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Front cover illustration. *Leptopelis viridis* (Savanna tree frog). Photograph by Linda Barnett. See article on page 6.

EDITORIAL

The Herpetological Journal on-line!

In 2007 *The Herpetolgical Journal* – the British Herpetological Society's primary scientific journal – is moving to on-line production, and will be available to subscribed members via the internet. Printed copies will also continue to remain available, at least for the foreseeable future. *ED*

Letter to the Editor

Dear Sir,

In an otherwise informative note in *The Herpetological Bulletin* on behavioural time allotment in *Alsophis*, Heinz *et al*. (2004) make the following statement:

'Because we were unable to determine whether or not such pauses were the result of our presence and despite statements by Gregory (2004) indicating that snakes are not overly responsive to the presence of observers, we chose to err on the side of caution and disregarded all ambiguous observations from the data set…'

I am glad to learn that Heinz *et al*. took this precaution, but their reference to Gregory (2004) is an unrigorous paraphrasing of what I actually said. They have taken one sentence from a two-paragraph discussion of the subject of human influences on snake behaviour and used it out of context. I certainly have seen examples of snakes (mainly garter snakes) that seemed virtually unaffected by handling in their subsequent behaviour; I think that such (non-) responses are very interesting, but in no way do I claim that they are typical. Obviously, I should have made this clearer by adding a qualifier such as 'sometimes' or 'on occasion'. In fact, though, I did add that there likely is variation among taxa (and, I note here, among individuals) in their responses to humans, and that context matters. I also asked the following questions:

'How can we study any animal, even just watching it, without disturbing it? How can we know that what we are seeing is natural?'

Studies of defensive behaviour of snakes often use humans as proxies for natural predators (e.g. Arnold & Bennett, 1984; Herzog & Burghardt, 1986; Schieffelin & de Queiroz, 1991; Kissner *et al*., 1997; Passek & Gillingham, 1997) and for good reason - snakes usually respond to humans as if the latter were predators. An implicit assumption (or hope) here is that snakes respond to humans in the same way that they would to their natural predators. Whether or not they do is of course an important question, but we lack sufficient observations of natural encounters between snakes and their predators to answer it.

Reading a snake's mind is difficult, even elusive, and at present involves more than a little guesswork. We often are left to make subjective assessments (as Heinz *et al*. also did) about what snakes are responding to and when they are doing it. That said, I want to make it clear that I do not think '…that snakes are not overly responsive to the presence of observers…'.

Yours sincerely,

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Dated 17th October 2005

SHORT NOTES

First record of the colubrid snake *Rhadinaea anachoreta* Smith & Campbell from Honduras

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ABSTRACT — The colubrid snake *Rhadinaea anachoreta* is reported from Honduras for the first time, based on a specimen from the northern foothills of the Sierra de Omoa.

RESUMEN — El colúbrido *Rhadinaea anachoreta* está registrada por la primera vez de Honduras, basado en un especímen del pie de la montaña norteña de la Sierra de Omoa.

RHADINAEA Cope is a species-rich genus of colubrid snakes that occurs in the coastal plain of the southeastern United States and from mesic areas of Nuevo Léon and Sinaloa, Mexico, southward through Central America to southwestern Ecuador (Savage, 2002). Seven species of *Rhadinaea* have been reported to occur in Honduras: *R. godmani*, *R. kinkelini*, *R. lachrymans*, *R. montecristi*, *R. tolpanorum* (Wilson & McCranie, 2002), *R. decorata* (McCranie, 2004), and *Rhadinaea* sp. (McCranie & Castañeda, in press). In Honduras, members of this genus are known to inhabit elevations from 180 m (*R. decorata*; McCranie, 2004) to 2530 m (*R. montecristi*; Wilson & Meyer, 1985). *Rhadinaea decorata* is the only lowland-inhabiting representative of the genus in Honduras, with the other six species occurring in upland pine-oak forest or upland rainforest.

On 22nd July 2005, a single specimen of *Rhadinaea anachoreta* (UF 144825) was recovered from a pitfall trap at 130 m elevation in the El Paraiso Valley Ecological Reserve (15º40'36.0"N, 88º06'02.7"W), Departamento de Cortés, Honduras. El Paraiso Valley Ecological Reserve is a privately owned reserve on the northern slope of the Sierra de Omoa, protecting secondary broadleaf forest in the steep sided valley of a small river, the Río Piedras de Muclé. The pitfall trap was part of a drift fence array placed below a steep slope leading down to a dry streambed. This area was located in a patch of 15–20 year old secondary rainforest containing a moderately dense under-story characterized by an abundance of cacao, banana, and *Heliconia* sp. Unfortunately, the snake died the night it was collected and became desiccated before it was preserved. Subsequent examination of UF 144825 using a stereomicroscope showed it to be in complete agreement with the description of *R. anachoreta* provided by Smith & Campbell (1994). Relevant data for UF 144825 is presented as follows, with ranges from Smith & Campbell (1994) given in parentheses where pertinent: 17 dorsal scales rows, ventrals 145 (139–147), subcaudals 75 (74–80), supralabials 8–8, infralabials 8–8, postocular 1, preocular 1, temporals 1+1, snout-vent length approximately 160 mm (164–182 mm), tail length approximately 70 mm (72–74 mm).

The dorsal colouration and pattern in preservative of UF 144825 are described as follows: dorsal ground colour brown; two brown ventrolateral stripes present on edge of ventrals and lower edge of first dorsal scale row and on lower edge of second dorsal scale row and upper

edge of first dorsal scale row; black stripe present on upper half of third and lower half of fourth dorsal scale rows; thinner black stripe visible on upper edge of sixth and lower edge of seventh dorsal scale rows; black vertebral stripe completely covers vertebral scale row and proximal edges of paraveterbral rows; ventral colouration is cream, with some brown flecking present towards posterior portion of body; dorsal surface of head brown with some paler mottling, two irregular pale spots forming partial nuchal band posterior to parietals; supralabials 1–3 mostly brown with cream spot in upper anterior corner; supralabials 4–5 cream on anterior half, brown on posterior half; supralabials 6–7 with brown with pale stripe from lower back corner of orbit to angle of jaw; supralabial 8 brown, blending it to dorsal colouration; mental scale with cream ground colour and two brown spots on outer anterior edges; infralabials and chinshields cream.

Smith & Campbell (1994) first described *R. anachoreta* on the basis of three specimens collected between about 500 m and 1180 m elevation in the Sierra de Santa Cruz and the Sierra de Caral in northeastern Guatemala. The Sierra de Caral is a name used for the northern Guatemalan portion of the Cordillera de Merendón, and the type locality is 0.2 km from the border of Depto. Santa Barbara, Honduras. The Sierra de Omoa in northwestern Honduras is also part of the Cordillera de Merendón, and though the locality where UF 144825 originated is on the northern Caribbean slope of the Sierra de Omoa and at a lower elevation than had previously been reported for this species, it is not surprising that *R. anachoreta* occurs in northwestern Honduras. All three specimens reported by Smith & Campbell (1994) were collected in secondary vegetation in rainforest areas, as was UF 144825.

ACKNOWLEDGEMENTS

Fieldwork was conducted as part of Operation Wallacea's Honduras Forests Conservation Project, and our work was facilitated and supported by Roberto Downing M., Tim Coles, and Richard Field. Phillip J. Lewis and Charlotte C. Woodhead assisted in the field. Research and export permits were issued by Conrado González, Martha Moreno, and Ibrahim Padilla of the Departamento de Areas Protegidas y Vida Silvestre (DAPVS) of AFE-COHDEFOR. We are grateful to Don Enrique Morales Alegría for permitting us to work on his property, and to Doña Telma for being a gracious hostess during our stay in El Paraiso.

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On the occurrence of *Psammophis punctulatus* Bibron & Duméril 1854 in Egypt

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DURING field investigation of the herpetofauna of Gebel Elba in the extreme south east of Egypt in November 2000, the first author observed closely a distinctive snake of the genus *Psammophis*, which obviously differed from the three other congeners known from the country: *P. aegyptius* Marx, 1958, *P. schokari* (Forskål, 1775) and *P. sibilans* (Linnaeus, 1758) (Anderson, 1898; Flower, 1933; Marx 1968; Saleh, 1997; Baha El Din, 2001). Unfortunately that specimen escaped, preventing further detailed study. However, it was tentatively assigned by Baha El Din (2001) to *Psammophis punctulatus*, based on its distinctive colour and pattern, general morphology, and its known geographic distribution and ecology. In November 2004 the second author encountered a further specimen and obtained good diagnostic photographs (e.g. Fig. 1), which unquestionably confirm the initial designation made by Baha El Din (2001). This is the first confirmed report of the species from Egypt.

The two Egyptian examples were both between 900 and 1200 mm long, slender with a long tail. Eyes notably large. Dorsal side of head and neck plain light olive-grey. Two narrow black stripes extended on each side of the head from the snout through the eyes and merging on the neck, forming a single broad black median stripe that extends posteriorly to the tail tip. This median stripe is bordered on each side by a narrow yellowish stripe, followed by a broad grey band on each flank. Venter white with scattered black spots, throat and labials white.

Two subspecies of *P. punctulatus* are recognised. The nominate subspecies is found in Sudan, Eritrea, Ethiopia, Djibouti, Somalia and north-west Kenya (Parker 1949; Pitman 1974; Spawls *et al.,* 2002) and is the form found in Egypt. Specimens of *P. punctulatus* (FMNH 167907 & 190326) from Kassala, Sudan are identical in colouration to Egyptian animals (Fig. 2). Scortecci (1928) describes a similar specimen with a total length of 1260 mm, from Dangollo Mountain (approx. 15°N20'N 38°30'E), Eritrea. *Psammophis p. trivirgatus* (Peters, 1878) (sometimes regarded as a full species), which is found further south in Somalia, Kenya, Uganda, and Tanzania, has a reddish head (Parker, 1949; Pitman, 1974; Spawls *et al.,* 2002).

The two Egyptian animals were found in Wadi Aidieb (22°12'N 36°22'E), a boulder strewn, lightly vegetated wadi in dry *Acacia* scrubland. Both animals were found in the afternoon, at an elevation between 200–500 metres. The first animal was encountered while it was pursuing a *Ptyodactylus ragazzii* across a large boulder.

In Egypt *Psammophis punctulatus* appears to be confined to Gebel Elba. It is unlikely that the species will be found any further north, due to the lack of suitable habitats. The species is probably localised and uncommon or rare, given the fact it has not been encountered previously, despite being a fairly large, active, diurnal snake.

Gebel Elba receives up to 400 mm of precipitation annually (compared with less than 50 mm in surrounding desert), mostly in the form of dense mists, hence its description as a 'mist oasis'. This relatively high precipitation has allowed many sub Saharan elements of flora and fauna, which do not occur further north, to exist in this enclave. Amongst the herptofauna, there are several species of East African and south Arabian affinities, including *Bufo dodsoni* Boulenger,

Figure 1 (above). *Psammophis punctulatus* in Wadi Aidieb, Gebel Elba, Egypt, November 2004. Photograph by Osama Ghazali.

Figure 2 (below). Close up of FMNH 167907 (*P. punctulatus* from Kassala, Sudan, collected by Harry Hoogstraal and Ibrahim Helmy) for comparison. Photograph by Sherif Baha El Din.

1895; *Hemidactylus foudaii* Baha El Din, 2003; *H. sinaitus* Boulenger, 1885; *Latastia longicaudata* (Reuss, 1834); *Leptotyphlops nursii* (Anderson, 1896); *Ophisops elbaensis* Schmidt & Marx, 1957; *Pseuderemias mucronata* (Blanford, 1870) and *Ptyodactylus ragazzii* (Schmidt & Marx, 1957; Baha El Din, 2001, 2003).

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The amphibian fauna of The Gambia, West Africa

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THE amphibians of The Gambia, the smallest country in West Africa, have received little attention from herpetologists, with only a few surveys carried out at a limited number of sites within the last few decades. Between March 1999 and July 2005 the authors have surveyed the amphibians and reptiles of The Gambia on a casual basis, with three periods of more concentrated effort during 2000, 2002 and 2004/2005, using drift fences. In this paper we have collated the data from the existing literature including unpublished material and from our own surveys to form an up-to-date checklist for The Gambia.

THE GAMBIA

The Gambia is the smallest country in continental Africa, covering just 11,300km^2. It is surrounded by the much larger country of Senegal to the north, east and south, and borders the Atlantic Ocean to the west. The shape of the country is defined by the River Gambia, which flows from its eastern border for 480 km to its juncture with the Atlantic Ocean. However, in spite of its small size, The Gambia is considered to be the fourth most densely populated country in Africa with approximately 1.5 million people in 2003. The climate consists of a short rainy season (from mid-June through to early October) and a longer dry season (from mid-October through to early June). Average rainfall per year is around 1,020 mm, but it is normally much higher in the western parts of the country (up to 1,700 mm) and drier in the eastern parts of the country (as low as 800 mm); Baldeh *et al*. (1997).

PREVIOUS AMPHIBIAN RESEARCH

The biodiversity of The Gambia as a whole has been poorly studied, with the possible exception of its plants and birds. An inventory of known species has recently been compiled by Emms & Barnett (2005), which lists only 3,335 species (including all plants and animals) so far recorded for The Gambia. Only a handful of recent studies have been undertaken on the amphibians (e.g. Barnett *et al*. (2001), Gruschwitz *et al*. (1991), Miles *et al*. (1978), Pauwels & Meirte (1996), Wanger (2005) and many of these have been carried out in very limited areas with most of them concentrating on Abuko Nature Reserve in the western part of the country. There is very little information known about the status and distribution of Gambian amphibians, especially on the north bank of the River Gambia and in the eastern half of the country.

METHODOLOGY

In order to add to our knowledge of the amphibian species present in The Gambia, and their status and distribution, several drift fences have been erected and monitored for short periods throughout the western half of the country, on both the north and south banks of the River Gambia. Casual records have been kept for all amphibians located in the country between March 1999 and July 2005.

Drift fence location and recording details

From June to September 2000, two drift fences were monitored on a daily basis, one in gallery forest and one in Guinea savannah, in Abuko Nature Reserve (Fig. 2a). These results have been published in Barnett *et al.* (2001). During June 2002 seven drift fences were monitored in western Gambia, one each in Niumi National Park, Sittanunka and Bao Bolon Wetland Reserve in the North Bank Division, Tanji River Bird Reserve, Abuko Nature Reserve, and Makasutu Culture Forest in the Western Division and Kiang West National Park in the Lower River Division. These were monitored on a daily basis by the staff of Makasutu Wildlife Trust, the Department of Parks and Wildlife Management, Makasutu Culture Forest and the Gambian Reptile Farm. Between May 2004 and July 2005 two drift fences, again one in gallery forest and one in Guinea savannah, have been monitored on a daily basis (excluding weekends when lids were placed over the pitfalls to prevent captures) in Abuko Nature Reserve by the staff of Makasutu Wildlife Trust as part of the capacity building and research undertaken on the Darwin Initiative project. The aim of the Darwin Initiative project in The Gambia is to increase the number of personnel in The Gambia able to assess and monitor its biodiversity. It is focused on the Darwin Field Station (DFS) in Abuko Nature Reserve. This facility provides training courses about biodiversity and related issues, educational material on biodiversity and facilitates and stimulates biodiversity research. It is run by a local NGO Makasutu Wildlife Trust.

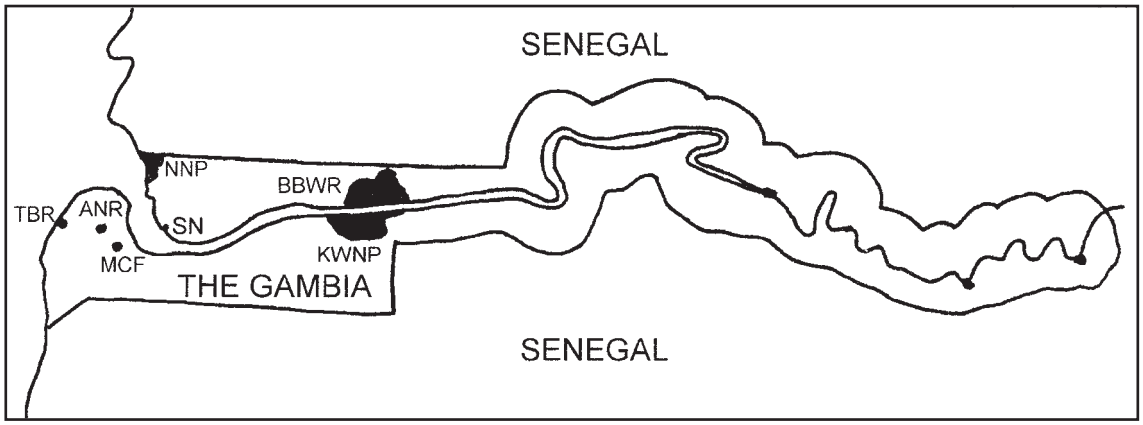
Some specimens were collected for identification purposes and as vouchers (they are stored at the Zoology Museum of the University of Michigan, and the Darwin Field Station, Abuko Nature Reserve) in ethanol (70%). All other captures were released unharmed 50–100m from the drift fences. The specimens have been identified by G. Schnieder of the Zoological Museum of the University of Michigan and by M.-O. Rödel. During August and September 2003, T. Wanger installed and monitored three drift fences in the south-eastern part of Kiang West National Park. The drift fence catches were identified by T. Wanger and M. Solé-Kienle, with their determinations checked by photographs sent to M.-O. Rödel; Wanger (2005).

All of the drift fences were approximately 30m in length with pitfalls placed every 3m. They were made of local materials to reduce costs (rice bags sewn together for the fence, and oil containers or plastic buckets for the pitfalls). The location of the sampling sites is shown in Figure 1 and recording details of the drift fence fieldwork are presented in Table 1.

RESULTS

In the following systematic account we have included all known locations, with references, for the individual species in The Gambia.

Figure 1. Map of The Gambia showing locations of sampling sites. Key: ANR = Abuko Nature Reserve; BBWR = Bao Bolon Wetland Reserve; MCF = Makasutu Culture Forest; NNP = Niumi National Park; SN = Sittanunku; TBR = Tanji River Bird Reserve.



Name	Recording period	Latitude/ Longitude	Capture Effort (= days x number of buckets)	Description of habitat around drift fences
Abuko Nature Reserve	June-September 2000	16°39'W 13° 24'N	61 x 10 = 610	Gallery forest adjacent to large permanent freshwater pools.
Abuko Nature Reserve	June-September 2000	16°39'W 13° 24'N	61 x 10 = 610	Southern Guinea savannah in an area prone to flooding during the rainy season.
Abuko Nature Reserve	June 2002	16°39'W 13° 24'N	30 x 10 = 300	Gallery forest between small concrete-lined pools.
Abuko Nature Reserve	July 2004 – June 2005	16°39'W 13° 24'N	156 x 12 =1872	Southern Guinea savannah in grassy area. No freshwater features close by.
Abuko Nature Reserve	July 2004 – June 2005	16°39'W 13° 24'N	156 x 12 =1872	Gallery forest adjacent to large permanent freshwater pools.
Tanji River (Karinti) Bird Reserve	June 2002	16°47'W 13°23'N	30 x 10 = 300	Moist coastal forest along a little-used footpath. No freshwater features close by.
Makasutu Culture Forest	June 2002	13°19'N 16°39'W	30 x 10 = 300	Heavily wooded southern Guinea savannah, along a little-used footpath located above a freshwater flush vegetated with sedges.
Kiang West National Park	June 2002	15°50'W 13°08'N	30 x 10 = 300	Degraded Sudan savannah, adjacent to a small 'stream' formed by a leaking freshwater tank.
Kiang West National Park	August-September 2003	15°50'W 13°08'N	31 x 21 = 651	Guinea savannah beside stream and small pool, Guinea savannah and rice fields
Niumi National Park	June 2002	16°30'W 13°30'N	30 x 10 = 300	Interface between moist southern Guinea savannah and coastal scrub dominated by *Tamarix*. Adjacent to an area that is temporarily flooded during the rainy season.
Sittanunka	June 2002	13°23'N 16°28'W	30 x 10 = 300	Sparsely-wooded southern Guinea savannah adjacent to farm building. No freshwater features close by.
Bao Bolon Wetland Reserve	June 2002	13°34'N 15°50'W	30 x 10 = 300	In cultivated bush land adjacent to rice fields close to the village of No-Kunda.

Table 1. Location and recording period of drift fences during the study period.

FAMILY PIPIDAE

Silurana tropicalis

The Tropical platanna has so far been recorded in a very limited area of Western Division: Abuko Nature Reserve in drift fences; Barnett *et al.* (2001); Barnett & Emms (2002) and the 2004–5 survey; Gruschwitz *et al*. (1991) as *Xenopus tropicalis*; Jones *et al*. (1991); Lamin as *X. tropicalis*; Gruschwitz *et al.* (1991); Pauwels & Meirte (1996); Makumbaya as *X. tropicalis*; Pauwels & Meirte (1996) and as *Dactylethra calcaratus* with no location mentioned by de Rochebrune (1884). 7 specimens are stored at the Zoology Museum, University of Michigan and 4 specimens are stored at the Darwin Field Station.

FAMILY BUFONIDAE

Bufo maculatus (Figure 2b)

The Flat-backed toad appears to be well distributed, at least in the west of The Gambia, having been recorded in the North Bank, Western and Lower River Divisions. It was recorded by Barnett *et al.* (2001) in Abuko Nature Reserve in drift fences and the 2004–5 survey; in Kiang West National Park in drift fences by Barnett & Emms (2002) and Wanger (2005); Towtoo and Jinack Island in Niumi National Park by Barnett & Emms (pers. obs.) One specimen of this species is stored at the Zoology Museum, University of Michigan.

Bufo pentoni

Penton's toad also appears to be well distributed, having been recorded in the same three divisions as the Flat-backed toad; at Abuko Nature Reserve by Barnett *et al*. (2001) in drift fences and the 2004–5 survey; at Bao Bolon Wetland Reserve by Barnett & Emms (2002); Kiang West National Park in drift fences by Barnett & Emms (2002) and Wanger (2005). Four specimens are stored at the Zoology Museum, University of Michigan.

Bufo regularis

The Common African toad appears to be the commonest and most widespread of the *Bufo* species in The Gambia. Several records include information on the predators of this toad, which include Nile monitor (*Varanus niloticus*), Black cobra (*Naja melanoleuca*) and the Herald snake (*Crotaphopeltis hotamboeia*): It has been recorded near Bakoteh and Lamin by Pauwels & Meirte (1996); at Sintet in a village compound by Miles *et al*. (1978); with no location mentioned in hotel grounds, savannah and gallery forest by Gruschwitz *et al*. (1991); at Abuko Nature Reserve in drift fences by Håkansson (1974), Barnett *et al*. (2001), Barnett and Emms (2002) and the 20045 survey; in Kiang West National Park in drift fences by Barnett *et al.* (2001), Barnett & Emms (2002) and Wanger (2005) and Bao Bolon Wetland Reserve in drift fences by Barnett *et al*. (2001) and Barnett & Emms (2002); at Tanbi Wetland Complex by Barnett *et al.* (2000); and Makasutu Culture Forest (Barnett & Emms, pers. obs.). 16 specimens are stored at the Zoology Museum, University of Michigan.

Bufo xeros

The Savannah toad appears to have a wide distribution in The Gambia, having been recorded in the Western, North Bank and Lower River Divisions: at Abuko Nature Reserve in drift fences by Barnett *et al.* (2001); Niumi National Park by Barnett *et al*. (2000); Kiang West National Park by Wanger (2005); and with no location mentioned by Jones *et al*. (1990). Three specimens are stored at the Zoology Museum, University of Michigan.

FAMILY HEMISOTIDAE

Hemisus marmoratus

The Shovel-nosed frog appears to be widespread, at least in the western part of The Gambia, having been recorded in Western Division and the western part of North Bank Division: It was recorded at Abuko Nature Reserve in drift fences by Barnett *et al.* (2001), Barnett & Emms (2002) and in the 2004–5 survey; Niumi National Park and Sittanunka in drift fences by Barnett & Emms (2002); and with no location mentioned by Jones *et al*. (1991). Four specimens are stored at the Zoology Museum, University of Michigan.

FAMILY RANIDAE

Hildebrandtia ornata

There has been no mention of the locations in which Budget's burrowing frog has been reported from The Gambia, as *H. budgetti* (Jones, 1991) and as *H. ornata* (Rödel, 2000).

Figure 2a. Gallery forest drift fence at Abuko Nature Reserve 2004–2005.

Figure 2b. Flat-backed toad, *Bufo maculates.*

Figure 2c. Accra puddle frog, *Phrynobatrachus accraensis*

Figure 2d. Edible frog, *Pyxicephalus edulis.*

Figure 2e. *Hyperolius spatzi* (dorsal colour).

Figure 2f. *Hyperolius spatzi* (ventral colour).

Figure 2g. Red rubber frog, *Phrynomantis microps.*

Figure 2h. Ground tree frog, *Leptopelis bufonides.*

Hoplobatrachus occipitalis
The Groove-crowned bullfrog appears to be a common and widespread species in The Gambia, with the distinction of being one of the few species that appears to be able to breed throughout the dry season if suitable habitat is available: It has been recorded at Bakoteh, Mandinaba, Lamin and Makumbaya (one mile from Mandinari), as *Dicroglossus occipitalis* by Pauwels & Meirte (1996); Serrekunda, Lamin and Abuko Nature Reserve, as *D. occipitalis* by Gruschwitz *et al*. (1991); Abuko Nature Reserve as *H. occipitalis* in drift fences by Barnett *et al.* (2001) and in the 2004–5 survey; with no location mentioned as *D. occipitalis* by Jones *et al.* (1990); Kiang West National Park in drift fences by Wanger (2005); and Pirang Forest Park – in wells by the forest by Emms & Barnett (2004) and Makasutu Culture Forest – in a freshwater pool by Barnett & Emms (pers. obs.).

Amnirana galamensis
This species was formerly known as *Hylarana galamensis*, but is now placed in the genus *Amnirana* (Dubois, 1992). The Yellow-striped frog appears to be widespread but uncommon: it has been recorded near Fajara by Gruschwitz *et al.* (1991); MacCarthy Island by Andersson (1937); with no location mentioned by Jones *et al*. (1990); and Kartong – in a well by Barnett & Emms (pers. obs.).

Ptychadena bibroni
The Broad-banded grass frog appears to have a wide distribution in The Gambia, having been recorded in the Western Division and Central River Division: at a hotel near Serrekunda, Abuko Nature Reserve and MacCarthy Island, as *P. maccarthyensis* by Gruschwitz *et al.* (1991); Abuko Nature Reserve in drift fences by Barnett *et al.* (2001); and with no location mentioned as *P. maccarthyensis* by Jones *et al*. (1990) and *P. bibroni* by Rödel (2000). Four specimens are stored at the Zoology Museum, University of Michigan.

Ptychadena longirostris
The Snouted grassland frog has only been recorded in one location in The Gambia: at Kalagi, on the bank of riverside rice field by Miles *et al.* (1978); and with no location mentioned as *P. longirostris* and *P. aequiplicata* by Jones *et al*. (1990). It is not easy to distinguish this and the following species. However, as both are recorded from Senegal their occurrence in The Gambia is likely.

Ptychadena tellini
This species was formerly known as *P. schubotzi* [compare Rödel (2000), Largen (2001)]. It has so far not been recorded from The Gambia. However, the records from the Senegal makes it very likely that it occurs in The Gambia as well (Joger & Lambert, 2002).

Ptychadena oxyrhynchus
The Sharp-nosed grass frog has so far only been recorded definitely from Abuko Nature Reserve in The Gambia by Gruschwitz *et al.* (1991) and in drift fences by Barnett *et al*. (2001). It has also been reported with no location mentioned by Jones *et al.* (1990). One specimen is stored at the Zoology Museum, University of Michigan.

Ptychadena pumilio
Jones *et al*. (1990) reports the Little rocket frog from The Gambia, but without mentioning locations.

Ptychadena tournieri
Tournier's rocket frog has been reported from The Gambia by Jones *et al.* (1990) and Rödel (2000) but without details of the locations.

Ptychadena trinodis
The Dakar grassland frog has so far been recorded only from the Western Division and Lower River Division: Mandinaba by Pauwels & Meirte (1996); Abuko Nature Reserve in drift fences by Barnett *et al.* (2001); and Kiang West National Park in drift fences by Wanger (2005).

Pyxicephalus edulis (Figure 2d)
The Edible frog has been recorded only once at a single location in The Gambia: Bao Bolon Wetland Reserve in a drift fence by Barnett & Emms (2002). This record is an important first step to close the enormous distribution gap

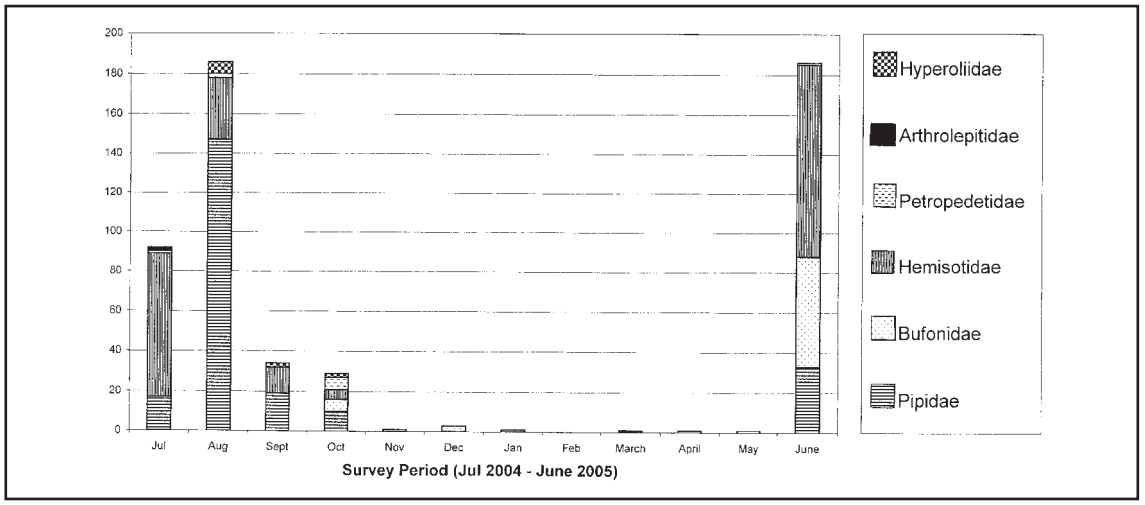


Figure 3. Number of individuals per family recorded in Abuko Nature Reserve gallery forest drift fences.

between Mauritania in the west; Böhme *et al.* (2001) and Benin; Nago, Grell & Rödel (unpubl. data) and Nigeria in the east; Walker (1966). The specimen caught in The Gambia is stored at the Zoology Museum, University of Michigan.

FAMILY PETROPEDETIDAE

Phrynobatrachus cf. *calcaratus*

This species of Puddle frog has been recorded only once (two individuals) in Abuko Nature Reserve in drift fences during the 2004–2005 survey. The specimens are stored at the Darwin Field Station, Abuko Nature Reserve.

Phrynobatrachus francisci

This species of Puddle frog appears to be the commonest and most widespread species of its genus in The Gambia: It has been recorded near Bakoteh and Mandinaba by Pauwels & Meirte (1996); at Abuko Nature Reserve and near Serrekunda by Gruschwitz *et al.* (1991); at Abuko Nature Reserve in drift fences by Barnett *et al.* (2001), Barnett & Emms (2002) and in the 2004–5 survey; with no location mentioned by Jones *et al.* (1990); at Kiang West National Park in drift fences by Barnett & Emms (2002) and Wanger (2004); and with no location mentioned as *P. cf. francisci* by Rödel (2000). Thirteen specimens are stored at the Zoology Museum, University of Michigan.

Phrynobatrachus accraensis (Figure 2c)

The Accra puddle frog has been recorded in The Gambia only in Abuko Nature Reserve: in drift fences in the 2004–2005 survey, and with no location mentioned as *P. latifrons* by Jones *et al.* (1990). The two specimens are stored at the Darwin Field Station, Abuko Nature Reserve.

Phrynobatrachus natalensis

There has been no mention of the locations in which the Cape puddle frog has been recorded in The Gambia: Jones *et al.* (1990), and as *P. cf. natalensis*: Rödel (2000).

FAMILY ARTHROLEPTIDAE

Arthroleptis cf. poecilonotus

The West African screeching frog has been recorded several times in a single location in The Gambia: Abuko Nature Reserve in drift fences by Barnett & Emms (2002) and the 2004–5 survey. The taxonomy of West African Screeching Frogs is so far unsettled – compare Rödel & Bangoura (2004), and thus a reliable determination of these frogs at the species level is impossible. However, this record is a range extension for the genus and shows the potential of The Gambia to harbour not only savannah, but forest associated taxa as well. Two specimens are stored at the Zoology Museum, University of Michigan, and one specimen at the Darwin Field Station, Abuko Nature Reserve.

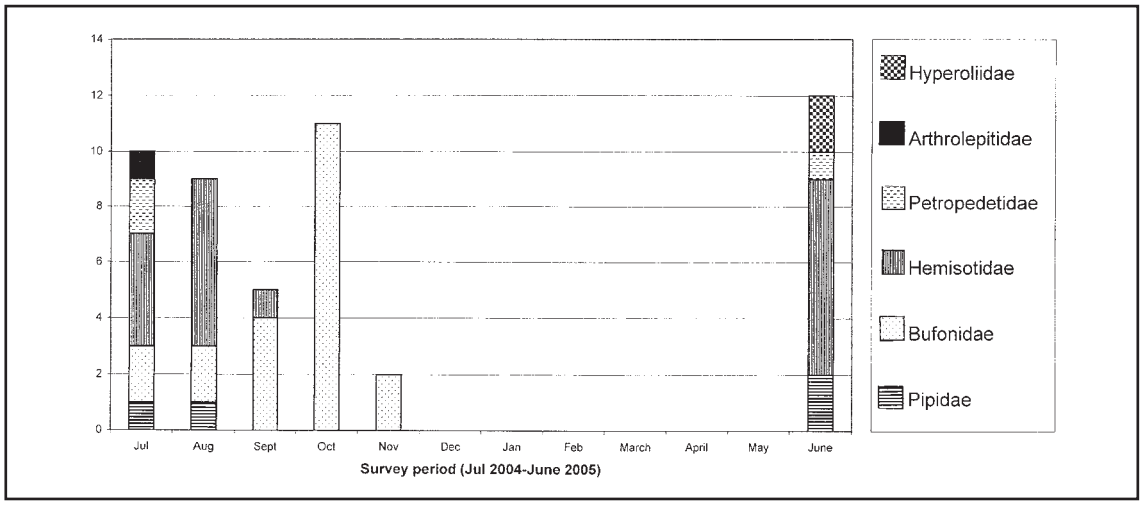


Figure 4. Number of individuals per family recorded in Abuko Nature Reserve Guinea savannah drift fence.

FAMILY HYPEROLIIDAE

Afrixalus fulvovittatus

The Striped spiny reed frog has been recorded in The Gambia only in Abuko Nature Reserve, in drift fences by Barnett *et al.* (2001). It was also recorded by Jones *et al.* (1990) as *A. f. fulvovittatus* with no location mentioned. This frog is more closely associated with forest than *A. vittiger*, that is a pure savannah species. The taxonomy of this and the following species is debated [see Schiøtz (1999), Rödel (2000)]. Schiøtz is naming this taxon as *A. fulvovittatus* type B and the following one as type A. We are thus unsure as to the exact identity of the four specimens stored at the Zoology Museum, University of Michigan, although they may be type A.

Afrixalus vittiger

The Spiny reed frog has only been recorded in Abuko Nature Reserve and Kiang West National Park in drift fences by Wanger (2005) and in the 2004–5 survey. Rödel (2000) also reports this species from The Gambia with no location mentioned. One specimen is stored at the Darwin Field Station.

Afrixalus weidholzi

Weidholz's Banana frog has been recorded only once in a single location in The Gambia: Kiang West National Park in drift fences by Wanger (2005). It is also quoted from Frost (1985).

Hyperolius concolor

This species of reed frog has been recorded only once in The Gambia by Barnett *et al.* (2001) from the Abuko Nature Reserve and is most probably a misidentification as preserved individuals in alcohol of this species and of *H. occidentalis* are not really distinguishable. According to Schiøtz (1999), *H. concolor* does not range as far west as The Gambia, but is replaced there by *H. occidentalis*. As long as no confirmed record of *H. concolor* from The Gambia is available, it should be deleted from the country's species list.

Hyperolius nitidulus

There has been no mention of the locations in which the West African reed frog has been recorded in The Gambia as *H. nitidus*; Jones *et al.* (1990) and as *H. nitidulus*; Rödel (2000). However, the latter author included *H. spatzi* within the synonymy of *H. nitidulus*. After studying *H. spatzi* vouchers from westernmost Guinea and photos from the Gambia we agree with Böhme (1978) that *H. spatzi* most likely is a taxon distinct from *H. nitidulus*. As long as no confirmed records of *H. nitidulus* from The Gambia are available, this species should be deleted from the country's species list.

Hyperolius occidentalis
The Western reed frog has only been recorded in Abuko Nature Reserve in The Gambia: Gruschwitz *et al.* (1990); Barnett *et al.* (2001); Joger (1981).

Hyperolius spatzi (Figures 2e and f)
This species from the *H. viridiflavus*-group Schiøtz (1999) was considered a synonym of *H. nitidulus*; Rödel (2000); Frost (2004). It has the same body shape as *H. nitidulus,* but a chalk white dorsal surface, covered with tiny black spots, instead of a brownish or yellowish back. It also lacks the black lateral line and spots of *H. nitidulus*. The ventral surfaces are yellow, not white as in *H. nitidulus*. The only known locality of *H. spatzi* in The Gambia is Abuko Nature Reserve. Two specimens are stored at the Darwin Field Station, where they were found in 2005.

Kassina cassinoides
The Large running frog has only been recorded in The Gambia in the Lower River Division: at Kiang West National Park in drift fences by Wanger (2005); and with no location mentioned by Jones *et al.* (1991).

Kassina fusca
The Pale running frog has been recorded in The Gambia in the Western Division and Lower River Division: at Abuko Nature Reserve in drift fences by Barnett *et al.* (2001) and Kiang West National Park in drift fences by Wanger (2005); and with no location mentioned by Jones *et al.* (1990). Five specimens are stored at the Zoology Museum, University of Michigan.

Kassina senegalensis
The Senegal running frog has been recorded in The Gambia in the Western Division and Lower River Division: at Abuko Nature Reserve in drift fences by Barnett *et al.* (2001) and the 2004–5 survey; Kiang West National Park as juveniles in drift fences by Wanger (2005); and with no location mentioned by Jones *et al.* (1990). Five specimens are stored at the Zoology Museum, University of Michigan and two specimens at the Darwin Field Station.

Leptopelis bufonides (Figure 2h)
The Ground tree frog has been recorded in The Gambia in the Western Division and Lower River Division: at Abuko Nature Reserve in drift fences by Barnett *et al.* (2001) and the 2004–5 survey; Kiang West National Park in drift fences by Barnett & Emms (2002) and in maize, cous-cous and rice fields by Wanger (2005). Seven specimens are stored at the Zoology Museum, University of Michigan.

Leptopelis viridis
The Savannah tree frog has been recorded in The Gambia in the Western Division and Lower River Division: Abuko Nature Reserve in drift fences by Barnett *et al*. (2001), Barnett & Emms (2002) and the 2004–5 survey; Kiang West National Park in drift fences by Barnett & Emms (2002); and with no location mentioned Jones *et al.* (1990). 13 specimens are stored at the Zoology Museum, University of Michigan.

FAMILY MICROHYLIDAE
Phrynomantis microps (Figure 2g)
The Red rubber frog has been recorded in The Gambia in the Western Division and Lower River Division: Kiang West National Park in drift fences by Barnett & Emms (2002) and Wanger (2005); at Towtoo, a few kilometres from Banjul International Airport by Barnett & Emms, (pers. obs.); and with no location mentioned by Jones *et al.* (1990). The former genus name *Phrynomenrus* is no longer valid for African species – compare Dubois (1988), Rödel (2000).

Drift Fence Catches in Abuko Nature Reserve
Monthly numbers of individuals recorded in the drift fences located in the gallery forest and Guinea savannah habitats of Abuko Nature Reserve during the 2004–5 survey are shown in Figures 3 and 4 respectively. The greatest variety and numbers of amphibians coincided with the beginning of the rainy season (July and August in 2004 and June in 2005).

The drift fence catches peaked in the gallery forest in August 2004, and fell away sharply to almost nothing (apart from the occasional *Bufo* species) during the dry season. A large proportion

of the catch during August was made up of *Silurana tropicalis* (80%) and *Hemisus marmoratus* (17%). Drift fence catches in the Guinea savannah were much lower both in diversity and numbers of amphibians. 545 amphibians were caught in the gallery forest drift fence and 49 amphibians were caught in the Guinea savannah fence. A large proportion of the catch throughout the year in the savannah habitat was made up of *Bufo* species, but particularly during the period September–November (80–100%). It appears from the results that amphibian surveys in The Gambia should be carried out in the first few months after the rains start and that drift fences should be sited near to water, (even if it is seasonal) and preferably near forest habitats to obtain the maximum amount of species.

DISCUSSION

The information presented in this paper was collected through reviewing past records and papers and carrying out field work, including gathering casual records and establishing drift fences at various times and in various locations in the country during the period 1999–2005. Despite the fact that the seven fences erected in June 2002 coincided with a drought year resulting in small catches, during this time we have added six new species of amphibians to The Gambian checklist; *Bufo maculatus, Bufo pentoni, Phrynobatrachus* cf. *calcaratus, Pyxicephalus edulis, Arthroleptis* cf. *poecilonotus* and *Leptopelis bufonides*, and extended the known range of several species within the country.

The intensive fieldwork at Abuko Nature Reserve, especially in the last two years has provided good baseline information on the abundance and diversity of the amphibian fauna throughout the year in this area and afforded an ideal opportunity to train local researchers in identification and survey skills. This will allow on-going monitoring of the amphibian populations in future years. The results have also allowed us to produce an easy to use field guide on the *Common Amphibians of The Gambia*; Barnett & Emms (2005), with the aim of stimulating interest in this area. We have donated 400 copies of the book to the lower basic schools in The Gambia as part of the Darwin Initiative project towards this endeavour.

Abuko Nature Reserve is probably the most studied area with respect to its biodiversity in The Gambia. Yet during the present study new species have been recorded for the country from this reserve. This is due in part to the paucity of past research and a lack of in-country expertise. A large part of The Gambia (east of Bao Bolon Wetland Reserve on the North Bank and Kiang West National Park on the South Bank) remains unsurveyed for its amphibians. The variety of species in Abuko Nature Reserve gives an indication of what may be discovered in the rest of The Gambia, a task now made a little easier with a country field guide on the common species and trained field workers.

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Hyla Park: managing an amphibian conservation area in an eastern Canadian urban setting

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THE Gray treefrog, *Hyla versicolor* LeConte, has a wide distribution over the eastern United States and southeastern Canada. Since at least 1935 an isolated population, the most northeasterly for *H. versicolor*, has been known to occur at Fredericton in central New Brunswick, Canada**.** Bleakney (1958) suggested that this northern disjunct was the remnant of a much wider distribution during a post-glacial hypsithermal period, some 7,000–5,500 YBP. For many years a site at Barker's Point (45^{o} 57' N 66^{o} 37' W), Fredericton, provided habitat for the only population of *H. versicolor* known in Maritime Canada. With the site at Barker's Point under threat from encroaching development, the Gray treefrog was at one time proposed for protection under the New Brunswick Endangered Species Act (Majka, 1981).The Barker's Point population remains disjunct, although recent work has shown the species to have an expanding range in extreme southwestern New Brunswick (McAlpine *et al.,* 1991, McAlpine, 1997) and its status is now considered secure in the province.

It was in the context of protecting the most northeasterly North American population of the Gray treefrog that Hyla Park was established at Barker's Point by the Nature Trust of New Brunswick in 1995. Hyla Park consists of about 9 hectares of wetland and surrounding woodland within the municipality of Fredericton, a city with a population of about 50,000, and appears to be the first conservation area in Canada set aside specifically to protect an amphibian. Here we review and assess the first decade of efforts to manage the site, develop public programs, and protect the resident Gray treefrogs. Our experiences may be instructive for others who are contemplating protecting wetland habitat with a focus on amphibians, especially where budgets are limited and volunteers integral.

Site Description

The Fredericton region sits on glacial deposits - alluvial surface sands overlie lacustrine clays and silts. Aerial photography shows that prior to 1941 Hyla Park was forested. Within a decade the site was cleared and alluvial deposits quarried for fill. Surface topography of the site is now generally flat with steep slopes at all four boundaries. On average, Hyla Park is now 4 m below the grade of surrounding properties. Where excavation has penetrated the water table, ponds and marshy areas have formed. Aerial photographs indicate most of these ponds developed after 1951. Recent bottom coring of ponds supports this, suggesting ponds range in age from 36–51 years (Cain, 2001). Re-vegetation of the site appears to date from the early 1970's (Jacques Whitford, 1995). Wetlands within Hyla Park are now dominated by *Typha latifolia* L., *Carex* spp., *Alnus incana* L., and *Salix* spp. Old field habitat bordering ponds has been increasingly overtaken by a mixedwood overstory of *Populus tremuloides* Michx, *Betula papyrifera* Marsh, and *Abies balsamea* (L.) and an understory of Poacea spp., Compositae, and various bryophytes (Cain 2001). Including the Gray treefrog, 75% of the amphibian species native to Maritime Canada occur at Hyla Park; *Ambystoma maculatum* (Shaw), *A. laterale* Hallowell, *Notopthalmus viridescens* (Rafinesque), *Plethodon cinereus* (Green), *Pseudacris crucifer* Wied, *Rana catesbeiana* Shaw, *R. clamitans* Latreille, *R. pipiens* Schreber, *R. sylvatica* LeConte, and *Bufo americanus* Holbrook are all common to abundant.

Several provincially rare plants, including *Agalinus tenufolius* (Vahl.), *Gratiola neglecta* Torr., and *Polygala sanguinea* L., have also been documented to occur in the Park.

Although quarrying for gravel was the principal commercial activity taking place at the site before the establishment of Hyla Park, from about 1964–1968 the property supported a stock car racing track and associated structures, and there has been some dumping of soil and rock debris. The city of Fredericton also used the property as a disposal site for elms (*Ulmus americana*) removed during the municipal Dutch Elm Disease Control Program. Although residential development, including a trailer park, has increased on several adjacent properties since the early 1970's, Hyla Park remains connected to some large forested areas. An abandoned railway line, now the Gibson Walking Trail, skirts the northern border of the Park.

Hyla Park Development and Management

Using the publication *Critical Natural Areas in New Brunswick* (Dionne *et al.,* 1988) as the basis for a 1988 review, the Fredericton Planning Department identified Barker's Point as an environmentally significant site within the city's boundaries. Independently, Vail approached the City in 1991 about protecting the site, which was municipal property, with the result that city officials contacted the Nature Trust of New Brunswick. The Nature Trust, a non-profit charitable organization, operates with a paid Executive Director, paid staff on various projects as funds permit, and a volunteer Board of Trustees. As of 2005 the Trust oversees 23 properties totaling 868 hectares, all of special ecological significance to New Brunswick.

During discussions in 1994-95, City officials agreed that the Trust would not be liable for any toxic contamination on the site which might originate from a nearby metal recycling facility and also agreed to provide park status for Hyla Park under city by-laws once the Trust declared the site a nature reserve. Additionally, the city agreed to protect the site against further dumping of refuse and all-terrain and other vehicle traffic,to install large boulders at all entrances, to provide a truck and personal to help with clean-up, and to ensure that residents were informed of the new status for the site. Initially, the Trust managed the site under a 5 year lease with the municipality of Fredericton, which in 2000 was renewed for a further 10 years.

Prior to signing the lease the Trust engaged environmental consultants Jacques Whitford Limited to carry out a Phase 1 Environmental Site Assessment (ESA 1) of the Hyla Park site. The intent of an ESA 1 is to disclose environmental information and render an opinion, following a review of records, a site visit, and interviews with regulatory officials and others associated with the property and properties adjoining. In addition to providing a full history of commercial site usage, the ESA 1 suggested that there was potential for contamination of pond water and sediment at Hyla Park, especially with lead and PCB's, from the battery and metal recycling operation and from a former electrical transformer storage site. Petroleum storage tanks and associated contaminated soil had also been removed from an adjacent property in 1990 (Jacques Whitford, 1995).

As with all Trust properties, a volunteer Steward is responsible for monitoring the site and reporting annually. A Hyla Park Committee of four, including the Steward, oversee programs and maintenance of the property. Under the terms of the lease this Committee includes a member of the Fredericton Parks and Trees Division of Community Services. The City maintains garbage cans and a picnic table at Hyla Park, as well an entry kiosk, as part of the city's regular maintenance schedule. The Fredericton Trails Patrol helps monitor the approximately 1 km of trails that have been established within Hyla Park and under the lease agreement, where possible, the City works with the Nature Trust to carry out any development of the site. Nonetheless, this agreement also states that the City has no funds for development of Hyla Park and that the costs of development and programs will be the responsibility of the Trust. Although the lease obliges the Trust to maintain liability and property damage insurance on property and programs equivalent to no less than 2 million dollars, and allows the City to restrict or forbid work or

activity at the site it might deem inappropriate, the lease also states that the City will pay the property taxes.

Thirty-six months elapsed from the signing of the lease between the City and the Trust and the official opening of Hyla Park on 3rd October 1998, a community event attended by about 200 people. During that period 33 volunteers donated 364 hours of time; refuse was removed from the site, 400 donated trees were planted, over 1 km of self-guided trails, incorporating 13 numbered reference posts, was installed, an accompanying brochure was produced, and six entry signs were erected. A public meeting invited input from local residents on how the site should be protected and developed, encouraged volunteer participation, and billed the project as 'a new kind of community park'. The City poured a concrete base for an entry kiosk and four inmates from the New Brunswick Central Reformatory, a local minimum security institution, built the kiosk. On Arbour Day, a year before the Park opened, students from a local school planted 100 trees along the boundary of the Park where all-terrain vehicle (ATV) use on the Gibson Trail had lead to soil erosion. A grant of $4,288 from the Shell Environmental Fund covered material costs that were not donated. Presentations to local Scout and other youth groups also helped ensure that the local community was aware of the activity at the site.

Since the official opening other initiatives have been undertaken by the Hyla Park Committee. In 1999 federal funding allowed the Trust to place a student interpreter in the Park for the summer. Hyla Park has also become the site of choice for the delivery of the wetland educational program, 'It's Not Easy Being Green', delivered by the New Brunswick Ducks Unlimited office to 200–300 students annually in May-June. A series of summer walks led by naturalists, advertised through the municipal tourism authority and emphasizing wetland conservation and the identification of amphibians, have been delivered, and a video about the Gray treefrog produced jointly with the New Brunswick Museum has been distributed to local schools. These latter two projects have encouraged people to visit the Park and make use of the self-guiding brochure and trail system. Park visitation is also encouraged through its listing on a geocaching website. Under the auspices of the Committee a wildlife inventory has been ongoing and a draft long-term management plan for the site has been prepared, the latter as a thesis project by an undergraduate Forestry student from the University of New Brunswick (Cain, 2001). In 2002 the Nature Trust of New Brunswick was awarded the Silver Salamander Award for the Trust's work in establishing Hyla Park. This annual award, presented by the Canadian Amphibian and Reptile Conservation Network, recognizes efforts in Canada to conserve amphibians and reptiles and their habitats.

Management Challenges: It's not easy being green

The establishment of Hyla Park has not been without problems. Most of the trees planted by students for Arbour Day in 1997 were promptly stolen. The Trust has banned dumping, campfires, and ATVs in Hyla Park, and has posted these restrictions at the Park entrances. Nonetheless, the site has a long history of usage by local people for all three activities and it has proven impossible to enforce restrictions. However, this previous activity has left a network of roads and trails that have proven useful to the Trust in providing public access to the Park and developing the trail system. And ATV use at the site seems to be dropping off since the Park was established, with the monitoring Steward characterizing ATV traffic in Hyla Park in the past few years as light. Although refuse and fire pits may be unsightly, and ATV traffic may damage trails, these activities seem to have had no impact on numbers of Gray treefrogs calling at the Park. Signs of drinking, drug-use, and arson have been recorded. A stove was recently dumped into one of the ponds and annual volunteer clean-ups of the site have proven necessary. The more serious, and costly, problem has been continued vandalism to the kiosk and accompanying interpretive panel at the entrance to the Park. The best solution would be an on-site presence within the Park, but unfortunately this is not financially feasible.

Vandalism has included defacing and spray-painting signs, removing or burning self-guiding trail posts, and stealing the brochure holder. Increased police patrols in 2001 seem to have

reduced, but not eliminated, problems. Nonetheless, a decision was made to delay expanding the Hyla Park trail system due to the threat of vandalism. Reluctantly, a decision was made in 2003 to remove the kiosk and a large interpretive panel and substitute smaller more economically replaced signage. Instead of making free copies of the self-guiding brochure available at the Park entry, new signage has been erected with a phone number where further information and free copies of the self-guiding brochure can be obtained.

While the Park has provided more educational opportunities than anticipated, the commitment demanded of volunteers to ensure the success and continuing maintenance of the site has proven greater than expected. Trust Executive also recognize the need to re-invigorate the Hyla Park Committee, which has not met in the past several years. The draft management plan for the Park has noted that the gradual infilling of some ponds at the site may require dredging if ponds are to continue to provide habitat that is suitable both for egg-laying and hibernation for amphibians (Cain, 2001). This will be especially important for species such as *Rana catebieana, R. clamitans*, and *R. pipiens*, which hibernate on pond bottoms and have larvae which take more than a single season to reach metamorphosis at eastern Canadian latitudes. The problem is less of an issue for *Hyla versicolor*, a terrestrial hibernating, freeze-tolerant, species that is well adapted to breeding in ephemeral ponds. However, it may prove necessary to actively manage the site so as to maintain a mix of old-field and early successional woodland habitats in the Park. The past use of the Hyla Park site for dumping tree trunks and limbs from the Fredericton Dutch Elm Disease Control Program has left much coarse woody debris on the site. This has provided amphibian cover-habitat that may need to be replaced in the future. Finally, residential development is likely to increase on the northern and western borders of the Park. The recently completed draft management plan for Hyla Park has recommended that a 20 m forested corridor be established linking Hyla Park to the nearby Nashwaak River, and thereby the vast wetlands of the Saint John River system (Cain, 2001).

DISCUSSION

Isolated, peripheral populations, often genetically distinct, are an important component of biodiversity. Small refuges like Hyla Park can therefore play an important role in conservation. Semlitsch (2000) has discussed the value of small, isolated wetlands in maintaining biodiversity and notes the loss of small wetlands may impede rescue effects at the metapopulation level for amphibians. Small wetlands are an important source of juvenile amphibian recruits and Semlitsch (2000) reports some of the highest amphibian diversities have been recorded in small wetlands. Habitat loss and degradation are the principal causes of amphibian declines in Canada (Weller & Green, 1997), as elsewhere. Still, some amphibian species are clearly more sensitive to habitat disturbance than others. The increasing isolation of Hyla Park over time could well reduce the diversity of the amphibian community at the site, especially those species most sensitive to the loss of nearby forested habitat, such as *Rana sylvatica* and the ambystomid salamanders. Conversely, *Hyla versicolor*, the species for which the Park was established, would appear to be particularly resilient to habitat disturbance and fragmentation (Kolosvary and Swihart 1999). Unfortunately, there are no abundance estimates for amphibians at Hyla Park and it is therefore difficult to assess the actual impact of protected status for the site on resident amphibian populations, beyond the fact that wetland habitat has been maintained. In the future it may be necessary for the Trust to manage the site with the entire amphibian community in mind. Hyla Park, through ease of access within an urban environment, has proven a popular site for wetland education programs. Nonetheless, in the long-term the Trust, with limited resources, may need to explore opportunities for partnering with other agencies or conservation groups in order to maintain its commitment to the Park. Apparent expansion in the range of the Gray treefrog provincially, the complexity of establishing a

forested corridor to nearby natural wetlands, and the eventual need to dredge ponds and maintain wooded areas on the site in an early successional stage will all be considerations. It is also clear that stewarding groups like the Hyla Park Committee must remain active, but this often requires time and effort on the part of Trust employees. Together, these factors reinforce the need for Land Trusts to be cautious in taking on properties that will clearly require significant active management.

ACKNOWLEDGEMENTS

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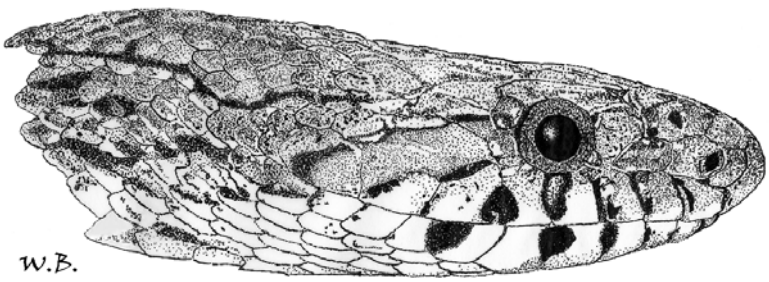

Corn snake, *Elaphe guttata*. Illustration by Will Brown, produced from original photograph manipulated and enhanced using digital imaging software. www//blueridgebiological.com

Restoration of ponds in a landscape and changes in Common frog (*Rana temporaria*) populations, 1983–2005

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ABSTRACT – Monitoring of a population of the Common frog (*Rana temporaria*) was undertaken between 1983-2005 by annual counts of frogspawn during a pond restoration programme at the 103 ha Fryent Country Park, London, UK. Pond restoration, creation and management since 1983 resulted in a landscape with 31 water-bodies by 2005, though not all of these were suitable for breeding by frogs. Generally, smaller water-bodies were more prone to drying-up in dry seasons. Total annual frogspawn increased from 40 clumps in 1983 to a maximum of over 1,850 clumps. Populations of the Common frog appeared to respond to the pond restoration programme, though the quantity of frogspawn was also influenced by other, in particular, weather-related factors. There was a strong correlation between the size of ponds during the winter and the average spawn laid in available ponds. The quantity of frogspawn was strongly correlated with the number of ponds at the time of spawning and at the time of spawning in the previous year; and with the number of water holding ponds during the previous summer.

DECLINES in the populations of the Common frog from ponds and the countryside of lowland England as a result of habitat loss has been noted by e.g. Beebee (1983), Baker & Halliday (1999). Studies of the recovery of Common frog populations following the creation or restoration of ponds have included that of Baker & Halliday (1999); and of Cooke & Oldham (1995) who monitored a population of the Common frog for six years following the translocation of spawn to a new nature reserve.

Restoration and creation of ponds in the landscape at Fryent Country Park, in London, commenced in the early 1980s. This provided an opportunity to investigate how a population of the Common frog responded to increases of pond habitats.

Previous studies on the breeding of Common frogs in ponds on London Clay include that by Savage (as summarised in Frazer, 1983) at Totteridge, approximately 8 km north-east of Fryent Country Park. At Fryent Country Park studies have reported on changes in the Common frog population during the first ten years of the pond restoration programme (Williams & Green, 1993); a description of the flora of the ponds (Williams, 1990), the presence of the Meniscus midge *Dixella attica* in Honey Slough pond (Williams & Fowler, 1986) and a survey of dragonflies (Wilson, 1999).

METHODS

Study area

Fryent Country Park is a 103 ha Local Nature Reserve of lowland countryside, formerly in the parishes of Harrow and Kingsbury in the county of Middlesex; and now in the London Borough of Brent. The Park is surrounded by suburbia and bisected by a road, Fryent Way. The Park is approximately 15 km north-west of central London and 2 km from Wembley Stadium. Barn Hill, the highest point, rises to 86 m O.D. and is capped by Pebble Gravel, while Gotfords Hill, Beane Hill and the remainder of the Park are on London Clay. A tributary of the Gaderbrook flows through the north of the Park. Fryent Country Park is owned by Brent Council; and is managed for public recreation and wildlife conservation by the Council and the volunteers of Barn Hill Conservation Group. A Countryside Stewardship scheme was in operation from 1996 onwards. The Park is managed organically and produce has been certified to the Soil Association Organic Standard since 1998.

Over half of the Country Park area is of grassland, typically of meadows on neutral soils which are cut once annually, usually for hay. Other habitats include hedgerows, deciduous woodland, scrub, horse grazing, acid grassland, roadside mounds, ponds and an orchard (Williams & Cunnington (1985), Williams, Cunnington & Hewlett (1985), and Williams (1996)).

The first Ordnance Survey maps of the area, dating from the mid-nineteenth century, indicate that there were approximately 18 mapped ponds within the area corresponding to the current Country Park. Most of the ponds appeared to be farm ponds, presumably excavated rather than of natural origin, and distributed so that most fields had access to a pond. Some ponds were on hedgerow ditches and served two fields. London Clay holds water well during the winter months. During the summer, water levels can fall considerably and ponds can dry up due to reduced precipitation, increased evaporation and seepage as the level of the surrounding water table falls. One pond was constructed as part of a landscape scheme of Humphry Repton in about 1793 and is known locally as the 'Fishpond'. It is atypical of the other ponds in being the largest pond in the Country Park (at about 0.12 ha), located near to the summit of Barn Hill; and constructed in the Pebble Gravel capping the hill though the base of the pond was within the London Clay.

Monitoring

Records were maintained of the progress of the pond restoration programme including the date and a brief description of work undertaken, whether ponds held water in the winter and summer, and of annual counts of frogspawn at each pond.

Winter water: The presence or absence of water at each pond location was recorded at the time of spawning. This was generally the late winter between mid-February and mid-March, and thus the period of highest expected water level after ponds re-filled during the winter.

Summer water: The monitoring of summer water in ponds was more problematic than the winter survey, as the driest period of the year could fall anytime from late spring through to mid-autumn. Ponds could also dry up and then re-fill with water within this time. Generally the survey was undertaken in mid-late summer (late July to mid-September) supplemented by opportunistic records at other times. It was not practicable to measure the changing depths, areas and volumes of each pond. There were also borderline cases in which ponds were reduced to puddles.

Spawn counts: One frog species, the Common frog (*Rana temporaria*) occurred at Fryent Country Park. Spawning usually took place between mid-February and mid-March. The method for counting the frog spawn followed that in Griffiths & Raper (1994) and involved visits to each pond during the breeding season to count the clumps of frogspawn. As each mature female lays one clump of spawn per year, the count provided an estimate of the number of breeding females. The Common frog is generally considered to have a sex ration of 1:1, so the total breeding population would be approximately twice the number of females.

It was assumed that there could have been movements of Common frogs between the Country Park and the surrounding suburban areas. Similarly, whilst it is considered that all, or almost all of the spawn included in the results was laid by local frogs, the extent of translocations of spawn, tadpoles or frogs by human activity to and from the Country Park, or between ponds, was not known. For this purpose, a search was undertaken of any records associated with the pond restoration programme.

The data is presented using basic statistical summaries, Spearman Rank Correlation Analysis (using StatView software) and graphs.

RESULTS

By the early 1980s many of the farm ponds had fallen into disuse and presumably held less water than previously due to the accumulation of alluvium and vegetation growth. At least two ponds had been filled-in. The initial emphasis was on the removal of accumulated material from the ponds. Though most of this early work was undertaken manually, machinery was increasingly employed. Some of the original farm ponds were also enlarged and new ponds created. An artificial liner was used on one pond, that in the orchard, but had to be replaced once, due to theft.

Table 1 provides some information and location details for each of the ponds that were included in the monitoring. Ponds were named on the basis of the field in which they were located or by reference to other features. Of the 31 ponds or water bodies, one was the landscape-era Fishpond, 11 were farm ponds marked on the mid-19th century maps, while 19 ponds or water bodies were created during the pond restoration programme. Note that though spawn was laid in a small scrape at 'Hedge 74' and that that spawn has been included in the spawn totals used in this paper, the winter and summer water levels at this location were not monitored and

therefore have been excluded from the totals and analysis involving the numbers of ponds.

Figure 1 indicates the trend of the pond restoration and creation work by reference to the number of ponds that held water in the winter (February / March); and throughout the summer of each year. At the start of the restoration programme in 1982/83, 10 ponds held water during the winter. The number of ponds holding water in the winter rose to 28 in 1991 and to 30 in 1998; and did not fall below 22 since 1989 with the exception of the dry winter of 1991/92 when 16 ponds held water.

The number of ponds retaining water throughout the summers was highly variable; and was indicative of factors including the pond restoration programme, the quantity of rain and of water loss during the summer and early autumn. The Fishpond was the only pond that held water continuously throughout this investigation and the only pond that held water during the dry summer of 1983, before

Table 1. Summary information on the ponds at Fryent Country Park. Farm ponds are ponds that were marked on the mid-19th Century Ordnance Survey maps. The Fishpond was created as part of a landscape scheme in about 1793.

	Grid reference (TQ)	Pond origin	Cumulative spawn, 1983-2005.	Size of ponds (square metres)	No. of years winter water, 1983-2005.	No. of years summer water, 1983-2004.
Fishpond	1931, 8741	Landscape	8879	1200	23	22
Upper Hydes	1929, 8779	Farm pond	2834	195	21	13
Oldefield mid	2006, 8830	1980s	1528	80	17	9
Great Hydes	1934, 8782	1980s	1290	800	20	17
Robert Southwell	2005, 8840	1980s	1236	90	21	13
Gotfords	1969, 8828	Farm pond	1128	196	23	11
Lower Hydes	1936, 8807	Farm pond	595	250	23	13
Oldefield south	2005, 8828	Farm pond	555	80	22	9
Oldefield north	2005, 8833	1980s	290	30	17	9
Little Hillcroach	1999, 8777	1980s	287	100	21	16
Richards	1947, 8796	Farm pond	278	450	23	14
Long Down	1986, 8732	Farm pond	230	90	23	17
Robert Southwell north	2004 8840	1990s	218	60	8	6
Warrens	1970, 8780	1980s	155	100	21	10
Coneyvale Glade	1929, 8750	1980s	145	90	18	1
Orchard (with liner)	2006, 8813	1990s	111	4	13	12
Gotfords ditch	1968, 8829	1980s	96	20	19	8
Hedge 7 pond	1916, 8786	1990s	82	10	11	0
Meade	1969, 8787	Farm pond	79	10	22	6
Dormers Meade	1978, 8773	Farm pond	67	50	18	10
Goldringe	1962, 8796	Farm pond	16	6	20	0
Honey Slough	1946, 8801	Farm pond	13	75	23	21
Great Cowlays	1987, 8734	Farm pond	12	50	19	0
Hedge 74 ditch	1992, 8836	1980s	11	1		
Little Cowlays east	1986, 8744	1980s	8	2	8	0
Little Cowlays west	1982, 8745	1980s	2	3	18	2
Clump	1919, 8751	1980s	1	2	11	0
Hedge 3 pond	1939, 8783	1980s	0	5	17	0
Great Cowlays south	1988, 8730	1980s	0	2	13	0
Great Cowlays mid	1987, 8732	1980s	0	3	13	0
Homefield summit	1992, 8809	1980s	0	2	12	0

restoration work had had an effect on other ponds. The number of ponds that held water throughout the summer increased to 15 in 1988, 17 in 1993 and 19 in 2000–2002, but in interceding dry summers numbers reduced to 2 in 1990, 4 in 1995 and to 6 in 2003.

The investigation was in a semi-natural landscape surrounded by suburban London. Ponds were restored or created by human activity. The records accompanying the pond restoration programme noted the introduction of frogspawn, tadpoles and frogs from suburban ponds and some translocation of amphibians between ponds particularly in 1984. The notes suggested that these movements were proportionally greater towards the start of the investigation. This coincided with a national campaign (see Gibb & Foster, 2000) to 'rescue' excess frogspawn from garden and other ponds with the aim of stocking other ponds. Thus the initial colonisation of the Common frog to ponds that were restored at Fryent Country Park could have proceeded at a faster rate than that which may have occurred naturally. Removal of frogspawn from the Country Park by the public was also observed during the 1980s. The net effect of incoming and outgoing translocations is not known.

The total counts of clumps of Common frog spawn from 1983–2005 are shown in Figure 2. The total frog spawn in all ponds in the Country Park increased from 40 clumps in 1983 to a maximum of 1,852 in 2002. Though the general trend during the investigation was of increasing spawn, there were fluctuations from year to year. For example, in 2004 spawn declined to 1,000 clumps.

The majority of spawn was laid in a relatively small number of ponds, with almost half the total at one pond (the Fishpond), and a skewed distribution of lower counts at other ponds. Eight ponds accounted for 89% of the spawn. In the early years of the investigation, all or a majority

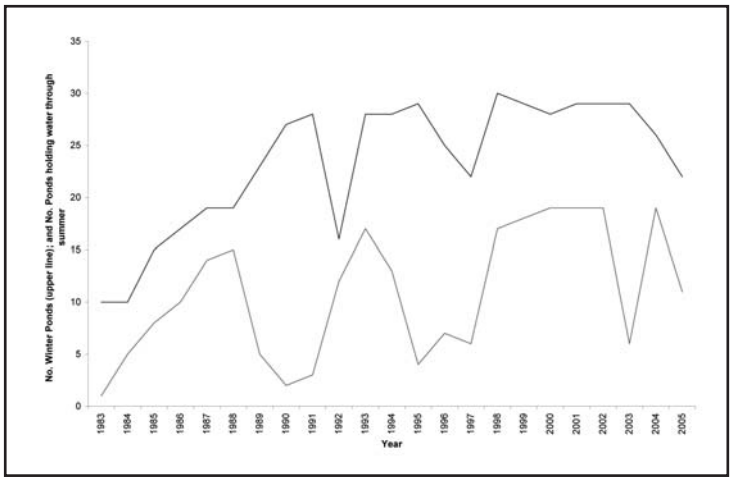
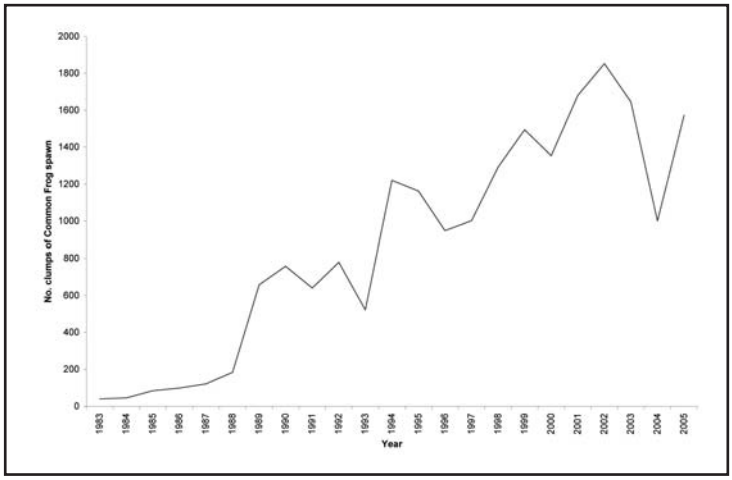


Figure 1. The number of ponds holding water in the winter (February/March), and throughout the summer at Fryent Country Park, 1983–2005.

of the spawn was laid at the Fishpond. Spawn in the Fishpond peaked at 900 clumps in 1998 but declined to 214 clumps in 2004, whereas the total of frog spawn in all the other ponds increased from none in 1983 to a maximum of 1,253 clumps (in 2005).

As the pond restoration and creation programme progressed, increasing numbers of ponds were potentially available, and used, for breeding. The utilisation rate varied from year to year. In the earlier years only a small proportion of ponds were used for breeding, but for much of the investigation

Figure 2. Total counts of clumps of Common frog spawn at Fryent Country Park, 1983–2005.



most of the ponds were used for breeding each year. The number of ponds used for breeding in any one year varied from one in 1983, to 17 in 1989 and peaked at 20 in 2000. Since 1983, a total of 27 ponds have been used for breeding.

Generally, the first spawning would occur within two years of the restoration or creation of a pond, albeit the presence of frogs in the Fishpond at the start of the investigation and introductions of frogs to some ponds during the early years of the investigation. Subsequently, spawning did not appear to conform to a simple pattern. Though there was often a rapid increase in spawn following colonisation, over longer periods the patterns varied. Apparent re-colonisations could follow declines and the absence of spawn in some years. Within the period 1983–2005, the peak spawn counts at some ponds did not occur until 20 years after the initial restoration.

There was a strong correlation (Spearman Rank Correlation Coefficient, $r_s = 0.804$, $p < 0.001$) between the size of ponds at the time of spawning taken as an estimation of the surface area in the winter of 2003/2004, and the average number of clumps of frogspawn taken as the average number of clumps for those years between 1983–2005 that the pond held water at the end of the winter. The surface area of a pond could be considered as a proxy for the size of a pond and hence the ability of a pond to retain water throughout the year, albeit ponds could vary in relative depths and profiles.

There was a strong correlation ($r_s = 0.783$, $p < 0.001$) between the annual total counts of Common frog spawn and the number of water-holding ponds for the 23 winters from 1983–2005. This correlation also held between the total counts of frogspawn and the number of water-holding ponds during the previous winter ($r_s = 0.787$, $p < 0.001$), but tailed to a modest and lower correlations for the winters of earlier years. The trend of increasing spawn since the start of the pond restoration programme in 1983 was broken by a decline of spawn in 1993, possibly as a consequence of the reduced number of ponds available during the dry winter of 1991–1992. Field notes indicate that in early 1992 the water levels in some ponds (Little Hillcroach, Warrens, Oldefield Mid and Oldefield North) were so low that the spawn was laid in puddles within the pond basins and, as a consequence the survival rate was probably low. However, other declines in spawn, including that during 2003-2004, did not correspond with marked reductions in the number of ponds available in winter.

As frogspawn is laid in February/March, any causal relationship with the number of summer water-holding ponds would need to take account of the number of ponds in previous years. There was a strong correlation ($r_s = 0.700$, $p < 0.01$) between the annual total counts of frogspawn and the number of ponds that held water in the previous summer for the 22 data sets from 1984-2005. This reduced to a modest correlation ($r_s = 0.562$, $p > 0.01$) for the previous but one summer for the 21 data sets from 1985–2005.

Though the quantity of light at ponds during the investigation was not measured, it was noted that the shaded Honey Slough Pond that held water continuously since late 1983 accounted for less than 0.1% (13 clumps) of the total spawn. Conversely, Hedge 7 Pond which did not hold water throughout any summer was used for spawning in seven years with a total of 82 clumps (0.4% of the total). Other apparent anomalies included Coneyvale Glade Pond which held water in only one summer since 1983 but accounted for 0.7% (145 clumps) of spawn.

Two other amphibian species were encountered during the investigation. Smooth newts (*Triturus vulgaris*) were observed at some ponds, while the adults were noted away from ponds. It is possible that the Common toad (*Bufo bufo*) was either absent from the Country Park at the start of the investigation or present at a low density as one strand of toadspawn was found in the Fishpond in 1985. Following rescue translocations from suburban and other ponds during the 1980s, the Common toad established throughout much off the Country Park to breed in several ponds.

DISCUSSION

The results suggested that there were strong correlations between the spawn laid and hence the population size of the Common frog, and the size and number of ponds in winter, and the number of ponds that held water in the previous summer. There were also correlations with the number of ponds in recent winters and summers prior to the current year. The net contribution of each of these effects, and of factors that were not monitored and of any interactive effects were not separated out.

Nevertheless, the population of the Common frog appeared to increase in response to the pond restoration programme, though seasonal weather was a major factor in year to year fluctuations in the quantity of spawn laid.

Only a small proportion of spawn reaches adulthood and hence the environmental conditions during the early seasons of life would affect the number of frogs that enter the breeding population. Cooke & Oldham (1995) in their investigation of the translocation of frog spawn to a new site found that frogs tended to reach maturity and lay spawn from the second year following their own introduction as spawn; a figure which appeared to be typical from other introductions in lowland Britain that they cite and from the first spawning at restored or created ponds at Fryent Country Park.

As weather comprises many factors each of which could affect the various stages of a life cycle, the measurement of relevant factors and their correlation with population data can be problematic as noted by White & Lindley (1976). In practice, the presence of winter and summer water in ponds acted as an indicator of the combined effects of the pond restoration programme and of recent weather. Whilst the counts of the number of clumps of frogspawn relied on estimations using a standard method, and the number of ponds that held water in the winter was easy to quantify, it was less easy to measure the number of ponds that held water during the summer. In part this was due to variation of the timing and duration in which ponds could dry. Tadpoles of the Common frog are dependent on ponds that hold water throughout the spring / early summer. At Fryent Country Park, with shallow spawning ponds prone to seasonal drying, a dry summer could result in the loss of a high proportion of that year's spawn, and affect the number of mature frogs that would be available to spawn in the future. Part of the effect of dry summers on frog survival could also act via drought conditions on the terrestrial habitats that frogs use at other times of the year.

Populations of the Common frog could also have been affected by factors that were not recorded as part of this investigation. These include water quality, disturbance, light/shade, vegetation, the spatial relationship between ponds and frog populations both within and beyond the study area, the quality of habitat around ponds, climatic change, competition, predation and disease. Neither was this investigation under experimental control which limited the application of statistical analysis. Oldham *et al.* (2000) used ten habitat criteria to produce a Habitat Suitability Index to assess sites holding or with the potential to support populations of the Great crested newt (*Triturus cristatus*). Ehrlich & Hanski (2004) in describing the spatially realistic metapopulation theory noted that the population capacity of an area increases with the number, average size and average connectivity of representative habitat. While it was assumed that the Common frogs within Fryent Country Park represented one meta-population, in practice there may have been more than one meta-population and/or movements of frogs with nearby populations in suburban gardens. Movement of the Common frog within the Country Park was assumed to have contributed to the colonisation of newly restored and created ponds. Baker & Halliday (1999) noted that *Rana temporaria* colonised new ponds at distances of up to 950 m from existing ponds. Frazer (1983) noted that during their migration between the hibernation site and the breeding pond, Common frogs travel through a series of ponds; and that within a group of closely-spaced ponds the majority of the spawn would not necessarily be laid in the same pond each year. At Fryent Country Park, there were ponds in which two areas were used for spawning in some years, and this was often repeated for several years.

Though the net effect of translocations of spawn, tadpoles and frogs was not estimated during this investigation, Cooke & Oldham (1995) suggested that in Huntingdonshire, there was a net loss of spawn from rural ponds due to the collection of frogspawn for garden ponds in the 1970s and early 1980s, but that the net effect had been reversed by the late 1980s due to deposition of surplus spawn from garden ponds into some rural ponds. Baker & Halliday (1999) found that the presence of Common frogs at new ponds in a rural area of Northamptonshire, west Bedfordshire and north Buckinghamshire was associated with introductions of frogspawn, though amphibians were readily able to colonize new ponds on farmland.

Only the Fishpond maintained fish populations throughout the investigation. Fish were found in a small number of the other ponds but as these were susceptible to drying in some summers, the fish

populations would have then been lost. The Smooth newt has been observed at locations throughout the Country Park and is considered to be predatory on young Common frog tadpoles (Beebee, 1996).

It would appear that the better ponds for encouraging breeding of Common frogs were those that were larger, held water at the time of spawning and throughout most summers. Such conditions were probably conducive also to other pond fauna and vegetation, and a lack of shade may be beneficial too. These criteria conform to those suggested by Frazer (1983) in that breeding Common frogs were attracted to ponds by the smell of glycolic acid produced by algae. Algae is more frequent in ponds that held water into the early summer and as the algae was a foodsource for the young tadpoles, these factors increased the chances of survival by allowing the young froglets to reach a life cycle stage at which they could leave the water. The inference was that small water bodies that dried up each summer and ponds that were heavily shaded were unlikely to support algae in quantity.

Using the same assumptions as Cooke & Oldham (1995), that all of the frogspawn was found, that an adult female frog lays one clump of spawn per annum and that there was a sex ratio of unity, the adult frog population during recent years was in the range of 2,000–3,700. That would approximate to a density of 19–36 adults / ha for the Country Park area, though the edge effect with neighbouring areas is not known.

Taking the number of ponds that held water throughout typical recent years as 19, the average density of ponds in the 103 ha Country Park was 18.4 per square km in 2005. This compared with an average of 1.4 ponds per square km in rural Britain (Swan & Oldham, 1993 cited in Latham, 1995) and with 1.7 ponds per square km in England in 1996 (Williams *et al*., 1998). Haines-Young *et al*. (2000) estimated that the number of lowland ponds in England and Wales increased by about 6% between 1990 and 1998, with much of the net increase in the years 1996-1998.

The pond restoration programme was undertaken, in part, to reverse the effects of the natural infilling of ponds. At Honey Slough Pond, excavation in 1983 worked through layers of sediment and embedded artefacts dating from the 1930s and earlier, though undated material was found below that level, and it was not possible to estimate when the pond was last cleared or originally excavated. Sediment accumulations within the range of 0.5–4 cm per year have been suggested by Williams *et al.* (1998) based on measured rates within young ponds of 2.5–3.0 cm per year. Obviously these rates could vary as a consequence of leaf fall from trees, nutrients, local soil types and whether a pond was acting as a silt-trap.

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NATURAL HISTORY NOTES

***BOTHROPS ASPER* (Barba amarilla, Terciopelo): MAXIMUM ELEVATION**. The pitviper *Bothrops asper* (Garman) is one of the best-known and most feared snakes in Latin America. This highly venomous snake is found from southern Tamaulipas and southern Chiapas, Mexico, to northern Colombia and Venezuela and along the Pacific coast to southwestern Ecuador (Campbell & Lamar, 2004). In Central America, *B. asper* is a species of low and moderate elevations, from sea level to 1200–1300 m (Campbell & Lamar, 2004; Savage, 2002; Wilson & Meyer, 1985). Specific elevation records for Honduras include 1060 m from the Sierra de Agalta, Depto. Olancho (Wilson *et al*., 1991), approximately 1143 m in Subirana, Depto. Yoro (Stadelman, 1930), and 1300 m at Quebrada Grande, Parque Nacional Cerro Azul, Depto. Copán (McCranie, 2004). *Bothrops asper* occurs in a wide variety of habitats, including disturbed agricultural areas, secondary and primary tropical rainforest, tropical deciduous forest, and pine savanna (Campbell & Lamar, 2004; McCranie *et al.*, 2006). In dry habitats, *B. asper* are typically found near water bodies, including streams and rivers (Campbell & Lamar, 2004).

Figure 1. Adult female *Bothrops asper* found at 1300 m elevation. Parque Nacional El Cusuco, Honduras. Photograph by Brooke L. Talley.

From 23rd June to 19th August 2005, the authors conducted herpetofaunal surveys in and around Parque Nacional El Cusuco, a cloud forest preserve in the Sierra de Omoa of northwestern Honduras. Specimens taken during these surveys were preserved in 10% formalin solution, and then transferred within a week to 70% ethanol. Species identifications were aided by using the keys and descriptive information in Köhler (2003). Specimens were deposited at the Florida Museum of Natural History (UF collection).

During this fieldwork, *B. asper* was recorded for the first time within the park (Wilson & McCranie, 2004). Three individuals of this species were documented at 1220 m, 1300 m, and 1450 m elevation, with the latter being the highest reported elevation for *B. asper* in Central America.

The first two specimens were collected during night opportunistic field searches near Guanales Camp (1220 m elevation) in regenerated secondary broadleaf forest. Resting at the bottom of a steep ravine, Guanales Camp (15º48.9'N, 88º23.3'W) lies near a tributary river of the Río Naco surrounded by primary and secondary broadleaf forest. The third individual was encountered outside of Guanales Camp during a morning opportunistic search.

The first *B. asper* specimen (UF 144699; female; SVL 86.5 cm; BL 82 cm; TL 97.5 cm) was collected on 9th July 2005 at 22:00 hrs (1220 m elevation), while moving from a terrestrial position into a stream. Colour characteristics of UF 144699 are as follows: dorsal pattern brown fading to gray laterally with 25 pale-edged dark-brown triangles laterally, ventral pattern cream with dark mottling, and top of head medium brown with a pale occipital streak originating posteriodorsally to the eye. On 10th July 2005, the second *B. asper* specimen (UF 144698; female; SVL 95 cm; BL 91 cm; TL 107.5 cm) was collected near Guanales camp at 21:00 hrs (1300 m elevation), as it moved in the direction of a nearby river. Colour characteristics of this individual (UF 144698) were similar to those of UF 144699, except the dorsal pattern brown faded to brown-gray laterally instead of gray (Figure 1). This variation in color characteristics agrees with that typically found in *Bothrops asper* (Campbell & Lamar, 2004).

The final *B. asper* recorded during the 2005 field season was detected on 23rd August 2005, near the confluence of two small streams outside Guanales Camp. The individual was encountered in primary broadleaf forest at 1450 m elevation (10:00 hrs), as it actively moved across the forest floor. Because of the specimen's large size (>1.75 m) and aggressive temperament, the snake was not collected. Based on colour notes from the two previously collected *B. asper* (see above) and background knowledge of general physical characteristics, identification of the third *B. asper* is certain.

Collection of UF 144699 and UF 144698 and identification of the final *B. asper* in the field indicates that this species may be prevalent at relatively high elevations in Parque Nacional El Cusuco and/or additional areas of the Sierra de Omoa in northwestern Honduras. The third and final *B. asper* seen during the 2005 field season represents a new maximum elevation record at 1450m elevation. This elevation is approximately 150 m higher than those for previously recorded individuals in Honduras (McCranie, 2004) and Central America in general (Campbell & Lamar, 2004), in both cases 1300 m. Future research should focus on observation and collection of *B. asper* in high elevation habitats in Honduras and other Central American countries so that our knowledge of this snake's natural history assessment will be enhanced.

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BOOK RIEVIEWS

Life-Histories of the Frogs of Okefinokee Swamp, Georgia. North American Salientia (Anura) No. 2

Wright, Albert Hazen (2002)
Cornell University Press, Ithaca, NY
Pp. xxi+509. ISBN 0-8014-4046-7

A reprinted edition of Wright's original (1932) classic work on the anurans of what is North America's largest swamp – and largest protected wetland forest – as J. Whitfield Gibbons informs us in his Foreword to the modern edition. We are also warned that the books' contents will absorb even the most technical of modern academics, indeed anyone with an interest in the natural history of frogs and toads.

The Okefenokee (as it is now spelt) wetland straddles the Georgia-Florida border and has been largely protected since President Roosevelt designated it a National Wildlife Refuge in 1937. This followed the extensive logging which prompted the multiple 'Cornell Expeditions' to the

swamp carried out by Wright and his colleagues, and ultimately to this work (and others on different components of the swamp's fauna). The original aim seems to have been to document what was a disappearing and poorly-understood wonder, but the end result was (as with all endeavours conducted out of a love for a subject) the infection of Wright's evident fascination with Okefenokee; surely a factor in the area's eventual preservation.

The enthusiasm and knowledge with which Wright writes of Okefenokee's frogs and toads is apparent from the outset. A brief Preface and then Introduction with Acknowledgements quickly (almost) degenerate into faunistic lists from previous expeditions and thence (via necessary asides on geography and plants) to an anuran species list of the area with a brief note on each. Introductions dispensed with, Wright launches directly into his General Discussion. There follows much useful information, such as the comparison of various biometric data between species (some of it standardized to a common snout-vent length to better enable species identification!) and a wealth of other notes that better aid understanding of the later descriptions of individual species. Common aspects of life histories are discussed in a most logical order: from mating and vocalization, through a key to tadpoles, to growth rates and potential predators. This section of the book concludes with a discussion of 'Affinities' – efforts to assign species groups based on life-history traits that today seem outmoded and almost quaint but are nonetheless insightful even in the light of many modern techniques. Wright also poses questions for "local or resident naturalists and collectors" for each species e.g. *Rana heckscheri* ('Why has it been overlooked for so long?') and *R. septentrionalis* ('Actual mating and amplexation we have not observed. What is the normal hatching period?'). These enquiries are not only a window on the process involved in understanding a region's anuran fauna, but reflect many of the questions modern herpetologists face when studying species previously 'overlooked' or aspects of whose life histories are 'not observed' and, unfortunately these days, may already have populations which are declining or threatened.

The next section is that of the black-and-white plates. These would benefit from being in colour but for their day they are good and designed to illustrate aspects of life history or stage, as well as for identification purposes. They would be disappointing in a modern book but are very much relevant to this work's value as a thorough discussion of Okefenokee's anurans. A map of the swamp is also included here.

It is the comprehensive species descriptions that probably will most captivate the reader. Modern texts tend to avoid the conversational and informal but Wright's often-casual text make excellent use of them! The first species discussed is *Scaphiopus holbrooki* for which the only (but informative) sentence on 'Habitat' quotes a Colonel of 1886 in saying '…I will venture to say even the most knowing, in nine cases out of ten, will only find a Spadefoot by accident'. The remaining text is peppered with such quotes – but every one serves to illustrate an aspect of a species' life history, and therefore contributes to the understanding of its biology, which could probably not be bettered by resorting to technical or more precise language. A further 'Afterword', again by Whit Gibbons, updates Wright's taxonomy and puts his observations into perspective with respect to amphibian declines, but without detracting from the style: this is a far better way to update a classic work than to scatter the text with copious footnotes and cross-references.

I have to admit this is an enjoyable book (as we were warned) for anyone with a real interest in the lives of frogs and toads. I have relished dipping into it and will continue to do so, if only as a potential antidote to contemporary herpetology!

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Past Presidents (retiring date)

Dr. M.A. Smith (1956), Dr. J.F.D. Frazer (1981), The Earl of Cranbrook (1990), Prof. J.L. Cloudsley-Thompson (1996), Dr. R. Avery (1997), Dr. H. Robert Bustard (2005)

Honorary Life Members (maximum 10)

Mrs. M. Green (1960), Prof. J.L. Cloudsley-Thompson (1983), Dr. D.G. Broadley (1983), Mrs. E. Haselwood (1990), Dr. T.J.C. Beebee (1995).

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