand Lahou, Ehrié, Aby, Tendo and Ehy lagoons (Waitkuwait, 1986)	Baoulé, Bagoé, Sassandra Bafing, Nzo, Lobo, Cavalla, Hana, Meno, Néka, Tabou, Dodo, Néro, San Pedro, Bandama, Maraoué, Badénou, Solomougou, Nzi, Boubo, Go, Comoé, Iringou, Kongo, Kolonkoko, Agnéby, Bia and Tanoé rivers, Grand Lahou, Ebrié, Aby, Tendo and Ehy lagoons (Waitkuwait 1986)
Burkina Faso	Comoé, Black-Volta, Bougouriba rivers (Waitkuwait 1986)	Comoé, Black-Volta, Bougouriba rivers (Waitkuwait 1986)
Ghana	Black-Volta, Tanoé, Bia rivers (Waitkuwait 1986); Densu, Pra, Mole, White Volta rivers, Obosum and tributaries, Dwija and tributaries, Sene and tributaries, Lake Volta and Lake Kainji (Pooley 1982)	Black-Volta, Tanoé, Bia rivers Offin and (Waitkuwait 1986) Bia rivers, other small forest rivers, Volta Lake (Pooley 1982)

Table 4. (cont.).

Togo	Mono and Oti rivers (Tornier 1901, Waitkuwait 1986)	Mono and Oti rivers (Waitkuwait 1986); Mare at Kini Kopé (Tornier 1901, IUCN 1984)
Benin	River Ouémé (Pooley 1982, Waitkuwait 1986	Ouémé, Mékrou and Alibori rivers (Pooley 1982, Waitkuwait 1986)
Niger	no information available	no information available
Nigeria	Gaji, Yankari, Barkono, Benue rivers (Pooley 1982)	River Sombreiro near Abua (King 1955); more common in forest rivers in central east, less common in west (Pooley 1982)
Cameroon	tributaries of the River Cross (Torniet 1902, Abercrombie 1978)	near Douala, small rivers of Mount Cameroun (Tornier 1902, Pooley 1980)
Chad	Chari, Aouk, Aoukalé, Bangoran rivers, Lake Chad (Pooley 1982)	no information available
Central African Republic	River Oubangui and tributaries (Gournay pers. comm.)	Birao region (Pooley 1982)
Gabon	River Ogooué, small coastal and inland rivers (IUCN 1979, Pooley 1980)	mangroves near Libreville, swamp areas of Woleu N'tem and Ogooue Ivindo (Pooley 1982)
Congo	Oubangui, Sanga and other rivers near to the Central African border (Pooley 1982, Waitkuwait 1986)	Oubangui, Sanga and other rivers near to the Central African border (Pooley 1982, Waitkuwait 1986)
Zaire	Dungu, Népoko, Uele, Oubangui, Zaire rivers (Pooley 1982, Waitkuwait 1986)	Subspecies *O. t. osborni* in the northeast, lower parts of River Zaire. Subspecies *O. t. tetraspis* in the upper parts of River Zaire (Pooley 1982)
Tanzania	only in Lake Tanganyika in Luichi, Malagarasi rivers (Pooley 1982)	not present
Angola	only in rivers at the border to Zaire and Cabinda (Pooley 1982)	only in the Cabinda enclave (Pooley 1982)
Zambia	Luapula, Kalungwishi rivers, Lakes Mweru, Mweru Wantipa and Tanganyika (Pooley 1982)	not present

BIOLOGY AND ECOLOGY

A comparative analysis of the biology and ecology of two related species living in the same environment should show particular adaptations in terms of different habitat preferences, nesting areas, reproductive timing and behavior, feeding resources, according to the different ecological niches inhabited. In this way the two species coexist rather than compete within the ecosystem. For this reason one can find a situation of only partial competition reflecting the degree of the relationship between the two species.

Habitat - Table 5 shows the habitat preferences of the two crocodile species indicated by hunters and fishermen in 60 villages in the Ivory Coast in questionnaires conducted by Waitkuwait (1986).

Table 5.

Species	*Crocodylus cataphractus*	*Osteolaemus tetraspis*
uncovered, bright water	23 (38.3%)	4 (6.7%)
covered shady water	23 (38.3%)	13 (21.7%)
swamps and swamp forests	14 (23.3%)	43 (71.7%)
total number of answers	60 (100%)	60 (100%)

This table shows that *C. cataphractus* prefers to stay mainly in the open waters of rivers, lakes or lagoons. *O. tetraspis* enters these only occasionally, preferring swamps beside the open water systems and water pools remaining in periodically flooded swamp forests. It remains in the vicinity of slow flowing waters and calm bays, and stays in burrows beside the waterline.

These results are confirmed by night-counts in different biotopes of the Ivory Coast (Waitkuwait 1986). In the Comoé National Park situated in Sudanese savanna only 1 *O. tetraspis* for every 15 *C. cataphractus* could be found. In the Tai National Park in rain forest the crocodile population of the Hana River was found to be composed of 95.5% *C. cataphractus* and 4.5% *O. tetraspis*. In the Azagny National Park, a swamp area separating two lagoons, all crocodiles found on the actual floating vegetation mat which constitutes the Rhaphia Swamp were *O. tetraspis*; whereas all *C. cataphractus* observed in this area were found in the water of the channels dug out for the tourist management of the park.

Also, elsewhere *O. tetraspis* has been found in small water pools, often far away from the nearest open water. In the interior of Comoé National Park it has been observed several times in the so called "mares," where they remain during the dry season in self-made burrows (Waitkuwait 1986, Gilbert pers. comm.). Similar observations have been made by Villiers (1956a) in the Niokolokoba National Park in Senegal. This was again confirmed for the Marahoué National Park in the contact zone forest savanna in the Ivory Coast (Waitkuwait 1986). Even in the tropical rain forest in the interior of Tai National Park it shows this habitat preference. Up to 10 individuals of different age classes (juveniles, subadults, adults) have been observed throughout the year in the same small water pools. They stayed there permanently, some individuals going on short journeys and returning afterwards (Waitkuwait 1986). It was found that *O. tetraspis* walks around often in the forest, especially during the night or after a heavy rainfall. Several times it has been observed crossing tracks in the forest some km away from the nearest flowing water (Waitkuwait 1986, Hoppe, Merz, Martin pers. comm.).

It has also been observed in water collecting basins at the head of rain forest creeks (Boesch, pers. comm.) and in banana plantations situated on low lying grounds (Gournay, pers, comm.). One *O. tetraspis* stayed for several years in a well, the only water point, isolated in the center of a large oil palm plantation in the Ivory Coast (Maroncelli, pers. comm.).

In contrast to this in all these biotopes *C. cataphractus* has never been observed far from water. It stays in all kinds of rivers mainly covered by dense, shady vegetation, and it avoids uncovered bright sunny areas. The conditions in which its typical habitat is found becomes more scarce as one moves away from rain forest to savanna, as well as where the water courses become wider (Villiers 1956a, 1958, Waitkuwait, 1986).

Nest construction - As *C. cataphractus* and *O. tetraspis* live in habitats covered by dense vegetation, insolation - the normal source of heat for other reptiles - is reduced. One would suppose that it is for this reason both species construct mound nests of dead leaves and rotting vegetation collected from within a diameter of several meters. The mounds are flat on two sides and steeply sloped on the other two sides and have a furrow across the top made by the female lying on the nest or creeping over it. The nests are built in several stages. The female uses fore and hind limbs for the construction. It is thought that the decomposition of the vegetative materials of the mound guarantees the heating of the egg chamber, necessary for embryo development. This nest building behavior has been described in the wild by Villiers (1956, 1958) and Waitkuwait (1982, 1986), and in captive breeding by King (1955), Beck (1978), Sims and Sing (1978), and Tryon (1980).

Table 6 shows the nest dimensions for the two west African mound nest builders as found by Waitkuwait (1986) in the wild.

Table 6 Dimensions of the mound nests.

Species	*Crocodylus cataphractus*	*Osteolaemus tetraspis*
height (cm)	58.6 ± 11.6	47.5 ± 17.1
length (cm)	134.7 ± 36.7	131.3 ± 19.3
width (cm)	152.4 ± 29.6	123.8 ± 50.2
sample	n = 31	n = 4

The sizes of the nests seem to vary according to environmental temperature which depends on the season and on the density of the vegetation surrounding the nesting place. For this reason the size doesn't allow species classification of the nests. Tryon (1980) used damp hay as nesting material in captive breeding of *Osteolaemus* and found that the nest size varied directly to the amount of added material. The nests at Fort Worth Zoo were tightly packed and urination and defecation took place on the clutch and throughout the nest mound. Teichner (1976) gave one nest dimension for *Osteolaemus* of 91 x 61 x 41 cm, and Sims and Singh (1978) described a nest 70 x 50 cm for this species.

Nest site - In contrast Waitkuwait (1986) found that a species classification of the nests is possible according to the species specific nest site chosen by the female crocodile, as can be seen in Table 7.

Table 7. Nest sites of mound nests.

Species	*Crocodylus cataphractus*	*Osteolaemus tetraspis*
Distance from water (m)	3.8 ± 2.2	16.9 ± 22.2
Height over water level (m)	1.8 ± 0.7	1.4 ± 0.6
Sample	n = 73	n = 4

Corresponding to their habitat preferences, the two species also avoid any competition in the choice of their nesting areas. The distribution of *C. cataphractus* mound nests was found to be linear, following the river banks, whereas the distribution of *Osteolaemus* nests was found to be bi-dimensional.

In 3 successive years from 1981 to 1983, 12 nests of *C. cataphractus* were observed by Waitkuwait (1986) alongside the Gabo River in the interior of the Tai National Park. Table 8 shows the average distance between the nests.

Table 8. Average distance between *C. cataphractus* nests.

Year:	1981	1982	1983
distance (km)	1.13	0.7	1.66
standard variation (km)	±0.67	±0.49	±1.72
sample (nests)	n = 12	n = 12	n = 12

From the observed variations of the distances between two nests, it can be derived that either the females choose a new nest site every year within their territory, or they change their territory, or even that some females do not reproduce every year.

In 1982 and 1983, only two nests were found to be constructed on a nest of the previous year.

Knoepfler (1974) speculated that *Osteolaemus* may use the same mound in successive years.

Nesting period - Table 9 shows the period of nesting activities of *C. cataphractus* and *O. tetraspis* in the tropical rain forest of the Ivory Coast found by Waitkuwait (1981, 1982, 1985, 1986).

Table 9. Dates of nesting activities.

Species	*Crocodylus cataphractus*	*Osteolaemus tetraspis*
date of nest construction	April 8 ± 18 days	April 30 ± 60 days
date of hatching	July 17 ± 18 days	September 15 ± 76 days
main nesting period in the year	March 21 to Aug. 4 over 136 days/year	March 1 to November 30 over 274 days/year

Nest construction for both species starts at the end of the dry season in the Tai forest when the most of fallen leaves are available for the nest mounding, so the subsequent nesting period covers principally the season of high rainfall. One can see that the main nesting period stretches over a longer period of time for the *O. tetraspis* than for the *C. cataphractus*.

High water levels in the small forest rivers during egg incubation and hatching seem to be very important for *C. cataphractus* so that the female can remain in water close by to guard the eggs and hatchlings. Whereas in rivers these conditions are found for only part of the year, the swampy habitat chosen by *O. tetraspis* offers almost all year round the necessary hydrological conditions for its nesting almost all the year. The main nesting period for both species has been defined as the period during which 2/3 of all nests constructed per year can be observed (data based on the standard variation calculation), 1/3 of nests being constructed outside this period according to climatic fluctuations or to differences in the individual behavior of the females.

Chronological order of reproductive activities - Available data are very scarce. Tryon (1980) states that both sexes of *Osteolaemus* mature at age five years and that courtship and mating of captive *Osteolaemus* starts every year in late November in Fort Worth Zoo. Copulation peaks during March and April. Drumming, neck rubbing, and male combat are described as courtship behaviour by Beck (1978), Teichner (1976, 1978) and Tryon (1980). The last author found that *Osteolaemus* females are unreceptive in late April and early May. Nest building began in June (Teichner 1976, 1978, Tryon 1980), actual laying occurred 5 to 47 days after mounding. Waitkuwait (1982) mentions that courtship and mating of *C. cataphractus* in Abidjan Zoo takes place in February and March. Actual oviposition occurred between a few days and one week after nest mounding.

Eggs and incubation - Just as the *Osteolaemus* female is small in size (about 1.50-1.60 m) in comparison with the *C. cataphractus* female (about 2.2 m), the same difference in clutch and egg size has been found by Waitkuwait (1986), as shown in Table 10.

Table 10. Clutch and egg size.

Species	*C. cataphractus*	*Osteolaemus tetraspis*
egg number per nest	16.0 ± 7.0	10.0 ± 4.0
egg length (mm)	85.5 ± 3.2	68.9 ± 2.4
egg diameter (mm)	52.9 ± 1.5	37.1 ± 1.2

The mean clutch size shown above for *Osteolaemus* is consistent with data published by Greer (1975), Knoepfler (1974), Beck (1978), Wilson (1977), Hara and Kikuchi (1978), Sims and Singh (1978), Teichner (1976, 1978), and Helfenberger (1981), gathered during captive breeding of this species. Tryon (1980)found that the mean egg number for 25 *Osteolaemus* clutches was 13.28. Data on egg length and diameter published by him are consistent with the data in Table 10.

In contrast the data on egg incubation show no species-specific differences. The length of the incubation period is determined to be 100 ± 10 days for *C. cataphractus* as well as for *O. tetraspis* (Waitkuwait 1981, 1982, 1986). Other data on length of incubation period are available from the captive breeding of *O. tetraspis*: 84 days (Wilson 1977), 118 days (Hara and Kikuchi, 1978), 109 days (Tryon 1980), and 84 days (Helfenberger, 1981). Incubation temperatures range between 26°C and 34°C in mound nests of both species (Waitkuwait 1981, 1982, 1986), being constant in each nest (with daily fluctuations of less than 0.5°C) and about 5°C greater than the environmental temperature.

Figures 1 and 2 show temperature data gathered on a *C. cataphractus* mound nest in the Tai National Park. The endogenous heat in conjunction with the insulation given by the nest walls creates a largely autonomous microenvironment. However, as shown in Figure 1, the outside influences are not completely cut off. A longterm drop in the outside temperature, as recorded in June and July, resulted also in a lowering of the temperature in the nest.

O. tetraspis was bred successfully in captivity at incubation temperatures fluctuating between 25°C and 34°C (Tryon 1980) and 27°C and 33°0 (Helfenberger 1981). The humidity in mound nests of both species was also found to remain constant over the whole incubation period (Waitkuwait 1981, 1982, 1986). Table 11 shows the percentage of dry matter in the nesting material.

In the air space of the egg chamber the relative humidity was therefore almost always at saturation point.

Table 11. Dry matter of mound nests.

Nest of	% Dry matter
C. cataphractus from forests	45.3
C. cataphractus from savanna	47.8
O. tetraspis from swamps	37.2

Hatching of the young and behavior of the mother - As for most of the crocodile species, it has also become apparent for *C. cataphractus* and *O. tetraspis* that the mother crocodile guards and visits the nest during the whole of the incubation period (King 1953, Tryon 1980, Waitkuwait 1982, 1986). On captive *Osteolaemus* it could be observed that the female spent up to 50% of her time on guarding the nest, that vocalization and aggressiveness, even against man, increased (Tryon 1980, Helfenberger 1981). Wild breeding *C. cataphractus* females were found to be very shy (Waitkuwait 198l, 1982). Cracks developed on the eggs and the young became vocal in answering movements in the nest surroundings by croaking heavily for about 1-2 days before actual hatching.

The mother crocodile is alerted by the calling of the young and is stimulated to excavate the nest and to help in hatching the young. For this she picks up the neonates partly emerged from the eggs, rolls them between her jaws until the eggshells have been removed, and transports the neonates in her mouth into water. This hatching process has been described by Tryon (1980) on captive *Osteolaemus* in the Fort Worth Zoo and has been observed on wild *C. cataphractus* and *O. tetraspis* (Waitkuwait 1981, 1982, 1986).

After hatching, the mother crocodile stays in the vicinity of the young to protect them. Communication is guaranteed by the vocalization of the young; Tryon (1980) found the calling of the young was not species-specific.

Waitkuwait (1982) observed that of the 17 eggs in a wild *C. cataphractus* nest 2 eggs were predated, 10 hatched successfully, embryonic death occurred in two, and 3 eggs were probably infertile.

Of 85 *Osteolaemus* eggs incubated at Fort Worth Zoo, Tryon (1980) found that 37 hatched, 39 were infertile, 2 contained fully formed but dead embryos, 2 contained living anomalies, and 1 contained twin crocodiles. Table 12 shows the total length of neonate *C. cataphractus* and *O. tetraspis* (Waitkuwait 1986).

Table 12.

Species	*Crocodylus cataphractus*	*Osteolaemus tetraspis*
total length (mm) at hatching	315.1 ± 23.3	279.3 ± 4.0

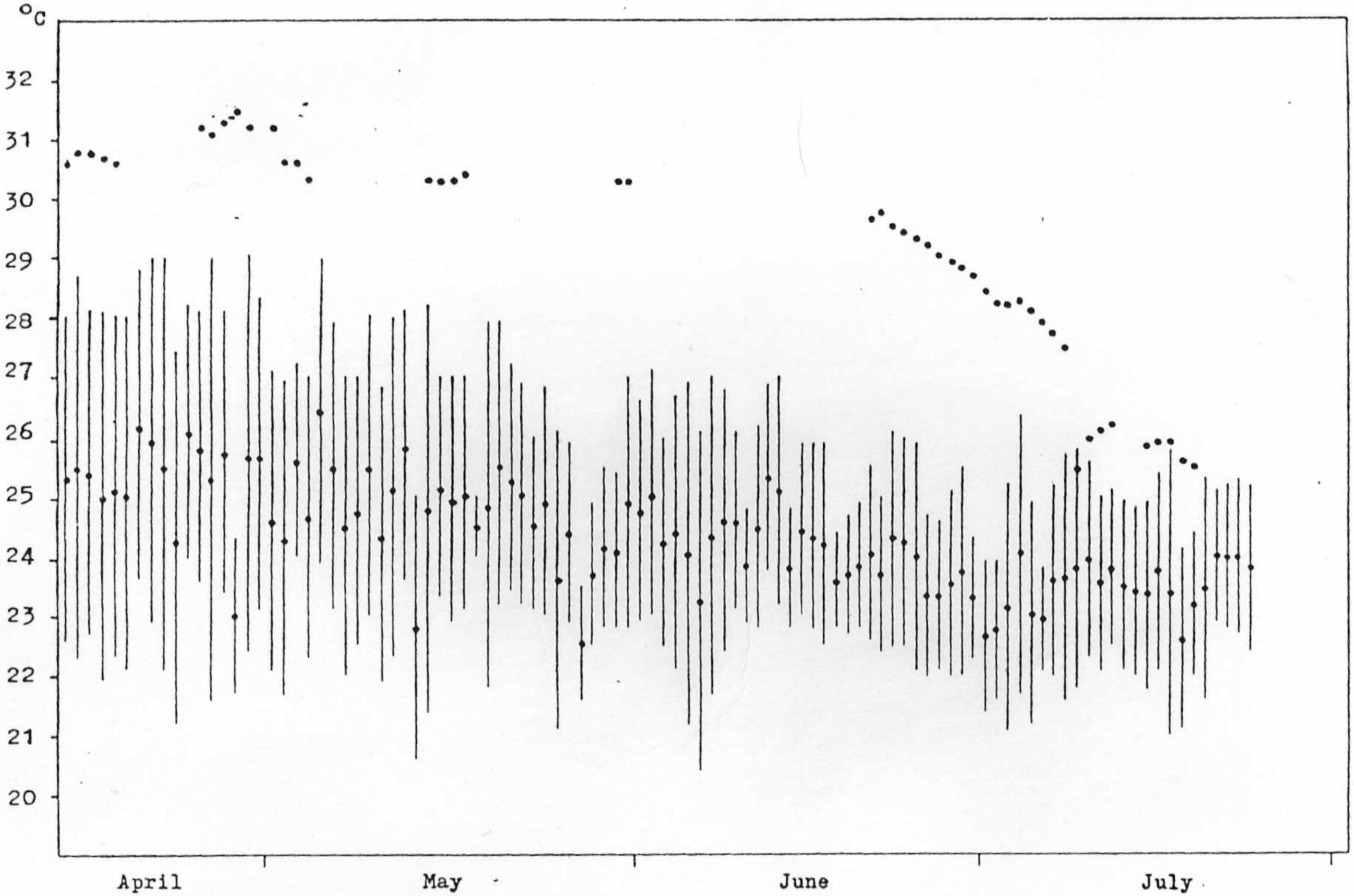

Figure 1. The nest temperature (above) in relation to the amplitudes outside the nest (below) from 14 April to 24 July 1980.

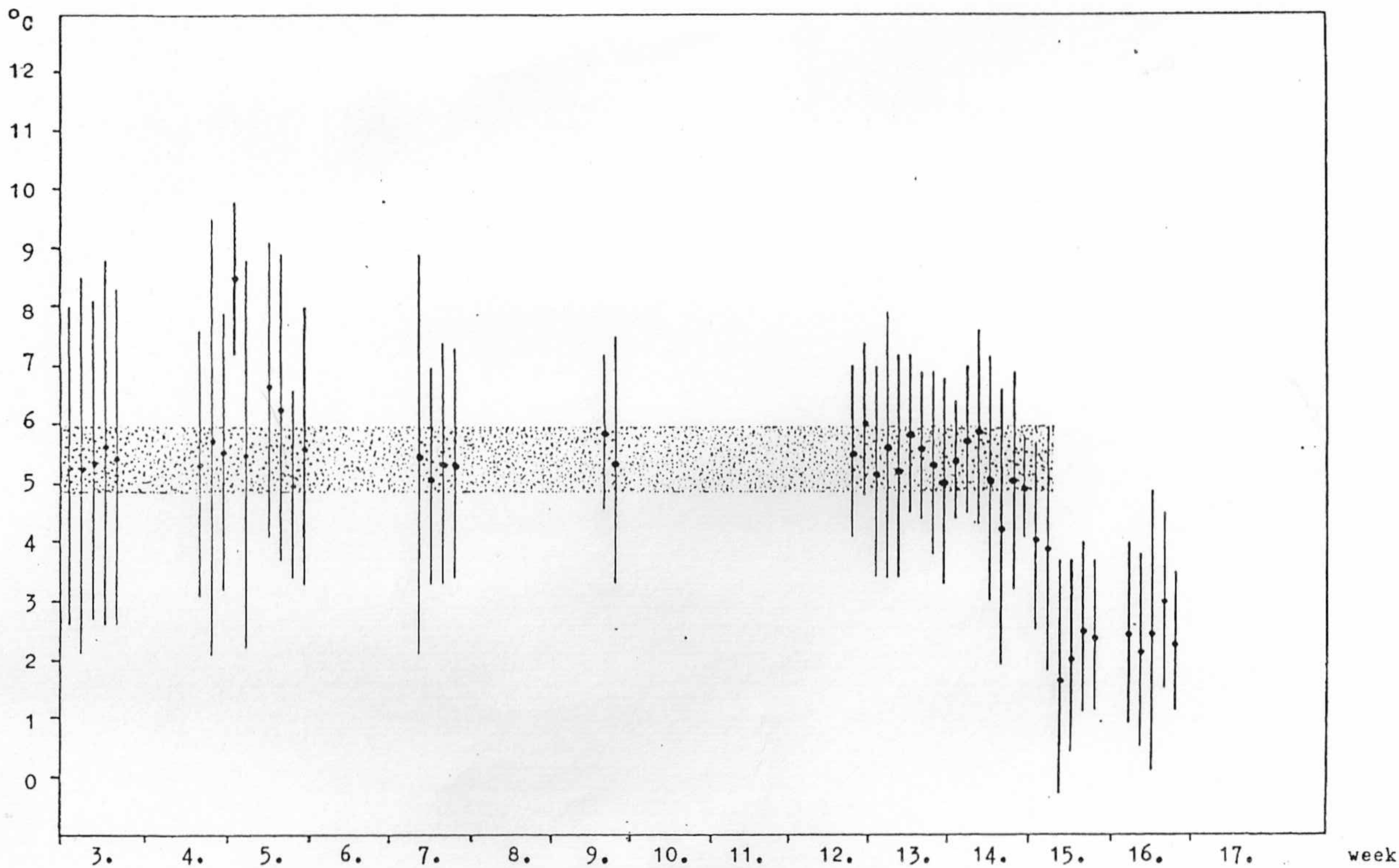

Figure 2. The constant difference between the incubation temperature and the mean day temperature outside the nest from the third week of incubation to the opening of the nest in the fifteenth week.

Tryon found the mean total length per clutch of *Osteolaemus* hatchlings at Fort Worth Zoo to be between 216.7 and 242.5 mm . Captive bred *Osteolaemus* neonates measured by Helfenberger (1981) showed a total length of 19 cm.

Feeding - Progressive differentiation of the body proportions of the two species occurs during growth. This finally results in adult *C. cataphractus* having a total length and a relative head and tail length greater than that of *O. tetraspis*. One would suppose that this phenomenon of allometry reflects different specializations concerning species-specific modes of hunting and ranges of prey.

C. cataphractus develops a slender snout and a long tail, both of which are necessary for a rapid hunting in water. The slender-snouted crocodile preys principally on fish and aquatic birds. Its large size also allows it to attack small- or medium-sized mammals, such as duikers (Cephalophinae), rodents (Rodentia), genettes (Viverrinae), monkeys (*Colobus* sp., Cercopithecidae), etc., which come to drink in the rivers (Waitkuwait 1986). In contrast, *O. tetraspis* has a stumpy, large snout and a short tail which favor land-based hunting in its swampy habitat. Some rare observations indicate that it feeds on amphibians, reptiles, annelides, crabs, and fish, (Villiers 1958, Waitkuwait 1986). Hatchlings of both species seem to have the same feeding regime as *C. niloticus* hatchlings, which was described in detail by Cott (1961): larvae of aquatic insects, tadpoles, etc.

Enemies - In general, predation on crocodiles occurs principally at the egg and hatchling level. According to Waitkuwait (1982, 1986) the following animals in the tropical rain forest of the Ivory Coast are potential predators against crocodile eggs and juveniles: Nile monitor (*Varanus niloticus*), otters (*Lutra maculicollis*, *Aonyx capensis*), water mongoose (*Atilax paludinosus*), tree civet (*Nandinia binotata*), genets (Viverrinae), leopard (*Panthera pardus*), golden cat (*Felis aurata*), herons (*Egretta alba*, *Ardea purpurea*), birds of prey (Accipitridae), and soft-shelled turtles (*Trionyx triungius*). Although predation has been observed several times, it is apparent that the density of predators in tropical forests is too low to severely reduce the crocodile population. The only predator threatening crocodile populations in west Africa is, like elsewhere, man, both through commercial hunting and increasingly through habitat destruction. As a consequence of human influences the west African crocodile populations are presently collapsing. This was confirmed by Ivorian hunters and fishermen (Table 13; Waitkuwait 1986).

Table 13. Frequency of Crocodiles in the lvory Coast according to hunters and fishermen.

Frequency	*Crocodylus niloticus*	*Crocodylus cataphractus*	*Osteolaemus tetraspis*	Total
no answer	0 (0%)	7 (8.6%)	3 (3.7%)	10 (4.1%)
not or no more occurring	10 (12.3%)	14 (17.3%)	6 (7.4%)	30 (12.3%)
rare	62 (76.5%)	55 (67.9%)	60 (74.1%)	177 (72.8%)
less rare to locally frequent	9 (11.1%)	5 (6.2%)	12 (14.8%)	26 (10.7%)
frequent	0 (0%)	0 (0%)	0 (0%)	
Total number of answers	81 (100%)	81 (100%)	81 (100%)	243 (100%)

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