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    The Bulletin was edited and produced by John Pickett and Simon Townson. Contributions and correspondence arising from the Bulletin should be sent to Peter Stafford, Botany Department, Natural History Museum, Cromwell Road, London SW7 5BD.

FRONT COVER

Phyllomedusa vaillanti see "A Survey of the Anuran Fauna of Montagne Belvédère" by Philippe J.R. Kok. Page 6.

AMPHA FEEDING GROUND FOR JUVENILE GREEN TURTLES, *CHELONIA MYDAS*, ON THE WESTERN COAST OF TURKEY

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ABSTRACT

In this study, it is proved that Fethiye Beach (western coast of Turkey) represents a feeding ground for juvenile Green Turtles, *Chelonia mydas*. However, the size of the population that has been using this area could not be determined. Some precautions were recommended for the conservation of this endangered species.

INTRODUCTION

The biology of sea turtles has mostly been studied on the nesting beaches. Our knowledge of immature sea turtles is still poor and little is known of the situation in the Mediterranean. All dead turtles were recorded between Mersin and the Syrian border, most of them along the Çukurova coast (Baran & Kasparek 1989). Another record of an immature Green Turtle that washed ashore at Serik (Vilayet Antalya) with a carapace length of 44 cm was made by Basoglu and Baran (1982). This specimen is still kept in the collection of the Aegean University, Izmir. Baran and Kasparek state that there is another record from Büyük Menderes Delta.

An intensive study was carried out by DHKD on trawl fishing and its effects on marine turtles in the eastern Mediterranean (Oruç *et. al.* 1997). It is likely that juvenile Green Turtles are more localized in distribution to the east, where they often caught in fisheries and recorded stranded (Baran & Kasparek 1989; Laurent *et al.* 1996; Margaritoulis et al. 1996; Godley *et. al.* 1998). The estimated annual female nesting population of Green Turtles could be as low as between 300-400 in the Mediterranean (Groombridge, 1990).

Important feeding grounds for Green Turtles include the Miskito Cays of Nicaragua, the coastal shallows of Brazil, the Gulf of Oman in the Middle East, the Arafura and Coral Seas between Vanuatu and Fiji in the South Pacific, the Pacific side of the Japanese Archipelago and the East China Sea, the coastal waters of Baja California, and the Pacific Coast of the Americas from Costa Rica to Peru (Ripple, 1996).

Up to now there is no record of feeding grounds for juvenile *Chelonia mydas* on the western coast of Turkey. Our aim in this study was to prove that Fethiye Beach represents a feeding ground for juvenile *C. mydas*.

MATERIAL AND METHODS

In this study, Fethiye Beach (Figure 1), Vilayet Mugla, was investigated for the nesting status of the Loggerhead Turtle throughout the breeding seasons from 1993 to 1998.

Plate 1. Juvenile *Chelonia mydas*

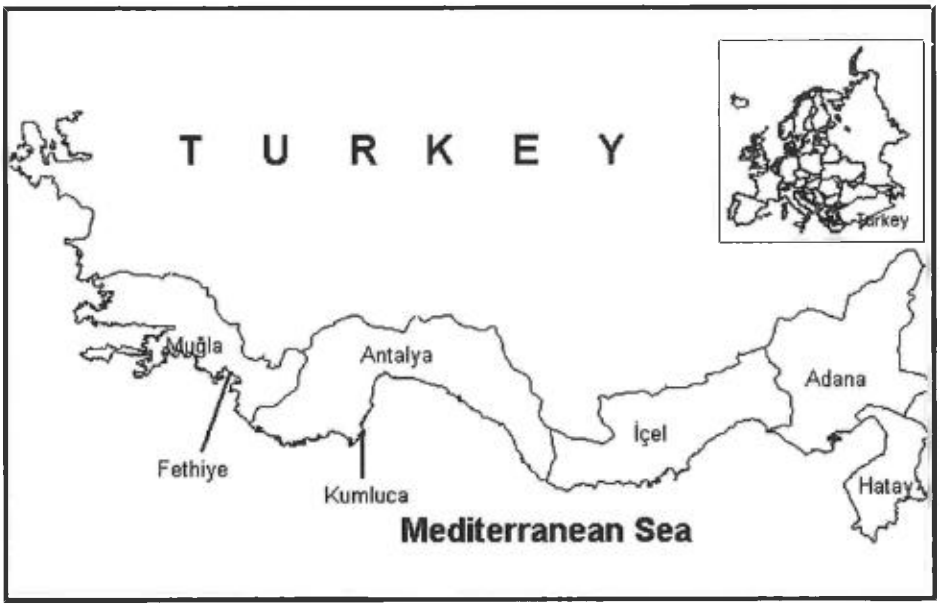

Fig. 1 Map showing the location of Fethiye Beach, on the western coast of Turkey

During this period, the number of juvenile *C.mydas* that were washed ashore or incidentally caught were recorded. The presence of juvenile *C.mydas* in front of the beach pushed us to make an underwater survey in 1995.

RESULTS

A total of 9 juvenile *C. mydas* (Plate 1) were recorded during our 6 year survey in front of the nesting beach. Of these, 4 were washed ashore and 5 were incidentally caught by fishermen and released. Details of these juveniles are presented in Table 1 with respect to years.

Table 1: The information on juvenile Green Turtles recorded at Fethiye Beach, Turkey

Date	SCL (cm)	SCW (cm)	CCL (cm)	CCW (cm)	Explanations
1994	–	–	–	–	• 3 live juvenile *C. mydas* were incidentally caught by a fishing boat and then released • 1 dead washed ashore, most probably drowned.
16.6.1995	–	–	–	–	• Juvenile *C.mydas*. Head and extremities had been cut
19.9.1995	–	–	–	–	• Found dead on beach
12.7.1996	41	33.5	45	40	• Tagged with monel tag and then released. Tag no 761
25.7.1998	–	–	43	31.5	• Found dead. Most probably drowned
3.9.1998	48	39	51	48	• Tagged with monel tage and then released. Tag no 242

These records were made only in front of our study site. These records may be increased with an intensive study in co-operation with the fishing boats in the whole region. The presence of only juveniles of *C. mydas* in the region convinced us that this site most probably represents a feeding ground for juvenile *Chelonia*. Our underwater survey in 1995 increased the possibility of this matter. In front of the beach, where the juveniles were recorded, the following species were identified:

Eupagurus caunensis
Cerithium sp.
Anemone sulcata
Schizaster canaliferus
Spirographis spallanzani
Cliona celata
Peltodoris atromaculata
Trucullariopsis trunculus
Macropodia sp.
Petrosia fuciformis
Spirastrella cuncatrix
Hinia sp.
Hermodice carunculata
Zostera marina
Caulerpa prolifera
Charonia sp.
Astropecten sp.
Halophila stipulacea
Cerastoderma sp.
Sphaerechinus granularis

The bottom of the sea was covered especially with Eelgrass *(Zostera marina)*. According to literature, the diet of the Green Turtle, *Chelonia mydas*, is well known and in certain parts of its range stomach contents of large numbers of individuals have been examined. Immature Green Turtles in Mosquito Lagoon, Brevard Country, Florida seem to be grazing exclusively on sea grasses *(S. filiforme, Halodule wrightii and Halophila sp.)*. The Green Turtles of the Galapagos islands feed mainly on algae, especially green algae of the genera *Ulva* and *Caulerpa*. Green Turtles of the Infiernillo region, between the island and mainland feed on Eelgrass, *Zostera marina*. (Mortimer, 1995). The stomach contents of 94 Green Turtles between 31 and 120 cm of carapace length from the commercial catch of the coast of Ceara, Brazil included 88.3 % to 95.5 % of bentic algae and the remainder was made up of small quantities of phanerogams, sponges, bryzoans, crustaceans, sea urchins, molluscs and sea squirts (Marquez, 1990). Durmus (1998) has dissected a Green Turtle that washed ashore in Samandag (on the easten coast of the Mediterranean). He has found *Posidonia oceanica* and *Zostera sp.* in the stomach contents.

DISCUSSION

Baran and Kasparek (1989) suppose that immature Green Turtles stay around their birth place and later nesting ground. Up to now, no nesting or nesting attempts of the Green Turtle have been recorded from Fethiye Beach or in the vicinity (Baran & Kasparek, 1989a, Türkozan & Baran, 1996, Baran & Türkozan 1996, Türkozan 1998). The closest nesting of the Green Turtle was recorded from Kumluca (Fig 1) with 7 nests (Yerli & Demirayak, 1996). This site is almost 120 km distant from Fethiye as the crow flies. A high level of site fidelity was recorded for juvenile Green Turtles in St. Lucie County, Florida (Bresette *et al.* 1998).

Fishermen in Turkey caught an estimated 2.5 turtles/boat/year versus an estimated 4.0 turtles/boat/year in Cyprus. This yielded a likely minimum bycatch estimate of over 2000 marine turtles per year in the region (Godley *et al.* 1998). Due to the highly endangered status of the Green Turtle urgent measures should be taken. The fishermen especially should be educated not to kill the marine turtles incidentally caught by their nets. The site studied should be placed under strict protection.

We need to make a detailed survey to identify the size of the population feeding at Fethiye Beach.

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A SURVEY OF THE ANURAN FAUNA OF MONTAGNE BELVÉDÈRE, COUNTY OF SAÜL, FRENCH GUIANA: FIELD LIST WITH COMMENTS ON TAXONOMY AND ECOLOGY

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ABSTRACT

Systematic surveys of the anuran fauna of Montagne Belvédère (county of Saül, French Guiana), conducted during 3 short missions, revealed the presence of about 41 species of frogs. 6 Bufonidae, 1 Centrolenidae, 6 Dendrobatidae, 13 Hylidae, 14 Leptodactylidae and 1 Microhylidae were recorded from this small site located in central French Guiana. 15 of these species were unknown from the county of Saül before this survey. *Hyla minuscula* and *Osteocephalus cf. cabrerai* are reported for the first time from French Guiana. Two probably new species of *Adenomera* were collected.

INTRODUCTION AND STUDY SITE

The anuran fauna of French Guiana is relatively well known, mainly thanks to the work of Lescure who published the first checklist in the seventies (1976). Few additional new species were described these last years like *Colostethus baeobatrachus* (Boistel & de Massary, 1999) and increased the number of species present in the country. Some species like *Ctenophryne geayi* (de Massary & Lescure, 1998; Kok, 1998) or *Pipa aspera* (Lescure et al., 1998) were only recently found in French Guiana and are known by very few French Guianan specimens in museum collections.

Some systematic herpetofaunal surveys on regions like the Trois Sauits area (Lescure, 1987), the Petit Saut area (Hoogmoed & Avila Pires, 1991) and the biological research station "Les Nouragues" (Born, 1996) were undertaken and results were published. Until today, it was not the case for the area surrounding the small village of Saül although of special interest since some species like *Atelopus spumarius barbotini* Lescure, 1981 could be endemic to it. However, it must be noted that Lescure and botanists like de Granville collected material in the area surrounding Saül but no specific publication followed. It must be emphasized that this area is of special interest for ecotourism and is dedicated to be part of a national park (see Mori, 1999).

In order to facilitate our work, we chose a very limited area to survey (ca 400 ha). Observations and collections of specimens were strictly restricted to this site, called here study site (SS). The SS is situated in the county of Saül in central French Guiana. The small village of Saül houses more or less 80 inhabitants and is located at about 170 km southwest of Cayenne in the geographic centre of the country (N 3° 37', W 53° 12'). Montagne Belvédère (fig. 1) is a small hill (highest point at ca 330 m) located at about 7 km southwest of the village (base camp at the foot of the hill, between the "Crique

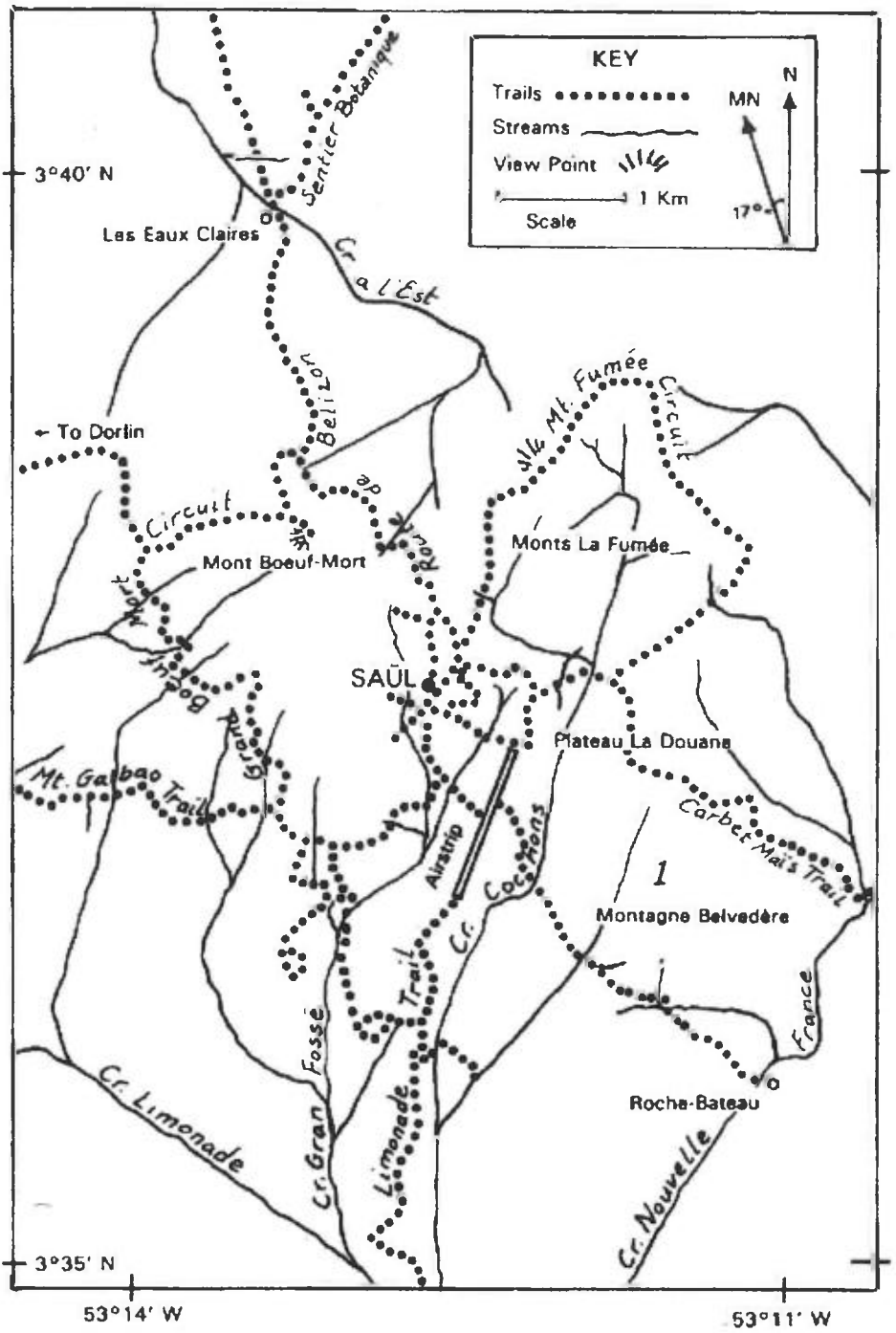

Fig. 1
Map of Saül and surroundings showing the location of Montagne Belvédère (1)

Popote" and the Carbet Maïs trail: N 3° 36', W 53° 10'). Several habitats are represented: streams (called "criques") and ripicolous forest, permanent ponds, semi permanent ponds, swamps, artificial clearings (called "abattis") at the foot of the hill and terra firme primary forest on the hillsides and on the summit. The accessibility is facilitated by marked trails.

MATERIAL AND METHOD

Collections and observations of the anuran fauna were undertaken during three short missions (of about three weeks each) in November-December 1996, June 1998 and April-May 1999. Due to the strict French regulation concerning collection of specimens of amphibians in French Guiana, we collected only a few specimens as voucher specimens.

The specimens collected were encountered on the forest floor, under the leaf litter, fallen trees, decaying wood, on rocks, in creeks and in the vegetation. Higher vegetation and the canopy were also investigated using caving equipment. Voucher specimens were collected by hand at various times of day and night. Habitat, microhabitat and other data like reproduction, atmospheric conditions or peculiar activity were recorded for each specimen collected (see Heyer et al., 1994). Pictures (colour slides) were taken in vivo from almost each voucher specimen. A Global Positioning System (GPS)) Garmin® 50 was used to record the exact position of the base camp. The few collected frogs were anesthetized by Xylocaïne® prior to fixation in a 10% formalin solution. All the material was deposited in the herpetological collections of the Institut royal des Sciences naturelles de Belgique (Brussels, Belgium).

Specific names follow the most recent revision (Duellman, 1993). Museum abbreviations follow standardized usage (Leviton et al., 1985). Sex was determined by dissection.

SPECIES ACCOUNT

BUFONIDAE
Genus *Atelopus*
flavescens group
Atelopus spumarius barbotini Lescure, 1981

Voucher specimen(s): IRSNB 12724, IRSNB 12890, IRSNB 12896, IRSNB 12931, IRSNB 12933-34, IRSNB 12963-69.

The systematic status of this subspecies is unclear. During the survey, we collected specimens representing different forms of *Atelopus* clearly belonging to the *flavescens* group (sensu Lescure "1972" [1983]).

Some of our specimens fitted well with the description of *Atelopus spumarius barbotini* Lescure, 1981 (see Lescure, 1981a) (black to blackish brown with pale red markings on the dorsum, see Plate 2), others appeared to be *Atelopus flavescens* Duméril & Bibron, 1841 (brownish with or without yellowish brown vermiculations, see Plates 3 and 4). These last specimens were mainly identical to the *vermiculatus* form *A. flavescens* described as a separate species by McDiarmid (1973) and synonymized with *A. flavescens* by Lescure (1976). We found also many specimens intermediate between these two taxa (see Plate 5) and we collected a male of "*Atelopus spumarius barbotini*" in amplexus with a female of *Atelopus flavescens* (see Plate 6). It must be noted that some of the "intermediate" specimens collected were gravid females. All of our

specimens had a pinkish or violet ventral coloration. These field observations seriously questioned the validity of *Atelopus spumarius barbotini*. In the laboratory, further examination of the material collected on Montagne Belvédère corroborated that *Atelopus spumarius barbotini* could be a synonym of *Atelopus flavescens* and a morph of this polymorphic species. We will discuss this case in detail in another paper.

This common toad was encountered during the day, usually near streams, but some specimens were observed far from water on the hillsides of the mountains. Males call from low (0.1 - 1.5 m) vegetation along streams. However, specimens were observed as high as 2 m from the ground, especially early in the morning. Males have slightly more powerful anterior members.

IRSNB 12724 (male, 24.9 mm SVL) was calling during the day, 0.18 m high on a leaf of a small bush, 2 m from a stream in primary forest in November. IRSNB 12890 (male, 27.1 mm SVL) was collected during a rainy day, on the floor, 3 m from a stream in primary forest in June. IRSNB 128966 (male, 26.1 mm SVL) was calling during the day, 0.05 m high on a leaf of a small bush, 4 m from a stream in primary forest in June. IRSNB 12931 (male, 25.7 mm SVL) was calling during the day, 0.8 m high on a limb, 2 m from a stream, after a short rain in primary forest in April. IRSNB 12933 (female containing small unpigmented ovarian eggs, 39.2 mm SVL) was collected far from water, on the floor, during the day in primary forest in April. IRSNB 12934 (male, 27 mm SVL) was collected during the day, on the floor, 10 m from a stream in primary forest in April. IRSNB 12963 (female containing small unpigmented ovarian eggs, 32.9 mm SVL) was collected during the day, on the floor, along a trail in primary forest in November. IRSNB 12964 (female containing small unpigmented ovarian eggs, 38.6 mm SVL) was found during the day in amplexus with IRSNB 12965 (23.8 mm SVL), on the floor, along a trail in primary forest in November. IRSNB 12966 (male, 28 mm SVL) was collected during the day, on the floor, along a stream in primary forest in June. IRSNB 12967 (male 26.7 mm SVL) was found on the floor, during the day, 6 m from a stream in primary forest in June. IRSNB 12968 (Male, 28 mm SVL) was calling during the day, 0.8 m high on an horizontal tree trunk, 3 m from a stream in primary forest in June. IRSNB 12969 (male, 27 mm SVL) was collected during the day, on a root, 0.05 m from the ground in primary forest in June.

Genus *Bufo*
guttatus group
Bufo guttatus Schneider, 1799

Voucher specimen(s): IRSNB 12697, IRSNB 12944.

This toad was observed in late afternoon and at night on the floor, exclusively along streams in primary forest. Males begin to call just before the night. IRSNB 12967 (male, 133.6 mm SVL) was calling at night, on the floor, 3 m from a stream in primary forest in November. IRSNB 12944 (male, 140 mm SVL) was collected at night, on the floor, 5 m from a stream in primary forest in April.

marinus group
Bufo marinus (Linnaeus, 1758)

Voucher specimen(s): IRSNB 12900, IRSNB 12980.

This very common species was encountered at night, in the base camp but also in primary forest where the biggest specimens occur. IRSNB 12900 (juvenile, 46.6 mm

SVL) was collected in late afternoon on an horizontal tree trunk (0.6 m from the ground) in the base camp in June. IRSNB 12980 (juvenile, 14.9 mm) was collected during the day on the floor, 4 m from a stream in primary forest in June.

typhonius group
Bufo margaritifera (Laurenti, 1758)

Voucher specimen(s): IRSNB 12718, IRSNB 12761-63.

This common diurnal toad was encountered on the floor in primary forest. We observed several males calling along a stream during the day in May 1999. IRSNB 12718 (female, 51.3 mm SVL) was collected during the day on the forest floor in November. IRSNB 12761 (juvenile, 27.8 mm SVL) was collected during the day on the forest floor, near a small stream in November. IRSNB 12762 (juvenile, 21.7 mm SVL) was collected during the day on the forest floor in November. IRSNB 12763 (female, 50.5 mm SVL) was collected during the day, 5 m from a stream on the forest floor in November.

Bufo species (*typhonius* complex)

This complex of species (minimum 2 different species were observed on the SS) is under study by M.S. Hoogmoed (RMNH). We encountered these diurnal toads along streams, but far from water too (on the hillsides). We shortly discuss here each taxon under numerical designation.

Bufo species 1
This species is characterized by hypertrophied supratympanic crests and bronze iris.

Voucher specimen(s): IRSNB 12893-94, IRSNB 12955-56.

IRSNB 12893 (male, 38.2 mm SVL) and IRSNB 12894 (male, 38.7 mm SVL) were collected during the day, on the floor in primary forest in June. IRSNB 12955 (female, 46.8 mm SVL, containing small pigmented ovarian eggs) was collected during the day, on the floor, along a small stream in primary forest in April. IRSNB 12956 (female, 35.9 mm SVL, containing small pigmented ovarian eggs) was collected during the day, on the floor, along a trail in primary forest in April.

Bufo species 2
This species is characterized by hypertrophied supratympanic crests and green iris.

Voucher specimen(s): IRSNB 12760, IRSNB 12764-65, IRSNB 12898, IRSNB 12911-12, IRSNB 12919.

IRSNB 12760 (female, 45.5 mm SVL, containing small pigmented ovarian eggs) was collected during the day, on the floor, in primary forest in November. IRSNB 12764 (juvenile, 27.9 mm SVL) was collected during the day, on the floor, 4 m from a stream in primary forest in November. IRSNB 12765 (female, 48.1 mm SVL, containing small pigmented ovarian eggs) was collected during the day, on the floor, along a trail in primary forest in November. IRSNB 12898 (male, 37.9 mm SVL) was collected during the day, on the floor, 10 m from a stream in primary forest in June. IRSNB 12911 (juvenile, 15 mm SVL) and IRSNB 12912 (juvenile, 10.7 mm) were collected during the day, on the floor, 5 m from a stream in primary forest in June. IRSNB 12919 (male, 38.4 mm) was collected during the day, on the floor, along a trail in primary forest in June.

CENTROLENIDAE
Genus *Hyalinobatrachium*
fleischmanni group
Hyalinobatrachium taylori (Goin, 1968)

Voucher specimen(s): not collected

We recorded the call (an easily recognisable trill) of this species at night, along a small stream, in primary forest in April.

First record for the region of Saül.

DENDROBATIDAE
Genus *Colostethus*
Colostethus baeobatrachus Boistel & de Massary, 1999

Voucher specimen(s): IRSNB 12976-79, IRSNB 12753-57, IRSNB 12970.

This small diurnal species was found on the floor in primary forest, usually near trails. Males call just after rain showers. IRSNB 12976 (female, 17.6 mm SVL) was collected during the day on the floor in primary forest in April; IRSNB 12977 (male, 16.9 mm SVL with third finger distinctly swollen), IRSNB 12978 (female, 18.6 mm SVL) and IRSNB 12979 (male 17.9 mm SVL with third finger distinctly swollen) were collected during the day on the floor along a trail in primary forest in June; IRSNB 12753 (female 13.7 mm SVL), IRSNB 12754 (female, 14.8 mm SVL) and IRSNB 12755 (female, 16.5 mm SVL) were collected during the day, on the floor along a trail in primary forest in November. IRSNB 12970 (female, 13.5 mm SVL) was collected during the day, on the floor, 5 m from as stream in primary forest in June.

The case of *Colostethus baeobatrachus* is particularly interesting. First proposed by Edwards in his Ph. D. Thesis (1974) (which does not consist of a valid description following the International Code of Nomenclature [Anonymous, 1985]), the name of *Colostethus baeobatrachus* was recently used by Boistel & de Massary (1999) who proposed a picture of the animal and a very short description. They did not mention the thesis of Edwards (1974) nor of a collected specimen that could be used as a reference specimen.

As Boistel & de Massary did not designate holotype or syntypes we consider the animal represented on the picture given by them as the holotype. In order to clarify the situation, we propose here a complete redescription of the species on the basis of our material coming from Montagne Belvédère and from material previously collected in the county of Roura. We follow the characters used for the diagnosis of the *Colostethus* of Ecuador given by Coloma (1995).

Diagnosis – (**1**) SVL males, 16.9 - 17.9 (x = 17.4; n = 2), females, 13.5 - 18.6 (x = 16.1; n = 10); (2) disc on third finger expanded; (3) first finger generally longer than second; (4) fringe absent on second finger; (5) disc of fourth toe expanded; (6) fringe generally present on fourth toe; (7) presence of an internal tarsal fold and presence of an external metatarsal fold; (8) vestigial web on toes; (9) dorsolateral stripe absent; (10) oblique lateral stripe present, sometimes irregular, extending to eye; (11) ventrolateral stripe absent; (12) markings absent on the chest-gular region; (13) abdomen white, greyish or yellow never spotted; (14) third finger distinctly swollen in males; (15)) testes small and white.

C. baeobatrachus is easily distinguished from the two other *Colostethus* found in French Guiana (*C. beebei* (Noble 1923) and *C. degranvillei* Lescure, 1975). The ventral face of *C. baeobatrachus* is white or yellow, never spotted, while grey, brownish or even black with white spots in *C. degranvillei.* Furthermore, *C. degranvillei* has no clear oblique lateral stripe. *C. beebei* has an unspotted yellow or white ventral face but its general aspect is slender and the oblique lateral stripe is missing.

Description of IRSNB 12976 Plate 7): Adult female, 17.6 mm SVL; body moderately slender; head slightly longer than wide; head length 33% SVL; head width 31.3% SVL; snout truncate in dorsal view and slightly projecting in profile; loreal region slightly concave; nostrils slightly protuberant laterally; eye-nostril distance about two thirds of the diameter of eye; supratympanic fold and tympanum little visible; tympanum diameter 47% diameter of eye. Forelimbs moderately long; first finger slightly longer than second; fingers unwebbed, lacking lateral fringes; terminal discs expanded; subarticular tubercles large and protuberant, rather ovoid; external plamar tubercle large, round and protuberant; internal palmar tubercle clearly smaller than external, ovoid and protuberant. Hind limbs long, moderately robust; tibia length 44.9% SVL; foot length 40.3% SVL; outer tarsal fold absent; inner tarsal fold present on distal half of tarsus; outer metatarsal tubercle round, about half size of elliptical inner metatarsal tubercle; vestigial web between finger II and III and between finger III and IV; absence of lateral fringes on the toes; terminal discs expanded; subarticular tubercles small and rather ovoid; supernumerary tubercles absent.

Skin of dorsum, flanks and venter smooth, slightly granulated on the limbs; anal opening directed posteroventrally at quart level of thighs; anal sheath short; tongue elongately elliptical, distinctly widest posteriorly and free posteriorly for about two thirds of its length.

Measurements (in mm): SVL 17.6, tibia length 7.9, foot length 7.1, head length 5.8, head width 5.5, eye diameter 2.5, eye-nostril distance 1.6, tympanum diameter 1.2.

Color in preservative: Dorsal color brown; white oblique lateral stripe; black stripe on the flanks; upper lip white; dorsal surface of arms greyish with brown flecks; dorsal surface of legs greyish with brown longitudinal stripes; two white anal stripes slightly continuous on the posterior face of brownish thighs, surface between the two stripes dark brown; brown transversal stripe on the inner face of thighs; dorsal surface of fingers and toes greyish with brown flecks; throat, chest and belly white; plantar and palmar surfaces brownish.

Color in life: Dorsum brownish to dark brown, generally uniform; dorsal surface of head generally light brown; canthus and flanks dark brown to black usually with numerous small white or light blue dots; upper lip cream or greyish, usually with white or light blue dots; oblique lateral stripe constituted of numerous white or light blue dots which give it sometimes an irregular aspect; arms brownish to dark brown, sometimes with white or light blue dots; small orange spot at the base of upper arm; legs dark brown, with black, and sometimes irregular, longitudinal stripes (usually with white or light blue dots); two orange anal stripes slightly continuous on the posterior face of thighs; surface between these two stripes dark brown to black; belly white or yellow, sometimes greyish; iris bronze to greyish; tips of fingers and toes light blue.

Colostethus beebei (Noble, 1923) (Plate 8)

Voucher specimen(s): IRSNB 127566-58, IRSNB 12892, IRSNB 12906, IRSNB 12946.

This small diurnal dendrobatid was observed during the day on the forest floor, usually along trails and sometimes near streams. IRSNB 12756 (sex undefined, 12.6 mm SVL), IRSNB 12757 (sex undefined, 14.7 mm SVL) and IRSNB 12758 (male, 15.8 mm SVL) were collected during the day, on the floor along a trail in primary forest in November. IRSNB 12892 (male, 15.6 mm SVL) was collected during the day, on the floor, 15 m from a stream in primary forest in June; IRSNB 12906 (male, 19.9 mm SVL with 18 back-riding tadpoles) was found on the floor in primary forest in June; IRSNB 12946 (female containing pigmented ovarian eggs, 17.7 mm SVL) was collected during the day, on the floor, 5 m from a stream along a trail in primary forest in April. Third finger not distinctly swollen by males.

First record for the region of Saül.

Colostethus degranvillei Lescure, 1975

Voucher specimen(s): IRSNB 12951-53.

This small species was observed on the floor, exclusively along small sandy streams, in primary forest where males were actively calling. All the voucher specimens are males (15.5 mm, 14.3 mm, 14.2 mm and 16.1 mm SVL respectively) and were collected calling during the day, along a small stream in primary forest in April.

Genus *Allobates*
Allobates femoralis (Boulenger, 1884 "1883")

Voucher specimen(s): IRSNB 12910, IRSNB 12930.

This species, very common near the village of Saül, was only observed twice on the SS. The two specimens collected are juveniles. IRSNB 12910 (8.6 mm SVL) was collected during the day, on the floor, in a clearing in primary forest in June and IRSNB 12930 (13.7 mm SVL) was collected during the day, on the floor, 10 m from a semi permanent pool in primary forest in April.

Genus *Epipedobates*
Epipedobates hahneli (Boulenger, 1883) (Plate 9)

Voucher specimen(s): IRSNB 12853-54.

Only two specimens were collected. One of them (IRSNB 12853, male, 19.8 mm SVL with 9 back-riding tadpoles) was found during the day, on the floor in a primary forest swamp in June. The other (IRSNB 12854, female, 20.1 mm SL) was collected on the same day on the hillside of the mountain, on the floor, at the foot of a big granitic rock in primary forest.

We follow Haddad & Martins (1994) in recognizing this species distinct from *E. pictus*.

First record for French Guiana.

Genus *Dendrobates*
Dendrobates ventrimaculatus Shreve, 1935 (Plate 10)

Voucher specimen(s): not collected.

Only one specimen (sex undertermined) of this species was observed during the day on an horizontal tree trunk in a clearing in primary forest. *D. ventrimaculatus* is very rare on Montagne Belvédère, probably due to the lack of suitable bromeliads to breed.

First record for the region of Saül.

HYLIDAE
Subfamily Hylinae
Genus *Hyla*
albopunctata group:
Hyla multifasciata Günther, 1859 "1858"

Voucher specimen(s): IRSNB 12701-02, IRSNB 12920.

This species was exclusively observed in secondary vegetation in artificial clearings, usually not far from water. Males were actively calling from low bushes (0-0.7 m) in December and May. IRSNB 12701 (male 55.2 mm SVL with small prepollical spine) was calling at night, 5 m from a quiet moving stream, in a small bush (0.5 m from the ground), in an artificial clearing in November. IRSNB 12702 (male, 51.5 mm SVL with small prepollical spine) was calling the same night at the same locality 0.3 m from the stream in a small bush (0.15 m from the ground). IRSNB 12920 (male, 57.2 mm SVL with small prepollical spine) was calling 6 m from a quiet moving stream in secondary vegetation (0.05 m from the ground) in June.

boans group
Hyla boans (Linnaeus, 1758)

Voucher specimen(s): IRSNB 12698, IRSNB 12901.

This big nocturnal species was found at night, along rocky and sandy streams, where males were calling from the ground or in vegetation (0.5 - 3 m). Fights between males were often observed in December and May. Eggs and tadpoles were found in small cavities along the streams in May, June and December. IRSNB 12698 (male, 106.6 mm SVL with curved prepollical spine) was calling at night on a banana tree (2 m from the ground) along a cascading stream in an artificial clearing in November. IRSNB 12901 (male, 124.2 mm SVL with curved prepollical spine) was collected at night on a rock along a cascading stream in primary forest in June.

geographica group
Hyla calcarata Troschel, 1848

Voucher specimen(s): IRSNB 12940-41.

Two males (42.9 and 44.3 mm SVL respectively, with nuptial excrescenses on the thumbs) were collected at night in a bush (1 - 1.5 m) above a small semi permanent pond in primary forest in April.
Hyla fasciata (Günther, 1859 "1858" Plate 11)

Voucher specimen(s): IRSNB 12960.

Only one female (IRSNB 12960, 51.7 mm SVL) containing pigmented ovarian eggs was found in April in low vegetation (1.5 m) between a stream and a semi permanent pool in primary forest.

First record for the region of Saül.
Hyla geographica Spix, 1824

Voucher specimen(s): IRSNB 12699, IRSNB 12700, IRSNB 12902.

Specimens of this species were found on low vegetation along a small, quiet moving stream in a clearing in primary forest. Tadpoles were observed in December and May. IRSNB 12699 (male, 48.4 mm SVL) was collected at night in a bush (0.4 m from the ground) along a quiet moving stream in a clearing in primary forest in November. IRSNB 12700 (male, 46.4 mm SVL) was collected during the same night at the same locality but on a vertical tree trunk (0.8 m from the ground). IRSNB 12902 (male, 49.2 mm SVL) was collected at night in a bush (1.3 m from the ground) along a quiet moving stream in a clearing in primary forest in June.

First record for the region of Saül.

microcephala group
Hyla minuscula Rivero, 1971 (Plate 12)

Voucher specimen(s): IRSNB 12959.

We collected only one calling male (19.1 mm SVL) of this small species along a semi permanent pool, at night, in primary forest. The specimen fits relatively well with the original description of Rivero (1968) and with the description given by Duellman (1997) from specimens from southern Venezuela. Duellman examined our specimen and identified it without doubt as H. minuscula (Duellman, pers. com.). This consists of the first record of this species for French Guiana.

Genus *Osteocephalus:*
Osteocephalus cf. cabrerai (Cochran & Goin, 1970) (Plate 13)

Voucher specimen(s): IRSNB 12939, IRSNB 12962.

One male (IRSNB 12939, 39.4 mm SVL) with keratinized excressences on the thumbs was collected along a semi permanent pool in primary forest (1.6 m high in a bush) in April. Two females (one of them collected, IRSNB 12962, 51 mm SVL, containing pigmented ovarian eggs) were observed perfectly homochromes on leaves of small plam trees (*Astrocaryum sp*) far from water in May. We follow Duellman & Mendelson (1995) in recognizing this species as distinct from *O. buckleyi* (formerly synonymizied by Trueb & Duellman, 1971). Our specimens fit well with the original description of Cochran & Goin (1970) and with the color plate and description given by Duellman & Mendelson (1995). The only difference we noted is a light blue coloration on the flanks of IRSNB 12962 (female).

First record for French Guiana.

Osteocephalus taurinus Steindachner, 1862

Voucher specimen(s): IRSNB 12708-09, IRSNB 12905.

This very common frog was observed at night in primary forest. Usually observed between 0. 5 m and 3 m high from the ground, some specimens were seen 15 m high in trees, during

the day, *O. taurinus* takes refuge in tree holes. IRSNB 12708 (female, 93.9 mm SVL, containing pigmented ovarian eggs) was collected at night on a small bush (0.6 m from the ground) in primary forest in late November. IRSNB 12709 (female, 87.8 mm) was collected at night on a tree trunk (0.8 m from the ground) in primary forest in November and IRSNB 12905 (male, 77.1 mm SVL) was collected at night on the forest floor in primary forest in June.

First record for the region of Saül.

Genus *Phrynohyas*
Phrynohyas resinifictrix (Goeldi, 1907)

Voucher specimen(s): not collected.

We recorded the distinctive call of this species high in the trees, at night, in primary forest in June.

Phrynohyas sp

Voucher specimen(s): not collected.

This still undescribed species is under study by French and German colleagues. We recorded calling males (the call of this species is peculiar and well known) from holes high in the trees, at night, primary forest in May.

Subfamily Phyllomedusinae
Genus *Phyllomedusa*
Phyllomedusa bicolor (Boddaert, 1772)

Voucher specimen(s): IRSNB 12938.

This species was observed at night, along a semi permanent pool, in primary forest. Males were calling from 1.5 to ca. 15m in trees surrounding the pool in May. Tadpoles were found in the pool. IRSNB 12938 (male, 111.2 mm SVL) was collected 1.5 m high on a bush along a semi permanent pool in primary forest in May.
Phyllomedusa tomopterna (Cope, 1868)

Voucher specimen(s): IRSNB 12961.

Only one female (IRSNB 129661, 53.4 mm SVL) containing unpigmented ovarian eggs was collected at night on low vegetation (1.1 m) near a semi permanent pool in primary forest in May.

Phyllomedusa vaillanti Boulenger, 1882 (See front cover)

Voucher specimen(s): IRSNB 12915, IRSNB 12917.

Several males of this common species were observed calling at night from low vegetation (0.2 - 1.3 m) near a semi permanent pool in primary forest. Typical nests were observed along the pool within which tadpoles occurred numerously. The voucher specimens are two males having 50.8 and 51.1 mm SVL respectively. They were collected at night, on the floor, near a semi permanent pool in primary forest in June.

Plate 2: *"Atelopus spumarius barbotini"*, typical morph.

Plate 3: *Atelopus flavescens,* typical morph.

Plate 4: *"Atelopus flavescens, vermiculatus* morph.

Plate 5: Intermediate specimen between *:Atelopus spumarius barbotini"* and *Atelopus flavescens.*

Plate 6: *"Atelopus spumarius barbotini"* and Atelopus flavesens in amplexus.

Plate 7: *Colostethus baeobatrachus*

Plate 8: *Colostethus beehei*

Plate 9: *Epipedobates hahneli*

Plate 10: *Dendrobates ventrimaculatus*

Plate 11: *Hyla fasciata*

Plate 12: *Hyla minuscula*

Plate 13: *Osteocephalus cf. cabrerai*

Plate 14: *Adenomera species 2*

Plate 15: *Leptodactylus leptodactyloides*

Plate 16: *Physalaemus petersi*

Plate 17: *Otophryne robusta*

LEPTODACTYLIDAE
subfamily Ceratophryinae
Genus *Ceratophrys*
Ceratophrys cornuta (Linnaeus, 1758)

Voucher specimen(s): IRSNB 12907.

Only one female (IRSNB 12907, 110 mm SVL) containing pigmented ovarian eggs was collected at night, far from water, on the floor in primary forest in June.

First record for the region of Saül.

Subfamily Leptodactylinae
Genus *Adenomera*

We collected at least three distinct species of *Adenomera* on the SS. One of them was easily identified as *Adenomera andreae*, but the two others could not be determined at specific level. We briefly discuss here these two species under numerical designation. We will treat these species in details in another paper.

Adenomera andreae Müller, 1923

Voucher specimen(s): IRSNB 12752, IRSNB 12891, IRSNB 12981-84, IRSNB 12897, IRSNB 12903, IRSNB 12937.

Many specimens were observed during the day, on the floor, in primary forest during the three missions.

IRSNB 12752 (female, 20.1 mm SVL containing small unpigmented ovarian eggs) was collected during the day, on the floor, between a trail and a stream in primary forest in November. IRSNB 12891 (sex undetermined, 15.7 mm SVL) was collected during the day, on the floor, 6 m from a semi permanent pond in primary forest in June. IRSNB 12981 (female, 21.1 mm SVL) was collected during the day, on the floor, 10 m from a semi permanent pond in primary forest in June. IRSNB 12897 (male, 16.5 mm SVL) was collected during the day, on the floor, along a stream in primary forest in June. IRSNB 12982 (sex undetermined, 13.7 mm SVL) was found during the day, on the floor, along a trail in primary forest in June. IRSNB 12982 (sex undetermined, 18.7 mm SVL) was collected during the day, on the floor, 10 m from a stream in primary forest in June. IRSNB 12983 (male, 18.6 mm SVL), IRSNB 12984 (female, 23 mm SVL) were collected during the day, on the floor, in primary forest in June IRSNB 12937 (male, 23 mm SVL) was collected during the day, on the floor, in primary forest in April.

Adenomera species 1

Voucher specimen(s): IRSNB 12985.

This species is bigger than *A. andreae*, has a different coloration and a different call.

IRSNB 12985 (male, 25.3 mm SVL) was found during the day, on the floor, at the foot of an *Astrocaryum paramaca* in primary forest in June.

Adenomera species 2 (Plate 14)

Voucher specimen(s): IRSNB 12986-87.

This species is slightly bigger than *A. andreae* and has a different coloration.

IRSNB 12986 (female, 20.6 mm SVL) was collected during the day, on the floor, 0.3 m from a semi permanent pond in primary forest in June. IRSNB 12987 (male, 20.2 mm SVL) was found during the day, on the floor, in primary forest in June.

Genus *Leptodactylus*
fuscus group
Leptodactylus mystaceus (Spix, 1824)

Voucher specimen(s): IRSNB 12936.

Only one juvenile (IRSNB 12936, 25.3 mm SVL) was found during the day, on the floor, 10 m from a stream in primary forest in April.

First record for the region of Saül.

melanonotus group
Leptodactylus leptodactyloides Andersson, 1945 (Plate 15)

Voucher specimen(s): IRSNB 12729, IRSNB 12916.

Only two specimens of this species were collected. IRSNB 12729 (male, 43.3 mm SVL with two small black spines on each thumb) was collected at night on the floor 2 m from a steam in primary forest in November, IRSNB 12916 (female, 49 mm SVL, containing unpigmented ovarian eggs) was collected at night, on the floor, 1 m from a stream in partially disturbed primary forest in June. The two specimens have yellowish-brown ventrolateral glands and a yellowish longitudinal stripe on the posterior surface of the thighs. Our specimens fit well with the description given by Heyer (1994).

First record for the region of Saül.

pentadactylus group
Leptodactylus knudseni Heyner, 1972

Voucher specimen(s); IRSNB 12949.

Only one juvenile (IRSNB 12949, 47 mm SVL) was found at night, on the floor along a trail in primary forest in April.

First record for the region of Saül.

Leptodactylus pentadactylus (Laurentil, 1768)

Voucher specimen(s): IRSNB 12703-05, IRSNB 12918.

Many specimens were observed at night, on the floor, in primary forest. Males were calling at night along streams in May. IRSNB 12703 (female, 93.3 mm SVL), IRSNB

12704 (female, 109.1 mm SVL) and IRSNB 12705 (male, 146.7 mm SVL) were collected during the same night, on the floor in primary forest in November. IRSNB 12918 (female, 71.1 mm SVL) was collected at night, on the floor, 3 m from a cascading stream in primary forest in June.

Leptodactylus rhodomystax Boulenger, 1884 "1883"

Voucher specimen(s): IRSNB 12706a-c, IRSNB 12707, IRSNB 12908a-b.

Several specimens were observed at night on the floor in primary forest, usually along trails. Three females, IRSNB 12706a (73.5 mm SVL), IRSNB 12706b (75.4 mm SVL) and IRSNB 12706c (79.3 mm SVL) containing unpigmented ovarian eggs were collected during the same night, on the floor, along a trail in primary forest in November. One male (IRSNB 12707, 69.3 mm SVL) with nuptial spines on the prepollex and chest was collected the following night, on the floor, along the same trail. IRSNB 12908a (19.3 mm SVL) and IRSNB 12908b (18.1 mm SVL) were collected at night, on the floor, in a partially dried swamp in primary forest in June.

First record for the region of Saül.

Genus *Physalaemus*
Physalaemus petersi (Jiménez de la Espada, 1872) (Plate 16)

Voucher specimen(s): IRSNB 12932, IRSNB 12942-43, IRSNB 12948.

Males were observed called at night, on the floor, along a semi permanent pool in primary forest. Juveniles were collected during the day under dead leaves. One nest assigned to this species was observed along a semi permanent pool in primary forest. IRSNB 12932 (juvenile, 12.5 mm SVL) was collected during the day under dead leaves, 8 m from a stream in primary forest in April. IRSNB 12942, a calling male (32.3 mm SVL), was collected on the floor, 3 m from a semi permanent pool in primary forest in April. IRSNB 12942, a calling male (32.3 mm SVL), was collected on the floor, 3 m from a semi permanent pool in primary forest in April. IRSNB 12943 (subadult unsexed, 19.6 mm SVL) was collected during the same night under a fallen tree trunk, 10 m from a stream in a clearing in primary forest. IRSNB 12948, a calling male (32 mm SVL), was collected on the floor, 1 m from a semi permanent pool in primary forest.

Subfamily Telmatobiinae
Genus *Eleutherodactylus*
Subgenus Eleutherodactylus
conspicillatus group
Eleutherodactylus chiastonotus Lynch & Hoogmoed, 1977

Voucher specimen(s): IRSNB 12909, IRSNB 12899a-b.

This very common species was observed during the day, on the floor, in primary forest. A lot of juveniles were found during April, May and June especially near rotten tree trunks. IRSNB 12909 (male, 39.2 mm SVL) was collected during the day, on the floor, along a trail, 5 m from a stream in primary forest in June. Two juveniles (IRSNB 12899a, 10.6 mm SVL and IRSNB 12899b, 10.4 mm SVL) were collected on a rotten tree trunk (0.1 m from the ground) in an artificial clearing in primary forest in June.

Eleutherodactylus gutturalis Hoogmoed, Lynch & Lescure, 1977

Voucher specimen(s): IRSNB 12904, IRSNB 12947, IRSNB 12957.

Three specimens of this poorly known species were collected. IRSNB 12904 (sex undetermined 13.2 mm SVL) was collected during the day, on the floor, along a trail in primary forest in June. IRSNB 12947 (male, 15.4 mm SVL) was collected during the day, on the floor, along a trail, 10 m from a stream in primary forest in April and IRSNB 12957 (male, 16.8 mm SVL) was collected during the day, on the floor, along a stream in primary forest during the same month.

Eleutherodactylus zeuctotylus Lynch & Hoogmoed, 1977

Voucher specimen(s): IRSNB 12913, IRSNB 12922, IRSNB 12929, IRSNB 12945.

Several specimens were observed, usually during the day, on the floor or between rocks in primary forest. Four calling males were recorded along a stream in April. IRSNB 12913 (female, 30.2 mm SVL) was collected during the day, on the floor, 5 m from a stream in primary forest in June. IRSNB 12922 (female, 34.5 mm SVL) was collected in early morning in the base camp, on the forest floor in July. IRSNB 12929, (male, 22.2 mm SVL) was collected during the day on the forest floor in secondary vegetation in an artificial clearing in April. IRSNB 12945, a calling male (25.9 mm SVL) was collected at 19h55, on limbs (0.4 m from the ground) 6 m from a stream in a primary forest's disturbed area in April. Three other males were calling at the same place.

unistrigatuss group
Eleutherodactylus marmoratus (Boulenger, 1900)

Voucher specimen(s): IRSNB 12921, IRSNB 12935, IRSNB 12958.

Many males were called during the day and night in April and June but located with difficulty due to their minute size. We found this species, usually during the day, on the floor or in low vegetation in primary forest. IRSNB 12921, a calling male (12.2 mm SVL), was collected at night on a leaf 0.1 m from the ground in a swampy area in primary forest in June. IRSNB 12958 (male, 17.4 mm SVL) was collected during the day, on the floor, along a trail in primary forest in April. IRSNB 12935 (male, 14.6 mm SVL) was collected during the day, on the floor, in primary forest after a short rain in April. In life, this last specimen had darker dorsal and ventral coloration (nearly black) and a clear dorsal line; nevertheless, body proportions and other details of coloration agree well with the original description (Boulengere, 1900) and the diagnosis given by Lescure (1981b).

MICROHYLIDAE
Subfamily Otophryninae
Genus *Otophryne*
Otophryne robutsa Boulenger, 1900 (Plate 17)

Voucher specimen(s): IRSNB 12954.

Only one female (IRSNB 12954, 49.2 mm SVL) containing unpigmented ovarian eggs was collected on leaves, along a small stream in primary forest in April.

First record for the region of Saül.

CONCLUSION

This inventory is probably incomplete because we did not sample long enough to encounter rare and very rare species (like *Ctenophryne geayi* or *Scinax proboscidea*). Some species like *Dendrobates tinctorius, Scinax boesemanni, Eleutherodactylus inguinalis, Adelophryne gutturosa* and *Chiasmocleis shudikarensis* were expected but not found on the study site. It must be noted that the weather during the missions was notably drier than usual (effect of El Ninio).

Attention to vocalization is invaluable for the precision of species survey. Some species are virtually never observed but commonly heard (like *Phrynohyas* species). Once the calls are known, the survey of a site is usually faster and easier.

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A METHOD OF ATTACHING RADIO TRANSMITTERS TO DESERT MONITORS, *VARANUS GRISEUS* IN ZARANIK PROTECTED AREA, NORTH SINAI, EGYPT

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Radiotelemetry has afforded a conclusive method for studying several aspects of ecology. Monitors have been equipped with transmitters by various methods; externally to the pelvic region (Green and King, 1978; Stanner and Mendelssohn, 1987), and on the tail (Weavers, 1993; Phillips, 1995; Thompson, 1992, 1994, 1995). Transmitters with attached antennae were implanted in the body cavity (Stebbins and Barwick, 1968; Weatherhead and Anderka 1984), with the aerial under the skin of the tail (Christian and Weavers, 1994), and under skin folds of the lateral side of abdominal wall (Thompson *et al,* 1999). Reinert and Cundall (1982) illustrated a technique in which the transmitter is deposited into the posterior coelomic cavity of snakes and the whip antenna is escalated through the body wall and is implanted subcutaneously. They claimed that their technique bypasses the problem of post-ingestion behaviour, as well as the perpetual complexity of regurgitation or defecation of the ingested transmitter elements. Wang and Adolph (1995) examined the effect of transmitter implantation surgery on behavioural thermoregulation in the western fence lizard, *Sceloporus occidentalis.* They found a small but potential effect on behavioural thermoregulation for the first two days after surgery. This effect was short-lived and vanished by the third day after surgery. In this study, temperature sensitive transmitters were embedded subcutaneously and their whips were externally attached. The same type of transmitters were previously implanted under skin in snakes and both the snakes and transmitters behaved normally (Ibrahim *et al.,* 1998).

Five healthy, *Varanus griseus* (snout to vent length 30.2- 36.0 cm; tail length 39.7-44.8 cm, and mass 295- 455 g) were captured in the Zaranik protected area in North Sinai, Egypt (31° 07 - 02 N, and 33° 25 - 52E) for studying their home range, movements and activity from 14 July 1997 to 30 June 1998.

SI-2T temperature sensitive transmitters with a whip antenna (24 cm standard nylon coated stainless steel wire) (Holohil Systems Ltd, Canada) were used. The transmitter is cylindrical, its body length is 35 mm, and the diameter of its base is 9 mm. It weighs eight g and is operated by a lithium battery with a life of about 14 months at 20°C. Transmitter signals were detected with a RX-1000 portable radiotelemetry receiver with a three element – Yagi Antenna (Wildlife Materials Inc., USA).

Prior to implantation, monitors were placed in cloth bags, and cooled in the fridge at 3°C for 3-4 hours. This hypothermic anaesthesia rendered the monitor to be moderately motionless. Implantation was initiated by making a horizontal 10-15 mm incision in the skin, at the left aspect of abdomen wall, about one cm anterior to the left hind limb using a Bard scalpel (Becton Dickinson Acute Care, USA). Little connective tissue was found between the dermis and the muscular layer, therefore no tissues were removed.

Another incision (about 10 mm) was made in the muscular layer immediately below the first incision. This incision was made about 3 mm deep, but not reaching the body cavity. Transmitter was inserted with the thumb in the incision starting with its base, then the whole body of the transmitter was interjected by rotating and pushing it with thumb and fore finger, thus enlarging the hole slightly, and leaving the long antenna outside of the body. When the transmitter was deposited in the muscular layer, the incision was closed by 3 to 4 sutures. Thus, the transmitter was held in place and kept off from moving. Five to six sutures were used to close the outer incision, sealing the skin and leaving no space around the antenna wire. Incision sites were cleaned with iodine solution and 70% ethyl alcohol. Sterile gloves, and sterilized surgical equipment were also used. The antenna was then traversed over the left thigh, positioned along the mid-dorsal line of the tail, and taped there by a strong heat resistant (up to 80°C) plastic tape (Manco, Inc., USA) to the tip of the antenna. Fixing antenna in both positions in the skin and on the tail resulted in creating untaped bridge-like part of the antenna. This position kept the antenna from moving and hence, kept the sutured hole from being enlarged.

Wounds healed within four to five days, and the monitors were released into the wild. Each monitor appeared to have normal behaviour and were monitored for one year. The monitors maintained a home range size up to 22.8 ha, but one male moved about 8 km in two months following its release, and crossed two marshes of high salinity; another increased its body mass by 480g during the year. High air temperature, rocky terrain, and lizard movements, resulted in some of the attachment tapes holding the antenna in place coming loose a few weeks before the end of study (one year). These lizards were not recaptured to replace the tape because their movements and the transmitter signal appeared to be normal. At the end of the study, it was noted that the wounds were completely dry, and the antenna was firmly fixed. To get the transmitters out, monitors were cooled in the fridge again as before, and the same incisions were reopened. Incisions were sutured back again. and the monitors were released into the wild.

This method of attaching temperature-sensitive transmitters with whip antenna may avoid problems associated with the placement of transmitters in the stomach, or in the coelomic cavity. The taping of the antenna along the mid-line of the dorsal surface of the tail seemed to function well for signal detection.

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SOCIAL BEHAVIOUR, DIETARY PREFERENCES AND BODY TEMPERATURES IN A CAPTIVE COLONY OF GREEN IGUANAS *(IGUANA IGUANA)* IN A NATURALISTIC ENVIRONMENT

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INTRODUCTION

Studies of wild populations of the Green Iguana *(Iguana iguana)* have indicated that whilst males are highly territorial, females are remarkably non-aggressive with other females (Swanson, 1950) except when nest sites are scarce (Rand, 1968). Social behaviour is particularly important in the applied husbandry of captive *Iguana iguana,* since injuries through conflict can increase mortality levels. Continuous direct observation of animal behaviour in captive environments may not relate in detail to the animals' natural behaviour, but it can be a useful guide for captive husbandry programs in relation to (for example) stocking densities and population structure. The results presented in this paper were part of a second year BTEC National Diploma Animal Behaviour Assignment at Huddersfield Technical College, carried out at the college's herpetological unit from 1997 - 1998. The objectives of the assignment were to investigate social hierarchies in Green Iguanas – particularly in females, dietary preferences, activity patterns and thermoregulation.

METHODS

Observations were made on six Green Iguanas. A male and three females were released into the enclosure as juveniles in the autumn of 1996. A juvenile male was released during January 1997 and a ten year old female (which had been a family pet) during February 1997. The observations were carried out in a tropical enclosure subject to natural sunlight, measuring 6 by 5.5 metres at ground level and 4 metres high.

A series of naturally growing plants were present (Table 1) with the main shade species *Cyperus alternifolius, Ficus, Dracaena & Monstera sp.* The inclusion of tree branches, a small pond with waterfall in addition to the abundant shade plants, give a light – shade mosaic effect similar to their natural habitat. Two spot lamps of 275w, one above a tree branch and one directed at ground level, gave the lizards the opportunity to bask on cloudy days.

Behaviour patterns. A total of 59.25 hours of continuous observation were made on the lizards' behaviour. Behaviour was defined as:- **active,** walking around the enclosure for more than a few brief seconds, **shade,** inactive in an area where there was no sunlight, **feeding,** this could either be from a bowl of food supplied or on any of the plants growing in the enclosure. There were two types of **basking,** a) under the spotlamps or b) in the sun's rays. When the weather was overcast an animal was scored as basking if it was lying in an area without cover.

Social behaviour. The behaviour of the lizards when they came into contact with one another was recorded. A successful encounter was scored when a lizard drove the other animal away. A retreat was scored if the animal moved away at the approach of another lizard and a friendly encounter scored when there was no aggression during a contact. Dominance was estimated by observing the lizards with the highest number of successful encounters and lowest numbers of retreats.

Thermoregulation. Body temperatures (n = 40) were measured using an infra-red detector (Digitron 232-3305 Pyrometer). This is a non-invasive instrument that measures skin surface temperatures by detecting the infra-red energy emitted by reptiles (Tracy, 1982). A method of estimating the core temperature from skin surface temperature has been given by Alberts and Grant (1997), which showed differences of up to 3°C between skin surface from core temperature in lizards of the size range used in the study. Simultaneous measurements were also made of air temperatures.

RESULTS

Behaviour patterns. Figure 1 shows lizard behaviour patterns with the results expressed as percentage time spent in each behaviour. Figure 1a shows behaviour during intermittent sunshine and Figure 1b behaviour when the weather was overcast. Basking either in sunshine (intermittent sunshine = 44.3%) or under a heat lamp (cloudy = 71.9%; intermittent sunshine 25.9%) was the principal activity whatever the weather conditions. Basking whilst gaping was observed under very hot sunshine or under heat lamps when the weather was overcast. Rather more time was spent in the shade during intermittent sunshine (12.6%) than when the weather was cloudy (5.02%). There was little difference between the amounts of time the lizards spent feeding (intermittent sunshine 6.6%; cloudy 5.8%) or in a locomotory activity (intermittent sunshine 10.8%; cloudy 9.6%) under different weather conditions. As can be seen these latter activities formed only a small part of total behaviour.

Thermoregulation. Figure 2 shows daytime body temperature levels of the six Green Iguanas with the data grouped at 2°C intervals. The results show a peak level between 36-38°C although a maximum body temperature of 41.1°C and minimum body temperature of 26.2°C were recorded. The interquartile range was 32.1-38.3°C (median = 36.8°C). Air temperatures in the enclosure ranged from 17.2-36.0°C (mean = 27.07°C). Body temperatures were significantly higher than corresponding air temperatures ($F_{(1, 78)} = 57.1$, $p < 0.0001$). Regression analysis of body temperatures with air temperatures (Huey & Slatkin, 1976) with body temperatures treated as the dependent variable and air temperatures the independent variable, gave a regression coefficient of 0.20 ($R^2 = 0.08$), which was not significantly different from 0 (t 1.72, $p > 0.05$, 38 d.f.), the value required for a hypothetical perfect thermoregulator (Huey, 1982).

Social behaviour. Figure 3 shows a series of bar charts which give the results of social encounters between the lizards. Areas of conflict were most frequently observed around the feeding bowl or during overcast weather under basking lamps. The most successful lizard in these encounters was a large female (F1) which was never observed to retreat from any other lizard including the males. The males, which were both physically smaller than the females, would often be driven from under the basking lamps by all the females with the exception of F4, a 10 year old lizard who was introduced around 6 months after the others into the enclosure. This lizard would often close its eyes when approached by certain lizards (particularly M1) and when touched by humans. Eye closing has been described as a possible mechanism for, among others things, reducing aggression in *Iguana iguana* (Distal & Veazy, 1982).

The results in Figure 3 indicate a female hierarchy of, in order of dominance, F1, F2, F3 & F4. Size did not necessarily guarantee high social position since F3 was heavier than F2 by almost 400g. The apparently dominant F1 and lower ranked F3 were the largest lizards with weights of nearly 3Kg at the end of the study period.

The two males continually fought when they came into contact, with the smaller animal persistently retreating. This lizard was eventually removed from the enclosure as the fighting intensified. However, despite his low ranking, M2 was seen mating with two of the larger females (F2 & F3) before his eventual removal. The male M1 was seen mating with all the females despite usually being greeted by the threat of biting. This was involved in more social encounters than any of the other lizards.

Food preferences. Table 1 shows the plant species consumed by the iguanas. A total of 20 plant species were consumed more than once and a further 4 species were grazed on at least one occasion. Particular favourites were passion flower *(Passiflora),* spider plant *(Chlorophytum)* and dragon trees *(Dracaena).* None. of the bromeliad species were used as food despite several species being present in the enclosure. Iguana foraging tended to follow cycles and heavy grazing on particular species following by periods of non interest.

Table 1

Plant species present in the enclosure and the number of times (N) they were observed being consumed by Green Iguanas. Also shown are the plant species observed being eaten on one occasion only, in addition to species present but seen consumed.

Plant species consumed	N	One observation	Plant species present but not consumed
Dracaena sp	15	*Aloe barbadensis*	*Schlumbergera bridgesii*
Dracaena tricolor	12	*Aeonium sp*	*Maranta leuconeura*
Crassula argentea	3	*Iresine herbsei*	*Stramanthe sanguinea*
Zingeraceae sp	3	*Tradescantia sp*	*Sedum spathulifolium*
Chlorophytum commosum	51		*Mandevillia laxa*
Cymbopogon citratus	6		*Ficus benjamina*
Zantedeschia aethiopica	4		*Ficus pumila*
Aloe ciliaris	2		*Agave americanum*
Cymbidium hybridis	4		*Begonia sp*
Cyperus alternifolius	14		*Sedium spathifolium*
Kohleria bogotensis	2		*Cerapegia woodii*
Rhoeo disclor	5		*Calathea sp*
Sanseveria trifaciata nana	3		*Nerium oleander*
Asparagus asparagoides	6		BROMELIADS
Ixora sp	7		*Aechmea fasciata*
Monstera delicosa	3		*Guzmania lingulata*
Passiflora caerulea	32		*Billbergia sp*
Ociumum basilicum	26		*Neoregelia carolina*
Iresine herbesei	4		*Tillandsia argentea*

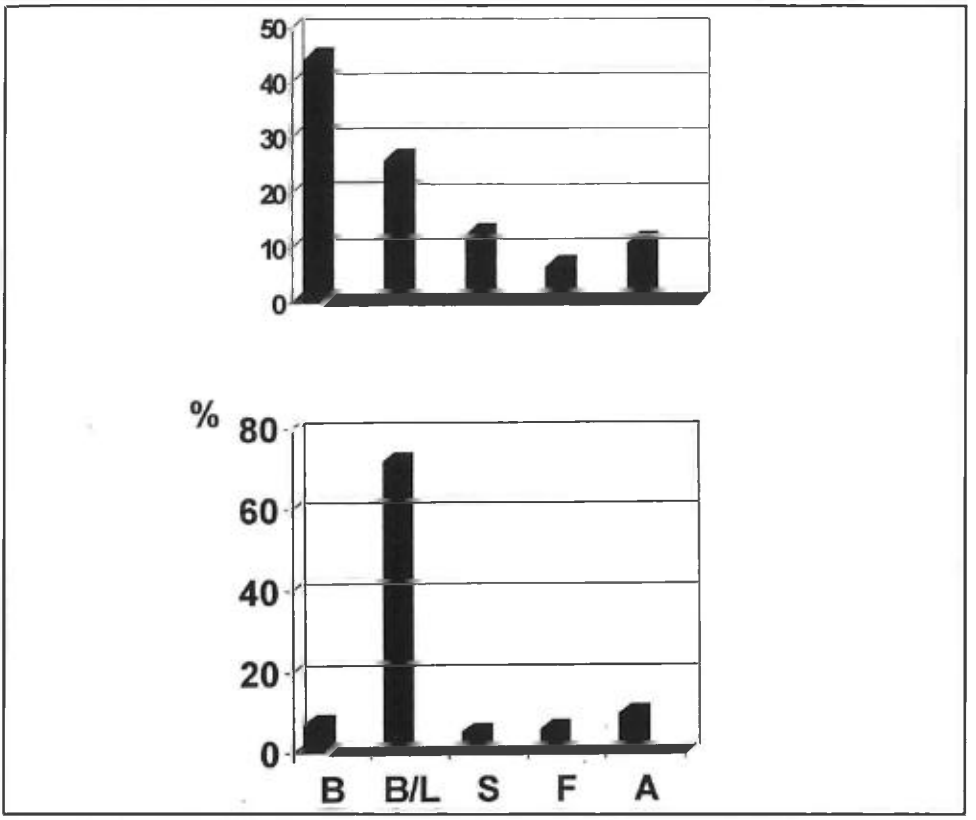

Fig. 1: Behaviour of Green Iguanas *(Iguana iguana)* under different weather conditions. Chart A shows behaviour when the weather had some sunshine, chart B when the weather was overcast. The charts show how much time, as a percent frequency of total observations, the lizards spent basking B, basking under a heat lamp BL, in the shade S, feeding F and active A.

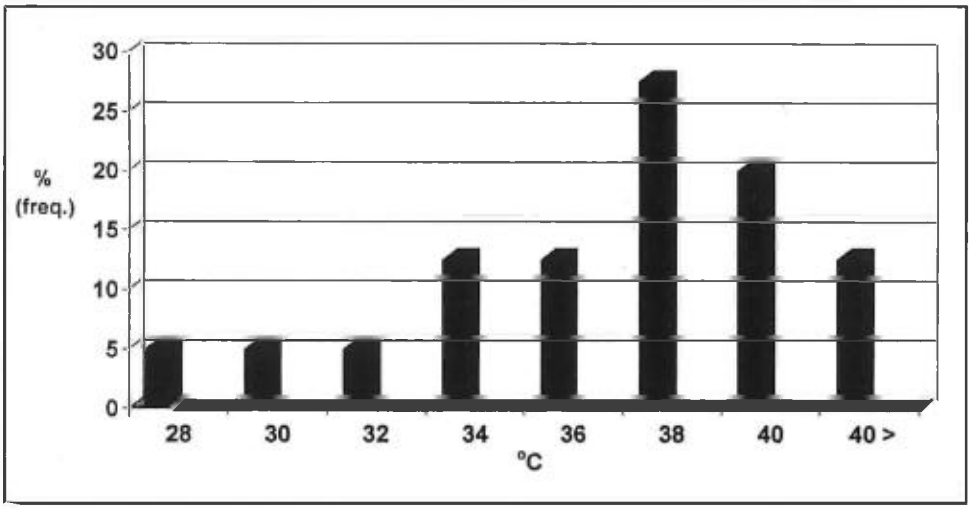

Fig. 2: Frequency distributions (%) of iguana body temperature at 2°C intervals. See text for other details

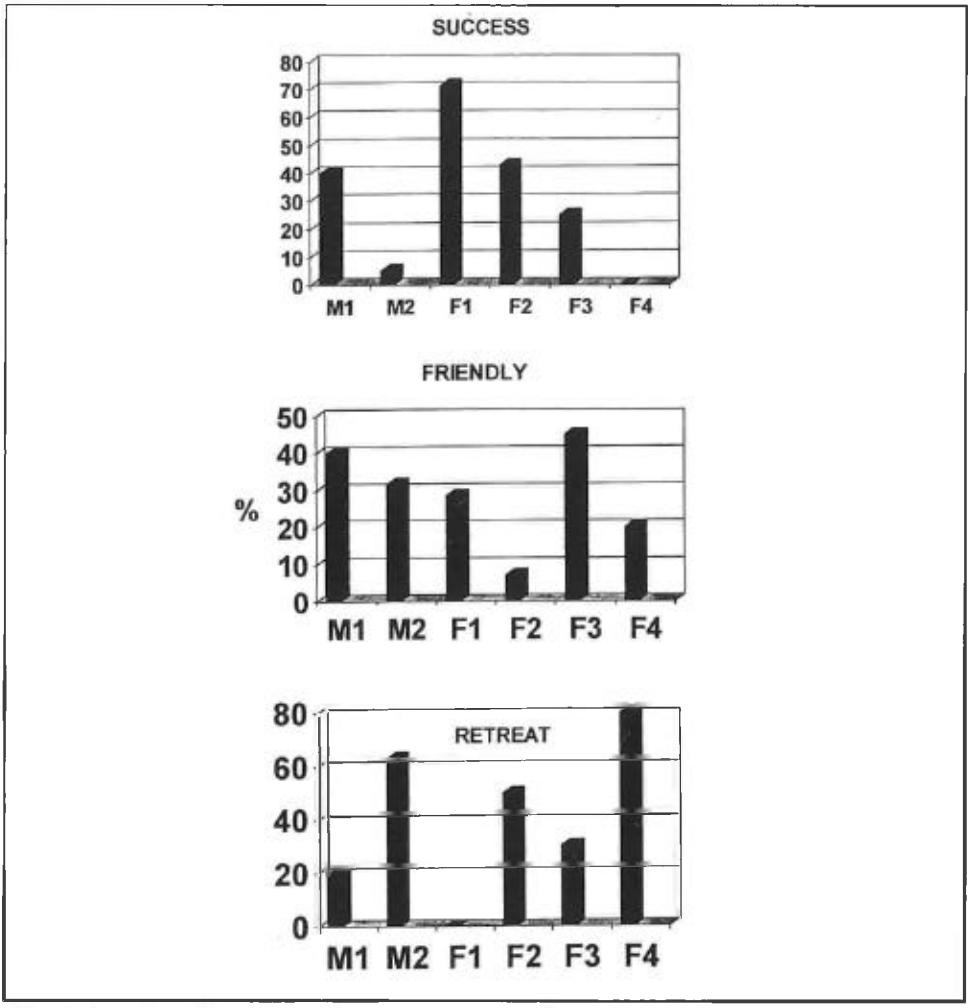

Fig. 3: A series of bar charts showing outcomes of encounters between iguanas. The top chart shows the number of successful encounters of each lizard, the middle chart the number of friendly or non-aggressive encounters and the bottom chart the number of retreats. The y - axis shows the frequency of observations as percentages and the x-axis the code names of the lizards as mentioned in the text.

DISCUSSION

The results of this study have shown that the female iguanas formed social hierarchies in which no injuries were inflicted during the study period. This contrasted with the behaviour of the two males where fighting could be intense and result in injuries. Two types of dominance hierarchies in lizards have been recognized, the 'peck-right' where aggression is one sided and the subordinates almost never attack higher ranking animals, and 'peck-dominance' where subordinates may attack higher ranking animals. The lizards in this study apparently operated the peck-right system in common with most species of iguanids (Stamps, 1977).

Much of the lizards' time in the enclosure was spent in an inactive state. The ectothermic nature of their physiology in addition to the fact that they are hind gut fermenters

(Iverson, 1982; McBee & McBee, 1982) imposes a daily routine that largely involves basking and temperature control. Efficient temperature regulation is an important aspect of behaviour in a hind gut fermenter since progressive departures from optimal body temperatures renders digestion increasingly more difficult. Troyer (1987) reported good digestive efficiency in *Iguana iguana* at body temperatures of 36.5-37.5°C which is in approximate agreement with the body temperatures selected by the lizards in this study. Natural populations of *Iguana iguana* apparently alternate between days of foraging for plant material and basking (van Marken Lichtenbelt *et al*, 1997), which in general was the routine that this captive colony followed. Moberly (1968) estimated that *Iguana iguana* spends 90% of its time resting and other field workers as much as 96% inactive and 1% feeding (ref. in Iverson, 1982). Foraging activity in the captive colony was slightly higher than reported for these wild populations. Activity in the males during the summer and autumn appeared to be driven by sexual behaviour, particularly the dominant of the two (M1).

The dietary habits of the lizards indicate that they were not highly selective feeders although certain species of plant were more frequently consumed. In addition to direct observation there was evidence of evening grazing on certain species, for example on *Rhoeo discolor*. Supplementary food was also given to the lizards daily. This consisted mainly of kale, coriander, bananas, tomato, alfalfa pellets, grapes, apple and commercial iguana pellets. Occasionally low grade cereal based dog food was also given (mixed with alfalfa pellets) and the animals would also consume any giant mealworms they came across. Reports, however, of iguanas consuming insects in their natural habitat apparently stem from a single observation of a juvenile eating a grasshopper (Hirth, 1963).

Field studies indicate that a wide diversity of plant species – primarily the leaf material, form the natural diet of *Iguana iguana* (Van Devender, 1982, van Marken Lichtenbelt, 1993, Rand *et al,* 1990). The leaves of some plants have been found to be indigestible to herbivorous lizards e.g. *Cyclura carinata* and *Cyclura cornuta* and may be passed intact (Iverson, 1982), but there was no evidence of this in this study, although the observation suggests that many herbivorous reptiles are opportunistic foragers. Indeed feeding behaviour may be learned in iguanas. As an example, when the first of two *Dracaena* species were planted in the enclosure, the lizards initially showed little interest, but after several weeks the male (M1) climbed the tree and began feeding on the leaves. Within the following hour all the lizards had climbed the tree and virtually decimated its leaves. However the time lag between the introduction of a plant and the lizards' interest was not always so prolonged; passion flower *(Passiflora caerula)* leaves were consumed within an hour of the plants' introduction to the enclosure. There was, additionally, evidence of the lizards attempting to feed on *Allamanda carthartica,* a species with toxic compounds. Several species of reptilian herbivores have been observed in their natural habitats feeding on plants with distasteful or toxic substances, for example *Testudo hermanni* (Meek, 1985), *Cyclura cornuta* and *Cyclura carinata* (ref. in Inverson, 1982).

SUMMARY

Captive female *Iguana iguana* formed a hierarchy which was more tolerant than those of two males living in the colony. The most intense period of female conflict was during the initial introduction of the group into the enclosure. Once the pecking order was established, the number of incidents began to decrease and were usually centred around the feeding bowl and basking lamps. In males, on the other hand, fighting appeared to increase with increasing size. Thermoregulation to body temperatures similar to those recorded from free-living iguanas was achieved by the use of basking lamps when the

weather was overcast and during hot sunshine by shuttling between the mosaic of sunlit and shaded areas provided by vegetation. Social structure and environmental complexity (Avery, 1985), including providing an appropriate thermal environment and the cultivation of a broad selection of plant species as potential food, are important considerations to be taken into account when establishing captive colonies of iguanas.

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CONTENTS

BHS BULLETIN – CHANGE OF EDITORSHIP

John Pickett has stood down as Editor of the Bulletin. I have associated this 'name' with the Bulletin for almost as long as I can remember, though it still came as something of a surprise to learn that he has notched up over ? years. The Bulletin is recognised both in the UK and internationally for the wide appeal of its articles, and surely at least some credit for this must be attributed to John and its two other long-standing Editors, Simon Townson and John Spence. I very much hope that they will continue to maintain an interest in the future of the Bulletin.

As the Bulletin's new Editor, one of the things I'd like to try and do is assume the task of typesetting myself, although this may not necessarily happen straight away – I need to make sure I've got the hang of desktop publishing before messing up someone's carefully produced manuscript! Preparing the Bulletin in this way will have several major advantages, not least in increased flexibility, but it does mean that articles should now as far as possible be prepared using a word-processor and submitted on computer diskette (as well as in hard copy form, 2 copies, double spaced). Please indicate disk format (Windows or Macintosh) and word-processing software used, and if possible also include a text-only version of the file. I am VERY aware that some may find it difficult to comply with, and do not want to dissuade potential contributors from submitting an article simply because they do not have access to a computer. Consequently, typed hard copy and hand-written articles will STILL be accepted, but please bear in mind that this material will need to be copy-typed (*by me*), which may take considerable time and delay publication of their work.

There will be more news concerning the Bulletin in a future issue, but for the time being I would just like to inform potential authors that all new submissions should now be addressed to myself at: Department of Botany, The Natural History Museum, Cromwell Road, London SW7 5BD.

Peter Stafford

BRITISH HERPETOLOGICAL SOCIETY

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ADDENDA TO 'A SURVEY OF THE ANURAN FAUNA OF MONTAGNE BELVÉDERE, COUNTY OF SAÜL, FRENCH GUIANA'

PHILIPPE J.R. KOK

Herpétologie, Section Systématique et Taxonomie biochimique, Département des Vertébrés récents, Institut royal des Sciences naturelles de Belgique, rue Vautier 29, B-1000 Brussels, Belgium. E-mail: phkok@yahoo.com

IN a recent paper (Kok, 2000), I mentioned the presence of *Otophryne robusta* on Montagne Belvédère in central French Guiana. In fact, shortly after the submission of my paper, I received a reprint of an article by Campbell & Clarke (1998) in which these authors reviewed the genus *Otophryne*. It appears that the species present in French Guiana is a new species, *Otophryne pyburni* Campbell & Clarke, 1998 and not *Otophryne robusta* Boulenger, 1900. At the time this new information was received my paper was already in press and the modification could not unfortunately be carried out.

I mentioned also the presence of *Colostethus baeobatrachus* Boistel & de Massary, 1999, but Martins (1989), in a poorly known report, described a new species, *Colostethus stepheni*, and mentioned that *'C. baeobatrachus'* of Edwards (1974) corresponds to this species. I carefully read the article and the diagnosis of Martins and conclude that the species I called *Colostethus baeobatrachus* Boistel & de Massary is in fact a junior synonym of *Colostethus stepheni* Martins, 1989. This record considerably extends the range of *C. stepheni* which was only known from the region of the type locality (Amazonas, Brazil).

Concerning *Bufo* species 1 and *Bufo* species 2 (page 10), the reader needs to read 'not hypertrophied' instead of 'hypertrophied'.

I would like also to thank Dr. Scott Mori (New York Botanical Garden) for the permission to use the map of Saül and surroundings illustrating the article.

ACKNOWLEDGEMENTS

I thank H. Bringsøe for his judicious comments on *Colostethus stepheni*.

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Editor's note:

The original article referred to here regrettably also contained a number of printing mistakes, for which we apologize; the principal errors that readers should be aware of are listed below.

p. 6, 3rd paragraph; Trois Sauts - and not Trois Sauits.

p. 15, concerning *Hyla minuscula*, line 3; Rivero (1971) - and not Rivero (1968).

p. 18, plate 6; *Atelopus flavescens* - and not Atelopus flavesens.

p. 18, plate 8; *Colostethus beebei* - and not *Colostethus beehei*.

p. 22, concerning *Leptodactylus pentadactylus* (Laurenti, 1768) - and not (Laurentil, 1768)

p. 23, concerning *Physalaemus petersi*; males were calling - and not 'were called'.

p. 24, concerning *Eleutherodactylus marmoratus*; males were calling - and not 'were called'.

LETTER TO THE EDITOR

Dear Editor:

I am writing to express my concern about an article published in the Spring 2000 Bulletin by Adel A. Ibrahim, concerning work in Egypt with Desert Monitors (*Varanus griseus*). The author described the use of hypothermia (cooled in the fridge at 3°C for 3-4 hours) as anaesthesia and used this method of physical immobilisation to carry out surgical procedures on his subjects.

The use of hypothermia for painful procedures in reptiles has been condemned for many years (Cooper & Jackson, 1981) and in some countries of the world employing this technique could lay one open to prosecution under animal welfare legislation. Britain, in particular, has played a leading part in promoting the use of proper chemical anaesthetic agents for reptiles and in ensuring that inhumane techniques, such as hypothermia, are not employed (UFAW/WSPA, 1989).

Having lived in Africa for some years and currently working on reptiles with colleagues in Uganda, I am conscious of the difficulties that often face scientists there and elsewhere, especially when developing research procedures or wanting to obtain equipment. However, the successful use of injectable or inhalation anaesthetic agents in monitors and other species of reptile is well documented (Beynon et al., 1992; Frye, 1991; Mader, 1996) and such techniques are used routinely elsewhere in much of Africa and the Middle East.

I am concerned that the BHS has published this article, apparently without first consulting members of the Society or others who might have been able to advise as to the acceptability of the techniques. The net result could be that other scientists may be encouraged to use similar methods. It saddens me, as a long-standing member of the BHS, that our Society should appear to endorse a method of immobilising reptiles for surgery that would be totally unacceptable in much of the world and which is so out of keeping with the modern technology and good scientific method described elsewhere in the same paper.

I should add that I would be happy to advise the author of the article in question on preferred methods of anaesthesia if this would assist his work. So too, I am sure, would other veterinary colleagues who are members of the BHS.

Yours sincerely,

JOHN E. COOPER, c/o Wild Animal Research and Management (WARM), Faculty of Veterinary Medicine, Makerere University, P.O. Box 7062 Kampala, Uganda.

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Editor's comment: the current Editor is unaware of the circumstances surrounding the publication of this article, but by way of reassurance to Prof. Cooper and the Society at large it is now routine practice for articles containing issues of a veterinary or welfare nature to be assessed by at least one professionally qualified referee. Prof. Cooper's offer to assist in this respect is gratefully acknowledged.