ISSN 0260-5805

THE BRITISH HERPETOLOGICAL SOCIETY

BULLETIN

No. 30
Winter 1989

BRITISH HERPETOLOGICAL SOCIETY

c/o Zoological Society of London
Regent's Park, London NW1 4RY

Correspondence, membership applications, subscription renewals and purchase orders for the British Journal of Herpetology should be sent to the above address.

The British Herpetological Society was founded in 1947 with the broad aim of catering for all aspects of interest in reptiles and amphibians. Initiated by a small number of enthusiastic and well-known naturalists, including the first President and author of the standard textbook on British herpetofauna Dr. Malcolm Smith, the Society expanded rapidly and today enjoys national status with many international connections.

Activities of members range over a number of interrelated fields. In many cases the prime interest is in maintaining, breeding and observing various species in captivity and the Society acts as a forum for the interchange of experiences in this area. Others are concerned with the observation of animals in the wild state. There are active sub-committees which help to cater for these various tastes, notably the Captive Breeding Committee and the Conservation Committee. The former encourages the development of effective breeding techniques for captive specimens, thus providing animals for observation and study in vivaria, and for conservation purposes, while simultaneously reducing the need to take fresh stock from wild and possibly declining populations. The Conservation Committee is actively engaged in field study, conservation management and political lobbying with a view to improving the status and future prospects for our native British species. It is the accepted authority on reptile and amphibian conservation in the U.K. and has an advisory role to the Nature Conservancy Council (the statutory Government body). There are also professional scientists within the ranks of the Society engaged in increasing our understanding of all aspects of reptile and amphibian biology.

Meetings

About ten meetings covering a broad sphere of interests are held each year.

Subscriptions

Ordinary Members £15. Junior Members £5. (Junior Members do not receive the British Journal of Herpetology). Institution rates £25 (U.S. $40).
All subscriptions become due on the first day of January each year.

The Bulletin is edited and produced by
John Pickett and Simon Townson

Contributions and correspondence arising from the Bulletin should be sent to:
John Pickett, 84 Pyrles Lane, Loughton, Essex IG10 2NW

FRONT COVER
Male Alpine Newt from a garden pond colony in the north of England. See *Alpine Newts in North East England* by Brian Banks, page 4.

LONDON MEETINGS 1990

Meetings are held either in the Lecture Theatre of the Linnean Society of London, Burlington House, Piccadilly, London W1 (*), or in the Lecture Theatre of the Zoo Studies Centre, Zoological Society of London, Prince Albert Road (opposite Ormonde Terrace), London NW1 (**), and start at 7.00 pm, ending at 9.00 pm, unless indicated otherwise.

February 27th*	Dr Robert Bustard (Perth, Scotland): Keeping and breeding chameleons on the Isle of Man.
March 27th*	A.G.M. (see separate Agenda) followed by Mr David Bird (BHS Council): Herpetofauna of Yugoslavia, especially Dalmatia.
April 19th*	To be arranged.
May*	To be arranged. Full details and date to be issued later.
June 10th	Dr T.R. Halliday (Open University; Chairman, BHS Research Committee) (organiser): Behavioural ecology of newts and salamanders. Other contributors: Dr J.W. Arntzen (Institute of Taxonomic Zoology, University of Amsterdam, the Netherlands) and Dr R.A. Griffiths (North-East Surrey College of Technology; Deputy Chairman, BHS). Meeting starts at 5.00 pm in the Lecture Theatre, Zoological Society of London, Outer Circle, Regent's Park, London NW1. BHS members welcome.
Late June* (or July) – date later	*Amphibia and Reptilia worldwide: their care and breeding.* A discussion organised by the Captive Breeding Committee (Chairman: Mike Linley). Members are encouraged to bring live animals, preserved specimens, amphibian voice recordings and 35 mm colour slides for display and to illustrate discussions.
September** – date later	*Care and breeding of amphibians and reptiles: an open meeting.* Contributions from members – live animals and photographic displays. There will be the opportunity for the sale and exchange of members private home-bred stock. A Saturday Afternoon meeting from 2.00 to 5.30.
October 10th*	Mr Mark O'Shea (Wolverhampton): Reptiles, especially snakes, of Papua New Guinea.
November 13th*	To be arranged.

1990 SPONSORED TOAD LIFT

ON BEHALF OF THE BRITISH HERPETOFAUNA CONSERVATION APPEAL

The British Herpetological Society's Conservation Committee (BHSCC) is mid-way through an appeal to raise money to safeguard once and for all some of the key sites for rare amphibians and reptiles.

They intend to do this by site purchase or lease and long term management and, with the assistance of the WorldWide Fund for Nature (WWF) and the Nature Conservancy Council (NCC), have already purchased two sites and have secured long term leases on a number of others. These sites are predominantly heathland or dune habitat, the former being the only habitat used by both the Sand Lizard and Smooth Snake and the latter being vital to the survival of the Natterjack Toad in Britain. The dune systems of the Lancashire coast also support the extremely endangered Northern race of the Sand Lizard.

All three of these animals are now very rare but even so they are still under increasing pressure as suitable habitat continues to disappear at an alarming rate. Both habitat types are also important for other plants and animals and the BHSCC management regimes, developed from over 20 years practical experience, benefit a wide variety of wildlife including several other rarities. Both habitat types are internationally recognised as endangered and Britain contains some of the best remaining examples. Other conservation organisations, particularly the RSPB, are mobilising their resources to protect what is left, but more still needs to be done.

During 1990, the BHSCC hopes to raise over £100,000 to help fund this important aspect of their work, and one campaign that they are launching is based on the annual assistance that many people now give to Common Toads as they cross roads on the way to their breeding ponds.

The '1990 SPONSORED TOAD LIFT' involves volunteers asking their friends, relatives and colleagues to sponsor each toad that is successfully 'helped'. The BHSCC are hoping to attract significant publicity for the scheme with the message that if every Common Toad assisted this spring raised just £1, the BHSCC would exceed its target of £100,000. This sum could enable several hundred acres of unique and valuable wildlife habitat to be secured and managed solely for conservation.

Contributions from other fund raising activities will also be extremely gratefully received and similarly acknowledged. Cheques and POs should be made payable to the British Herpetological Society Conservation Committee. Every organisation (or individual) raising in excess of £50 will be rewarded with a Gift of Land Certificate and will receive regular details about the usage of the fund.

More details, together with sponsorship forms, can be obtained by sending a stamped addressed envelope to: BHSCC, PO Box 126, Farnham, Surrey GU10 3QL.

The British Herpetological Society (BHS) is a registered charity, Registered Number: 205666.

HUNGARIAN TOAD ACTION GROUP MEETING

The Toad Action Group (TAG) of ELTE Nature Conservation Club, Budapest invites foreign participants to its 3rd international spring camp which is to be held at Parassapuszta, Hungary from 30th March to 8th April 1990. The 1989 camp was attended by conservationists from Czechoslovakia, East Germany, Netherlands and the United Kingdom. The camp focuses on practical amphibian conservation and the collection of scientific data. Participants are also invited to give presentations on current conservation issues and should take appropriate materials. The only necessary individual costs are for food and transport. For more details contact Miklós Puky, Hungarian Danube Research Station of the Hung. Ac. Sci., 2131 Göd Jávorka S. u. 14, Hungary.

NEW THREAT TO ALYKI TORTOISES

ADRIAN HAILEY

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After my intensive work in Greece from 1984-1986, I revisited Alyki in May/June 1988 and April 1989, handling 880 and 960 individual tortoises. The total number marked now stands at 4150, on which 14,000 captures have been made. Analysis of these results is continuing in the direction of population dynamics, especially regulation by female mortality and its effect on the sex ratio. The recent references are given below; I'm sorry there are no more reprints from these papers.

The heath was still in good condition in spring 1989, and the hawthorn bushes were regenerating. However, I was informed by Dr. V. Goutner of the University of Thessaloniki, that the local villagers had regained control of the site, and building was expected this summer or next. These were the people responsible for burning and ploughing the site in 1980, causing the death of about half the tortoises (see Biol. Conserv. 31: 125-152, 1985).

I am currently editing a short book on the site, with about equal weight being given to the tortoises and to the sea birds of the lagoon, which are also threatened and which have been studied by Dr. Goutner and his group from Thessaloniki. This document will be used in a campaign to save the site, mostly aimed at the European Commission in Brussels; the Greek conservation legislation is ineffective.

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ALPINE NEWTS IN NORTH EAST ENGLAND

BRIAN BANKS

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This continental newt has been introduced to a number of sites in southern England where it has succeeded in establishing viable populations, often in garden ponds. This article concerns the former presence of two populations of this newt considerably further north, in Sunderland, (north-east England).

One population was established in a garden pond at NZ 383 552 shortly before the 1981 Wildlife and Countryside Act came into force. The introduction stock consisted of two pairs of animals, derived from a garden population in Brighton, released as an experiment to test the newts adaptability to the cool climate of the area. The pond was about 4m in area with vertical sides down to a maximum depth of 1m. It was stocked with goldfish but had thick growths of aquatic plants which provided good cover for newt larvae. This pond was surveyed in 1982 (Banks and Laverick, 1986) but the presence of the newts was not reported as at that time a colony was not properly established.

Breeding in the first season was successful with many young newts metamorphosing in late August. During the following two years only one male was found, but three years after the introduction several adults were found in the pond and breeding continued here until the spring of 1988. The pond was subsequently infilled when the property was sold and as there are no other garden ponds in the vicinity this population is likely to have become extinct.

In 1984 a totally separate population was discovered in a large concrete lined pond in the grounds of the Sunderland Polytechnic buildings more than three kilometers away at Doxford Park (NZ 375 528). This was a considerably larger pond, about 30m by 10m and again at least 1m deep. It was stream fed, but during the summer the stream dried-up and as the concrete liner was cracked the pond tended to dessicate in late summer. Like the other pond

The former breeding pond at Doxford Park with the usual complement of children with nets.

Smooth Newts were present, and there were also fish too, although in this case they were Sticklebacks which invaded the pond via the stream. Water weed, other than filamentous algae was absent. I heard of the newts via local children who went fishing there but visits in the spring of 1984 and 1985 yielded only sightings of individual animals, as the pond suffered dense algal blooms. However on a visit in August 1985 I removed a sample of 12 newt larvae from a drying puddle that contained many specimens. Ten of these later turned out to be Alpine Newts, distinguished by the blue-grey marbled colouration, immaculate yellow-orange belly and a short orange vertebral stripe on the centre of the back. I have no doubt that Alpine Newts were relatively abundant at this site.

The origin of the newts is unknown, however the demise of this colony can be reported, for I understand that the pond was infilled by 1987. As it was regularly fished by local children it is possible that there are now other local populations of this colourful newt established in the area and this may be worthwhile considering if local amphibian surveys are planned in Sunderland in the future.

It is clear that the Alpine Newt can survive the cool climate of the north-east of England, and in particular the cool summers, and this suggests that it has the potential to survive over much of lowland England although it will require more prolonged survival of breeding ponds if the species is to survive and spread elsewhere in Britain.

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ON THE DISTRIBUTION OF THE PALAEARCTIC NEWTS (GENUS *TRITURUS)* INCLUDING THE DESCRIPTION OF A FIVE SPECIES POND IN WESTERN FRANCE

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INTRODUCTION

Since the publication of Thorn's (1968) excellent handbook on the biology of the Palaearctic salamandrids twenty years ago, a large amount of data has accumulated in the literature. Most attention has been given to those species that have their distribution in western Europe. The knowledge of *Triturus*, the genus of Palaearctic aquatic salamanders, has especially profited from the increased interest in amphibian biology. Ecological studies by our collegues and ourselves on the amphibians of western France and the updated distribution maps presented by Macgregor, Sessions and Arntzen (1989) provide the focus for the present observations. The paper is in two parts. The first part concentrates on the distribution and ecology of five species of newts in the département (province) of Mayenne in western France. In the second part we relate our observations to the overall distribution patterns in *Triturus* and try to provide an explanation for the high number of species that can be found in France.

SYMPATRY OF FIVE SPECIES IN FRANCE

The approximate boundaries of the ranges of the five species of *Triturus* found in France are shown in Fig. 1. *T. helveticus* is the most widespread and can be found all over the country, with the exception of the alpine region in the southeastern part. *T. alpestris, T. cristatus* and *T. vulgaris* are distributed over the northern and central parts of France. The southernmost occurrences of these three species are recorded in the east; in western France *T. vulgaris* has a wider distribution than the other two species. The distribution of *T. marmoratus* is restricted to the central and southern parts of the country. The area in which all five above-mentioned species show range overlap is a relatively narrow zone in central France. Towards the west the zone is wider than in the east. This zone accommodates the maximum number of *Triturus* species (five) to be found sympatrically. Indeed, the presence of the five species was reported from the vicinity of Rennes (Abbayes, 1932).

In 1979 an inventory was made by J. Schoorl and A. Zuiderwijk in the département Mayenne which is located in the centre of the widest part of the zone of sympatry. Their records and additional data have been presented by Evrard and Daum (1982) in a grid system with rectangular areas ('squares') of approximately 7 x 10 km. This grid system is based on the French topographical maps of the Institute Géographique National. The maps of scale 1/50,000 cover eight squares.

Three major landscape types can be recognized in Mayenne (Fig. 2). The northern part is hilly and forested, the southern part is flat and open, and the central part is flat and forested. This latter landscape type, the so-called 'watery area' of Schoorl and Zuiderwijk (1981), is characterized by a hydromorphic soil and many ponds can be found in this area. Although the inventory of Schoorl and Zuiderwijk comprised the whole département and over 300 sites were investigated, a pond accommodating all five newt species was not documented. *T. helveticus* is widely distributed all over the département and recorded from all three landscape types. In Mayenne, *T. helveticus* is the most abundant amphibian species (Schoorl and Zuiderwijk, 1981), recorded in 55 squares. When the squares that are located partially outside Mayenne are omitted from the analysis, the species occurs in 46 out of a total of 57. Accordingly, the index of presence *(P)* of the species can be computed at (46/57) x 100% = 81%.

T. alpestris and *T. vulgaris* are the rarest newt species in Mayenne (Schoorl and Zuiderwijk, 1981), with *P* values of 19% and 14% respectively. *T. alpestris* is found in the southwestern

Figure 1. The distribution of the genus *Triturus* in France (after Macgregor, Sessions and Arntzen, 1989). Indicated are the approximate range borders of : *T. cristatus* (open round symbols), *T. marmoratus* (solid round symbols), *T. alpestris* (triangle symbols), *T. helveticus* (open square symbols) and *T. vulgaris* (sold square symbols). Symbols are placed at the inner side of the species' ranges. In black : the département Mayenne.

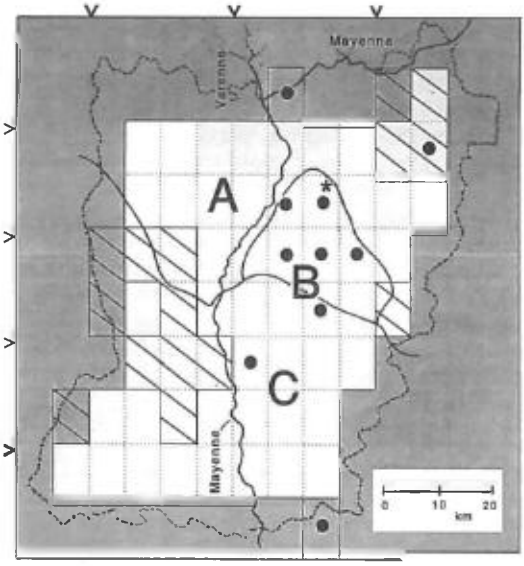

Figure 2. Schematic representation of the distribution of newts in dept. Mayenne, France, according to Schoorl and Zuiderwijk (1981), Evrard and Daum (1982) and observations of the authors. *T. cristatus* is found in area B, C and sporadically in A, *T. marmoratus* is found in area A, B and occasionally in C. *T. alpestris* is found in the hatched 'squares'. *T. vulgaris* is widespread in area B and found occasionally in area A and C (squares indicated by solid round symbols). *T. helveticus* is found in most squares all over the département (light shading); records from squares (partially) outside Mayenne are ignored. The location of the newly described five species pond is indicated by an asterisk. Landscape types are: A - hilly area, B - pond rich area with hydromorphic soil, C - flat area, according to Schoorl and Zuiderwijk (1981). The dark shaded squares are the ones located (partially) outside the département Mayenne. Arrows at the edge of the map refer to the formats of the topographical maps of scale 1/50,000.

and the northeastern corners of the département and at the southeastern corner of the hydromorphic soil area. *T. vulgaris* is recorded from ten squares in the east of the département; as yet no populations of *T. vulgaris* have been found west of the rivers Varenne and Mayenne (Fig. 2). Most records come from the area with hydromorphic soil. The more detailed inventory that we performed in that area indicates that the species may well have a wider distribution than is documented. We found it in 35 out of 91 ponds investigated, but often in low frequencies. Large samples of newts are generally required to demonstrate its presence. In six ponds only *T. vulgaris* was more abundant than *T. helveticus.*

The two large bodied species, *T. cristatus* and *T. marmoratus,* for which *P* is 56% and 46% respectively, are widely distributed. *T. marmoratus* is distributed in hilly and forested areas in the northern parts of Mayenne and occasionally in the south, while *T. cristatus* is abundant in the flat areas in the south of the département and found sporadically in the north. Detailed field studies indicate that these species generally have mutually exclusive, parapatric rather than sympatric distributions (Zuiderwijk, 1980; Schoorl and Zuiderwijk, 1981). The area with hydromorphic soil in the centre of Mayenne is exceptional as it accommodates both species, often coexisting in the same pond (Arntzen, 1986).

Assuming a random distribution of newts over the département and a random inventory, the probability of finding a square with all five species can be calculated by multiplication of the recorded *P* values. The result predicts a small chance (approximately 0.6%) of recording five species in a single square. The relative scarcity of some species of *Triturus* in Mayenne, combined with the parapatric distribution pattern of others led us to believe that four was the maximum number of species to co-exist in a pond. All the greater, then, was our surprise when one of us (PdW) demonstrated the occurrence of *T. alpestris* in a pond at the edge of the hydromorphic soil area, where the other four species were also found.

The pond is situated 1 km north of the hamlet of Grazay (Fig. 2) in a small piece of wood surrounded by meadows. The site is a former quarry of manganese. The quarry was created early in the 19th century and in use till 1840. Later on it served as a refuse dump. When the dump was covered up, the size of the pond was substantially reduced (B. Cheminau, pers. comm.). The main feature of the pond is its heterogeneity (Fig. 3). It has a large irregular surface area of approximately 1500 m^2, with shallow – deep (2.5 m), shaded – sunny and vegetated – nonvegetated parts. In early spring, parts of the surrounding woods are flooded. In exceptionally dry years it may dry up completely but generally the pond is permanent. Dominating plant species in the pond are *Lemna* sp., *Hottonia palustris, Ranunculus* sp., *Iris pseudacorus, Oenanthe aquatica* and the algae *Cladophora* sp. Due to forestry work many trunks and branches are laying in the water. Three visits to this pond during the reproductive season of the newts in 1987 gave the following catching results: 2 *T. cristatus,* 2 *T. marmoratus,* 6 *T. vulgaris,* 15 *T. helveticus* and 53 *T. alpestris.* During a visit in early April 1989 again the five species were found (1 *T. cristatus,* 3 *T. marmoratus,* 3 *T. helveticus,* 9 *T. vulgaris* and 17 *T. alpestris).* All males were in breeding condition and the females were spawning. To the best of our knowledge this is the first record of a pond that accommodates five species of *Triturus.*

In Mayenne, a number of ponds with four species have been recorded and more often than not *T. alpestris* is the missing species. The distribution pattern of *T. alpestris* all over Europe indicates that it is a mountain dwelling species. This is particularly clear at the southern edges of its range where relict populations are found in mountainous regions. Also, it is a newt that is more often found in shaded ponds than any of the other species. In Mayenne, however, a preference of *T. alpestris* for the northern hilly area is not evident, nor is *T. alpestris* recorded from any of the large forests. As yet we do not know how to explain its fragmented distribution in this area.

DISTRIBUTION OF THE GENUS *TRITURUS*

Newts of the genus *Triturus* are found in all European countries with the exception of Iceland and Malta. Some species occur in adjacent parts of Asia, such as Turkey, Iran, Syria, Lebanon and Israel. Fig. 4 is a somewhat simplified map representing the co-occurence of species, based on the updated distribution maps for all twelve *Triturus* species by Macgregor, Sessions and Arntzen (1989). It demonstrates that newts are absent in the colder areas of northern Europe

Figure 3. Pond accommodating five species of *Triturus*.

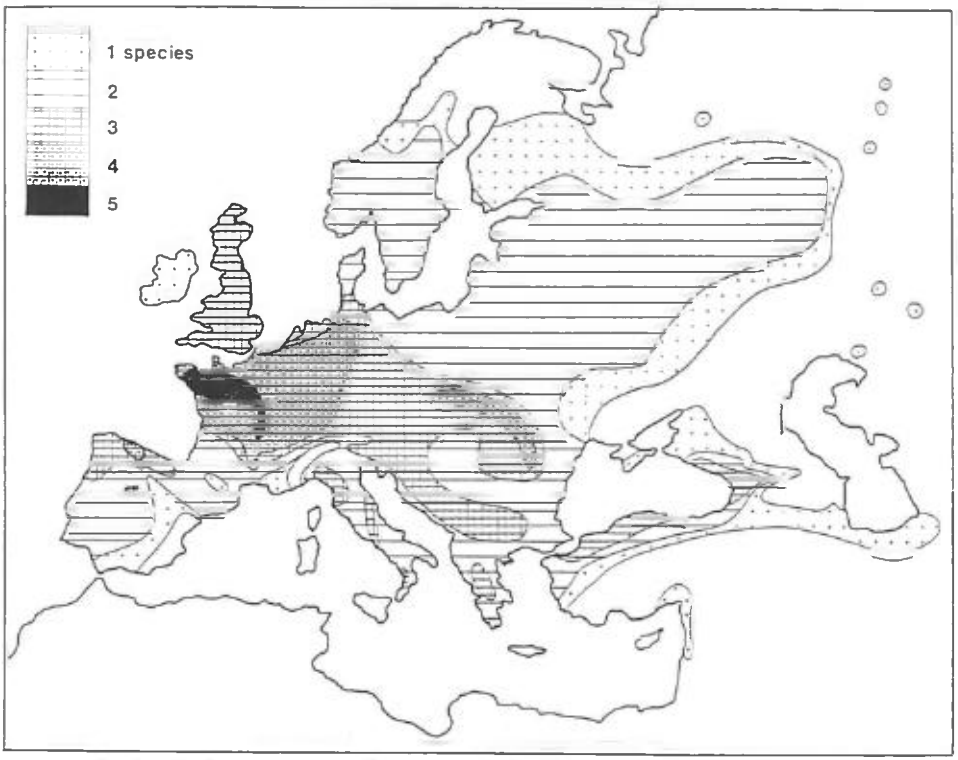

Figure 4. Species density contour map for the genus *Triturus* (simplified after Macgregor, Sessions and Arntzen, 1989).

and in the drier areas of the southern USSR and the Middle East. The highest rate of species density is found in western Europe. In our opinion two factors are influencing this pattern of species distribution, a climatological and a historical one.

High levels of annual rainfall are found in the subatlantic region. The rainfall pattern clearly coincides positively with the species density distribution of *Triturus*. This interpretation of the distributional and pluviometric maps is enforced by the fact that a relatively high number of species (three) is found to the south and east of the Black Sea, an area characterized by high precipitation (Schmidtler and Schmidtler, 1967). Precipitation appears to be an important factor in the distribution of newts. An exception to the general pattern is found in the upper regions of the Pyrenean Mts. and at the southern fringes of the Alps. Most secondary mountain ranges have relatively high rates of species density. A major component of this pattern is the distribution of two mountain dwelling species: *T. montandoni*, a species endemic to the Oder and Carpathian Mts., and *T. alpestris*. For North America, Kiestler (1971) concludes that species diversity of the Amphibia is positively correlated with secondary mountain regions and with annual rainfall. We conclude that the main parameters influencing species diversity of Palaearctic newts are the same as those for the amphibians of the Nearctic.

Secondly, we have to consider the biogeographical history of the newts in the light of the Pleistocene climatological events known as the Ice Ages. The harsh climatic conditions in the northern parts of Europe made life impossible for newts. Refuges during the last Ice Age can be hypothesized in a straightforward way from the present-day distribution of the species (Zuiderwijk, 1980; Wilkinson, 1988). The southern European peninsulae (Iberian, Apennine, and Balkan Peninsula) are likely pleniglacial refuges for newts as well as for many other plant and animal species, while the refuge of *T. montandoni* may have been situated in the southern part of the Carpathian mountains. When the climatic conditions improved at the end of the Weichselian, about 12,000 BP, the species were able to recolonise central and northern Europe. Some species, but not all, reached the British Isles before they became separated from continental Europe by the rising sea level (see Wilkinson, 1988, and references therein).

The actual distribution pattern of newts and that of European amphibians in general, indicates that the postglacial invasion of northern Europe was most successful from the southwestern (Iberian Peninsula) and the southeastern (Balkan Peninsula) refuges. Few species found a refuge in the Apennine Peninsula, probably because it is more isolated from the rest of Europe (by the arc formed by the Alps) than the other peninsulae are (Zuiderwijk, 1980; 1984). Zones of postglacial secondary contact are found all over Europe and well documented examples exist for various animal groups (Hewitt, 1988). In species that frequently or occasionally hybridize most of these zones seem to be narrow. Parapatric distributions are found more frequently than widely overlapping distributions. In the genus *Triturus* many such zones of secondary contact have been found, for example in southeastern Europe where the four members of the *Triturus cristatus* superspecies show an essentially parapatric type of distribution (Wall and Arntzen, 1989; Macgregor, Sessions and Arntzen, 1989). Another narrow contact zone, between *T. montandoni* and *T. vulgaris*, may exist in the foothills of the Carpathian Mountains, but their distributions in relation to one another are not yet precisely documented.

Highest species density is often taken as an indication for the centre of dispersal. In newts this would point to western France, but we feel that this notion is misleading. We have to consider the origin and radiation of *Triturus*, and separate it from the present-day climatologically induced distribution patterns and routes of postglacial dispersal. Morphological and genetic variation within *Triturus* species is highest in southeastern Europe and adjact Asia (Schmidtler and Schmidtler, 1983; Kalezic, 1984; Arano and Arntzen, 1987). Species diversity likewise is the highest in this area although many species are not distributed sympatrically. In southern Europe five (sub)species occur on the Iberian Peninsula, four on the Apennine Peninsula while six (sub)species are found in the Asiatic part of Turkey and ten in the Balkan Peninsula (Macgregory, Sessions and Arntzen, 1989). In our opinion, this is evidence that the Balkan Peninsula, rather than western Europe, is the centre of dispersal of *Triturus*.

The taxonomic relationships within the family Salamandridae are not resolved unequivocally and it is not clear which genera are phylogenetically closest to *Triturus*. The available evidence suggests a close relationship of *Triturus* to the genera *Neurergus* and *Paramesotriton* (Wake

and Özeti, 1969). These genera have Central Eastern and Far Eastern distributions, respectively, which points to an eastern Palaearctic origin for this group of Salamandrid genera as a whole. This again would better fit the view that the Balkans is the centre of dispersal for *Triturus*, rather than western Europe.

So we conclude that the present-day high rate of species density in western France is of postglacial origin, does not reflect the centre of dispersal of the genus *Triturus* and is in line with climatological patterns. Up to five *Triturus* species may occur in sympatry and, in exceptional cases, share breeding sites. This situation, as found in western France, provides unique opportunities to study the interspecific ecological relationships of newts. Comparisons may involve closely related species, *T. helveticus* – *T. vulgaris* and *T. cristatus* – *T. marmoratus*, as well as more distantly related species, for example all comparisons involving *T. alpestris*.

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REPRODUCTION TWICE A YEAR OF THE CRESTED NEWT IN CAPTIVITY

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As with most temperate amphibians, the Crested Newt *(Triturus cristatus)* undergoes brief, annual periods of mating. Mating always takes places in spring and is accompanied by great morphological changes. During the breeding season the male develops a high dorsal crest and its colours become more vivid. The crest begins to grow, and the tail-stripe to intensify in colour just before the males go into hibernation, complete development taking place rapidly when the males enter the water in spring (Steward, 1969).

The gametogenetic cycles in newts are controlled by endogenus (hormonal) and environmental (temperature, moisture and photoperiod) factors. Temperature seems to be the major factor controlling gametogenesis in many salamanders, including newts (Duellman & Trueb, 1986).

In nature newts reproduce only once a year, during springtime when courtship, mating and oviposition take place. Simms (1968) reports a captive female of *Triturus cristatus* that mated twice (that is, during two different periods) and laid two clutches of eggs in one season.

There are two possible ways of stimulating the reproduction of newts outside their normal breeding season. One is by inducing breeding with pituitary extracts or human chorionic gonadotropin; the other one uses a low-temperature treatment (mentioned by Astier, 1975).

I succeeded in inducing captive newts to breed twice a year by maintaining them during the summer period at low temperatures (4-8°C). After the normal spring mating the appetite of the newts starts decreasing and they begin to manifest their desire to quit the water. This is correlated with the increasing temperatures at the beginning of summer. Normally the newts will pass to their terrestrial phase of life and will return to water only next spring (or sometimes in autumn for hibernation). By taking the newts at this moment and placing them in a clean plastic box filled with pieces of moist sponge, a box that can be easily kept in a refrigerator, one can speed up their normal life cycle. The box will be provided with sufficient holes so as to ensure good ventilation. Two major points are to be considered when placing the newts in the refrigerator, i.e. in choosing the shelf that offers a temperature around 6°C and in providing good ventilation. Death of animals might occur at this stage due to excessive moisture, because of a too low temperature, or because of a deficit in aeration. It is therefore advisable to check the box every week, and remove any dead animals.

It is necessary for the newts to be healthy and well fed. Very good results are obtained when 2-3 weeks before placing them in the refrigerator they are fed every other day with whiteworms and earthworms *ad libidum.* During the last 4-5 days feeding must be stopped, thus allowing the newts to eliminate the faeces.

It is quite difficult to establish the period required for keeping the newts at low temperature. The most important factor to be considered is the outside temperature. To remove the newts at outside temperatures of about 30°C will just spoil things, since the temperature needed for their reproduction is around 15-20°C. Anyway, the minimum period of time needed for keeping them in the refrigerator is about 30-40 days.

After taking the newts out from the refrigerator, care must be taken, as some newts might refuse to enter the water. A good method is to place them in shallow water and then raise the water level little by little; or, to place a small raft in the aquarium and release the newts on it; in less than an hour most of them will enter the water. If everything goes well the newts will start feeding the next day. At this stage any kind of live food will do. By now the animals will start developing sexual characters and in about a month from the induced hibernation courtship will start. It is not possible to obtain the same degree of fecundity and of courtship display in autumn as in spring. The first eggs deposited may be infertile but

the rest will develop well. If the females are kept without males they will deposit less than a dozen unfertilized eggs.

The last important point to be remembered is to ensure a temperature of about 20°C for the developing eggs and the hatched larvae.

This method may be applied to other species of newts as well. It can be applied all year long: for example, we can "store" the newts in October and take them out in January, so that by springtime we can have fully developed larvae.

The amount of eggs deposited by a female will not exceed one third of the number of eggs it deposited in the previous spring period of reproduction. This might be due to the so-called post-nuptial spermatogenesis, that results in the male having a limited sperm supply (Verrell, 1986), and, of course, to a limited amount of eggs available by the female.

It seems necessary to mention that if after the induced reproduction the newts are allowed to hibernate normally (outdoors or in a cold room), the forthcoming spring they will reproduce normally.

This method is easy to do and will provide you with year-long satisfaction in breeding newts.

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TAXONOMIC DIAGNOSTIC CHARACTERS OF TORTOISES (1): OBSERVATIONS ON THE TAXONOMIC SIGNIFICANCE OF THE DIVISION OF THE SUPRACAUDAL SCUTE IN *TESTUDO*

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INTRODUCTION

Reference is frequently made to taxonomic diagnosis within the genus *Testudo* on the basis of a divided or undivided supracaudal scute. One common misconception is that *Testudo hermanni* invariably possess a divided supracaudal whilst the supracadal of *T. graeca* is always single. This view is unfortunately propagated by several popular works of reference likely to be consulted by field workers, e.g. "The Mediterranean spur-thighed tortoise *(Testudo graeca)* may appear superficially similar to Hermann's *(T. hermanni),* but in terms of its shell structure it does not have a divided supracaudal scute" (Alderton, 1988). See also p.22 fig. 1 (Devaux, 1988) and p. 403 (Pritchard, 1979). Earlier, Wermuth noted this character in relation to the diagnosis of *T. hermanni hermanni* GMELIN 1789 and his proposed *T. hermanni robertmertensi* WERMUTH 1952. It should be noted that under recent revision *T.h. robertmertensi* WERMUTH 1952 has been revised to *T. hermanni hermanni* GMELIN 1789 and Wermuth's *T. hermanni hermanni* GMELIN 1789 to *T. hermanni boettgeri* MOJSISOVICS 1889 (Bour, 1987).

The following observations by the present author cast serious doubt upon the value of this character to differentiate species, but indicate that it may be useful as an indicator of zoogeographic distribution and of local origin within species.

T. graeca LINNAEUS 1758

A divided supracaudal scute is rare but not entirely unknown within this species (terra typica Oran, Algeria). In one instance a clutch of eggs from a pair of Moroccan *T. graeca* was incubated and of the resultant young exactly half had a divided supracaudal, and half a single supracaudal. In another instance a different pair of Moroccan *T. graeca* (the male of which has been in captivity in the U.K. for 68 years at the time of writing) this year produced a clutch of 5 eggs of which two were fertile. Neither parent possessed a divided supracaudal but this character was present on both hatchlings.

T. ibera PALLAS 1814

Although not often seen, a divided supracaudal scute is sometimes encountered within this species which has a very extensive zoogeographic distribution (from the USSR, through Turkey and western Iran to Syria). It is found equally in males and females, particularly those from Turkey. Of a clutch of 4 *T. ibera* hatched by the author in 1988 3 juveniles had a single supracaudal and on the other it was divided. Neither parent possessed the character.

T. hermanni hermanni GMELIN 1789

The population of France, Corsica and Corfu appear to possess a divided supracaudal scute almost exclusively. Of 300 tortoises recently examined by the author in various locations in southern France every specimen had a clearly divided supracaudal. A similar situation appears to apply to the populations of Spain and the Balearic islands.

T. hermanni boettgeri MOJSISOVICS 1889

Of the population of Romania and Yugoslavia some localised populations appear to possess a divided supracaudal and others an undivided one. Each population seems to be restricted to a very localised distribution, and within that group the character may be almost exclusively either present or absent, or mixed. Petzold (1966) reported approximately 8-10% of individuals within some eastern Adriatic populations lacked the feature whilst the majority featured it. Windolf (1982) however reported finding only 1 example without the character in a survey

Plate 1. Eastern *T.h. boettgeri* with division of supracaudal

Plate 2. Eastern *T.h. boetterri* without division of supracaudal

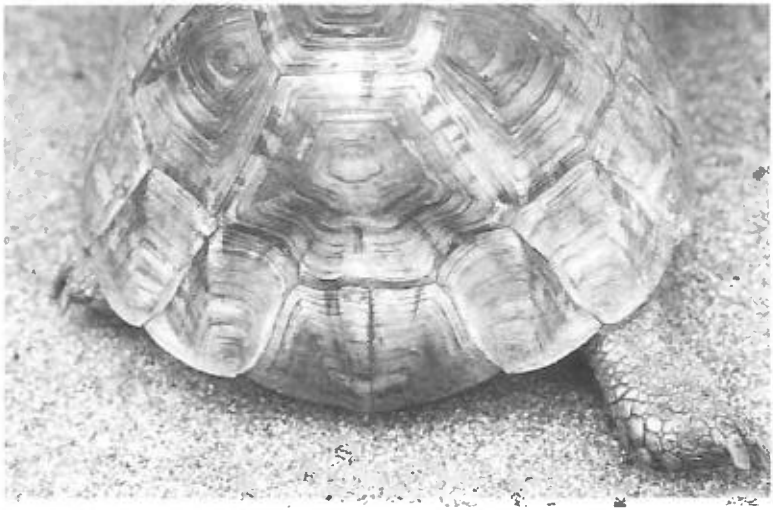

Plate 3. Algerian *T. whitei* BENNETT 1836 with divided supracaudal

of the same locality in a sample of 30 specimens examined. One of the largest specimens of *T. hermanni* ever recorded (264mm/3,420g and of eastern racial origins) also possessed this feature in addition to a perfect set of 4 claws both anteriorly and posteriorly (Highfield, 1988).

***T. whitei* BENNETT 1836**

This is the largest member of the north African *Testudo* (up to 280mm long and 4.366 Kg)

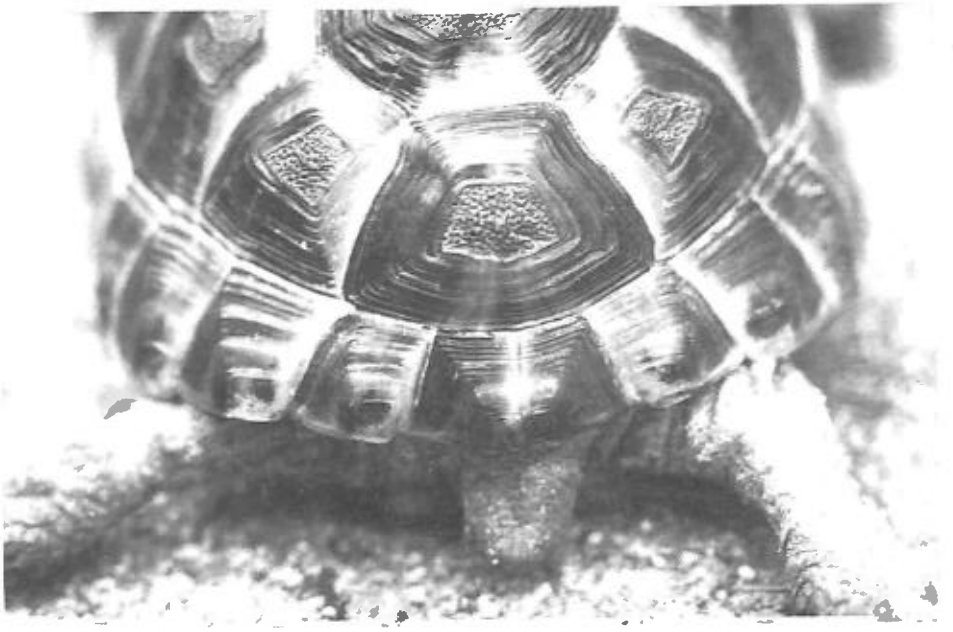

Plate 4. Juvenile *T. ibera* PALLAS 1814 with divided supracaudal

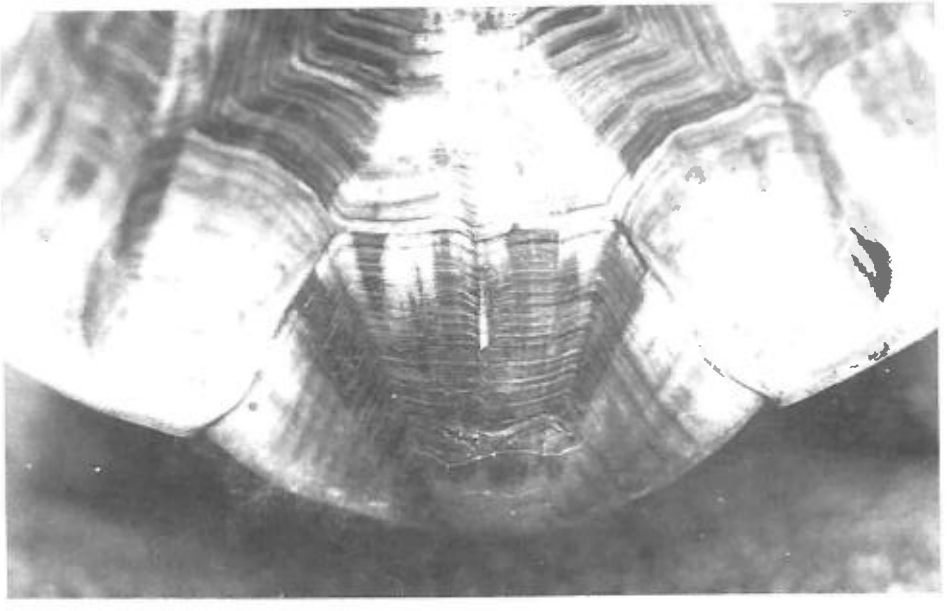

Plate 5. Adult Moroccan *T. graeca* L. 1758 with divided supracaudal

and a divided supracaudal is relatively commonplace although still only possessed by a minority of the population. This species' distribution is not wide, being centered upon Algiers (Highfield & Martin, 1989a). It does not appear to exist sympatrically with *T. graeca* L. 1758.

It has been suggested that the absence of a divided supracaudal in some specimens of *T. hermanni boettgeri* MOJSISOVICS 1889 may indicate hybridisation with *T. ibera* PALLAS 1814. This appears extremely unlikely in the complete absence of any other characters indicating hybridisation and also considering that entire localised populations of individuals without the character can be located. It is much more likely that this is an inherited genetic character independent of species which may become either suppressed or dominant within particular populations. The author's experiments with captive breeding appear to support this hypothesis, particularly the result where offspring with the character were produced from parents without it clearly indicating transmission in such instances by recessive gene. To date, no evidence has emerged of an instance where both parents with the feature have produced young lacking it. Where one parent has the character and the other lacks it, there appears an approximately 50/50 chance of inheritance. Neo (1978) reports that heterozygous values tend to be higher in reptiles than in birds or mammals, however island populations are more generally homogenous (Frankel and Soule', 1981). Because of their highly specific biotypic requirements and generally isolated habitats with minimal transit of individuals between populations a high degree of genetic convergence is often found within groups. Where a greater exchange of individuals occurs, in more easily traversed and larger habitat areas, then a state of balanced polymorphism may occur between homozygous, dominant homozygous and recessive individuals (Croudace, 1989). This occurs due to the phenomena of "heterozygous advantage" described by Strickenberger (1968) where the heterozygous individual has greater reproductive fitness.

Readers of this 'Bulletin' with long memories may recall that the usefulness of the division or otherwise of the supracaudal scute as diagnostic evidence of speciation has been questioned before (Gardiner, 1978). The present author concurs entirely with the views expressed then, and also notes the similarity of breeding result obtained where a pair of *T. hermanni,* one with and one without a supracaudal division produced offspring with a division.

Those who are accustomed mainly to encountering tortoises in captivity, most of which will have originated from widely disparate locations in the wild, or as first generation captive bred specimens from such collections, often express the view that considerable random specialisation of characters exists, particularly in carapace pattern and colouring within a species. In fact this view is misleading and most in-situ localised populations display a remarkable similarity of characters between individuals. With practice, it becomes possible in many instances to identify tortoises taken from individual hillsides with considerable accuracy once the specific characters typical of that particular loction are understood and recognised – much as occurs in an extreme example on Isla Isabela, Galapagos where each volcanoe's inhabitants have been accorded sub-specific status (despite the highly questionable validity of this practice in at least one instance, *Chelonoidis (Geochelone) elephantopus becki* ROTHSCHILD 1901).

CONCLUSIONS

Divided supracaudal scutes are found not only within *T. hermanni* but also within the general 'spur-thighed' complex comprising *T. ibera, T. graeca* and *T. whitei* where the trait is recessive to a greater or lesser extent. No data exists for the level of incidence in *Testudo zarudnyi* NIKOLSKI 1896 (Highfield & Martin, 1989b). Division of the supracaudal has not been reported in *T. marginata* SCHOEPFF 1792. The division of the supracaudal is not universal within *T. hermanni* although it is dominant within western populations of *T.h. hermanni* GMELIN 1789. Many eastern examples of the sub-species *T.h. boettgeri* MOJSISOVICS 1889 lack the character however. This character should therefore not be used to differentiate between *T. hermanni* and other species.

The presence or absence of a divided supracaudal may however be extremely useful in identifying certain local populations of the same species or sub-species within a comparatively restricted geographical area, and possibly in some limited instances in distinguishing sub-species from one another. In order to preserve the individual locality-identity of wild populations and thus the genetic diversity of a taxon as a whole care must always be exercised in conservation

captive breeding programs where re-introductions occur, even to the preservation of specific character traits at infrasubspecific rank.

ACKNOWLEDGEMENTS

The author would like to express thanks to Roger Bour for an interesting and rewarding introduction to the tortoise of the Massif des Maures, also to Eric and Ella Gibson of SOPTOM for their hospitality and kindness.

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GROWTH DYNAMICS OF JUVENILE SLOW-WORMS *(ANGUIS FRAGILIS)* IN CAPTIVITY

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INTRODUCTION AND METHODS

Since virtually nothing is known about the growth of Slow-Worms *(Anguis fragilis* L.) the following data may be of some interest. The measurements were made on four juvenile lizards from a litter born in captivity in August 1986. These juveniles were kept with their litter mates and their mother in an indoor vivarium measuring 76 x 38 x 30 cm. Each of the four was marked with a spot of different coloured quick-drying lacquer paint to enable it to be recognised; each spot was replaced weekly. The lizards were fed small grey slugs *(Deroceras reticulatum)* at frequent but irregular intervals. Each slug was weighed to an accuracy of about ±0.2 mg and presented to a Slow-Worm individually using forceps, so the food intake of each marked lizard could be measured. Growth rates were determined by weighing the lizards at intervals.

RESULTS

The experiment commenced on 17 October 1987. The growth of the four marked juveniles

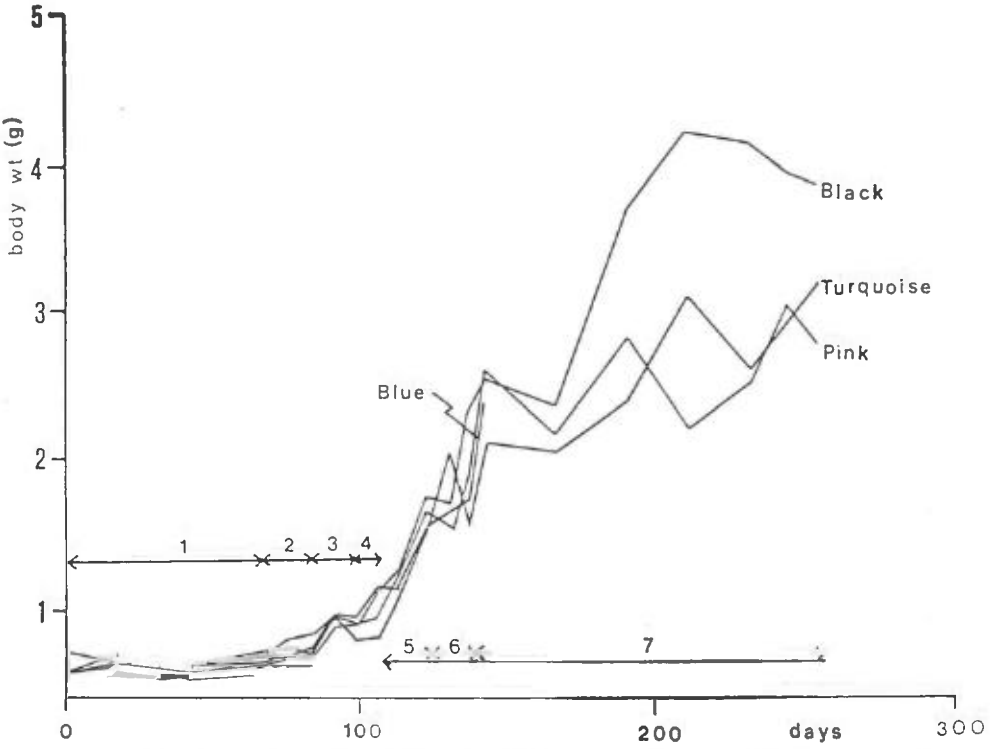

Fig. 1 Growth of the four Slow-Worms. Day 0 = 17 October 1987. Phases 1-7 are referred to in the text.

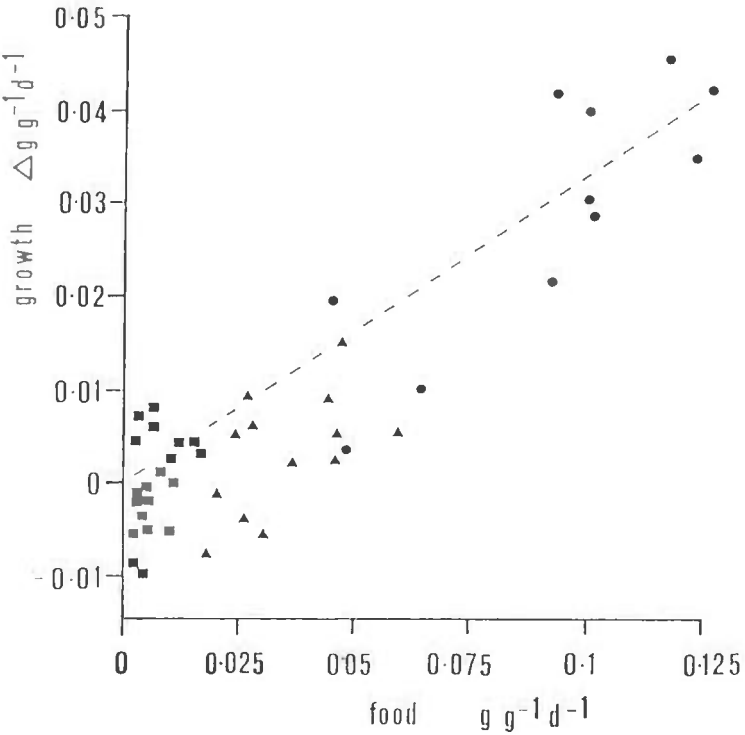

Fig. 2 Relationship between growth and food consumption. Squares represent phase 1, triangles phase 7 and circles phases 3 and 5.

(labelled 'blue', 'black', 'turquoise' and 'pink') is shown in Fig. 1. For the first 73 days the vivarium was unheated (phase 1), but from this point onwards the lizards were given a 100 W tungsten bulb suspended 24 cm above the soil in the vivarium and switched on for a variable time each day, beneath which they could bask. This increased food consumption and growth rates, although there were three periods associated with sloughing when feeding and growth were sporadic (phases 2, 4 and 6). At the end of phase 6 growth continued at a slower rate until 8 June 1988 (phase 7: total time = 242 days) when the experiment was terminated and all of the Slow-Worms released into the wild. Observations on juvenile 'blue' ceased on day 139 because the paint spot was lost and this was noticed too late to distinguish it from the unmarked lizards in the cage.

The lizards were weighed at varying intervals which averaged about 14 days. For comparative purposes, growth within each interval has been calculated on a daily basis, using the relative unit change in mass (g) per g per day (ΔW g^{-1} d^{-1}). Food consumption was converted to equivalent units, i.e. F g^{-1} d^{-1} (the lizard body mass used in the calculations was the mean of the body masses at the beginning and the end of the time interval). There was a clear correlation between growth and food consumption (Fig. 2: r = 0.92, d.f. = 43, P<0.001); because of the variability due to sporadic feeding, some of the data in phases 2, 4 and 6 have not been used in plotting this Figure). The mean gross growth conversion efficiency (growth x 100 / food) at relatively high levels of feeding (F>0.1 g g^{-1} d^{-1}) was 33%. At lower levels of feeding the efficiency fell: the linear regression of growth on food consumption is $G = 0.35F - 0.0046$ (the dashed line in Fig. 2 shows the expected relationship if growth conversion efficiency remained constant at 33%). This regression shows that growth efficiency is 20% at F = 0.03 g g^{-1} d^{-1} and that growth is negative (i.e. slow-worms will lose weight) at levels below 0.015 g g^{-1} d^{-1}.

DISCUSSION

The data presented here show that the growth dynamics of Slow-Worms are essentially similar

to those of the diurnal Common Lizard *(Lacerta vivipara)* and the Wall Lizard *(Podarcis muralis),* which are lacertids and in which gross growth conversion efficiency is 35% when the animals are able to thermoregulate for appreciable periods. Reduced food intake in these species results in a reduction in conversion efficiency (Avery, 1984; Perkins & Avery, 1989). There was no *a priori* reason for expecting this similarity; Slow-Worms are anguid lizards, which have lower metabolic rates (Hailey, 1984) and may differ also in other physiological respects from Lacertidae (Hailey & Theophilidis, 1987), and they are secretive and largely crepuscular.

In captive *L. vivipara* the rate of food consumption by an individual lizard, which in turn largely controls its growth rate, is affected by ambient temperature and by the period for which the animal can thermoregulate (Avery, 1984). The data shown in Fig. 1 suggest that this is also the case for Slow-Worms: low rates of food consumption and growth occurred during phase 1, when there was no bulb for thermoregulation; higher rates during phases 3 and 5. The reasons for the later reductions in growth seen during phase 7 are not known. They probably reflect the fact that by then the animals were long-term captives, which furthermore had been kept active during the winter period when they would normally have been hibernating. These animals may have been stressed in some way, and this would result in reduced appetite, food intake and growth. However, all the Slow-Worms were active and apparently healthy at the end of the experiment; 'turquoise' and 'pink' were still growing (Fig. 2).

It would be most interesting to compare the rates of growth recorded here with those which occur in the field; the fact that the necessary data was not available highlights the need for further research on Slow-Worms. It has been assumed in the interpretation of the data offered above that Slow-Worms in this study thermoregulated during phases 3 - 7 at times when the bulbs were switched on. We did not have the facilities to investigate this. There are no detailed studies in the literature which address this question, although there is plenty of evidence that Slow-Worms may bask and otherwise thermoregulate under some circumstances in both the field and the laboratory (Simms, 1970; Spellerberg, 1976; Gregory, 1980; Frazer, 1983).

ACKNOWLEDGEMENTS

We are most grateful to Dr David Hill for constant encouragement and advice. The manuscript was improved following comments from David Hill and Adrian Hailey.

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A NOTE ON THE HERPETOFAUNA OF SOUTH-EAST CYPRUS

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INTRODUCTION

The curiosity of my family and myself had ben aroused by articles in the *BHS Bulletin* about the herpetofauna of Cyprus (Demetropoulos & Lambert, 1986; Lambert 1987, 1988,) and we were pleased therefore to be able to make a visit there from 2 to 15 April 1989. Our enthusiasm dampened however, as the only available accommodation was outside the now notorious resort of Ayia Napa. Described by the guide books as a quaint fishing village with an ancient monastery, it has in fact been rapidly developed into a medium-sized resort catering mainly for northern Europeans. The original fishermens' houses have all long disappeared and the Venetian monastery remains as a peaceful anachronism amidst the paraphernalia of tourism that abounds in every direction. Ayia Napa is situated on the southern coast of Cape Greco which forms the south easternmost corner of Cyprus. Since the partition of the island in 1974, thousands of people from Turkish-held Famagusta 6 miles (9.6 Km.) to the north have crossed the frontier and settled in the once remote region of sandy beaches, dunes and undulating agricultural country. Not only the village of Ayia Napa, but also coves such as "Fig Tree Bay" on the east coast, formerly popular only with H.M. Forces in Cyprus, are being urbanised very fast. Despite the degradation of the coastal environment however, the herpetofauna in the area is still fairly rich, some species being much more common in the country immediately adjacent to the new developments than further a-field. Whether this is because the broken terrain and abundance of building materials create a better environment, or whether this is merely a temporary phenomenon created by transient reptiles fleeing the chaos is a moot point. A tract of country near the frontier is fortunately virtually unspoilt, but herpetological investigation is somewhat restricted by the vigilance of zealous guards. Börner (1974) has also made some observations on the lizards in the area, at Varosha, a suburb about a kilometre south of Famagusta, in December/January 1973/74. The weather was sunny with mid-day air temperatures about 21°. We explored the area by foot and bicycle, principal sites (Fig. 1) being:-

1. Shoreline between Ayia Napa and Nissi Beach.
2. Beach and hinterland running east from Ayia Napa.
3. Field edges and roadside between coast and Sotira Forest.
4. Degraded mimosa scrub and waste ground north of coast road at Nissi Beach.
5. Coast road between Protaras and the frontier south of Varosha.

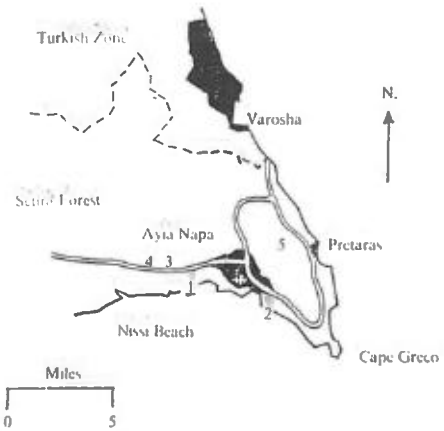

Fig 1. Sketch map of South-East Cyprus, showing principal sites (see text).

Species were identified using the fieldguide of Arnold, Burton & Ovenden (1978).

SPECIES LIST

GEKKONIDAE

Cyrtodactylus kotschyi

A small species found during the day under large stones at the top of the beach; at night it was seen by lamplight in concrete conduits at the edge of the main road west of Ayia Napa. An individual was observed late on the afternoon of 3 April basking in the company of *Ablepharus kitaibelii* on a tree trunk in the gardens of Ayia Napa monastery, apparently oblivious to the milling crowds of holiday makers.

AGAMIDAE

Agama stellio

Very abundant, particularly in areas at the edge of Ayia Napa where it could be seen basking on house walls, road edges, rubbish dumps, piles of broken stones and generally disturbed ground. Familes would congregate on rock piles behind the beach. It was much less densely distributed in open countryside and on the hillside behind the village. At sunrise a family of six would warm up on the eastern wall of our apartment, sometimes making much noise running in and out of air vents, and so providing us with a 'natural alarm clock'! At sunset they retired beneath flat stones near their basking sites and could easily be caught, the warmth of one's palm quickly arousing them so that they vigorously scratched ones fingers in their eagerness to escape. The head to tail length of mature males was at least 30cm and their well developed limbs were large and muscular. During the day, the most dominant male (distinguished by the strength of orange pigment in the rhomboidal pattern down his back), would posture on the highest point of his territory, bobbing his head rapidly up and down before finally leaping to safety.

CHAMAELEONIDAE

Chamaeleo chamaeleon

One seen 7 April in the garden of a hotel on the shore east of Ayia Napa. With independently rotating eye-balls and strange rigid posture, it was "mincing" its way through a bed of succulents. Whether it occurred in the garden naturally or had been released, was difficult to determine. A large area of mimosa scrub adjacent to the hotel could have been its natural habitat.

LACERTIDAE

Acanthodactylus schreiberi

This Levantine spiny-foot lizard is larger (up to 10 cm snout to vent), than *A. erythrurus,* the species found in the Iberian Peninsula. The young are similar in colour to the European species, but the adults are a uniform sandy hue and almost devoid of markings. The lizards are frequently observed on the less disturbed dunes and sandy field edges, but seem to be retreating before the well maintained gardens of beach hotels that are being built everywhere. Several animals were observed flattened on paths used by moped riders.

Ophisops elegans

This is an attractively coloured and graceful little lizard and could be found everywhere where there was rough ground with some vegetation. The males have two narrow turquoise stripes running down the length of each side. We saw none with red tails. The 'Snake-eye' could be easily seen in basking individuals. This species seems to be holding its own fairly well against the onslaught of urbanisation.

SCINCIDAE

Ablepharus kitaibelii

This little skink which, like the last species, has no obvious eye-lids, could be observed basking early in the morning and in the evening. During the warmer part of the day, it could be found under old pieces of wood and flat stones in a number of locations near the shore. It also frequented field edges and waste ground in the suburbs of the town. It was generally very timid and fast moving, several attempts made to capture one were all unsuccessful. The species appears to be establishing itself in the newly created succulent gardens that surround hotels, restaurants and stalls associated with coastal developments.

TYPHLOPIDAE

Typhlops vermicularis

One specimen about 20 cm. long found under a stone about 19.15 hours on 14 April on the edge of the beach west of Ayia Napa. After being taken home and photographed, it was released the following morning. Superficially very worm like in appearance, its true reptilian qualities were revealed in the poise of its head as it began to glide around the converted coffee pot in which it was placed.

COLUBRIDAE

Malpolon monspessulanus

Two Montpellier snakes were found. One badly mutilated east of Nissi Beach on the afternoon of 5 April; the other an immature speckled specimen about a metre long which had recently been killed by what looked like a bite from a small mammal on its neck, south of the frontier at Varosha about 1600 hours on 9 April.

Coluber gemonensis

One 80 cm long snake was seen rapidly crossing the coast road just north of Protaras Bay about 16.20 hours on 13 April. It was probably this species because it lacked the 'frog-face' look of *Malpolon monspessulanus*, but equally probably it could have been *Coluber cypriensis*, a new species described by Schatti (1985) which at the time we were unable to identify.

BUFONIDAE

Bufo viridis

One adult found on two occasions (3 April and 12 April) under the same abandoned flooring tile in a rubbish dump between the coast road and Sortira Forest. The habitat was made up of somewhat degraded scrub with a small, newly built housing estate in the vicinity.

HYLIDAE

Hyla arborea

These tree-frogs congregate in great numbers at night in high walled water cisterns and were calling loudly. On returning the next day (4 April) to one such cistern, we were surprised to find only one yellow-coloured frog still there. Some of the cisterns that these little amphibians visited had walls over 2.4 metres high.

RANIDAE

Rana ridibunda

Abundant in low lying water cisterns near farms, and in streams on the edges of villages. Some specimens were very large (up to 17 cm.), and were drab brown in colour; a minority were uniformly light-green dorsally.

DISCUSSION

The sandy littoral of South East Cyprus provides a suitable environment for several interesting species of reptiles and amphibians. At present the lizard population has not yet been affected by the urbanisation of Ayia Napa and other lesser resorts in the area, though *Acanthodactylus schreiberi* seems to be retreating. Snakes, however, would appear to be rare. Fourteen days of careful surveilance only revealed two live specimens; a *Typhlops* on the beach and a Colubrid in relatively undisturbed countryside. Whilst the life-style of the subterranean Worm Snake may afford the species some protection from the development that is taking place, the Colubrid was seen at some distance from the environs of the town. We had expected to encounter many more whip snakes, for notwithstanding Cyprus's insularity, one makes many more sightings of 9 different snake species in other Mediterranean countries in spring. Even as far north as the Dordogne in France, *Coluber viridiflavus* can frequently be seen in a variety of habitats. In terms of conservation and other environmental considerations Ayia Napa would appear to have grown too big, the change of land use concomitant with development even causing the local inhabitants to depart from the area. If the herpetofauna in the south-east of Cyprus are to be preserved for posterity, then the littoral development should be controlled now.

ACKNOWLEDGEMENTS

I would like to express my gratitude to Dr M.R.K. Lambert for his valuable comments for the preparation of the manuscript.

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LIZARD PREDATION BY THE WIDOW SPIDERS *Latrodectus pallidus* and *L. revivensis* (Theridiidae)

SYRIL BLONDHEIM* AND YEHUDAH L. WERNER

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In their review of vertebrate predation by arthropods, McCormick & Polis (1982) cite reports of three species of comb-footed spiders (Theridiidae) which prey on vertebrates. For all three- *Achaeranea (Theridion) tepidariorum, Latrodectus hasselti* and *Latrodectus mactans*– most vertebrate prey items were reptiles. These included skinks of the genera *Lygosoma* and *Leiolopisma* and several kinds of snakes. For *A. tepidariorum* and *L. hasselti,* prey also included a mouse. McKeown's (1952) book on Australian spiders shows a photograph of *L. hasselti* with two lizards in its web; and König (1987) photographed a gecko, *Phyllodactylus marmoratus,* in the web of *Latrodectus mactans hasselti.*

We here report predation on a lacertid lizard. *Mesalina (=Eremias) guttulata* (Lichtenstein, 1823), by two additional species of widows (genus *Latrodectus* Walckenaer, 1805) from Israel: *L. revivensis* and *L. pallidus.* Further, we postulate that since the venom of widows is effective against reptiles, any reptile species whose habits permit encounter with the sticky web of these spiders, is potential prey.

Remains of a lizard, probably *Mesalina (=Eremias) guttulata,* were found in a deserted nest of *L. revivensis* collected at Sede Boqer (Negev, Israel) (Zilberberg 1988).

At the village of Kefar Adumin (Judean Desert, Israel) at 1915 hrs on 21 June 1988, a plump, mauve-hued juvenile lizard of the same species was found in the process of being hoisted by an adult female *L. pallidus* from her feeding platform up to her nest. The ocellated pattern of the lizard was clearly visible through the silk wrapping.

The spider spent most of the following day feeding on the lizard. On 26 June, the nest was photographed, showing both predator and prey, the latter by now coiled and shrunken (Plate 1). The lizard was removed from the nest, measured, and preserved in the herpetology collection of the Zoological Museum of the Hebrew University of Jerusalem (HUJ-R 17078). Its length was 25 mm excluding the tail, which was whole.

From the remains of prey in the nests of *Latrodectus* spp., it is apparent that ground-frequenting arthropods, such as tenebrionid beetles, isopods, ants and scorpions constitute the bulk of the diet of widow spiders (Shulov 1948; Zilberberg 1988; personal observations). Despite this preponderance of arthropods in the diet, the venom of widows is poisonous in varying degree to a wide variety of animals, vertebrate and invertebrate (see Foelix 1982, Table 1, p. 46, for a review of the LD50 of spider venoms).

Out of 101 reported instances of vertebrate predation by spiders, only 19 are of reptiles (from McCormick and Polis 1982). In contrast to such spiders as *Dolomedes* spp. (Pisauridae) which regularly eat fish fry, minnows and tree frogs, or *Nephila* spp. which include birds in their diet, most of the vertebrate prey of comb-footed spiders is reptilian.

It is doubtful if *Latrodectus* predation plays a significant role in the population ecology of small reptiles. The predation reported here may represent either isolated instances of capture of vertebrate prey, or routine but small-scale trapping. If the latter, it is surprising that this has not been reported previously for spiders studied as extensively as the widows. It is nevertheless possible that investigators have failed to identify disfigured remains of small vertebrates when these are wrapped in silk, or possibly broken up and distorted by the elements, or both. Perhaps more careful study of prey remains, either those woven onto the outside of the nest, or those cut out of the web by the spider and found under the nest, might provide additional evidence for predation on vertebrates not only by these, but also by *L. tredecimguttatus, L.* aff. *hesperus, L. dahli* and *L. geometricus,* other widow spiders reported from Israel (Levy and Amitai 1983).

* Deceased 9 October, 1989

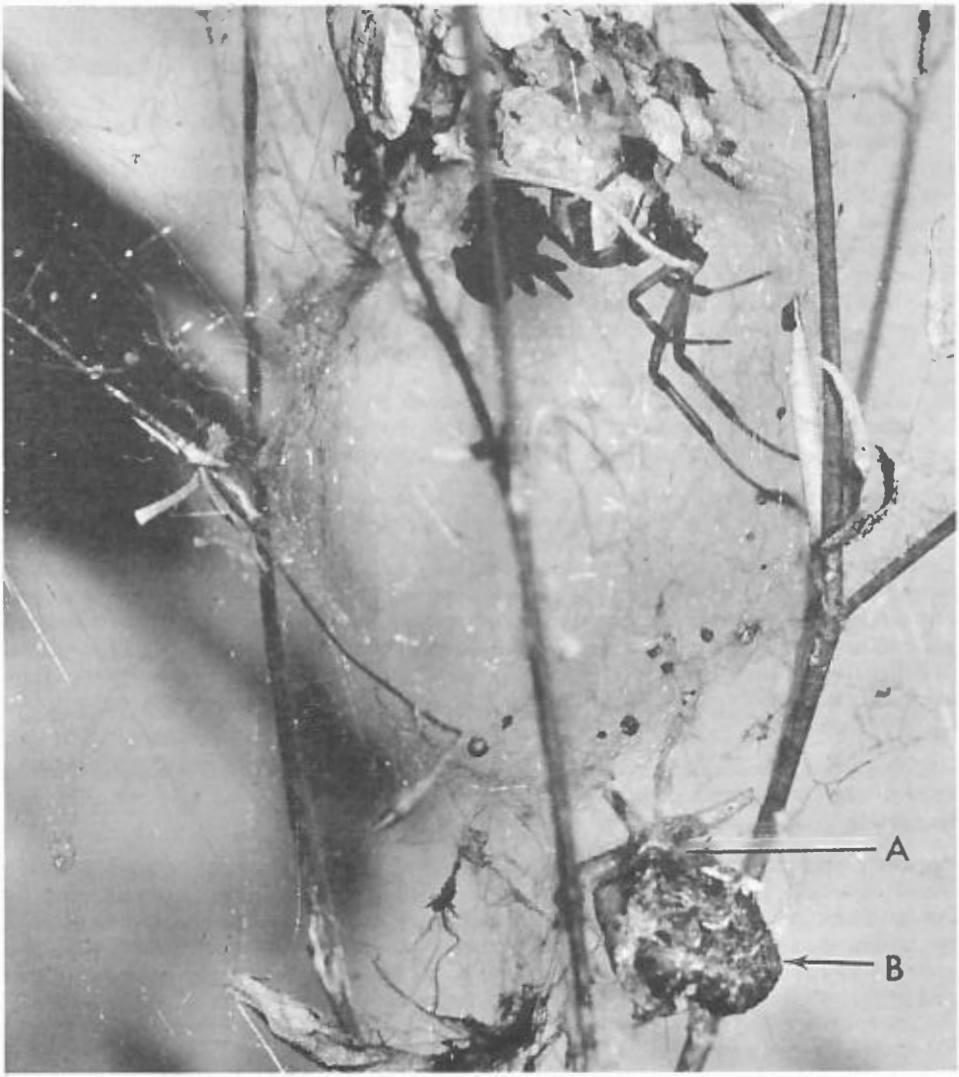

Plate 1. The *Latrodectus pallidus* at the entrance to her pebble-clad nest (above) and the coiled, shrivelled carcass of her prey, the lizard *Mesalina guttulata* (A, left orbit; B, dorsum).

Mesalina guttulata is among the few lizards is Israel whose stomach contents have been studied. Orr et al. (1979) found both Scorpionidae and young Theridiidae, so that it is highly probable that *Latrodectus* spp. are included in *Mesalina guttulata's* diet. Thus, the predator-prey relationship between *Latrodectus* spp. and *Mesalina guttulata* is probably reciprocal.

ACKNOWLEDGEMENTS

We thank A. Niv for assistance in photography and G. Levy and Y. Lubin for reading the manuscript and offering helpful suggestions.

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BOOK REVIEW

Härlekinfrosche der Gattung Atelopus. Ralf Heselhaus and Matthias Schmidt. 1988. Softback, 63 pages, 49 photos, 25 in colour. Published by Herpetologischer Fachverlag, Münster. ISBN: 3-9801853-0-3. Available from specialist booksellers, approximately £6.

It is seldom that German language publications are reviewed for the non-technical press, but this little book fills a noticable gap in the literature and deserves a wider readership.

'Harlequin Frogs of the genus *Atelopus*' provides a succinct introduction to the lives of these 'stump footed frogs'. A brief overview of the systematics of *Atelopus* is followed by an account of their distribution and characteristic habitats. Colour and black and white photos of habitats and shots of collecting and photographing *Atelopus* are given throughout the text. The authors describe trips to Panama and French Guyana giving useful details on vegetation and the problems associated with photographing and collecting *Atelopus.* Important reference is made to the status of the endangered 'Golden Frog' *Atelopus zeteki.*

Atelopid toxins are discussed with reference to their function in nature. The natural breeding cycle of *Atelopus* is discussed in some detail with interesting notes on mass spawning and population size.

A useful chapter on *Atelopus* in the terrarium, illustrated with a diagram and photos of naturally furnished vivaria, is followed by the bulk of the book (35 pages) giving species accounts for *Atelopus chiriquiensis, A. flavescens, A. ignescens, A. senex, A. spumarius barbatinii, A. s. spumarius, A. varius varius, A. v. ambulatorius, A. v. loomisi and A. zeteki.* Each account gives a brief description, notes on the distribution, habitat and care in captivity of each species and is accompanied by at least one excellent colour photo of the species in a natural surrounding. Additional black and white photos supplement the accounts and the authors have included colour photos of species variants. Four colour variants of *A. v. varius* are shown illustrating the bewildering variety exhibited by this species.

A general distribution map for the genus *Atelopus* is followed by a clearly laid out species table giving, at a glance, the size, colouration, distinguishing characteristics and distribution for fifteen species and subspecies not treated in the preceding accounts. A short bibliography lists relevant references.

'Harlequin Frogs of the genus *Atelopus*' exemplifies the type of book that, until recently, has been lacking on the herp. book market. Covering a narrowly defined subject area it will appeal to herpetologists and herpetoculturists with an interest in frogs, to the bibliophile and to workers in Neotropical herpetology. By retaining control of the publishing the authors have avoided the major fault that mars so many of the mainstream herp. publications – the lack of good original photos. Illustrated to the high standard that we have come to expect from European publications ten species and subspecies of *Atelopus* are pictured in colour and black and white. For the non-German reader the standard of photos alone would compensate for any difficulty with the text and would make this little book a useful purchase. It is hoped that future publications from the authors will appear in an English language edition to bring them the wider readership they so obviously deserve.

Steven Simpson, PO Box 853, Brighton BN1 5DY

LETTERS TO THE EDITORS

Dear Sir,

I was very surprised to read in Professor Cloudsley-Thompson's article on the Vine Snakes that these snakes "are practically harmless to human beings". This may well be true of many, or even most, of them but is not so in the case of *Thelotornis kirtlandii.*

I took two specimens of this species in Nigeria in the middle sixties and was bitten by one of them, though without effect. It was this experience which impressed so clearly on my mind a report of two fatalities caused by the bite of this snake which I read in a Journal, the name of which now escapes me, in about 1970. I also remember discussing this animal with John Visser at about the same time. He was of the opinion that *T. kirtlandii* was a very dangerous snake and the action of its venom was similar to that of the one I was working on at the time, *Agkistrodon rhodostoma.*

Fitzsimmons refers to *T. kirtlandii* as being the possessor of venom which he describes as "extremely toxic" and compares it with that of *Dispholidis.* In the US Navy's Manual for Amphibious Forces this snake is described as the only "rear-fanged snake that is known to cause serious injury, and occasionally death".

As with all back-fanged species, of course, the chances of receiving a serious bite are slight but I think all herpetologists should be aware of the danger, particularly as almost all injuries have occurred while handling captive snakes rather than during accidental encounters in the wild.

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M. Buchanan-Jones
Perry's Acre, Micheldever, Hampshire SO21 3DF

Ed. Note: *Thelotornis* is included on the schedule of U.K. Dangerous Wild Animals Act (1984 Modification).

Dear Sirs,

Carl Gans' letter in Bulletin 26, on the Saw-scaled Viper, is a timely reminder of the importance of venomous snake taxonomy in the treatment of her bites.

The *Echis carinatus* complex is not the only group of venomous snakes which was once thought to be monospecific, but which in fact consists of several species. Another example is the Asiatic Cobra *(Naja naja)* assemblage, which was until now considered to be monospecific: work now in progress in this Department has shown that this group consists of at least five species. As is the case in *Echis,* some of these species require different antivenoms for the neutralization of their venoms. This is particularly important since some of these species occur sympatrically in some areas, such as southern Thailand.

Important inter-population differences in venom properties have also been found within species of venomous snakes. The effects of the venom of Russell's Viper differ radically from area to area, and antivenom produced against the snakes in one region does not necessarily neutralize the venoms of snakes from other regions. Differences in venom properties have also been found within other species, such as several rattlesnake species.

In consequence, persons intending to come into contact with any widespread species of venomous snake, either in the field or in a captive situation, should endeavour to ascertain the origin of the snakes, and to obtain antivenom produced from the venom of snakes from the particular region.

Wolfgang Wüster, Department of Zoology, University of Aberdeen, Tillydrone Avenue, Aberdeen AB9 2TN, Scotland

Dear Sirs,

Herpetological Society in Southern Spain

I am very pleased to contact you as a member of the Asociación de Amigos de la Herpetologia, created in Sevilla in 1987 with the purpose of gathering together the persons interested in reptiles and amphibians in the south of Spain.

The aims of this association are to exchange information between ourselves, hold periodical meetings, field collecting trips, lectures in schools (we think it very important to inculcate in children the idea of reptiles as beneficial to society), etc.

The small number of members and financial status (most are students) have prevented us from issuing a magazine or a bulletin of information.

Anyway, we would be very glad to keep in contact with you for anything in relation to herpetology and you are kindly requested to give our address to your members in order to exchange information, animals (mainly snakes), books, etc.

Thanks in advance for your cooperation, we look forward to your news.

We remain, yours sincerely,
Rafael Guerrero Garcia
Jesus de la Vera Cruz, 9 prim.dcha., 41002 Sevilla, España

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- **New Publication:** "Biology and Conservation of the Green Lizard *Lacerta viridis* and the Wall Lizard *Podarcis muralis* in Jersey" by C.J. Perkins & R.A. Avery. Jersey Wildlife Preservation Trust Special Scientific Publication No. 2, 55 pages including photographs and a colour frontispiece. Obtainable at £8 per copy from Roger Avery, Zoology Department, The University, Bristol BS8 1UG.

- **Wanted:** Loan of Lacertid Lizard for research. We are currently investigating maximum running speeds and allometric changes in body proportions in Lacertid Lizards and how these factors may relate to habitat adaptation. Some preliminary results on allometric scaling and running speeds in these lizards have been obtained but we can see now that a larger data base is required, both to clarify inter-specific and ontogenetic differences. We would, therefore, be most interested to hear from any Herpetologists who could help with this project by supplying individuals of any species of Lacertid Lizards, adults or juveniles, for photographic purposes and measurement. All animals, if required, can be returned after this simple procedure and acknowledgements of assistance will be included in any publications. If you can be of help, please contact either:–
  Dr. Roger Avery, Dept. of Zoology, University of Bristol, Woodlands Road, Bristol.
  Tel: 0272 303765 (daytime)
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