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THE HERPETOLOGICAL BULLETIN

The Herpetological Bulletin is produced quarterly and publishes, in English, a range of articles concerned with herpetology. These include society news, full-length papers, new methodologies, natural history notes, book reviews, letters from readers 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).

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Front Cover: Common grass snake (*Natrix natrix*) sighted by a local fisherman in Derbyshire. Photograph taken by Tracy Farrer. See articles on pages 16 and 28.

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The development and activities of the British Chelonia Group (BCG)

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For tortoise, terrapin and turtle care and conservation

BACKGROUND

The inaugural meeting of the BCG was held in April 1976, when a small band of enthusiasts proposed forming a new group in the Bristol area for people who were interested specifically in chelonia, as it was felt that other herpetological organisations did not offer them enough specialist information and guidance. The intention was to concentrate on personal contact and veterinary surgeries to gain potential members. This first 'Bristol Chelonia Group' meeting attracted 20 people in a private house and was described in Newsletter No.1, subsequent issues of which soon expanded in content and interest.

At the next few meetings fund-raising began, followed by donations of books, to start a library. Advice was given on tortoise hibernation in the Newsletter and, if the local veterinary surgeon was not familiar with reptile diseases, contact could be arranged with veterinary surgeons John E. Cooper, Peter Holt or the late Oliphant F. Jackson for advice. A long association of these Veterinary Advisers with the BCG was established from this initial offer; Professor Cooper remains the Group's Scientific Adviser to this day, with Professor Peter Holt the current President.

From these small beginnings, membership and activities gradually increased until a small committee was needed and an annual subscription was introduced to help with running costs. The group was renamed the 'British Chelonia Group' to reflect its being the only group in the United Kingdom to cater solely for the chelonian enthusiast; the Newsletter was to be published six times a year, a new scientific journal named *Testudo* would be produced annually and a constitution was subsequently drawn up,.

In 1978 the need for regional meetings was agreed, so that members living away from the Bristol area could become more involved, and these are now widely spread over the UK. The committee was enlarged, adding a Conservation Officer, Veterinary Liaison Officer and Fund-raising Officer. In 1987, the BCG benefited from a legacy from Miss Kay Gray, of Exmouth, who was dedicated to chelonian welfare. At this point, charity status was sought and was achieved the following year. Annual symposia were introduced, bringing members in touch with researchers, conservationists and interested veterinary surgeons, and links were forged with conservation projects worldwide via Annual Appeals. Associations were developed with many organizations and zoos, such as MEDASSET (Mediterranean Association to Save the Sea Turtles), MCS (Marine Conservation Society), GCT (Galapagos Conservation Trust) and Jersey Zoo (now the Durrell Wildlife Conservation Trust).

The Group was honoured in 2001 by Professor David Bellamy, OBE, becoming Patron of the BCG. At a meeting of the GCT at the Geographical Society in London, attended by several BCG committee members, he agreed to support the Group's work for chelonia. As a distinguished conservationist, his interests have specifically included the prevention of unscrupulous development in Turkey that would have destroyed a beach used by nesting turtles.

The final improvement in status came more recently with the Group becoming a charitable company. The remit of the BCG is to be of 'Public Benefit' as well as for chelonian care and conservation.

The aims of the Group

- To provide chelonia keepers with the support needed to ensure that their captive animals receive quality husbandry.
- To raise funds from members, and from the public, to finance chelonian rescue, research and conservation projects worldwide.
- To discourage the importation and purchase of wild caught specimens, in favour of responsible captive breeding.

These objectives are achieved in the following ways.

Information for the Public

The advent of the Group's 'Care Sheets' was triggered by a donation from Friends of the Earth via an early BCG member, with updates for various tortoise species as knowledge has increased. They have been available at local meetings and tortoise health checks. These health checks have been held by regional groups all over the country for many years and can attract hundreds of tortoise owners (plus the occasional terrapin). Tortoises are weighed and measured and owners advised to keep records for comparison as a guide to the health and growth rate of their animals, especially before and after hibernation. Often a

veterinary surgeon is present to give professional advice or, if not, the team checking the animals will be able to sex and identify the species and pick out those that need to be taken for treatment. Husbandry, feeding and hibernation advice are all given, and strict protocols are followed to prevent disease transmission.

Publicity has been given to correct hibernation via the BBC's 'Blue Peter' children's television programme, when young BCG members helped TV vet Joe Inglis demonstrate how to prepare Horsfield's tortoises (*Testudo horsfieldi*) for hibernation. Several appearances on BBC television's 'Crimewatch' have helped with the recovery of lost tortoises.

With the coming of the Internet a website was developed, starting with the Group's Care Sheets, making them freely available to the wider public. Further information has gradually been added, including papers from back issues of every volume of *Testudo*, plus conservation topics, details of the appeals, veterinary information and much more.

The BCG symposia

The first symposium was in March 1983 at the University of Bristol, run in conjunction with the Adult Education Department. The morning session was chaired by Dr Roger Avery, with lectures on tortoise anatomy and the Mediterranean tortoise trade and its implications. The afternoon session, chaired by Dr Peter Holt, covered aspects of tortoise disease, finishing with a question and answer session. This set the pattern for an annual symposium, sometimes attracting over 100 delegates, which later moved to a more central location at the Open University in Milton Keynes. Many of the lectures have been published in *Testudo*.

The Gilbert White connection

Several additional meetings were organized by Dr June Chatfield, Curator of the Gilbert White Museum in Selborne. These included visiting the museum at 'The Wakes' (now called Gilbert White's House) and the five acre garden, home of naturalist The Rev Gilbert White's famous tortoise 'Timothy' - owned by his aunt Mrs Snookes for nearly 40 years and inherited by him when she died in 1780. This was the venue for the first formal AGM of the Group.

The Northern Symposium

In 1995, the need for a symposium accessible to members in more northerly locations resulted in the first such event taking place at Blackpool Zoo, with the lecture room packed to capacity by the 80 delegates. The venue subsequently changed to the larger lecture theatre at Chester Zoo. Speakers have ranged from students to professors, hobbyists to zoo-keepers, vets to conservationists and virologists to homeopaths - truly something for everybody.

Re-homing

This is a perpetual problem, for several reasons. Firstly, the longevity of tortoises, which may reach over 100 years of age, means many will outlive their owners. Secondly, the difficulties of keeping exotic species (especially terrapins and tropical tortoises) may prove to be too much in effort and expense for their keepers, where they not only have to provide specific conditions all the year round, but also, for the larger species, considerable space. Thirdly, some individuals are not as docile as you might expect and their continual molesting of their companions means they have to be re-homed if they cannot be kept separately. Over the years, many hundreds of animals have been placed with new owners, with the Re-homing Officer always ensuring that facilities are satisfactory in the new home and that the animals will not be offered for sale. The latter is to comply with the strict CITES (Convention on International Trade in Endangered Species) regulations that apply to protected species. To help with any subsequent health problems, a 'veterinary fund' is set aside to assist the new owners if unable to afford essential treatment.

Lost and Stolen Tortoises

In 1997, retired Police Inspector John Hayward became the Group's Theft Co-ordinator. His role is with the National Theft Register, which assists zoos and animal societies in the recovery of lost or stolen exotic species. He has issued security guidelines to members, and has been instrumental in recovering many missing tortoises. Some of the lucky ones include five tortoises stolen from a garden in Hampshire: thanks to a newspaper appeal, they were recovered in rather dubious circumstances after a reward was offered. In another case, a leopard tortoise *Stigmochelys pardalis* in Norfolk was accidentally scooped up by refuse collectors, but was recovered thanks to swift intervention. 'Lost and found' reports are now a regular feature of the BCG Newsletter, and the importance of being able to prove ownership of tortoises by photographing distinctive features, 'fingerprinting' or microchipping has been emphasised.

Microchipping

CITES, to which the UK became a party in 1976, was given official recognition in Europe when EC regulations were introduced in June 1997. This meant that commercial trade of all 'Annex A' species, which includes Mediterranean tortoises, was banned, apart from certain exemptions for breeding and scientific research. These exemptions depended on the animals being identified by microchip implants. There was great concern about the health implications of this, especially for small tortoises, and approaches were made to the Department of the Environment (DoE, as it then was). In 1998 a meeting was held between government officials, representatives from the BCG, the British Veterinary Zoological Society (BVZS) and from other veterinary interests and tortoise groups. As a result, the regulations were changed so that microchips were not implanted into tortoises under 10cm in length. Since then, smaller microchips have also become available and these ISO compliant mini microchips, 8.5mm long, may be implanted in tortoises of 5cm in length.

The BCG Tortoise 'Fingerprinting' Scheme
This was originally set up when it was realized that the plastron patterns of individual tortoises are unique and can be used as a means of identification. For a small fee, BCG members can submit a photographic record of their tortoise's plastron to be kept on a database. A 'found' tortoise then has a better chance of being re-united with its owner.

BCG AWARDS

The BCG makes a number of different awards, from the largest funded by the Annual Appeal, down to smaller individual grants. Feedback is often given at the symposia, and many projects result in reports for *Testudo*.

The Annual Appeals
Major tortoise, terrapin and sea turtle projects have all benefited from the thousands of pounds raised by the appeals and over the past few decades BCG members have helped to raise over a quarter of a million pounds. The situation of some endangered species is so alarming that the appeal has been repeated, as with the tortoises of Madagascar. The following examples show just a few of the diverse projects that have been supported.

Tortoises
In 1990 the giant tortoises of the Seychelles benefited from the appeal for 'Operation Curieuse' when members supported the London Zoo's project to relocate a breeding group of Aldabran giant tortoises *Dipsochelys dussumieri*

Figure 1. Arnold's tortoises *D.arnoldi* being allowed to swim ashore after transportation from Silhouette to Grande Barbe islande island, Seychelles.

Figure 2. Adult and juvenile tortoises being transported to Cousine island, Seychelles.

Figure 3. Tortoises on the plateau of North island just after arrival. (Photo courtesy North island)

to the island of Curieuse in the Seychelles. Subsequent breeding of *D. hololissa* and *D. arnoldi* on Silhouette island by the Nature Protection Trust of Seychelles (NPTS), from the few remaining tortoises found, was so successful that the population expanded greatly (Gerlach, 2003; 2005; 2007) and many tortoises were relocated to other islands (Fig. 1).

Sadly, political interference can sometimes disrupt the most successful of conservation schemes and eventually all the tortoises had to be relocated (Gerlach, 2011; Figs. 2 & 3).

In 1993 £5,000 was raised for 'Project Angonoka'. With only 50 ploughshare (or Angonoka) tortoises *Astrochelys yniphora* left in the wild in Madagascar, urgent action was needed to save them from extinction, and the BCG's appeal funds helped Jersey Zoo set up a captive breeding programme. In 1996 it was the turn of the Madagascan flat-tailed tortoise, *Pyxis planicauda*, which was becoming rare: money was raised to help their 'Kapidolo' project, financing the installation of equipment for captive breeding in a near-natural environment, and funding further study of this little-known tortoise in its native habitat. Funds were raised again in 2006 and 2012. The Durrell Wildlife Conservation Trust has spent over thirty years working to restore the threatened populations of these tortoises and their 2012 report for the BCG can be found at http://www.britishcheloniagroup.org.uk/bcg-info/conservation/info.

In 1998, in a joint venture with the GCT, the appeal raised thousands of pounds towards building and equipping a laboratory on Isabela island to support the captive breeding programme of *Chelonoidis nigra*. The Charles Darwin Research Station Tortoise Breeding Centre has been a huge success, without which the Espanola subspecies *C. n. hoodensis* would almost certainly have become extinct, as the Pinta subspecies *C. n. abingdoni* now is with the demise of 'Lonesome George'. More appeal money has been raised towards repopulating Pinta island and studying the released tortoises with the aim of achieving ecological restoration and a balanced ecosystem (Rowley, 2012; Figs. 4 & 5).

Representatives from the BCG have visited both the Galapagos and Seychelles projects, among other overseas visits.

Figure 4. Searching for tortoises on Pinta island, Galapagos.

Figure 5. Downloading data from Galapagos tortoise #58's data-logger.

Figure 6. Dozens of market stalls each with hundreds of turtles can be found on the Xing Ping market in Guangzhou. (Photo by Peter Valentin)

Terrapins (including freshwater turtles)

In 1997 the 'Re-re' appeal raised £4,500. This big-headed side-necked turtle from Madagascar was losing its battle with habitat destruction and human consumption, and the BCG helped fund captive breeding ponds in Ampijoroa. In 2010 a second appeal helped fund the release and monitoring of juvenile turtles.

The critically endangered turtles of Asia were supported a number of times. The Burmese roofed turtle *Kachuga trivittata* was one of these, after a specimen was found by a collector on a Chinese food market. It was thought to be extinct, but others were subsequently found in a sacred 'pagoda pond' and this led to a breeding facility for a 'Colony of Assurance' being set up at Mandalay Zoo, with holding ponds being funded by the BCG in the 2005 appeal. The BCG also linked up with Jersey Zoo to facilitate breeding of the rare flowerback turtle *Cuora galbinifrons*, and helped fund the International Centre for the Conservation of Turtles (IZS) at Muenster Zoo (Meier & Raffel, 2007; Figs. 6 & 7).

Figure 7. Turtle tanks in the IZS. Tanks for *Cuora* species are kept separate as they are so sensitive to disturbance; other attractive species are on public display. (Photo by Martina Raffel)

Figure 8. A TED such as this, with the escape hole arrowed, can dramatically reduce turtle mortality.

Sea turtles

In 1993 money was raised to assist MEDASSET in their research into the effects of long-line fishing on the turtle population in the Ionian Sea. This and other research has exposed the high mortality rate of turtles (and other creatures) from the practice and in spite of turtle exclusion devices (TEDs) being available, more still needs to be done to involve fishing communities (Gopi et al, 2007; Fig. 8).

1999 was the BCG's 'Year of the Marine Turtle'; members contributed £6,000 towards many worthwhile causes to help the endangered sea turtles, funding expeditions and research to help understand their habits and devise ways of protecting them from the activities of humans.

Conservation awards

These are made to individuals or research teams worldwide, who apply in the first case to the BCG Conservation Officer. Some reflect our appeals, as with other Madagascan species in danger of extinction such as the attractive spider tortoise *Pyxis arachnoides*.

Some are for educational projects, particularly with the realisation that much more progress is made with saving species when local people are involved in a positive way rather than trampling on their traditions (White, 2013). The need for cooperation became very evident when student researchers teaming up with 'SOS Tobago' had their turtle nest protection markers deliberately destroyed; every effort is made to prevent such occurrences by education of the local community and encouragement of fishermen to become involved. Details of that organisation's activities can be found at http://sos-tobago.org.

Certain other awards are made on a regular basis to ensure continuation of local links, as with the Cyprus 'Turtlewatch' scheme whereby Glasgow University students have worked with local people and with staff at RAF Akrotiri monitoring trends in turtle nesting and safeguarding nests and hatchlings (Downie et al, 2003; Fig. 9).

Figure 9. The protected nest of a loggerhead turtle *Caretta caretta* is excavated two days after most hatchlings have emerged, to rescue any that remain trapped - in front of a crowd of local people and RAF personnel, preceded by an educational presentation.

Numerous other awards have been made, such as for the purchase of satellite transmitters (in collaboration with MCS) to track the migrations of sea turtles, thereby helping to devise protection strategies for them. The tortoise rescue and breeding facility SOPTOM at Gonfaron, France has also been supported and visited by members. These are just a few examples.

Student Award Schemes

Exeter University students have been able to apply for funding towards a research project with turtles or tortoises. A notable study was on the possible inter-species breeding between the introduced red-eared slider *Trachemys scripta elegans* and the indigenous hickatee *T. decussata* on Grand Cayman (Parry 2009).

The Kay Gray Award

In recognition of a lifetime devoted to improving the welfare of chelonia, an annual Kay Gray Award was established for an outstanding contribution to chelonia in any field of activity. The winner is presented with a rose bowl and a cheque. Among recent recipients is George Balazs, who has spent his life in sea turtle research. He was instrumental in setting up a volunteer turtle watch in Hawaii at a beach where, almost uniquely, turtles haul out to bask and the visiting tourists are monitored. A completely different example is the award presented to The Cambridge Veterinary Group, who donated many hours to health checking and microchipping terrapins destined for the Carapax rescue centre in Italy (see below). Tuition was also given in how to microchip the Seychelles giant tortoises before their final distribution around the islands.

The Oliphant Jackson Memorial Fund

This was set up after the untimely death of Dr Jackson, in recognition of his pioneering work in chelonian medicine, to encourage research in this field. A sum of money is awarded to any veterinary surgeon or student for an approved research project or case report in this field. A typical paper, on the treatment of serious rat-bite wounds on a tortoise, can be seen at http://www.worldwidewounds.com/2007/february/Cousquer/Tortoise-Rat-Bite-Injuries.html.

The importation problems

At an early stage in the Group's development, the rate of importation of tortoises into Britain was being criticized in the national press, suggesting 99% failed to survive poor transport conditions following capture or get through their first hibernation. Concerns were also being expressed by researchers who were studying dwindling Mediterranean tortoise populations (e.g. Lambert, 1979).

In 1978 the BCG committee outlined a policy statement concerning the trade in commonly imported species of terrestrial tortoises, i.e. *Testudo graeca*, the spur-thighed tortoise, and *T. hermanni*, Hermann's tortoise. The main concerns were the unknown effect on populations in the wild, the way the animals were transported, the high mortality

rate during the first year of captivity and the possible health risks. During this era, field studies were being carried out on tortoise populations in France, Greece, North Africa and the former Yugoslavia, which helped lay the foundations for population ecology (e.g. Meek, 1985; Stubbs et al., 1985).

The DoE and tortoise imports

In 1981, in reply to the BCG Conservation Officer concerning the tortoise trade, the DoE agreed to write to traders to ensure compliance with the size of at least 20cm in length; however, very small tortoises were still being imported. By 1982 anyone purchasing an imported tortoise had to sign a form issued by the DoE agreeing to comply with certain principles of husbandry for the animal, making the buyer liable to a fine of up to £400, but this proved to be unenforceable. Due to the efforts of various herpetological organizations, including the BCG, in seeking to ban the import and trade in Mediterranean tortoises, the announcement finally came that this would cease at the end of 1983. The ban duly came into force in 1984.

The red-eared terrapin problem

There were also concerns over the difficulty in finding suitable homes for the increasing number of unwanted red-eared terrapins. By 1989 thousands of red-ears, imported during the 'Ninja Turtle' craze and sold at pocket money prices, were dying annually. The survivors were causing problems both for their owners and for the environments in which they were being illegally abandoned. A working party was set up with the BCG and other animal welfare groups. At the AGM in 1991, the members passed a resolution to take all steps possible to influence the government, CITES and other responsible bodies to end the import of red-eared terrapins and their trade within the UK except under licence. The import of this species was eventually banned in 1998.

To try and address the problem of unwanted terrapins, the BCG appeal in 1992 was for donations towards trying to set up a refuge. A site was identified at the 'Secret World' wildlife sanctuary in Somerset, where a large greenhouse was offered in which to set up the project, named the Red-eared Terrapin Education Centre. The facility was finally finished in 1997 and was officially opened by Simon King, the wildlife film maker.

In 2000, the Annual Appeal raised a large sum towards another such facility. In a link-up with the Carapax organisation in Tuscany, which already housed both terrestrial and aquatic chelonia, the 'Louisiana Project' developed a secure purpose-built lake with continuously replenished water. After a veterinary check and microchipping, terrapins needing new homes were transported to Italy, with the collaboration of Virgin Express Airlines and much publicity. Many flights took place, relocating unwanted terrapins from all over the country to their new lake in Italy to live out their natural lives. Although the Carapax Centre has now closed to the public, the remaining terrapins are still being cared for.

The future

With the support of a generous membership, and contacts with conservation bodies and the veterinary profession in Britain and around the world, the BCG can continue to improve the lives of tortoises, terrapins and turtles in captivity and in the wild. The management team and regional groups are run by volunteers, and the symposium speakers give up their time for the Group for no reward. In this way the BCG continues to thrive for the benefit of chelonia, their keepers and their environment.

Past and current Presidents: Peter Holt, Ian Swingland.

BCG Chairmen: Derek Foxwell, Diane Tottle, Peter Holt, Robert Harper, Diana Pursall, Oliphant Jackson, June Chatfield, Bob Langton, Don Freeman, Henny Fenwick.

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An overview of current efforts to conserve the critically endangered mountain chicken (*Leptodactylus fallax*) on Dominica.

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Dominica was once the stronghold of one of the giants amongst frogs: the mountain chicken (*Leptodactylus fallax*). *L. fallax* is the largest amphibian in the Caribbean region (Fig. 1), and is currently listed as Critically Endangered by the IUCN (Fa et al., 2013). Currently, *L. fallax* is restricted to the islands of Dominica and Montserrat in the Eastern Caribbean; it was formerly far more widespread, occurring on seven Eastern Caribbean islands (Schwartz & Henderson, 1981). Island extinctions came about through a combination of habitat loss (forest and freshwater), introduced predators (especially rats and mongoose) and over-exploitation for food.

Figure 1. The mountain chicken *(Leptodactylus fallax)*

In December 2002, the presence of dead and sick *L. fallax* came to the attention of the authorities in Dominica. Over the following twelve to eighteen months, the Dominican *L. fallax* population crashed to the extent that no animals could be detected during routine surveys. The culprit was chytridiomycosis, a disease caused by the fungus *Batrachochytrium dendrobatidis* which has been identified as one of the principal drivers of recent amphibian declines and species extinctions. (Skerrat et al., 2007). This left Montserrat as the species' last stronghold, but chytridiomycosis reached that island in 2009 and all but wiped out the *L. fallax* population there (www.mountainchicken.org). Today, the remaining wild population across both islands has been estimated to be no more than a few hundred individuals (Hudson & Cunningham, unpublished observations), making *L. fallax* one of the most threatened frogs in the Caribbean region and, indeed, one of the most Critically Endangered species in the world.

Historically, hunting has been a threat to *L. fallax* as the frogs were a popular food item in both Dominica and Montserrat. In Dominica, *L. fallax* had the dubious status of being the island's national dish (Martin et al., 2007) with annual legal harvests on Dominica estimated at between 8,000-36,000 individuals per annum (Malhotra et al., 2007). Following the outbreaks of chytridiomycosis, all hunting of *L. fallax* was banned on both islands. *L. fallax* is of cultural importance to the people of Dominica, where the frog goes by the local name of "crapaud". Apart from being the national dish, the frog is emblematic and used as a logo by the island's indigenous bank, a college and a guesthouse. It can even be found on the nation's coat of arms. *L. fallax* also features in island folklore and proverbs, Sé lanng kwapo ki twayi kwapo (it's Crapaud's tongue that betrayed his own self) and Kwapo pa ka vanté soup-yo (Crapaud don't fan their own soup) to name just a few.

It is rare that an amphibian features so prominently in the culture and identity of a country and this, coupled with the incentive to protect it as an important food source, has been extremely advantageous to the conservation of the species.

For now, the immediate future of the species is uncertain with the most realistic hope being through captive breeding and release. In the face of the chytrid epidemic, *L. fallax*

from Montserrat were air-lifted to bio-secure facilities in several European zoos, where they are now breeding. On Dominica, the Forestry, Wildlife and Parks Division with the assistance of the Veterinary Services and the Zoological Society of London (ZSL) and with funding from ZSL and the UK government's Darwin Initiative, set up an in-country captive breeding programme.

The reproductive biology of *L. fallax* was described from captive specimens at Durrell Wildlife Conservation Trust (Gibson & Buley, 2004). Eggs are laid into a terrestrial foam nest and, when they hatch, the tadpoles are guarded by the adult frogs. The tadpoles are fed infertile eggs by the female throughout their larval development. Thus, captive breeding the frogs is not quite as straightforward as it might be for many other species. Also, being large and territorial and with voracious appetites, *L. fallax* are not the easiest - or cheapest - of frogs to maintain in captivity. A captive breeding facility was constructed in 2007 at the Botanical Gardens in Roseau, the capital of Dominica.

The most important husbandry aspect to address initially was that of securing an adequate food supply. In captivity, these gargantuan frogs can consume an astonishing 100 adult field crickets a week. Invertebrate colonies were set up using native species; non-native invertebrates could not be used as there was a real risk that they could establish on the island and become a new pest species. Over the course of several years of trial and error, several species became established enough to be produced on a large scale. This element of the project took huge investments of both time and money (and we are grateful to the British Herpetological Society for helping to fund this aspect of the work), but is vital to the longer term success of the project.

Four years after the Dominican facility was constructed, and with live food cultures running successfully, preparations were in place for an in-country captive population to be established. All that was needed were some frogs. Sadly, only the occasional individual had been reported or heard since the initial population crash. Over several months in 2011, eleven frogs were found in the wild and these were brought into the breeding facility in Roseau. The frogs have acclimatised well to life in captivity and it is hoped that, over the coming years, these frogs will reproduce and their progeny will eventually be released back into the wild.

Local capacity building was, and still is, a vital component of the project. Dominican forestry staff were trained in amphibian monitoring and disease surveillance techniques and perform regular surveys across the historical range of *L. fallax*. In 2005, a molecular laboratory was built and equipped and a local molecular biologist was appointed and trained to analyse samples for the presence or absence of *Batrachochytrium dendrobatidis*. In 2006, Dominican forestry staff received intensive training on the captive husbandry of *L. fallax* at London Zoo and at the Durrell Wildlife Conservation Trust. Since 2007, Department of Agriculture and Forestry staff have been trained in live food cultivation and amphibian husbandry in-country. It is vital that populations of *L. fallax* continue to be monitored in the wild. This work is on-going but desperately requires more funding and currently relies on volunteers.

The continued survival of the remaining frogs in the wild is far from assured, but there are some encouraging signs. In late 2011, several juvenile *L. fallax* were found in Dominica, the first evidence in recent years that the frogs are breeding in the wild and a fantastic boost for the project. We are also working on public outreach and engagement in order to build and maintain a large constituency for *L. fallax* conservation. This has included disseminating information to the Dominican public using information boards, posters, leaflets, radio and television, and giving talks to schoolchildren. We also run a campaign entitled "Have you seen me? Have you heard me?", where people are encouraged to report *L. fallax* sightings and vocalisations. This campaign included a series of public engagement events, such as a community group promoting the project in the 2012 carnival (Fig. 2), a 2014 carnival queen contestant using her talent and costume round to promote the crapaud story, an annual mountain chicken hike on the island and an annual Mountain Chicken Day.

Figure 2. The mountain chicken captive breeding facility in Roseau.

A crucial component of the outreach campaign is the involvement of local contributors. This helps to foster a sense of local pride and ownership for saving the species and can often be a more effective form of outreach as local people are usually more in tune with local issues, opinions and values. Recently a talented local poet, Delroy N. Williams, published a poem in support of the project called the "Crapaud Story" http://www.mountainchicken.org/blog/the-crapaud-story-a-poem-about-the-mountain-chicken-by-delroy-n-williams and collaboration with local artists has taken place to help use local talent and business to develop interest in the project. Finally, the use of social media, such as Facebook, has proved to be a great way to provide up-to-date information and to engage with the younger generation. You can check out our Facebook page at: https://www.facebook.com/pages/Dominican-Mountain-Chicken-Project_

As the crisis has deepened over the last few years for the *L. fallax*, UK NGOs such as the Zoological Society of London and Durrell Wildlife Conservation Trust have worked together and, with the support and involvement of the Dominican and Montserratian governments, merged their different projects on Dominica and Montserrat respectively, into a collaborative effort to develop a more cohesive *L. fallax* conservation project and the development of a long-term combined action plan. Greater governmental involvement in the project on both islands led to a species conservation action planning meeting in Montserrat in 2013 and a commitment to regular meetings to more-effectively monitor and coordinate mountain chicken conservation across the two islands. Another key aspect to the success of this project has been its foundations in scientific research which have underpinned decisions on surveys and interventions required to ensure the long term survival of this species. To continue to fulfil this requirement for research, a PhD student, funded by the Balcombe Trust, is conducting research on the emergence, epidemiology and impact of chytridiomycosis in *L. fallax* on both Dominica and Montserrat. On Dominica, this work is assessing the current size and disease status of the remnant *L. fallax* population and those of sympatric amphibian species on the island. There is still much work to do and continued support, especially financial, is required to ensure the future survival of *L. fallax*.

You can find out more and keep track of the latest project developments by visiting http://mountainchicken.org.

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The tadpole of *Litoria multiplica* (Anura: Hylidae) from Papua New Guinea

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ABSTRACT - We describe the tadpole of *Litoria multiplica* from Papua New Guinea. It is readily distinguished from other *Litoria* tadpoles known from New Guinea by its distinctive pigment patterns consisting of bold black or dark brown stripes with scattered gold iridophores in the intervening pale areas. The oral disc is located ventrally and is completely surrounded by small papillae, adaptations for adherence to rocks in small streams where rapid increases in water flow are a common occurrence.

INTRODUCTION

The green treefrog, *Litoria multiplica,* (Tyler, 1964) is a medium-sized species (to ~47 mm SVL) known from several localities between about 1,000 and 1,500 m a.s.l. along Papua New Guinea's central cordillera. The distribution and advertisement call of this species were described by Richards et al. (2009). Although the egg-deposition behaviour of *L. multiplica* remains unknown, Menzies (2006) included the species in his *'L. iris* group', an assemblage of species that lay their eggs on leaves hanging over water, because a female examined contained only 'eight mature ova of slightly more than 2 mm diameter' suggesting it 'places its eggs in aerial situations'. He also provided a lateral drawing of a tadpole that he assigned to this species, with the brief description 'strikingly marked in black and gold, the fins moderately arched and evenly tapering to a narrow terminal ending' (Menzies, 2006: p146). No additional information on the tadpole of this species is available. Furthermore, the basis for the association of the tadpole illustrated by Menzies (2006) with *L. multiplica* was not provided. Our collection of a small series of tadpoles that we assign to *L. multiplica* confirms that the tadpole illustrated by Menzies (2006) is indeed likely to be that species, and provides the opportunity to present a detailed description of the body form and oral morphology of *L. multiplica* tadpoles from Papua New Guinea.

METHODS

Collection details

Five tadpoles were collected from a small (1-3 m wide), shallow, rocky stream (Fig. 1a) in lower-montane rainforest at Tualapa, Southern Highlands Province, Papua New Guinea (05°18.245' S, 142°30.704' E, 1,438 m a.s.l.) between 11 and 26 July 2008. Tadpoles were placed in a tray and photographed in life, and then preserved in 5% formalin.

Measurements

Measurements of preserved specimens were taken in the laboratory using vernier calipers and an eye-piece micrometer attached to a Wild M5 stereoscopic microscope. The drawing of the oral disc was prepared with the aid of a drawing tube attached to the microscope. Tadpoles were staged according to Gosner (1960). Morphometric measurements used are explained in Table 1 and measurements are presented in Table 2. Description format, measurements and terminology follow Anstis (2013).

Identification

It was not possible to raise tadpoles to metamorphosis in the field to confirm identification, and all material was preserved in formalin precluding DNA matching. However we assign the tadpoles reported here to *L. multiplica* on the basis that 1) males of this species were calling over the stream pools containing the tadpoles, 2) the only other *Litoria* species present during a week at the collection site was *L. modica*, a species with very different suctorial tadpoles (Richards, unpublished data), and 3) tadpoles identical to those described here were observed at another site further east in Papua New Guinea (Crater Mountain Wildlife Management Area, Eastern Highlands Province; 6°30.082' S, 145°01.977' E, 1,540 m a.s.l.), where again *L. multiplica* adults were calling over the stream pools. At this latter site the only other *Litoria* species present along the streams over three weeks were *L. eucnemis* and *L. iris*, and neither of these species has tadpoles similar to those assigned here to *L. multiplica* (Tyler, 1963; Anstis, 2013). We are therefore confident that the material described here represents *L. multiplica*.

Character	Abbrev.	Description
Total length	TL	From tip of snout to tip of tail (lateral view)
Body length	BL	From tip of snout to tail-body junction at anterior ventral edge of tail muscle (lateral view)
Body depth	BD	Maximum vertical depth of body (lateral view)
Body width	BW	Maximum width of body across abdomen (dorsal view)
Eye-body width	EBW	Width of body in line with eyes (dorsal view)
Basal tail muscle depth	BTM	Maximum vertical depth of anterior tail muscle at tail-body junction (lateral view)
Snout to spiracle	SS	Distance from tip of snout to posterior dorsal edge of spiracular opening (lateral view)
Snout to eye	SE	Distance from snout to anterior edge of eye in (lateral view)
Snout to naris	SN	Distance form tip of snout to anterior edge of naris (lateral view)
Eye diameter	ED	Maximum eye diameter (lateral view)
Tail depth	TD	Maximum vertical depth of tail (lateral view)
Dorsal fin depth	DF	Dorsal fin vertical depth in line with TD (lateral view)
Tail muscle depth	TM	Tail muscle vertical depth in line with TD (lateral view)
Ventral fin depth	VF	Ventral fin vertical depth in line with TD (lateral view)
Inter-orbital span	IO	Distance between inner edge of each eye (dorsal view)
Inter-narial span	IN	Distance between inner edge of each naris (dorsal view)
Narial diameter	N	Maximum diameter of naris (dorsal view)
Oral disc width	ODW	Maximum width of oral disc (ventral view)
Snout-width	SW	Maximum width of snout in line with midline of oral disc (ventral view)
Labial tooth row formula	LTRF	after Altig (1970)

Table 1. Description of morphometric measurements of preserved tadpoles of *L. multiplica*.

Stage	25	26	32	34	35
TL	34.5	38.5	46.6	45	45.5
BL	11.3	12.6	14.8	14.5	15.1
BD	5.2	5.5	7.0	7.0	7.2
BW	5.6	6.3	8.1	8.1	8.4
EBW	5.8	6.3	7.6	7.8	8.1
BTM	2.9	3.4	4.3	4.5	5.0
BTMW	2.7	3.2	4.3	4.7	4.8
SS	6.8	7.4	8.4	8.2	8.4
SE	3.6	3.5	4.4	4.2	4.2
SN	1.6	1.5	1.9	1.9	1.9
ED	1.0	1.2	1.5	1.6	1.9
TD	6.1	6.6	8.2	8.2	8.5
DF	1.9	1.9	2.6	2.6	2.7
TM	2.4	2.9	3.3	3.4	3.2
VF	1.8	1.8	2.3	2.3	2.6
IO	3.4	3.5	4.2	4.2	4.1
IN	2.4	2.7	3.1	3.2	3.2
N	0.3	0.3	0.4	0.5	0.5
ODW	3.2	3.4	4.5	4.3	4.3
SW	2.9	4.0	4.8	4.5	4.7

Table 2. Morphometric measurements of preserved tadpoles of *L. multiplica*. Stages after Gosner (1960). See Table 1 for explanation of terminology.

RESULTS

Tadpole morphology

Five preserved tadpoles collected at stages 25, 26, 32, 34 and 35 were used for this description.

Maximum length

The latest developmental stage collected was stage 35, but the maximum total length of 46.6 mm was a specimen at stage 32. It is likely tadpoles may reach a slightly greater length than this in later stages. Limb development is delayed, and one tadpole at stage 25 (prior to the first emergence of a minute hind limb bud) is about three-quarters the body length and total length of the largest tadpole at stage 32.

Body

Body medium, oval to cylindrical and slightly depressed anteriorly. Abdomen slightly wider than deep in dorsal view. Snout broadly rounded in dorsal view, rounded in profile. Eyes appear near-lateral in life, tilted dorsally following preservation. The iris has a distinct gold ring around the pupil with a few fine iridophores scattered towards the margin. The nares are moderate in diameter (0.5 mm, stages 34 and 35), widely spaced and directed anterolaterally. The spiracle is narrow, relatively short and opens posteriorly or slightly dorsoposteriorly on or just below horizontal body axis, posterior to midpoint of body. The vent tube is dextral, broad, and opens diagonally down to edge of ventral fin (type b, Anstis 2013).

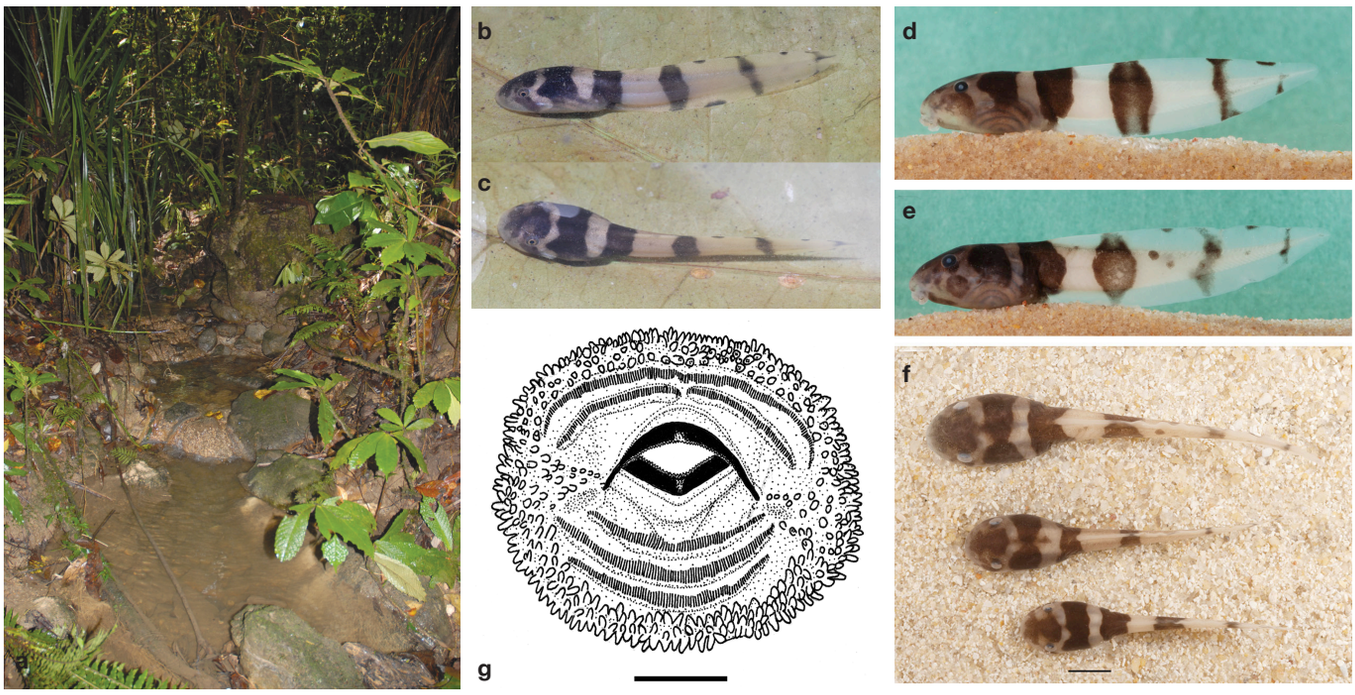

Figure 1a. Stream habitat of *L. multiplica* in lower-montane rainforest at Tualapa, Southern Highlands Province, Papua New Guinea. **b** = dorsolateral and **c** = dorsal views of *L. multiplica* tadpoles. **d** to **f** preserved tadpoles of *L. multiplica* showing stage 26 (**d** lateral view), stage 32 (**b** lateral view) and **f** stages 32 (top) 26 (middle) and 25 (lower). **g** shows oral disc of *L. multiplica* at stage 32. Bare represents 1mm.

Tail

Fins shallow. Dorsal fin begins at a point just proximal to body-tail junction and arches only slightly or not at all over midpoint, before tapering to a narrowly rounded tip. Ventral fin not arched. Muscle robust anteriorly, tapers posteriorly to a narrow point.

Colour in life

A strikingly beautiful species with bitonal pigmentation on body and tail (Fig. 1b to 1f). Three broad black or dark brown bands circumvent the dorsum and sides; one over the head from just posterior to the eyes to the snout, one across the mid-dorsal region and one over the base of the body and onto the tail. Between these bands are irregular pale areas with fine gold iridophores. The lateral line patterns are golden and clearly visible. As tadpoles grow, additional smaller dark spots may develop on the pale areas between the dark bands. In lateral view the abdomen becomes increasingly translucent towards the venter and intestines are partly visible. The tail is translucent milky-white with fine iridophores over the anterior dorsal muscle and fin and two prominent black or dark brown vertical bars, with a less prominent small vertical bar and or a few scattered dark spots posteriorly. Golden lateral line rows extend dorsolaterally along the muscle. The shape of the bands and other spots on body and tail is individually variable.

Colour in preservative.

Most pigment is retained in preservative except for the gold iridophores. The ventral surface is mostly translucent whitish to unpigmented in preservative but may have fine iridophores in life. The tail muscle is white and brown.

Oral Disc

Type 3 (Anstis, 2013), ventral. Three to four rows of small crowded papillae completely surround the disc, with additional submarginal papillae extending towards the jaw sheaths at each side. The disc is almost as broad as the snout (e.g. ratio of ODW to SW = 0.93, stage 32). Papillae reduced to two rows anteriorly in the medial margin of some specimens. Posterior papillae are generally larger than most other papillae. Two anterior and three posterior tooth rows, of which A^1 is the longest row and A^2 has a narrow medial gap. P^1 has a narrow medial gap in some specimens, but is fused in others. Jaw sheaths medium, upper sheath moderately arched with long sides. LTRF = 2(2)/3 or 2(2)/3(1). The oral disc is illustrated in Fig. 1g. It is likely that the oral disc of this tadpole is capable of maintaining adherence to rocks in flowing water, given its broad surface area and complete papillary border.

Behavioural observations

Tadpoles of *L. multiplica* were always observed in slower-flowing, deeper stretches of streams (Fig. 1a). They were never encountered during sampling in shallow riffles and torrents in the same streams. Tadpoles appeared to spend most time on the rocky substrate, grazing from algae growing on the rocks; they were only occasionally seen swimming in the water column. Following heavy rainfall, tadpoles moved to the more sheltered edges of the stream pools, where they were observed to adhere to rock substrates with their oral discs to avoid being washed away.

DISCUSSION

Knowledge about the larval morphology of most New Guinean frogs with free-swimming tadpoles is lacking. However a number of tadpoles there have evolved highly specialised mouthparts with which they attach to rocks in fast-flowing water (e.g. Tyler, 1963; Menzies & Zweifel, 1974; Günther, 2006), a response to the steep terrain and torrential waterways typical of the island's rugged central cordillera. While considered 'suctorial' (*sensu* Anstis, 2013) because of their ability to adhere to rocks in flowing water, the tadpoles of *L. multiplica* do not exhibit the extreme morphological adaptations seen in other New Guinean torrent-dwelling treefrogs such as the *L. arfakiana* group (e.g. Menzies & Zweifel, 1974), and the *L. nannotis* group in Australia (Richards, 1992; Anstis, 2013). These species have strongly dorso-ventrally depressed bodies and a mouth modified into a broad, ventrally located suctorial disc. The tadpole of *L. multiplica* has an oral disc more typical of tadpoles occupying streams with moderate flow levels (Anstis, 2013). The body shape is oval to cylindrical rather than dorsally depressed, and the oral disc is much smaller than that of species occupying torrential habitats. The disc is, however, almost as broad as the snout (Table 2), completely surrounded by numerous oral papillae and is ventrally located, adaptations for clinging to the substrate in flowing water (Anstis, 2013). Indeed the general body form and oral morphology of *L. multiplica* are typical of a number of congeners from Australia that are known to occupy small streams where flow rates may increase rapidly for short periods of time (e.g. *L. staccato*, *L. coplandi*, *L. personata* and members of the *L. lesueuri* comple**x**; Anstis, 2013). These morphological features reflect the nature of the small, rocky streams where the tadpoles of *L. multiplica* were found. Observations in the field indicated that these streams flow gently during periods of dry weather but flood rapidly when heavy rain falls, a common occurrence in the mountains of New Guinea.

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Reptiles and amphibians of a village in Somerset, England

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ABSTRACT - Surveys were carried out to identify the presence and abundance of four widespread British reptiles (*Anguis fragilis, Zootoca vivipara*, *Natrix natrix* and *Vipera berus*) and five amphibians (*Rana temporaria, Bufo bufo, Lissotriton vulgaris, L. helveticus* and *Triturus cristatus*) in and around the Somerset village of Westbury-sub-Mendip. All five species occurred within < 1 km of the village centre. Slow-worms (*A. fragilis*) were widespread within the built-up area whereas grass snakes (*N. natrix*) were frequent but mostly seen around the periphery. Adders (*V. berus*) were rare and also peripheral and there was just a single record of viviparous lizard (*Z. vivipara*). Common frogs (*R. temporaria*) and palmate newts (*L. helveticus*) were the commonest amphibians in garden ponds while great crested newts (*T. cristatus*) only occurred in two ponds after deliberate introductions many years ago. There was a cline of increasing relative abundance of palmate to smooth newts along a north transect through the village corresponding to a change from low-lying alluvial soils to limestone-based substrates in higher parts of the village. Evidently village gardens can provide sanctuary for most of Britain's widespread herpetofauna.

Four species of reptiles and five amphibians are widespread in Britain and occur in a wide range of habitats across the country. The two lizards (viviparous lizard *Zootoca vivipara* and slow-worm *Anguis fragilis*), two snakes (adder *Vipera berus* and grass snake *Natrix natrix*), two anurans (common frog *Rana temporaria* and common toad *Bufo bufo*) and three urodeles (smooth newt *Lissotriton vulgaris*, palmate newt *L. helveticus* and great crested newt *Triturus cristatus*) are all resident and widespread in Somerset, south-west England (Beebee, 2013). However, at least some of these animals have undergone recent declines in many areas of Britain. These certainly include *V. berus* (Wilkinson & Arnell, 2013), *B. bufo* (Carrier & Beebee, 2003) and *T. cristatus*, (Jehle et al., 2012) and perhaps also *Z. vivipara* (anecdotal observations). These declines have various but always anthropogenic causes, especially agricultural intensification but also increasing road mortality and possibly climate change (Beebee, 2013).

Urban habitats offer a potential sanctuary for at least some of these widespread species. In the Brighton (Sussex, UK) area *A. fragilis* was the only reptile commonly seen in gardens while *N. natrix* was a rare visitor to some garden ponds. Amphibians fared rather better with many populations of *R. temporaria, B. bufo and L. vulgaris* (Beebee, 1979). However, Brighton is a heavily urbanised region and outlying rural developments may be more accommodating, especially for reptiles. This paper reports on the results of reptile and amphibian surveys in a small rural village surrounded by relatively low intensity farming activity.

METHODS

Study area

Westbury-sub-Mendip is a village of about 290 households and 800 people at the foot of a south-facing scarp slope of the Mendip Hills in Somerset, UK (centred at 51°14'7.43N, 2°42'56.15W). It lies on the main road (A 371) between Wells and Cheddar at a mean altitude of about 45 m ASL. The Mendips, a limestone formation, rise steeply to about 250 m ASL within 2 km to the north of the village while to the south the land flattens out, within < 1 km, to < 15 m ASL on the alluvial soils of the Somerset Levels wetlands. Landscape around the village is primarily pasture with some woodland, demarcated by extensive hedgerows and dry-stone walls.

Survey methods

A request for information on recent (within the last five years) reptile sightings in and around (within c. 1 km) of the village was circulated to residents via the Westbury Society's email network in the spring of 2013. Appeals were also made in the Village Hall during Society meetings. Records were verified as far as possible by discussion with the providers. Amphibian breeding sites were investigated by a garden pond survey in spring 2014, also advertised by the Westbury Society as well as by a talk in the village hall in February and by posters distributed at 10 sites around Westbury. Methods followed standard procedures for amphibian survey in the UK (Griffiths et al., 1996; Gent & Gibson, 1998). Every pond on offer was visited twice during March and April. On the first inspection, use by *R. temporaria* or *B. bufo* (evidenced by spawn)

Species	Total number of reptile records	Reptile records at village periphery (%)	Number of amphibian breeding ponds (% of ponds surveyed)
Zootoca vivipara	1	0 (0)	
Anguis fragilis	13	3 (23)	
Vipera berus	4	4 (100)	
Natrix natrix	15	14 (93)	
Rana temporaria			12 (44)
Bufo bufo			2 (7)
Lissotriton vulgaris			10 (37)
Lissotriton helveticus			17 (63)
Triturus cristatus			2 (7)

Table 1. Summary of reptile and amphibian records

was determined. Numbers of spawn clumps or strings were counted. On the second visit, designed to detect newts *L. vulgaris, L. helveticus* and *T. cristatus*, the ponds were either searched after dusk using a powerful torch or 5-8 bottle traps were set in the evening and inspected the following morning. The first method was employed where there was abundant open water (13 ponds) and the second where aquatic vegetation was dense everywhere (14 ponds). Numbers of each species were recorded though only male *L. vulgaris* and *L. helveticus* were registered by torch survey due to the difficulty of identifying the females of these species.

Data analysis

Standard statistical tests were applied using the STATISTIX software package (Tallahassee, USA).

RESULTS

Reptiles

A summary of the reptile and amphibian records from Westbury-sub-Mendip is shown in Table 1. All four widespread reptiles were reported, by a total of 15 contributors, in or around the village. Evidently both *A. fragilis* and *N. natrix* were frequent while *V. berus* and *Z. vivipara* were much rarer. The geographical distribution of reptile sightings is shown in Fig 1. A general feature was for slow-worms to occur mainly within the built-up area while snakes were more often seen on the outskirts. Three of the four *V. berus* records, all of which were outside but within 500 m of the village centre, were road kills. By contrast, only three of the 15 *N. natrix* records were of dead animals. The behavioural difference between *A. fragilis* and *N. natrix* was significant, with the snake seen beyond the housing areas (7 records) or visiting gardens around the village edge from adjacent fields (8 records), in total 14 out of 15 'boundary' instances whereas only three of the 13 *A. fragilis* records were similarly peripheral (Yates-corrected $\chi^2 = 5.99$, df = 1, P <0.05). Indeed, *A. fragilis* occurred in one garden in the very centre of the village housing block.

Amphibians

All five of the widespread British amphibians bred in Westbury garden ponds (Table 1), 27 of which were surveyed.

A minimum of >9% (27/c.290) households in the village therefore had ponds, with an average surface area of 5.9 m^2. Only two ponds (7%) had no breeding amphibians. Two species were rare. *T. cristatus* was found in just two ponds, to both of which it was introduced >20 years ago. This newt has evidently maintained populations in both places but not spread to others. Toads *B. bufo* also only bred in two ponds in 2014 but this may underestimate their true abundance. Two other ponds apparently have toads in most years and animals are regularly encountered in gardens all over the village. In 2014 each of the two breeding ponds had only one spawn string and one of these was completely dead. The year may have been a poor one for *B. bufo* since unusually low numbers were seen in regularly monitored ponds elsewhere in the area (J. Dickson, personal communication). Three of the four 'usual' toad ponds (75%) contained ornamental fish, whereas overall fish were present in just seven of the 27 ponds (26%).

Frogs *R. temporaria* and the two small newt species were widespread in garden ponds. Frogs preferred fish-free pools (Wilcoxon Rank Sum test, P = 0.013) and were

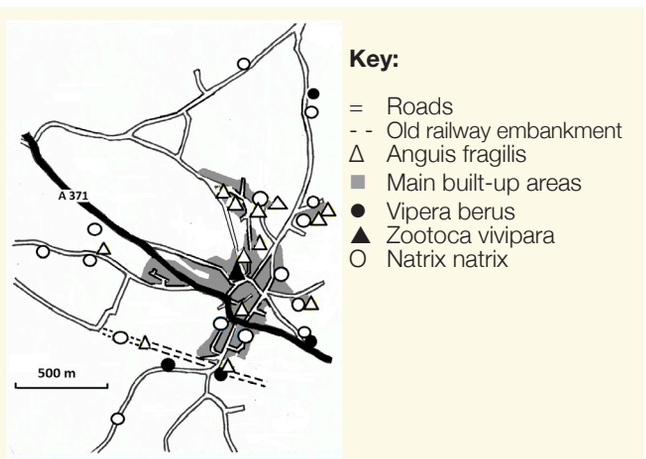

Figure 1. Distribution of Westbury-sub-Mendip reptile records.

found in ponds with one or both of the small newts more often than in newt-free ponds (Wilcoxon Rank Sum test, P = 0.017). There was however no significant relationship between numbers of spawn clumps and numbers of small newts, either individually or collectively summing both species together (r_s = -0.338, df = 15 , P = 0.086) although a trend towards an inverse relationship was suggested. There was also no preference of frogs for ponds of a particular size; spawn occurred in the smallest (0.5 m^2) and largest (15 m^2) of the ponds surveyed. The average number of spawn clumps was 5.5 and 10 was the highest number seen.

Smooth newts *L. vulgaris* were too rarely found with fish to test their response whereas palmate newts *L. helveticus* were more common in fish-free ponds (Wilcoxon Rank Sum test, P = 0.034) and collectively (pooling *L. vulgaris* and *L. helveticus*) the selection against fish was even more marked (P = 0.017). Neither separately or collectively was there any evidence of pond size preferences for the two small newts.

Of particular interest was the changing relative frequencies of *L. helveticus* and *L. vulgaris* along a south-north transect in the village (Fig 2) in the 16 ponds occupied by one or both species, excluding the two ponds where newts were deliberately introduced. The proportion of newt samples constituted by *L. helveticus* was low in the south but increased dramatically about 100 m north of the disused railway (roughly corresponding with the main A 371 road) and was consistently high further north. The relationship was probably asymptotic but there was nevertheless a significant linear relationship between relative *T. helveticus* abundance and latitude (r_s = 0.773, df = 15, P = <0.001).

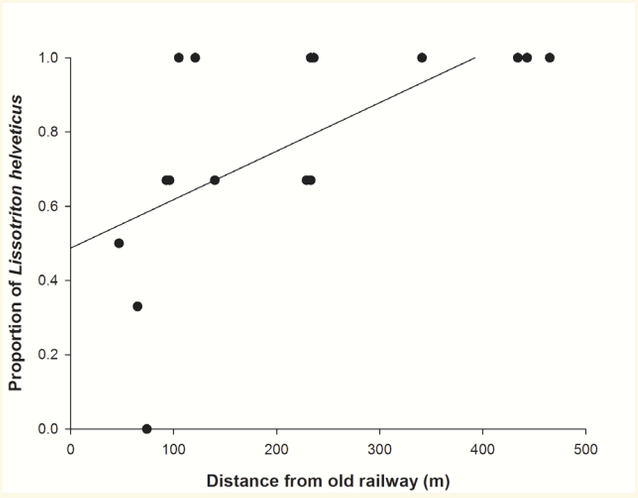

Figure 2. Gradient of palmate relative to smooth newt abundance.

DISCUSSION

Until recently there have been no studies reported of reptiles in British gardens. However, a wide-ranging investigation of urban amphibians and reptiles, with several thousand participants across the country, revealed that *A. fragilis* occurred in 16% and *N. natrix* in 13% of gardens overall (Humphreys et al., 2011). The other species were very rare, as also found at Westbury. Slow-worms are clearly well-suited to gardens, probably because their secretive behaviour minimises risks from predation or disturbance. Grass snakes in Westbury were regular visitors to garden ponds on the village margins, a relatively large habitat in this small community with a high edge:centre ratio. At least one compost heap was used for breeding, as evidenced by relict egg membranes. Adders (*V. berus*) were rarely encountered, perhaps because of past persecution (one respondent had been bitten in her garden) but are fairly common on the Mendip Hills. The scarcity of *Z. vivipara* was more difficult to explain. It too is common on the hills and much of the habitat around the village looks suitable. Perhaps disturbance and predation (by cats or birds) are too high for this species which basks conspicuously but this lizard may be experiencing declines in some parts of Britain (H. Inns, personal communication, and personal experience) and is in considerable difficulty in the Netherlands (Zuiderwijk & Janssen, 2008). The single record, by an experienced zoologist, was of an animal basking on a compost heap.

The value of garden ponds as a habitat for amphibians has been recognised for some time and began to compensate for pond losses in the wider countryside more than 40 years ago (Cooke, 1975). Studies in the south-east and north-east of England confirmed widespread use of gardens by all five widespread amphibians, though *T. cristatus* and *L. helveticus* were relatively uncommon compared with *R. temporaria*, *B. bufo* and *L. vulgaris* (Beebee, 1979; Banks & Laverick, 1986). The present study, however, confirms that gardens can also provide excellent habitat for *L. helveticus* when conditions (probably water quality) are appropriate. Cooke & Frazer (1976) found that this species preferred potassium and sodium-rich waters, often of low pH, and was less often associated with calcareous circumneutral ponds. The abundance of *L. helveticus* in an area dominated by calcium-rich limestone where ponds are invariably circumneutral (data not shown) is therefore somewhat surprising though I have no data on concentrations of the other metal ions. Evidently Westbury is on the cusp of a habitat transition between limestone-rich soils in the north and alluvial sediments in the south, fortuitously revealing how the two small newts respond to this difference. An alternative explanation, that palmate newts are advantaged by increasing altitude, seems unlikely (Cooke & Ferguson, 1975). All three species of newts occur at higher elevations on the Mendips but *L. helveticus* seems to be the most common and widespread there. By contrast, on the Somerset Levels south of Westbury it is rare to find any newt other than *L. vulgaris*. Thorough survey of amphibian breeding sites in rural areas requires substantial effort to establish absence, ideally with four visits per pond, using four different methods (Sewell et al., 2010). However, garden ponds are relatively easy to survey and although species may occasionally have been missed I believe that this would have been a rare event in these small pools. No non-native species of reptiles or

amphibians were encountered during the Westbury surveys.

The convenience of garden amphibian populations has facilitated several studies. Griffiths (1984) investigated *L. vulgaris* activity and behaviour in a London garden pond; Beebee (1995; 2007; 2012) reported on the population dynamics of several species in a Sussex garden pond including phenological responses to climate change and the consequences of a Ranavirus outbreak; Baker & Beebee (1997) demonstrated competition between *Rana* and *Bufo* larvae in garden ponds; and several studies have implicated genetic changes in *Rana* and *Bufo* populations, including increases in larval mortality, deformities and albinism (Hitchings & Beebee, 1997; 1998; Pash et al., 2007; Zeisset et al., 2010), some of which may imply inbreeding problems in small, isolated breeding sites.

Garden habitats seem likely to be important safeguards for at least some of Britain's widespread reptiles and amphibians into the foreseeable future. Villages such as Westbury are particularly well placed because of the relatively low impact of road vehicles and the extensive margins of good rural habitat, all of which should minimise inbreeding problems. These features were also identified as optimal in the national survey (Humphreys et al., 2011) together with fish-free ponds and high permeability fencing between gardens. Evidently there is scope for more research on garden-based herptile populations as well as opportunities for volunteer input ('citizen science') in future monitoring schemes.

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Reproduction in the Beerr Sheva fringe-fingered lizard, *Acanthodactylus beershebensis* (Squamata: Lacertidae) from Israel

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The ground-dwelling lacertid lizards, *Acanthodactylus*, are found in the Old World where they occur in sandy areas from south-east Turkey to southern Arabia and from the Mediterranean and Red Sea to Pakistan and north-west India (Harris & Arnold, 2000). There are currently 42 recognized species of *Acanthodactylus* (Uetz & Hosek, 2014). The Beerr Sheva Fringe-fingered Lizard, *Acanthodactylus beershebensis* Moravec, El Din, Seligmann, Sivan & Werner, 1999 is found in Israel, Gaza and the West Bank where it inhabits loess flatlands in the Negev and the southern Judean Desert (Sindaco & Jeremcenko, 2008; Bar & Haimovitch, 2011). All lizards utilized in this study were taxonomically identified as *A. beershebensis*. Frankenberg & Werner (1992) reported a mean clutch size of 4.8. range = 3-7 for 25 *A. beershebensis* (as *A. pardalis*). The purpose of this paper is to supply additional information on the reproductive cycle of *A. beershebensis* from a histological examination of museum specimens from Israel as part of an ongoing series of studies on the timing of events in the reproductive cycle of Middle-Eastern lizards. In view of the difficulty in obtaining collecting permits for large monthly samples of reptiles, utilizations of existing collections in museums has become increasingly important.

A sample of 53 *A. beershebensis* consisting of 25 mature males (mean snout-vent length, SVL = 65.3 mm ± 6.0 SD, range = 54-75 mm), 27 mature females (mean SVL = 63.0 mm ± 5.9 SD, range = 55-72 mm) and one subadult female (SVL = 53 mm) collected in Israel between 1941–2008 and deposited in the Zoological Museum of Tel Aviv University (TAUM), Tel Aviv, Israel was examined by (region): Central Negev: 996–998, 1628, 1629, 2505–2209, 3645; Northern Negev: 905, 906, 940, 941, 1039, 1041, 1046, 1047, 1049, 1050, 1052, 1586, 2105, 2106, 2110, 2804, 2805, 2911, 2917–2921, 2923–2927, 3854, 4248, 4869, 5165, 5167, 15845, 15846; Yehuda Desert: 892, 916, 922, 923, 958, 960, 1734.

A small slit was made in the left side of the abdomen and the left testis was removed from males and the left ovary was removed from females for histological examination. Enlarged ovarian follicles (> 4 mm) or oviductal eggs were counted in situ. No histology was performed on them. There was a high probability that follicles of > 4 mm size would have completed yolk deposition and ovulated. Removed gonads were embedded in paraffin, sections were cut at 5 μm and stained by Harris' hematoxylin followed by eosin counterstain (Presnell & Schreibman, 1997). Slides of the testes were categorized as to the stage of the testicular cycle. Epididymides were examined for the presence of sperm. Slides of ovaries were examined for yolk deposition or corpora lutea. Histology slides were deposited in the National Collections of Natural History at Tel-Aviv University. Mean body sizes (SVL) of male and female *A. beershebensis* were compared using an unpaired t-test; the relation between female body size (SVL) and clutch size was examined by linear regression analysis (Instat vers 3.0b, Graphpad Software, San Diego, CA).

There was no significant size difference in mean SVL length between adult male and female samples of *A. beershebensis* (unpaired t–test, t = 0.1, p = 0.16). Two stages were noted in the testicular cycle: (1): spermiogenesis (seminiferous tubules lined by clusters of sperm and/or metamorphosing spermatids; (2) recrudescence = renewal (proliferations of germ cells for the next period of spermiogenesis). Primary spermatocytes predominated. Males undergoing spermiogenesis by month were: February (N = 2), March (N = 4), April (N = 12), July (N = 1), October (N = 3), November (N = 2). Epididymides of all spermiogenic males contained sperm. The one September male examined (TAUM 1586) exhibited recrudescence. The epididymides was empty. In the present study *A. beershebensis* males from August were not examined so it is not known if the September male in recrudescence was preceded by a summer period of regression which is common in temperate zone lizards (Goldberg 1974; 1975). The smallest reproductively active male (spermiogenesis) measured 54 mm SVL (TAUM 2505) and was collected in March.

Four stages were present in the ovarian cycle (Table 1); (1) quiescent, no yolk deposition; (2) yolk deposition, basophilic yolk granules in the ooplasm; (3) enlarged ovarian follicles > 4 mm; (4) oviductal eggs. The female reproductive period encompassed February to April. Three females from February with follicles > 4 mm but no oviductal eggs suggests February is close to the start of female reproduction. It is not known when female reproductive activity ceased as no samples from May or June were examined. Mean clutch size (N = 22) was 4.9 ± 1.2.SD, range = 3-7. Linear regression analysis revealed a significant positive relation between female body size (SVL) and clutch size (N = 22): Y = -4.36 + 0.143X, r = 0.62, p = 0.002. Three females with oviductal eggs and concurrent yolk deposition from March indicate *A. beershebeensis* may produce multiple clutches in the same reproductive season. The smallest reproductively active females, both from February, measured 55 mm SVL (TAUM 2209, yolk deposition; (TAUM1050, 3 follicles > 4 mm). One slightly

smaller female (SVL = 53 mm) with quiescent ovaries from August (TAUM 15846) was considered to be a subadult.

The mean clutch size of 4.9 ± 1.2 SD, range is almost identical to that of Frankenberg & Werner (1992) for *A. beershebensis* (as *A. pardalis*). Production of multiple clutches has been reported for other species of *Acanthodactylus*: *A. erythrurus* in Spain (Carretero & Llorente, 1995) and *A. schmidti* in Saudi Arabia (Al-Johnay & Spellerberg, 1988). Perry & Dmi'el (1994) reported the congener *A. scutellatus* from Israel deposited 1-4 clutches in captivity between May and June. However, adverse weather conditions may reduce production of multiple clutches by females of *Acanthodactylus* (Castlla et al., 1992). As has been reported for other lizards from Israel (Goldberg, 2011; 2012; 2013), *A. beershebensis* commences spermiogenesis in autumn. Examination of other lizards from the Middle East are needed to ascertain whether fall spermiogenesis is typical for lizards from this region.

	N	Quiescent	Yolk deposition	Enlarged follicles >4	Oviductal eggs
February	3	0	0	3	0
March	12	0	0	6	6***
April	8	0	1	4	3
September	2	2	0	0	0
November	2	2	0	0	0

Table 1. Monthly stages in the ovarian cycle of 27 Acanthodactylus beershebensis from Israel; * indicates a female with oviductal eggs and concurrent yolk deposition for a subsequent clutch.

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Lissotriton vulgaris (smooth newt): Parasitism or phoresy?

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On the 23 February 2009 an adult male smooth newt, *Lissotriton vulgaris*, with a snout-vent-length of 43mm and a weight of 4g was seen near the surface of a semi-permanent, brackish pond on the southern end of Portmarnock Strand, Co. Dublin, Ireland (53° 24' 03.4"N 06° 06' 54.1" W). The individual was caught by hand and manipulated for an examination of body condition. During the examination a leech dropped from the axial region on the left side of the newt's body. The leech was captured and preserved in 70% etOH. Subsequent inspection of the newt revealed no obvious signs of bleeding or skin damage around the area that the leech detached from, although this could have been hampered by the difficulty of locating tiny dermal abrasions against the dark colouration of the skin, and by the small size of the specimen.

The leech was identified as *Helobdella stagnalis*, a predatory species of freshwater leech that is known to parasitise the common frog, *Rana temporaria* (Tiberti & Gentilli, 2010), a species that occurs sympatrically with *L. vulgaris* at the capture site. Given that we did not observe the leech directly attached to the newt, it is not possible to decisively determine between the two candidates for the nature of this interaction: parasitism versus phoresy (the use of a host solely for transport purposes). Given that *H. stagnalis* is known to parasitise amphibians in other parts of its distribution, e.g. *Ambystoma tigrinum* in the U.S.A (Platt et al., 1993), and *R. temporaria* in Italy (Tiberti & Gentilli, 2010), we consider a strictly phoretic relationship between *L. vulgaris* and *H. stagnalis* to be unlikely. Any relationship between these two species is likely to be temporally restricted due to the bi-phasic natural history of *L. vulgaris*. This particular specimen was in the aquatic breeding phase at the time of capture and we can only assume that once the breeding phase ends newts are no longer vulnerable to parasitism by *H. stagnalis*. If this is in fact an observation of parasitism as opposed phoresy then it constitutes the first European observation of a urodele amphibian host for this leech species, and only the third record of *H. stagnalis* specifically parasitising live amphibians (Platt et al., 1993; Tiberti & Gentilli, 2010). The cryptic lifestyle of smooth newts makes it difficult to make observations such as the one described here, and as such it is possible that the predatory leech *H. stagnalis* may have a more prevalent relationship with *L. vulgaris* than previously known.

Given that leeches have recently been identified in playing a much greater role in the localised decline of amphibian species than previously thought (for examples see Elliott & Tullett, 1984; Toledo, 2005; Romano & Di Cerbo, 2007; Wells, 2007; Ayres & Iglesias, 2008; Beukema & de Pous, 2010; Kutschera et al., 2010; Stead & Pope, 2010), coupled with their potential to serve as a vector for disease (Raffel, Dillard & Hudson, 2006), the effects of this relationship upon the smooth newt as a host organism requires further investigation, particularly since this kind of leech-amphibian interaction appears to be more prevalent than previously thought.

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Salamandra algira (North African fire salamander): New distribution area in Algeria

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The North African salamander, *Salamandra algira* Bedriaga, 1883 is an endemic amphibian from northern Morocco and Algeria (Ben Hassine & Escoriza, 2014). It appears in isolated populations, some of them constituting distinct genotypes. The nominal subspecies is present in Algeria, since the neotype of *S. algira* was designated in Mont Edough (northeastern Algeria; Escoriza & Comas, 2007).

The first author to mention the presence of *S. algira* in Algeria was Poiret (1789), in his "Voyage en Barbarie ou lettres écrites de l'ancienne Numidie''. In this book he gave a short description of the species under the name "*Lacerta salamandra*". Guichenot (1850) reported "*Salamandra maculosa*" (= *Salamandra algira* Bedriaga, 1883) to be very rare in the region of Oran. Guichenot (1850) stated that Colonel Levaillant found this species in Constantine. Lallemant (1867) describe it as a rare species in Algeria found in Oran, Kabylie, Bône (Annaba) and forest of Edough. Boulenger (1882, 1891) considered "*Salamandra maculosa var. algira*" to be localized in Algeria, but common in the sites where it appears. This author reported it from Algiers (Alger), and Bône (Annaba) and stated that other authors also recorded *S. algira* in Algeria: *S. algira* was also found in large numbers in Bône (Annaba) by Dr. Hagenmüller. Lataste and Lallemant collected several larvae from L'Arba (30 km south of Alger). Hanoteau and Letourneux founded *S. algira* in the forest of Akfadou (Kabylie), Fort National (Larbaâ Nath Irathen) and Bougia (Béjaïa). The last was confirmed subsequently by Dr. Boettger.

Olivier (1894) provided a similar list of records to that of Guichenot (1850), Lallemant (1867) and Boulenger (1891), but included Bugeaud (Seraïdi). Doumergue (1901) recorded this species in the extreme northwest of Algeria, in the mines de Rar-el-Maden, close to Montagnac. Pellegrin (1927) collected the citations previously described by Boulenger (1891) and Guichenot (1850). Seurat (1930) stated that this species was recorded by several naturalists in Bône, Forêt d'Edough, southern side of l'Haïser in Djurdura (at 980 m.a.s.l.) and the Atlas of Blida (at 1300 m.a.s.l.). Balozet reported the presence of salamanders in the Kabylie, in the region between Tikjda and Tizi n'Kouilal, at 1550 m.a.s.l. (Bons, 1972). More recent observations of *S. algira* in Algeria were reported within the previously known range (Iboudraren et al., Bouali & Oneimi, 2005) and Seraïdi (Samraoui et al., 2012). Schleich et al. (1996), Salvador (1996), Escoriza et al., (2006) and Mateo et al., (2014) described the presence of *S. algira* in some of the historic sites. On the basis of these historical records and similarly to Morocco, the distribution of *S. algira* in Algeria seems to be discontinuous. *S. algira* populations are separated by long distances; in particular, those in the western core (around Oran) from the populations in the regions of Blida and Kabylie (Fig. 1). The historical records and the general distribution of the species in Algeria, according to the IUCN (2014), are shown in Fig. 1. In February 2013, the authors discovered larvae of *S. algira* in a previously unknown area of the species' distribution in Algeria. In this region two breeding sites were found around the village of Zitouna, wilaya of Skidda, northeastern Algeria (36.92ºN, 6.44ºE and 36.90ºN, 6.40ºE; Fig. 1a). The climate of the region, according to Köppen–Geiger classification, is of the type dry-summer subtropical, with an annual average temperature of 15.5 ºC, and average annual rainfall of 1231 mm, and classified as humid (Trabucco & Zomer, 2009; World climate database, 2014). The vegetation is mainly composed of meso-thermal broadleaf mixed oak forests dominated by *Quercus suber* and *Quercus canariensis*, along with a dense understory of shrubs and small trees (Fig. 1b). In both sites the larvae were located in temporary ponds. At the first site, located 297 m above sea level, we captured two specimens (an example is shown in Fig. 2) and at the second site, located 700 m above sea level, three specimens were found.

These records fill the void that existed between two main northeast Algerian populations, Kabylie (50 km to the west) and Mont Edough (110 km to the east; Fig. 1a). The newly discovered populations indicate that *S. algira* could be more widespread in Algeria than suggested by historical records, and the apparent discontinuity in its distribution could be due to insufficient survey effort. Suitable conditions for this species may exist in much of the northeast of Algeria, particularly in the coastal mountain ranges.

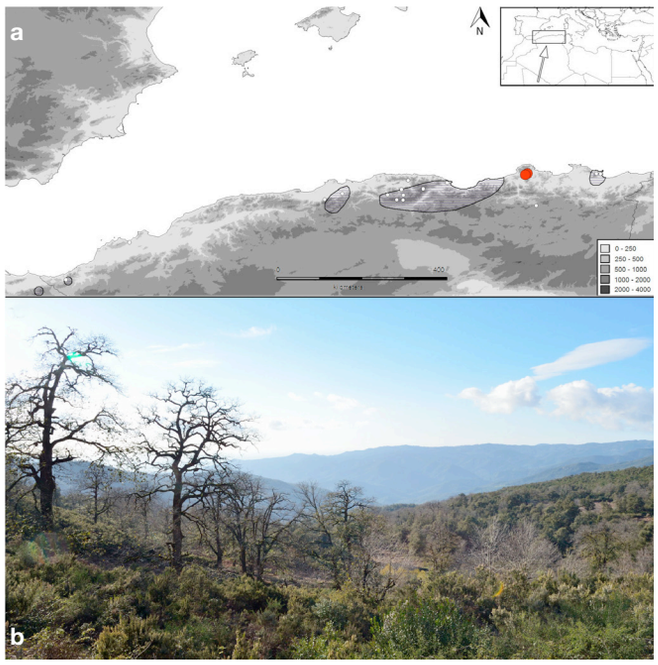

Figure 1. a) Distribution map of *Salamandra algira* Bedriaga, 1883 in Algeria. White dots, literature records. Shaded area, range according to IUCN (2014). Red dots, new records in the region of Skidda, northeastern Algeria. b) Habitat of *S. algira* around Zitouna. Mesic broadleaved forest of Algerian oaks *Q. canariensis*.

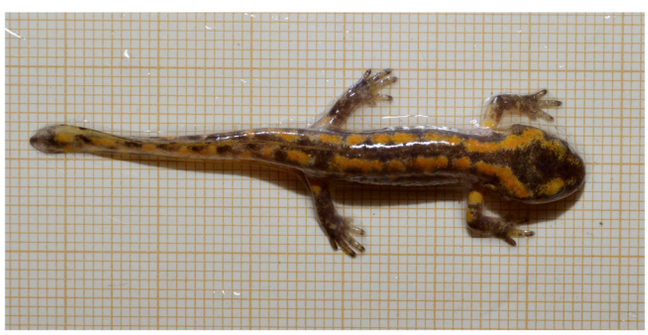

Figure 2. Prometamorphic larvae of *Salamandra algira*, found around Zitouna.

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Phalotris mertensi (false coral snake): Predation

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The false coral snake, *Phalotris mertensi,* is an endemic snake from Brazilian Cerrado (Lema, 1984). It has predominantly fossorial habits, displaying a mimetic pattern of coral snakes, covered with reddish dorsal scales with black apices and white and black cervical collars. This snake has diurnal and nocturnal habits (Lema, 1984; Sawaya et al., 2008), and similar to most reptiles from the Cerrado ecosystem, there is a lack of data on its natural history.

The burrowing owl *Athene cunicularia* is a small bird widely distributed in American continent, inhabiting savannas, deserts and urban areas (Del Hoyo, 1999). It feeds mostly on invertebrates, with less than 10% of its diet consisting of vertebrates (Motta-Junior & Alho, 2000).

Here we describe the predation of *P. mertensi* by the burrowing owl. The predation event occurred at 9:30pm on October 8, 2013, on Santa Bárbara farm (20°09'26/48°07'51"), in Miguelópolis municipality, São Paulo state, southeastern Brazil. As we drove along an unpaved road, located between a sugarcane plantation and an open grassland area, we observed a pair of burrowing owls with two chicks, less than 1m from the nest or burrow, attacking the snake. When they noticed our presence, the two chicks quickly entered the burrow and the adults flew to a nearby fence (Fig. 1). We found the *P. mertensi* specimen (36.5cm of total body) decapitated (Fig. 2), but still performing serpentine movements. The voucher specimen of *P. mertensi* is deposited in the herpetological collection of the Universidade Federal de Ouro Preto, Minas Gerais state, Brazil, under the label LZV1313S.

There is evidence that species presenting aposematic traits are less preyed-upon by birds (Brodie III, 1993). However this is the second record preyed upon a Burrowing Owl, the first being an *Oxyrophus rhombifer* (Sawaya et al., 2003).

Other species of snakes recorded as prey of *A. cunicularia* are *Bothrops alternatus* (Martins et al., 2003), *Bothrops neuwied pauloensis* (Valdujo & Nogueira, 2000), *Philodryas patagoniensis* and *Chironius sp*. (Vieira & Teixeira, 2008). Nevertheless, sightings of predation events are infrequent and usually accidental, and there are almost certainly other species of snakes preyed upon by this bird. Studies on the diet of these birds have revealed the occurrence of snakes in their regurgitations (Vieira & Teixeira, 2008). However, it is difficult to identify the content to species level.

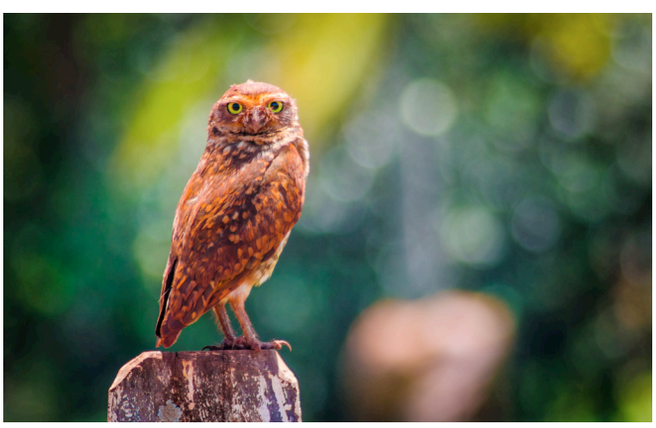

Figure 1: Adult of *Athene cunicularia* that preys on *Phalotris mertensi* in Miguelópolis municipality, São Paulo state, southeastern Brazil. Photo by A. J. R. Cruz

Figure 2: The specimen of *Phalotris mertensi* captured by the burrowing owl, in Miguelópolis municipality, São Paulo state, southeastern Brazil. Photo by A. J. R. Cruz.

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Natrix natrix (grass snake): Pale coloration

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The general coloration of grass snakes in Britain has been described as olive-green or olive-brown (Smith, 1964; Appleby, 1971; Beebee & Griffiths, 2000; Inns, 2009) although descriptions extend to include olive-grey (Smith, 1964), grey (Beebee & Griffiths, 2000) or grey-green (Inns, 2009). In the Sandlings of East Suffolk there has been a series of sightings of pale-coloured grass snakes that could be described as grey-green, but which appear distinctly different to conspecifics found elsewhere in the county. In 2007 two pale hatchlings were found on farmland bordering the River Alde near Snape, one of which is illustrated here (Fig. 1a). Two adult grass snakes with similar coloration were found in woodland near to Sudbourne, one photographed by Neal Armour-Chelu in 2007 (Fig. 1b), the other by Jamie Peters in 2009 (Fig. 1c). More recently (1 June 2014) Mark Jones found a pale-coloured juvenile, probably a one-year-old (33 cm total length), on the outskirts of Aldeburgh (Fig. 1d).

All of these snakes had dark markings and none had the pink eyes of an albino, yet most of them showed indications of hypomelanism. The bars and spots on the bodies of the younger snakes were fainter than normal giving them a lemon-yellow tint. Jamie Peters' snake from Sudbourne had a pink tongue (Fig. 1c). One of the hatchlings from Snape and the juvenile from Aldeburgh both had brown tongues, in contrast with the black, normally coloured tongue of the other Snape hatchling (Fig. 1a).

Pale coloured grass snakes have been found at two other locations; there have been two sightings in Epping Forest (e.g. plate 38 in Vaughan, 2014) and one in Cannock Chase (Mike Potts, pers. comm.) but otherwise this coloration appears highly unusual. The snakes described here were all found within a 4 km radius suggesting a relatively localised nature of this colour variation within Suffolk. It would be interesting to know whether there are clusters of similarly coloured grass snakes elsewhere.

I am grateful to Neal Armour-Chelu, John Goldsmith, Mark Jones, Jamie Peters, Mike Potts, Kevin Simmonds, Duncan Sweeting and Robert Vaughan for sharing observations and photographs of grass snakes.

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Fig. 1a. Hatchling from Snape showing black tongue (John Baker). **Fig. 1b**. Adult from Sudbourne (Neil Armour-Chelu). **Fig. 1c** Second adult from Sudbourne showing pink tongue (Jamie Peters). **Fig. 1d.** Juvenile from Aldeburgh showing brown tongue (John Goldsmith/Kevin Simmonds).

Nymphargus grandisonae (red-spotted glassfrog): Reproductive behaviour

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The family Centrolenidae (glassfrogs) includes about 150 species (Frost, 2014) of nocturnal Neotropical anurans that reproduce along streams. Egg laying typically occurs on vegetation or rocks overhanging water, where larval development occurs (Cisneros-Heredia & McDiarmid, 2007). Several studies have examined phylogenetic relationships (e.g Guayasamin et al., 2008), diversification patterns (e.g. Hutter et al., 2013a) and ecological and behavioural aspects of glassfrogs (e.g. Vockenhuber et al., 2008; Delia et al., 2010; Vargas-Salinas et al., 2014). However, details of the natural history of most species remains poorly documented. The red-spotted glassfrog *Nymphargus grandisonae* is a Centrolenid species for which information is available. Its tadpole, egg clutches, territorial behavior and diversity of auditory signals have been described (Hutter et al., 2013b), but there are no detailed descriptions about its reproductive behaviour. Here, we provide data about amplexus and oviposition behaviour of *N. grandisonae*. On 17 April 2014, we observed an amplectant pair of *N. grandisonae* in the municipality of Pijao (3° 55'10" N; 68° 7'36' W; 1747 m elevation), department of Quindío, central Andes of Colombia. To observe the behaviour we used red light to minimise disturbance. The amplexus was observed on the upper side of a large leaf at 260 cm height from water surface at 20:25 hrs (Fig. 1a). During 3.08 hrs of continuous monitoring, we observed the pair moving around the leaf before moving to other leaves then returning to the location of the initial observation. Possibly the female was looking for a place for oviposition. Frequently, the male exhibited muscle contractions in body flanks. Sometimes the male twisted his body separating his ventral area from the female dorsum, but always maintaining the axillary amplexus position. At 23:33 hrs the pair returned to the initial place of observation, but this time the female rotated her body and her posterior part was near the leaf edge; minutes later the oviposition began. From all places where amplexus was seen, this specific place was the one with lower height above water. The female laid several eggs while moving forward; simultaneously, the male also moved forward, but additionally raised the posterior portion of his body and moved his legs rhythmically in circular shapes (Fig. 1b-c). We assumed that by this time the male had released his sperm and the leg movements assisted in egg fertilization. The synchronized forward movement of female and male continued several centimeters until egglaying was completed. Later, the male moved away from the female dorsum and jumped to another leaf (~20 cm from the female); during the following eleven minutes the male emitted 13 auditory signals, which sounded similar to the advertisement call of the species. The female stayed motionless on the leaf for a short period (seconds) before moving backward gently and covering the egg clutch with her body (Fig. 1d-e). She remained on the eggs for more than 25 minutes. Male and female were captured and their body size (snout-vent length, SVL) was recorded with a digital caliper (SVL male= 27.94 mm, SVL female= 32.64 mm). The clutch consist of 61 eggs with a mean diameter of 2.12 mm ± 0.24 (N= 20). Females of other glassfrogs *Espadarana prosoblepon* and *Ikakogi tayrona* also stay covering their eggs for a time after oviposition (Jacobson, 1985; M. Rada, pers. comm. cited by Cisneros-Heredia & McDiarmid, 2007). It is not known if in *N. grandisonae* this behaviour enhances fertilization or increase egg hydration (i.e. maternal care). We hope our observations offer baseline data for further comparable studies in this and other taxa, to get a more comprehensive understanding of the evolutionary biology of Centrolenidae.

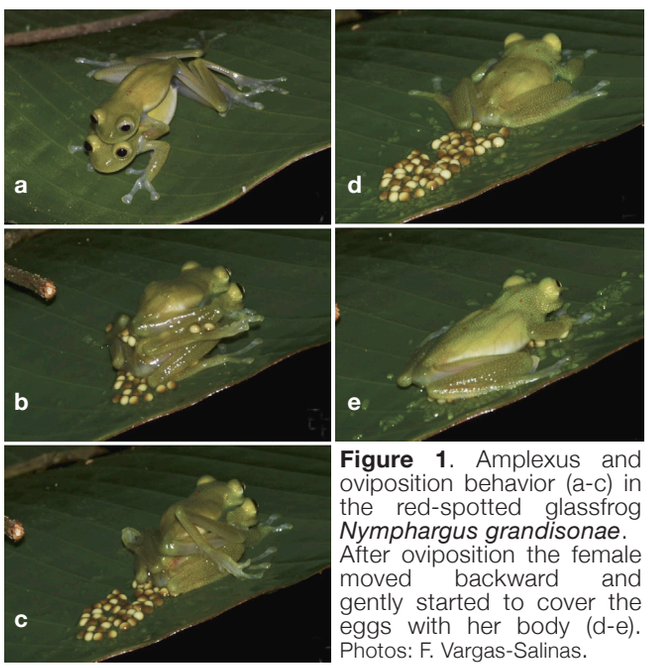

Figure 1. Amplexus and oviposition behavior (a-c) in the red-spotted glassfrog *Nymphargus grandisonae*. After oviposition the female moved backward and gently started to cover the eggs with her body (d-e). Photos: F. Vargas-Salinas.

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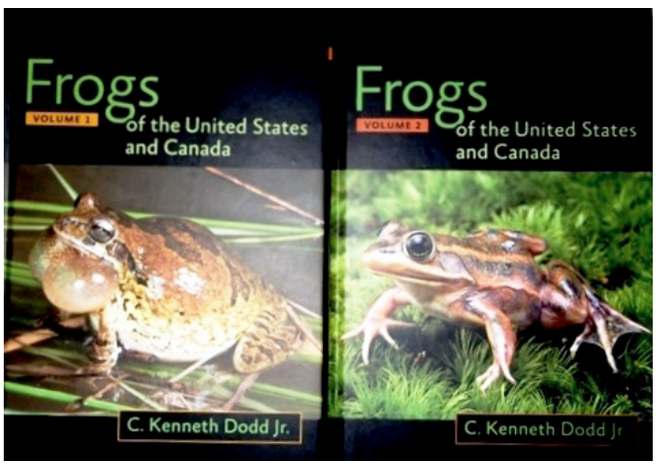
Frogs of the United States & Canada

C. Kenneth Dodd Jr. (2013)

Baltimore, USA: John Hopkins University Press. 982 pp. in 2 vols.
ISBN 978-1-4214-0633-6 and ISBN 978-1-4214-0633-0 (hardcover).



What a beautiful day! How tickled am I to be reviewing a really nice-looking book on North American anurans?! Well, pretty tickled actually because this synthesis is not by a jaded comedian from the Jam Butty Mines of northern England, but very well-respected US herpetologist C. Kenneth Dodd Jr. Though in two volumes, they are not stand-alone, the first volume contains a short introductory section and then hops right into species accounts on all the frogs, toads and treefrogs of the US and Canada arranged by family (Ascaphidae to Rhinophrynidae in the first volume). Volume 2 covers Ranidae, Scaphiopodidae and established non-natives, but is slightly the larger of the volumes as it also contains the extensive Bibliography! You will of course need this to delve into the individual studies these volumes cover. So the reason for division into two tomes is for practicality, ease of handling and because of the sheer detail and wealth of information contained in this immense work.

Unlike many such specialist books, the Introduction is not laboured (thank goodness), providing the essentials on frogs and toads, including anatomy, evolution and life history in just a few pages, before listing the protected species of the US and Canada and an interesting short section on the etymology of North American generic names (who knew that Hyla was named after an Argonaut?). The last part of the introductory section explains that the work is not intended as a field key or guide, but rather as a synthesis of the huge volume of work covering North American anurans…

The bulk of the two volumes is therefore devoted to substantial Species Accounts, each arranged in a standard format beginning with specific etymology and alternative scientific names. Identification of all life stages is then followed by distributional information with a map for every species. A nice feature of what might otherwise become visually "samey" over its full length is the inclusion of clear colour photos of both the animals and their habitats and, where needed, diagrams to aid species diagnosis (such as of the parotoid patterns of the various toads). If you're interested in systematics and geographic variation, there's plenty of that where it's available (though of course as in the rest of the world the available knowledge varies according to the amount of work carried out to date on each species).

What I think many batrachogeeks like myself might find most fascinating, however, is the distillation of information (with references) on species' habitats, ecology and breeding behaviour - with headed sections such as "Calling Activity and Mate Selection" separated out from simple "Reproduction". These sections (and the work in general) will provide both a good read and a source for casual reference over time. As if that weren't enough, there are data on diets, diseases, stressors and "Status and Conservation" to satiate you no matter what your particular area of interest. The conservation sections are a good way of ending each species account and put the state of knowledge on each species into contemporary context. No choruses of the Mexican burrowing toad have been heard within US borders since 1984, for example, though the species remains protected in Texas. In these troubling times of global amphibian declines, such status information might unfortunately prove of greatest long-term import and I have no doubt this particular Ken Dodd's work will be a benchmark for comparisons for a while to come. So, if you're interested in anurans, North American herpetology or species status, or just want to add a fine reference book to your collection, put away your tickling-sticks, get out your Christmas book tokens and get this on your shelf!

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Frogs of the United States & Canada

C. Kenneth Dodd Jr. (2013)

Baltimore, USA: John Hopkins University Press. 982 pp. in 2 vols.
ISBN 978-1-4214-0633-6 and ISBN 978-1-4214-0633-0 (hardcover).

With one-third of all amphibians now considered threatened worldwide and a further 168 amphibians having become extinct within the last two decades; clearly, these are treacherous times for many frogs, as many of the species accounts contained within the Frogs of the United States and Canada indicates.

This beautifully presented and illustrated set of books is the obvious culmination of blood, sweat and tears by C. Kenneth Dodd Jr and his long list of people who provided help with literature and information; straight away capturing why many of us got into biology and herpetology: "First, nature fascinates me. I have always been astonished at the diversity of life and how the sum total of its parts, from basic chemistry through physiology and genetics all the way to immense ecosystems, still cannot explain the essence and "why" of life." and "The second reason for becoming a biologist was the dread of working in an office building. I wanted to be outdoors, not anchored to a desk; if there were canyons and forests and wild animals "out there", why be inside?".

Frogs of the United States and Canada is a hugely informative and comprehensive desk resource that has exquisite attention to editorial detail. Encompassing such a large geographical range, it is not surprising that this book is a hard hitter amongst those describing amphibians, covering 106 species, over 1062 pages within the 2 volume set. Designed to synthesize the literature on all frogs of North America; north of the Mexican border, it collates an impressive 4,500 of the most pertinent papers, ranging from the 1700's to mid-2011 and is more targeted to researchers, students, conversationists and professionals, working within the field than amateur herpetologists and naturalists. The author does however state that no attempt has been made to cite every paper, note, thesis or dissertation ever published on North American frogs.

Instead of being split into chapters, the books are quite sensibly broken down by Family, of which there are 10: Ascaphidae (the tailed frogs), Bufonidae (true toads), Craugastoridae (the barking frog), Eleutherodactylidae (chirping frogs), Hylidae (cricket, common tree, chorus and burrowing frogs), Leptodactylus (the Mexican white-lipped frog), Microhylidae (the narrow-mouthed and sheep frog), Rhinophrynidae (the mexican burrowing toad), Ranidae, Scaphiopodidae (spadefoot's), as well as the description for a further six established non-native species. Within the description for each family (or in the case of invasive species; species), the books are split down by Genus and Species, where for each species there are a number of suitably informed sub-sections providing species-specific details on their nomenclature, etymology, identification, distribution, fossil record, systematics and geographic variation, adult habitat, terrestrial and aquatic ecology, calling activity and mate selection, reproduction, larval ecology, diet, predation and defence, population biology, community ecology, diseases, parasites and malformations, susceptibility to potential stressors, status and conservation. Each description is nicely accompanied by images of various life-stages of the individual, its preferred habitat, distribution maps. The author explains that the identification of most species of North American frogs is relatively straight-forward, and "the verbal descriptions and photo-graphs of postmetamorphs should provide sufficient for identification", however, in some circumstances identification sketches have been provided within individual species descriptions.

There is one drawback to a book of this magnitude and size. It is anticipated that with the current level of interest in the field of herpetology, some of the research contained within these books will have already been expanded upon date before it even made it to print (August 2013). It does however provide an excellent benchmark which should be expanded upon by reader.

To sum it up; these books are quite simply a must for researchers, students, conversationists and professionals working with frogs and toads in North America and Canada and are not to be read from cover to cover. They are more specifically designed to be dipped in-and-out-of for that species information which is of the most interest as attention to detail and extensive referencing helps any reader grasp the important of the work which has been/currently is being undertaken with the reduced distribution for a number of species provides sobering reading.

Unfortunately, it would be impossible to comment on every species within these books which provides personal interest in this single review for the Bulletin, but I hope by offering a taste of its overarching, encompassing content; it will enthuse readers to buy a copy. Its price [at £93.50] does however reflect what one would expect for its size and content.

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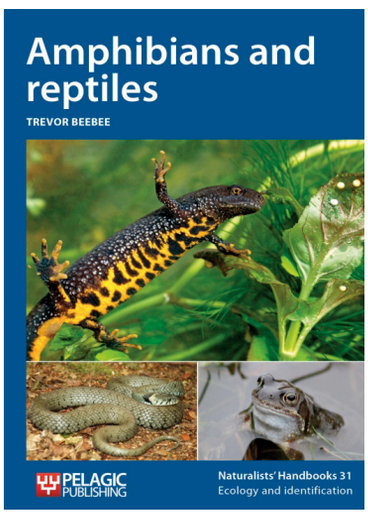
Amphibians and Reptiles (Naturalists' Handbook 31)

Trevor Beebee (2013)

Exeter, UK: Pelagic Publishing. 170 pp. ISBN 978-1-907807-45-9 (softcover).



This book is the thirty-first in the Naturalists' Handbook series, recently revived and revitalized by Pelagic Publishing having been published previously by a number of other stables (including Cambridge University Press). It is a comprehensive guide to all the UK's native and established non-native species.

There are effectively three sections. The first (divided into different chapters) covers biology, ecology, conservation, surveying and studying amphibians and reptiles, and also has a very useful chapter on *How Schools Can Help*, which I think will be popular. Educators will glean ideas for class study of these taxa and, perhaps more importantly, a few pupils might begin to find tadpoles more interesting than *Grand Theft Auto 5*. The earlier chapters are just as interesting though - written to be accessible to a wide audience, cynical herpetologists and novices alike will find something of interest. For the latter, terms such as oviparous are explained with periodic marginal notes (so no need to continually turn to a Glossary) and textual points are well illustrated with clear colour photos. A full list of native and established UK species is given and so are diagrams showing the family (taxonomic) relationships of amphibians and reptiles, and where British genera sit within them. The chapters on surveying and studying are particularly informative, and Trevor doesn't shy away from technical terms, supported by appropriate graphs and diagrams where these are required. This overall approach is one that fosters understanding and interest.

The middle section of the book is devoted to identification. There is a colour photo of just about everything and these are divided by life-stage (eggs, tadpoles, adults etc.), rather than by species, to allow comparison! I haven't seen that for a while. The only illustrations lacking appear to be those of frog and toad metamorphs… so good job there's a clear and simple key to all species and stages and which refers directly to the photographs. Phew. Is this the first book in which I've seen a picture of a natterjack tadpole's chin patch? Well, yes, it is. You can find distribution maps and habitat information here too. The final section contains advice on working with amphibians and reptiles, and again I think it will be popular. There's common sense here but also useful information for those craving a career or course of study involving herpetofauna (including a bit on statistics, don't be scared!).

We can usually expect two things from a new book by Trevor Beebee - the benefit of a lifetime's experience and, of course, clear, well-written text. I think both are delivered here. A non-UK colleague of mine told me he found this book "inspiring"… add to that the fact that the author royalties are being donated to *Amphibian and Reptile Conservation* and there's really no reason not to buy it! Unless of course you're lucky enough to have been sent a review copy…

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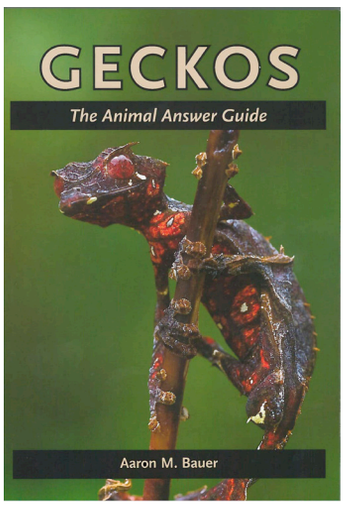
Geckos: The Animal Answer Guide

Aaron M. Bauer (2013)

JHU Press, 192 pp, ISBN 978-1421408538



You'd be forgiven for thinking this to be a kid's book judging by the title, but a glance at the authors name will make you realise that this is more than that; Aaron M. Bauer has been working with geckos for many years and has published hundreds of papers based on his research. This accumulation of knowledge allows him to answer a range of questions in a clear and informative way, that add up by the end of the book into a very good overview of gecko natural history and biology. Technical terminology doesn't feature too heavily and when it is in a laid back and non-threatening way that should encourage readers with varying degrees of knowledge to enjoy the book. Gecko classification, potentially difficult to explain to a non-herpetologist, is dealt with in a very clear way, and the discussion of diurnal and nocturnal activity and the relevance of temperature and competition is concise and jargon-free but still very informative. The explanation of autotomy and it's consequences is as good an introduction to the subject as I've seen. The question and answer format might put some people off but I'd recommend persevering; the simple 'Do all geckos lay eggs?' for example was followed by an answer that manages to discuss viviparity, oviparity, the effects of temperature and geography, embryonic survival and growth rates as well as the general evolutionary aspects involved - in about two pages! Also included are a few brief but sensible sections dealing with geckos in captivity.

All information presented here seems totally up to date, there is a selected bibliography pointing to further sources of information and a complete and informative list of all known gecko species. There are two very good sections of colour plates and many black and white photos throughout. Although well placed to explain and illustrate points in the text, about half of them appear rather too dark which is frustrating and detracts slightly from the overall feel of the book. Ignoring that and the odd typo and mistake that crop up in the second half, this book is a success. To make science and herpetology in particular, accessible and interesting to a wider audience has to be a target for us all if we are to enhance people's understanding and appreciation of, and therefore potential to care about and conserve these animals. If ever a reptile group is going to win over non-herpers surely it must be the geckos with their wide range of colours and patterns, frequent presence around humans and their harmless nature. But don't be put off if you are already well read in the world of lizards - I certainly found a number of nuggets of information that I wasn't aware of and this book is by no means 'just' for a general readership. Respect is due to Aaron M. Bauer for distilling vast amounts of information into a very readable summary of gecko biology, diversity and ecology.

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