BASELINE DATA ON HEMATOLOGICAL AND BIOCHEMICAL PARAMETERS FOR THE USE OF WILD JUVENILE BROAD-SNOUTED CAIMAN (*Caiman latirostris*) AS BIOINDICATORS IN ATLANTIC FOREST, SOUTHEASTERN BRAZIL

NÓBREGA, Yhuri Cardoso [1];
CURBANI, Flávio [2];
ALVARENGA, Fernando Paulino [1];
MENEZES, Paulo Quadros de [1];
SILVA, Thassiane Targino da [1];
FONSECA, Leandro Abreu da [3];
SANTOS, Marcelo Renan de Deus [1];
SRBEK-ARAÚJO, Ana [4].

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[1]Caiman Project, Marcos Daniel Institute; [2]Department of Industrial Technology, Technological Center, Federal University of Espírito Santo; [3]Viçosa University; [4]Vila Velha University.

ABSTRACT

Crocodilians are considered as good indicators of ecosystem health since environmental conditions will influence them at individual (body condition and health parameters) and populational levels (population dynamics and behavior). Despite that, there are few attempts to use crocodilians as bioindicators and the lack of baseline health parameters is an impediment to this. Here, hematological and biochemical reference values for free-ranging *Caiman latirostris* (broad-snouted caiman) in the Brazilian Atlantic Forest, one of the most threatened biomes in the world, are proposed. Young caiman are more sensitive to environmental variations, besides being more abundant and more easily captured, when compared to adults, which facilitates their use as bioindicators. Furthermore, problems that affect young caimans may represent future population problems. The data obtained is an important tool in assessing the health of free-living populations, contributing to the use of *C. latirostris* as a bioindicator of health in the Atlantic Forest aquatic ecosystem.

Keywords: Blood parameters. Bioindicator. Conservation medicine. *Crocodilia*. Health assessment.

INTRODUTION

Caiman latirostris (broad-snouted caiman) is a Neotropical caiman species widely distributed in South America: its range extends from Bolivia to Argentina (VERDADE, 2004). In Brazil, the species can be found in the Atlantic Forest, Caatinga, Cerrado, and Pampa biomes. It is a medium-sized animal, and male adults can reach up to 3.5 meters in length (VERDADE, 2004). Evidence shows that the species is extremely important for the functioning of aquatic ecosystems, especially because it tolerates anthropized environments and has physiological characteristics that make it a possible bioindicator of the quality of the environment in which it is found (SOMAWEERA et al., 2020).

Assessments of hematological tests and serum biochemical dosages are valuable parameters in the analysis of animal health. They are essential physiological patterns for the development of research in wild population's health (CAMPBELL, 1996) and fundamental in the accomplishment of programs evaluating ecosystem health that use animals as bioindicators (ALMOSNY, 2014). From a methodological point of view, any parameter that indicates the physiological state of an animal quickly can be used as a tool to clarify the effects caused by some imbalance in the health of a natural population. One of the least invasive techniques for such evaluation is the analysis of hematological parameters (SÁNCHEZ-GUZMÁN et al., 2004). These parameters allow the detection of changes in physiological conditions that may reflect environmental conditions, either in individuals or at the population level (SÁNCHEZ-GUZMÁN et al., 2004).

The difference in this type of study is the potential for detecting acute physiological changes in live animals, allowing for possible mitigation actions (ARTACHO et al., 2007). In addition, monitoring the health of wild animals through laboratory blood tests can serve as a tool for public health, considering that the functioning of ecosystems depends on the health of animals, plants and humans (MANGINI; SILVA, 2006). There are few studies on hematological and biochemical reference values for hatchling of *C. latirostris* (ZAYAS et al., 2011). There are also eco-toxicological studies on puppies and juveniles of *C. latirostris* that use hematological values as biomarkers of a disturbed environmental condition (LATORRE et al., 2016; LÓPEZ GONZÁLEZ et al., 2013; SIROSKI et al., 2016). However, all these studies used animals kept in a controlled environment and hematological studies on free-living animals that reflect the environmental biotic and abiotic variables found in the natural environment are needed.

MATERIAL AND METHODS

For this research, 68 young specimens of *C. latirostris* were captured in a lake complex (23˚13.41'74''S, 40˚15.04'72''W), located in Serra, central portion of the state of Espírito Santo, Brazil. The lake complex was composed of seven natural lagoons with perimeters ranging from 231 to 1902 m. The lagoons had aquatic vegetation and were surrounded by mixed secondary vegetation with a predominance of reforestation exotic tree species, and there were areas available for thermoregulation and alligator nesting.

The capture of the specimens was made at night, during the period of greatest activity of the species (from 10 pm to 3 am). The animals were sighted and obfuscated using a 55-watt flashlight connected to a 12-V automotive battery. The team approached the animals in a 4.2 m aluminum boat with a 25-HP nautical engine, at constant speed. In total, 68 clinically healthy specimens of free-living *C. latirostris* young were sampled. It was not possible to distinguish between the sexes due to the size of the animals. The specimens were captured manually, without the need for support equipment.

After captured, the caimans were subjected to physical restraint by immobilizing their mouths with adhesive tape (BASSET, 2016). The snout-vent length (SVL), head length, body length, and weight were measured, and the body mass index (BMI) was calculated (BMI=weight/total length (TL)).

Biometrics was performed with the aid of a flexible measuring tape. To weigh the animals, a 0.01-kg precision digital scale (Sf-400) was used. The classification of the age group was carried out based on the SVL, and animals smaller than 40 cm were considered prepubertal (COUTINHO et al., 2005). Clinical and physical evaluation were performed, as well as observation of capillary perfusion time (ARTACHO et al., 2007) (Table 1).

Table 1 - Biometric data for reference intervals (RIs) for healthy wild juvenile Broad-snout caiman (*Caiman latirostris*) in Espírito Santo state, Brazil.

Parameter	Units	N	Mean	SD	Median	Min-Max		Reference Interval		LRL 90% CI		URL 90% CI		Outliers	Distribution	Method
Body weight	kg	68	0.26	0,07	0.44	0.03	2.90	0.04	2.03	0.03	0.04	0.90	2.90		NG	NP
Body mass index	kg/m^3	68	36.27	25.61	42.96	2.89	255.1	10.31	215.41	2.89	18.21	121.1	255.1	SI	NG	NP
Head length	cm	68	4.85	4.00	1.73	3.30	12.00	3.30	10.55	3.30	3.47	8.55	12.00		NG	NP
Snout length	cm	68	2.14	1.80	1.09	1.10	7.00	1.17	5.55	1.10	1.20	3.99	7.00		NG	NP
Snout-vent length	cm	68	17.37	13.9	7.03	12.0	39.00	12.00	39.00	12.0	12.36	33.20	39.00	SI	NG	NP
Body length	cm	68	36.08	29.55	14.19	17.5	86.00	22.58	83.10	17.5	26.0	69.85	86.00	SI	NG	NP
Capillary perfusion time	s	68	2.13	2.00	0.42	2.00	4.00	2.00	4.00	2.00	2.00	3.00	4.00	SI	NG	NP

N: number; SD: standard deviation; Min: minimum; Max: maximum; LRL: lower reference limit; CI: confidence interval; URL: upper reference limit; SI: suspected were kept; NG: non-Gaussian and asymmetric; NP: non-transformed parametric.

To collect the samples, the volume equivalent to a maximum of 0.5% of the body weight of each animal was determined as a limit (CAMPBELL, 2015) and collected by puncture in the occipital venous sinus, after asepsis of the region with iodized alcohol, using 25 mm x 0.8 mm hypodermic needles and 5 ml disposable syringes according to the technique described by Myburgh et al. (2014). Immediately after blood collection, blood smears were performed without anticoagulant and their fixation was done in methyl alcohol, to guarantee the integrity and quality of the smear until arriving at the laboratory (ALMOSNY, 2014).

The collected samples were fractionated into tubes containing lithium heparin and then stored in an isothermal container kept from 4 ^{o}C to 8 ^{o}C until arrival at the Animal Diagnostic Institute laboratory (IDAN) in Vila Velha, Espírito Santo, Brazil, to perform the complete blood count (CBC) and biochemical analyses (ALMOSNY, 2014; CAMPBELL, 2015). One ml of blood from each specimen was used to perform the CBC. The remaining sample was centrifuged at 5,000 RPM for 10 minutes to obtain plasma, which was stored at -20 ^{o}C in cryotubes for subsequent biochemical analysis. The blood counts were always performed less than 6 hours after the collection of blood samples. The determination of the hematocrit (Ht) was performed by micro-centrifugation, and the total count of red blood cells (He), leukocytes (L) and thrombocytes (Tb) was performed in a Neubauer Chamber (CAMPBELL, 2015). The measurement of hemoglobin (Hb) was performed using the cyanmethemoglobin method (Labtest®). The reading was made in 10 mm square cuvettes in a spectrophotometer (Q898DPT), with a 540 nm filter (ALMOSNY, 2014; CAMPBELL, 2015). From the values of Ht, He, and Hb, the calculation was performed to determine the Mean Corpuscular Volume (MCV) and the mean corpuscular hemoglobin concentration (MCHC) (ALMOSNY, 2014).

The differential leukocyte count was performed after staining by the Romanowski method (InstantProv®) (MEUTEN, 2015). One hundred cells were counted for leukocyte differentiation. The determination of plasma biochemical values of glucose, total plasma proteins, albumin, globulin, albumin/globulin ratio, uric acid, creatinine, triglycerides, total cholesterol, potassium, sodium, chlorine, calcium, phosphorus, lactate, aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP), gamma-glutamyl transferase (GGT), and creatine kinase (CK) were performed by means of spectrophotometric colorimetric analysis and enzymatic kinetics in an AU2700 Beckman Coulter® automatic analyzer, previously calibrated.

The commercial kits (Labtest®) were used according to the manufacturer's recommendations.

For data analysis, the 95% reference intervals (RIs) and the 90% confidence intervals (CIs) were determined using the Reference Value Advisor (RVA), version 2.1 (GEFFRÉ et al., 2011), according to the recommendations of the International Federation of Clinical Chemistry (IFCC) and the Clinical and Laboratory Standards Institute (CLSI). Descriptive statistics (sample size, mean, standard deviation, median, minimum and maximum values) were determined. The Anderson-Darling test was used to assess the distributions of variables as to normality, considering $p>0.05$ as Gaussian (normal) distribution. The values considered outliers were detected by the Dixon-Reed and Tukey tests. Those classified as suspected were kept (SI), and the discrepant (DR) were removed from the analysis.

The RI values were determined using non-transformed parametric (NP) or parametric transformed (TP) methods by Box-Cox when Gaussian distributions occurred, robust non-transformed methods (RT) or Box-Cox robust transformed (RT) when symmetrical distributions occurred, or by non-parametric (NP) methods when the distributions were non-Gaussian and asymmetric. In addition, following the recommendations of the IFCC-CLSI, non-parametric methods were used when the number of samples was greater than or equal to 40 ($n\geq40$). In situations in which there was a small blood sample volume, the performance of the blood count was prioritized. The reference values for the hematimetric (Table 2), leukometric (Table 3) and biochemical (Table 4) parameters proposed for the species are presented below.

Table 2 - Hematimetric data for reference intervals (RIs) of healthy wild juveniles of the Broad-snouted caiman (*Caiman latirostris*) in the state of Espírito Santo, Brazil. The number of observations (N) varies because not all parameters were evaluated for each caiman.

Parameter	Units	N	Mean	SD	Median	Min-Max		Reference Interval		LRL 90% CI		URL 90% CI		Outliers	Distribution	Method
Red blood cells	106/µL	52	0.47	0.45	0.16	0.08	0.88	0.15	0.79	0.09	0.21	0.72	0.85	SI	G	TP
Hemoglobin	g/dL	52	7.19	7.20	2.38	1.50	13.70	1.57	13.38	1.50	3.20	11.60	13.70	SI	NG	NP
Hematocrit	%	52	18.94	18.50	5.82	10.00	35.00	9.10	32.32	7.84	10.51	29.32	35.70		G	TP
Mean corpuscular volume	fL	52	413.19	403.75	129.59	178.60	742.90	150.53	675.84	96.88	201.38	620.41	728.23		G	TP
Mean globular hemoglobin	pg	51	163.15	147.30	56.32	28.80	337.50	57.74	285.27	40.97	75.85	259.16	312.73	DR	G	TP
Mean corpuscular hemoglobin concentration	g/dl	52	41.51	40.95	14.34	8.33	82.80	8.39	81.89	8.33	24.20	71.52	82.80	SI	NG	TP

N: number; SD: standard deviation; Min: minimum; Max: maximum; LRL: lower reference limit; CI: confidence interval; URL: upper reference limit; SI: suspected were kept; DR: discrepant were removed; G: Gaussian; NG: non-Gaussian and asymmetric; TP: parametric transformed; NP: non-transformed parametric.

Table 3 - Leukometric data for reference intervals (RIs) of healthy wild juveniles of the Broad-snouted caiman (*Caiman latirostris*) in the state of Espírito Santo, Brazil. The number of observations (N) varies because not all parameters were evaluated for each caiman.

Parameter	Units	N	Mean	SD	Median	Min-Max		Reference Interval		LRL 90% CI		URL 90% CI		Outliers	Distribution	Method
Leucocytes	1/µL	52	4765.8	4625.0	2274.3	1000.0	11750.0	1135.8	10173.9	778.7	1618.70	8846.9	11379.4		G	TP
Heterophils	%	52	75.5	79.0	10.8	51.00	90.0	48.9	91.7	32.9	57.6	88.9	93.5		G	TP
Lymphocytes	%	52	19.7	19.0	8.5	8.00	43.0	7.3	45.9	6.1	9.3	37.6	54.5		G	TP
Monocytes	%	51	0.7	0.0	0.7	0.0	4.0	0.0	3.0	0.0	0.0	2.0	4.0	DR	NG	NP
Eosinophils	%	51	3.7	4.0	3.9	0.0	14.0	0.0	14.0	0.0	0.0	9.0	14.0	DR	NG	NP
Basophils	%	52	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Heterophils	1/µL	52	3564.9	3382.0	1768.1	800.0	9870.0	934.8	9002.5	800.0	1388.0	6525.0	9870.0	SI	NG	NP
Lymphocytes	1/µL	52	1001.8	790.0	775.4	150.0	3225.0	166.5	3168.8	150.0	214.3	2495.5	3225.0	SI	NG	NP
Monocytes	1/µL	51	22.8	0.00	58.0	0.00	300.0	0.00	265.0	0.0	0.0	161.0	300.0	DR	NG	NP
Eosinophils	1/µL	51	169.0	105.0	162.9	0.00	625.0	0.0	584.0	0.0	0.0	462.2	625.0	DR	NG	NP
Basophils	1/µL	52	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00			
Thrombocytes	1/µL	52	161903.5	178500.0	59419.0	27000.0	230000.0	28950.0	229675.0	27000.0	40000.0	222375.0	230000.0		NG	NP

N: number; SD: standard deviation; Min: minimum; Max: maximum; LRL: lower reference limit; CI: confidence interval; URL: upper reference limit; SI: suspected were kept; DR: discrepant were removed; G: Gaussian; NG: non-Gaussian and asymmetric; TP: parametric transformed; NP: non-transformed parametric.

Table 4 - Biochemical data for reference intervals (RIs) of healthy wild juveniles of the Broad-snouted caiman (*Caiman latirostris*) in the state of Espírito Santo, Brazil. The number of observations (N) varies because not all parameters were evaluated for each caiman.

Parameter	Units	N	Mean	SD	Median	Min-Max		Reference Interval		LRL 90% CI		URL 90% CI		Outliers	Distribution	Method
Glucose	1/µL	42	96.35	97.50	35.98	15.90	185.50	22.81	169.88	7.24	39.90	153.53	185.47		G	PT
Uric acid	1/µL	42	2.30	1.90	1.45	0.20	6.80	0.22	6.72	0.20	0.52	4.69	6.80	SI	NG	NP
Sodium	1/µL	42	146.83	148.00	10.45	123.0	167.00	122.90	165.78	116.06	129.15	162.12	169.09		G	PT
Chlorine	1/µL	42	109.48	108.80	7.81	93.20	128.20	93.35	127.90	93.20	98.53	123.50	128.20	SI	NG	NP
Total plasma protein	1/µL	42	3.95	3.80	1.49	1.30	6.90	0.90	7.00	0.19	1.58	6.26	7.65		G	PT
Albumin	1/µL	42	1.37	1.20	0.72	0.30	3.40	0.25	3.07	0.11	0.39	2.64	3.57		G	PT
Globulin	1/µL	42	2.59	2.60	0.96	1.00	4.60	0.63	4.56	0.15	1.08	4.13	4.95		G	PT
Albumin-globulin ratio	1/µL	40	0.48	0.46	0.15	0.18	0.76	0.17	0.80	0.11	0.24	0.72	0.86	DR	G	PT
Oxaloacetic transaminase	1/µL	42	156.65	121.50	104.84	5.10	454.10	5.49	447.28	5.10	34.94	319.89	454.10		NG	NP
Pyruvic transaminase	1/µL	41	33.89	25.80	27.74	3.30	119.30	3.76	113.19	2.95	5.86	85.58	145.70	DR	G	PT
Triglycerides	1/µL	40	56.73	38.00	46.73	12.00	192.00	12.66	188.33	11.90	14.75	141.56	247.65	DR	G	PT

Calcium	1/µL	41	10.46	10.82	2.67	3.67	15.30	3.67	15.23	3.67	4.65	13.55	15.30	DR	NG	NP
Alkaline phosphatase	1/µL	36	12.46	12.00	7.54	3.00	35.00	2.51	31.37	2.22	3.60	25.53	37.78	DR	S	RT
Total Cholesterol	1/µL	42	118.10	92.00	82.09	31.00	342.00	31.00	341.10	31.00	42.00	305.68	342.00	SI	NG	NP
Phosphorus	1/µL	41	5.45	5.30	2.23	2.10	10.70	1.25	10.27	0.54	2.08	9.21	11.49		G	PT
Gamma glutamyl transferase	1/µL	42	6.73	6.45	3.33	1.00	18.80	1.05	18.29	1.00	2.96	11.61	18.80	SI	NG	NP
Calcium-phosphorus ratio	1/µL	41	2.25	2.09	0.97	0.54	5.39	0.56	5.38	0.54	1.16	3.57	5.39	SI	NG	NP
Urea	1/µL	40	9.87	5.75	10.20	0.50	39.70	0.54	39.61	0.50	2.00	35.34	39.70	SI	NG	NP
Seric iron	1/µL	42	68.33	59.15	39.63	14.00	192.70	14.54	191.16	14.00	26.63	133.43	192.70	SI	NG	NP
Creatine kinase	1/µL	42	1516.91	403.00	3064.51	0.9	15316.0	3.57	14848.8	0.29	60.50	8329.7	15316.0	SI	NG	NP
Creatinine	1/µL	42	0.33	0.29	0.15	0.19	1.05	0.19	1.02	0.19	0.20	0.49	1.05	SI	NG	NP
Potassium	1/µL	42	4.58	4.15	1.38	2.50	9.20	2.53	9.06	2.50	3.19	6.97	9.20	SI	NG	NP
Lactate	1/µL	42	18.14	15.20	11.49	0.10	50.70	0.12	50.36	0.10	3.30	35.78	50.70	SI	NG	NP

N: number; SD: standard deviation; Min: minimum; Max: maximum; LRL: lower reference limit; CI: confidence interval; URL: upper reference limit; SI: suspected were kept; DR: discrepant were removed; G: Gaussian; NG: non-Gaussian and asymmetric; TP: parametric transformed; NP: non-transformed parametric.

RESULTS AND DISCUSSION

The use of hematological and biochemical standards in the evaluation of health, diagnosis and prognosis of diseases of individuals and populations, especially those at risk, is a valuable non-invasive tool (CASAL; ORÓS, 2007). In veterinary practice, the use of complementary tests in the analysis of the health of captive and free-living reptiles is of paramount importance, since these animals have slow metabolism and are slow to demonstrate clinical signs of diseases (STACY et al., 2011). In addition, laboratory tests are useful as biomarkers of environmental impacts, exposing which contaminants these animals are in contact and/or measuring the stress caused by external factors of the ecosystem in which they are inserted, and such alterations may influence the parameters of hematological and biochemical values (ALMOSNY; MONTEIRO, 2007).

Several environmental and physiological factors can lead to changes in blood composition leading to variations in the different hematological and biochemical parameters, since they are relatively constant (SOMAWEERA et al., 2020). Thus, for a correct interpretation of hematological and biochemical tests, the influence of these factors, such as the quality of the environment in which the individual lives, geographic location, genetic variations, maturity, gender, reproductive status and nutrition must be taken into consideration (STACY et al., 2011). The use of clinical-laboratory parameters of reptiles allows the accurate definition of the health status of individuals within a given environmental condition, but for that, parameters of normality need to be known. As an example, parameters such as hematocrit, total protein, cholesterol, and triglycerides allow the identification of cases of caloric-protein malnutrition in situations of scarce food resources (STACY et al., 2011).

Parameters such as elevated liver enzymes may indicate effects of acute contamination by pollutants, especially if associated with other more specific tests, such as oxidative stress enzymes (plasma acetylcholinesterase and cytochrome P450 and GSH-1 detoxification enzymes, and glutathione). The hematocrit of most clinically healthy reptiles is generally 20% to 40% lower than in mammals and birds, indicating less oxygen-carrying capacity. The hemoglobin concentration is also lower (5.5-12 g/dl) (STACY et al., 2011). The reference range for hematocrit, hemoglobin and circulating red blood cell values proposed for young

of *C. latirostris* in this study was greater than in a similar study by Zayas et al. (2011) with captive young animals.

These results reflect the environmental conditions that the study specimens were exposed. In captive animals, the RI is expected to be lower, since their breeding has been standardized; in contrast, free-living animals must compete for resources, which are not always available, thus presenting a higher RI due to the heterogeneity of development. Heterophiles were the most numerous leukocytes in the peripheral blood of the prepubescent *C. latirostris* specimens studied, corroborating most of the data reported for crocodilians, in which heterophiles appear to be the most common blood leukocytes (CASAL; ORÓS, 2007). Leukocytes from young of *C. latirostris* respond to *in vivo* exposure to insecticides (endosulfan and cypermethrin) with alteration of the differential count of heterophiles, lymphocytes and monocytes, indicating its usefulness as a biomarker (LATORRE et al., 2016).

Glucose levels are highly influenced by the fasting period (OLIVEIRA et al., 2014), and when the fasting period is unknown, as in free-living animals, the values found should be used with caution because there is no way to predict whether the specimens studied fed prior to their capture and blood collection. For a correct interpretation of serum levels of total cholesterol and triglycerides, the feeding history needs to be known (CAIXETA et al., 2015). In free-living caiman populations that inhabit the same area, this evaluation may reflect the availability of prey with a consequent reflection on the population studied (CAIXETA et al., 2015).

Differences were observed when comparing our data with those found by Zayas et al. (2011) in a similar study. These differences can be easily explained by the varied diets of the studied specimens, since in the work of Zayas et al. (2011) the animals were in a controlled environment. The wide range of fluctuation in the values found in our study for serum biochemical and enzymatic values is also reported in the study by Zayas et al. (2011), demonstrating that the biotic and abiotic variables found in different populations are fundamental and should always be considered when assessing the tests.

CONCLUSION

Hematological and biochemical data in crocodilians are important for characterizing stress in a controlled or natural environment, in the prevention and diagnosis of diseases, as well as environmental biomarkers, even for abundant and widely distributed species. This information is relevant for assessing the health of individuals and their populations and can support studies on management and conservation projects.

DADOS BÁSICOS DOS PARÂMETROS HEMATOLÓGICOS E BIOQUÍMICOS PARA O USO DE JACARÉS-DE-PAPO-AMARELO JUVENIS (*Caiman latirostris*) COMO BIOINDICADORES EM MATA ATLÂNTICA, SUDESTE DO BRASIL

RESUMO

Os crocodilianos são considerados bons indicadores da saúde do ecossistema, uma vez que as condições ambientais irão influenciá-los em nível individual (condição corporal e parâmetros de saúde) e populacional (dinâmica e comportamento populacional). Apesar disso, existem poucas tentativas de usar crocodilianos como bioindicadores e a falta de parâmetros de saúde básica é um impedimento para isso. São propostos valores de referência hematológicos e bioquímicos para *Caiman latirostris* de vida livre na Mata Atlântica brasileira, um dos biomas mais ameaçados do mundo. Jacarés jovens são mais sensíveis às variações ambientais, além de serem mais abundantes e mais facilmente capturados, quando comparados aos adultos, o que facilita seu uso como bioindicadores. Além disso, os problemas que afetam os jacarés jovens podem representar problemas populacionais futuros. Os dados obtidos são uma importante ferramenta na avaliação da saúde de populações de vida livre, contribuindo para o uso de *C. latirostris* como bioindicador de saúde no ecossistema aquático da Mata Atlântica.

Palavras-chave: Avaliação da saúde. Bioindicador. *Crocodilia*. Medicina de conservação. Parâmetros sanguíneos.

DATOS BÁSICOS SOBRE PARÁMETROS HEMATOLÓGICOS Y BIOQUÍMICOS PARA EL USO DE JUVENILES DE CAIMÁN DE HOCICO AMARILLO (*Caiman latirostris*) COMO BIOINDICADORES EN LA MATA ATLÁNTICA, SUDESTE DE BRASIL

RESUMEN

Los cocodrílidos son considerados buenos indicadores de la salud del ecosistema ya que las condiciones ambientales influirán a nivel individual (condición corporal y parámetros de salud, dinámica y comportamiento). A pesar de esto, hay pocos intentos de usar cocodrílidos como bioindicadores y faltan parámetros de salud para esto. Se proponen referencias de valores hematológicos y bioquímicos para *Caiman latirostris* de vida libre del Bosque Atlántico brasileño, uno de los biomas más amenazados en el mundo. Los jacarés jóvenes son más sensibles a los cambios ambientales, además de ser más numerosos y fáciles de capturar, en comparación con los adultos, lo que facilitan su uso como bioindicadores. Además, los problemas que afectan a los jacarés jóvenes pueden representar problemas de población en el futuro. Los datos obtenidos son una importante herramienta en la evaluación de la salud de las poblaciones de vida libre contribuyendo para el uso de *C. latirostris* como bioindicador de salud en el ecosistema acuático de la Mata Atlántica.

Palabras clave: Evaluación de la salud. Bioindicador. *Crocodilia*. Medicina de la conservación. Parámetros sanguíneos.

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Corresponding author:
Paulo Quadros de Menezes.
Caiman Project, Marcos Daniel Institute. Av. Eugênio Pachêco de Queirós, s/n. Jardim Camburi, Vitória (ES), Brazil. CEP: 29092-170.
pauloquadros.vet@gmail.com