Distribution of *Typhlonectes natans* in Colombia, environmental parameters and implications for captive husbandry

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ABSTRACT - The distribution, ecology and habitat requirements of most caecilians are unknown. We reviewed the distribution of the Typhlonectid caecilian *Typhlonectes natans* in Colombia using published reports and our own collecting experience. *T. natans* is more widely distributed than previously reported. This caecilian is the most commonly kept in captivity. Published reports regarding the captive requirements of the species are conflicting. We recorded the environmental parameters in habitats where *Typhlonectes natans* was found to allow for an improved captive management of the species. Without exception this species was found associated with flowing water. It is apparent that this species disperses into floodplains during the rainy season.

CAECILIANS (order Gymnophiona) remain enigmatic to a large extent. Their tropical distribution and often subterranean habits mean that they are rarely encountered in routine herpetological surveys (Gower & Wilkinson, 2005). The population and therefore conservation status of many caecilian species is unknown (IUCN et al., 2006). There are two species in the neotropical genus *Typhlonectes* (Typhlonectidae) and they are both completely aquatic (Kupfer et al., 2006). *T. natans* has been caught by hand (Verdade et al., 2000), by hook (Taylor, 1968) and by line (Kupfer et al., 2006). Kupfer et al. (2006), also report the passive trapping of *T. compressicauda* using funnel traps.

The distribution of *Typhlonectes natans* (front cover and Fig. 1) in Colombia was first reviewed by Lynch (1999). Its status and distribution were then proposed by IUCN et al. (2006) in the global amphibian assessment (GAA). The current distribution of *T. natans* does not entirely concur with the localities of collected specimens that are held in several scientific institutions in Colombia (IUCN et al., 2006; Nelson, 2008). This study reviews the literature for *T. natans* and produces an updated map of the localities where the species has been collected in Colombia.

T. natans is one of the few caecilians that can be purchased regularly in Europe and there are several publications that detail its captive care and breeding (Herman, 1994; Wake, 1994; Kowalski, 2001; Parkinson, 2004). However, there is a lack of consensus regarding finer captive requirements such as exact temperatures and water parameters. Whitaker & Wright (2001) state that water harder than 150 ppm may cause skin lesions in captive Tyhlonectid caecilians. This study aimed to document the environemtnal parameters of the natural habitat occupied by *T. natans* to allow for improved captive management.

METHODS AND MATERIALS

We combined the distribution of *T. natans* from Lynch (1999) and the following locations;

Location 1. Hacienda La Condesa, 294 m ASL, (5°18'9.6''N 074°48'4.6''W, Department Tolima, Colombia). A slow flowing stream feeding into a large lagoon situated in a mosaic of pastures and xerophytic forest. The stream bed was littered with boulders, pebbles and detritus. Stream banks supported thick vegetation and stream sides were bordered with dense mats of floating vegetation.

Location 2. Hacienda La Condesa, 294 m ASL, (5°18'9.6''N 074°48'4.6''W, Department Tolima, Colombia). A Lagoon fed by a small stream (Fig. 2), with an outlet stream leading to Guarinó river. The Lagoon substrate consisted of sand covered with detritus and some rounded rocks. Its edge was characterised by dense mats of floating sedges and grasses. Fish observed in the lagoon included *Caquetia kraussii*, *Poecilia caucana* and *Hoplias malabaricus*. Vegetation mats were suprisingly devoid of invertebrates, although we did encounter Nepidae and Odonata larvae. A single *Caiman crocodilus* was observed.

Location 3. Village of Guarinócito (Fig. 3), 209 m ASL (5°20'28.8''N 74°44'9.9''W, Department Caldas, Colombia). A slow flowing stream leading to an Oxbow lake (at the time of the survey, the wet season, the oxbow lake was continuous with the Rio Magdalena). The stream substrate was composed of rocks, small boulders and broken concrete. Associated vegetation included *Pistia stratiotes*, *Eichornia* sp. and *Colocasia* spp. *Bufo marinus* was also observed in the stream. There were many cat fish *Primelodus* cf. *blochii* and characins.

Location 4. Nechi River, 120 m ASL (7°46'18.4''N, 74°46'19.2''W, Department Antioquia, Colombia). This location has a lagoon associated with the Nechi river. The lagoon was surrounded by grasses and sedges. Five specimens of *Typhlonectes natans* were captured. Water parameters were not recorded in this location.

Location 5. Marbella farm, 30 m ASL (9°2´13´´N, 75°54´38´´W, Department Sucre, Colombia). A muddy complex associated with floodplains at the junction between Magdalena and Cauca Rivers (Fig. 5). One specimen of *T. natans* was captured. Other amphibians observed in and around this aquatic habitat included *Pseudis paradoxa* and the terrestrial caecilian *Caecilia caribea*. Water parameters were not recorded in this location.

Water temperatures for the Rio Magdalena at Honda (the closest monitoring station to location 1, 2 and 3) were obtained from the Instituto de Hidrología, Meteorología y Estudios Ambientales de Colombia (IDEAM). This data set included monthly temperatures for the Rio Magdalena from 1988 to 2006.

Water parameters were recorded at locations 1, 2 and 3 using a max-min thermometer (ETI Ltd ©) and Aquarium Pharmaceuticals Incorporated © master test kit and Aquarium Pharmaceuticals Incorporated © KH and GH test kit. pH readings were taken using OAKTON © pH/mV/^{o}C Meter, pH 300 Series.

RESULTS

The farm workers at Hacienda La Condesa informed us that when they were cleaning the lagoon of floating vegetation they often encountered *T. natans* wrapped around the dense roots of the floating vegetation mats. We used a rake and hauled mats of floating vegetation from the lagoon and the stream feeding it onto land (Fig. 4). Once on land these mats were searched for specimens. In two hours of work at location 2, one specimen was captured at 12:30 but unfortunately escaped before any data could be recorded. *Typhlonectes natans* was not observed in location 1. A mask and snorkel were used at sites 1 and 2 to search for *T. natans* but none were found.

In location 3, four specimens were caught by hand. Specimens were visually located and slowly approached under water and grasped securely by the mid-body and temporarily removed from the the water into a bucket. Two additional specimens were caught by enticing them out from their refugia using water scented with fish blood and placing fish viscera at the entrance to rock crevices. Once enticed out of refugia specimens were apprehended by hand. Specimens were captured between 16:00 and 17:30.

The five specimens captured at location 4 were found at night (19:00-20:00) by wading through the water. Specimens were located swimming against the current from the Nechi river into the alluvial floodplain. The water was approximately 1.3 m deep. Specimens were caught using a snake hook.

All specimens captured at location 3 were

Figure 2. Location 2 lagoon at Hacienda La Condesa. © Ben Tapley. ◄

Figure 1. *Typhlonectes natans*. © Ben Tapley. ▼

Figure 3. Location 3, Guarinócito. © Ben Tapley.

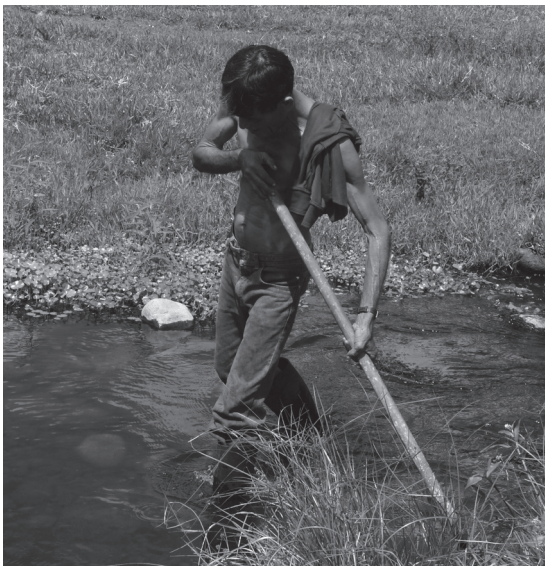

Figure 4. Searching vegetation mats for *Typhlonectes natans*. © Ben Tapley.

Figure 5. Location 5 Floodplains in Caimanera area Departamento of Sucre. © Andrés Acosta.

	Location 1	Location 2	Location 3
Date	22.11.08	22.11.08	25.11.08
Time	14:00	14:30	16:00
Weather conditions	Sun no wind	Sun no wind	Sun no wind
Water temperature (˚C)	28.2	28.7-30.7	29.2
pH	7.06	6.17	6.92
Ammonia (ppm)	0.00	0.25	0.00
Nitrite (ppm)	0.00	0.00	0.00
Nitrate (ppm)	0.00	0.00	10.00
GH (ppm)	71.6	71.6	107.4
KH (ppm)	71.6	71.6	107.4

Table 1. Water parameters from locations 1, 2 and 3 where *Typhlonectes natans* occur or are thought to occur.

weighed in life. Three of the specimens captured at location 3 (1 male, 2 females) were housed in an aquarium in Bogotá. These three specimens were photographed with a scale to obtain total length in mm (Table 2). The remaining three specimens captured at location 3 were preserved as voucher specimens. Specimens were euthanized using Chloretone (2 drops/10 ml water) and total length taken post death (Table 2). Specimens were fixed in buffered 10% formalin and then transferred to 70 % ethanol. They were then deposited at the Pontificia Universidad Javeriana, Bogotá. Specimens were sexed by examining the diameter and shape of the cloacal disc. The diameter of the cloacal disc in males is greater than that of the females (Stebbins & Cohen, 1995) and the cloacal disc of the female is slit-like and more elongated.

In location 5 the single specimen was captured by hand at night (20:00). Local fishermen explained that the species can be captured in fishing nets.

DISCUSSION

Collection localities of *Typhlonectes natans* in Colombia are shown in Fig. 6. Lynch (1999) reported specimens from the department of Atlántico, municipality Barranquilla, extending the northern range of *T. natans* reported by the GAA. Lynch (1999) also reported specimens from the department of Cordobá, municipality Tierra Alta, extending the westerly range of *T. natans* reported by the GAA. The distributional map of *T. natans* provided by the GAA does not regard habitat type or altitude. Subsequently the species distribution according to IUCN et al. (2008) encompasses high-altitude paramo habitat. Lynch reports the altitudinal range of *T. natans* in Colombia to be 100-1000 m ASL. We believe that *T. natans* may occur further south in the Magdalena valley (High Magdalena) than Fig. 6 shows. This region requires further investigation to ascertain the presence or absence of this species in the area. We also suggest that *T. natans* may occur further south at the source of the Urrá river. Our thoughts need verification by future prospecting for *T. natans* in this region. The evaluation of voucher specimens held by institutions outside of Colombia was beyond the scope of the study.

From the four capture sites described in the methods section it is apparent that *Typhlonectes natans* is associated with alluvial floodplains of the Magdalena and Cauca rivers. *T. natans* appears to migrate to the floodplains, against the river flow during the wet season. This information was supported by observations from local fishermen of Guarinócito who said that they did not encounter *T. natans* during the dry season. They reported that the area where we collected specimens in Guarinócito shrinks in volume to become a very small stream in the dry season. Without exception *T. natans* was associated with flowing water in all sites where we observed them.

Villagers at Guarinócito concurred with our observations to support the findings of Hoffer (2000). Hoffer (2000) stated that Typhlonectids are often associated with fishing villages and will feed on the discarded entrails of fish. In Guarinócito the local people explained that they did not encounter small (juvenile/neonate) specimens. One small, and possibly young, specimen was captured on the floodplain in location 4, indicating that all age classes of *T. natans* migrate to the floodplains during the wet season.

Sex	Total length (mm)	Weight (g)
Female	434.0	52.6
Female	439.0	55.5
Female	413.0	51.1
Female	637.0	172.2
Female	415.0	57.3
Male	374.0	37.9

Table 2. Morphometric data for specimens captured in Guarinócito.

The local name for *Typhlonectes natans* is 'Anguila' (Spanish for eel). Many locals did not recognise *T. natans* as an amphibian, but instead believed that it was a fish and belonged with the ichthyological fauna of the region. This point is important to remember when working with local rural communities when interviewing them about observations. Despite its illusive nature, *T. natans* is notorious enough in the region to earn its place in local folklore. At Hacienda La Condesa locals explained that if a woman's hair is placed in a bottle, and the bottle is left under water, the next day a caecilian will appear in the bottle.

The water temperatures in location 2 (Table 1) varied between 28.7-30.7ºC. The water was at its warmest amongst the submerged roots of vegetation mats, exactly where the single *T. natans* was captured. Unfortunately we were unable to obtain night-time water temperatures at this location.

There was little variation in the water parameters between sites. The water parameters and temperature records are valuable as a base line for maintaining *T. natans* ex situ. The Ammonia, Nitrite, Nitrate, general hardness (GH) and Carbonate hardness (KH) were recorded using aquaria test kits which are known for their approximate results. Therefore data presented herein for these values should be considered as approximate. The purchase of more sophisticated water test kits was not possible for

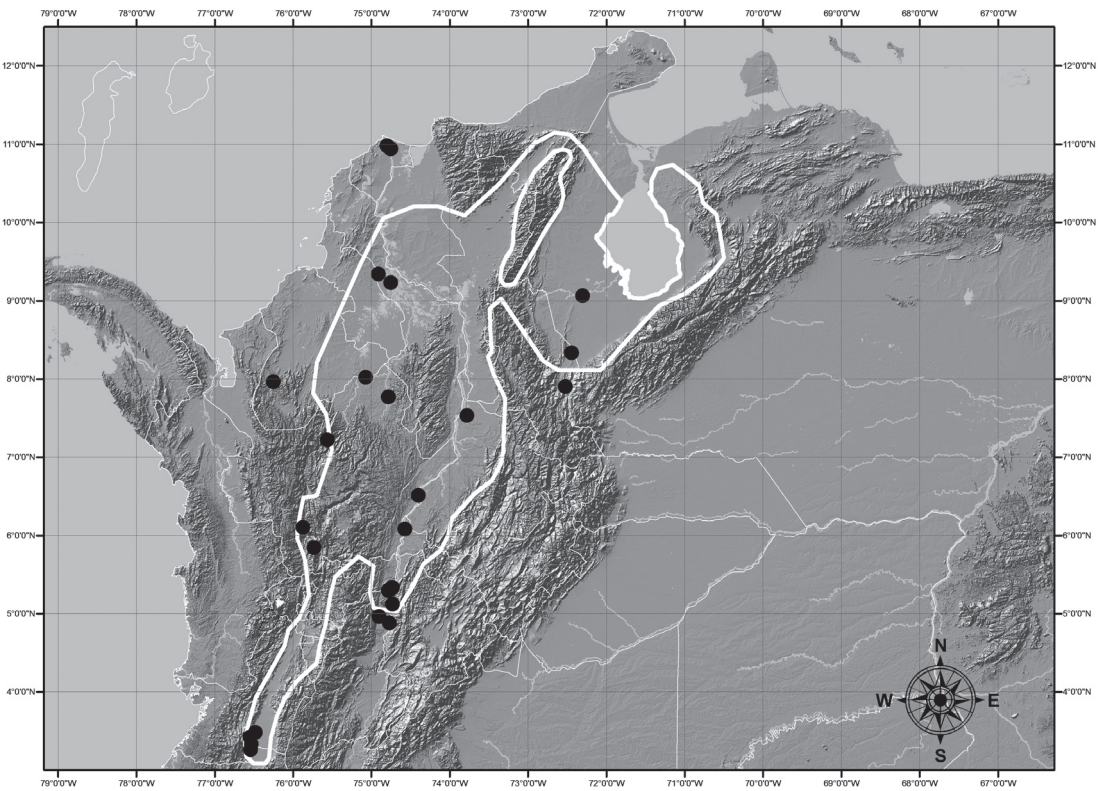

Figure 6. Additional localities to the range of *Typhlonectes natans* (dots) in Colombia; the yellow line corresponding to the distribution of (Mijares et al. 2009).

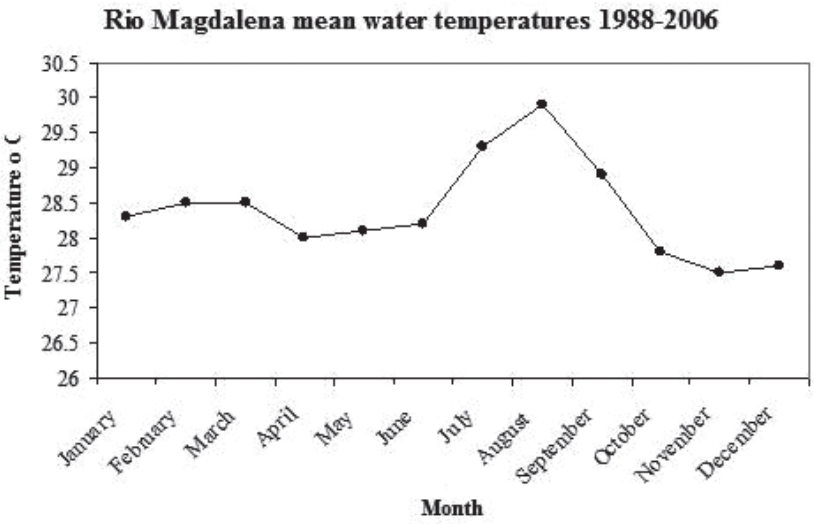

Figure 7. The mean temperatures of the Rio Magdalena at Honda from 1988-2006.

this study. The time of year the temperature data (Table 1) were collected coincided with the end of the wet season. At this time the Magdalena river was in full flood, swollen with rainwater carried to it by the numerous streams and tributaries. We therefore believe that our data exhibit lower daytime temperatures that *T. natans* would experience annually. This suggestion is supported by the temperature data in Figure 7.

Many reports of *T. natans* in captivity suggest that the animals be maintained at 24-28ºC, a temperature range significantly lower than that experienced by the species in the wild, at least in this area of Colombia (Fig. 7). The stream at location 3 was used by villagers for washing, rinsing clothes and washing vehicles. When many local people were washing upstream the water smelt strongly of soap. At this time, we noted that fish temporarily dispersed and it is unclear whether *T. natans* would have also reacted in this way.

It is hoped that the environmental data collected in this study will allow for greater precision when keeping this species in captivity. We suspect that the seasonal temperature fluctuations may prove an important reproductive trigger for this species. Seasonal changes in other water parameters would require further investigation to conclude any recommendations. In both locations where *T. natans* was found the specimens were associated with flowing water. The occurrence of *T. natans* in lagoons and streams in the wet season also provides a glimpse at of the species' seasonal movement patterns.

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