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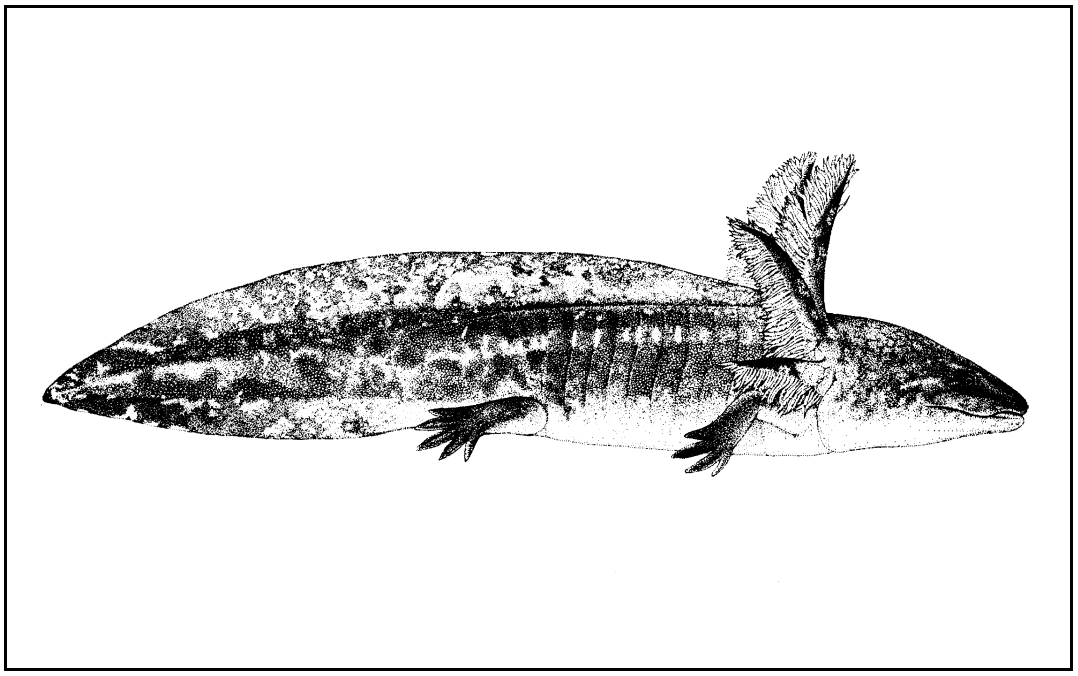

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Cover: Eastern tiger salamander, *Ambystoma tigrinum*, full-grown larva. Drawing from *The Salamanders of New York* by Sherman C. Bishop, New York State Museum Bulletin Number 324, June 1941.

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Measuring Effective Vitamin D_3-Producing Ultraviolet B Radiation Using Solartech's Solarmeter® 6.4 Handheld, UVB Radiometer

Jukka Lindgren[1], William H. Gehrmann[2], Gary W. Ferguson[2] and John E. Pinder[2]

Abstract

Several types of UVB-emitting lamps were tested for their ability to generate vitamin D_3 and related isomers from precursor 7- dehydrocholesterol or provitamin D_3 in an in-vitro ampoule system. Lamp output was also measured using a spectroradiometer and two types of broadband UVB meters. UVB recorded in spectroradiograms was partitioned in several different ways, for example, as sub-bands. The various measures of UVB, including UVB meter readings, were regressed against the ampoule measurements of percent photoproduct to determine which could best explain D_3 synthesis. It was found that UVB irradiances between 280 and 304 nm, D_3 Yield Index, and Solarmeter® 6.4 readings each explained greater than 95% of ampoule D_3 synthesis. Equations are presented that allow conversion of Solarmeter® 6.4 units (IU/min) to D_3-irradiance units ($\mu W/cm^2$) or D_3 Yield Index values. Unlike other broadband UVB meters, readings by the Solarmeter® 6.4 of a variety of lamp types are directly comparable for D_3-synthesizing ability regardless of differences in spectral output among lamps.

Introduction

The recognition that ultraviolet radiation (UV) is of importance to reptiles (Laszlo, 1969) was followed by studies to determine the wavelengths involved and the quantity required. It became evident that the most important component is ultraviolet B (UVB) (280–315 nm) because of its role in vitamin D_3 (D3) synthesis and indirectly in calcium/phosphorus metabolism. UVB drives the conversion of proD3 (7-dehydrocholesterol = DHC) to preD3, which is then thermally isomerized to D3 (Chen, 1999; Holick, 2004). In the 1970s, some cases of nutritional metabolic bone disease (nutritional secondary hyperparathyroidism) in captive reptiles were recognized as resulting from an insufficiency of D3 caused by inadequate levels of UVB radiation (Frye, 1981), a condition that remains of concern to this day (Mader, 2006).

Knowing the quantity of UVB, often expressed as irradiance ($\mu W/cm^2$), emitted by natural light and various lamps is essential for the evaluation of their D3-synthesizing potential. Spectroradiometers that record irradiances at one-nm intervals across the UV and visible bands are available. Lindgren (2004) used such a spectroradiometer to measure the output from a variety of lamps used in herpetoculture; this included an analysis of UVB and the calculation of a D_3 Yield Index that was meant to accurately reflect the true D3-synthesizing potential of a lamp. Unfortunately, these meters are relatively costly and not always convenient to work with. Handheld broadband UVB radiometers manufactured by several companies are available; they are less costly and easier to use. However, it has been reported that several of these meters may give a different irradiance reading from the same light source (Gehrmann et al., 2004a, b). Part of this discrepancy is attributable to wavelengths at the red and near-infrared end of the spectrum erroneously processed as UVB readout. Thus, a meter might indicate the presence of UVB from a source known to emit none. Being made aware of this, Solartech, Inc. (Harrison Township, Michigan) created their Solarmeter® 6.2 UVB meter to reject out-of-bandwidth response, hence eliminating this unwanted input.

Wavelengths within the UVB band are not equally efficacious in producing preD3 from DHC. This is reflected in the action spectrum, a graph which relates ability to produce D3 to specific wavelengths (MacLaughlin et al., 1982). This action spectrum has now been re-evaluated and published (with full data) as the definitive pre-vitamin D_3 action spectrum (CIE, 2006). The maximum conversion occurs at about 298 nm, with wavelengths on either side of 298 nm becoming progressively less efficient in driving the conversion. About 60% is produced between 290 and 300 nm. Broadband UVB meters characteristically measure UVB wavelengths outside the effective D3-synthesizing band, making it difficult to relate the meter reading to the actual D3-synthesizing potential. Solartech, Inc. designed a Solarmeter® 6.4 that was essentially responsive only to wavelengths within the D3 action spectrum and furthermore weighted the input to reflect the efficiency for producing preD3 from DHC (Solartech, Inc., 2005). The readout was designed to reflect the D3 production rate (in IU D3/min) for human type 2 skin. How this reading is related to D3 synthesis in various reptiles and other species remains largely unknown at this time.

In the 1980s, Michael Holick's lab at Boston University Medical School developed a technique for measuring the D3-synthesizing ability of a UVB source by measuring the production of D3 and related photoproducts from DHC contained in UVB-permeable glass ampoules. This procedure represents a direct way of measuring D3-synthesizing potential that can be related to irradiance readings from meters and used to judge the validity of their output. Two such studies have been published (Gehrmann et al., 2004a, b). The use of ampoules also allows for validation of the analysis of UVB, including the D_3 Yield Index conducted by Lindgren (2004).

1. Humikkalantie 101 A 2, FI-00970 Helsinki, Finland. Testudo@testudo.cc
2. Department of Biology, Texas Christian University, Fort Worth, Texas 76129. Williamg@flash.net

Table 1. Various lamps used in current study. These lamps were acquired in 2005 and most are quite different in spectral output from lamps sold with the same brand names in 2008.

Lamp	Manufacturer	Type	Power (W)	Distance (m)
Zoologist Mega-Ray	Mac Industries Inc. (Reptile UV)	Narrow flood	100	1.22
Mega-Ray	Mac Industries Inc. (Reptile UV)	Narrow flood	100	0.30
PowerSun UV 160 W	Zoo Med Laboratories, Inc.	Spot	160	0.30
PowerSun UV 100 W	Zoo Med Laboratories, Inc.	Spot	100	0.30
Reptisun 10.0 UVB	Zoo Med Laboratories, Inc.	1219 mm (48") tube	40	0.30
Reptisun 10.0 UVB Desert	Zoo Med Laboratories, Inc.	Compact fluorescent	26	0.30
Reptisun 5.0 UVB Tropical	Zoo Med Laboratories, Inc.	Compact fluorescent	26	0.30
UVB Mystic Compact	Big Apple Herpetological (made in China)	Compact fluorescent	18	0.30

The purpose of this study is to evaluate the relationship of the D_3 Yield Index and irradiances within the UVB band for several lamps, as measured by a spectroradiometer, to the production of D3 and related photoproducts as measured in ampoules. Furthermore, we compare these results to outputs from the Solarmeter® 6.2 and Solarmeter® 6.4 meters.

Materials and Methods

Eight different UVB-emitting lamps were obtained from either Zoo Med Laboratories Inc. (San Luis Obispo, California) or Mac Industries Inc. (Cedar Point, North Carolina) (Table 1). All lamps were pre-conditioned by burning them for 100 hours prior to testing. For stability, each lamp was pre-heated for 30 minutes before actual measurements to allow it to reach its nominal working temperature. Spectral measurements were made by Suomen Aurinkosimulaattori Oy/Solar Simulator Finland Ltd. (Raisio, Finland) using IL700A Research Radiometer (International Light Inc., Newburyport, Massachusetts). All measurements were taken in free field, at a distance of 30 centimeters from the surface of the lamp. Fluorescent tubes were measured at their center point, perpendicular to the longitudinal axis of the lamp. Bulbs were measured from the direction of base longitudinal axis at a distance of 30 centimeters from the face of the lamp, except for the Zoologist Mega-Ray, whose recommended minimum distance is 122 cm; this recommendation was followed. Compact fluorescents were measured at 90-degree angle from their central axis.

The lamps used in this study were selected for their variety of output and structure as required in this study for the validation of consistent response of the Solarmeter® 6.4 in predicting ampoule response. Most of the lamps marketed at this time (2008) using the brand names in Table 1 are quite different with respect to distribution and output of UV from those characterized here. A website that offers information on a wide variety of lamps is http://www.uvguide.co.uk/index.htm.

The numerical analysis of spectral data is identical to Lindgren (2004). The UVB range was divided into two sub-bands, UVB-1 (280–304 nm) and UVB-2 (305–319 nm) to facilitate separate analysis of the bandwidth range where the D3 photosynthesis mainly takes place.

The D_3 Yield Index was obtained by first calculating the biologically effective UV irradiance (UVBE) of a source with the following equation:

$$\mathrm{UVBE} = \sum_{\lambda=252}^{313} S(\lambda)A(\lambda)\Delta\lambda$$

where:

$S(\lambda)$ = measured irradiance at wavelength λ ($\mu W/cm^2$)
$A(\lambda)$ = coefficient factor for wavelength λ, derived from action spectrum of DHC to PreD**3** photosynthesis from MacLaughlin et al. (1982)
$\Delta\lambda$ = wavelength stepping, here 1 nm.

The UVBE was converted to the final index value by a suitable proportionality constant. As in Lindgren (2004), a constant was selected which would give the reference sun (in Finland) a value of 1000. If sufficient solar data become available, a more universal reference may be specified in future work.

The ampoules were exposed for 120 minutes. The Solarmeter® 6.2 and 6.4 measurements were taken simultaneously in the same configuration. After exposure, three replicates per ampoule were analyzed using a Waters 501 HPLC pump and a 490E multiwave detector set to read at 260 nm and controlled by a Millennium 2010 Chromatography Manager program (Waters Chromatography Division, Milford, Massachusetts). The mobile phase was 8% ethyl acetate in hexane and the column was Econosphere silica, 5 µm, 250 × 4.6 mm (Alltech Associates, Inc. Deerfield, Illinois). The flow rate was 1.8 ml/min. Ampoule contents were analyzed for substrate (DHC), photoproducts (preD3 and lumisterol), and D3 concentrations. The percent of photoproducts and D3 synthesized were calculated (see Gehrmann et al., 2004b, for more details).

Results

Table 2 shows the results of the spectrophotometric analysis, ampoule production of D3 and related photoproducts, and Solarmeter® readings for the eight lamps used in this study.

The greater the effective UVB irradiance, the greater will be the amount of DHC substrate converted and the greater will be the *total* amount of photoproducts produced in ampoules

Table 2. UVB and vitamin D_3-synthesizing characteristics of various lamps used in this study.

Lamp	UVB (280–319 nm)	UVB-1 (280–304 nm)	UVB-2 (305–319 nm)	D_3 Yield Index	Total (% Product)	Prod. Rate (% / sec)	Model 6.2 ($\mu W/cm^2$)	Model 6.4 (IU/min)
Zoologist Mega-Ray	73.0	11.7	62.0	2168	28.54	46.68×10^{-6}	100	52
Mega-Ray	180.0	30.2	150.0	5657	53.98	107.81×10^{-6}	202	106
PowerSun UV 160 W	29.0	2.1	27.0	471	8.56	12.42×10^{-6}	52	17
PowerSun UV 100 W	20.0	2.8	17.0	581	11.10	16.34×10^{-6}	32	16
Reptisun 10.0 UVB	24.0	1.4	23.0	416	3.16	4.46×10^{-6}	37	9
Reptisun 10.0 UVB Desert	9.2	1.6	7.5	346	4.18	5.92×10^{-6}	11	6
Reptisun 5.0 UVB Tropical	3.4	0.6	2.8	132	0.97	1.35×10^{-6}	3	2
UVB Mystic Compact	31.0	11.7	19.0	2260	39.03	68.72×10^{-6}	51	50

during a given exposure time (see Table 2). However, the amount of photoproducts formed in ampoules exposed to lamps with higher effective irradiances will be *proportionately* less than the amount formed in ampoules exposed to lower irradiances because the rate of photoproduct formation declines as the DHC substrate concentration decreases. In order to compensate for this curvilinearity, we calculated a proportional rate that allows for a less biased comparison among lamps. We used the following equation:

$$s(t) = s(0) \times e^{-rt}$$

where:

r = the proportional rate of transformation of substrate to D3 and other photoproducts;
t = time in seconds;
s(t) = % of DHC substrate remaining after t seconds.

Solving the equation above for r, substituting 100% for s(0), and evaluating at t = 7200 sec (= 120 min) gives:

$$r = \{\ln(100) - \ln(s(7200))\} / 7200$$

See Table 2 for the calculated value of the production rate r for each of the lamps.

The calculated proportional rates in the ampoules for each of the lamps serves as the dependent variable in the regression equation calculated for each of the independent measures of UVB-D3 synthesizing ability, including the meter outputs, shown in Table 2. The coefficient of determination (R^2) associated with each regression indicates the extent to which the ampoule values are explained by the various independent UVB values. The R^2 values, multiplied by 100 to yield percent, are shown in Figure 1. It is evident that the Solarmeter® 6.4 (ST6.4), D_3 Yield Index (D3 YI), and UVB-1 each account for greater than 95% of the variation. In contrast, Solarmeter® 6.2 (ST6.2), total UVB, and UVB-2 are 80% or lower.

The output for the Solarmeter® 6.4 is in IU/min but for some purposes irradiance units ($\mu W/cm^2$) or D_3 Yield Index units might be more convenient. Accordingly, UVB-1 and D_3 Yield Index values were regressed on Solarmeter® 6.4 values, all values from Table 2, and the R^2 values and best-fit equations were determined. The R^2 values for both UVB-1 (Figure 2) and D_3 Yield Index (Figure 3) are both equal to 0.997. The prediction equation for each showing the predicted value of UVB-1 and D_3 Yield Index for various values measured by the Solarmeter® 6.4 is shown on the appropriate figure and in the conclusions.

Discussion

The quantity of UVB-synthesized D3 photoproducts in ampoules is directly related to the totality of effective wave-

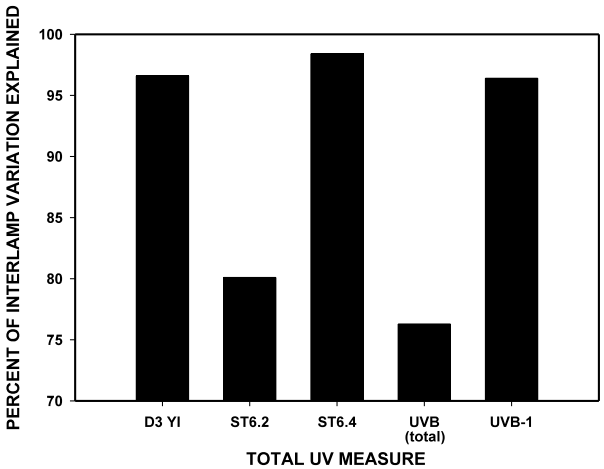

Figure 1. The extent to which variation in D3 product synthesis among ampoules exposed to different lamp irradiances is explained by various measures of UVB. UVB-2, which is not shown, is 26 %.

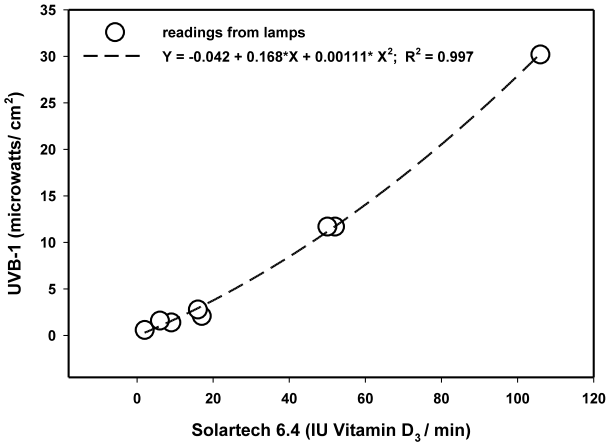

Figure 2. The quantitative relationship between the readings from a Solartech 6.4 meter and UVB irradiance contained within the 280-304 nm band. The equation and the associated R^2 value are shown at the top of the graph.

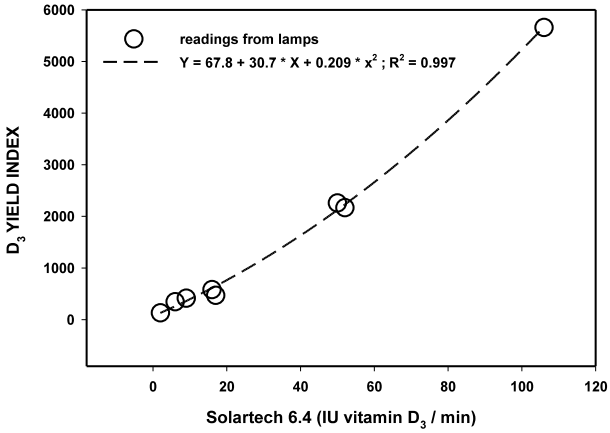

Figure 3. The quantitative relationship between readings of the Solartech 6.4 meter and the D_3 Yield Index. The equation and associated R^2 value are shown at the top of the graph.

lengths and their relative efficacy in producing preD3 from DHC. This relationship is embodied in the action spectrum, which shows that the most effective wavelengths lie between 280 and 305 nm. The observation that UVB-1, D_3 Yield Index, and Solarmeter® 6.4 readings all account for more than 95% of the variation in ampoule D3 photoproducts is expected because the UVB-1 sub-band lies entirely within the most effective D3 synthesizing band, and the D_3 Yield Index and Solarmeter® 6.4 readings are actually referenced to the action spectrum for production of pre-vitamin D3 from DHC.

The lamps in this study represent a variety of fluorescent and self-ballasted mercury vapor arc lamps. The ability of UVB-1 irradiance, D_3 Yield Index, and Solarmeter® 6.4 meters to predict ampoule D3 synthesis is expected to hold for virtually any lamp in these categories. The extent to which they will predict ampoule D3 synthesis by UVB from natural light remains to be determined but it is expected to be comparable to that of lamp-based sources of UVB.

Table 3. Relationship between the Solartech 6.4 readout (IU/min) and the UV Index (UVI) for the lamps used in this study.

Lamp	Model 6.4 (IU/min)	UV Index (6.4 reading divided by 7.14)
Zoologist Mega-Ray	52	7.3
Mega-Ray	106	14.8
PowerSun UV 160 W	17	2.4
PowerSun UV 100 W	16	2.2
Reptisun 10.0 UVB	9	1.3
Reptisun 10.0 UVB Desert	6	0.8
Reptisun 5.0 UVB Tropical	2	0.3
UVB Mystic Compact	50	7.0

The Solarmeter® 6.4 is an inexpensive broadband UVB meter that adequately describes the quantity of D3-synthesizing UVB. However, the output from the meter is referenced to the rate of D3 synthesis (IU/min) by type 2 human skin. The extent to which these units may be applied to reptile skin is unknown but their use may be confusing since most studies involving reptiles have described the amount of UVB as irradiance ($\mu W/cm^2$). For some purposes, it may be desirable to use the Solarmeter® 6.4 but convert the units to "D3 irradiance" using the equation presented herein (see conclusion 4 below).

Users of Solarmeter® 6.4 should note that the Excel-application (calculator) provided with the instrument will give slightly different results when the IU/min readout is converted to effective UVB. The values obtained by the equation given in Figure 2 are consistently lower than those obtained with the calculator. This is explained by the fact that while the calculator is based on human type 2 skin in specific circumstances, the data presented in this paper is based on the *in vitro* results of ampoule D3 synthesis.

The ampoule D3 production rates given in Table 2 can be used as a guide to estimate the rate of D3 photosynthesis in actual skin. The ampoules are a good approximation of photosynthesis taking place in skin, but the formation of the actual vitamin D3 is a multi-stage process. Its speed is largely temperature-dependent and there are significant differences in speed of the entire process in various species of animals. For example, in comparison to *in vitro* results, the speed of thermal isomerization of preD3 to D3 can be more than 10 times faster in actual skin samples of humans, frogs (*Rana temporaria*) and iguanas (*Iguana iguana*) (Holick et al., 1995). The rates have also been shown to differ among species of lizards of the gen-

era *Anolis*, *Sceloporus* and *Hemidactylus* (Ferguson et al., 2005).

Solartech, Inc. has designed a meter (Solarmeter® 6.5) to measure the Ultraviolet Index (UVI) directly (www.solarmeter.com/model65.html). It is essentially a Solarmeter® 6.4 with the IU/min dimensions internally divided by 7.14 to produce a readout in UVI units (see Table 3 for values associated with the lamps used in this study). The UVI is a universally recognized measurement and is appropriate for describing the UVB environment globally. The World Health Organization booklet www.who.int/uv/publications/en/GlobalUVI.pdf. offers information about the UVI and lists links to sites that cover specific geographic areas. For example, annual time series of UVI values from natural light for selected cities in the USA can be found at www.cpc.ncep.noaa.gov/products/stratosphere/uv_index/uv_annual.shtml. These values can be used as a guide to determine the maximum allowable UV irradiation. However, it is important to consider the reptile's natural habitat and activity patterns when evaluating readings taken in vivaria illuminated with lamps. The meteorological readings are always taken unobstructed and out in the open, but very few reptile species spend any length of time in exposed areas under full sunlight.

Conclusions

1. Both the unweighted UVB irradiance between 280 and 304 nm and the D_3 Yield Index calculated from spectroradiograms explain greater than 95% of the variation in D3 synthesis in ampoules.

2. The broadband UVB Solarmeter® 6.4 explains greater than 95% of the variation in D3 synthesis in ampoules.

3. A major advantage of the Solarmeter® 6.4 is that readings from a wide variety of UVB sources may be compared directly for D3-synthesizing potential without compensation for differences in spectral output among lamps.

4. The readout from the Solarmeter® 6.4 in IU/min can be converted to D3 irradiance in $\mu W/cm^2$ by use of the equation:

$$D3\ Irrad = 0.00111 \times (IU/min)^2 + 0.168 \times IU/min - 0.042$$

5. The readout from the Solarmeter® 6.4 in IU/min can be converted to D3 Yield Index by use of the equation:

$$D_3\ Yield\ Index = 0.209 \times (IU/min)^2 + 30.7 \times IU/min + 67.8$$

6. The readout from the Solarmeter® 6.4 as IU/min can be converted to the UV Index by dividing IU/min by 7.14. This value of UVI will be the same as the UVI output from the Solarmeter® 6.5, which can therefore be used in place of the Solarmeter® 6.4.

Acknowledgments

All lamps used in this study were donated and their spectral measurements funded by their respective manufacturers, Mac Industries Incorporated (Cedar Point, North Carolina) and Zoo Med Laboratories Inc. (San Luis Obispo, California). A Solarmeter® 6.4 handheld radiometer was donated by Solartech, Inc. (Harrison Township, Michigan). Premises for lamp conditioning and ampoule exposure were kindly provided by Yrjö Huttunen of Data Engineering Ltd. (Helsinki, Finland). Support for the HPLC analysis was provided by the TCU Department of Biology. We thank Frances Baines and Steve Mackin for their helpful comments and suggestions.

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An Unusual Microhabitat for an American Toad (*Anaxyrus americanus*)

Philip A. Cochran
Biology Department
Saint Mary's University
700 Terrace Heights
Winona, MN 55987

North American toads (genus *Anaxyrus*) do not typically climb trees. However, a recent report described a southern toad (*Anaxyrus* [as *Bufo*] *terrestris*) in a tree cavity approximately 1.6 m above the ground in a situation where it was likely that it had climbed the vertical trunk (Kornilev, 2007). This reminded me of a similar case involving an American toad (*A. americanus*).

I recorded the following observation at the Nelson-Trevino Bottoms of the Chippewa River, Buffalo County, Wisconsin (T23N,R14W,S27) (Cochran, 2001). On 23 August 1997, I discovered an adult American toad sitting partially embedded in a slight depression of rotted wood on top of a vertical tree stump approximately 25 cm in diameter and 1 m above the floodplain forest floor. One possibility, however unlikely, is that the toad climbed to this position. An alternative explanation is that it reached the top of the stump by swimming during the spring high water period, but it is not clear why the toad would have remained there during the subsequent months. Heavy shading by the forest canopy may have kept temperature and moisture within acceptable limits.

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Review: *An Ecological Risk Assessment of Nonnative Boas and Pythons as Potentially Invasive Species in the United States* by Robert N. Reed. 2005. Risk Analysis 25(3):753-766.

David G. Barker and Tracy M. Barker
vpi@beecreek.net

We didn't pay much attention to this paper when it was published. But what seemed a speculative and hypothetical paper three years ago now has taken on new significance. A Notice of Inquiry was posted by the U.S. Fish & Wildlife Service on 31 January 2008 in the Federal Register, the purpose being to request biological and economic information on certain species of boas and pythons with a view toward assessing whether or not these species should be added to the Injurious Wildlife List of the Lacey Act. In light of this turn of events, we feel this paper now requires a careful evaluation.

The author, Robert N. Reed, was on the faculty of Southern Utah University when the paper was written. He currently is employed by the U.S. Geological Service in the Biological Services Division. Reed is identified on the internet as an "invasive species biologist." Among his current projects, he is one of several biologists from several government agencies that are monitoring and studying Burmese pythons, *Python molurus bivittatus*, in the Everglades.

The paper is divided into numbered sections and subsections, which we describe and review in order below.

Section 1. Introduction

The Introduction starts with a brief history of the most famous case of the establishment of a nonnative snake, that being the brown tree snake, *Boiga irregularis*, a colubrid species introduced in Guam. The purpose of the paper is then given as to model " . . . the risk associated with boas, pythons and relatives as potential invasive species in the continental United States."

A discussion follows that understandably argues that boas and pythons warrant this investigation. We offer the following summary.

There is a general review of the factors that might predispose boas and pythons to become invasive species. There is a brief overview of the classification and distribution of boas and pythons. Reed then details some aspects of the pet trade, emphasizing the numbers of boas and pythons that annually are imported.

Then follows a general discussion of factors of reproduction that could predispose snakes in general to become established and invasive. Some factors, such as high fecundity, are characteristic of some of the species in this paper; other boas and pythons have low fecundity. Another factor, sperm storage, is undoubtedly a beneficial trait for an invasive snake species, but nothing like the abilities of the brown tree snake is known in boas and pythons. Similarly, parthenogenesis could be a benefit, and has been reported in a Burmese python; we note that it is an extraordinarily rare event and is unknown in other boas or pythons. Fast growth – early maturation is another positive factor for several species, but is dependent on other environmental factors; not all boas and pythons have this potential.

Reed mentions climate as an important predictor of invasion. He stresses that not all boas and pythons are entirely tropical. For example, he identifies carpet pythons, *Morelia spilota*, as a species that exists in temperate climates. In nature the species ranges from near-equatorial tropics in New Guinea to temperate southern Australia to about 37°S latitude. There is the unstated implication that carpet pythons might be able to survive at 37°N latitude (about the latitude of Nashville or Las Vegas).

We point out that a problem with this example is that essentially all carpet pythons in the United States are descended from populations in the tropics from 7 to 20°S latitude. In the northern hemisphere, this latitude range would be from northern Colombia to Veracruz, Mexico.

There is a small captive U.S. population of diamond pythons, *Morelia spilota spilota*, probably the most temperate-adapted of all pythons. There are probably fewer than 100 animals (our estimate). Imports and exports are essentially nonexistent; these are valued and rare snakes and they have never been found in the wild in this country. In fact, this last sentence applies to the more common carpet pythons, as well.

Habitat preference is next identified as a predictor of invasive risk. Reed references the work of Madsen and Shine (1996, 1999) on water pythons (*Liasis fuscus*). He cautions that water pythons might be able to survive in the extensive swamps and marshes of the American south in a manner similar to what was described by Madsen and Shine at Fogg Dam, the study site for the above-referenced papers.

The population of water pythons at Fogg Dam is the densest known population of pythons in the world; in fact it is the densest known population of vertebrate predators ever studied. Interestingly, the Fogg Dam site was created by a man-made dam; it is not a naturally occurring habitat, but rather the consequence of extensive habitat and ecological disturbance.

Fogg Dam is at 12°S latitude, and the huge shallow lake formed by the seasonal monsoon rains becomes a cracked mud flat for seven months of the year. There is no exactly similar habitat in this country; the only place even remotely comparable to Fogg Dam is the Everglades, but the climate and the water temperature are both significantly cooler. Interestingly, there is no further discussion of Madsen and Shine (1999), a study of how python nest sites even a few degrees cooler than optimum results in sharply increased mortality of breeding females and a significant reduction in hatching success. We question why this important and relevant result was not considered in Reed's study when apparently the author had the paper in hand.

Reed ends the introduction with vague statements on the dangers of imported parasites and pathogens, but as the pri-

mary example cites how human activity and the pet trade have spread chytrid fungi that affect toads and frogs — a story that has no bearing on the issues in this paper.

Section 2. Methods

Subsection 2.1 is a discussion on how the 23 taxa used in the risk analysis were chosen. Reed arbitrarily chose to concentrate on terrestrial or arboreal species. Only species for which more than 100 individuals had been imported during the 12-year period 1989–2000 were selected. Reed's Table I lists the 23 species selected, and the total numbers of each that were imported during that period.

Reed comments that there are little or no applicable data available from studies of any of the species in nature. He chose not to use data based on captive populations. He states "In the absence of adequate data for the majority of species, therefore I used body size and fecundity as factors in my analyses, as follows."

Reed uses maximum total length of each species for the value of body size in his analyses. He uses the highest known reproductive output as the value for fecundity for each species in the analyses.

To summarize the climatic profiles of the native ranges of each species, Reed uses data collected for each species based on the maximal known latitude and the maximal reported elevation for each species. It is stated that this is to calculate the coolest mean temperatures likely to be experienced by a species.

The highly biased filters placed on the data create a skewed profile based on the most extreme and aberrant values known for each species. Were Reed doing a similar analysis of primates, the value representing human body size would be 272 cm in height (107.1 inches). The values for fecundity would be 69 offspring for one female, in excess of 850 offspring for one male. We are not certain if the climatic profile for our species would be the South Pole or the top of Mount Everest. Do we need to comment further on the relevancy of the data in Reed's analyses?

Section 2.2 is a brief explanation of the source for the total numbers of individuals that were imported during the 12-year period of 1989 through 2000. The data were taken from the Law Enforcement Management Information System (LEMIS). Also, a factor in the risk analyses is the average economic value of an individual of each of the species. This datum was derived from the declared values of the imported animals in the LEMIS database, which has now been determined to have errors and be inappropriate for certain types of data analysis (Reaser and Waugh, 2007). In some cases — for example, ball pythons and boas — the values in the LEMIS database reflect wholesale prices for the purchases of large numbers of animals and are not in any way representative of the accepted values of those animals in the marketplace. Placing a contrived low value on these animals creates a strong bias against these species in the analyses that follow.

Section 2.3 lists the six predictions made by Reed on which his "quantitative model" is based. The "predictions" are actually assumptions, and there is no attempt to prove or disprove the validity of each. They seem, for the most part, to be logical or obvious statements, but they are not based on published information or experimentation, and are either untested or untestable hypotheses.

The assumptions are as follows, our comments are in brackets:

A. *Wild caught imports present a greater risk as an invasive species*. [We would agree that it seems likely that a wild-caught adult animal might have a better chance to survive if released than would a captive-raised adult animal, but we are not aware of any research with snakes that supports this supposition. In fact, a significant percentage of imports are animals that are captive-hatched and captive-born. We do not assume that these animals have any greater ability to survive outside of captivity than the already present captive populations. Neither do they have increased loads of internal or external parasites.]

B. *Species commanding high prices in the pet trade present a lower risk as invasive species*. [We observe that, based on the available data, they present zero risk. This is an important insight on the part of Reed. It follows that if a surcharge in the form of a tariff was placed on all imported reptiles, so that the minimum value of every imported reptile was equal or greater than $20, perhaps $30, then all imported animals would present minimal or no risk for invasion. It is the importation of large numbers of "cheap" reptiles that creates the greatest risk that they will be released or escaped into the wild.]

C. *Species that are imported in high numbers present a greater risk as invasive species*. [Maybe, but based on the fact that none of the total number of animals that were imported during 1989–2000, as reported in subsection 3.1 of this paper, became invasive during that period or since to the present, then the value for actual observed risk is zero. It is our opinion that any greater risk posed by species imported in high numbers comes from that fact that these are the "cheap" species; they have less value to importers, distributors, and eventually to owners. Again, we propose that the solution is to regulate through tariffs the minimum value for imported reptiles.]

D. *Species of larger body sizes present a greater risk as invasive species*. [We would dispute this statement as conjecture not borne out in observation or reason. Even Reed states "Of all the predictions listed here, this statement is perhaps the most debatable…" While this might be true for ornamental fish, it is generally true that as pythons and boas attain larger sizes and sexual maturity they have greater value. We propose that there are ecological and climatic reasons why large species do not naturally occur in the continental United States. It is our observation that across the United States, the average sizes of large native species such as bullsnakes, indigos, eastern diamondback rattlesnakes and western diamondback rattlesnakes are decreasing.]

E. *Species of higher fecundities present a greater risk as invasive species*. [Reed states "all things being equal . . . " but in fact all things are not equal. In the absence of data on the rate of reproduction or the reproductive life span of any of

these species, and the survival rate of offspring, this assumption is baseless. In most cases, species with high fecundity are known to have offspring with low rates of survival. We realize that Reed here may be basing this assumption on propagule pressure theory—that for each species there is a minimum number of individuals necessary to establish a population, and that high fecundity increases the odds that that number will be equaled. However, so far as we can find, there simply is nothing published or proven with regard to the establishment of reptiles in a novel environment. For the purposes of these analyses, it is our opinion that the use of the maximum reproductive output as the value for fecundity rather than average annual output completely invalidates this assumption.]

F. *Species with a greater range of climatic tolerances present a greater risk as invasive species*. [This assumption contradicts one of the most basic tenets of ecology, that individuals of a population are adapted to particular selective pressures in their environment. For example, the species *Boa constrictor* occurs from northern Argentina to the Amazon Basin and on to the Sonoran desert of northwestern Mexico and Tamaulipan thorn scrub of northeastern Mexico. Reed's assumption would predict that because *Boa constrictor* can be found in a wide range of habitats, elevations and climates, it presents a greater risk as an invasive species because it is so adaptable. In fact, this is false. Were such an assumption true, then it would follow that a boa from the Sonoran desert would thrive in the Amazon Basin or in Patagonia. This seems unlikely, and it is without any basis in experiment or in the literature. In our opinion, there is no boa that will thrive throughout the range of boas, just as there is no species of boa or python that is such a generalist as to be able to colonize any more than a small area that happens to match its particular genetic and behavioral adaptations.]

Reed's Table II lists for each species the values of the variables that were used in his risk-assessment analyses. In the following subsections, Reed defines the equations he used to perform three different risk analyses.

In subsection 2.3.1, the following formula is used to estimate T, the relative risk associated with international trade in live snakes:

$T = \%WC \times (Imports/Value)$

where:

%WC = percent of imported snakes declared as wild-caught in the LEMIS database;
Imports = mean number of animals imported annually; and
Value = the average declared value (in US$) per imported animal.

In subsection 2.3.2 the following formula is used to model E, the risk from ecological variables:

$E = Fecund + TL - Temp$

where:

Fecund = maximum known number of offspring in a single reproductive bout;
TL = total length (m) of the largest reported individual; and
Temp = minimum temperature (°C) for persistence, as calculated by Reed based on the maximum elevation and maximum latitude at which the species is known to occur.

In subsection 2.3.3 the following formula is used to model risk using what Reed terms a "synthetic index." By combining values from the first two analyses, Reed derived the following equation: $R = T + E$, where "R" equals the overall relative risk of establishment.

In subsection 2.3.4, Reed describes the data treatment. All variables were standardized on a scale of 0 to 1. After this transformation, the value of 1 was added to each variable, so that no variable in the analyses would have a value of 0.

We make the following observations on the risk analyses:

1. As discussed, the data set is skewed to the point of being nonsensical.

2. The six assumptions on which the risk assessment is based are untested or untestable hypotheses. We feel that there are significant problems performing any analyses based on variables created from these assumptions. We do not feel that Reed adequately explained or defended the bases for each of the assumptions.

3. The equations with which the risk analyses were performed are imaginary constructs—there is no argument or proof offered to explain any basis for a second level of assumption that there is a quantifiable relationship, mathematical or otherwise, between any values used in the analyses. This is personal opinion disguised as science by mathematical equations.

4. The treatment of the data is incorrect. As described in subsection 2.3.4, by adding the value of 1 to each variable after being "standardized," the mathematical relationships between some variables are arbitrarily changed. For example, in the formula in subsection 2.3.1, the standardized variable for "imports/value" might be $.4/.6 = .67$, which is a significantly different value after 1 is added to the numerator and denominator, creating $1.4/1.6 = .875$.

5. The analyses do not indicate any actual potential for the overall risk of a species to become invasive. Rather the methodology rates the relative risk of a species in comparison to the other species in the analyses. For example, in the analysis based on ecological variables, a carpet python, *Morelia spilota*, generates a considerably greater risk value than a vine boa, *Epicrates gracilis*; that being interpreted as a prediction that the carpet python has a greater relative risk of becoming an invasive species compared to the vine boa—however, the values generated are not predictive of the actual potential or fitness of either species to be able to establish outside their natural range, rather the results of the analyses only compare the relative differences between the species in the analyses. The species may vary greatly in their comparisons to each other, but the species with the very highest risk values may actually have no ability whatsoever to establish outside their ranges or inside the continental boundaries of the United States.

Section 3. Results and Discussion

The entire section is conversational in tone. The section includes Tables III and IV. Table III lists for each species the three values generated by the risk assessment analyses. Table IV comprises three columns, each containing the list of species; each column represents one of the analyses, and the names of the species are sorted in the column according to their ranking in that particular analysis, with the species with the lowest values at the tops of the lists and the greatest values at the bottoms of the lists.

Subsection 3.1 is a general discussion of commercial trade in boas and pythons. The most important species in commerce are identified, and the numbers imported and the declared values of these species are detailed.

Reed states that during the period from which he selected his data, 1989–2000, a total of 404,177 boas, pythons and relatives were imported. This was 40 species in 17 genera. He refers to "and relatives" throughout the text, but specifically mentions only boas and pythons—we are not certain to what "relatives" he refers.

He then goes on to state that during this period, "the most important species in the import trade include *Python regius* (366,808 individuals), *Boa constrictor* (115,131 individuals), *Python reticulatus* (27,992 individuals), *Python molurus* (12,466 individuals), *Python curtus* (11,135 individuals), and *Python sebae* (8,245 individuals)." Reed notes that more than 1,000 individuals of each of six additional species were imported. These numbers for only 12 of the 40 species add to a minimum of 547,777 individuals, contradicting his stated total for all boas, pythons and relatives for the period.

Subsection 3.2 is a discussion of the risk assessment results. Subsection 3.2.1 is a discussion of the trade variables used in the data set; subsection 3.2.2 is a discussion of the ecological variables; and 3.2.3 is a discussion of the synthetic model.

Subsection 3.2 reads rather like a general text on the acquisition, maintenance and problems associated with each of the species, with some emphasis on the problems.

Subsection 3.3 is titled "The Consequences of Establishment." Subsection 3.3.1 is a discussion titled "Implications for Conservation of Species Listed under the Endangered Species Act." Here Reed emphasizes that introduced snakes might further endanger species that already are threatened or endangered. He states, "I therefore compared geographic distributions of species listed as threatened or endangered in the United States with the areas most likely to be colonized by invasive boas and pythons." Hawaii is identified as the place with the highest risk, but is dismissed as having strong laws forbidding the importation or possession of snakes. He then spends the remainder of the section discussing the possible results of boas and pythons becoming established in south Florida. He prefaces the south Florida scenario with the statement "Discussions of which species are most likely to be impacted by establishment of invasive snakes are, of course, speculative." Reed does not identify the criteria used in selecting south Florida.

Table V is a list of the vertebrate animals that are listed as threatened or endangered that are "likely" to be impacted by feral populations of boas and pythons. All but one species are restricted to south Florida and Florida Keys. At the bottom of the list the eastern indigo is identified in a separate section titled "Listed Species Likely to Experience Competition or Exposure to Pathogens from Boas, Pythons, and Relatives." According to Snow et al. (2007), one species from this list is reported to have been consumed by an introduced Burmese python (two Key Largo woodrats, *Neotoma floridana smalli*, were found in the stomach of one python.)

Subsection 3.3.2 is titled "Pathogens Associated with Imported Snakes." Not surprisingly, the first point made by Reed is that nonnative snakes may harbor pathogens that are zoonotic. In our opinion, the statistical probability of a boa or python carrying a zoonotic pathogen that actually infects any humans approaches zero. We base this statement on the fact that for the past 40 years and longer, American snake keepers have lived in close contact with a captive U.S. population of boas and pythons that has grown to 600,000–800,000 animals (our estimate), and there are essentially zero reports of disease purportedly derived from contact with those snakes. This is not a prediction; this is a fact that Reed has overlooked or ignored.

Reed states that "the best-documented zoonosis related to reptiles is salmonellosis" and cites as the reference for this statement a controversial animal-rights manifesto (Franke and Telecky, 2001). In fact, salmonellosis credited to exposure to snakes is nearly unknown (Barker and Barker, 2006). Reed then lists several genera of bacteria that have been identified as possible zoonoses in reptile species other than boas and pythons (Johnson-Delaney, 1997). Referring to possible arachnid-born zoonoses, Reed mentions the single case of Q fever that possibly was from ticks on imported ball pythons, but which was never verified (Anonymous, 1978); and the presence of West Nile virus in blood samples from U.S. native colubrid snakes (Johnson-Delaney, 1997)—neither is relevant to this discussion.

Reed turns the discussion to ticks on tortoises, specifying the dangers posed to deer and livestock from heartwater fever, a disease carried by some tick species that have been found on imported tortoises. He refers to the ban placed by USDA on tick-infested tortoises, a requirement that imported tortoises must be tick free. The point of this digression was apparently to recommend that imported boas and pythons also be required to be tick-free when imported. We are unaware of any report of heartwater fever identified in ticks found on boas and pythons.

Then, in an unexpected digression, Reed cautions that there may be a problem because exotic boa and python species in extralimital populations may have a significantly reduced parasite load compared to ambient levels observed within the natural range of the species. Apparently they can be too healthy. This startling new reason to worry is based on the work of Torchin et al. (2003). The study examined 26 taxa of invasive invertebrates and vertebrates including the cane toad, *Bufo marinus* (= *Rhinella marina*), the mourning gecko, *Lepidodactylus lugubris*, and one other unidentified reptile/amphibian species.

Section 4. Conclusion and Recommendations

We're not sure what conclusion was reached beyond the statement that this type of risk analysis used models "that incorporate some amount of ambiguity and arbitrariness."

Reed makes six general recommendations regarding imported boas and pythons. We find that we generally agree with these common sense statements, some more than others. We commend Reed for the first recommendation, being that emphasis should be made to increase the attractiveness of captive-bred snakes to potential purchasers. However, several recommendations emphasize the need for identification, treatment, and quarantine of hypothetical parasites and pathogens that potentially might arrive on pythons and boas in the future; this we consider unnecessary in consideration of the absence of any such problems during the past four decades of importation of boas and pythons.

We see no link between the recommendations that can be correlated with such analyses as were unconvincingly attempted. In our opinion, the conclusion and recommendations of this paper should be the considered as the opinion of the author, rather than the result of scientific investigation.

In the last section, "Acknowledgments," one of us [DGB] is cited as having made contributions. In fact, no criticisms or recommendations that were made, many repeated here, were incorporated into the final form of this paper.

To summarize our criticisms of this paper, it is a rambling and disjointed attempt to validate general suspicions that imported boas and pythons may become established in feral populations in the United States. As stated by Reed, "A major problem with this type of risk analysis is that it is essentially an untestable hypothesis." We point out that scientific analysis must be testable, or there is no science. In our opinion this entire paper is essentially a narrative assertion, a subjectively chosen collection of confirming anecdotes. All statements regarding any invasive risk from the 23 taxa used in the analyses should be regarded as invalid. Such recommendations as are made in this paper are the outcome of the narrative and not the result of any statistical analysis or scientific investigation.

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What You Missed at the March CHS Meeting

John Archer
j-archer@sbcglobal.net

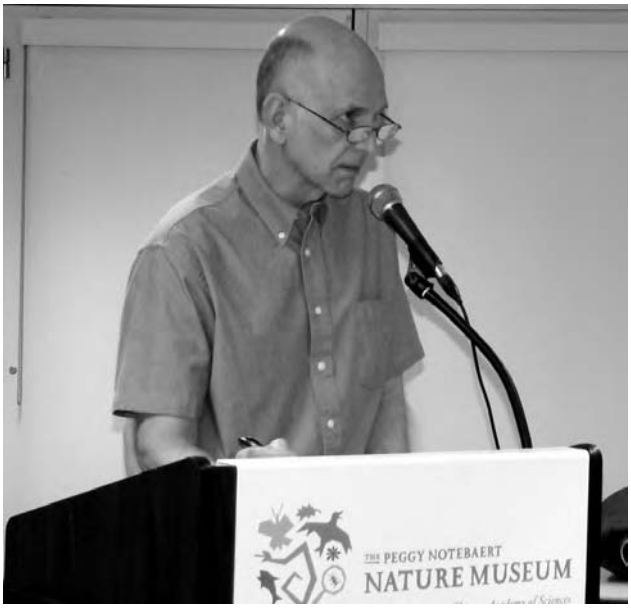
I showed up at the meeting last month with my daughter. She hasn't been attending the meetings much lately because of other priorities, but I know that both my kids enjoy hanging around the CHS when they're able. I think that says something about the organization and the people who belong to it. My kids are older now, almost of the age where I can't call them kids anymore, and as a matter of fact my son is drinking legally (I don't want to know what he did before.) It's a major life event the first time you take your family out to eat and your son orders a beer. My daughter will vote for the first time this year, and she's trying to decide which college she'll be attending. She wants to be a vet, and I know that the favorable image she has of that profession has only been solidified by the quality of the vets in our organization. I really like my kids, and they just keep getting better and better. Even as teenagers they were fun to be with and some of that may be credited to the CHS. I don't want to take anything from my wife, who, in spite of me, has raised two very nice kids, but I know that the experiences my children have had with the CHS have shaped them for the better. My daughter told me the other day that it would feel really weird the first year she'd be unable to work ReptileFest (this will be her last year). In his first year in college, my son actually planned to drive from his college in Iowa so he could work at 'Fest. I convinced him that his schoolwork was more important. My kids are responsible, reliable and sociable.

As are most of the people at the CHS, which is why I'm glad my offspring are involved. When things really need to get done, someone usually makes it happen. Did anyone suffering from a dry throat appreciate the drinks Zorina Banas sold at the meeting? Zorina stepped in after Mike Scott couldn't attend the general meetings anymore. Mike is staying involved by attending all the board meetings. Not many of the attendees realized it, but we almost didn't have a presentation last meeting because of computer compatibility problems, but during the first hour Aaron Laforge, Miller Ray, and Roberto Bonilla stepped in to save the day. Miller even drove home and back to get the right equipment. How can hanging around people like that not favorably shape kids?

The raffle table. Photograph by Dick Buchholz.

The reason my daughter came to the March meeting was the speaker. While not attending many meetings, my daughter has managed to help with many of the shows we do for the CHS. In fact, I often feel that the only reason I'm invited to do a show is because my daughter might also come. At a number of these shows we've had the pleasure of working with Bryan Suson, March's speaker. Bryan is a CHS member who works for Rob Carmichael at the Wildlife Discovery Center in Lake Forest, and we've often found ourselves at the same shows. Both my daughter and I count him as a friend, and when my daughter heard he was speaking, she showed up because "It's Bryan." Bryan's one of those typically reliable, responsible, and sociable people you want your offspring to hang around. I was looking forward to his presentation, and I wasn't disappointed.

I do have one problem with Bryan. He's way too young to know so much and have traveled to so many places. He's been to Australia, Costa Rica, Panama and much of the U.S. He's got a B.S. in Environmental Science with a minor in Communi-



CHS President John Archer kept the March meeting running smoothly. Photograph by Dick Buchholz.

Deb Krohn reminded everyone about the upcoming Salamander Safari. Photograph by Dick Buchholz.

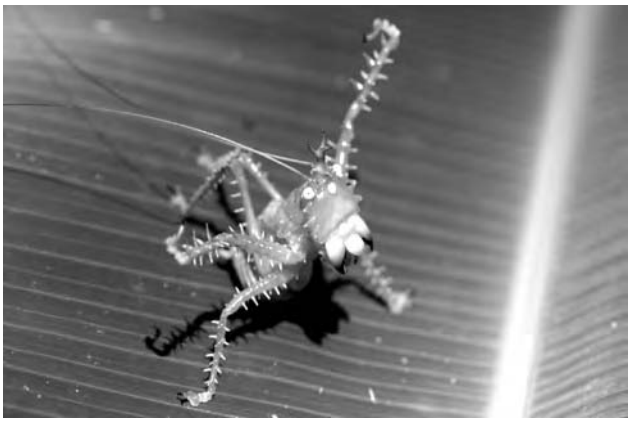
Bryan Suson displaying some of the insect specimens he collected while in Ecuador. Photograph by Dick Buchholz.

cations. His talked revolved around his multiple trips to Ecuador, a country of tremendous diversity that is extremely popular with birders and growing in popularity with other naturalists. Bryan made the point that mainland Ecuador is much less popular as a tourist destination than the Galapagos Islands, but would always rank higher in his estimation. Because it spans the Andes, mainland Ecuador contains herp habitat that ranges from the cold, boggy, shrubby Páramo between 3000 and 5000 meters in altitude to the 0–900 meters of the steamy Amazonian lowlands and the warm, humid Pacific lowlands, called the Chocó, the most endangered habitat in Ecuador. He gave us a brief description of each, accompanied by photographs that had my daughter begging to go. Pictures of hills covered with stunted plants illustrated the Páramo, and dense, cloud-shrouded jungle scenes showed the epiphyte-covered montane rain forest. The Chocó holds many species that are still being named, even as logging threatens its existence. We looked at slides of the native Huaroani people, and slides of the available transportation, which often involved the roof of a bus.

Then Bryan moved on to the animals. He didn't just flash picture after extraordinary picture, but built the presentation around one of his favorite topics, crypsis, throwing in aposematic coloring and mimicry for good measure. With a sampling from virtually every habitat he's visited, Bryan gave us a view of the diverse and exciting world of Ecuadorian fauna. Dead leaf crypsis was illustrated with pictures of a few insects, some *Eleutherodactylus* species (The most speciose genus of frogs, or any vertebrate, on the planet), and a striking picture of a bright orange *Rhinella margaritifera*, a highly polymorphic species of toad. The picture of a young *Trachyboa boulengeri* filled the screen, and I think it runs a close second to the tentacled snake (*Erpeton tentaculatus*) in the weird snake contest. He had pictures of a smooth-fronted caiman (*Paleosuchus trigonatus*), and even a picture of the rare rufous potoo, a bird that will sway with a light breeze even while it's asleep, thus helping to conceal it. Bryan showed us live foliage crypsis with pictures of a sad-eyed glass frog (*Nymphargus* [formerly *Cochranella*] *wileyi*) and a monkey frog (*Phyllomedusa vaillantii*), which clung frozen to his finger for 45 minutes as Bryan carried him back to camp to be photographed. If you're camouflaged, staying still may be the best defense even when you're sitting on the threat. Lots of bugs were shown but my favorite, and Bryan's, was a conocephaline, a spear-headed katydid which threatened us with spine-studded limbs and sharp mandibles capable of inflicting nasty bites. Bryan punctuated his talk with find-the-animal slides, and no one could spot the pretty little vine snake (*Xenoxybelis boulengeri*) shown in one.

He showed frogs demonstrating moss crypsis and lizards and birds blending into bark. He had photos of bugs looking like bird poop, and tree roots displaying "phallic crypsis." Bryan handled that with the skill of a stand-up comic and had everyone rolling in the aisles with laughter. A picture of a tropical screech owl had everyone gasping when Bryan told us that the owl we were certain was looking at us, actually was looking away. We had bugs mimicking frogs, nonvenomous snakes mimicking venomous snakes and, of course, animals so brightly colored that any encounter warned a predator away. At the end of Bryan's talk, my daughter wanted to go to Ecuador even more, and if Bryan does start the tour company he's thinking about, I might go with her.

After the meeting many of us went for pizza, where I had the chance to talk with Bryan's guest for that evening, Caleb Gordon, a professor at Lake Forest College and an accomplished birder who first talked Bryan into going to Ecuador. Caleb also has herps, and that night joined the CHS and by the time you read this, will have exhibited at ReptileFest with his young daughters. He seems responsible, reliable and sociable. Should be a perfect fit.



A creature that is even more imposing on the big screen, a spear-headed katydid (a conochephaline). Photograph by Bryan Suson

A juvenile galliwasp, *Diploglossus monotropis*, with a tail possibly mimicking a coral snake. Photograph by Bryan Suson.

A Huaroani tribesman in Ecuador. Photograph by Bryan Suson.

Nymphargus wileyi, a glass frog, looking a little world weary. Photograph by Bryan Suson.

The strange looking *Trachyboa boulengeri*. The adults get about the size of rosy boas. Photograph by Bryan Suson.

In leafy vegetation, this vine snake, *Xenoxybelis boulengeri*, is almost impossible to see. Photograph by Bryan Suson.

Rhinella margaritifera is a small, polymorphic toad. Photograph by Bryan Suson.

Unofficial Minutes of the CHS Board Meeting, March 14, 2008

The meeting was called to order at 7:45 P.M. at the Schaumburg Public Library. Board members Deb Krohn, Andy Malawy, Linda Malawy and Matt O'Connor were absent.

Officers' Reports

Recording Secretary: Cindy Rampacek read the minutes submitted by Amy Sullivan and they were accepted.

Treasurer: John Archer presented the information in Andy Malawy's absence and no questions were raised.

Membership Secretary: Mike Dloogatch shared the failed renewals with the board and chastised several board members who forgot to send in their renewals.

Vice-president: Jason Hood reported that Steve Barten made an excellent suggestion for a future guest speaker. Jason is looking for more suggestions for upcoming months. A current list of speakers can be found on the forum.

Sergeant-at-arms: Attendance at the February general meeting was 48.

Committee Reports

Shows:

- The Kids Expo, where we were guests of the *Oaklee Guide*, went great.
- Chicagoland Family Pet Expo is going well with one day down and two remaining.
- We will be at the Peggy Notebaert Nature Museum the first weekend in May.
- April 19 — Sandridge Nature Center in South Holland.
- April 26 — The Lake Katherine Nature Preserve in Palos Heights would like us to join them for Arbor Day.

Please let Jenny Vollman know if you are available to help at CHS shows.

ReptileFest: We are looking for volunteers contact former exhibitors to check if they are interested in coming back. T-Shirts have had snags, but we should have plenty to go around to everyone. Gary Fogel's video promos are up on YouTube. News promos should be up this week and on TV. We are looking for members to let us know if they see them. CHS tablecloths are good to go and we hope they will offer a nice addition! Cindy Rampacek made a motion to allow Clear Image to run a PSA advertising Reptile Fest and the advantages of staying in school on both CNN and CLTV. Dan Bavirsha seconded the motion and it was passed unanimously.

Old Business

The new CHS personalized vehicle magnets will be at fest!

New newsletters were handed out for events. New show and meeting dates have been added.

We are looking at a new provider for board of directors' insurance.

Many changes are coming to the website. Stop by to check out our new look.

New Business

Dan presented an idea for a folder of brief fact sheets on reptiles and amphibians. Board members were asked for assistance and a lively discussion followed in regards to the advantages of offering it as a freebie or selling it. No decision was made and members have volunteered to work on it. If it is completed we may have it available this year for ReptileFest.

Keep an eye on the forum for upcoming CHS information on shows, events and volunteer needs.

We have various exchange periodicals that need to be organized and moved from Linda's home. The possibility of renting a storage facility was discussed briefly.

The Peggy Notebaert Nature Museum is hosting a special event the same evening as the April CHS meeting. They request that we please be sure to head straight up to the meeting room and please be as quiet as possible. If everyone can be respectful that would be GREAT!

The Bartel Grassland Restoration Project has asked if the CHS would like to do a herp survey of the 1 sq. mi. area.

Mike Dloogatch moved that the CHS extend a 1-year membership to Jim Nesci in gratitude to him for opening his home for a CHS field trip. Deb Krohn seconded the motion and it passed unanimously.

The meeting adjourned at 9:39 P.M. and a very exhausted group went home.

Respectfully submitted by recording secretary Cindy Rampacek

Advertisements

For sale: rats and mice—pinkies, fuzzies and adults. Quantity discounts. Please send a SASE for pricelist or call Bill Brant, *THE GOURMET RODENT*, 6115 SW 137th Avenue, Archer FL 32618, (352) 495-9024, E-mail: GrmtRodent@aol.com.

For sale: from **The Mouse Factory**, producing superior quality, frozen feeder mice and rats. We feed our colony a nutrtionally balanced diet of rodent chow, formulated especially for us, and four types of natural whole grains and seeds. Mice starting from: pinks, $.17 each; fuzzies, $.24 each; hoppers, $.30 each; weanling, $.42; adult, $.48. Rats: starting with pinks at $.45 each, to XL at $1.80 each. Discount prices available. We accept Visa, MC, Discover or money orders. PO Box 85, Alpine TX 79831. Call **toll-free** at (800) 720-0076 or visit our website: < http://www.themousefactory.com> .

For sale: **high quality frozen feeders**. Over a decade of production and supply. Seven sizes of mice availabe: small newborn pinks up to jumbo adults. Prices start at $25 per 100. Feeders are separate in the resealable bag, not frozen together. Low shipping rates. Free price list. Kelly Haller, 4236 SE 25th Street, Topeka KS 66605, (913) 234-3358 evenings and weekends.

For sale: Graptemys.com T-shirts, 100% cotton, pre-shrunk, pigment-dyed shirts with the Graptemys.com embroidered logo. These are very high quality shirts with that stylish faded look. Sizes S-M-L-XL-XXL. Colors: Pacific blue, nautical red, brick red, plum, granite, khaki green and putty. All profits made from these shirts goes directly to in situ *Graptemys* research. $20 each with $3.00 shipping. Email: chris@graptemys.com or call (239) 437-4148 to order. You can look at the shirts at http://www.graptemys.com/shirts.htm

For sale: Never used Neodesha glass front cages; eight 24" ($45 each), nine 36" ($75 each), & three 48" ($155 each). All were purchased new from the manufacturer (Bush Herp) just months before they closed down. I originally purchased them for a tortoise breeding project which did not materialize. These are perfect for snakes, lizards, spiders or ?? They all have side vents with doors and front litter/moisture dams. Prices are wholesale cost. I also have new incandescent fixtures for each. Will sell individual units for above prices or all for $1,200. Bob Krause, 224-875-0090, robertkrause@aol.com Also have various aquariums, new screen covers etc.

For sale: Neodesha cages, with 2' dams. Have four 36" with single piece plate glass and aluminum top guide, asking $50 ea. Have six 48" with two piece plate glass and aluminum top guide, asking $120 ea. Never exposed to sunlight. None previously used to house animals. Ben Entwisle, Entwisleassoc@aol.com, (r) 815-838-2871, (o) 815-838-1200, (c) 815-685-2740.

For sale: Well started 2008 C.H. Sri Lankan stars, leopard tortoises and pancake tortoises. All captive-hatched by us and eating great. Stars are $450 each, with temperature-sexed pairs from unrelated females available. Leopards are $125 each and pancakes are $350. Contact Jim or Kirsten Kranz at 262-654-6303 or e-mail KKranz1@wi.rr.com.

For sale: Trophy quality jungle carpet, diamond-jungle, and jaguar carpet pythons. Website: moreliapython.googlepages.com E-mail: junglejohn@tds.net

For sale: Well started spider morph ball pythons (*Python regius*) available for free delivery in the Chicagoland area—males, $350. Also available are high-contrast, Sarawak locality and Walnut × Sarawak pairing Borneo pythons (*Python breitensteini*). Pricing is based on male sex with $50 more for females, if available: 2007 high-contrast, $150; 2007 Sarawak, $175; 2006 Sarawak,$200, 2007 Walnut × Sarawak (melanistic Borneos), $125. All feeding on frozen thawed adult mice and/or rats. Shipping available as an additional cost, if needed. Details and helpful info on my website at www.richcrowleyreptiles.com Contact Rich Crowley at 708-646-4058 or email pogona31@yahoo.com.

For sale: I am continuing to pare down my collection. I am selling my one-year-old male Mandarin ratsnake with a gorgeous darker pattern for $300. Please contact me at (773) 403-4680 or mroconnoDVM@gmail.com if you would like to see pictures or purchase him.

Costa Rica Wildlife Tour: Nature's Spectacles, October 9-24,2008, featuring the nesting of olive ridleys (the most abundant sea turtle) and the migration of raptors. Watch as perhaps hundreds or even thousands of these turtles lay their eggs on the beach at Ostional on the Pacific Coast. Marvel as many as l00,000 raptors (of an annual total of over two million) migrate in a day past our observation platform on their southward journey along the Caribbean—one of the three largest raptor migrations in the world. This trip is timed to be at these locations at the peak of the raptor migration and the most likely period of the largest arribadas (arrivals) of nesting olive ridleys. We'll also visit Tortuguero, the area made famous by Archie Carr's studies of the green turtle there. The geothermal Rincon de la Vieja National Park in the dry, tropical forest is also on our itinerary.

Green iguana, ctenosaurs, ameivas, spectacled caiman, American crocodiles, eyelash vipers, boas, black river turtles—as well as olive ridleys—are among the reptiles we're likely to see. Coatis, sloths, three species of monkeys, collared anteaters, and a panoply of tropical birds—toucans, tanagers, parrots, hummingbirds, warblers—are only a few of the mammals and birds we'll seek out. A knowledgeable, bilingual, Costa Rican naturalist guide will accompany us throughout along with our own coach and driver. Enjoy charming accommodations in lovely natural settings and delicious local cuisine. Maximum group size is 16. The land cost for this unique l6 day tour is $3995 which includes all meals, lodging, guiding, and national park fees. The tour price includes a $300 donation to the Chicago Herpetological Society for all CHS members, friends, and relatives who go. International airfare is not included. For a detailed itinerary, please email William Turner at toursbyturner@aol.com, call (303) 795-5128, or mail a request to 7395 S. Downing Circle W.; Centennial, CO 80122.

Herp tours: **Madagascar—Tortoise Tour** & **Chameleon Tour** seeking adventurous members for January-February 2009. The goal of the tortoise tour, to be co-led by **Peter Pritchard** of the Chelonian Research Institute and **Bill Love**, will be to see all native species in the wild and record various aspects of their lives photographically. The later chameleon tour, co-led by **Mike Monge** of FL Chams and **Bill Love**, will focus on panther chameleons, trying to find and photograph as many of the color morphs as possible in the wild. Details are at Blue Chameleon Ventures' site at: www.bluechameleon.org.

Herp tours: The beautiful Amazon! Costa Rica from the Atlantic to the Pacific! Esquinas Rainforest Lodge, the Osa Peninsula, Santa Rosa National Park, and a host of other great places to find herps and relax. Remember, you get what you pay for, so go with the best! GreenTracks, Inc. offers the finest from wildlife tours to adventure travel, led by internationally acclaimed herpers and naturalists. Visit our website < http://www.greentracks.com> or call (800) 892-1035, E-mail: info@greentracks.com

Line ads in this publication are run free for CHS members—$2 per line for nonmembers. Any ad may be refused at the discretion of the Editor. Submit ads to: Michael Dloogatch, 6048 N. Lawndale Avenue, Chicago IL 60659, (773) 588-0728 evening telephone, (312) 782-2868 fax, E-mail: MADadder0@aol.com

UPCOMING MEETINGS

The next meeting of the Chicago Herpetological Society will be held at 7:30 P.M., Wednesday, April 30, at the Peggy Notebaert Nature Museum, Cannon Drive and Fullerton Parkway, in Chicago. **Bill Love** will speak on "Herp Photography—Beyond Snapshots." Bill writes a monthly Q&A column, "Herp Queries," for *Reptiles* magazine. He also leads eco-tours to Madagascar for his own company, Blue Chameleon Ventures. His photographs regularly appear in herp magazines and books.

At the May 28 meeting, **Kevin Messenger**, a vet tech from Raleigh, North Carolina, will speak to us about the "Herpetofauna of Shennongjia National Reserve, Hubei Province, China ." Kevin is a graduate from NC State University, receiving his B.S. in zoology in May 2006. Three days after graduating he was on a plane to China for four months to study herps in a remote region of central China. His job was to survey the 800,000-acre forests of Shennongjia National Reserve; a location that previously had never been surveyed for herps.

The regular monthly meetings of the Chicago Herpetological Society take place at Chicago's newest museum — the **Peggy Notebaert Nature Museum**. This beautiful new building is at Fullerton Parkway and Cannon Drive, directly across Fullerton from the Lincoln Park Zoo. Meetings are held the last Wednesday of each month, from 7:30 P.M. through 9:30 P.M. Parking is free on Cannon Drive. A plethora of CTA buses stop nearby.

Board of Directors Meeting

Are you interested in how the decisions are made that determine how the Chicago Herpetological Society runs? And would you like to have input into those decisions? If so, mark your calendar for the next board meeting, to be held at 7:30 P.M., May 16, in the adult meeting room on the second floor of the Schaumburg Township District Library, 130 S. Roselle Road, Schaumburg.

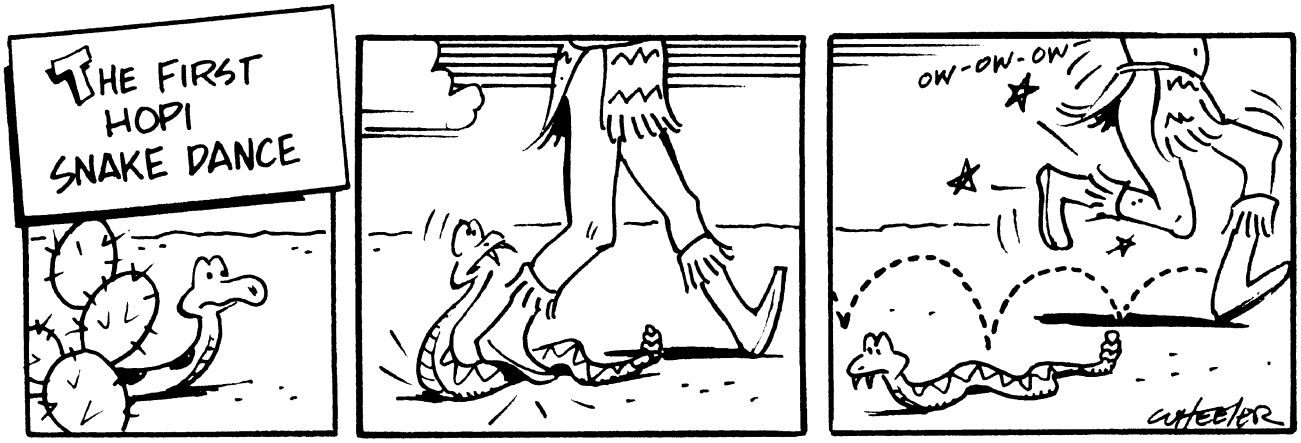
The Chicago Turtle Club

The monthly meetings of the Chicago Turtle Club are informal; questions, children and animals are welcome. Meetings normally take place at the North Park Village Nature Center, 5801 N. Pulaski, in Chicago. Parking is free. For more info visit the CTC website: http://www.geocities.com/~chicagoturtle.

MARCH SHOWS

Many thanks to everyone who gave their time and energy to our events during the month of March!
March 1, The Notebaert Nature Museum: John Archer, Bob Bavirsha, Molly Carlson. March 2, The Notebaert Nature Museum: Bob Bavirsha, Dick Buchholz, Nancy Kloskowski, Teresa and Molly Carlson, Josh Chernoff. March 7, University of Illinois School of Public Health, International Night: Bob Bavirsha, Dan Bavirsha. March 8, Kids Expo: Deb Krohn, Dick Buchholz, Jenny Vollman. March 14, Chicagoland Family Pet Expo: Bob Bavirsha, Dan Bavirsha, Dick Buchholz, Nancy Kloskowski, Cindy Rampacek, Jenny Vollman. March 15, Chicagoland Family Pet Expo: Bob Bavirsha, Dick Buchholz, Cindy Rampacek, Linda Malawy, Cecil, Denise and Kurt Woolridge, Mike Scott, Jenny Vollman. March 16, Chicagoland Family Pet Expo: Bob Bavirsha, Mike Scott, Rick Hoppenrath, Kirsten and Jim Kranz, Sally Hajek, Jenny Vollman. March 22, Notebaert Nature Museum: John Archer.

THE ADVENTURES OF SPOT



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