The HERPETOLOGICAL BULLETIN

Number 75 – Spring 2001

4th World Congress of Herpetology, Sri Lanka • Origin and history of Bojanus' *Anatome Testudinis Europaeae* • Diet of the Malayan Krait • Man eating by Estuarine Crocodiles; the Ramree Island incident • Cultural attitudes of people towards reptiles in Nigeria • Translocation study of Crested Newts • Unseasonal activity in *Natrix natrix* • Cannibalism in *Lacerta monticola*

THE HERPETOLOGICAL BULLETIN

The **Herpetological Bulletin** (formerly the British Herpetological Society Bulletin) is produced quarterly and publishes, in English, a range of articles concerned with herpetology. These include full-length papers of mostly a semi-technical nature, book reviews, letters from readers, society news, and other items of general herpetological interest. Emphasis is placed on natural history, conservation, captive breeding and husbandry, veterinary and behavioural aspects. Articles reporting the results of experimental research, descriptions of new taxa, or taxonomic revisions should be submitted to The Herpetological Journal (see inside back cover for Editor's address).

ISSN 1473-0928

Printed by Metloc Printers Limited. Old Station Road, Loughton, Essex.

Information for contributors

1. Contributions should be submitted in hard copy form (2 copies of manuscript, double-spaced) AND on computer diskette. The Bulletin is typeset directly from the author's diskette, so wherever possible all manuscripts should be prepared using a word-processor. Please indicate disk format (Windows or Macintosh) and word-processing software used, and if possible also include a text-only version of the file. The text should be arranged in the following order: *Title; Name(s)* of author(s); *Address(es)* of authors (please indicate corresponding author); *Abstract* (optional); *Text; Acknowledgements; References; Appendices.* Footnotes should not be included. Refer to this issue for style and format information.
2. Slides are the preferred form of illustration, although black and white prints are also acceptable. It is possible also to reproduce line drawings, graphs, and charts if executed clearly in black ink. All illustrations should be entirely relevant to the text and numbered sequentially with Arabic numbers.
3. Authors will be informed promptly of receipt of their manuscript and given a time-scale within which it will be published. Acknowledgement of the receipt of work ***does not*** indicate acceptance for publication. Contributions are liable to assessment for suitability and ethical issues, for which the advice of one or more external referees may be sought. The Editor reserves the right to shorten or amend a manuscript, although substantial alterations will not be made without permission of the primary author.
4. Ten offprints and one complimentary copy of the Bulletin are provided to authors. Further copies may be available from the Editor at cost. Slides, artwork, and other original material will be returned following publication.
5. The significance and importance of some articles may be such that the Editor will offer the author a year's free subscription to the Society for their work.
6. The Editor is keenly aware that contributors may find some of these instructions difficult to comply with and is anxious that the pages of the Bulletin should remain open to as wide a range of correspondents as possible. Therefore, if an author has concerns about the suitability of a manuscript, or would like help in preparing it, please contact the Editor to discuss.

The views expressed by the contributors to the Bulletin are not necessarily those of the Editor or the British Herpetological Society.

All submissions and correspondence arising from the Bulletin should be sent to the Editor, Peter Stafford, c/o Dept. of Botany, The Natural History Museum, Cromwell Road, London, SW7 5BD. *E-mail: pjs@nhm.ac.uk*

Front cover illustration
Estuarine Crocodile *(Crocodylus porosus).* Photograph © Stephen Von Peltz. See article on page 15.

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.

REFERENCES

Beynon, P., Lawton, M.P.C. & Cooper, J.E. (1992). Manual of Reptiles. Cheltenham, Glos.: British Small Animal Veterinary Association.

Cooper, J.E. & Jackson O.F. (1981). Diseases of the Reptilia. London and New York: Academic Press.

Frye, F.L. (1991). Biomedical and Surgical Aspects of Captive Reptile Husbandry. Malabar, Florida: Krieger Publishing Co.

Mader, D.R. (1996). Reptile Medicine and Surgery. Philadelphia and London: WB Saunders.

UFAW/WSPA (1989). Euthanasia of Amphibians and Reptiles. Report of a Joint UFAW/WSPA Working Party. Potters Bar, Herts.: Universities Federation for Animal Welfare.

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.

FORTHCOMING MEETINGS

SRI LANKA - VENUE OF THE 4TH WORLD CONGRESS OF HERPETOLOGY 2-9 DECEMBER 2001

MICHAEL LAMBERT

Natural Resources Institute, University of Greenwich, Central Avenue, Chatham Maritime, Kent ME4 4TB, UK.

A British Crown Colony since 1802, Ceylon became an independent member of the Commonwealth in 1948, and the island was renamed Sri Lanka (= 'Resplendent Island'). Covering an area of 25,332 square miles (65,610 km²) - with the greatest length (north-south) of 270 miles (434 km) and greatest width 140 miles (225 km) - Sri Lanka has a tropical climate, warm throughout the year, with high relative humidity, and a more temperate climate in the hills. Rainfall is generally heavy, with two main monsoon seasons: the south-west in mid-May to September, and the north-east in November to March. Inland waters make up 33 square miles (85 km²), and areas over 2000 feet (610 m) support grasslands. Adam's Peak at 7,360 feet (2243 m) is about the highest in the central massif, and is a place of pilgrimage for Buddhists, Hindus and Muslims. Sinhala is spoken by 74% of the population, and Tamil by 18%; English is effectively the *lingua franca* and widely spoken by local people. I had the opportunity to visit Sri Lanka in December 1998/January 1999. Sri Lanka is the venue of the 4th World Congress of Herpetology, 2-9 December 2001. Further details about the Congress can be obtained from Mr. Anslem de Silva, Congress Director, 4WCH, c/o Faculty of Medecine, Peradeniya, Sri Lanka; fax: +94 74 470733; e-mail: dir4wch@kandy.ccom.lk OR kalds@slnet.lk. The Congress website is situated at http://www.4wch.com/homepg.htm, from which the colour brochure and registration form can be downloaded. Congress practical arrangements are being made by CDC Conventions (Pvt) Ltd., 58 Dudley Senanayake Mawatha, Colombo 8, Sri Lanka; tel.: +94 1 674950; fax: +94 1 694753; e-mail: cdc1@cdcconv.slt.lk. The deadline for receipt of abstracts, registration forms and accommodation requirements is 31 August 2001.

Herpetofauna recorded in Sri Lanka comprise 225 taxa - 51 amphibians and 174 reptiles - of which 125 (55%) are endemic (de Silva, 1996a). Sri Lanka has the greatest herpetofaunal richness in South-East Asia (A. de Silva, pers. comm.), and, in relation to the island's size, the highest diversity in the world. Identified threats to species' survival include vulnerability to predators due to ecological factors associated with rapid depletion of forests and destruction of other wildlife areas; increase in the human population resulting in high levels of consumption, killing and excessive collection of species that deplete natural habitats, and large scale application of pesticides and other agrochemicals for the production of such crops as rice, tea and vegetables. There is little information on the effects of agricultural pesticides on herpetofaunal richness in Sri Lanka (de Silva, 1996a), although the highest use of pesticide is known to be for tea production, with usage also very high in rice paddies situated in wet and intermediate, as well as in irrigated dry zones in Sri Lanka. The strikingly-marked Indian Star Tortoise *Geochelone elegans* is a CITES Appendix II listed species, and not uncommon in Sri Lanka's dry zone. It is regarded as a pest by farmers since tortoises enter vegetable plantations and feed on the tender leaves, buds, flowers and fruits of melons, and on the foliage of ground nuts, cow-peas and beans (de Silva, 1995c), including the new shoots of beans

heavily treated with pesticides. While also sustaining damage, often deliberate, from agricultural implements wielded by farmers, the effects of pesticides on tortoises are unknown. Farmers have also sought advice on how to control the creatures, not wanting to kill them, partly in line with their religious beliefs. There is a population of star tortoises, together with crocodiles, in the Bundala National Park in the south of the island just east of the fishing village of Hambantota.

As Congress Director, Anslem de Silva (Senior Staff Officer and Lecturer in the Faculty of Medicine, University of Peradeniya) is the island's main herpetologist and President of the Amphibia and Reptile Research Organisation of Sri Lanka (ARROS). Anslem de Silva also organised the International Conference of the Amphibians and Reptiles of South Asia, that was held in Sri Lanka (with around 60 participants) at the Institute of Fundamental Studies, Kandy, and the University of Peradeniya, 1-5 August 1996. He subsequently edited the proceedings of this meeting *'Biology and conservation of the amphibians, reptiles and their habitats in South Asia'* (1998) - ISBN 955-8213-00-4 - which contains approximately 50 papers, and is made up of 375 pages (18 x 25 cm), with author index, illustrations and colour group photograph of participants. This proceedings volume is now available, and can be ordered from Anslem de Silva, Faculty of Medicine, University of Peradeniya, Sri Lanka, at a price of US$ 35. Cheques should be made out to K.A.L. de Silva.

ACKNOWLEDGEMENTS

Upon our re-meeting in Sri Lanka (since Gonfaron, France, 1995) at the University of Peradeniya, Anslem de Silva kindly let me have a number of his publications listed in the bibliography (below).

BIBLIOGRAPHY

Recent publications on the herpetofauna of Sri Lanka by de Silva, A.

(1994a). An introduction to the herpetofauna of Sri Lanka. *Lyriocephalus* **1**(1 & 2), 3-19.

(1994b). The amphibia of Sri Lanka: a provisional checklist and their common names. *Lyriocephalus* **1** (1 & 2), 20-26.

(1994c). Some notes on *Gonydactylus frenatus* (Gunther, 1864) (Reptilia: Gekkonidae). *Lyriocephalus* **1**(1 & 2), 57-59.

(1995a). An introduction to the herpetofauna of Sri Lanka, part 2: historical aspects. *Lyriocephalus* **2**(1 & 2), 3-16.

(1995b). The reptiles of Sri Lanka, a checklist and common names, part 1: Testudines, Crocodylia and Lacertilia. *Lyriocephalus* **2**(1 & 2), 25-33.

(1995c). The status of *Geochelone elegans* in North Western Province of Sri Lanka: preliminary findings. In *International Congress of Chelonian Conservation - Gonfaron, France - 6th to 10th July 1995,* pp.47-49. Devaux, B. (Ed.). Gonfaron: Editions SOPTOM. 344 pp.

(1996a). *The herpetofauna of Sri Lanka: a brief review.* Peradeniya: private. 99 pp. + 15 plates.

(1996b). Proposed action plan: conservation, restoration and management of the Testudines and their habitats in Sri Lanka. Kandy: International Conference on the Biology & Conservation of the South Asian Amphibians and Reptiles, 1-5 August, 1996, Sri Lanka. 28 pp.

(1996c). The Amphibia of Sri Lanka: a checklist and an annotated bibliography. Kandy: Department of Wildlife Conservation and Protected Area Management Sri Lanka / Global Environment Facility Project. 48 pp.

(1996d). The testudines and crocodilians of Sri Lanka: a checklist and an annotated bibliography. Kandy: Department of Wildlife Conservation and Protected Area Management Sri Lanka Global Environment Facility Project. 42 pp.

(1997a). Marine turtles of Sri Lanka: an overview. *Lyriocephalus* 3(2), 16-25.

(1997b). *Lankascincus taprobanense* (Kelaart, 1854), a skink with a prehensile tail. Lyriocephalus 3(2), 26-27.

(1997c). Crab feeding on a tadpole. *Lyriocephalus* **3**(2), 28.
(1997d). A non-venomous colubrid bite: case report. *Lyriocephalus* **3**(2), 29.
(1998a). Sauria (lizards and varanids) of Sri Lanka: a checklist and an annotated bibliography. Kandy: Department of Wildlife Conservation and Protected Area Management Sri Lanka/ Global Environment Facility Project. 52 pp.
(1998b). Snakes of Sri Lanka: a checklist and an annotated bibliography. Kandy: Department of Wildlife Conservation and Protected Area Management Sri Lanka / Global Environment Facility Project. 112 pp.
(Ed.) (1998c). *Biology and conservation of the amphibians, reptiles and their habitats in South Asia.* Proceedings of the International Conference on the Biology and Conservation of the Amphibians and Reptiles of South Asia, held at the Institute of Fundamental Studies, Kandy, and University of Peradeniya, Sri Lanka, August 1-5, 1996). Peradeniya: Amphibia and Reptile Research Organization of Sri Lanka (ARROS). 375 pp.
de Silva, A. & de Silva, P. (1994a). Preliminary observations on the natural history of *Ramanella obscura* (Amphibia: Microhylidae). *Lyriocephalus* **1**(1 & 2), 33-37.
de Silva, A. & de Silva, P. (1994b). Common hourglass tree frog in Sri Lanka. *Re-Introduction News* **8**, 9.
de Silva, A. & de Silva, P. (1995). Some observations on *Kaloula taprobanica* (Amphibia: Anura; Microhylidae) in Sri Lanka. *Lyriocephalus* **2**(1 & 2), 48-51.

FORUM

COMMENTS ON 'A NEW ADDITION TO EGYPT'S HERPETOFAUNA: *COLUBER ALGIRUS* (JAN, 1863)' by S. BAHAH EL DIN

HERPETOLOGICAL BULLETIN
NO. 72, pp. 2-3.

ADEL A. IBRAHIM

Department of Biological Sciences and Geology, Faculty of Education at Al-Arish, North Sinai, Egypt.
E-mail: aibrahim@ismailia.ie-eg.com

NOT since John Anderson published his beautifully illustrated monographic study in 1898 has a major work on Egypt's herpetofauna appeared other than that of Saleh (1997). Since Anderson's time, only a few amphibian and reptile taxa have been added to the Egyptian fauna, and Baha El Din is one of a few contemporary Egyptian herpetologists whose contribution to the herpetofaunal knowledge of the region is widely recognised.

The two-page article in question includes an introduction, results and discussion, acknowledgements, and reference citations. The morphological description of the snake is concise, but fails to address some important characters, such as the shape of the snout and head scales; e.g. rostral, loreal, nasal, frontal, parietal, temporals....etc. Since the author has deposited his single specimen in his private collection, it would also have been helpful to provide a full morphological and morphometric account of the snake, especially when it serves as a new taxon to the country's fauna.

The author did not provide independent verification of the snake's identity. In his similarly short account, Baha El Din (1996) described a specimen of the worm snake, *Ramphotyphlops braminus*, also without

independent substantiation, considering it a new addition not only to the Egyptian but also the North African snake fauna. The omission of this detail does not necessarily mean that the identification is dubious, but it is usual practice for range extensions to be corroborated in this way.

The author fails to mention any Egyptian herpetological reference. He stated that there are 36 species of snakes in Egypt, and although this is correct, he could have cited the most recent book on the amphibian and reptiles of the country as a reference (see Saleh, 1997, p. 36.).

The author speculated that *Coluber algirus* could potentially be confused with *Coluber rogersi* in Marsa Matruh region. Nevertheless, he describes in the same paragraph how the two species differ significantly in terms of colour and pattern. This is a contradiction. Moreover, *C. algirus* does have a black band on the nape, while *C. rogersi* does not. It is not impossible for the informed reader to differentiate between the two species. The author cites Anderson, 1896 when in fact the correct one should be Anderson, 1898. However, neither of these works was listed in the literature citations.

The author states that 'six other snakes belonging to the genus *Coluber* are known from Egypt', yet he unintentionally lists only five. Saleh (1997) cited seven snakes from the genus *Coluber* including *C. elegantissimus*. However, only six species could be considered since he did not refer to a definite locality of the latter snake in Egypt. Again, the author did not mention the Egyptian reference (see Saleh, 1997, pp. 139-146). Despite this paper's inconsistencies, the inclusion of *C. algirus*, based on the information provided and the fairly good monochrome photograph, could still be a valid addition to the herpetofauna of Egypt.

REFERENCES

Anderson, J. (1896). A contribution to the herpetology of Arabia with a preliminary list of the reptiles and batrachians of Egypt. London: R. H. Porter. 122 pp.

Anderson, J. (1898). Zoology of Egypt. Vol. 1. Reptilia and Batrachia. London: Quaritch. 370 pp.

Baha El Din, S. (1996). *Ramphotyphlops braminus* (Daudin, 1803); a new addition to the Egyptian herpetofauna. Casopis Národniho muzea, Rada príodovendá **165**, 1-4. Praha.

Saleh, M. A. (1997). Amphibians and Reptiles of Egypt. Publications of National Biodiversity Unit No. **6**. 234 pp.

ARTICLES

SOME REMARKS ABOUT THE ORIGIN AND HISTORY OF BOJANUS' *ANATOME TESTUDINIS EUROPAEAE*

PIOTR DASZKIEWICZ

Muséum National de l'Histoire Naturelle
Institut d'Ecologie et de Gestion de la Biodiversité
Service du Patrimoine Naturel
57, rue Cuvier 75231, Paris cedex 05, France.
E-mail: piotrdas@mnhn.fr

THE monograph *Anatome Testudinis Europaeae* on the European Pond Tortoise *Emys orbicularis* by Bojanus is undoubtedly one of the more important works of comparative anatomy and herpetology in nineteenth century zoology. The work immediately came to the attention of zoologists. Such scientific journals as the 'Edinburgh Medical and Chirurgical Journal' or the 'Gottingische gelehrte Anzeigen' gave it enthusiastic reviews. After reading it, George Cuvier declared: 'I find it admirable. No animal will now be better known'. Victor Carus (1880) a nineteenth century historian of zoology said: 'The same Bojanus showed his capacity in a small isolated work, and his treatment of questions relative to morphology and embryology was distinguished by a great clarity and confidence of judgement. His anatomy of the European Pond Tortoise is a model of a monograph, such as hitherto there has been none on any animal'. Even today, the work of Bojanus astonishes us by its quality: *'Anatome Testudinis Europaeae*, published in two parts (1819, 1821; reprinted 1902, again in 1970), arguably the best atlas of any submamalian vertebrate ever published (...) . The result was a magnificent atlas whose value continues to endure after more than a century and a half' (Adler,1989). This work is also significant for the history of comparative anatomy. On several occasions, for example, Bojanus notices and describes the homology of the organs. All this notwithstanding, we actually know very little about the origins and circumstances surrounding this work.

The work of Bojanus on the European Pond Tortoise

Why did Bojanus choose the European Pond Tortoise as the subject of his anatomy? Ludwig Heinrich Bojanus (1776-1827), an Alsatian zoologist who worked at Vilna University, published some 70 titles on anatomy and veterinary medicine. Only seven of these dealt with the anatomy of turtles, lizards and snakes. Herpetology was not his principal field of research. Moreover, his contract and function of professor of veterinary medicine at Vilna University rather pointed him towards the study of domestic animals. He was also director of the zoological cabinet, and thus in charge of enlarging its palaeontological and faunistics collections. None of this seemed to direct his interest towards the European Pond Tortoise, however. It seems that Bojanus' interest in the anatomy of the tortoise is in fact related to his ideas about the origin of the cranium. He considered the cranium as the result of the evolution of the vertebra, a point of view that was hotly debated by the German Naturphilosophen. Bojanus was a representative of this nineteenth century school of biology. He also voiced rather special views concerning the osseous fish head, considering the opercular bones as parts of the mandibles, moved and modified. In this he went along with an

assumption formulated previously by Trévirianus and later taken up by Blainville. To establish this conception he continued his research on reptiles and amphibians, authoring a number of highly interesting descriptive documents in the process (Chaine, 1925).

Another reason for his interest in the tortoise may have been the facility it offered to obtain material for dissections. It seems that in the first half of the nineteenth century, the European Pond Tortoise was very frequent in the Vilna area. French naturalist and physician Jean-Emmanuel Gilibert (1741-1814), who spent a fruitful eight years (1775-1783) in Lithuania in the service of the Polish king, wrote that European Pond Tortoises were 'very common in Lithuania'. This opinion, formerly very widespread, is difficult to verify today for lack of sufficient documentation concerning the population of these animals. What is certain however, is that the tortoise was the reptile easiest to obtain in the markets of Vilna and in the surrounding countryside.

We know that in various parts of Europe the tortoise was an 'edible animal'. Contemporary natural science dictionaries described this consumption. The *Nouveau Dictionnaire d'Histoire Naturelle* (1819), for example, stated that 'its flesh is very good to eat; so that in southern Germany enough are captured to be sold in the markets'. Also 'One eats them in the countries to which they are native; but as far as I am able to judge, their flesh is inferior in quality to that of the American tortoises'. 'It appears however, that the flesh of individuals fed for some time on grass and roots is rather good'. (Duméril & Bibron, 1825). 'One feeds it in fish ponds or gardens, with bread, lettuce, vegetables etc.'. J.C. Wulff (Ichtyol. Regni Borussici) knew that *Prussian peasants keep some in the troughs, sometimes for two years to fatten them*' (Cloquet, 1828). We have archaeological evidence showing that the tradition of eating tortoise is very ancient in Europe (Cheylan & Courtin, 1976). Old dictionaries also inform us that: 'one frequently keeps them in the gardens of southern France, because they eat slugs, terrestrial snails, harmful insects and other pests' and 'one always finds live tortoises in several apothecaries in Paris, who import them from the Provence to make a potion considered very useful against chest complaints, and to repair forces exhausted by excess of the pleasures of love'. We do not know if this species was eaten in Lithuania. Old cook books make no mention of it. We know only that in certain areas of Poland the peasants kept these tortoises as charms against misfortune , especially 'to protect milk and cows' (Samek 1992).

It is certain that Bojanus must have often encountered tortoises on his wanderings around Vilna. Most likely he also saw them in the town markets. Perhaps he simply wanted to get better acquainted with a species so common and often used by man? We know that this desire was not rare at the time. Louis Agassiz, for example, wrote to Lucien Bonaparte: 'It is quite astonishing that the greatest confusion reigns in the classification of indigenous European fishes that we see and eat every day (for example the trout) and that they were the last to interest the naturalists'.

The Alsatian Bojanus was a naturalist at home in two cultures, the French and the German. Before coming to Vilna he had absolved a part of his studies in Paris, and he was well acquainted with the works of French naturalists in Poland. It is noteworthy that the work of these naturalists on the tortoise had a certain tradition. For example Jean-Emmanuel Gilibert writes, 'On July 7, 1776, not being able to continue my research on botany, since I was retained in my room by disease, I forced myself, to dissipate the trouble, to dissect some land tortoises that are very common in Lithuania'. He was also the author of *Observation sur les parties génitales des tortues* (Observations on the genitals of tortoises), where the genitals and the mating habits of these reptiles were probably described for the first time. Jean-Etienne Guettard (1715-1786), a naturalist and traveler, spent two years (1760-62) in Poland. The Muséum National d'Histoire naturelle in Paris has several of this scientist's manuscripts, among others the

Mémoire sur les écailles qui couvrent la peau de certains animaux (Report on the scales which cover the skin of certain animals); *Mémoire sur les tortues* (Report on the tortoises); *Mémoire sur les tortues de terre et tortues de mer* (Report on land tortoises and turtles). Doubtless Bojanus knew this work. As for Gilibert, who preceded him at Vilna University, one may even say that Bojanus continued his research program. Both naturalists shared an interest in the tortoise, as well as in the European Bison and certain other animal species.

From the technical point of view, *Anatome Testudinis Europaeae* is a considerable feat. It includes 40 folio plates with 213 drawings depicting the detailed anatomy of the European Pond Turtle, *Emys orbicularis*. Bojanus began working on this atlas soon after his arrival in Vilna and devoted ten years to the project before the first part was published. He used almost all the anatomical techniques that were known at the time, maceration and boiling in various solvents, injection of dyes, colouring with mercury and gelatin. Bojanus' anatomical preparations were preserved for a long time in Darmstadt, where he died, and in Kiev where the libraries of the science collections of Vilna University and of the Imperial Surgical and Medical Academy were transferred after Polish universities and academic institutions were closed in 1841 as a repressive measure. These anatomical preparations were often viewed and favourably remarked upon by nineteenth century zoologists. Bojanus made most of the original drawings, paid himself for the printing, purchased paper of the highest quality to hold the fine lines of the plates. The copper plates were engraved by the famous German illustrator Ferdinand Lehman, who came from Darmstadt to ilna especially to make these engravings. The original edition was limited to only 80 copies and cost 5000 rubles, the equivalent of two years of Bojanus' wages. Thus it comes as no surprise that this splendid work was the cause of serious financial problems for its author. Bojanus was also the author of a work on the anatomy of the ewe (with 600 illustrations), which for economic reasons was never published. Certain specialists claim that its scientific value was comparable only to his anatomy of the tortoise. The manuscript was preserved in Darmstadt for a long time; its present owner is unknown.

Some new data about *Anatome Testudinis Europaeaea*

The correspondence between Georges Cuvier and Ludwig Bojanus: The Muséum National d'Histoire naturelle and the Institut de France preserve the correspondence between Ludwig Bojanus and George Cuvier. Most of these letters, which are new to us, deal with *Anatome Testudinis Europaeae*. In the letter dated 23 December 1821, Bojanus wrote that his first thought had been to dedicate this work to George Cuvier in homage to Cuvier's contributions to natural science, and in particular for his work in the field of comparative anatomy. However, since he found it overly daring to put Cuvier's name on the first page of a work that did not yet enjoy recognition by the scientific world, Bojanus initially decided to ask for Cuvier's permission. The letter also informs us that he had succeeded in completing the work in spite of great difficulties, and had sent two copies of *Anatome* to Paris. The first was intended for Cuvier, and is currently in the Central Library of the Muséum. The second was for the Academy of Sciences. Bojanus insisted that dedicating his work to Cuvier had been problematic for political reasons. He recognised Cuvier's scientific merit, but found it difficult to forget the sufferings he had to endure because of the French. Bojanus fled from the French army twice, once after the occupation of Alsace in 1789, and for the second time in 1812 during the offensive by Napoleon's army. Cuvier, although a man of two cultures - German and French - like Bojanus, became a high-ranking civil servant of the empire, and a close adviser to Napoleon Bonaparte. In his second letter Bojanus expresses joy at the high esteem in which Cuvier holds his work. He stresses the fact that he worked upon it in Vilna, far from the great university centres. Apart from the letters,

the Archives of George Cuvier contain nine pages of drawings and anatomical descriptions made by Ludwig Bojanus. Some of these drawings were published in ISIS (Isis oder Encyclopadische Zeitung vorzüglich für Naturgeschichte, vergleichende Anatomie und Physiologie). Bojanus again took an interest in the anatomy of the tortoise shortly before his death. He wrote and published Uber das Schulterguste der Schildkröte, a work in which he described the bones and muscles of the acromiale part. Bojanus saw it as a complement to *Anatome Testudinis Europaeae*. One hundred and eighty years have passed since the publication of this work. Nobody has published the handwritten work of Bojanus, such as the monograph of the ewe, and for a long time the history of his anatomical preparations was obscure. Finding these documents and preparations, which were the foundation of one of the major works of nineteenth century herpetology, would be an undertaking of considerable interest and merit.

REFERENCES

Adler, K. (1989). Contributions to the History of Herpetology. Cantenburg. 202 pp.

Agassiz to Bonaparte, 6 mars1834 (Mss 2595-1/37, Fonds manuscripts, Bibliothèque Centrale de Muséum National d'Histoire Naturelle, Paris).

Anonym. (1819). Nouveau Dictionnaire d'Histoire Naturelle appliquée aux Arts, à l'Economie rurale et domestique, à la Médecine etc/ T. 34. Deterville (Ed.). Paris.

Bojanus, L. (1819-21). Anatome Testudinis Europaeae. Vilna. 178 pp.

Bojanus L. Mss627/I Bibliothèque Centrale Du Muséum National d'Histoire Naturelle.

Bojanus L. to Georges Cuvier, 19 May 1822. (Mss Fonds Cuvier 244.6 and 94, Bibliothèque de l'Institut de France, Paris). Carus, V. (1880). Histoire de la zoologie depuis l'antiquité jusqu'au XIX siècle. Paris. Ed. J-B Baillière et fils. 623 pp.

Chaine, J . (1925) Histoire de l'anatomie comparative. Bordeaux Ed. E. Daguerre Pp. 461

Cheylan, M Courtin, J. (1976). La consommation de la tortue cistude *Emys orbicularis* (L.) au post-glaciaire dans la grotte de Fontbregoua (Salernes-Var.) Bulletin du Museum d'Histoire naturelle de Marseille **36**, 41-46.

Cloquet, M. H. (1828). In *Dictionnaire des Sciences naturelles*. Levrault, F.G. (Ed.). Paris.

Duméril, C. 1803. Essai sur les moyens de perfectionner et d'étendre l'art de l'anatomiste. Paris. 47 pp.

Duméril, C. & Bibron, G. (1835). *Erpetologie générale ou histoire naturelle complète des reptiles*. Vol 2. Librairie Encyclopedique de Roret (Ed.). Paris. 680 pp.

Fedorowicz Z. (1958). Ludwik Henryk Bojanus. Ossolineum (Ed.). Wroclaw. 42 pp.

Lesson. (1830). In *Dictionnaire classique d'histoire naturelle*. Rey et Gravier (Ed).

Samek A. (1992). Historia naturalna opisujaca zwierzat opisanie. Krakow Ed. KAW. 232 pp.

Zemanek, M. (1991). The European pond tortoise, *Emys orbicularis* (L) - its occurence in Poland and the problems of its protection. Przeglad Zoologiczny **35** (3-4) 1991, 336-347.

NOTES ON THE DIET OF THE MALAYAN KRAIT, *BUNGARUS CANDIDUS* (LINNAEUS, 1758)

ULRICH KUCH

Sektion Herpetologie, Forschungsinstitut und Naturmuseum Senckenberg, Senckenberganlage 25, 60325 Frankfurt am Main, Germany.

ABSTRACT. – The genus *Bungarus* comprises medically important venomous snakes of the Oriental region, which have predominantly nocturnal and snake-eating habits. Faecal samples of two adult specimens of the Malayan Krait (*Bungarus candidus*) from northwestern Java were found to contain hair and incisors of adult, mouse-size rodents. This record is the first to provide evidence that rodents are part of the prey spectrum of wild *B. candidus*. The Malayan Krait is frequently found in rice fields and other agricultural areas, and its potential contribution to the natural control of rodent populations is discussed. In feeding experiments with recently collected Malayan Kraits, synbranchid eels (*Monopterus albus*) were also eaten. Captive *B. candidus* are known to thrive on a diet of small rats and mice.

THE genus *Bungarus* Daudin, 1803 comprises about 13 species of dangerously venomous snakes (Golay, 1985; Golay et al., 1993). Several of these have a wide distribution in south and southeast Asia, and some contribute significantly to the problem of regional snakebite morbidity and mortality (Warrell et al., 1983; Sawai et al., 1984; Hati et al., 1988). *Bungarus* species, generally known as kraits, are terrestrial and largely nocturnal snakes. Numerous observations made on wild and captive specimens of kraits have suggested that these animals prey exclusively on other snakes (see Kuch & Schneyer 1991, 1992, 1993, 1996 for reviews). However, analysis of published prey records and stomach contents reveals that there is a significant proportion of other food in the prey spectrum of the krait species for which data are available (Mao, 1970; Slowinski, 1994; Kuch, 1998). In addition, there are apparent differences between species as to the extent of non-snake prey (Slowinski, 1994). Species differences in the degree to which rodent prey are accepted were also observed in captive specimens of four *Bungarus* species (Kuch & Schneyer, 1996).

The Malayan Krait, *B. candidus* (Linnaeus, 1758), is widely distributed in mainland southeast Asia, peninsular Malaysia, Sumatra, Java, and Bali. It has also been collected in Sulawesi. *Bungarus candidus* is reported to prefer snakes, especially fresh-water snakes, as prey (Van Hoesel, 1959). Lim (cit. *fide* Tweedie, 1983) found skinks of the genus *Mabuya* in the stomachs of two *Bungarus candidus*, and Slowinski (1994a) found three tail fragments of an unidentified skink in a *B. candidus* of 105 cm total length. Schäfer & Grossmann (2000) report on a field observation of an adult *B. candidus* swallowing a caecilian (*Ichthyophis* sp.). The Malayan Krait is said to also feed on 'toads, lizards and small mammals' (De Rooij, 1917), however, this appears not to have been substantiated with data from wild specimens. A photograph showing a *B. candidus* in the process of swallowing a tree snake (*Ahaetulla prasina*) is contained in Van Hoesel (1959), but likely to have been taken in captivity, where the species is known to thrive on a diet of laboratory mice and rats (Kuch & Schneyer, 1991). In this communication I report on the prey items of two wild *B. candidus*, as suggested by undigested prey remains in faecal samples, and on a feeding experiment using potential natural prey and recently-collected Malayan Kraits.

Adult *Bungarus candidus* with head hidden beneath body coils in typical defensive posture. Photograph by Peter Stafford.

Captive adult male *B. candidus* (120 cm total length) feeding. Photograph by author.

MATERIALS AND METHODS

Live adult *B. candidus* were obtained from local snake dealers in West Java province, Indonesia. The snakes had been collected in rice fields, sugar cane plantations, and unspecified habitat in the vicinity of villages. While some snakes appeared to have been captive for a prolonged period as suggested by the relatively high degree of dehydration and malnutrition, others had obviously been collected very recently. All kraits were sexed by probing, marked by ventral scale clipping (following the technique proposed by Brown & Parker [1976]), and housed individually in plastic boxes. The boxes were kept in the shade and subjected to the local climate and daylight cycle of the Depok area, West Java. Initially a 1-2 cm water level was maintained in the boxes to allow for continuous transcutaneous water intake, and to facilitate defecation. After one or two days, newspaper sheets were used as substrate and shelter, and water was provided *ad libitum* in small plastic water containers. Faecal samples were collected and preserved in 70 % ethanol, and examined macroscopically and microscopically.

For feeding experiments, live synbranchid eels (*Monopterus albus*) of 25-40 cm total length and 1.5-2 cm body diameter were obtained from local markets. Water was added to the boxes with the snakes to achieve a 1-2 cm level, and then one *Monopterus* was put into each box in the early afternoon. Observation was continued for two hours, and the boxes were again controlled on the next morning.

RESULTS

On 10 January 1998, two of the apparently recently collected *B. candidus* defecated while partly submerged in the water, and prey remains were found. Both snakes (field numbers UK-B13 and B44) were healthy adult males measuring approximately 110 cm in total length. UK-B13 had a body mass of 525 g. The suspended faeces of both UK-B13 and B44 contained a high amount of dark mammalian hair. Additionally, the sample from UK-B44 contained three only partly digested incisors of a rodent. The overall evidence indicates that the two snakes had recently preyed upon adult rodents of mouse-size. No prey remains were detected in the faecal samples of more than 50 other specimens of *B. candidus* and *B. fasciatus.*

Feeding experiments with *M. albus* (known in Bahasa Indonesia as ikan belut) were carried out on 5 March 1998 (using 17 *B. candidus* of both sexes) and 6/7 March 1998 (using twelve *B. candidus* not before tested). On both dates, many kraits showed a decided interest in these fishes as demonstrated by close inspection and increased tongue-flicking. This was however not

correlated with successful predation or observed predation attempts. On 5 March, two *B. candidus* (one of them UK-B13) swallowed the offered swamp eel within the first two hours of observation (13:00-15:00 hr). On the following morning, four more *B. candidus* were found to have consumed this food. Eleven additional Malayan Kraits had refused to feed on the *Monopterus*. In the morning of 7 March, three *B. candidus* had fed while nine had not. Both the group that had accepted *M. albus* as food and the specimens which refused to feed on the swamp eels comprised kraits of both sexes, with body masses ranging from 200-400 g in the females and 300-550 g in the males. Digestion of the fish was uneventful in seven of the nine Java Kraits, however, two males regurgitated their apparently too large prey on 11 March 1998.

DISCUSSION

Although the hypothesis cannot be refuted in principle that the two kraits which had remains of rodents in their faeces had swallowed other snakes, which in turn had contained rodents, I consider this scenario extremely unlikely. Snakes which contain prey tend to be rarely encountered at least by herpetologists (see Lim, 1956; Mao, 1970), and no reptile scales, teeth, or bones were observed in either faecal sample, whereas the quantity of undigested hair and incisors was high. In addition, any snake capable of swallowing an adult mouse, and with such a prey in the stomach, would very likely be too big and bulky to be swallowed and digested by the two kraits in question. No water or food had been offered to the kraits by the local snake dealers where the animals had been kept in rodent-proof facilities. This excludes the possibility of the prey having been ingested in captivity where, in fact, several specimens of *B. candidus* have been maintained successfully on a diet of live or dead rodents (Kuch & Schneyer, 1991). Food intake in these snakes is frequent and the number of prey ingested high. Digestion is generally complete, i.e., no undigested hair, bones or teeth are found in the faeces. Regular shedding of the skin, increase in total length and body mass, and normal behaviour indicate that rodents of manageable size are an adequate diet for adult *B. candidus*, and that their long-term survival (nine to more than 13 years) on an exclusive rodent diet is possible at least under laboratory conditions. Similar observations have been made in three other *Bungarus* species (Kuch & Schneyer, 1991, 1992, 1993, and unpubl. data).

The observed spontaneous acceptance of synbranchid eels as prey is not surprising as these animals occur in virtually the same habitats frequented by *B. candidus*, and are also nocturnal. Consequently, *B. candidus* is often best known to those who collect *M. albus* at night, and neurotoxic envenomation from snakebite is an occupational hazard for these people. Synbranchid eels are an elongate, heavy-bodied prey type that would seem very suitable for those krait species which inhabit rice fields or live in close proximity of similar water bodies. In Taiwan, *M. albus* was shown to be a major part of the diet of the Many-banded Krait, when swamp eels were found in the stomachs of 14 out of 36 *Bungarus m. multicinctus* which had contained food (Mao, 1970).

The observed large number of Malayan Kraits that refused the swamp eel in the experiment may be explained by two reasons. On the one hand, kraits are highly susceptible to stress due to capture, inadequate housing, transport, and prolonged contact with conspecifics. Recently collected kraits will therefore often refuse to eat for a long time, even if apparently suitable food is offered (Petzold, 1976). On the other hand, kraits which are seriously dehydrated, malnourished and otherwise in poor condition, will also frequently refuse any prey. In the studied series of *B. candidus*, there was a strong tendency of specimens in poor condition not to eat the swamp eel. This had also been observed in a different series of captive Malayan Kraits in which the best nourished and healthiest looking specimens accepted rodent prey spontaneously or after a very short period of time, while malnourished and ill specimens ate only snakes, if at all (unpubl. data).

In Java, *B. candidus* and *B. fasciatus* are known to be able to cope with disturbed habitats like rice fields and other plantations and gardens. However, their actual prey spectrum in these areas, and their possible impact on rodent populations, has not been studied so far. Rats and moles are a major pest in the rice-producing regions of Java. These rodents are believed to cause a 6 % annual waste between rice harvest and consumption (Whitten et al., 1996), and they damage the structure of the rice fields by digging holes in the dams. Directing research to the natural control of rodent populations would therefore appear to be an important means of increasing rice production (Whitten et al., 1996). In this context it would be useful to assess the diversity of snake species in this habitat type, and their relative contribution to rodent control. The present communication demonstrates how little is actually known about the natural history of most Oriental snakes, and that even species with a reputation of being strictly ophiophagous might turn out to play a significant role in the natural control of rodents. Regardless of the limited database, countries such as Thailand have acknowledged the importance of effective rodent control by introducing programmes to educate farmers about the advantages of protecting snakes and other predators (Hodges, 1993). This is unheard of in Indonesia, where farmers are encouraged to pay for rodenticides which they can ill afford and which are at best only partially effective (Hodges, 1993).

ACKNOWLEDGEMENTS

I am grateful to Frank Bambang Yuwono for providing working facilities and invaluable logistical support, and to Pak Pendi for technical assistance. I thank Stefanie Hornig, Heinz Kuch, and Ursula Kuch for help with logistics, and Richard Hodges, S. Juliani, and Joe Slowinski for reviewing the manuscript. Gerhard Storch kindly contributed a mammalogist's opinion on the samples. The author's research on *Bungarus* was funded in part by grants from the Hermann Willkomm-Stiftung and the Studienstiftung des deutschen Volkes.

REFERENCES

Brown, W.S. & Parker, W.S. (1976). A ventral scale clipping system for permanently marking snakes (Reptilia, Serpentes). *J. Herpetol.*, **10**, 247-249.

De Rooij, N. (1917). The Reptiles of the Indo-Australian Archipelago. II. Ophidia. Leiden: E. J. Brill, 334 pp.

Golay, P. (1985). *Checklist and Keys to the Terrestrial Proteroglyphs of the World.* Elapsoidea, Geneva. 91 pp.

Golay, P., Smith, H.M. Broadley, D.G., Dixon, J.R., McCarthy, C., Rage, J.-C., Schaetti, B. & Toriba, M. (1993). *Endoglyphs and Other Major Venomous Snakes of the World. A Checklist*. Geneva: Azemiops Herpetological Data Center. 478 pp.

Hati, A.K., Saha, S.G., Banerjee, D., Banerjee, S. & Panda, D. (1988). Clinical features of poisoning by Common Kraits and treatment with polyvalent antivenin. *The Snake*, **20**, 140-143.

Hodges, R. (1993). Snakes of Java with special reference to East Java province. *Brit. Herpetol. Soc. Bull.*, **43**, 15-32.

Kuch, U. (1998). *Bungarus multicinctus* (Many-banded Krait). Diet. Herpetol. Rev., **29**(3), 169.

Kuch, U. & Schneyer, W. (1991). Experiences with the captive husbandry of four species of diet-specialized elapid snakes of the genus *Bungarus* Daudin, 1803. Part I. *Bungarus candidus* Linnaeus, 1758. *Sauria (E)*, **1**(2), 7-14.

Kuch, U. & Schneyer, W. (1992). Experiences with the captive husbandry of four species of diet-specialized elapid snakes of the genus *Bungarus* Daudin, 1803. Part II. *Bungarus multicinctus* Blyth, 1861. *Sauria (E)*, **1**(3), 25-32.

Kuch, U. & Schneyer, W. (1993). Erfahrungen mit der Terrarienhaltung von vier Arten nahrungsspezialisierter Giftnattern der Gattung *Bungarus* Daudin, 1803. Teil III. *Bungarus fasciatus* (Schneider, 1801). *Sauria*, **15**(1), 27-37.

Kuch, U. & Schneyer, W. (1996). Erfahrungen mit der Terrarienhaltung von vier Arten nahrungsspezialisierter Giftnattern der Gattung *Bungarus* Daudin, 1803. Teil IV. *Bungarus flaviceps* Reinhardt, 1843. *Sauria*, **18**(2), 3-16.

Lim, B.L. (1956). The natural food of some Malayan snakes. *Malayan* Nat. J., **10**, 139 - 144.

Mao, C.-Y. (1970). Food of the common venomous snakes of Taiwan. *Herpetologica*, **26**(1), 45-48.

Petzold, H.-G. (1976). Bemerkungen zur Fütterungstechnik bei nahrungsspezialisierten Giftnattern und einige Angaben zur Haltungsdauer von Elapiden im Tierpark Berlin. *Zool. Garten (N.F.)*, **46** (1/2), 9-23.

Sawai, Y., Toriba, M., Itokawa, H., de Silva, A., Perera, G.L.S. & Kottegoda, M.B. (1984). Study on deaths due to snakebite in Anuradhapura district, Sri Lanka. *The Snake*, **16**, 7-15.

Grossmann, W. & Schäfer, C. (2000). Eine Blindwühle der Gattung *Ichthyophis* Fitzinger, 1826 als Beute des Malayen-Kraits *Bungarus candidus* (Linnaeus, 1758). *Sauria*, **22**(2), 45-46.

Slowinski, J.B. (1994). The diet of kraits (Elapidae: *Bungarus*). *Herpetol. Rev.*, **25**(2), 51-53.

Tweedie, M.W.F. (1983). The Snakes of Malaya. Singapore: Singapore Natl. Printers. 167 pp.

Van Hoesel, J.K.P. (1959). Ophidia Javanica. Mus. Zool. Bogoriense, Pertjetakan Archip., Bogor, 188 pp.

Warrell, D.A., Looareesuwan, S., White, N.J., Theakston, R.D.G., Warrell, M.J., Kosakarn, W. & Reid, H.A. (1983). Severe neurotoxic envenoming by the Malayan krait *Bungarus candidus* (Linnaeus): response to antivenom and anticholinesterase. *Brit. Med. J.*, **286**, 678-680.

Whitten, T., Soeriaatmadja, R.E., Afiff, S.A. (1996). The Ecology of Java and Bali. Singapore: Periplus. 969 pp.

MAN EATING BY ESTUARINE CROCODILES: THE RAMREE ISLAND MASSACRE REVISITED

STEVEN G. PLATT[1], WIN KO KO, KALYAR, MYO MYO[2], LAY LAY KHAING[3], and THOMAS R. RAINWATER[4]

[1]*Wildlife Conservation Society, P. O. Box 9345, Siem Reap, Cambodia.*
[2]*Wildlife Conservation Society, Bldg. C-1, Aye Yeik Mon 1st Street, Yadanamon Housing Ave., Hlaing Township, Yangon, Myanmar.*
[3]*Shwe Settaw Wildlife Sanctuary, Nature and Wildlife Conservation Division, Ministry of Forestry, Myanmar.*
[4]*The Institute of Environmental and Human Health, Texas Tech University, Box 41163, Lubbock, TX 79409-1163, USA* [author for correspondence].

MAN eating has been reported among most of the larger crocodilians, but only the Estuarine Crocodile (*Crocodylus porosus*) and Nile Crocodile (*Crocodylus niloticus*) regularly prey on humans (Pooley et al., 1989). The most notorious man eating incident occurred in Burma (Myanmar) during World War II when almost 1000 Japanese soldiers were allegedly killed by Estuarine Crocodiles in a single night (Guggisberg, 1972; Pooley et al., 1989). Man eating by *C. porosus* is well documented (Loveridge, 1944; Neill, 1971; Guggisberg, 1972; Daniel & Hussain, 1973; Allen, 1974; Heatwole, 1975; Webb et al., 1978; Kar & Bustard, 1983; Edwards, 1989; Pooley et al., 1989; Webb & Manolis, 1989), but the human mortality resulting from this attack is unprecedented, and a critical re-examination of the incident is therefore warranted.

The crocodile attack is said to have occurred on Ramree Island, a large (ca. 80 km x 30 km) coastal island in western Myanmar (Figure 1), separated from the mainland by a network of estuarine rivers and extensive mangrove swamps (Figure 2). A combined British and Indian force invaded the island as part of an offensive to recapture Rangoon (Yangon) from the Japanese. Securing the airfields at Kyaukphyu was considered essential to the campaign, and an Allied amphibious assault force landed at the northern tip of Ramree Island on 21 January 1945. The Japanese garrison defending the island numbered approximately 1000 men. Allied forces rapidly captured Kyaukphyu, and then attacked southward toward Ramree Town. Their position now untenable, the defenders retreated into the extensive mangrove swamps on the eastern side of the island, planning to withdraw to the mainland and rejoin the main Japanese force (Figure 2). However, a Royal Navy flotilla quickly blocked their escape, trapping the Japanese in the swamp (Owen, 1946; Slim, 1956; Slim, 1961; Wright, 1962; Allen, 1984; Hickey, 1998).

It was in this swamp that the Japanese soldiers were supposedly massacred by repeated crocodile attacks. The original account of the incident is provided by Bruce Wright (1962), a Canadian biologist serving with the British forces, who stated:

'That night [19 February 1945] was the most horrible that any member of the M.L. [Marine Launch] crews ever experienced. The scattered rifle shots in the pitch black swamp punctured by the screams of wounded men crushed in the jaws of huge reptiles, and the blurred worrying sound of spinning crocodiles made a cacophony of hell that has rarely been duplicated on earth. At dawn the vultures arrived to clean up what the crocodiles had left. Of about one thousand Japanese soldiers that entered the swamps of Ramree, only about twenty were found alive'.

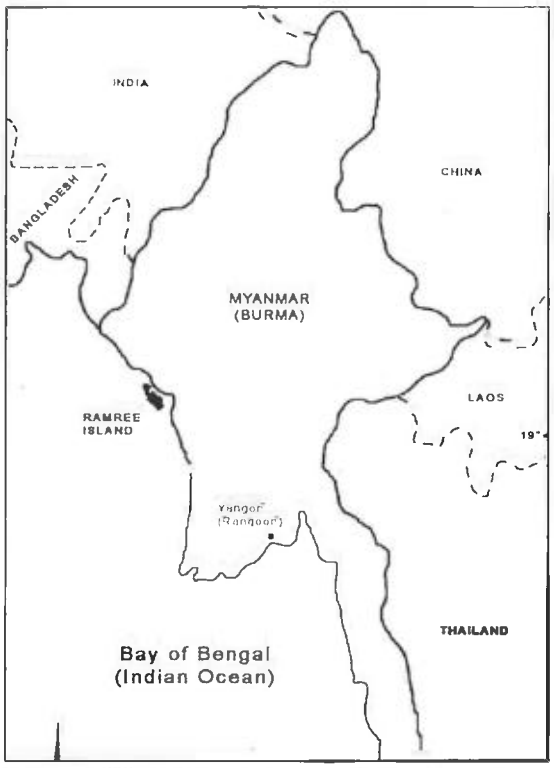


Figure 1. Map of Burma (Myanmar) showing position of Ramree Island relative to the mainland.

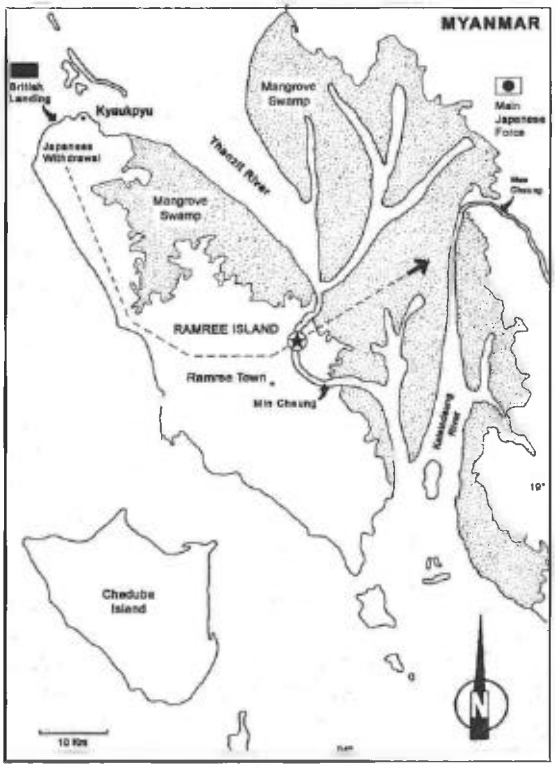


Figure 2. Map of Ramree Island showing major geographic features, Allied and Japanese troop dispositions, military movements, and site of crocodile attack (denoted by star).

Guggisberg (1972) considered this the 'biggest man-eating orgy any crocodilians have ever been offered', and embellished the account by stating that while 'some Japanese were certainly killed by gunfire, [and] others drowned, the *majority* seem to have been eaten by crocodiles' [italics added]. This incident has been uncritically accepted by later authors and recounted in a number of popular and semi-technical publications (Guggisberg, 1972; Capstick, 1977; Capstick, 1981; Campbell & Winterbotham, 1985; Pooley et al., 1989). Only Campbell & Winterbotham (1985) have expressed skepticism concerning the scale of the massacre. However, the events surrounding this incident fail to withstand critical analysis.

First, it is important to note that contrary to the statements of some authors (Guggisberg, 1972; Campbell & Winterbotham, 1985; Pooley et al., 1989), Bruce Wright was apparently not present on Ramree Island at the time of the massacre, instead being assigned to the Allied crossing of the Ayeyarwady River near Pagan (Wright, 1962). Furthermore, Wright never stated that he actually witnessed the massacre, and unlike the other chapters of his book, the Ramree Island account is written in the third, rather than first person. Although Wright fails to identify a source for his Ramree Island chapter, the story was most likely related to him by friends among the Marine Launch crews. Nor does Wright attribute the majority of Japanese casualties to crocodile predation; this contention appears to have originated with Guggisberg (1972). Wright merely states that only 20 of the original 1000 defenders survived the battle. Prior to describing

the crocodile attacks, he discusses the emaciated condition of the Japanese roops, their reluctance to surrender, and the intense Allied bombardment, implying crocodiles were just one of many hazards faced by the retreating Japanese.

Additionally, there is little evidence in military accounts of the campaign to suggest that a large-scale massacre of Japanese troops by crocodiles actually occurred. Most campaign histories contain no reference to the alleged massacre (Romanus & Sunderland, 1956; Moser, 1978; Allen, 1984). Others are ambiguous or suggest that only a limited number of soldiers were taken by crocodiles. In his memoirs, Lieutenant General William Slim (1956), commander of the Allied forces in Burma, stated the retreating Japanese 'fell victim to naval patrols - and the sharks - as they attempted to reach the mainland'. However, these events are not mentioned in a later, abridged edition of his memoirs (Slim, 1961). According to Hickey (1998), the Japanese 'were forced into one corner of the island where, amongst crocodile-infested swamps, most of them died from drowning, disease or starvation. Only 20 ever surrendered'. The only account suggesting crocodiles were responsible for at least some Japanese casualties is provided by Owen (1946) who noted that 'prey to flies, mosquitoes, scorpions, and most horrible, the crocodiles, and without food or water, the Japanese died in the hundreds. Many were drowned or else crocodiles got them. No more than 20 ever surrendered'.

Most convincingly, during a recent visit to Ramree Island (Platt, 2000), we interviewed a number of older residents who cast additional doubt on the magnitude of the alleged massacre. These individuals ranged from 67 to 86 years old, and all lived on Ramree Island during World War II. Several had billeted Japanese soldiers in their homes, and most were conscripted as porters by the Japanese Army. These individuals all related a similar version of events. The Japanese force retreated into the mangrove swamp and rapidly exhausted their food and water rations. Fresh water was unavailable and the soldiers were forced to drink brackish water resulting in severe dehydration. Dysentery and other diseases were rampant among the Japanese, and many succumbed to these privations. The only crocodile-related deaths occurred when 10 to 15 soldiers were killed attempting to ford Min Chaung, a tidal creek near Ramree Town (Figure 2). Our informants unanimously discounted any suggestion that large numbers of Japanese fell prey to crocodiles. Moreover, an informant in Kyaukphyu who conducts regular tours for visiting Japanese veterans stated his clients often recount their wartime experiences, but have never mentioned crocodile attacks.

In summary, there is no evidence that a large-scale massacre of Japanese soldiers by Estuarine Crocodiles occurred on Ramree Island during World War II. That nearly 1000 Japanese died is well documented and undisputed; however there is little need to invoke crocodile predation to explain the demise of the Japanese force. Nor is it surprising that only 20 Japanese emerged from the swamp to surrender, for these soldiers were imbued with the Samurai Code of Bushido; death in battle or even suicide was preferable to the dishonour of surrender (Bergerud, 1996). Indeed, the bag of 20 prisoners from an initial force of 1000 is noteworthy, for Japanese typically surrendered at a ratio of only 1 per 120 dead (Chang, 1997; in contrast Allied soldiers surrendered at the rate of 1 per 3 dead). The question is whether the Japanese fell victim to crocodile attack or succumbed to a variety of other causes. In this the historical documentation and our interview data are emphatic; nearly 1000 Japanese soldiers died from combat, disease, starvation, and even shark attack, but only a small fraction of this total fell victim to crocodiles. Crocodiles alone certainly did not decimate the Japanese force.

ACKNOWLEDGEMENTS

Fieldwork in Myanmar was funded by the Walt Disney Company Foundation. The Department of Forestry is thanked for granting permission to

conduct research in Rakhine State. Expedition logistics were arranged by U Saw Tun Khaing and U Thanh Myint (WCS Myanmar Program). Critical references were supplied by librarians at Texas Tech University and Wildlife Conservation Society. Support for TRR was provided by Mark and Monique Howells and the Lamanai Field Research Center, Indian Church, Belize. Finally, we are most indebted to the many people on Ramree Island who welcomed us into their homes and related their wartime experiences.

REFERENCES

Allen, G.R. (1974). The marine crocodile, Crocodylus porosus, from Ponape, eastern Caroline Islands, with notes on food habits of crocodiles from the Palau Archipelago. *Copeia* **1974**, 553.

Allen, L. (1984). *Burma: The longest war, 1941-45*. New York: St. Martin Press.

Bergerud, E. (1996). *Touched by fire: The land war in the South Pacific*. New York: Penguin Books.

Campbell, G.R. & Winterbotham A.L. (1985). Jaws too!: *The natural history of crocodilians with emphasis on Sanibel Island's alligators*. Fort Meyers, Florida: Sutherland Publishers.

Capstick, P.H. (1977). *Death in the long grass*. New York: St. Martins Press.

Capstick, P.H. (1981). *Maneaters*. Los Angeles: Peterson Publishing Company.

Chang, I. (1997). *The rape of Nanking*. New York: Basic Books.

Daniel, J.C. & Hussain, S.A. (1973). The record (?) salt water crocodile (*Crocodylus porosus* Schneider). *Journal Bombay Natural History Society* **71**, 309-312.

Edwards, H. (1989). *Crocodile attack*. New York: Harper and Row.

Guggisberg, C.A.W.(1972). Crocodiles: *Their natural history, folklore and conservation*. Harrisburg: Stackpole Books.

Heatwole, H. (1975). Biogeography of reptiles on some of the islands and cays of eastern Papua-New Guinea. *Atoll Research Bulletin* **180**, 1-32.

Hickey, M. (1998). *The unforgettable army: Slim's XIV army in Burma*. Staplehurst: Spellmount Publishing.

Kar, S. K. & Bustard, H. R. (1983). Saltwater crocodile attacks on man. *Biological Conservation* **25**, 377-382.

Loveridge, A. (1944). Capt. P. J. Darlington attacked by a crocodile in New Britain. *Copeia* **1944**, 204-206.

Moser, D. (1978). *China-Burma-India*. Alexandria, Virginia: Time-Life Books.

Neill, W. T. (1971). T*he last of the ruling reptiles*. New York: Columbia University Press.

Owen, F. (1946). *The campaign in Burma*. London: Whitefrairs Press Ltd.

Platt, S.G. (2000). *An expedition into central Rakhine State, Myanmar*. Report to Wildlife Conservation Society, New York (Archived in Campbell Museum, Clemson University, Clemson, South Carolina).

Pooley, A.C., Hines, T. & Shield, J. (1989). Attacks on humans. In *Crocodiles and alligators*, pp. 172-187. Ross, C.A. (Ed.). New York: Facts on File.

Romanus, C.F. & Sunderland, R. (1956). *United States Army in World War II: China-Burma-India Theater: Stilwell's command problems*. Washington, D.C.: Office of Military History, Department of the Army.

Slim, W. (1956). *Defeat into victory: Battling Japan in Burma and India, 1942-1945*. New York: Cooper Square Press.

Slim, W. (1961). *Defeat into victory: Battling Japan in Burma and India, 1942-1945*. New York: David McKay Company.

Webb, G.J.W. & Manolis, S.C. (1989). *Crocodiles of Australia*. Frenchs Forest, New South Wales: Reed Books Pty., Ltd.

Webb, G.J.W., Yerbury, M. & Onions, V. (1978). A record of a *Crocodylus porosus* (Reptilia, Crocodylidae) attack. *Journal of Herpetology* **12**, 267-268.

Wright, B. (1962). *Wildlife sketches, near and far*. Fredericton, New Brunswick: Brunswick Press.

A SURVEY OF THE CULTURAL ATTITUDES OF PEOPLE TOWARDS REPTILES IN THE NIGER DELTA, NIGERIA: IMPLICATIONS FOR CONSERVATION

GODFREY C. AKANI[1] AND LUCA LUISELLI[2]

[1]*Department of Biological Sciences, Rivers State University of Science and Technology, P.M.B. 5080, Port Harcourt, Rivers State, Nigeria. E-mail: g.c.akani@us2.net*
[2]*Instituto di Studi Ambientali 'Demetra' and F.I.Z.V., via Olona 7, I-00198 Roma, Italia; and Museo Civico di Storia Naturale, piazza Aristide Frezza 6, I-00030 Capranica Prenestina, Roma, Italia. E-mails: lucamlu@tin.it; lucalui@iol.it* [author for correspondence]

ABSTRACT. – Interviews with people from different villages and different ethnic groups of Niger Delta (southern Nigeria, West Africa) were conducted to survey the cultural attitudes of local populations towards reptiles, with a conservation perspective. This is of importance in as much as environmentalists working in sub-Saharan Africa need to be aware of the cultural attitudes of people for planning reliable animal conservation strategies. We conclude that there is some basis for developing reliable conservation plans for reptiles in this area by means of systems of protected areas connecting sites where traditional beliefs may effectively protect certain species. Moreover, there is some basis also for undertaking sustainable farming of crocodiles, monitor lizards, and pythons. Currently, the reptilian species that seem to be most in danger in the Delta are *Crocodylus cataphractus* (critically endangered), *Crocodylus niloticus* (endangered), *Osteolaemus tetraspis*, *Kinixys* spp., and *Python sebae* (all vulnerable).

THE political aspects of conservation are complicated and a matter of concern in many sub-Saharan countries. In these countries, the need for organising and developing effective conservation strategies for critically threatened faunas must be considered in the context of improving the quality of life for rapidly growing human populations in poor and fragile environments (e.g. see Blake & Loveridge, 1975; IUCN, 1980; Eltringham, 1984, 1994). Moreover, the environmentalists may also need to struggle with deteriorating infrastructure, political chaos, the corruption of the political institutions, and ethnic instability. These factors have produced terrible famine and massacres in some countries, with dramatic effects on the local wildlife conservation (e.g. the case of Rwanda and the conservation of Mountain Gorillas *Gorilla gorilla beringei*, cf. Cooper & Cooper, 1996; Delvingt, 1996). Thus, it is not surprising that it has proven difficult to achieve ongoing and effective conservation programs in some areas of sub-Saharan Africa (Eltringham, 1984).

Because of the negative interaction of the above-mentioned factors, conservationists must adopt a wide variety of conservation strategies, and it is important that they know the cultural traditions of the local communities inhabiting the regions being considered for conservation programs (Politano, 1997). For example, in addition to standard ecological and biodiversity surveys, the conservationists working in sub-Saharan countries should be aware of the local 'cultural' protection that some species may enjoy from animistic taboos and religious beliefs (Eltringham, 1984; Politano, 1997; Oduro, 1999), and they should know the main economic use that local people make of the target species proposed for conservation.

Since 1996 we have been working on long-term ecological studies of reptiles in southern

Nigeria (e.g. see Luiselli et al., 1998, 1999a, 2000a, 2001; Luiselli & Angelici, 2000). In this paper, we investigated the reptiles that are conserved or protected for cultural reasons and compared them with the species that are subjected to human persecution (including killing for profit - harvest, exploitation - and killing from fear - opportunistic killing; see below for further specifications).

STUDY AREA

The present study was conducted in several localities of the Niger Delta, southern Nigeria. Localities from five major ecological zones, lowland forest, flood forest, mangrove forest, eastern flank, and barrier islands, were surveyed. The ecological characteristics of each of these zones are described by Powell (1993, 1994, 1996). All the localities were included in Delta, Bayelsa, and Rivers States, all in Niger Delta basin.

MATERIALS AND METHODS

We conducted field surveys to obtain information on human attitudes to reptiles all over the Niger Delta region (south eastern Nigeria) between 1996 and 2000 at 38 villages representing all of the principal ethnic groups (see table 1 for a complete list of all the surveyed localities). At each village, a standardised questionnaire was distributed. Information sources used were: (1) hunters, (2) farmers, (3) chiefs of villages that provided information on the traditional beliefs, and (4) bush-meat dealers. At each station 10 to 20 adults belonging to the above-mentioned categories were interviewed individually, and questioned about their attitudes and perceptions to the herpetofauna. Every effort was made to avoid the proportion of interviews being heavily biased towards one particular category of interviewees. Nevertheless, there was a strongly biased gender in our interviewee sample (men more than women), as women were normally reticent to answer. Since there were in some cases minor differences in the responses of the four groups, we tried to ensure 'balanced reporting' from the different areas, and considered information to be an accurate reflection of attitudes if there was consensus among at least 70% of the interviewees. Remains of animals traded in bush-meat markets, juju markets, and shrines, were also observed. Information was also collected concerning the various uses of reptile body parts by the local population.

RESULTS AND DISCUSSION

A list of the attitudes of people towards reptiles locality -by- locality is presented in Table 1.

As a general trend, it is clear that snakes (except pythons) are opportunistically killed everywhere as they are believed to be venomous. Indeed, several lethal species are found in the area (i.e. *Bitis gabonica, B. nasicornis, Naja nigricollis, N. melanoleuca, Dendroaspis jamesoni, Pseudohaje goldii*, etc., cf Luiselli et al., 1998), and some of them (especially *N. nigricollis* and *D. jamesoni*) are also found in suburbia (Luiselli & Angelici, 2000; Luiselli et al., 2000a), and thus could represent potential threats to humans. In fact, unpublished research by the writers indicate that most of the cases of venomous snake bite in rural areas of Niger Delta are caused by *N. nigricollis*.

Local people recognise both *Python regius* and *P. sebae*; their attitude toward both species is identical. In Delta State there is more persecution of pythons (they are actively hunted for leather and food), whereas in Rivers and Bayelsa States there is more veneration, especially in sites with Calabari people. People of this ethnic group often believe that pythons are gods, and that pythons may offer protection against enemies to the people.

The three species of crocodiles (*Crocodylus cataphractus, C. niloticus, Osteolaemus tetraspis*) are subjected to strong hunting pressure for meat and leather in all the three States (Rivers, Delta, and Bayelsa). But, in a few sites of the Rivers State (see Table 1), they are subjected to veneration as totem animals.

Clearly, the hunting pressure to which they are currently subjected should be carefully monitored, as one species (*Osteolaemus tetraspis*) is still abundant but locally declining (Luiselli et al., 1999b), whereas the two larger species (*Crocodylus cataphractus, C. niloticus*) are extremely rare and endangered (Luiselli et al., 2000b). The Niger Delta people take large numbers of *Osteolaemus tetraspis*, despite the fact that it is reported to have a low quality leather (Ross, 1997). This is probably due to the decline of the other two species, which could no longer sustain the local market request of leather.

Tortoises (*Kinixys homeana, K. erosa, K. belliana nogueyi*) are also harvested in almost every locality investigated. They are considered a food delicacy by most people, their shell is used as a musical instrument, and as juveniles they are also kept as pets. In some localities they are used also for traditional medicine. In Bayelsa and Rivers States, however, these tortoises are locally venerated, especially in villages of Ijaw people. These localities where tortoises are 'traditionally' protected offer opportunities for the development of proper conservation programmes for these species, and to create sanctuary areas for them.

Freshwater turtles (genera *Pelusios, Pelomedusa, Trionyx*) are hunted everywhere, because they are consumed as food, and they are also used to prepare musical instruments, and for traditional medicine. Another problem for these species is that not only are they threatened by hunting, but also by progressive habitat destruction (i.e. 'reclamation' of swampy lands, etc.).

Nile Monitors (*Varanus niloticus ornatus*) are strongly hunted in several villages, but traditionally protected in several others (Table 1). Veneration of this species is especially concentrated in Delta State and Rivers State localities, whereas they are persecuted nearly everywhere in Bayelsa State. Persecution is due to the fact that Nile Monitors are considered a desirable food. Their skin is also of value, and together with crocodiles, these lizards tend to be the reptiles most often offered for sale as stuffed souvenirs in the tourist shops of Port Harcourt city. Almost everywhere they are called 'iguanas' in pidgin English. In the case of the Nile monitor, there is a potential basis for a conservation programme based on cultural beliefs. It may be possible to link all the villages where Nile Monitors are venerated and form an institutional 'varanus-oriented' mosaic of legally protected forest reserves.

Rainbow Lizards (*Agama agama*) are neither venerated nor persecuted in any of the investigated localities, and, perhaps also for that reason, they are the most abundant reptiles of the area, especially around human settlements (Akani et al., 1999).

Wall geckos (*Hemidactylus* spp.) are opportunistically killed in some localities of the Rivers State (Table 1), but are in general venerated almost everywhere. Intentional persecution is limited by the fact that some people think they are venomous. Veneration seems to be related to the soft nature of their skin and the delicate movements that they exhibit. Geckos are sometimes believed to be a symbol of peace, or a sign of abundant children to be born.

Skinks (genera *Mabuya, Mochlus, Panaspis*) are generally persecuted (opportunistically killed) because most people think that they are 'a kind of small snake with a venomous bite'.

Chameleons are so scarce in the area that they are probably neither venerated nor persecuted. In some cases they are used for traditional medicine, or even kept as pets. In most cases the people we interviewed were not able even to recognise a chameleon, possibly because of its rarity.

Data on the attitude towards reptiles of local people in relation to the ecological zone where their own villages are situated is also presented in Table 1. Generalizations are difficult in this respect, given the migratory trends of large groups of people in this part of Nigeria (normally in the direction of larger urban centres where the conditions of life are much better). However, in general terms it seems that people inhabiting areas with mangroves (and people of riverine villages as well) are more likely to venerate the reptiles, possibly because they rely on fish and

Locality	Local Govt.	State	Ecol. Zone	Sn P	Sn V	Py P	Py V	Cr P	Cr V	NM P	N M V	W G P	W G V	S K P	S K V	Ch P	Ch V	To P	To V	Tu P	Tu V
Ughelli	Isoko North	Delta	FF	X		X		X			X		X	X				X		X	
Patani	Patani	Delta	FF	X			X		X		X		X	X				X		X	
Oleh	Isoko South	Delta	FF	X		X		X			X		X	X				X		X	
Okuovu	Sapele	Delta	FF	X		X		X		X			X	X				X		X	
Nembe	Nelga	Bayelsa	MGF	X			X	X		X			X	X				X		X	
Okpo-Ama	Brass	Bayelsa	MGF	X			X	X		X			X		X			X		X	
dagbabiri	Sagbama	Bayelsa	MGF	X			X			X			X		X			X		X	
Emwari	S. Ijaw	Bayelsa	MGF	X			X	X			X		X	X				X		X	
Otuoke	Ogbia	Bayelsa	FF	X			X	X					X	X				X	X	X	
Angalabiri	Sagbama	Bayelsa	FF	X			X			X		X		X				X		X	
Otukpoti	Ogbia	Bayelsa	FF	X			X	X					X	X				X		X	
Sangana	Brass	Bayelsa	BI	X			X	X					X	X				X		X	
Odioma	Brass	Bayelsa	BI	X			X	X					X	X				X		X	
Toru-Ebeni	Mein /Oakiri	Bayelsa	FF	X			X			X			X	X				X	X	X	
Ekpetiama	Yenagoa	Bayelsa	FF	X			X			X			X	X						X	
Erema	Onelga	Rivers	LFF	X			X	X					X					X		X	
Ubarama	Ahoada-W	Rivers	LFF	X			X			X			X	X				X		X	
Omokwa	Abua /Odual	Rivers	EF	X		X		X					X	X		X		X		X	
Egbema	Onelga	Rivers	LLF	X				X					X	X				X		X	
Elele	Kelga	Rivers	LLF	X				X					X	X				X		X	
Ndele	Emolga	Rivers	LLF	X				X					X	X				X		X	
Abonnema	Akulga	Rivers	MGF	X			X	X					X	X				X		X	
Soku	Akulga	Rivers	MGF	X			X	X					X	X				X		X	
Ido	Asalga	Rivers	MGF	X			X	X						X				X		X	
Buguma	Asalga	Rivers	MGF	X			X	X						X				X		X	
Abalama	Asalga	Rivers	MGF	X			X	X					X	X				X		X	
Ke	Degema	Rivers	MGF	X			X		X				X	X				X		X	
Kula	Degema	Rivers	MGF	X			X		X				X	X				X	X	X	
Banana	Degema	Rivers	MGF	X		X		X					X					X		X	
Bonny	Bonny	Rivers	BI	X		X			X		X	X	X					X		X	
Opobo	Opobo /Nkoro	Rivers	BI	X		X					X	X	X							X	
Bodo	Gokana	Rivers	LLF	X		X			X	X	X							X	X	X	X
Yeghe	Gokana	Rivers	LLF	X		X	X	X			X	X						X		X	
Zor-Sogho	Khana	Rivers	LLF	X		X			X		X	X	X							X	
Kebara Kira	Tai	Rivers	LLF	X			X	X	X		X	X	X					X		X	
Okrika	Walga	Rivers	LLF	X			X	X		X	X	X	X					X		X	
Bolo	Ogu Bolo	River	MGF	X			X	X		X	X	X	X					X		X	
Ozuoba	Obalga	Rivers	LLF	X			X	X	X			X	X					X			
PERCENT				**100**	**0**	**26**	**71**	**68**	**24**	**29**	**29**	**32**	**89**	**66**	**10**	**3**	**0**	**89**	**13**	**95**	**2**

shrimps in their diet. The same is not true in the forests, where hunters kill everything they can catch to eat. This pattern does not seem to be linked to differences in religion among sites. Indeed the greater majority of people in southern Nigeria are Christian (about 70%), with nearly 20% being Muslim and 10% animistic, without evident differences among tribes inhabiting the different ecological zones of Niger Delta.

It is difficult (and certainly premature at the present stage of our knowledge) to give a full report on the differences between ethnic groups in terms of attitude towards reptiles. This difficulty depends on the fact that in the actual social standing of Nigeria, most villages are no longer 'mono-ethnic', but rather a mosaic of people of different ethnic background. And, it is worth mentioning that in Nigeria there are hundreds of ethnic groups, with diverging traditions and languages, and with English or, more frequently, pidgin English as *lingua franca*. Thus it was possible to find clear-cut differences only among ethnic groups, but rather than villages.

In conclusion, we believe that veneration of reptiles is locally still quite high in the Niger Delta area, and that good habitat management in hand with an understanding of local traditional beliefs could help considerably in improving the conservation potential for reptile species in the area. Particular attention should be paid to generating proper conservation plans, based also on a careful knowledge of local beliefs, for the endangered species of the genus *Crocodylus*, *Osteolaemus, Kinixys*, and *Python*. In particular, we suggest creating 'mosaics' of protected areas formed by interconnecting patches of forest, e.g. along the rivers Orashi, Sambreiro, and Nun, where there is still considerable veneration for reptiles and relatively intact forest as well. It is clear, however, that the creation of such protected areas for these species cannot be realised without a feasibility project involving the various communities owning the study sites. It is likely that the economic and social conditions of Nigeria (now improving due to the new democratic government headed by President O. Obasanjo, after several years of military dictatorship) would permit also the establishment of farms for sustainable use of crocodiles, pythons, and monitor lizards. These farms, which have been shown to benefit both people and conservation in several tropical countries (e.g. see Ross, 1997), seem essential in a social environment of the kind found in southern Nigeria, where the human population density is one of the highest of the continent, and anthropic pressure on natural resources continues to be enormous. Moreover, to our knowledge, no farms for these large reptiles presently exist in southern Nigeria, which presumably means that the hundreds of specimens harvested for meat and skin are all removed from the wild. Currently, the species that seem to be most in danger in the Delta are *C. cataphractus* (critically endangered), *C. niloticus* (endangered), *O. tetraspis*, *Kinixys* spp., and *Python sebae* (all vulnerable).

ACKNOWLEDGEMENTS

We thank E.N.I.-Agip Environmental Department, Aquater S.p.A., Snamprogetti S.p.A., T.S.K.J. Nigeria Ltd., Ecosystem s.r.l., Demetra s.r.l., F.I.Z.V., and Chelonian Research Foundation (Linnaeus Fund), for having financially supported parts of our long-term research in Nigeria. Dr. Massimo Capula, Dr. Dario Capizzi, Dr. Francesco M. Angelici, and

Table 1. Raw data on persecution (P) and veneration (V) of reptiles in the Niger Delta States of Nigeria. For more details on the type of persecution or veneration, see text. Ecological zones: LLF = lowland forest; MGF = mangroves; FF = flood forest; EF = eastern flank; BI = barrier islands. Reptile groups: Sn = Snakes; Py = Pythons; Cr = Crocodiles; NM = Nile Monitor; WG = Wall geckos; SK = Skinks; Ch = Chameleons; To = Tortoises; Tu = Turtles. Note that in some cases a given type of animal is either venerated or persecuted at a single locality on the basis of the ethnic group of the interviewees. Blank spaces in both 'P' and 'V' columns at a single locality indicate that no specific attitude toward the given reptile type emerged from our interviews.

Dr. Zena Tooze critically commented on previous drafts of this manuscript, and gave important data input. Several colleagues helped us in the field, and Zena Tooze is especially thanked for her logistical help over part of the present research project. Dr. Rob Stuebing and Dr. Daryl R. Karns considerably improved an earlier version of this paper.

REFERENCES

Akani, G.C., Luiselli, L., Angelici, F.M. & Politano, E. (1998). Bushmen and herpetofauna: notes on the Amphibians and Reptiles traded in bush-meat markets of local people in the Niger Delta (Port Harcourt, Rivers State, Nigeria). *Anthropozoologica* **27**, 21-26.

Akani, G.C., Luiselli, L. & Politano, E. (1999). Ecological and conservation considerations on the reptile fauna of the eastern Niger Delta (Nigeria). *Herpetozoa* **11**, 141-153.

Blake, D.K. & Loveridge, J.P. (1975). The role of commercial crocodile farming in crocodile conservation. *Biological Conservation* **8**, 261-272.

Cooper, J. & Cooper, M. (1996). Mountain gorillas - a 1995 update. *African Primates* **2**, 30-31.

Delvingt, W. (1996). L'intervention de l'union européenne dans le Parc National des Virunga. *African Primates* **2**, 28-30.

Eltringham, S.K. (1984). Wildlife resources and economic development. Chichester: John Wiley & Sons.

Eltringham, S.K. (1994). Can wildlife pay its way? *Oryx* **28**, 163-168.

IUCN (1980). *The World Conservation Strategy*. Gland, IUCN.

Luiselli, L., Akani, G.C. & Capizzi, D. (1998). Food resource partitioning of a community of snakes in a swamp rainforest of south-eastern Nigeria. *Journal of Zoology, London* **246**, 125-133.

Luiselli, L., Akani, G.C. & Capizzi, D. (1999a). Is there any interspecific competition between dwarf crocodiles (*Osteolaemus tetraspis*) and Nile monitors (*Varanus niloticus ornatus*) in the swamps of central Africa? A study from south-eastern Nigeria. *Journal of Zoology, London* **247**, 127-131.

Luiselli, L: & Angelici, F.M. (2000). Ecological relationships in two Afrotropical cobra species (*Naja melanoleuca* and *Naja nigricollis*). *Canadian Journal of Zoology* **78**, 191-198.

Luiselli, L., Angelici, F.M. & Akani, G.C. (2000a). Large elapids and arboreality: the ecology of Jameson's green mamba (*Dendroaspis jamesoni*) in an Afrotropical forested region. *Contributions to Zoology* **69**, 147-155.

Luiselli, L., Angelici, F.M. & Akani, G.C. (2001). Food habits of *Python sebae* in suburban and natural habitats. *African Journal of Ecology* **39**, 116-118.

Luiselli, L., Politano, E. & Akani, G.C. (1999b). Crocodile status and distribution in South Eastern Nigeria: *Osteolaemus tetraspis*. *Crocodile Specialist Group Newsletter* **18** (3), 5-7.

Luiselli, L., Politano, E. & Akani, G.C. (2000b). Crocodile distribution in S.E. Nigeria, Part II. *Crocodile Specialist Group Newsletter* **19** (1), 4-6.

Oduro, W. (1999). Ghana - Attack a threat to crocodile conservation. *Crocodile Specialist Group Newsletter* **18** (2), 3-4.

Politano, E., ed. (1997). A study of the fauna (Amphibia, Reptilia, Aves, Mammalia) of the Niger Delta of Nigeria and evaluation of the impacts caused by the working of two natural gas tracing pipelines. Bari, Ecosystem Press. 174 pp.

Powell, C.B. (1993). Sites and Species of Conservation Interest in the Central Axis of the Niger Delta. Abuja, Natural Resources Conservation Council.

Powell, C.B. (1994). Wildlife Species Known / Suspected in the Upper Orashi Forest Reserve. Yenagoa, RISOPALM Project.

Powell, C.B. (1996). Wildlife Study I. Port Harcourt, Shell Petroleum Developmental Company.

Ross, J.P. (1997). *Crocodiles: Status Survey and Conservation Action Plan*. Oxford: IUCN (Information Press).

TRANSLOCATION OF SMALL NUMBERS OF CRESTED NEWTS (*TRITURUS CRISTATUS*) TO A RELATIVELY LARGE SITE

A. S. COOKE

13 Biggin Lane, Ramsey, Cambridgeshire PE26 1NB, UK.

ABSTRACT. – In 1985, 38 Crested Newts (*Triturus cristatus*) were moved from a doomed site in Kent to ponds at Worlick Farm in Cambridgeshire. The translocation was monitored by means of night counting. Difficulties in monitoring small translocations are discussed, as are precautions needed concerning night counting. After six years, the translocation appeared to have failed, and it was only after at least eight years that increasing counts became evident and eventually demonstrated the establishment of a colony. In any such exercise, monitoring should be of sufficient duration to enable success or failure to be confirmed.

IN this country there have been many examples of translocations of Crested Newts (*Triturus cristatus*) over the last three decades. Oldham et al. (1991) reviewed 86 translocations that occurred between 1970 and 1990, and decided there was no conclusive evidence of success. Problems identified included inadequate monitoring, releases to sites with resident unmarked newts, failure for predictable reasons and a preponderance of garden ponds as receptors. Oldham & Humphries (2000) updated this review and concluded that 37% of an overall total of 178 translocations were successful when judged by the 'minimal criterion' of the presence of at least one adult newt in the year following release. Even the most large-scale and detailed published accounts have, however, involved monitoring for only a few years (eg Horton & Branscombe, 1994; Langton et al., 1994; Oldham & Humphries, 2000). To be confident of distinguishing between success and failure in the longer term, monitoring for ten years or more may be needed (Dodd & Seigel, 1991; Cooke, 1997). This paper reports the translocation of a small number of newts to a relatively large site with monitoring over a 14 year period.

SITE AND NEWTS

The receptor site consists of six large ponds set in about 5ha of woodland, scrub and rank grassland on the edge of the Fens at Worlick Farm in Cambridgeshire (grid reference TL 315865). The ponds are shown as site 1 on the map, and are numbered in this paper as 1/1-1/6. Total area of the six ponds is about 0.25ha with 0.5km of edge. Centuries ago, the ponds were used to rear fish for the table by the monks of Ramsey Abbey. The ponds now constitute an Historic Monument, a fact which has safeguarded them from any threat of being turned into arable farmland. The site is more or less surrounded by arable land although a house and farm buildings are within 200m. The site has no public access, being about 1.5km down a farm track from the nearest road (see Map).

No other ponds are shown closer than 1km on the 1:25000 Pathfinder map. With little recent history of livestock farming, the Fens have a low density of ponds. An old field pond (site 2 on the Map) incorporated into a farmhouse garden is 1km away in a straight line across the fields or 1.3km via the farm track. A single night visit, made in 1990, revealed one Crested Newt in this pond. Additionally there is a farm reservoir (site 3) about 1km away, which is used for fishing and has a large population of Common Toads (*Bufo bufo*).

In June 1983, I visited the site to advise the landowner on how it might be improved for

One of the ponds at the release site at Worlick Farm in 1985, just after translocation. Photograph by author.

wildlife generally. One specific suggestion was that the site could be suitable as a receptor site for Crested Newts. Clearance within the six ponds of dumped rubbish and silt, and clearance of scrub and rank vegetation, mainly from around the southern edges of the ponds, was undertaken by October 1984. Fish were believed to be absent.

The donor site was at Swanscombe in Kent. In 1985, a chalk pit was being infilled and the Crested Newt population, which bred in pools on the floor of the pit, was rescued and moved elsewhere. Thirty-eight adult Crested Newts were available for translocation to the ponds at Worlick Farm under licence from the Nature Conservancy Council. Although both sites are in eastern England, movement over such a distance (>100km) is unlikely to be permitted now. The newts were released into two of the Worlick Farm ponds on 16 June 1985.

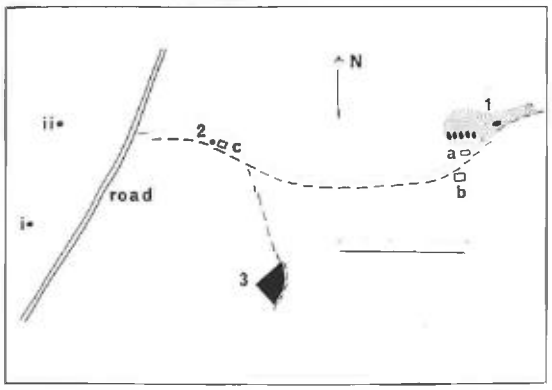
MONITORING

Night counting was the technique selected to detect newts and to monitor change (as used by Cooke, 1995 and 1997). It was decided to undertake single counts each year at peak season as routine, but not preclude additional counts as necessary. Statistical analysis would be used to test whether numbers counted increased over time. At the outset, duration of monitoring was not fixed, the aim being to continue until it was clear that the translocation had succeeded or failed. Netting the ponds for larvae and searching on land for subadults were considered impractical, but any incidental observations of egg laying or subadults in the breeding season would help to confirm success. Residents of the nearby house reported the presence of Smooth Newts (*Triturus vulgaris*) prior to the translocation of Crested Newts, and both species were monitored.

It was appreciated that conditions of the ponds and their surrounds might influence monitoring results. Accordingly, notes were kept of pond size and depth as these might affect numbers of newts present, together with quantitative or descriptive information on variables that might affect the proportion of newts recorded (extent of pond edge surveyed (largely governed by accessibility), water turbidity, and whether copious plant growth might hide many newts).

RESULTS

Results for the two newt species are depicted in Figs 1 and 2. Counts were undertaken between 12 April and 20 May each year. Only one count was performed each year except for 1989 when a second was done because the first had failed to detect any newts; the mean count for Smooth Newts in 1989 is shown in Fig. 2. Illness prevented night counting from being undertaken in 1999, so the monitoring was drawn to a close. Eventually, Crested Newts were recorded in all six ponds, but out of a total of 101 sightings, 65% were in pond number 1/6 (Fig. 1). Egg laying was noted in 1986, 1987 and 1994, with subadults in 1992 and 1995.



A sketch map of Worlick Farm showing the features discussed in the paper. The translocation in 1985 was to the east of the road (B 1096) in site 1; ponds 1/1-1/6 are indicated by solid shading and the terrestrial habitat by stippling. The nearest water bodies to site 1 are an old field pond (2) and a reservoir (3). The main farm tracks are shown as broken lines, and buildings are a house (a), farm barns (b) and a farmhouse (c). Reference is made in the Discussion to two other ponds (i and ii) to the west of the road. The scale bar is 500m with sub-divisions at 100m. The whole area shown is <10m above sea level.

No newts were seen on the pre-translocation count in April 1985; while this was consistent with an absence of Crested Newts, the count also failed to detect any Smooth Newts which were known to be present. During the period 1986-1998, counts of Crested Newts increased significantly over time (Spearman rank correlation coefficient $r_s = 0.810$, $P<0.01$). There was no such increase for Smooth Newts, neither were fluctuations in their counts related statistically (by a rank correlation test) to those of Crested Newts.

Counts for both species were low or zero during 1989 to 1991, raising the possibility that pond conditions may have been at least partially responsible. This region suffered prolonged drought from early 1990 to mid 1992 (Cooke, 1995); by May 1991 one of the ponds had little water and by the following April three ponds were dry, but the two best ponds continued to hold water. Extent of pond edge surveyed tended to decrease as the cleared banks scrubbed over. Thus dividing input into convenient periods of 3-4 years reveals that mean coverage was not especially low during 1989-1991 (58% edge surveyed 1986-1988, 48% in 1989-1991, 44% in 1992-1994 and 34% in 1995-1998). The number of turbid ponds recorded each year was slightly higher 1989-1991 (mean numbers were 2.0, 2.5, 1.7 and 1.8 respectively for the same time periods as above). In 1989 all ponds had unusually thick growth of water plants; and in 1990 the two ponds (numbers 1/2 and 1/6) that had all the Crested Newt sightings up till then again had dense gowth.

The dissimilar patterns of counts for the two species between 1992 and 1998 suggested that pond conditions may not have been of over-riding importance latterly (if they had been, then both species should have shown similar trends). Crested Newt counts increased despite access to pond edges being more difficult (see above), and with up to three ponds desiccating in 1997 and 1998.

DISCUSSION

Night counting revealed small numbers of Crested Newts during the three years following translocation; counts of 2-3 newts were equivalent to 5-8% of the newts introduced to the site. At Shillow Hill, 5km to the south west of Worlick Farm, mean night count was 6% of the estimated total (Cooke, 1985). So, assuming the newts seen in the Worlick ponds were introduced animals and many still survived, a few sightings might have been expected in the year(s) following translocation. This does, however, raise a general problem over the translocation of small numbers of newts in that it may not be possible to detect their presence after release, especially with a single count per year. Fortunately, clearance work at this site made monitoring fairly easy immediately following translocation, otherwise it might have been necessary to undertake several night visits. A related issue is that as the original newts die or perhaps emigrate, fewer may be seen at night.

No Crested Newts were recorded from 1989 to 1991 despite night counts being duplicated in

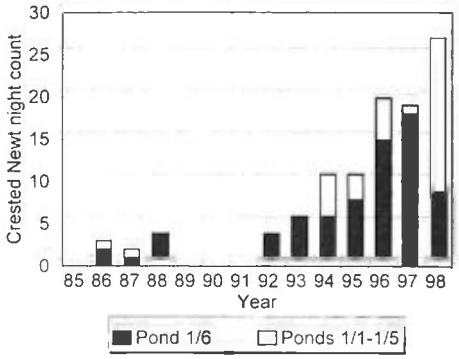


Fig. 1. Night counts of Crested Newts in ponds 1/1-1/5 (unshaded) and pond 1/6 (shaded).

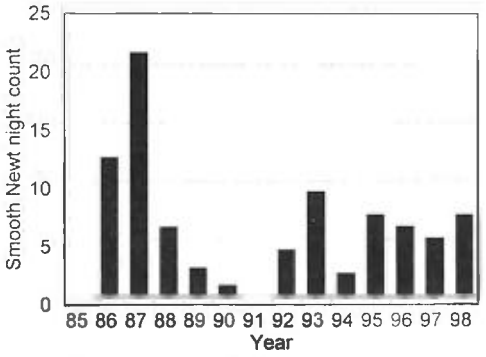


Fig. 2. Night counts of Smooth Newts in ponds 1/1-1/6.

1989. Excessive growth of water plants in 1989 and 1990 will have hindered counting, as may slightly higher levels of turbidity 1989-1991. Several ponds desiccated in the drought of 1991-1992; little water in the spring may mean fewer newts returning to breed (Cooke, 1995). Nevertheless, pond conditions during 1989-1991 alone are unlikely to explain the total absence of sightings of Crested Newts, and the conclusion must be that numbers were unusually low at this time. As the newts were all adults when translocated in 1985, they will then have been at least two years of age (Beebee & Griffiths, 2000); so by 1991, minimum possible age would have been eight years, which is the average life span (Beebee & Griffiths, 2000). It seems that few survived till 1991, and there were few of their progeny either. When 5-6000 adult Common Toads were translocated to a new site, high mortality and/or emigration occurred in the first year (Cooke & Oldham, 1995).

After 1991, it might have been reasonable to terminate monitoring because the exercise appeared to have failed. By that time, however, this site had been incorporated in a local monitoring programme involving several sites (Cooke, 1994); so, rather fortuitously, night visits continued. Subsequent monitoring saw the night count rise steadily to 1998, by when it was an order of magnitude higher than the counts immediately after translocation. Occasional records of egg laying and subadults helped to confirm breeding. However, before concluding that the translocation was a success, other explanations for the monitoring results need to be considered.

It is possible that small numbers of Crested Newts occurred at the site before translocation, but none was seen at night in 1985 and the residents of the nearby house had seen none during the early 1980s. Also such a scenario does not explain failure to see any during 1988-1991 nor the rise recorded thereafter.

Another potential explanation is that Crested Newts colonised naturally during the observation period. The nearest site is 1km away, but only a single newt was recorded there in 1990. Also another release of Crested Newts was made in 1991 to a pond about 2km to the west (site i on the Map); although this introduction was successful (and will be reported separately), newts had failed to colonise a further pond (site ii) only 400m along a hedge-line by 1998. In a study of farm ponds in Bedfordshire, Northamptonshire and Buckinghamshire, Baker & Halliday (1999) found that Crested Newts failed to colonise new ponds 400m or more away from existing populations. It seems, therefore, that natural colonisation can be discounted at Worlick Farm.

It is conceivable that someone else introduced newts, resulting in the increase seen in the 1990s.

However, this site is almost as remote as is possible in lowland England. Contact was maintained with the landowner, residents, farm-workers, gamekeeper and scientists researching other aspects of the site without learning of any such activity. In the extremely unlikely event of a second introduction by persons unknown, then this would still be an example of a successful release.

One is left with the reasonable conclusion that, despite slow colonisation initially, the translocation of Crested Newts in 1985 eventually resulted in a self-sustaining colony, without having any detrimental effect on the Smooth Newts already there. Numbers of Crested Newts counted at night were still increasing when monitoring had to be stopped in 1998, and it is likely that adults in the population considerably outnumbered those released at the site 13 years before.

ACKNOWLEDGEMENTS

Considerable support and encouragement has been received from Lord de Ramsey, his staff and the local residents. I am also grateful to Tim Sparks for statistical advice and to Rob Oldham for commenting on a draft of the manuscript.

REFERENCES

Baker, J.M.R. & Halliday, T.R. (1999). Amphibian colonization of new ponds in an agricultural landscape. *Herpetol. J.* **9**, 55-63.

Beebee, T. & Griffiths, R. (2000). *Amphibians and reptiles*. London: Harper Collins.

Cooke, A.S. (1985). The warty newt (*Triturus cristatus*) at Shillow Hill: numbers and density. *Huntingdon Fauna Flora Soc. Rep.* **37**, 22-25.

Cooke, A.S. (1994). Fluctuations in night counts of crested newts at eight breeding sites in Huntingdonshire 1986-1993. In *Conservation and management of great crested newts*, pp. 68-70. Gent, A. & Bray, R. (Eds). English Nature.

Cooke, A.S. (1995). A comparison of survey methods for crested newts (*Triturus cristatus*) and night counts at a secure site, 1983-1993. *Herpetol. J.* **5**, 221-228.

Cooke, A.S. (1997). Monitoring a breeding population of crested newts (*Triturus cristatus*) in a housing development. *Herpetol. J.* **7**, 37-41.

Cooke, A.S. & Oldham, R.S. (1995). Establishment of populations of the common frog, *Rana temporaria*, and common toad, *Bufo bufo*, in a newly created reserve following translocation. *Herpetol. J.* **5**, 173-180.

Dodd, C.K. & Seigel, R.A. (1991). Relocation, repatriation and translocation of amphibians and reptiles: are they conservation strategies that work? *Herpetologica* **47**, 336-350.

Horton, P.J. & Branscombe, J. (1994). Case study: Lomax Brow: great crested newt project. In *Conservation and management of great crested newts*, pp.104-110. Gent, A. & Bray, R. (Eds.). English Nature.

Langton, T.E.S., Beckett, C.L., Morgan, K. & Dryden, R.C. (1994). Translocation of a crested newt *Triturus cristatus* population from a site in Crewe, Cheshire, to a nearby receptor site. In *Conservation and management of great crested newts*, pp. 92-103. Gent, A. & Bray, R. (Eds.). English Nature.

Oldham, R.S. & Humphries, R.N. (2000). Evaluating the success of great crested newt (*Triturus cristatus*) translocation. *Herpetol. J.* **10**, 183-190.

Oldham, R.S., Musson, S. & Humphries, R.N. (1991). Translocation of crested newt populations in the U.K. *Herpetofauna News* **2**(5), 3-5.

NATURAL HISTORY NOTES

Natural History Notes features shorter-style articles documenting original observations made of amphibians and reptiles mostly in the field. Articles should be concise and may consist of as little as two or three paragraphs, although ideally will be between 500 and 700 words. Preferred contributions should represent an observation made of a free-living animal with little human intrusion, and describe a specific aspect of natural history. Information based on a captive observation should be declared as such in the text and the precise geographical origin of the specimen stated. With few exceptions, an individual 'Note' should concern only one species, and authors are requested to choose a keyword or short phrase which best describes the nature of their observation (e.g., Diet, Reproduction). The use of photographs is encouraged, but should replace words rather than embellish them. Contributions are accepted on the premise that they represent a previously unreported observation, and may be edited prior to acceptance. Standard format for this section is as follows:

SCIENTIFIC NAME (Common Name; the abbreviation NCN should be used where none is recognised): KEYWORD. TEXT; this should include date, time and locality (with full map co-ordinates if possible), precise details on the nature of the observation with some discussion of its significance, and references to pertinent literature. If the information relates to a preserved specimen, its catalogue number and place of deposition should also be given. REFERENCES. Then leave a line space and close with 'Submitted by:' (give name and address in full).

***NATRIX NATRIX* (Grass Snake): UNSEASONAL ACTIVITY.** On 20 January 2001 I found a recently-killed female Grass Snake on the B-road between Farringdon and West Worldham, north Hampshire, UK, grid ref. SU 727364. At 12:45 h the carcass was largely flattened but a couple of sections were relatively undamaged and soft, despite a severe overnight frost that had left the ground in the area bone hard. This suggests that it had been killed that morning. I can offer no convincing explanation as to how this reptile had come to be there, but the adjacent field had been ploughed that morning. Prior to this it had been left fallow with the previous year's stubble etc. intact, but appeared unpromising ground in which to hibernate. It was, however, bathed in sunlight, unlike the fields on the other side of the road, which were still frosted. Indeed the whole district had been gripped by icy conditions for nearly a fortnight. I had last seen a Grass Snake active on 26 October 2000, near Reading in Berkshire, which as in itself a very late date, and Spring encounters are rarely made before April.

Submitted by: JONTY DENTON, 2 Sandown Close, Alton, Hampshire GU34 2TG, UK.

***LACERTA MONTICOLA* (Iberian Rock Lizard): CANNIBALISM.** Cannibalism or intraspecific predation is a widespread interaction among reptiles that refers to killing and ingestion of individuals of the same species at any stage of their life cycles (Polis, 1981). A particular case of cannibalism is infanticide, in which predated individuals are neonates or juveniles (see e.g. Jenssen et al., 1989). This practice occurs in Squamata, where it has been recorded in several families including Lacertidae. Within this family, cannibalistic behaviour has been cited in *Acanthodactylus erythrurus* (Busack & Jaksic, 1982), *Gallotia galloti* (Barbadillo et al., 1999), *Lacerta bilineata* (Salvador, 1998), *L. agilis* (Salvador, 1998), *L. lepida* (Busack & Visnaw, 1989; Galán & Fernández Arias, 1993), *L. dugesii* (Sadek, 1981), *Podarcis atrata* (Castilla & Van Damme, 1996), *P. lilfordi* (Salvador, 1986), *P. muralis* (Salvador, 1998) and *Psammodromus algirus* (Mellado, 1980). The present note describes the first records of cannibalism (infanticide) in *Lacerta monticola*. Our observation was recorded on September 8 near Laguna de los Pájaros, a 4866 m² pond located at 2180 m of altitude at the Peñalara Natural Park

(Madrid, Spain) (UTM 30T-VL 202239). The surroundings of the pond hold a relatively high density of *L. monticola*. We observed at least 3 adult and 7 subadult specimens at 14:30 h in a small accumulation of rocks (less than 2 m^2 in extension). The lizards were active, laying flattened against the substrate in characteristic thermoregulation behaviour (Martín & Salvador, 1993). Subsequently, an adult male was observed capturing a juvenile, which had lost its tail previous to the attack. After a short struggle, the prey escaped, but a few moments later it was captured again and ingested in less than two minutes. Several minutes later, another adult specimen, slightly smaller than the first one was observed capturing another juvenile which had its tail intact. In this case, I could not observe if the prey was finally consumed because the adult specimen noticed my presence and ran out of sight under the rocks still holding its prey.

Generally, intraspecific predation is associated with opportunistic, euryphagous species that prey upon a wide range of prey taxa depending on their disponibility (Polis & Myers, 1985), as it may be the case for the populations of *L. monticola* at Sierra del Guadarrama (Salvador, 1998). High altitude populations of *L. monticola* are characterised by a relatively large clutch size, ranging from 3 to 9 eggs per clutch (average = 5.4) (Barbadillo, 1985), and by having a short hatching period, resulting in high densities of juveniles. The probability of intraspecific encounters among differently sized individuals is increased when high densities of newborn specimens coexist with large adults. The two instances of cannibalism were recorded in less than ten minutes, which suggests a high frequency of these interactions, higher than generally assumed. In this context, cannibalism should be interpreted as a by-product of normal feeding activities (Polis & Myers, 1985). Alternatively, differential predation on juveniles (infanticide) may not only represent an immediate energetic benefit for the cannibalistic individual, but may also be associated with density-dependent regulation at the population level (Polis, 1981). In short term, when a severe decline in resources is predictable, predation pressure on juveniles would reduce competition for limited resources and increment per capita food intake for cannibalistic individuals. Males of *L. monticola* have different foraging microhabitats than females and subadults (Pérez-Mellado, 1982), but some degree of trophic niche overlap is likely to occur among juveniles and adults of *L. monticola* because adult specimens, although consuming larger prey than juveniles, do not exclude small prey items from their diets (Pérez-Mellado et al., 1991).

Adult specimen of *Lacerta monticola* preying upon (above) and consuming (below) a conspecific juvenile. Peñalara Natural Park (Madrid, Spain). Photographs by author.

Regulation by cannibalism may also act in the long-term. Infanticide, besides eliminating future competitors, would also eliminate individuals with less a priori possibilities of winter survival, keeping the population size always below the carrying capacity of the environment (Polis, 1981). Besides, cannibalistic individuals would be

better prepared to survive the wintering period. Bauwens (1981) found no significant differences in survival to the wintering period between sex and age classes in *Lacerta vivipara*, although juveniles survived less well than adults, especially those suffering from tail loss. Differential cannibalism on juveniles suffering from tail loss could be thus interpreted as a homeostatic mechanism at the population level. However, data at hand are too scarce to test the existence of such selective predation and support this interpretation of cannibalism in lizards.

ACKNOWLEDGEMENTS

I thank people working at the Peñalara Natural Park for working facilities. This work is funded by a CAM-CSIC-MNCN predoctoral fellowship at the project PB-97-1231.

REFERENCES

Barbadillo, L. J. (1985). Nuevos datos sobre la reproducción de *Lacerta monticola* (Lacertidae, Reptilia) en España Central. *Doñana, Acta Vertebrata* **12**(2), 189-196.

Barbadillo, L. J., Lacomba, I., Pérez-Mellado, V., Sancho, V. & López-Jurado, L. F. (1999). *Anfibios y Reptiles de la Península Ibérica, Baleares y Canarias*. Barcelona: Geoplaneta.

Bauwens, D. (1981). Survivorship during hibernation in the European common lizard, *Lacerta vivipara*. *Copeia* **4**, 741-744.

Busack, S. D. & Jaksic, F. M. (1982). Autoecological observations of *Acanthodactylus erythrurus* (Sauria: Lacertidae) in southern Spain. *Amphibia-Reptilia* **3** (2-3), 237-255.

Busack, S. D. & Visnaw, J. A. (1989). Observations on the natural history of *Lacerta lepida* in Cádiz province, Spain. *Amphibia-Reptilia* **10**, 201-213.

Castilla, A. M. & Van Damme, R. (1996). Cannibalistic propensities in the lizard *Podarcis hispanica atrata*. *Copeia* **4**, 991-994.

Galán, P. & Fernández Arias, G. (1993). *Anfibios e réptiles de Galicia*. Vigo: Xerais.

Jenssen, T. A., Marcellini, D. L., Buhlmann, K.A. & Goforth, P. H. (1989). Differential infanticide by adult curly-tailed lizards, *Leiocephalus schreibersi*. *Animal behaviour* **38**, 054-1061.

Martín, J. & Salvador, A. (1993). Thermoregulatory behaviour of rock lizards in response to tail loss. *Behaviour* **124**(1/2), 123-136.

Mellado, J. (1980). Utilización del espacio en una comunidad de lacértidos del matorral mediterráneo en la Reserva Biológica de Doñana. *Doñana, Acta Vertebrata* **7** (1), 41-59.

Pérez-Mellado, V. (1982). Datos sobre *Lacerta monticola* Boulenger 1905 (Sauria, Reptilia) del Sistema Central. *Doñana, Acta Vertebrata* **9**, 107-130.

Pérez-Mellado, V., Bauwens, D., Gil, M., Guerrero, F., Lizana, M., & Ciudad, M. J. (1991). Diet composition and prey selection in the lizard *Lacerta monticola*. *Canadian Journal of Zoology* **69**(7), 1728-1735.

Polis, G. A. (1981). The evolution and dynamics of intraspecific predation. *Annual Review of Ecology and Systematics* **12**, 225-251.

Polis, G. A. & Myers, C. A. (1985). A survey of intraspecific predation among reptiles and amphibians. *Journal of Herpetology* **19**(1), 99-107.

Sadek, R. A. (1981). The diet of the Madeiran lizard *Lacerta dugesii*. *Zoological Journal of the Linnean Society* **73**(4), 315-341.

Salvador, A. (1986). *Podarcis lilfordi* (Günther, 1874). Balearen-Eidechse. En: *Handbuch der Reptilien und Amphibien Europas*. Band 2/II: Echsen (Sauria) III (Lacertidae III: *Podarcis*), pp. 83-110. Böhme, W. (Ed.). Wiesbaden: Aula-Verlag

Salvador, A. (1998) (Coord.). *Fauna Ibérica*. Vol 10. (Reptiles). Ramos, M. A. et al. (Eds.). Madrid: Museo Nacional de Ciencias Naturales, CSIC.

Submitted by: IÑIGO MARTINEZ-SOLANO, Museo Nacional de Ciencias Naturales, C.S.I.C., José Gutiérrez Abascal, 2 28006 Madrid, Spain. *E-mail: mcnim548@mncn.csic.es*

BRITISH HERPETOLOGICAL SOCIETY COUNCIL 2000/2001

Society address: c/o Zoological Society of London, Regent's Park, London NW1 4RY
Website: http://www.thebhs.org

President:	Dr. H. Robert Bustard	Airlie Brae, Alyth, Perthshire PH11 8AX. Tel: 01828 632501
Chairman:	Vacant	
Treasurer:	Mrs. P. Pomfret	15 Esk Way, Bletchley, Milton Keynes, MK3 7PW Tel: 01908 370112
Secretary:	Mrs. M. Green	28 Dollis Hill Lane, London, NW2 6JE. Tel: 020 8452 9578
The Herpetological Journal **Receiving Editor:**	Dr. C. Cummins	Institute of Terrestrial Ecology, Monks Wood, Abbots Ripton, Huntingdon, PE17 2LS. Tel: 01487 773381
Managing Editor:	Dr. R. Griffiths	Durrell Institute of Conservation & Ecology, University of Kent, Canterbury CT2 7PD. Tel: 01227 764000
The Herpetological Bulletin **Editor:**	Mr. P. Stafford	Dept. of Botany, The Natural History Museum, Cromwell Road, London SW7 5BD. Tel: 020 7942 5092
The Natterjack **Editor:**	Mr. D. Latham	2 Stratford Grove, Heaton, Newcastle NE6 5AT *E-mail: dorian-latham@yahoo.com*
Events Officer:	Mr. B. Pomfret	15 Esk Way, Bletchley, Milton Keynes MK3 7PW. Tel: 01908 370112
Education Officer:	Vacant	
Librarian:	Mr. D. Bird	Jacaranda Cottage, New Buildings, Spetisbury, Blandford Forum, Dorset DT11 9EE Tel: 01202 686712 (work), 01258 857869 (home)
Development Officer:	Mr. J. Wilkinson	Dept. of Biology, Open University, Walton Hall, Milton Keynes MK7 6AA. Tel: 01908 652274
Trade Officer	Mr. P. Curry	106 Cranley Gardens, Muswell Hill, London N10 3AH.
Land Fund (co-opted)	Mr. B. Banks	14 Wilderness Gardens, Northam, E. Sussex.
Captive Breeding Committee Chairman:	Dr. S. Townson	103 Chancellors Road, Stevenage Old Town, Herts SG1 4TZ Tel: 01438 219522. *E-mail: simon.townson@ntlworld.com*
Conservation Committee Chairman:	Mr. D. Bird	See Librarian above
Education Committee Chairman:	Mr. D. Freeman	272 Whaddon Way, Bletchley, Milton Keynes, MK3 7TP.
Research Committee Chairman:	Dr. C. Cummins	See Journal Editor above
North-West England Group Representative:	Mr. R. Parkinson	317 Ormskirk Road, Upholland, Skelmersdale, Lancs. Tel: 01695 558177
Scottish Group Representative:	Mr. A. Martin	The Stables, Wood of Arbeadie, Banchory, Aberdeenshire AB31 4EP

Ordinary Members

Mr. M. Hollowell	46 Orson Leys, Hillside, Rugby, CV22 5RF. Tel: 01788 522320	(2nd year)
Mr. L. Gillett	1 Fleets Lane, Tyler Hill, Canterbury, Kent CT2 9LY Tel: 01227 471913	(1st year)
Prof. R. Oldham	Old Rectory, Coleorton, Leics. Tel: 01530 412967	(3rd year)

Observer Status

Dr. C.J. McCarthy,
Tetrapods and Fish Division,
Department of Zoology,
The Natural History Museum,
Cromwell Road, London SW7 5BD

Herpetological Conservation Trust,
c/o Jonathan Webster,
655a Christchurch Road,
Boscombe,
Bournemouth, Dorset BH1 4A

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).

Honorary Life Members (maximum 10)

Mrs. M. Green (1960), Prof. J.L. Cloudsley-Thompson (1983), Prof. R. Conant (1983), Dr. D.G. Broadley (1983), Prof. H. Saint Girons (1984), Mrs. E. Haslewood (1990), Dr. H. Fox (1992), Dr. T.J.C. Beebee (1995).

THE HERPETOLOGICAL BULLETIN

Number 75, Spring 2001

BRITISH HERPETOLOGICAL SOCIETY

- Registered Charity No. 205666 -