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

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Front cover illustration. *Plectrohyla exquisita* from Parque Nacional El Cusuco, Honduras. See article on page 13. Photograph © J. R. McCranie.

EDITORIAL

Meeting announcement

Joint Scientific Meeting: The British Herpetological Society and The Herpetological Conservation Trust. Saturday 4th December 2004 at the Open University, Milton Keynes.

Targeting research where it's needed

This one-day scientific meeting is a collaborative effort between the BHS and the HCT. It aims to examine whether current research is addressing ecological and conservation needs, and how we might ensure that it does in the future. By hosting presentations on research that clearly has useful applications, we hope to encourage greater communication in the future between academic researchers, conservationists, NGOs, statutory agencies and decision-makers.

Registration price, schedule and programme to be confirmed. Call for papers: Whilst the programme will include invited papers and time will be limited, we welcome suitable offers of verbal or poster presentations. Contact Chris Gleed-Owen: research@thebhs.org or chris.go@herpconstrust.org.uk

NOTES AND COMMENTS

Non-venomous bite from a Lowland Swamp Viper, *Proatheris supercilliaris*

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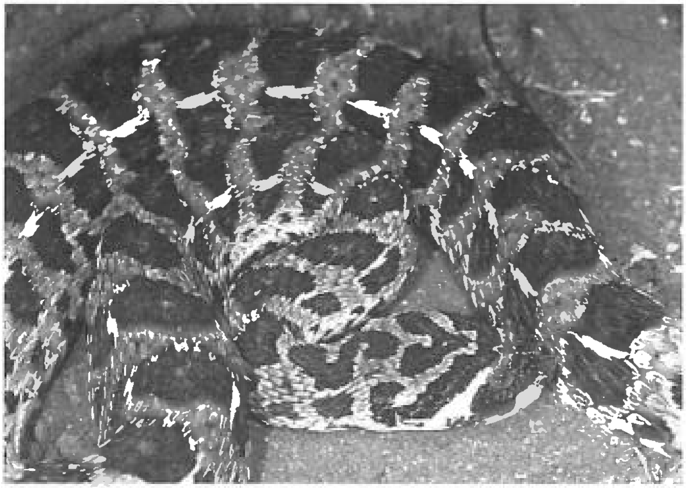
On October 11th 2003, during a photographic session at the Pretoria Zoological Gardens, I was bitten by an adult female Lowland Swamp Viper. One fang penetrated the third finger on the right hand midway between the first and second joint. Apart from the initial sting of the actual bite there was no pain, tingling or burning sensation that one would normally associate with a viper bite. However, one symptom was very notable in that the puncture wound bled freely, in fact it dripped like a tap for ten minutes then abated a little but continued to bleed for a further twenty minutes. The wound was bathed liberally with a strong antiseptic solution and dressed. My right arm was then kept immobile by my side. Immediately after the bite the local A&E was alerted and several people who had experience with this species were contacted, including Dave Morgan who had some information with regard to a recent case history. Dave liaised with hospital staff and emphasised the species concerned, and also that there was no antiserum cover.

After an hour although still a bit shaken, I was feeling well and just sat quietly in a comfortable chair in the office being checked by the head keeper Lauren Nels every five minutes or so. Lauren had been on the telephone with regard to the recent case history and stated that there had been initial pain and burning but more importantly there had been a delayed reaction where the patient had experienced dizziness and nausea some six hours after the initial bite. So it was decided that I should sit it out for a while, but after four hours it was obvious that I had received a dry bite, and rightly or wrongly, I went on to photograph another little viper, *Bitis cornuta*, without any further mishap.

Els (1988) describes an account of one case history where a twenty four year old male was bitten by a 20 cm neonate, one fang penetrating the left index finger. There was immediate intense burning and only slight bleeding from the site of the bite. After fifteen minutes the site of the bite was blue-black and blistered. On day two the pain was reduced but the bite area was sensitive. Recovery was complete within just over a week.

The captive *Proatheris* at Pretoria was an adult female originally from Lake Chilwa in Malawi and measured 68 cm, which is very large compared to wild specimens which average 40–50 cm with a maximum of 60 cm (Mallow et al., 2003; Morgan 1988). It has also been stated that more serious bites could be expected from larger specimens of *Proatheris* (Spawls & Branch, 1985).



Proatheris supercilliaris. Photograph by author.

During forty years of handling venomous snakes I have suffered three what I consider to be serious bites, all from vipers namely, *Vipera berus*, *Bitis arietans*, and *Crotalus atrox*. I have also received a number of bites which have had less serious effects, again *V. berus*, but also *Bothreichis schlegelii* and *Trimeresurus albolabris*. Without exception all these incidents have one thing in common; they were the result of silly mistakes.

This most recent incident was no exception really. The snake was being photographed on a table top which had been dressed to resemble it's natural habitat. I was being assisted by Lauren and when placed on the table the snake was active but non-aggressive. The camera was on a tripod and the front of the lens was 60 cm away from the coiled snake. The first part of the shoot went without incident and then I switched to a hand held digital camera. Again the camera was about the same distance away, but I was concentrating on the viewing screen, and not the snake. The viper struck without warning, literally launching itself the full length of it's body, and after biting, fell to the floor. The range of that strike was amazing and it took me completely by surprise. I have photographed hundreds of similar-sized vipers in the same manner without incident. These have included some notoriously aggressive species, such as saw-scaled vipers, *Echis* spp. and young Puff Adders, *Bitis arietans*. But this species was new to me and I forgot the golden rule, always expect the unexpected, so there is no excuse, just another mark on that learning curve.

Information: The Lowland Swamp Viper was until quite recently included as a terrestrial species of *Atheris* (bush vipers), along with another terrestrial form, the Kenyan Mountain Viper, *Montatheris hindii*. Broadley (1996) created the two new genera in his review of the Atherini group. *Proatheris superciliaris* is an eastern African species found on the Mozambique plain from Biera northward and following the Zambezi River floodplain to Lake Malawi and Tanzania (see Branch, 1988).

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Effect of husbandry manipulations on respiratory rates in captive Bearded Dragons (*Pogona vitticeps*)

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ABSTRACT — The behaviour, body temperatures and respiratory rates of captive Bearded Dragons (*Pogona vitticeps*) were recorded during periods with handling and non-handling intervals. Respiratory rates increased at approximately equal rates with increasing body temperatures irrespective of whether the animals were handled or not. Respiratory rates increased significantly after handling but there were no significant differences in behaviour before and after handling. The implications of the results are discussed with regard to use of animals in captive husbandry and education programmes.

REPTILE behaviour is shaped by many factors; their genetic heritage, environments, and experiences among others, and these may interlink to define what are easy or difficult species to deal with in a husbandry context. Progress in reptile husbandry has now gone beyond basic techniques and in recent years has extended to asking questions about behavioural and physiological problems in captive conditions (Warwick et al, 1995). As captive breeding and rearing of reptiles becomes more common and perceived as both an aid to conservation and education, there is a need for an increased understanding of the subtler requirements of their maintenance in captivity and the frequency of their usage in demonstrations for educational purposes.

In this respect it is interesting that the response to captive conditions are varied and often surprising. For example the discovery of elevated body temperatures after husbandry manipulations in the teiid lizard *Callopistes maculatus* (Cabanac & Gosselin, 1993) which has been termed emotional fever, does not necessarily apply to all lizards; a recent study on the Australian Bearded Dragon (*Pogona vitticeps*) was unable to detect any significant influence of handling on thermoregulation (Cannon et. al., 2002). However the effects of handling on lizards may concern factors other than thermoregulation and we have expanded the question to test for the effects on respiratory rates in *P. vitticeps*. One of the benefits of this approach is that although respiratory frequency is irregular in lizards (Avery & D'Eath, 1986), it is readily observed and often elevates in response to external stimuli (Milsom, 1984; Avery, 1993) and hence it is a convenient, albeit indirect, method for determining stress as direct measurement requires the examination of hormone levels such as adrenalin and corticosteroids. We simultaneously measured behaviour and body temperatures to test for any possible influences they may also have had on respiration. The results are based on data collected by K.M. for a second year HND research assignment at Huddersfield Technical College supervised by R.M. but with additional data gathered by T.W.

METHODS AND MATERIALS

The observations were made between September 2002 and February 2003 on five adult *P. vitticeps* aged 3–4 years consisting of one male and four females. All animals were captive bred at the

	Before handling		No handling at all		After handling	
	Median	*Q*1 - *Q*3	Median	*Q*1 – *Q*3	Median	*Q*1 – *Q*3
Basking	37.5	25.0 - 70.0	20.0	3.3 - 53.5	66.6	20.0 - 73.3
Perching	40.0	28.4 - 52.5	73.3	34.0 - 79.9	40.0	13.3 - 80.0
Shade	5.0	1.25 - 27.5	13.3	6.6 - 23.3	1.0	0 - 10.4

Table 1. Behaviours of *P. vitticeps* with the results shown as the grand medians (with interquartile ranges *Q*1 - *Q*3) which have been calculated from the median percentage frequencies of individual lizards, i.e. $n = 5$.

college and had previously been employed in teaching programmes including demonstrations in animal handling. The data were usually collected once a week between 12:30 and 15:00 hours on a single enclosure measuring 2.24 m long and 0.94 m wide with a height of 1.77 m. The cage was exposed to natural sunlight as well as light provided by UV lamps and infrared heating lamps. The latter produced a temperature range of between 28 and 49°C. Body temperature, here determined as skin surface temperature, was measured using an Omega OS204 non-invasive digital thermometer by directing the instrument about 1– 5 cm from the surface of the skin. Skin surface temperature is in good agreement with cloacal temperature in lizards particularly in medium sized animals (Meek, 1999).

The observational conditions were 1) 30 minutes of continuous observation with no handling at any time, 2) 15 minutes of no handling with a 5 minute handling interval followed by 3) a further 15 minute period of no handling after the handling interval. The lizards were handled on a 1-week rotational basis, two females were handled during one session followed by a week of no handling with the other two females handled on the weeks when the others were not handled. The male was handled on alternate weeks. The behaviours were: *basking*, positioned either in the sun or under a heat lamp which could be either on tree stumps or rocks; *perching*, positioned in an open area but not in sun or under a lamp; *hiding*, located down an under ground retreat area; *locomotory activity*, engaged in movement in any area of the enclosure. Counts of respiratory frequency were based on each complete cycle of ventilatory movements of the anterior rib cage (Milsom, 1984) lasting 1 minute at 5-minute intervals over the 15 or 30-minute observational periods.

The total data collected were 320 observations each on behaviour and body temperature and 320 one-minute observations periods of respiration. However, because of the degree of scatter in respiratory frequency when the animals were active these data have been eliminated from the main analysis and used only in calculating behaviour frequencies. Therefore observations of respiratory frequencies were 309. The method of analysis used here however was to consider each individual lizard as one data point based on the means of respiratory rates, body temperatures or the medians of individual percentage behaviours (Hurlbert, 1984). This considerably reduces the degrees of freedom and hence the possibility of committing a type II statistical error (Wilson & Dugatin, 1996) but it avoids overestimating the degrees of freedom, as would be the case if each measurement had been treated as an independent event (Lombardi & Hurlbert, 1996). Plus or minus values given are standard deviations.

RESULTS

Body temperature effects on respiration. To test for possible influences of body temperature on respiration it was found that the simplest method was to mathematically model the data sets and compare the rates of change. Since most physiological processes increase exponentially with temperature, body temperature (T_b) was treated as the independent variable x and the logarithmic transforms of respiratory rate as the dependent variable y giving an equation of the form:

$$y = ae^{bx}$$

where e is the base natural logarithm, b the exponential and a the y-intercept. Standard errors for b have been calculated using the method described by Bailey (1981). Figure 1 shows plots of the data on semi logarithmic coordinates and indicates increased respiratory frequency with increasing body temperatures, irrespective of whether the animals were handled or not. When the lizards were not handled (both no handling data sets pooled) the relationship was defined by:

$$Respiration = 1.548e^{0.06 \pm 0.01Tb} \quad n = 250 \quad (1)$$

and after handling by:

$$Respiration = 6.594e^{0.034 \pm 0.027b} \quad n = 59 \quad (2)$$

Equation (1) indicates a higher rate of increase in respiration with temperature but the standard errors attached to the exponentials are high in both equations particularly in equation (2) reflecting the amount of scatter. A test for differences between exponentials showed that they were not significantly different $t = 0.16$, $p > 0.05$ (Bailey, 1981) and therefore respiration increased with increasing temperature at similar rates.

Respiration rates. The mean respiratory rates of resting lizards are shown in Fig. 2 as box plots. The highest rates were from the animals after they were handled (grand mean = 20.6±1.0), before they were handled, grand mean = 14.1±1.2 and when they were not handled at any time 13.2±1.1. A test using ANOVA, $F_{(2,12)} = 64.61$, $p < 0.0001$ showed differences in the data sets. A two sample t-test with variances assumed unequal indicated that the differences were significant between respiration after the lizards were handled and the other two samples respectively: before they were handled, $t = 9.09$, $p < 0.0001$, $d.f. = 8$, not handled at any time, $t = 11.07$, $p < 0.0001$, $d.f. = 8$. These results support the validity of pooling both no handling data sets for calculating equation (1).

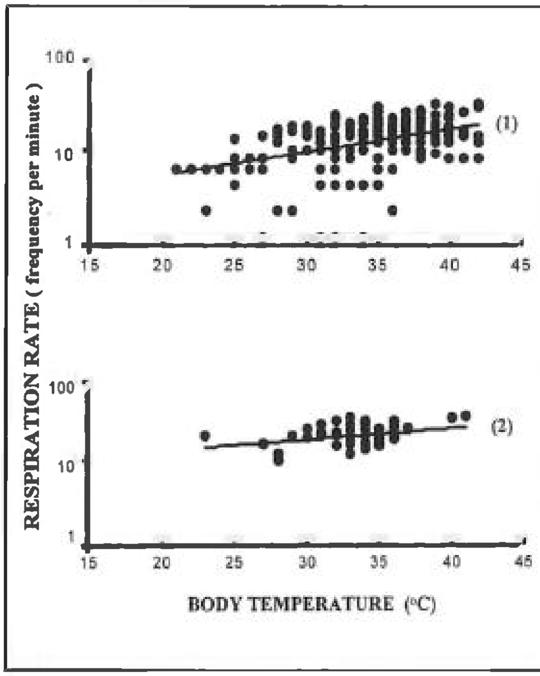

Figure 1. Graphs on semi logarithmic coordinates showing the relationship between respiratory rate and body temperature after handling (lower graph) and when not handled. The lines taken through the data were fitted using equations (1) and (2) given in the text. See text for a further explanation of these results.

Behaviour related respiratory rates. To determine whether there were purely behaviour aspects to respiratory rates, the data were analysed in their behaviour subsets. We could examine only for the principal behaviours as these had the only useful sample sizes. The results showed that the mean was greater in perching after handling (18.4± 3.9 per minute) compared to perching before handling (12.8±1.1per minute) and not handled at any time (11.7±1.8 per minute). ANOVA detected differences in the data sets $F_{(2,12)} = 10.71$, $p =$

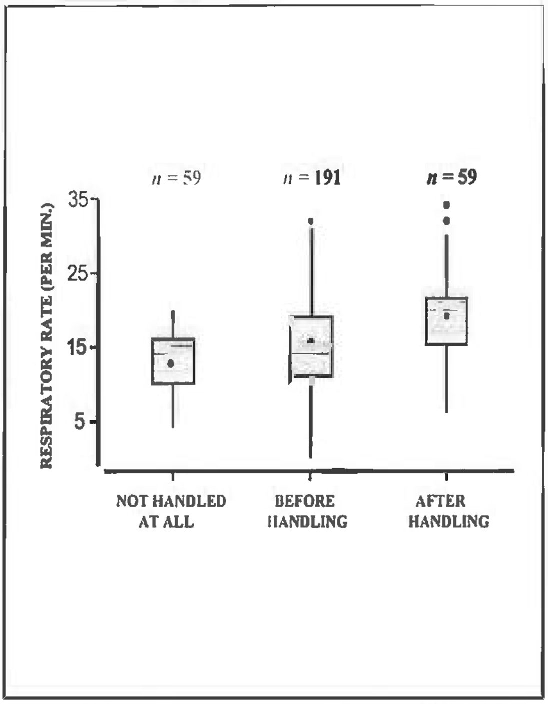

Figure 2. Box plots of respiratory rates of *P. vitticeps* when they were not handled at any time (left) immediately before (centre) and after they were handled. The boxes represent the interquartile ranges with the means shown as solid circles and medians as horizontal bars. The vertical lines either side of the interquartile ranges represent the general ranges of the data but solid circles indicate outliers – data that are between 1.5 to 3 times from the interquartile ranges.

0.002 and two sample *t*-tests with the variances assumed unequal showed the differences were between respiration rates after handling and the other two data sets: before handling, $t = 3.28$, $p = 0.03$, *d.f.* = 4, not handled at any time, $t = 3.65$, $p = 0.015$, *d.f.* = 5. Respiratory rates were greater in basking lizards after they were handled (mean = 20.2±2.3) followed by before handling (16.3±2.0) and when they were not handled at any time (14.4±1.0). Again ANOVA detected differences in the data sets, $F_{(2,12)} = 12.18$, $p = 0.001$ and two sample *t*-tests showed the differences in respiratory rates were between after handling and immediately before handling ($t = 2.79$, $p = 0.027$, *d.f.* = 7) and after handling and not handled at any time ($t = 5.06$, $p = 0.004$, *d.f.* = 5).

Behaviour. We compared behaviour differences to determine if changes here could have been influencing respiratory rates. The data were converted to percentage frequencies of total behaviours and the results are shown in Table 1 as median percent values. Kruskal Wallis non –parametric tests showed no significant differences between the data sets; *Basking*, $H = 3.96$, *perching*, $H = 4.74$, shade, $H = 3.04$, all $p>0.05$ and at $3n = 15$. Activity levels were low during the study (from 1.6 to 4.5% of total behaviours) and not considered viable for statistical testing.

DISCUSSION

The present findings show a strong association between lizard handling and increased respiratory rates in *P. vitticeps*. The statistical methods employed, including the obvious differences in *y*-intercepts between equations (1) and (2) satisfactorily eliminated behaviour and body temperature as contributing effects. The results therefore indicate that the increased respiration rates were due to handling with the expectation that adrenalin secretion followed. Why should the findings be a consideration in reptile husbandry? Previous research has shown that elevated respiratory rates, through what has been described as handling stress, initiated dramatic hormone changes even in reptiles that are habituated to humans (Lance, 1992) resulting in reduced growth, suppressed reproductive capacity and susceptibility to infection (Stephens, 1980; Lillywhite & Gatten, 1995; Guillette et. al., 1995). Irrespective of the view that animals must be at some time be subject to some stress in their natural environments (Greenberg & Wingfield, 1987) and is an evolutionary mechanism for adaptation to changing environments (Guillette, 1985), it would appear nevertheless that elevated respiratory rates, particularly if handling is a frequent normal practice, is an important issue not only for animal welfare but also captive breeding programmes. What was perhaps unexpected was the failure of our *P. vitticeps* to habituate to frequent handling, in the sense that subjectively they appeared to be little disturbed by the experience. However, increased respiratory rates associated with sudden stimuli – loud noises among other things, were observed in Lacertid lizards that had been in captivity for long periods (Avery, 1999) and prey capture probability also decreased with increasing respiratory frequency with a total absence of feeding at high respiratory movements (Avery, 1993).

A theoretical consideration is that being picked up and benignly handled is something that reptiles are unlikely to have experience of in natural conditions and therefore may have no inbuilt behavioural mechanisms, determined by evolutionary processes, that enable them to respond positively to the experience. Indeed contact, particularly with larger species, is something they would be expected to avoid based on evidence from observations on animals in both field and captive conditions. For example, free-living lizards that were awoken at night in their regular resting place avoided these spots on the following nights (Bowers & Burghardt, 1992) and captive Australian Treefrogs (*Litoria caerulea*) living in large naturalistic enclosures abandoned regular resting places after being handled (R. Meek, pers. obs.). This indicates the evolution of behaviours designed to avoid contact with other species, which must be adaptive in most circumstances – antipredation is one obvious example. Many reptiles held in private and education establishments are handled on an almost daily basis which may physiologically equate with frequent predator encounters, but there is no real evidence that reptiles are naturally subject to such high intensities of predator interaction and as such may be detrimental to long term well being.

It would appear then that the evidence suggests some species appear to be more affected by husbandry manipulations than others; an example is the different effects on thermoregulatory behaviour (e.g. Cabanac & Gosselin, 1993; Cannon et. al., 2002). Handling effects may very well depend on, among other things, the animal's natural lifestyle – species that employ flight as an escape tactic rather than crypsis could be more susceptible to stress through human contact. This could be a useful area for further investigation and a key factor to be taken into account in respect to research or educational programmes and relevant since practical husbandry courses on reptiles are a high growth area in UK education.

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Ecological notes on two colubrid snakes (*Coluber viridiflavus* and *Elaphe longissima*) in a suburban habitat (Rome, central Italy)

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THE colubrid snakes *Coluber viridiflavus* and *Elaphe longissima* are among the most conspicuous elements of the snake fauna in Mediterranean central Italy. They are known to inhabit a wide variety of habitats, from mixed forests to evergreen 'macchia' vegetation, and from grasslands to cultivated farmland (Bruno & Maugeri, 1977; Agrimi, 2000; Cattaneo & Capula, 2000). In addition, these species can also be found in suburban and urban areas (Bologna et al., 2003; Rugiero, 2003).

Published data on several aspects of the population ecology of these two species in Mediterranean central Italy are quite abundant for such disparate habitats as agro-forest (e.g., see Capizzi et al., 1995; Capizzi & Luiselli, 1996; Luiselli & Capizzi, 1997) and mixed oak forest (Rugiero et al., 2002). However, there are no data published as yet on the population ecology of these snakes in suburban areas. Our aim in this paper is to address some notes on the ecology of these two species in a suburban habitat situated near Rome, one of the largest towns in Italy.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1998	-	-	-	-	-	-	-	-	2455	2277	2190	-	6922
1999	-	-	1315	140	2545	1270	549	-	390	110	-	-	6319
2000	275	-	290	1304	652	573	-	-	180	315	-	-	3589
Total	275	-	1605	1444	3197	1843	549	-	3025	2702	2190	-	16830
Sampling effort	0.016	-	0.095	0.085	0.189	0.109	0.032	-	0.179	0.160	0.130		

Table 1. Field effort (in minutes) divided by month and by year at the study site.

STUDY AREA AND METHODS

The study area was situated at the southeastern peripheral border of Rome (Latium, central Italy), between two busy main roads ('via Prenestina' and the urban zone of 'Tor Bella Monaca'). It was a grassy area used for grazing and cultivation, with a small artificial canal crossing the grassy fields. The canal banks were vegetated with dense, spiny bushes of *Rubus ulmifolius.*

The field study was carried out between September 21st, 1998, and October 21st, 2000. Ninety days were spent in the field (25 in 1998, 32 in 1999, and 33 in 2000), for a total of 280.5 man-hours of research (115.4 in 1998, 105.3 in 1999, and 59.8 in 2000; see Table 1 for details). Unfortunately, we were unable to conduct any field surveys during February, August and December (Table 1). All captured specimens were individually marked by ventral scale clipping, and then measured to snout-vent length (to ± 0.5 cm) and sexed by examining the shape of the cloacal region. We also recorded dietary data via forced regurgitation of the ingested bolus (Luiselli & Agrimi, 1991), although limited this to only a small number of specimens to avoid excessive disturbance to the few snakes inhabiting the study area.

To assess monthly activity of the two species, we followed the same statistical procedures of Seigel (1992) and Rugiero et al. (1998). We first determined the relative sampling effort per month by dividing the number of minutes spent in the field each

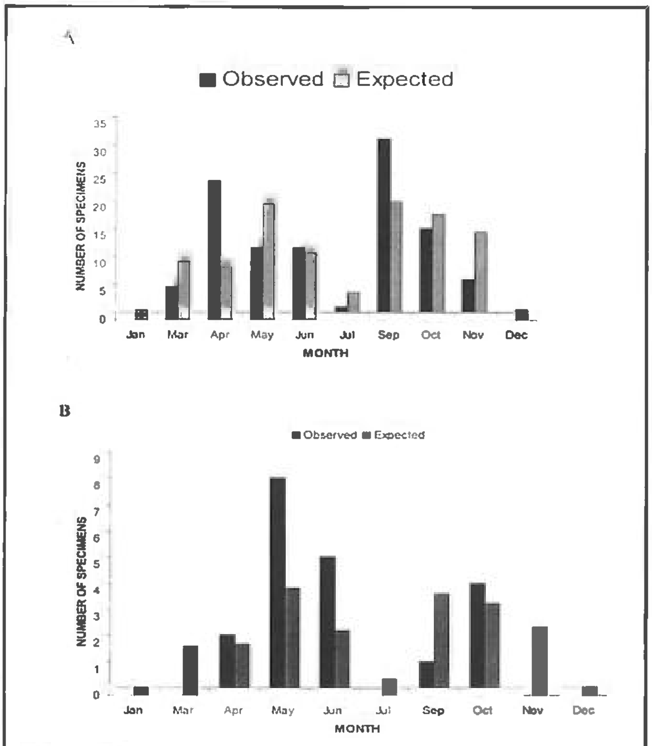

Figure 1. Observed and expected month-by-month frequency of occurrence of the two species of snakes at the study area, in relation to sampling effort. A: *Coluber viridiflavus*; B: *Elaphe longissima.*

month by the total number of minutes in the field during the entire research period. Using a null hypothesis of equal activity among months, we then generated the expected number of snakes active each month by multiplying the total number of snakes found active during the study by the relative sampling effort for each month.

Finally, observed and expected values were compared by using a χ^2 test. Statistical analyses were done by using the PC package 'Statistica' (for Windows, version 5.0), with all tests being two-tailed and alpha set at 5%.

RESULTS AND DISCUSSION

We found only two snake species at the study area: *Coluber viridiflavus* and *Elaphe longissima*. In total, we captured 37 *C. viridiflavus* (18 males, 13 females, 6 subadults), and 15 *E. longissima* (8 males, 6 females, 1 subadult). 37.8% of the marked *C. viridiflavus* were recaptured at least once (46.1 % of females, 38.9 % of males, and 16.7 % of subadults). The maximum number of recaptures (7) was for an adult male. With respect to *E. longissima,* we recaptured just two males and one female, i.e. 20% of the total marked sample.

In both species, males were significantly longer than females (87.5 ± 12.73 cm versus 79.28 ± 7.57 cm in *C. viridiflavus*; Student *t*-test with df = 35, $p < 0.05$; 102.57 ± 8.71 cm versus 93.05 ± 2.38 cm in *E. longissima*; *t*-test with df = 13, $p < 0.05$).

The observed and expected, month-by-month frequency of occurrence of the two species in relation to sampling effort is presented in Fig. 1. *Coluber viridiflavus* had two significant peaks of activity: April and September (in both cases the observed frequencies significantly exceeded the expected frequencies at $p < 0.05$, χ^2 test); *Elaphe longissima* had just a single activity peak during May–June observed frequencies significantly exceeded the expected frequencies at $p < 0.05$, χ^2 test).

Data recorded on the diet of the two species are presented in Table 2. There was an apparent partitioning in the food preferences between species, with *E. longissima* eating only small mammals and *C. viridiflavus* eating mainly lizards and, to a lesser degree, small mammals. However, the number of prey items recorded for both species was clearly too small to be sure.

Six out of 12 *C. viridiflavus* and two out of five *E. longissima* (captured in 2000) had the tail broken or injured (this type of data was not recorded in the previous years). In addition, five *C. viridiflavus* (13.5 % of the sample) and three *E. longissima* (20 % of the sample) were injured also along the body.

The summarized main patterns of population ecology for the two species in diverging habitats of Mediterranean central Italy are presented in Appendix 1. As can be seen, the two species were quite constant in much of their characteristics in each of the various habitats, although some relatively minor differences emerged in terms of adult sex-ratios and activity peaks. Given the apparent uniformity among habitats in the various population parameters examined, it is difficult to assess whether the urban environment had any notable effect on the population ecology of these two species. However, the proportion of urban specimens with injuries is relatively high, and it is thus unfortunate that such data were not collected

Type of Prey	**Prey items in** *C. viridiflavus*	**Prey items in** *E. longissima*
Reptilia, Lacertidae		
Lacerta bilineata	5 (33.3%)	-
Podarcis sicula	3 (20%)	-
Podarcis muralis	2 (13.3%)	-
Mammalia		
Rattus norvegicus	1 (6.7%)	5 (83.3%)
Muridae undetermined	4 (26.7%)	
Talpa sp.		1 (16.7%)
TOTAL	15	6

Table 2. Summary of diet data recorded for *Coluber viridiflavus* and *Elaphe longissima* from the study area. Percentages of total diet composition are also presented for both species.

Adult males of *Coluber viridiflavus* (top) and *Elaphe longissima* (below) from study area. Photographs © Lorenzo Rugiero.

for the other conspecific populations presented in Appendix 1. It is noteworthy that high injury rates (represented by specimens with broken tails) were also found in two *C. viridiflavus* populations inhabiting coastal 'macchia' and an agroforest habitat (Capula et al., 2000); however, in our urban area the frequency of specimens with broken tail was much higher than in either of the two above-mentioned areas (22.6% [n = 53] and 11.8% [n = 34] respectively), and it is thus likely that exposure to predation in such modified, unnatural sites is very high. It is probable that feral cats, which are very abundant in our urban study area, represent the most important predators of snakes in this community.

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APPENDIX I. Summarized patterns of population ecology of *Coluber viridiflavus* and *Elaphe longissima* in various habitat types of Mediterranean central Italy.

Habitat	Adult Sex-Ratio	Body Size	Activity	Diet	Reference
Coluber viridiflavus					
Urban	About 1:1	Males > Females	Bipeaked (April, September)	Lizards, and mice as secondary prey	This study
Bushy pastures	Skewed towards Males	Males > Females	Single peak (April-May)	Lizards, and mice as secondary prey	Capula et al., 1997
Oak Forest	About 1:1	Males > Females	???	Lizards, and mice as secondary prey	Rugiero et al., 2002
Mountain forest	Skewed towards Males	Males > Females	Single peak (April-May)	Lizards, and mice as secondary prey	Filippi & Luiselli, 2003
Agro-forest	About 1:1	Males > Females	???	Lizards, and mice as secondary prey	Capizzi & Luiselli, 1996
Elaphe longissima					
Urban	About 1:1	Males > Females	Single peak (April-May)	Mice	This study
Oak Forest	About 1:1	Males > Females	???	Mice, and birds and lizards as secondary prey	Rugiero et al., 2002
Mountain forest	Skewed towards Males	Males > Females	Single peak (April-May)	Mice	Filippi & Luiselli, 2003
Agro-forest	Skewed towards Males	Males > Females	???	Mice, and lizards as secondary prey	Capizzi & Luiselli, 1996

The herpetofauna of Parque Nacional El Cusuco, Honduras (Reptilia, Amphibia)

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ABSTRACT — Thirty species of amphibians and reptiles (four salamanders, nine anurans, six lizards, and 11 snakes) are recorded from Parque Nacional El Cusuco, located in the northwestern portion of the Honduran department of Cortés and adjacent Santa Bárbara. The park has an area of about 234 km^2 of mountainous terrain located in the Lower Montane Wet Forest formation. Elevations in the park range from 1500 m to 2242 m on the peak of Cerro Jilinco. The visitors' centre lies at 1550 m. The nuclear zone of the park receives a minimum of 3000 mm of rainfall annually. Mean annual temperature in this zone is 18°C at its lower reaches and 16°C at its higher reaches. The vegetation is characteristic of the Lower Montane Wet Forest formation of Holdridge and is organized into three strata. Population declines or disappearances of 30.8% of the amphibian species are documented in the park. Only 8.9% of the entire Honduran mainland and insular herpetofauna and 30.0% of the species found in the Lower Montane Wet Forest formation are afforded protection in the park. Careful and continuing monitoring of the park's remaining herpetofaunal populations will be necessary.

RESUMEN — Trienta especies de anfibios y reptiles (cuatro salamandras, nueve anuros, seis largartijas y 11 culebras) han sido registrados por el Parque Nacional El Cusuco, ubicado en la parte noroeste del departamento hondureño de Cortés y la parte adyacente de Santa Bárbara. El parque comprende approximadamente 234 kilometros quadrados de terreno montañoso en el cual se representan una formación vegetal, Bosque Muy Húmedo Montano Bajo. Las alturas en el parque se extienden entre 1500 m a 2242 m en el pico de Cerro Jilinco. El Centro de Visitantes está situado a 1550 m. La zona nuclear del parque recibe un mínimo de 3000 mm de lluvia anualmente. Temperatura anual promedia en esta zona es 18°C en los alcances bajos y 16°C en los alcances más altos. La vegetación es típica de la formación Bosque Muy Húmedo Montano Bajo y está organizo en tres niveles. Declinaciones o desaparecimientos de poblaciones de un 30.8 porciento de las especies de los anfibios son documentados en el parque. Solamente 8.9 porciento de la herpetofauna hondureña de la tierra firme y las islas y 30.0 porciento de las especies ubicados en la formación Bosque Muy Húmedo Montano Bajo son proveidos protección en el parque. Se necesita un monitoréo cuidadoso y continuo de las poblaciones remanentes de anfibios y reptiles.

OUR knowledge of the herpetofauna of Honduras has reached a point where it is possible to examine its conservation status, which we have been doing in a series of recent papers. Wilson & McCranie (1998) examined population declines in several amphibian species known from Parque Nacional Pico Bonito. Wilson et al. (2001) discussed in detail the efficacy of the current system of biotic reserves in providing protection to the country's herpetofauna. McCranie & Wilson (2002) assayed the probable future of the amphibian fauna of the country. Wilson & McCranie (2003) identified a group of so-called herpetofaunal 'indicator species' in order to assess the 'environmental stability' of habitats in Honduras. Wilson & McCranie (2004a) discussed the conservation status of the Honduran herpetofauna.

The assessments discussed above have indicated that the study of the Honduran herpetofauna has entered a new era. Since 1980, when the first new species (*Leptodactylus silvanimbus*; McCranie et al. 1980) was described in what can be labeled the 'modern era' of herpetofaunal research in Honduras (McCranie & Wilson, 2002), many new taxa have been added to the herpetofauna of this country (see McCranie & Wilson, 2002, for a discussion of the amphibian additions up to that time). Wilson & McCranie (1998), however, provided the turning point into a new era, one of significant population declines, especially in amphibians distributed at about 900 m and above in the country. These declines are especially important, inasmuch as it is the most distinctive segment of the Honduran amphibian fauna, the endemic species and those otherwise restricted to Nuclear Middle America, that have been most drastically affected (McCranie & Wilson, 2002). Nonetheless, it is also evident that reptile populations are also becoming adversely affected (Wilson & McCranie, 2003, 2004a), principally as a result of habitat destruction, so that both segments of the herpetofauna are involved.

That these trends are part of the problem of global biodiversity decline is becoming increasingly evident (see E. Wilson, 1988, 1992; E. Wilson & Perlman, 2000 for general assessments). It is also evident that these irreversible trends are occurring in the face of an extensive system of biotic reserves present in Honduras. The reasons for this set of circumstances have been examined at length by Wilson et al. (2001) and Wilson & McCranie (2004a).

We recently began a series of papers concerned with the composition, distribution, and conservation status of the amphibians and reptiles occurring in various biotic reserves in Honduras with an inaugural paper on Refugio de Vida Silvestre La Muralla in northwestern Olancho (Espinal et al, 2001). The present paper is the second in this series and examines these same aspects for Parque Nacional El Cusuco, a park established in the highest reaches of the Sierra de Omoa in the northwestern corner of Honduras.

One or both of us have made eight trips into this park, starting in 1979, at a time before the park was established.

The purpose of this paper is to discuss the composition, geographical and ecological distribution, and the conservation status of the herpetofauna of Parque Nacional El Cusuco. In addition, we also discuss the importance of this park as a herpetofaunal reserve.

MATERIALS AND METHODS

Specimens are deposited in the following museums: California Academy of Sciences, San Francisco (CAS); Field Museum of Natural History, Chicago (FMNH); Museum of Natural History, The University of Kansas, Lawrence (KU); Natural History Museum of Los Angeles County (LACM); Museum of Natural Science, Louisiana State University, Baton Rouge (LSUMZ); Museum of Vertebrate Zoology, University of California, Berkeley (MVZ); Royal Ontario Museum, Toronto, Canada (ROM); Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt am Main, Germany (SMF); National Museum of Natural History, Washington DC (USNM); Universidad Nacional Autónoma de Honduras, Tegucigalpa (UNAH).

Fieldwork for this paper is summarized as follows: Wilson and McCranie have made six trips together for a total of 18 days (12th–14th April 1979; 21st–23rd May 1980; 1st–3rd August 1982; 13th–14th July 1983; 3rd–7th August 1987; 22nd–23rd July 1996); McCranie made two trips by himself for 6 days (18th–21st August 1992; 9th–10th September 2003). In addition, our Honduran colleague Mario R. Espinal collected for 15 days on three trips in 1993 (11th–14th July; 17th–22nd August; 26th–30th September). The fieldwork by McCranie and Wilson was concentrated on the El Cusuco region up to 1850 m on Cerro Cusuco, whereas Espinal visited several nearby peaks and mountain slopes. We have also included specimens collected by Gunther Köhler in the El Cusuco area 24th–27th September 1996.

DESCRIPTION OF THE PARK

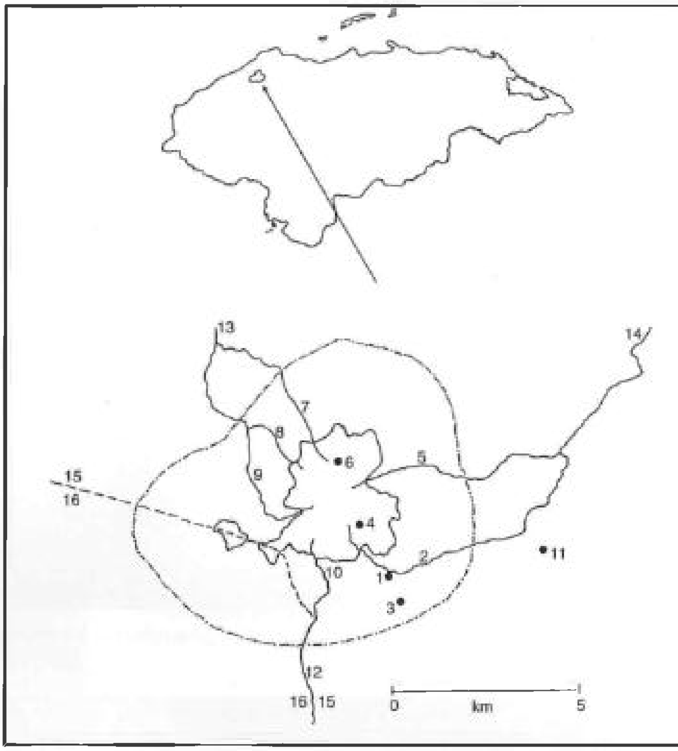
Parque Nacional El Cusuco is located in the northwestern sector of the Honduran department of Cortés and the adjacent portion of the department of Santa Bárbara (Map 1). The park encompasses an area of approximately 234 km^2, with a nuclear zone of about 7.7 km^2 (Anonymous, No Date). The park consists of elevations of 1500 m and higher, with those of 1800 m and higher making up the nuclear zone. A visitor's centre is situated near the road leading to the park from Buenos Aires at 1550 m.

Physiography

Parque Nacional El Cusuco is situated within the largest physiographic area in Honduras, the *Serranía* (Wilson et al., 2001). Moreover, it is found within the northern portion of the *Serranía*, called the Northern Cordillera. The park is located within the Sierra de Omoa (also called Cordillera de Merendón on some maps), the northwestern-most mountain range in Honduras. This range is bounded on the north and west by the alluvial plain of the Río Motagua and also on the north by the adjacent narrow coastal plain bounding the Bahía de Omoa. It is bounded on the east by the Sula Valley formed of the alluvial plains of the ríos Chamelecón and Ulúa and on the south by the valley of the Río Chamelecón and tributaries of the Río Motagua.

Climate

The park is subject to the Highland Wet climatic regime (Wilson & Meyer, 1985). Espinal et al. (2001:101) noted, for Refugio de Vida Silvestre La Muralla, 'The Highland Wet climate occurs primarily above 1500 m elevation and is characterized by 1500 mm or more of annual precipitation and a mean annual temperature of less than 18°C....'. Maps of isohyets and isotherms for Parque Nacional El Cusuco are presented in Anonymous (1994). The isohyet map illustrates that the nuclear zone of the park is surrounded by an isohyet of 3000 mm. The isotherm map



Map. 1. Boundary map of Parque Nacional El Cusuco and an outline map of Honduras showing the park's location. The dot-dash line shows the park's outline; the solid lines show the outline of the park's nuclear zone; the dash-dash line shows the departmental boundaries for Cortés and Santa Bárbara. The other solid lines are rivers and streams. Localities are: (1) El Cusuco; (2) Río Cusuco; (3) Cerro Las Minas; (4) peak of Cerro Cusuco; (5) Quebrada de Jimerito; (6) peak of Cerro Jilinco; (7) Quebrada El Jilinco; (8) Quebrada El Pizote; (9) Quebrada de Cantiles; (10) Quebrada Cabeceras de Naco; (11) Buenos Aires; (12) Río Naco; (13) Río Cuyamelito; (14) Río Cuyamel; (15) department of Cortés; and (16) department of Santa Bárbara.

indicates that the nuclear zone is surrounded by an isotherm of 18°C and that one of 16°C lies within the park.

Vegetation

The vegetation of Parque Nacional El Cusuco is referable to the Lower Montane Wet Forest formation, as slightly modified from Holdridge (1967), commonly referred to as 'cloud forest'.

Above: *Duellmanohyla soralia*. Below: *Norops johnmeyeri*. All photographs © J. R. McCranie.

This formation is found at elevations above about 1500 m and is characterized by a mean annual precipitation range of 2000–4000 mm and a mean annual temperature range of 12° to 18°C (Wilson & Meyer, 1985).

Anonymous (1994) indicated that this forest formation, called by them 'Zona de Vida Bosque Muy Húmedo Montano Bajo', is characterized by the presence of three strata. The uppermost stratum consists of a closed canopy of trees attaining heights of 35 to 40 m of the following species: *Quercus* spp.; *Podocarpus oleifolius*; *Clusia massoniana*; and *Liquidambar styraciflua*. The middle stratum is composed of the forgoing species lying in the shade of the taller conspecifics mixed with *Persea vesticula* and *Myrica cerifera*. The lowermost stratum is comprised of seedlings of the species in the middle and uppermost strata intermixed with palms such as *Chamaedorea costaricana* and *C. oblongata*, as well as *Geonoma congesta* and a great variety of ferns. Many epiphytic orchids, bromeliads, and mosses are present, as well as lianas and vines.

Microhabitats

Many microhabitats exist for the members of the herpetofauna in the park. There are numerous streams that provide habitat for streamside anurans, such as the species of *Plectrohyla* and *Ptychohyla* and their larvae. The undergrowth of the surrounding forests is a setting for the anoles of the genus *Norops*. Logs lying on the ground provide habitat for various semifossorial snakes, such as *Ninia espinali* and *Tantilla*

Bolitoglossa conanti.

Plectrohyla dasypus.

Hyla bromeliacia.

Dryadophis dorsalis.

Cerrophidion godmani.

Cerrophidion godmani.

schistosa, and the lizard *Mesaspis moreletii*. Numerous epiphytic bromeliads house salamanders of the genera *Bolitoglossa* and *Cryptotriton*, as well as the bromeliad frog *Hyla bromeliacia* and the stream-breeding frog *Plectrohyla dasypus*.

RESULTS

Composition

The known herpetofauna of Parque Nacional El Cusuco (Table 1) consists of 30 species, including four salamanders (13.3%), nine anurans (30.0%), six lizards (20.0%), and 11 snakes (36.7%). The colubrid snake *Coniophanes bipunctatus* was apparently erroneously reported from the park in a list in Anonymous (1994). That list was compiled by data from McCranie and collections made by

M. R. Espinal. We have been unable to locate this specimen among the collections made by M. R. Espinal (see Materials and Methods).

Broad patterns of geographical distribution

As did Wilson & Meyer (1985), Wilson et al. (2001), and McCranie & Wilson (2002), we placed the species occurring in the park into a set of distributional categories based on the entire extent of their geographic range (Table 1). Five of the categories used by Wilson et al. (2001) do not apply to this paper (species with the northern terminus of the range in the United States and the southern terminus in Central America south of the Nicaraguan Depression [category B], species with the northern terminus of the range in the United States and the southern terminus in Nuclear Middle America [category C], species with the northern terminus of the range in Nuclear Middle America and the southern terminus in South America [category G], marine species [category K], and insular and/or coastal species [category L]). The applicable categories are as follows:

A. Northern terminus of the range in the United States (or Canada) and southern terminus in South America;

D. Northern terminus of the range in Mexico north of the Isthmus of Tehuantepec and southern terminus in South America;

E. Northern terminus of the range in Mexico north of the Isthmus of Tehuantepec and southern terminus in Central America south of the Nicaraguan Depression;

F. Northern terminus of the range in Mexico north of the Isthmus of Tehuantepec and southern terminus in Nuclear Middle America;

H. Northern terminus of the range in Nuclear Middle America and southern terminus in Central America south of the Nicaraguan Depression;

I. Restricted to Nuclear Middle America (exclusive of Honduran endemics);

J. Endemic to Honduras.

The data on broad distributional patterns in Table 1 indicate that the largest number of species (10 or 33.3% of a combined total of 30 species) fall into the I category, i.e., that containing the Nuclear Middle American-restricted species (exclusive of the Honduran endemics). The next largest category is J, with nine species (30.0%), containing the Honduran endemics. Together, these two categories comprise 63.3% of the tally for the park. The other five categories contain from one to three species each and harbour, as a group, 36.7% of the total number.

Park distribution

We established three categories of distribution of the members of the herpetofauna within Parque Nacional El Cusuco (Table 1). Species are considered to be widespread in the park, restricted to the park or its immediate environs (although, in some cases, species may be distributed otherwise outside of Honduras), and peripherally distributed in the park.

Of the 30 species recorded from Parque Nacional El Cusuco, 15 (50.0%) are widespread, four (13.3%) are restricted to the park or its immediate surroundings, and 11 (36.7%) are peripheral.

Ecological distribution

In terms of vertical positioning within the primary microhabitat, 15 species (50.0%) were usually found only in arboreal situations, 14 (46.7%) only in terrestrial ones, and one (3.3%) in both (Table 1). With respect to occurrence in the two major microhabitats in the park (forest proper, streamside), 21 (70.0%) were found only within the forest proper, eight (26.7%) only along streams, and one (3.3%) in the forest and along streams.

If the two sets of categories, vertical position within the primary microhabitat and major microhabitats, are combined, then ten species (33.3%) are arboreal forest inhabitants, five (16.7%) are arboreal streamside inhabitants, 11 (36.7%) are terrestrial forest inhabitants, two (6.7%) are terrestrial streamside inhabitants, one (3.3%) is a terrestrial forest and streamside inhabitant, and one (3.3%) is a terrestrial-arboreal streamside inhabitant.

Table 1. Distribution of the 30 species of amphibians and reptiles known from Parque Nacional El Cusuco. Abbreviations include: Park Distribution-W = widespread in park, R = restricted to park or immediate environs, P = peripherally distributed in park; Primary Microhabitat-A = arboreal, T = terrestrial, F = forest inhabitant, S = streamside inhabitant; Relative Abundance-C = common, I = infrequent, R = rare; Conservation Status-S = stable populations in Parque Nacional El Cusuco, D = Parque Nacional El Cusuco populations declining, E = extirpated from park, N = no data on population status. See text for explanation of Broad Distribution Pattern abbreviations.

Species	Park Distribution	Elevational Range (m)	Broad Distribution Pattern	Primary Microhabitat	Relative Abundance	Conservation Status
Bolitoglossa conanti	P	1550-1560	I	A, F	I	S
Bolitoglossa diaphora	W	1550-2200	J	A, F	C	S
Bolitoglossa dunni	P	1550-1570	I	A, F	R	S
Cryptotriton nasalis	W	1550-2200	J	A, F	R	S
Bufo valliceps	P	1550	E	T, F	R	N
Duellmanohyla soralia	P	1550-1570	I	A, S	R	D
Hyla bromeliacia	W	1550-1790	I	A, F	C	S
Plectrohyla dasypus	R	1500-1990	J	A, S	C	S
Plectrohyla exquisita	R	1500-1680	J	A, S	C	S
Ptychohyla hypomykter	W	1500-1720	I	A, S	C	S
Eleutherodactylus milesi	W	1550-1720	J	T, S	C	E
Eleutherodactylus rostralis	W	1550-1800	I	T, F	R	D
Rana maculata	P	1580-1590	I	T, S	R	D
Mesaspis moreletii	W	1720-1870	I	T, F	I	S
Sceloporus malachiticus	W	1550-1660	H	A, F	C	S
Norops amplisquamosus	R	1530-1720	J	A, F	C	S
Norops cusuco	R	1550-1935	J	A, F	C	S
Norops johnmeyeri	W	1550-1825	J	A, F	C	S
Sphenomorphus cherriei	P	1590	E	T, F	R	N
Dryadophis dorsalis	P	1550-1570	I	T, F	R	N
Drymarchon melanurus	P	1550	A	T, F	R	N
Drymobius chloroticus	W	1550-1810	F	T, F, S	I	D
Imantodes cenchoa	P	1550	D	A, F	R	S
Leptophis ahaetulla	W	1680	D	T, A, S	R	N
Ninia espinali	W	1590-2242	I	T, F	R	S
Stenorrhina degenhardtii	P	1550-1630	D	T, F	I	S
Tantilla schistosa	W	1680	E	T, F	R	N
Micrurus diastema	P	1550	F	T, F	R	S
Bothriechis marchi	W	1550-1840	J	A, S	R	D
Cerrophidion godmani	W	1700-1880	H	T, F	I	S

Relative abundance

The 30 species known from the park are classified as being common (found on a regular basis, many individuals can be found), infrequent (unpredictable, few individuals seen), or rare (rarely seen). These classifications are historical (i.e., based largely on earlier trips to the parks) and do not take into consideration the population declines taking place for some species (see next section). Ten species (33.3%) are classified as being common (one salamander, five anurans, four lizards), five (16.7%) as being infrequent (one salamander, one lizard, three snakes), and 15 (50.0%) as being rare (two salamanders, four anurans, one lizard, eight snakes).

Population declines

Population declines, especially of amphibians, are underway in this national park (McCranie & Wilson, 2002), as is the case elsewhere in Honduras (McCranie & Wilson, 2002; Wilson & McCranie, 1998, 2003, 2004a). Of the 13 species of amphibians presently known from the park, 4 (30.8%) have either declining populations or are apparently extinct. Those with declining populations are *Duellmanohyla soralia, Eleutherodactylus rostralis*, and *Rana maculata.* One species, *Eleutherodactylus milesi,* appears to be extinct (see discussion below). *Eleutherodactylus milesi* is endemic to Honduras and *Duellmanohyla soralia, Eleutherodactylus rostralis,* and *Rana maculata* are restricted in distribution to Nuclear Middle America.

As discussed by McCranie & Wilson (2002: 412), 'The population of *Eleutherodactylus milesi* at El Cusuco, Cortés, has apparently disappeared. Concerted efforts to find this frog were unsuccessful on three days and four nights in August 1992 and three days and two nights in July 1996. Additionally, we did not find this frog during four days of general collecting at El Cusuco during August 1987, nor did M. R. Espinal on two collecting trips to the region in July and August 1993 [also in September 1993]. The forests at El Cusuco remain in a pristine condition, as the area has been a national park since 1987. El Cusuco serves as the visitors' centre for the park and has guards and park personnel on duty 24 hours a day. Permission is needed from park personnel just to use the park trails. The disappearance of *E. milesi* from El Cusuco appears to be part of a general pattern of disappearance of all streamside *Eleutherodactylus* populations in the country occurring at about 900 m elevation and higher ....' *Eleutherodactylus milesi* also could not be found during 9th–10th September 2003.

Study of tadpole collections made in 1996 at El Cusuco indicated that many specimens of *Plectrohyla dasypus* (Honduran endemic not known outside of the park) and *Ptychohyla hypomykter* (restricted in distribution to Nuclear Middle America) had deformed mouthparts. As noted by McCranie & Wilson (2002: 540), 'It appears initially that this phenomenon may be connected to such occurrences that are beginning to be reported elsewhere (Berger et al., 1998; Lips, 1998, 1999), and may be related to overall amphibian population declines or disappearances from pristine habitats at moderate to intermediate elevations recently realized in Honduras, as has been demonstrated also for several localities in Costa Rica and Panama (Lips, 1998, 1999)'. However, in September 2003, these two species were found to still be common in the park and were heard calling on both nights spent in the park. Also, all tadpoles of *P. hypomykter* collected at that time had normal mouthparts.

Parque Nacional El Cusuco harbours seven other Honduran endemics, including *Bolitoglossa diaphora, Cryptotriton nasalis, Plectrohyla exquisita, Norops amplisquamosus, N. cusuco, N. johnmeyeri,* and *Bothriechis marchi.* Three of these Honduran endemics (*P. exquisita, N. amplisquamosus,* and *N. cusuco*) are not known outside of Parque Nacional El Cusuco. Given the above-indicated documented cases of decline or disappearance, it is obviously critical that the populations of the species mentioned in this section be carefully monitored for changes in their population status.

IMPORTANCE OF THE PARK AS A HERPETOFAUNAL REFUGE

In the same manner as Espinal et al. (2001), we utilize the data in Wilson et al. (2001) in assessing the value of Parque Nacional El Cusuco as a refuge for amphibians and reptiles. Wilson et al. (2001) broadly dealt with the usefulness of the Honduran system of biotic reserves. This paper has the advantage of treating in more detail the herpetofauna of one of the country's better-known biotic reserves.

As currently understood, the herpetofauna of the mainland of Honduras, Bay Islands, Cayos Cochinos, Miskito Keys, Swan Islands, and territorial waters consists of 344 species (McCranie, 2004; McCranie & Castañeda, submitted; McCranie & Wilson, 2002; McCranie et al., 2002, 2003a,b, submitted; Wilson & McCranie, 2002; Wilson et al., 2003), including 120 amphibians and 224 reptiles (six of which are marine in distribution). The known herpetofauna of Parque Nacional El Cusuco (30 species), thus, comprises 8.9% of the 338 species known from the mainland and insular environments in Honduras. The percentage of the various mainland and insular species afforded nominal protection in the park varies widely. Neither of the two species of caecilians, none of the nine species of non-marine turtles, nor neither of the two crocodilians is recorded from the park. The percentages of the other groups are as follows: salamanders (15.4% of 26 species); anurans (9.8% of 92 species); lizards (6.8% of 88 species); and snakes (9.2% of 119 non-marine species).

As is obvious, the above figures are somewhat misleading, inasmuch as Parque Nacional El Cusuco harbours only one of the forest formations located in Honduras. It is more useful, therefore, to assess the park's importance by comparing the herpetofaunal composition in the park with that of the same formation in the country as a whole. McCranie & Wilson (2002) and Wilson & McCranie (2004b) demonstrated the presence of 15 salamander species and 28 anuran species in the Lower Montane Wet Forest formation in Honduras. With the addition of one salamander species to this formation (McCranie et al., submitted), the park's four salamander species make up 25.0% and its nine anurans 32.1% of the whole. Wilson & McCranie (2004b) recorded 22 lizard and 33 snake species from this same forest formation. With the addition of one species of snake to this forest formation (McCranie & Castañeda, submitted), the park's six lizard and 11 snake species constitute 27.3% and 32.4%, respectively, of the whole.

As is evident in almost every other biotic reserve in Honduras (Wilson et al., 2001; Wilson & McCranie, 2003, 2004a), Parque Nacional El Cusuco is subject to human-caused environmental problems. The threats to the integrity of this park have been elucidated by Anonymous (1994), including deforestation, farming and ranching, forest fires, natural landslides, and hunting.

Deforestation, with subsequent growth of secondary forest is a continuing problem in the park. It is noted in Anonymous (1994) that deforested patches range in size from two to 20 hectares. A three hectare deforested patch near the source of Quebrada de Cantiles at 1900 m was highlighted in that report.

Farming and ranching have been proceeding in the park for about two decades prior to the publication of Anonymous (1994), and were reported to have reached the vicinity of the nuclear zone of the park to the north and northeast of Cerro Jilinco at elevations of about 1700 m.

Forest fires are most frequently caused by spread of fires set to burn cropland residues prior to a new season of planting. They have the effect of killing the young trees as a consequence of the fire and the older trees as they become susceptible to illness and insect damage (Anonymous, 1994).

As noted in Anonymous (1994), landslides do occur naturally in the park, but can also result from deforestation and the resulting opening up of the soil to erosion.

Hunting for large mammals, including monkeys, has been more severe in the past (Anonymous, 1994), and has resulted in a scarcity of such animals in the nuclear zone of the park. Such animals are now protected by law in the park, and the threat is thought now to be less than in the past. Nonetheless, as discussed above, slightly less than half of the species of amphibians resident in the park have populations that are in decline or that have disappeared altogether. These species, all anurans, are either endemic to Honduras or are otherwise restricted in distribution to Nuclear Middle America. As a consequence of these documented declines and disappearances, it will be necessary to carefully monitor these and the other herpetofaunal populations in the park on a continuing basis.

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APPENDIX I - Specimen locality data

Bolitoglossa conanti.— El Cusuco, 1550–1560 m, MVZ 186755, 186757–58, 186760, 225842–43.

Bolitoglossa diaphora.— near Quebrada de Cantiles, ca. 1700 m, SMF 77611; El Cusuco, 1550 m, MVZ 186764, 221178, 221180, 225844–48, SMF 77610, 77614–15, USNM 335045–48; Cerro Jilinco, 2200 m, MVZ 221179.

Bolitoglossa dunni.— El Cusuco, 1550–1570 m, MVZ 186726, 186756, 186759.

Cryptotriton nasalis.— El Cusuco, 1550 m, KU 194183–87; Cerro Jilinco, 2200 m, USNM 339713–14.

Bufo valliceps.— El Cusuco, 1550 m, KU 209270.

Duellmanohyla soralia.— El Cusuco, 1550–1570 m, KU 195556, USNM 514521.

Hyla bromeliacia.— El Cusuco, 1550–1790 m, KU 194179–80 (both tadpoles), 194224, 209702 (tadpole), SMF 48024, USNM 304997 (tadpoles), 523169–70.

Plectrohyla dasypus.— Quebrada Cabeceras de Naco, 1990 m, SMF 78816, USNM 514409–13; Quebrada de Cantiles, 1825 m, USNM 514414; El Cusuco, 1550–1690 m, CAS 170006, KU 186025–33, 186035 (tadpoles), 186036–37, 186038 (tadpoles), 192879 (tadpoles), 209653–56, 209698 (cleared and stained adult), 209703, 209704 (tadpoles), 209710 (tadpoles), USNM 513859–62 (all tadpoles), 513863, 514415–16, 523472 (tadpoles); Quebrada El Pizote, 1570 m, USNM 514417.

Plectrohyla exquisita.— Quebrada de Cantiles, 1570 m, USNM 513488–89; El Cusuco, 1550–1680 m, KU 192880–84, 194178 (tadpoles), 209695–97, 223919 (tadpoles), UNAH 2510, USNM 513483–87, 513490–93.

Ptychohyla hypomykter.— El Cusuco, 1550–1720 m, KU 192885–87, 204197–202, 204211 (cleared and stained adult), SMF 77606–07 (both tadpoles), USNM 319923, 508456 (tadpoles), 514301–04.

Eleutherodactylus milesi.— El Cusuco, 1550–1720 m, KU 209040–57, 209060–75, 209107, 209141, LACM 137298–305.

Eleutherodactylus rostralis.— El Cusuco, 1550–1800 m, ROM 18093–94, SMF 77592–93, USNM 535858; Montaña San Ildefonso, 1600 m, USNM 535861.

Rana maculata.— El Cusuco, 1580–1590 m, KU 194242, 200549.

Mesaspis moreletii.— El Cusuco, 1720–1870 m, KU 200587–88, USNM 549353–54.

Sceloporus malachiticus.—El Cusuco, 1550–1660 m, KU 194316, 200569, 200620.

Norops amplisquamosus.— El Cusuco, 1530–1720 m, KU 219924–49, USNM 549356–58; Sendero El Danto, 1580 m, SMF 77747–48, 77750.

Norops cusuco.— El Cusuco, 1550–1935 m, KU 194275–85, SMF 78842, 79170–71, 79182, USNM 532567–68.

Norops johnmeyeri.— Quebrada de Cantiles, 1825 m, SMF 78824–26; El Cusuco, 1550–1580 m, KU 192623, LSUMZ 37834, SMF 77755, USNM 322902–08, 549363–66; Sendero de Cantiles, 1740–1770 m, SMF 77760–61; Sendero El Danto, 1580 m, SMF 77756–58.

Sphenomorphus cherriei.— Sendero Las Minas, 1590 m, SMF 78864.

Dryadophis dorsalis.— El Cusuco, 1550–1570 m, based on several specimens seen, but not collected.

Drymarchon melanurus.— El Cusuco, 1550 m, FMNH 23698.

Drymobius chloroticus.— El Cusuco, 1550–1810 m, KU 200598–99, ROM 19974–75, USNM 508411.

Imantodes cenchoa.—El Cusuco, 1550 m, USNM 559720.

Leptophis ahaetulla.— between El Cusuco and Quebrada de Cantiles, 1680 m, USNM 337533.

Ninia espinali.— Quebrada de Cantiles, 1825 m, USNM 333037; El Cusuco, 1590 m, USNM 333036; Cerro Jilinco, 2242 m, USNM 333038.

Stenorrhina degenhardtii.— El Cusuco, 1550–1630 m, KU 194349–50.

Tantilla schistosa.— El Cusuco, 1680 m, USNM 337556.

Micrurus diastema.— El Cusuco, 1550 m, unnumbered specimens in collection of the Fundación Ecologista 'Hector Rodrigo Pastor Fasquelle' at the visitors' centre.

Bothriechis marchi.— El Cusuco, 1550 m, ROM 20016; Sendero de Cantiles, 1840 m, SMF 78867.

Cerrophidion godmani.— El Cusuco, 1700–1880 m, KU 194362, 200624–27.

APPENDIX II - Gazetteer

Buenos Aires — village where road to El Cusuco leaves Cofradía-Buenos Aires road; 1140 m (15°30'N, 88°11'W).

Cabeceras de Naco, Quebrada — stream (upper tributary of Río Naco) draining southern slopes of Cerro Cusuco; collections made at 1990 m (15°29'N, 88°14'W).

Cantiles, Quebrada de — stream (upper tributary of Río Cuyamelito) on west side of Cerro Cusuco; collections made from 1570 to 1825 m (15°31'N, 88°14'W).

Cusuco, Cerro — see Cusuco, El.

Cusuco, El — finca and environs along Río Cusuco on Cerro Cusuco, 5.6 km WSW of Buenos Aires, now serves as visitors' centre for park; collections made in park from 1530 to 1935 m (15°31'N, 88°12'W).

Cusuco, Río — upper tributary of Río Cuyamel, visitors' centre along this river (see Cusuco, El).

Jilinco, Cerro — mountain just NNW of Cerro Cusuco; collections made from 2200 to 2242 m (15°31'N, 88°14'W).

Jilinco, Quebrada El — stream (upper tributary of Río Cuyamelito) draining north slope of Cerro Jilinco.

Jimerito, Quebrada de — upper tributary of Río Cuyamel in east-central portion of park.

Pizote, Quebrada El — stream (upper tributary of Río Cuyamelito) on western slopes of Cerro Jilinco; collections made at 1570 m (15°31'N, 88°15'W).

San Ildefonso, Montaña — mountains just NW of El Cusuco, of which Cerros Cusuco and Jilinco are a part; collections made in park at 1600 m (15°31'N, 88°14'W).

Sendero de Cantiles — trail leading from visitors' centre; collections made from 1740 to 1840 m (15°30'N, 88°14'W).

Sendero El Danto — trail leading from visitors' centre; collections made at 1580 m (15°31'N, 88°12'W).

Sendero Las Minas — trail leading from visitors' centre to Cerro Las Minas; collections made at 1590 m (15°29'N, 88°14'W).

Distributional records for some herpetofaunal species in the islands of SW Turkey, with notes on the diet of *Laudakia stellio*

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THE herpetofauna of the coastal islands of SW Turkey was the subject of a detailed study by Baran (1990), who explored more than 150 of the islands situated between Marmaris and İskenderun. In May 2003 we had the opportunity to visit some of these islands and to collect new data, the presentation of which is the aim of this paper. Among the islands visited, only Kizkumu Islet was not previously explored by Baran (1990); therefore no data on its herpetofauna are available in the literature (cf. Baran & Atatür, 1998; Sindaco et al., 2000, and references therein).

STUDY AREA

Most of the islands visited are situated in the Göcek-Fethiye Bay: Göcek (36°43'64"N 28°56'40"E), Yassica (36°42'23"N 28°56'01"E), Tersane (36°40'22"N 28°55'21"E), Domuz (36°39'69"N 28°54'06"E), and Delikli (36°40'04"N 29°02'12"E), the easternmost of a small group of islets with the same name, often indicated in maps as 'Deliklitas Adalari'. Kameriye (36°43'74"N-28°03'35"E) is located off the N coast of the Bozborun peninsula. Finally, Kizkumu (36°45'71"N 28°07'48"E) lies in the inlet of Keçibükü, at the end of the Orhaniye Bay, approximately 100 m off the coast. Geographical coordinates of the areas studied were determined using 'Cmapecs Electronic Chart System' software (version 4).

Land surface areas of the islands comprise between 0.044 (Kizkumu) and 4.87 km^2 (Tersane), and maximum altitudes are generally within 100 m a.s.l. The islands of Göcek-Fethiye Bay have a volcanic origin, while thoses of Bozborun peninsula, representing the top of submarine promontories, are characterised by massive Mesozoic limestone deposits. All of them are included in the isobath of –50 m and were connected with the mainland during the Pleistocene sea regressions. The climate is mediterranean, with an average annual temperature of 18.6°C and a total annual rainfall of circa 1,000 mm (recorded in Marmaris). Variation in annual rainfall, however, is considerable, and prolonged droughts are not uncommon. The relative humidity is low throughout the summer months (50–60%), and somewhat higher in winter (70–75%) (Carlström, 1987 and references therein). Superficial hydrography consists of two perennial streams in Göcek, a few wells, cisterns and small troughs in Tersane and Kameriye, and one salt-marsh coastal lagoon in Yassica. Vegetation is comprised mainly of scrub forest with *Quercus coccifera*, *Olea europaea* var. *sylvestris*, *Pistacia terebinthus*, *Ceratonia siliqua* on Domuz, Tersane, and Kameriye. Pine-woods with *Pinus brutia*, and low maquis with *Cistus* sp. and *Erica* sp. form a dense covering on Göcek and Yassica. A dense thorn forest vegetation with *Genista acanthoclada*, *Sarcopoterium spinosum*, *Pistacia lentiscus* and *Erica* sp. covers Delikli. Finally, a phrygana dominated by *Phlomis fruticosa*, with sparse *Olea europaea* var. *sylvestris*, is present in Kizkumu. In some islands (Tersane, Domuz, Kameriye, Kizkumu), grazing by goats has lead to significant change in the vegetation. Moreover, Tersane is currently inhabited by few people; a large part of Domuz is private property, used as a summer residence. On Kizkumu, ruins of a Byzantine fortress occur. The remaining islands are uninhabited, but commonly visited during summer by tourists.

SPECIES ACCOUNTS

Amphibians

Family Bufonidae

Bufo viridis (Laurenti, 1768)
One male found in Kameriye, in the vicinity of an old cistern located within about 150 m of the church ruins. This is the first evidence of the occurrence of *Bufo viridis* on the island.

Reptiles

Family Gekkonidae

Cyrtopodion kotschyi (Steindachner, 1870)
Two specimens found in Yassica, in the ruins of a building located about 100 m from the landing stage; several specimens found in Kizkumu, in rocky crevices and on the fortress walls. The species is new for both islands.

Family Agamidae

Laudakia stellio (Linnaeus, 1758)
This species is widely distributed in W and S Anatolia (Baran & Öz, 1985; Sindaco et al., 2000),

Table 1. Dietary composition of *Laudakia stellio* by numbers of items (*N*), percentage of total (*N*%), and numbers (*n*) and percentage (*n*%) of pellets containing that prey type.

PREY TYPE	*N*	*N*%	*n*	*n*%
unidentified Arthropoda	**9**	**3.22**	8	33.33
Arachnida	**(5)**	**(1.79)**		
Araneae	5	1.79	2	8.33
Orthoptera	**(26)**	**(9.31)**		
Acrididae	7	2.50	6	25.00
Tettigoniidae	19	6.81	17	70.83
Heteroptera	(37)	(13.25)		
Lygaeidae	3	1.07	3	12.50
Pentatomidae	18	6.45	12	50.00
other Heteroptera	16	5.73	8	33.33
Homoptera	**23**	**8.24**	9	37.50
Coleoptera	(58)	(20.76)		
Melolonthidae	4	1.43	1	4.16
Cetoniidae	21	7.52	7	29.16
Buprestidae	2	0.71	1	4.16
Curculionidae	13	4.65	7	29.16
other Coleoptera	18	6.45	12	50.00
Lepidoptera	(3)	(1.07)		
adults	1	0.35	1	4.16
larvae	2	0.71	2	8.33
Diptera	9	**3.22**	5	20.83
Hymenoptera	(109)	(39.06)		
Apoidea	25	8.96	14	58.33
Formicidae	74	26.52	15	62.50
other Hymenoptera	10	3.58	9	37.50

on the Aegean islands of the Dodecanese, as well as on the coastal Turkish islands (see Baran, 1990). However, in these latter islands it does not seem to be common: only one and three specimens were observed in Yassica and Tersane, respectively, where this species was previously recorded by Baran (1990). In contrast, a large population of *Laudakia stellio* occurs on Kizkumu living in the rocky cliffs and on the walls of the fortress ruins. On this islet, mean density was about 2–6 individuals per 10 m^2, but in some areas it reaches up to 10 or 12 individuals. During the transect surveys, we collected faecal pellets (n = 24) that could be attributed undoubtedly to this species, because of their characeristic shape and size. Pellets were examined in the laboratory under a dissecting microscope, and remains of 279 preys were identified to family level (mean = 11.6 identifiable food items per pellet). Although the sample size was inadequately small for statistical analysis, the data permit at least some general comments on diet in this population (summarised in Table 1). Prey items consisted mainly of insects, with Coleoptera and Hymenoptera representing circa 60% of the entire sample. Among these, ants seem to constitute the major prey group and occur in 62% of the pellets examined. Although lower in terms of percentage composition, katydids are also frequently eaten by the lizards, having been identified from 70% of the pellets. Katydids thus seem to comprise an important prey source in the population studied, and most of the remains could be furthermore referred to perhaps a single species, the size range of which was above average (about 25–27 mm in length). Most of the other prey items identified measured between 6 and 12 mm. An unidentified species of Tettigoniidae characterised by this particular size range was observed quite commonly on the islet, where it shows a surprising high population density. Prey availability on Kizkumu thus seems to correspond well to the dietary composition of *Laudakia stellio* in this environment. Furthermore, the wide range of different prey species (see Table 1) suggests that *L. stellio* is an opportunist, as indicated in other studies on trophic ecology in this species (Düşen & Öz, 2001; Lo Cascio et al., 2001). In addition to invertebrate prey, analysis of the pellet material also revealed a small but significant level of plant consumption (plant matter found in 16% of examined pellets, n = 4), which does not seem to be an important component of the diet when compared to populations from other insular environments (cf. Lo Cascio et al., 2001).

Family Scincidae

Ablepharus kitaibelii Bibron & Bory St. Vincent, 1833

Several specimens found in Delikli, where the species was previously unrecorded. Most were observed in leaf litter and low vegetation on a small beach of the NW coast. This species is well represented in the islands of coastal southwestern Turkey (Baran, 1990), as well as in W Anatolia; it is considered a polytypic species by Schmidtler (1997), even though this author did not discuss the subspecies that occurred in Anatolia.

Family Typhlopidae

Typhlops vermicularis Merrem, 1820

One dead specimen, probably trampled accidentally by goats, was collected in Domuz, along a path on the northeastern coast. Two others were observed respectively in Tersane and Kizkumu, while they were trying to hide under stones. The species is reported here as new for each of these islands. Its distribution covers almost the whole of Anatolia (Sindaco et al., 2000); however it does not seem to be frequent on the coastal Turkish islands (see Baran, 1990).

Family Colubridae

Hierophis jugularis Linnaeus, 1758

One adult found in Göcek, near the eastern stream, and the remains of one juvenile were also collected near the landing-stage. The species is new for this island. Widely distributed in S Anatolia, it does not seem to be common on the coastal Turkish islands (see Baran, 1990, as *Coluber jugularis*). In accordance with Schätti (1988), we refer this species to the genus *Hierophis* Fitzinger, 1843, recognized by this author as distinct from *Coluber* Linnaeus, 1758.

Eirenis modestus (Martin, 1838)
One specimen found in Kameriye, hidden under stones situated within a few metres from the sea. The species is new for the island. Within the genus *Eirenis* Jan, 1863, this is the only species with a distribution extending to SW Anatolia (Schmidtler, 1993). It seems to be relatively common on the coastal Turkish islands (see Baran, 1990).

SUMMARY

One amphibian and six reptile species are reported for the first time from the following islands of SW Turkey: Domuz (*Typhlops vermicularis*), Tersane (*Typhlops vermicularis*), Yassica (*Cyrtopodion kotschyi*), Göcek (*Hierophis jugularis*), and Delikli (*Ablepharus kitaibelii*), in the Göcek-Fethiye Bay; Kameriye (*Bufo viridis* and *Eirenis modestus*), located off the northern coast of Bozborum peninsula; and Kizkumu (*Cyrtopodion kotschyi*, *Laudakia stellio* and *Typhlops vermicularis*), in the Orhaniye Bay. Data concerning the diet of *Laudakia stellio* on the latter island are also discussed.

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NATURAL HISTORY NOTES

***CHIOGLOSSA LUSITANICA* (Golden-striped Salamander): DICEPHALIC LARVA.** The Golden-striped Salamander is an endemic species from northwestern Iberia, listed in the IUCN Red Data Book. It is a streamside salamander that occurs in mountainous areas not higher than 1200 m, with high precipitation and humidity levels (Sequeira et al., 1996; Arntzen, 1999; Teixeira et al., 2001). This species usually lays eggs in small clusters in submerged holes along stream margins, attached to the undersides of stones or against rocks in slow flowing water and in subterranean water channels (Arntzen, 1981; Sequeira et al., 2001). In some mine galleries, such as those at Serra de Santa Justa near Porto, Portugal, it is common to see hundreds of eggs on the walls. Due to their importance as reproduction sites, three mines have been monitored since 1994. In October 2003, during egg counting, a living two-headed larva of *C. lusitanica* was found and kept in captivity until its death on 29th November, apparently due to a fungus infection in the gills. External macro- and microscopic analysis shows two well-formed heads (Figure 1), but in the absence of thorough anatomical analysis it is not possible to draw conclusions regarding their development. The vertebral column is bifurcated in the cervical region, a condition known as derodidymus (Frye, 1991). In this region, the larva presents a hunched back appearance, and although it swims normally its resting position is not usually linear. Usually, the external bifurcation does not match that of the internal organs, such as the oesophagus or trachea (Sánchez-Garcia & Martínez-Silvestre, 1999). The ability of the larva to feed is therefore unknown.

Dicephalism is common in reptiles, mainly in ophidians and chelonians (Boyer & Baldwin, 1997), and although other kinds of morphological malformations have been reported (Dubois, 1977, 1979a, 1979b, 1982; Dubois & Fischer, 1979; Dubois & Vachard: 1969, 1971a, 1971b; D'Alte, 1941), dicephalism appears to be very rare in amphibians with only one known case in *Alytes* sp. (Crespo, pers. com.). In *Chioglossa lusitanica*, cases of polymely (D'Alte, 1945), polydactyly (Dubois & Thireau, 1972) and albinism (Brame & Freytag, 1963; Arntzen, 1999; Teixeira et al., 1999) have been reported, including in this same study-population, where Sequeira et al. (1999) found several pigmentary and anatomical abnormalities (polymely, polydactyly, missing toes, bifid tail and missing eye). However, this is the first time that dicephalism has been described in this species.

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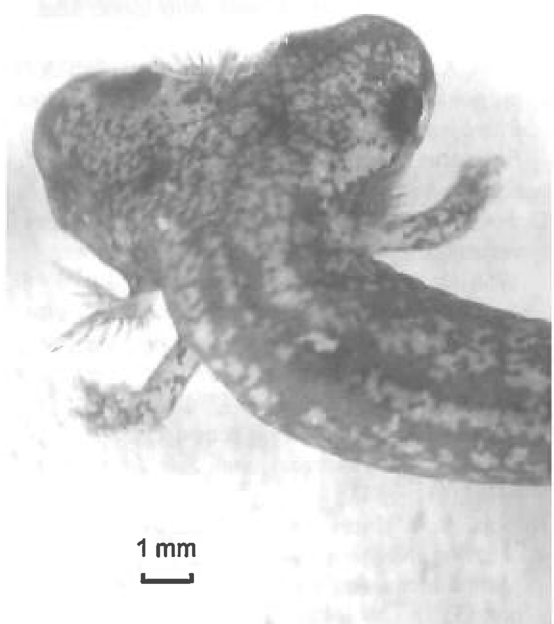
Figure 1. Two-headed larva of *Chioglossa lusitanica*. Photograph by Raquel Ribeiro.



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***LEPTOPHIS DEPRESSIROSTRIS* (Satiny Parrot Snake): REPRODUCTION.** *Leptophis depressirostris* is a slender green vine snake found from the Eastern slopes of Nicaragua to the Northern tip of Ecuador (Savage, 2002). On 29th November 2002 an adult female of this species (total length 780 mm; tail 213 mm; 66.2 g) was found during an expedition to the Tortuguero area of Costa Rica. The specimen was captured for identification during a visual survey of coastal forest inside the Parque Nacional Tortuguero. It was removed from a *Manicaria* swamp habitat (Myers, 1990) and taken back to our field base, the Cano Palma Biological Station, for more detailed observation. *Leptophis depressirostris* is an infrequently seen species identified by having a distinct loreal scale and two heavily keeled paravertebral scale rows on the dorsum (Savage, 2002). On closer inspection the individual appeared to be gravid and was provided with a wet, moist area within a vivarium. The snake was kept for two days before it deposited a clutch of five eggs, and then released a few days later. Its post-oviposition weight was 47.2 mm. After hatching the four neonate specimens were measured (length and mass) and then measured again after seven days before their release (near site of the captured parent). Measurements and hatching data for these individuals are presented in Table 1.

Information on reproduction in *Leptophis depressirostris* appears to be meagre, the only publised record of which I am aware being that of Dundee & Liner (1974), who collected three eggs together with four old eggshells in a bromeliad 3.5 m high on an Atlantic slope. The eggs measured 35–48 mm, and the hatchlings were 186–198 mm.

Measurements presented here show that hatchling size in *L. depressirostris* is variable, although whether hatchling size is related to egg or adult female size is questionable and must await the availability of further data. It is interesting to note, however, that the relative aseasonality of the Tortuguero area (receiving its heaviest rains and annual maximum of 6000 mm from November – February) may have a direct affect on hatchling emergence, and possibly also mating times of *Leptophis* spp. in the area.

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Table 1. Egg measurements and hatchling data.

	EGGS			HATCHLINGS		
Egg	Wt(g)	Size (mm)	Hatch	TOTAL (mm)	>7 days (mm)	Wt(g)
1	3.6	30 x 14	11.30 25/02/03	287	308	2.6
2	3.7	28 x 14	14.40 26/2/03	284	302	2.6
3	3.6	27 x 14	12.25 27/02/03	262	275	2.5
4	3.5	28 x 14	15.30 27/02/03	280	297	2.6
5	3.6	31 x 14.5		NO HATCH		

Book Reviews

Expedition Field Techniques: Reptiles and Amphibians

Daniel Bennett

93 pp. Published by the Expedition Advisory Centre. Distributed by the Royal Geographical Society, London.

ISBN 0 907649 81 5. Price £10

With most research leaning toward creatures of the furred and feathered varieties in Britain's zoology and biology departments, budding herpetologists can face an uphill struggle in obtaining even the most basic of advice, when planning field studies. In an attempt to provide key information to students considering research in the tropics, the Royal Geographical Society commissioned a series of nine field techniques manuals, of which Reptiles and Amphibians is just one. Although aimed at university students, the style of writing used, makes this a book that any keen naturalist would be at home reading.

Written by a self-confessed 'Varanid-lover', the author's bias is not apparent in the book's coverage. Broken down into seven sections the book begins where all good expeditions should – preparation. With several useful subsections detailing the importance of forming local affiliations and researching your study species, the first section helps to provide a guide to ensuring a successful trip.

Section two volunteers the basic guidance that other, more technical texts often omit. By making the reader question the basis of a trip, this section helps to bring focus to a study. What is achievable in a trip of this duration and what must be done to make the results reproducible? Handy hints are also provided on the usefulness of sampling parasites, preparation of voucher specimens and photographic techniques. With animal ethics a current issue of concern, it is pleasing to see that the author includes a brief diatribe of poor reptile and amphibian handling.

The third section of the book is that which many expedition planners will seek. Thirty pages of commonly used survey techniques are broken down into separate sections for reptiles and amphibians. These condensed reviews provides brief details on the more commonly used capture techniques and trapping methods employed in herpetology. With explanations of techniques to suit all expedition locations and budgets, this section provides an ideal base from which to trawl the primary literature for a more comprehensive explanation of specific methods. It was particularly nice to read some of the amusing anecdotes the author presented of his own experiences of many methods addressed.

Section four entitled 'Short notes on some reptiles, habitats and equipment' is aptly titled. With notes for nine-hundred species of geckoes being condensed to a single paragraph of text it can be said that this section of the book is somewhat lacking. Although all reptile groups and habitats have been given this treatment, it must be remembered that this volume was never intended to be used as anything other than a field techniques manual. Even though short, this section does provide an idea of the general ecology of the group and helps to suggest which method(s) may be suitable for your particular expedition.

Section five covers a topic that is universally accepted as the most important part of science, sharing your work. It is a sad fact that many expeditions still fail to provide a copy of the subsequent report, let alone a copy of their raw data, to the host country so it is pleasing to see that the author stresses the importance of this.

The final two sections round this short book off by providing detailed information of useful organisations and equipment suppliers as well as further sources of reference. The range of suppliers is comprehensive, from a plastic bag manufacturer right through to a videoscope supplier. Not only are the details of the literature cited present, also included is a number of texts for each geographic region's herpetofauna.

At a price of ten pounds, this book represents great value for money. Having used this book in preparation of an upcoming trip to Mauritius, I can personally say that it has provided invaluable advice that should stand me in good stead. The author's enthusiasm for the subject is infectious and may result in the reader formulating expeditions they had never previously envisaged. With the clarity of writing and comprehensive coverage provided, this compact volume should have a place in any travelling herpetologist's rucksack.

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