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HEALTH ASSESSMENT OF FREE-RANGING ANACONDAS (*EUNECTES MURINUS*) IN VENEZUELA

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Abstract: The health status of 24 free-ranging anacondas (*Eunectes murinus*) was evaluated as part of an investigation of their ecology and conservation in the Venezuelan llanos (seasonally flooded savanna). Evaluations included physical examination and blood sampling for biomedical analyses. Tests performed included complete blood counts, biochemical profiles, vitamins A and E and mineral analyses, screening for chlorinated pesticides and polychlorinated biphenyls, and parasite identification. Statistically significant differences ($P < 0.05$) for biomedical measurements were determined by *t*-tests. Female anacondas were significantly heavier and longer and were more likely to have been injured than were males. Females also had significantly lower packed cell volumes and higher heterophil and lower lymphocyte counts. Male anacondas had significantly higher alkaline phosphatase, creatinine, and amylase values and higher gamma-tocopherol and copper levels. Anaconda zinc levels were elevated (13.8 ± 2.5 ppm) as compared with normal values for mammals and birds. Other mineral values were within expected ranges. Injured anacondas had significantly higher heterophil counts and lower potassium and uric acid levels than did uninjured snakes. Blood samples collected from anacondas within 1 day of capture had significantly higher azurophil and lower lymphocyte counts and lower chloride values than did samples collected 2–10 days after capture. Blood samples processed within 12 hr of collection had significantly higher glucose, total CO_2, total bilirubin, and iron values and lower lactate dehydrogenase values than samples processed after storage on ice in a cooler or refrigerated for 1–2 days before processing. No toxins were identified. Parasites identified included the tick *Amblyomma dissimile,* tapeworm *Crepidobothrium* sp., subcutaneous nematode *Dracunculus* sp., an unidentified trematode, and an intraerythrocytic protozoal parasite, *Hemoproteus* sp.

Key words: Boidae, hematology, serum biochemistry, anaconda, *Eunectes murinus,* health assessment.

INTRODUCTION

There are few reports of health evaluations of free-ranging or recently captured snake species[20,30,31] and none for the family Boidae. However, information on the normal hematologic or biochemical values of captive snakes is available.[4,6,9,12,14,19,24,25] As part of a comprehensive field study of free-ranging anacondas (*Eunectes murinus*) at three study sites in Apure state in the Venezuelan llanos (seasonally flooded savanna), during 1992 and 1993 over 200 anacondas were examined, identified, weighed, measured, and released by field biologists at capture sites (Rivas and Muñoz, unpubl. rep.). Radiotelemetry and temperature transmitters were surgically implanted subcutaneously or intracoelomically in 12 anacondas to facilitate long-term biotelemetry studies of habitat utilization throughout different seasons (Rivas and Muñoz, unpubl. rep.).

To more intensively assess the health status of these populations, 24 anacondas were medically evaluated during the dry season in March 1992. Health assessment included physical examination and collection of blood for hematologic, serum biochemical, selected vitamin and mineral analyses, and screening for chlorinated pesticide residues and polychlorinated biphenyls (PCBs). Ex-

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ternal and internal parasites were also identified.

MATERIALS AND METHODS

Health evaluation and sample handling

Fifteen male and nine female anacondas were collected during the dry season from three field sites in Venezuela: Hato El Cedral (HEC; 7°25′N, 69°20′W), Hato Santa Luisa (HSL; 7°40′N, 67°35′W), and Agropecuaria Puerto Miranda (APM; 7°55′N, 67°35′W). HEC and HSL are large (>30,000 ha) ranches exclusively utilized for cattle ranching, and APM is smaller (3,000 ha), located on the outskirts of the town of San Fernando, and consists of both a cattle ranch and a rice farm (Rivas and Muñoz, unpubl. rep.).

Snakes were held in cloth bags or metal drums until examined. Physical examinations were conducted, and any injuries were noted, external parasites were removed, and weights and lengths (mean of three measurements) were recorded. Blood samples were obtained from the ventral coccygeal vein as previously described.[14,19] Samples with lymph contamination were discarded. Blood samples were collected with a 3-cm 21-ga needle and either a 5- or 10-ml syringe. Samples were either obtained with sodium heparin-flushed syringes and placed into plain vacutainer tubes (Vacutainer Systems, Becton Dickinson, Rutherford, New Jersey 07070, USA) or were obtained with plain syringes and placed into sodium heparin vacutainer tubes.

The time elapsed between collection of the snakes and health assessment and between sample collection and processing of specimens differed depending upon the availability of appropriate facilities at each field site and travel between sites. Most snakes were assessed and blood samples obtained within 24 hr of collection ($n = 15$), although some snakes were held for 2–10 days before sample collection ($n = 9$). Blood samples were refrigerated or stored in a cooler with ice until processing. Samples were either processed within 12 hr ($n = 13$) or held for 1–2 days before processing ($n = 11$). White blood cell counts were performed, and then the samples were centrifuged. Heparinized plasma was separated and frozen in polypropylene vials in a liquid nitrogen dry shipper for transport to the United States.

An additional two anacondas that had not been evaluated were found dead. Intestinal parasites and ectoparasites were collected at necropsy of these snakes for identification.

Hematologic and plasma biochemical analysis

At the field sites, white blood cell (WBC) counts were performed by a manual eosinophil counting technique described for birds[3] using a commercially available test kit (Unopette, Becton-Dickinson, Rutherford, New Jersey 07070, USA) for all 24 anacondas. Packed cell volume (PCV) was determined by centrifugation, the buffy coat was examined for microfilaria, and plasma total solids were determined with a refractometer. Three thin blood smears were prepared for each snake (one unfixed, one fixed in 99% methyl alcohol, and one fixed and stained with a Wright's-Giemsa type stain [Hematology Three Step Stain Set, Accra Lab, Bridgeport, New Jersey 08014, USA]). Examination for hemoparasites and differential WBC determinations were subsequently performed at the Wildlife Health Center (WHC), NYZS/The Wildlife Conservation Society (WCS).

Adequate blood volumes for biochemical profile determination were obtained from 20 of the 24 anacondas (12 male and eight female), representing all three field sites. Analyses were conducted using an automated analyzer designed for mammal blood (Ciba Corning Alliance 580 Auto Analyzer, Ciba Corning Diagnostics Corp., East Wapole, Massachusetts 02032, USA) at a commercial veterinary reference laboratory (CENVET, Woodside, New York 11377,

USA). The analytical profile included inorganic phosphorus (P), total protein (TP), albumin, globulin, calcium (Ca), glucose, total CO_2 (TCO_2), blood urea nitrogen (BUN), total bilirubin (TBili), alkaline phosphatase (ALP), lactate dehydrogenase (LDH), alanine aminotransferase, aspartate transaminase, sodium (Na), potassium (K), chloride (Cl), creatinine (Cr), cholesterol, amylase (Amy), iron (Fe), and uric acid (UA).

Vitamins

Vitamins A and E analyses were performed in the Nutrition Laboratory at the WHC. Adequate plasma volumes were available for analysis of plasma from 12 of the 24 anacondas (five male and seven female) from two of the field sites (HEC and HSL). The vitamin E assay included both alpha- and gamma-tocopherol isomers. Vitamin A analysis was for retinol. Vitamins were measured by high-performance liquid chromatography (HPLC) using a Series 400 Chromatograph (Perkin Elmer, Norwalk, Connecticut 06856, USA) equipped with a 15-cm C18 column. HPLC-grade methanol and water (98:2 vol/vol) was used as the mobile phase with a flow rate of 2.0 ml/min.[26] The other equipment and parameters were as previously described.[8]

Minerals

Adequate plasma samples from 12 of the 24 anacondas (five male and seven female) from two of the field sites (HEC and HSL) were available and were analyzed for boron (B), barium, Ca, copper (Cu), cobalt (Co), Fe, magnesium, manganese, molybdenum (Mo), P, zinc (Zn), aluminum (Al), and Na. Analyses were conducted by inductively coupled argon plasma emission spectroscopy as previously described.[27]

Toxicology

Plasma samples from one male and two female anacondas, one from each field site, were analyzed for PCBs and chlorinated pesticides (O,P′-DDD, P,P′-DDD, P,P′-DDE, O,P′-DDT, P,P′-DDT, aldrin, alpha-BHC, beta-BHC, dieldrin, endrin, heptachlor, heptachlor epoxide, and lindane [gamma-BHC]). Analyses were conducted by electron capture gas chromatography as previously described.[5]

Statistics

Statistical analyses were performed using a computer program (SYSTAT, Evanston, Illinois 60201, USA) to generate descriptive statistics and to test hypotheses with *t*-tests. Variables tested for significant differences ($P < 0.05$) in laboratory results were sex, presence or absence of injuries, time from capture until blood collection, and time from sample collection until analysis and processing. In addition, vitamins and minerals were evaluated for significant differences between the two field sites.

Parasitology

Ectoparasites were preserved in 70% ethyl alcohol and identification was performed at the Department of Defense, Defense Pest Management Information Analysis Center (Armed Forces Pest Management Board, Washington, D.C. 20307-5001, USA). Intestinal parasites recovered at necropsy were preserved in 70% ethyl alcohol and 10% buffered formalin and were identified at the New York State College of Veterinary Medicine, Diagnostic Laboratory, Ithaca, New York (14851-0786, USA). Hemoparasites were identified to genus at the WHC.

RESULTS

Health evaluation and sample handling

Mean values for body weight, body length, and the number of anacondas with injuries are listed in Table 1. Despite injuries, all snakes were considered to be in good physical condition. Females were significantly heavier and longer and were more frequently injured than were males. Injuries noted in all but one snake consisted of wounds

Table 1. Body weights and lengths of 24 free-ranging anacondas (*Eunectes murinus*) evaluated in Venezuela. All measurements were significantly different ($P < 0.05$) between the sexes.

Measurements	Male ($n = 15$)	Female ($n = 9$)
Weight (kg)		
$\bar{x} \pm$ SD	7.2 ± 2.3	31.9 ± 23.3
Range	3.5–11.0	4.4–74.0
Length (m)		
$\bar{x} \pm$ SD	2.6 ± 0.3	3.9 ± 1.0
Range	2.1–3.1	2.2–5.1
Number with injuries	1 (6.7%)	6 (66.7%)

that extended into muscle layers. These wounds were compatible with bite wounds inflicted by prey species. One anaconda had an ocular and maxillary abscess from which a wooden foreign body had been removed by a field biologist upon capture 1 wk prior to veterinary examination.

Blood analyses

Hematologic results are listed in Table 2. The mononuclear granulocyte of reptiles with blue-gray cytoplasm and azurophilic granules has been referred to both as a neutrophil[12,24,30] and as an azurophil.[13,14,21,25] In this study, the cell is referred to as an azurophil. Plasma biochemical results are listed in Table 3. BUN was below the detection limit (6 mg/dl) in all snakes.

Results of plasma vitamin and mineral analyses are listed in Table 4. Levels of several minerals were below the limit of detection (B < 1.66 ppm, Co < 0.167 ppm, Mo < 0.333 ppm, Al < 1.66 ppm). Levels for all 13 chlorinated pesticides were below the limits of detection (0.0025–0.026 ppm) for each toxin, as were the PCBs (<0.1 ppm).

Females had significantly lower PCVs and lymphocyte counts (relative and absolute) and higher relative heterophil counts. Males had significantly higher ALP, Cr, and Amy values as well as higher gamma-tocopherol and Cu levels (Table 5). Injured anacondas had significantly higher heterophil counts (relative and absolute) and lower K and UA values (Table 6). Blood samples collected from anacondas within 1 day of capture had significantly higher azurophil counts (rela-

Table 2. Mean hematologic values of 24 free-ranging anacondas (*Eunectes murinus*) evaluated in Venezuela.

Measure	Mean ± SD	Range
Packed cell volume (%)	24.1 ± 4.8	14–31
Total solids (g/dl)	5.9 ± 0.9	4.6–8.4
White blood cells ($10^3/\mu l$)	13.2 ± 6.5	5.04–26.8
Heterophils		
%	23.5 ± 11.6	5–52
$10^3/\mu l$	2.8 ± 1.5	0.7–6
Lymphocytes		
%	40.3 ± 15.8	17–93
$10^3/\mu l$	5.1 ± 2.9	1.9–13
Azurophils		
%	35.3 ± 16.3	0–65
$10^3/\mu l$	5.2 ± 4.3	0–16.4
Monocytes[a]		
%	1.7 ± 1	1–4
$10^3/\mu l$	0.24 ± 0.19	0.05–0.73
Basophils[b]		
%	1	1
$10^3/\mu l$	0.18 ± 0.06	0.1–0.24

[a] Monocytes were observed in blood smears of only 12 anacondas.
[b] Basophils were observed in blood smears of only four anacondas.

Table 3. Mean plasma biochemical values of 20 free-ranging anacondas (*Eunectes murinus*) evaluated in Venezuela.

Measure	Mean ± SD	Range
Total protein (g/dl)	5.7 ± 0.6	4.7–7.1
Albumin (g/dl)	2.3 ± 0.4	1.8–3.5
Globulin (g/dl)	3.4 ± 0.4	2.9–4.3
Phosphorus (mg/dl)	5.6 ± 3.7	3.2–14.9
Calcium (mg/dl)	13.3 ± 1.7	7.7–16.7
Glucose (mg/dl)	54.2 ± 14.5	41–98.7
Total CO_2 (mEq/L)	19.7 ± 1.8	17–23
Total bilirubin (mg/dl)	0.3 ± 0.1	0.1–0.7
Alkaline phosphatase (IU/L)	59.7 ± 17.9	38.5–114.3
Lactate dehydrogenase (IU/L)	87.1 ± 65.6	27.6–323.1
Alanine aminotransferase (IU/L)	17.3 ± 5.6	10.4–26
Aspartate transaminase (IU/L)	28.4 ± 8	15.2–45.5
Sodium (mEq/L)	153.9 ± 3.8	146.6–159.2
Potassium (mEq/L)	4.7 ± 0.7	3.7–6.2
Chloride (mEq/L)	113.1 ± 4.6	103–119.5
Creatinine (mg/dl)	0.5 ± 0.1	0.3–0.7
Cholesterol (mg/dl)	203.1 ± 39.5	122–289.5
Amylase (IU/L)	693.8 ± 152.8	300–934
Iron (mg/dl)	57.3 ± 10.6	50–96.3
Uric acid (mg/dl)	8.7 ± 2.2	5.2–13.5

tive and absolute) and lower relative lymphocyte counts and Cl values than did blood collected from snakes 2–10 days after capture (Table 7). Samples processed within 12 hr had significantly higher glucose, TCO_2, TBili, and Fe values and significantly lower LDH values than did samples processed after storage for 1–2 days (Table 8). Anacondas captured at HEC had significantly higher Na levels than those captured at HSL (3,689 ± 94 ppm vs. 3,825 ± 65 ppm).

There were no significant differences in hematologic values relative to the time until samples were processed and no significant

Table 4. Mean plasma vitamin and mineral values of 12 free-ranging anacondas (*Eunectes murinus*) evaluated in Venezuela.

Measure	Mean ± SD	Range
Vitamins (μg/ml)		
Alpha-tocopherol	12.4 ± 6.5	5.9–23.7
Gamma-tocopherol	0.4 ± 0.2	0.2–0.9
Retinol	0.08 ± 0.06	0.03–0.24
Minerals (ppm)		
Barium	0.15 ± 0.04	0.1–0.2
Calcium	171.2 ± 94	125-441
Copper	1.1 ± 0.5	0.4–1.7
Iron	1.4 ± 0.8	0.7–3.4
Magnesium	28 ± 5.3	20.1–39.9
Manganese	0.07 ± 0.02	0.06–0.08
Phosphorus	160 ± 105.3	97.3–462
Zinc	13.8 ± 2.5	10–18.4
Sodium	3,734.2 ± 106.2	3,590-3,890

Table 5. Statistically significant differences ($P < 0.05$) for mean hematologic and plasma biochemical, vitamin, and mineral values of free-ranging male and female anacondas (*Eunectes murinus*) in Venezuela.

Measure	Male		Female	
	$\bar{x} \pm$ SD	n	$\bar{x} \pm$ SD	n
Packed cell volume (%)	25.8 ± 3.6	15	21.2 ± 5.4	9
Heterophils (%)	18.3 ± 8.4	15	32.1 ± 11.3	9
Lymphocytes				
%	44.9 ± 18	15	32.4 ± 6.7	9
$10^3/\mu l$	6.2 ± 3.1	15	3.3 ± 1.4	9
Alakaline phosphatase (IU/L)	66.1 ± 19.3	12	50.2 ± 10.3	8
Creatinine (mg/dl)	0.5 ± 0.1	12	0.4 ± 0.08	8
Amylase (IU/L)	766.1 ± 129.7	12	585.3 ± 120.5	8
Gamma-tocopherol (μg/ml)	0.6 ± 0.3	5	0.3 ± 0.1	7
Copper (ppm)	1.4 ± 0.3	5	0.9 ± 0.4	7

difference in vitamin or mineral values due to the presence of injuries, length of time captive, or time until sample processing.

Parasitology

The tick *Amblyomma dissimile* was present on six of the 24 anacondas evaluated and on one of the anacondas that died. Male and female ticks were present; no other ectoparasites were identified.

Both of the dead anacondas had abundant cestodes and trematodes in the jejunum, and in one snake these parasites were also present in the duodenum. The tapeworms from both necropsies were identified as *Crepidobothrium* sp.; species identification was not possible. The trematodes could not be identified. In addition, one anaconda had several subcutaneous nematodes identified as *Dracunculus* sp. A *Hemoproteus* sp. was identified in blood smears from all snakes evaluated. No microfilaria were observed by buffy coat or blood smear examination.

DISCUSSION

Establishment of baseline biomedical information for free-ranging populations is a basic step in defining and describing their health status. These results can be valuable for comparisons between environments and over time and as indicators of environmental degradation. This information is also useful in developing, implementing, and monitoring conservation programs and for interpreting biomedical measures in captive populations.

Female anacondas, which are heavier and longer, are capable of taking larger prey than are males (e.g., spectacled caiman [*Caiman crocodilus*] and capybara [*Hydrochaeris hy-*

Table 6. Statistically significant differences ($P < 0.05$) for mean hematologic and plasma biochemical values of injured and uninjured free-ranging anacondas (*Eunectes murinus*) in Venezuela.

Measure	Injured		Uninjured	
	$\bar{x} \pm$ SD	n	$\bar{x} \pm$ SD	n
Heterophils				
%	34 ± 11.9	7	19.1 ± 8.5	17
$10^3/\mu l$	3.9 ± 1.7	7	2.3 ± 1.2	17
Potassium (mEq/L)	4.2 ± 0.3	6	4.8 ± 0.7	14
Uric acid (mg/dl)	7.0 ± 1.5	6	9.4 ± 2	14

Table 7. Statistically significant differences ($P < 0.05$) of free-ranging anaconda for mean hematologic and plasma biochemical values of free-ranging anacondas (*Eunectes murinus*) from Venezuela held captive for ≤1 day and anacondas held captive for 2–10 days before blood collection.

Measure	Captive ≤1 day		Captive 2–10 days	
	$\bar{x} \pm$ SD	n	$\bar{x} \pm$ SD	n
Lymphocytes (%)	33.1 ± 8.8	15	52.1 ± 18.2	9
Azurophils				
%	41.9 ± 14.7	15	24.3 ± 13.1	9
$10^3/\mu l$	6.8 ± 4.5	15	2.5 ± 2.4	9
Chloride (mEq/L)	111.8 ± 4.7	14	116.3 ± 2.2	6

drochaeris]). Such prey are more capable of inflicting serious injuries. Injuries were much more common in females in this study. Extensive analysis of field data for 100 anacondas has demonstrated that scars from healed wounds are significantly more frequent in females, are more numerous per individual in females, are more plentiful in larger snakes, and are more prevalent in the cranial body (due to constriction of prey species in this area) (Rivas and Muñoz, unpubl. rep.).

Heterophils increase under inflammatory conditions,[12,13,24] both relative and absolute heterophil counts were higher in injured anacondas. The higher relative heterophil counts observed in female anacondas may reflect an inflammatory response to observed injuries and to unrecognized, resolving, or inconspicuous lesions. The lower relative and absolute lymphocyte counts in females may also reflect an acute inflammatory or stress response. In addition, seasonal changes in the total WBC count and differential have been observed in other snake species.[9,31] These changes were most marked during the breeding season;[31] females have significantly higher total WBC counts and increased relative azurophil (neutrophil) counts during that time. This study was conducted during the breeding season for anacondas in the Venezuelan llanos, and the observed hematologic changes may have been due to breeding activity. Azurophils also increase under infectious and inflammatory conditions.[12,13,24] Elevated azurophil counts with concomitant depression of lymphocyte counts in blood samples collected from anacondas within 1 day of capture may be similar to the mammalian neutrophilia and lymphopenia stress response.

Reptiles have extensive lymphatic systems; in snakes, it extends into the tail.[23]

Table 8. Statistically significant differences ($P < 0.05$) for mean plasma biochemical values for blood samples collected from free-ranging anacondas (*Eunectes murinus*) in Venezuela and processed within 12 hr or stored for 1–2 days before processing.

Measure	Processed ≤12 hr[a] ($\bar{x} \pm$ SD)	Processed 1–2 days[b] ($\bar{x} \pm$ SD)
Glucose (mg/dl)	60.1 ± 15.4	45.3 ± 6.6
Total CO_2 (mEq/L)	20.7 ± 1.7	18.3 ± 0.7
Total bilirubin (mg/dl)	0.4 ± 0.1	0.2 ± 0.07
Lactate dehydrogenase (IU/L)	56.9 ± 22.5	132.5 ± 83.4
Iron (mg/dl)	61.3 ± 12.2	51.3 ± 0.7

[a] $n = 12$.
[b] $n = 8$.

Concentrations of cellular and biochemical elements differ between lymph and blood, so lymph contamination during venipuncture may affect reptile hematologic values.[15,23] Blood samples with recognized lymph contamination were discarded, and it was possible to obtain several milliliters of lymph during venipuncture attempts in large anacondas. The larger females may have had more frequent unrecognized lymph contamination due to their larger lymphatic ducts. Lower PCV values in female snakes of other species have been reported.[9,30] Both sexes have exhibited decreased PCV values during the breeding season,[9] with a significantly greater decline in females.[31] The lower PCV of female anacondas might be due to physiologic sex differences, their higher frequency of injuries, or lymph contamination.

The reason for the observed sex differences in ALP, Cr, and Amy values was not evident. The lower K and UA values in injured anacondas may have been the result of hypophagia. Marked elevations of Ca, P, and TP occur during folliculogenesis in female snakes;[6] however, significant differences in these values between males and females were not observed. The higher Cl levels in blood collected 2–10 days after snake capture may reflect mild dehydration, despite provision of water in the holding areas.

Sample handling and lymph contamination[15] and postprandial time[4] have been reported to affect biochemical values of reptiles.[15] It was not known when the anacondas in this study had last eaten. The anaconda hematologic and serum biochemical values determined are, in general, similar to previously reported values for boids.[4,24] Delayed processing of samples resulted in a decline in glucose due to cell metabolism.[29] The decrease in TCO_2 was due to evaporation from plasma. It is unclear why Fe values were higher in rapidly processed samples. TBili is light labile,[29] and exposure to light during the delay in processing is probably responsible for the lower levels observed. Biliverdin is the reptilian metabolic product of hemoglobin metabolism. The significance of bilirubin measurement is unknown, although snake TBili levels have been reported.[4,20] Plasma LDH leaches from red blood cells, so levels rise when cells are not promptly separated.[29]

Male anacondas had higher gamma-tocopherol and Cu levels. Anaconda sexual size dimorphism probably results in consumption of different prey items, which may be reflected in these circulating vitamin and mineral differences. Although alpha-tocopherol is the principal isomer with vitamin E activity in most feedstuffs, gamma-tocopherol predominates in seeds.[1] The smaller prey items of male anacondas may contain a greater relative proportion of seed in their gut contents than do prey of female anacondas. In general, vitamin E levels (measured as alpha-tocopherol plus 0.1 [gamma-tocopherol concentrations]) in free-ranging anacondas were higher than values previously reported for snakes in zoos (3.8–12.4 μg/ml, $n = 4$ from four species)[7] or for more current data on zoo anacondas (8.0 ± 1.9 μg/ml, $n = 4$; Dierenfeld, unpubl.) and other snakes (7.7 ± 8.5, $n = 34$ from 13 species; Dierenfeld, unpubl.).

Retinol values (as a measure of vitamin A status) were lower than those of carnivorous mammals and birds (normals of 0.2–0.8 μg/ml for most species) but were typical for reptiles and similar to data for zoo snakes (0.06 ± 0.05 μg/ml, $n = 31$, 12 species; Dierenfeld, unpubl.). The health significance of these observations or any implications concerning nutrient requirements or metabolism are unknown at this time.

Additionally, the significance of the differences in plasma Na levels between study sites is unclear but may reflect soil substrate chemical composition. The mineral content of soils, plants, or prey items were not examined in this study. Plasma Zn levels in all anacondas measured in our study were elevated as compared with those of mammal and bird species, but there are no published Zn levels for other reptile species and

no obvious explanation for these unexpectedly higher levels. PCBs and chlorinated pesticides were not detected in any of the three samples screened, a finding that is consistent with the lack of agriculture in the areas sampled.

Several parasites were identified in these anacondas. The tick *Amblyomma dissimile* has previously been recovered from anacondas.[17] Prevalence of infection was probably greater than observed because of unrecognized loss of ticks during handling and confinement prior to examination. *Hemoproteus* sp. were commonly found. The tapeworms were *Crepidobothrium,* but the species could not be identified; anaconda *Crepidobothrium gerrardii* infections have been reported.[18] *Dracunculus* sp. filarial nematodes have previously been reported from anacondas.[22] These parasitic infections are not uncommon in reptiles.[2,10,11,16,19,28]

The present study established baseline biomedical information from a limited random sampling of a single population of free-ranging anacondas during the dry season. Medical examination and evaluation of a larger sample of anacondas from this population and evaluation during different seasons are indicated. The baseline biomedical data base established can be a useful resource for comparison with captive and free-ranging populations of anacondas or related species for medical and conservation purposes.

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