Supplementary information

Cranial shape variation in jacarean caimanines (Crocodylia, Alligatoroidea) and its implications in the taxonomic status of extinct species: the case of *Melanosuchus fisheri*

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Institutional abbreviations

FLMNH, Florida Museum of Natural History, Gainesville, USA; **FML**, Fundación Miguel Lillo, Tucumán, Argentina; **MACN**, Museo Argentino de Ciencias Naturales “Bernardino Rivadavia”, Buenos Aires, Argentina; **MAS**, Museo de Ciencias Naturales y Antropológicas “Profesor Antonio Serrano”, Entre Ríos, Argentina; **MCNC**, Museo de Ciencias Naturales de Caracas, Venezuela; **MFA**, Museo Provincial de Ciencias Naturales "Florentino Ameghino", Santa Fé, Argentina; **MG**, Museo Provincial de Ciencias Naturales Dr. Ángel Gallardo, Rosario, Argentina; **MLP**, Museo de La Plata, Buenos Aires, Argentina; **NHMW**, Naturhistorisches Museum Wien, Austria; **SMF**, Senckenberg Naturmuseum Frankfurt, Germany; **ZSM**, Zoologische Staatssammlung München, Germany.

SUPP. TABLE 1. List of specimens, views, ontogenetic stage and number of missing landmarks used in the geometric morphometric analyses. Specimens with a centroid size smaller than half of the maximum centroid size (of each species) are considered to be premature (see Wilkinson and Rhodes, 1997 for *Alligator mississippiensis*). D = dorsal view; L = lateral view. Number of missing landmarks is shown in parentheses.

Species	Collection number	View	Ontogenetic stage	Landmark estimations	
C. crocodilus	ZSM 4/1911	Dorsal and lateral	mature	-	-
C. crocodilus	ZSM 7/1931	Dorsal and lateral	premature	D(1)	L(2)
C. crocodilus	ZSM 9/1911	Dorsal and lateral	mature	-	-
C. crocodilus	ZSM 10/1911	Dorsal and lateral	mature	D(2)	L(1)
C. crocodilus	ZSM 26/1911	Dorsal and lateral	mature	-	-
C. crocodilus	ZSM 32/1957	Dorsal and lateral	mature	D(6)	L(1)
C. crocodilus	ZSM 41/1911	Dorsal and lateral	mature	-	L(2)
C. crocodilus	ZSM 56/1936	Dorsal and lateral	mature	-	L(1)
C. crocodilus	ZSM 69/1937	Dorsal and lateral	mature	-	-
C. crocodilus	ZSM 70/1937	Dorsal and lateral	mature	D(1)	-
C. crocodilus	ZSM 71/1937	Dorsal and lateral	mature	-	-
C. crocodilus	ZSM 72/1937	Lateral	mature	-	-
C. crocodilus	ZSM 75/1935	Dorsal and lateral	premature	-	-
C. crocodilus	ZSM 78/1911	Dorsal and lateral	mature	-	L(1)
C. crocodilus	ZSM 80/1937	Dorsal and lateral	premature	D(2)	-
C. crocodilus	ZSM 81/1937	Dorsal and lateral	premature	-	-
C. crocodilus	ZSM 85/1937	Dorsal and lateral	premature	-	L(5)
C. crocodilus	ZSM 87/1937	Dorsal and lateral	premature	-	-

C. crocodilus	ZSM 95/1911	Dorsal and lateral	mature	D(1)	L(1)
C. crocodilus	ZSM 100/1911	Dorsal and lateral	premature	-	-
C. crocodilus	ZSM 101/1911	Dorsal and lateral	mature	-	-
C. crocodilus	ZSM 102/1911	Dorsal and lateral	mature	D(1)	-
C. crocodilus	ZSM 109/1933	Dorsal and lateral	mature	-	-
C. crocodilus	ZSM 112/1933	Dorsal and lateral	mature	-	-
C. crocodilus	ZSM 162/1929	Dorsal and lateral	mature	-	-
C. crocodilus	ZSM 163/1933	Dorsal and lateral	mature	-	-
C. crocodilus	ZSM 164/1929	Dorsal and lateral	mature	D(1)	-
C. crocodilus	ZSM 164/1933	Dorsal and lateral	mature	-	L(2)
C. crocodilus	ZSM 166/1929	Dorsal and lateral	mature	-	-
C. crocodilus	ZSM 167/1929	Dorsal and lateral	mature	-	-
C. crocodilus	ZSM 168/1929	Dorsal and lateral	mature	D(1)	-
C. crocodilus	ZSM 169/1933	Dorsal and lateral	mature	D(1)	-
C. crocodilus	ZSM 170/1933	Dorsal and lateral	mature	D(1)	-
C. crocodilus	ZSM 206/1925	Dorsal and lateral	mature	D(1)	L(1)
C. yacare	MACN 30523	Dorsal and lateral	premature	-	-
C. yacare	MACN 30525	Dorsal and lateral	premature	-	-
C. yacare	MACN 30526	Dorsal and lateral	premature	-	-
C. yacare	MACN 30527	Dorsal and lateral	premature	-	-
C. yacare	MACN 30528	Dorsal and lateral	premature	-	-
C. yacare	MACN 30530	Dorsal and lateral	premature	-	L(2)
C. yacare	MACN 30531	Dorsal	mature	-	-
C. yacare	MACN 30532	Dorsal and lateral	premature	-	-
C. yacare	MACN 30533	Dorsal and lateral	premature	-	-

C. yacare	MACN 30534	Dorsal and lateral	premature	-	-
C. yacare	MACN 30535	Dorsal and lateral	premature	-	-
C. yacare	MACN 30536	Dorsal and lateral	mature	-	L(1)
C. yacare	MACN 30537	Dorsal and lateral	premature	-	L(2)
C. yacare	MACN 30538	Dorsal and lateral	premature	-	L(2)
C. yacare	MACN 30539	Dorsal and lateral	premature	-	-
C. yacare	MACN 30540	Dorsal and lateral	premature	-	-
C. yacare	MACN 30541	Dorsal and lateral	premature	-	-
C. yacare	MACN 30542	Dorsal and lateral	mature	D(1)	L(1)
C. yacare	MACN 30543	Dorsal and lateral	premature	D(1)	L(1)
C. yacare	MACN 30544	Dorsal and lateral	premature	-	L(1)
C. yacare	MACN 30548	Dorsal and lateral	mature	-	-
C. yacare	MACN 30549	Dorsal and lateral	premature	D(1)	L(1)
C. yacare	MACN 30550	Dorsal and lateral	premature	-	-
C. yacare	MACN 30552	Dorsal	mature	D(5)	-
C. yacare	MACN 30553	Dorsal and lateral	mature	-	-
C. yacare	MACN 30554	Dorsal and lateral	premature	-	-
C. yacare	MACN 30555	Dorsal and lateral	mature	-	-
C. yacare	MACN 30556	Dorsal and lateral	premature	D(4)	-
C. yacare	MACN 30558	Dorsal and lateral	premature	-	-
C. yacare	MACN 30559	Dorsal and lateral	premature	-	L(1)
C. yacare	MACN 30560	Dorsal and lateral	premature	-	-
C. yacare	MACN 30561	Dorsal and lateral	premature	D(2)	-
C. yacare	MACN 30562	Dorsal and lateral	premature	D(1)	L(1)
C. yacare	MACN 30563	Dorsal and lateral	premature	-	-

C. yacare	MACN 30564	Dorsal and lateral	premature	D(2)	L(1)
C. yacare	MACN 30574	Dorsal and lateral	premature	-	-
C. yacare	MACN 30578	Dorsal and lateral	premature	-	-
C. yacare	MACN 30583	Dorsal and lateral	premature	-	L(1)
C. yacare	MACN 30584	Dorsal and lateral	premature	-	L(1)
C. yacare	MACN 30590	Dorsal and lateral	premature	-	-
C. yacare	MACN 30593	Dorsal and lateral	premature	D(1)	L(1)
C. yacare	MACN 30595	Dorsal and lateral	mature	D(8)	L(6)
C. yacare	MACN 30596	Dorsal and lateral	premature	D(1)	L(2)
C. yacare	MACN 30599	Dorsal and lateral	premature	-	-
C. yacare	MACN 30601	Dorsal and lateral	premature	D(1)	L(2)
C. yacare	MACN 30602	Dorsal and lateral	mature	D(10)	L(2)
C. yacare	MACN 30607	Dorsal and lateral	premature	-	L(1)
C. yacare	MACN 30617	Dorsal and lateral	premature	-	-
C. yacare	MACN 30625	Dorsal and lateral	premature	D(6)	L(1)
C. yacare	MACN 30626	Dorsal and lateral	premature	-	-
C. yacare	MACN 30631	Dorsal and lateral	premature	-	-
C. yacare	MACN 30635	Dorsal and lateral	premature	-	-
C. yacare	MACN 30637	Dorsal	mature	D(5)	-
C. yacare	MACN 30638	Dorsal and lateral	mature	D(5)	L(4)
C. yacare	MACN 43694	Dorsal and lateral	mature	-	-
C. yacare	MG-ZV-R-00001	Lateral	mature	-	-
C. yacare	MACN-I 15144	Dorsal and lateral	mature	D(2)	L(2)
C. yacare	MACN-I 8262	Dorsal and lateral	mature	D(11)	L(4)
C. yacare	MACN-I 8265	Dorsal and lateral	mature	-	-

C. yacare	MACN-I 8266	Dorsal and lateral	premature	D(3)	-
C. yacare	MACN-I 8267	Dorsal and lateral	mature	-	-
C. yacare	MACN-I 8268	Dorsal and lateral	mature	-	-
C. yacare	MACN-I 8270	Dorsal and lateral	mature	-	-
C. yacare	MLP 604	Dorsal and lateral	mature	-	-
C. yacare	MLP-R 5040	Dorsal and lateral	premature	-	-
C. yacare	MLP-R 5041	Dorsal and lateral	mature	D(12)	L(1)
C. yacare	MLP-R 5042	Dorsal and lateral	mature	D(1)	-
C. yacare	MLP-R 5044	Dorsal and lateral	mature	-	-
C. yacare	MLP-R 5045	Dorsal and lateral	mature	D(1)	L(1)
C. yacare	MLP-R 5046	Dorsal and lateral	mature	D(1)	-
C. yacare	MLP-R 5048	Dorsal and lateral	premature	-	-
C. yacare	MLP-R 5049	Dorsal and lateral	premature	D(9)	-
C. yacare	MLP-R 5050	Dorsal and lateral	premature	-	-
C. yacare	MLP-R 5052	Dorsal and lateral	premature	D(1)	-
C. yacare	MLP-R 5053	Dorsal and lateral	premature	-	-
C. yacare	MLP-R 5055	Dorsal and lateral	premature	-	-
C. yacare	MLP-R 5056	Dorsal and lateral	premature	D(1)	L(2)
C. yacare	MLP-R 5057	Dorsal and lateral	premature	-	-
C. yacare	MLP-R 5805	Dorsal and lateral	premature	D(1)	L(2)
C. latirostris	ZSM 298/1925	Dorsal and lateral	mature	D(2)	L(2)
C. latirostris	ZSM 2532/0	Lateral	mature	-	L(1)
C. latirostris	ZSM 3003/0	Dorsal and lateral	premature	-	L(1)
C. latirostris	ZSM 435/1911	Dorsal and lateral	premature	D(1)	-
C. latirostris	ZSM 73/1926	Dorsal and lateral	premature	-	-

C. latirostris	FML 23627	Dorsal and lateral	premature	-	L(2)
C. latirostris	MACN 7375	Dorsal and lateral	mature	-	-
C. latirostris	MACN 15232	Dorsal and lateral	mature	D(15)	L(6)
C. latirostris	MACN 30565	Dorsal and lateral	premature	D(12)	L(2)
C. latirostris	MACN 30566	Dorsal and lateral	mature	D(1)	-
C. latirostris	MACN 30567	Dorsal and lateral	premature	D(5)	-
C. latirostris	MACN 30568	Dorsal and lateral	mature	-	-
C. latirostris	MACN 30572	Lateral	mature	-	-
C. latirostris	MACN 30610	Dorsal and lateral	mature	D(2)	L(1)
C. latirostris	MACN 30611	Dorsal	mature	D(8)	-
C. latirostris	MACN-I 7021	Dorsal and lateral	mature	-	-
C. latirostris	MFA-ZV-Croc.O.25	Dorsal	mature	-	-
C. latirostris	MFA-ZV-Croc.O.40	Dorsal and lateral	mature	D(6)	L(1)
C. latirostris	MFA-ZV-Croc.O.41	Dorsal and lateral	mature	D(3)	L(1)
C. latirostris	MFA-ZV-Croc.O.8	Dorsal and lateral	premature	-	-
C. latirostris	MG-ZV-R-00070	Dorsal and lateral	mature	-	-
C. latirostris	MLP-R 5038	Dorsal and lateral	mature	D(1)	-
C. latirostris	MLP-R 5043	Dorsal and lateral	mature	-	-
C. latirostris	MLP-R 5364	Dorsal and lateral	mature	D(1)	L(1)
C. latirostris	MLP-R 5801	Dorsal and lateral	premature	-	-
C. latirostris	MLP-R 5802	Dorsal and lateral	premature	-	-
C. latirostris	MLP-R 5803	Dorsal and lateral	premature	-	-
C. latirostris	MLP-R 5804	Dorsal and lateral	premature	-	L(1)
C. latirostris	MLP-R 5806	Dorsal and lateral	premature	-	-
C. latirostris	MLP-R 5807	Dorsal and lateral	premature	D(9)	-

C. latirostris	MLP-R 5808	Dorsal and lateral	premature	D(10)	-
C. latirostris	MLP-R 5809	Dorsal and lateral	premature	-	-
C. latirostris	MLP-R 5810	Dorsal and lateral	premature	-	-
C. latirostris	MLP-R 5811	Dorsal and lateral	premature	-	L(1)
C. latirostris	MLP-R 5812	Dorsal and lateral	premature	D(1)	-
C. latirostris	MLP-R 6251	Dorsal and lateral	mature	-	L(1)
C. latirostris	MAS W/N	Dorsal and lateral	mature	-	-
M. niger	FLMNH 53600	Dorsal and lateral	mature	D(1)	-
M. niger	NHMW 2024	Dorsal and lateral	mature	-	-
M. niger	NHMW 2025	Dorsal and lateral	mature	-	-
M. niger	SMF 28182	Dorsal and lateral	mature	-	-
M. niger	SMF 30102	Dorsal and lateral	premature	-	L(1)
M. niger	SMF 30113	Dorsal and lateral	premature	-	L(1)
M. niger	SMF 40142	Dorsal and lateral	premature	D(1)	L(1)
M. niger	SMF 40171	Dorsal and lateral	mature	-	-
M. niger	SMF 40172	Dorsal and lateral	premature	-	L(1)
M. niger	ZSM 1/1906	Dorsal and lateral	mature	-	-
M. niger	ZSM 3/1911	Dorsal and lateral	mature	-	L(1)
M. niger	ZSM 11/1911	Dorsal and lateral	mature	-	L(1)
M. niger	ZSM 12/1911	Dorsal and lateral	mature	-	-
M. niger	ZSM 13/1911	Dorsal and lateral	premature	-	L(1)
M. niger	ZSM 14/1911	Dorsal and lateral	mature	-	-
M. niger	ZSM 27/1911	Dorsal and lateral	mature	-	-
M. niger	ZSM 35/1911	Dorsal and lateral	mature	-	-
M. niger	ZSM 46/1911	Dorsal and lateral	mature	-	-

M. niger	ZSM 52/1911	Dorsal and lateral	mature	-	-
M. niger	ZSM 57/1911	Dorsal and lateral	mature	-	-
M. niger	ZSM 62/1911	Dorsal and lateral	mature	-	L(1)
M. niger	ZSM 63/1911	Dorsal and lateral	mature	-	-
M. niger	ZSM 64/1911	Dorsal and lateral	mature	-	-
M. niger	ZSM 67/1911	Dorsal and lateral	mature	-	-
M. niger	ZSM 68/1911	Dorsal and lateral	mature	-	-
M. niger	ZSM 69/1911	Dorsal and lateral	mature	-	-
M. niger	ZSM 70/1911	Dorsal and lateral	mature	-	-
M. niger	ZSM 73/1911	Dorsal and lateral	mature	-	L(1)
M. niger	ZSM 74/1911	Dorsal and lateral	mature	-	L(1)
M. niger	ZSM 75/1911	Dorsal and lateral	mature	-	-
M. niger	ZSM 76/1911	Dorsal and lateral	mature	-	-
M. niger	ZSM 77/1911	Dorsal and lateral	mature	-	-
M. niger	ZSM 79/1911	Dorsal and lateral	mature	-	-
M. niger	ZSM 80/1911	Dorsal and lateral	mature	-	L(1)
M. niger	ZSM 83/1911	Dorsal and lateral	mature	-	L(3)
M. niger	ZSM 84/1911	Dorsal and lateral	mature	-	-
M. niger	ZSM 85/1911	Dorsal and lateral	mature	-	-
M. niger	ZSM 86/1911	Dorsal and lateral	mature	-	-
M. niger	ZSM 87/1911	Dorsal and lateral	mature	-	-
M. niger	ZSM 89/1911	Dorsal and lateral	mature	D(1)	L(1)
M. niger	ZSM 90/1911	Dorsal and lateral	mature	-	-
M. niger	ZSM 91/1911	Dorsal and lateral	mature	-	-
M. niger	ZSM 125/1911	Dorsal and lateral	mature	D(1)	-

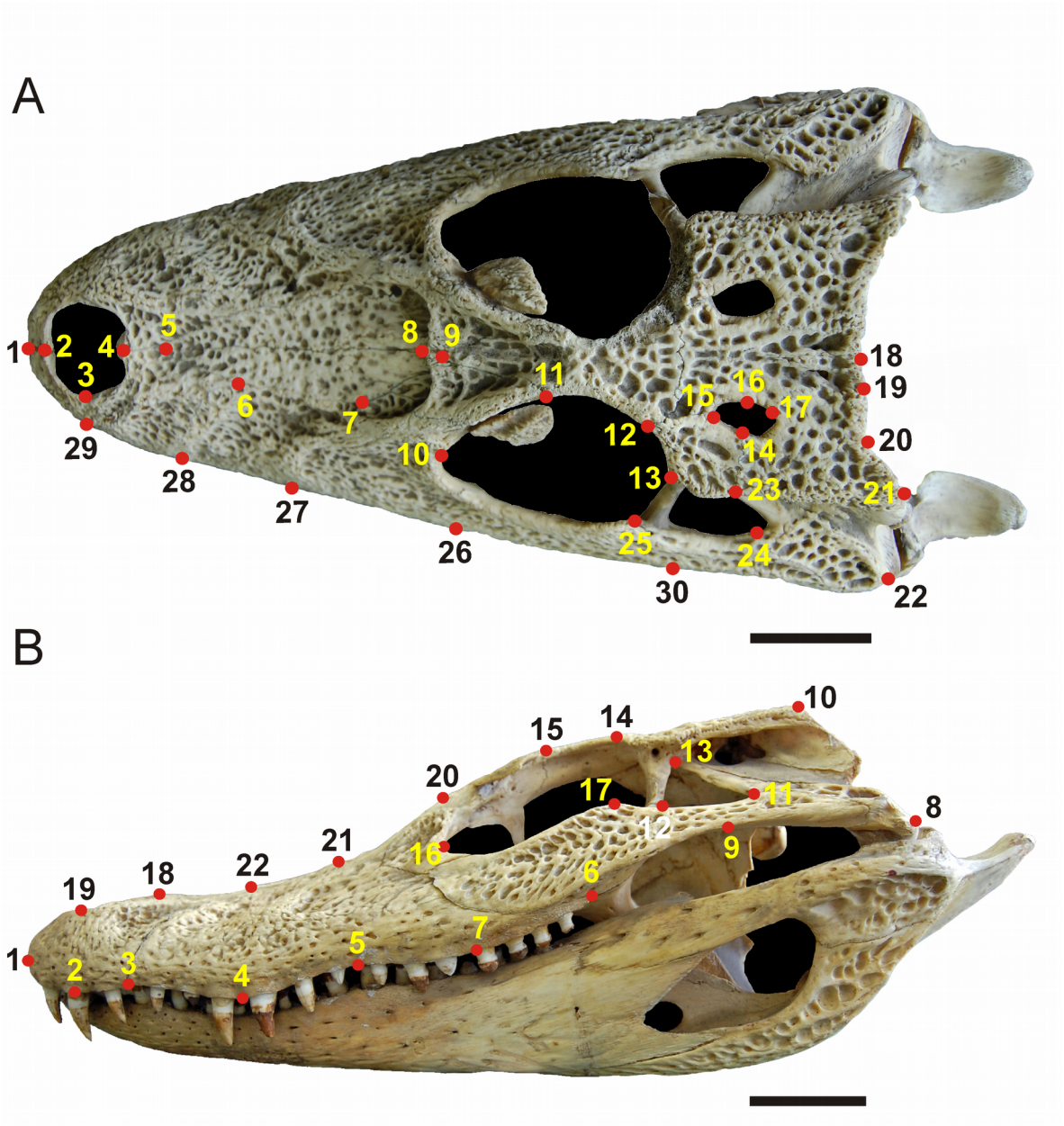
M. niger	ZSM 130/1911	Dorsal and lateral	mature	D(1)	-
M. niger	ZSM 223/1925	Dorsal and lateral	mature	-	-
M. niger	ZSM 2416/2006	Dorsal and lateral	mature	-	-
M. niger	ZSM 3039/0	Dorsal and lateral	mature	-	-
‘M. fisheri’	MCNC 234	Dorsal and lateral	mature	-	-

SUPP. TABLE 2. Description and type of landmarks and semi-landmarks in dorsal view.

Number	Definition	Homology
1	Most anterior contact between both premaxillae	Type I
2	Most anterior point of the nares where both premaxillae contact	Type I
3	Point of maximum curvature of the nares at the lateral edge	Type II
4	Most anterior point of the medial suture of premaxillae at the posterior margin of the nares	Type I
5	Anterior contact between both nasals	Type I
6	Contact between nasal, premaxilla and maxilla	Type I
7	Posterior contact between nasal and maxillae	Type I
8	Posterior contact between both nasals	Type I
9	Most anterior point of the frontal along the sagittal plane	Type I
10	Point of maximum curvature at the anterior edge of the orbit	Type II
11	Contact between frontal and prefrontal in the orbit	Type I
12	Contact between frontal and postorbital in the orbit	Type I
13	Anterior contact between postorbital and postorbital bar	Type I
14	Contact between squamosal and postorbital at the supratemporal fenestra	Type I
15	Contact between postorbital and parietal at the supratemporal fenestra	Type I
16	Point of maximum curvature of the medial edge of the supratemporal fenestra	Type II
17	Contact between squamosal and parietal at the supratemporal fenestra	Type I
18	Midpoint of the posterior margin of the skull along the sagittal plane	Type III
19	Posterior contact between supraoccipital and squamosal	Type I
20	Midpoint of the posterior margin of the squamosal	Type III
21	Most posterolateral point of the squamosal	Type III
22	Most posterior point of the quadrate-quadratojugal suture	Type I
23	Contact of squamosal-postorbital in the lateral edge of the skull roof	Type I
24	Contact between jugal and quadratojugal at the lateral margin of the infratemporal fenestra	Type I
25	Point of maximum curvature of the jugal at the posterolateral edge of the orbit	Type II
26	Contact between jugal and maxilla at the lateral margin of the skull	Type I
27	Point of maximum curvature of the maxilla at the lateral margin of the skull	Type II
28	Contact between maxilla and premaxilla at the lateral margin of the skull	Type I
s29	Midpoint between landmarks 1 and 28	Semi-LM
s30	Midpoint between landmarks 22 and 26	Semi-LM

SUPP. TABLE 3. Description and type of landmarks and semi-landmarks in lateral view.

Number	Definition	Homology
1	Most anterior point of premaxilla	Type II
2	Lower point of premaxilla	Type II
3	Contact of maxilla and premaxilla at the most ventral margin of the skull	Type I
4	The lowest point of the ventral margin of the maxilla	Type III
5	Most dorsal point of the ventral margin of the maxilla, posterior to the lowest point of maxilla (LM 4)	Type III
6	Ventral contact between maxilla and jugal	Type II
s7	Midpoint between landmarks LM 5 and LM 6	Semi-LM
8	Posterior contact between quadrate and quadratojugal	Type I
s9	Midpoint between landmarks LM 6 and LM 8	Semi-LM
10	Most posterodorsal point of squamosal	Type III
11	Most posterior point of the infratemporal fenestra	Type III
12	Most anterior point of the infratemporal fenestra	Type III
13	Most dorsal point of the infratemporal fenestra	Type III
14	Contact between frontal and postorbital in the orbit	Type I
15	Contact between frontal and prefrontal in the orbit	Type I
16	Most anterior point of the orbit	Type III
17	Point of maximum curvature of the jugal at the ventral edge of the orbit	Type II
18	Most dorsal point of premaxilla	Type III
s19	Midpoint between landmarks 1 and 18 along the dorsal margin of the snout tip	Semi-LM
s20–s22	Curve of three points between landmarks 15 and 18 (from the posterior to the anterior part of the skull) along the dorsal margin of the skull	Semi-LM



SUPP. FIGURE 1. Landmark positions shown on a skull of *Melanosuchus niger*. (A) ZSM 91/1911 in dorsal and (B) ZSM 67/1911 lateral view. Scale bar = 5 cm.

SUPP. TABLE 4. Results of different multivariate normality tests for cranial shape data based on Procrustes coordinates (ProCoor), un-pooled, non-allometric residuals (RES) and pooled, non-allometric residuals (p-RES). chi-square value of the skewness statistic (chi.skew), chi-square value of the small sample skewness statistic (chi.small.skew), Mardia's multivariate skewness statistic (g1p), Mardia's multivariate kurtosis statistic (g2p), Royston's H value (H), Henze-Zirkler value (HZ), p-value of kurtosis statistic (p.value.kurt), p-value of skewness statistic (p.value.skew), p-value of small sample skew statistic (p.value.small), and z value of the kurtosis statistic (z.kurtosis).

	Dorsal view			**Lateral view**		
	ProCoor	**RES**	**p-RES**	**ProCoor**	**RES**	**p-RES**
Henze-Zirkler's Multivariate Normality Test						
HZ	1.000	1.000	1.000	1.000	1.000	1.000
***p*-value**	0.000	0.000	0.000	0.000	0.000	0.000
Mardia's Multivariate Normality Test						
g1p	1218.369	1207.841	1196.645	768.470	738.724	719.764
chi.skew	39393.940	39053.520	38691.520	24719.130	23762.300	23152.410
***p*-value.skew**	0.000	0.000	0.000	0.000	0.000	0.000
g2p	3463.570	3464.098	3450.394	2079.204	2063.728	2046.014
z.kurtosis	18.627	18.672	17.488	47.838	45.984	43.861
***p*-value.kurt**	0.000	0.000	0.000	0.000	0.000	0.000
chi.small.skew	40024.730	39678.860	39311.060	25122.310	24149.880	23530.040
***p*-value.small**	0.000	0.000	0.000	0.000	0.000	0.000
Royston's Multivariate Normality Test						
H	226.791	187.328	235.271	400.321	329.633	346.462
***p*-value**	0.000	0.000	0.000	0.000	0.000	0.000

SUPP. TABLE 5. Statistical shape differences between the extant jacarean caimanine species *Caiman yacare*, *Caiman crocodilus*, *Caiman latirostris* and *Melanosuchus niger* in dorsal view based Procrustes coordinates. Significant differences are shown with underlined *p*-values.

MANOVA (Mahalanobis distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.002	0.000
C. yacare	**29.743**		0.000	0.000
C. latirostris	**153.470**	**116.348**		0.000
M. niger	**174.393**	**136.277**	**176.749**	
npMANOVA (*F*-values)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.001	0.001	0.001
C. yacare	**12.390**		0.001	0.001
C. latirostris	**50.320**	**63.640**		0.001
M. niger	**30.380**	**31.270**	**29.090**	
CVA (Mahalanobis distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**5.316**		0.000	0.000
C. latirostris	**12.216**	**10.660**		0.000
M. niger	**13.022**	**11.511**	**13.166**	
CVA (Procrustes distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**0.031**		0.000	0.000
C. latirostris	**0.086**	**0.072**		0.000
M. niger	**0.065**	**0.048**	**0.065**	
DFA (Mahalanobis distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**6.707**		0.000	0.000
C. latirostris	**18.545**	**15.529**		0.000
M. niger	**22.262**	**14.423**	**20.985**	
DFA (Procrustes distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**0.031**		0.000	0.000
C. latirostris	**0.086**	**0.071**		0.000
M. niger	**0.065**	**0.047**	**0.065**	

SUPP. TABLE 6. Statistical shape differences between the extant jacarean caimanine species *Caiman yacare*, *Caiman crocodilus*, *Caiman latirostris* and *Melanosuchus niger* in dorsal view based un-pooled, non-allometric residuals. Significant differences are shown with underlined *p*-values.

MANOVA (Mahalanobis distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.002	0.000
C. yacare	**31.779**		0.000	0.000
C. latirostris	**158.418**	**116.834**		0.000
M. niger	**66.178**	**21.415**	**57.087**	
npMANOVA (*F*-values)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.001	0.001	0.001
C. yacare	**11.570**		0.001	0.001
C. latirostris	**49.570**	**76.390**		0.001
M. niger	**42.550**	**51.310**	**27.050**	
CVA (Mahalanobis distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**5.355**		0.000	0.000
C. latirostris	**12.216**	**10.659**		0.000
M. niger	**7.754**	**4.542**	**7.439**	
CVA (Procrustes distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**0.027**		0.000	0.000
C. latirostris	**0.081**	**0.071**		0.000
M. niger	**0.070**	**0.054**	**0.057**	
DFA (Mahalanobis distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**6.994**		0.000	0.000
C. latirostris	**16.396**	**15.473**		0.000
M. niger	**17.592**	**6.675**	**11.805**	
DFA (Procrustes distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**0.027**		0.000	0.000
C. latirostris	**0.081**	**0.071**		0.000
M. niger	**0.070**	**0.054**	**0.056**	

SUPP. TABLE 7. Statistical shape differences between the extant jacarean caimanine species *Caiman yacare*, *Caiman crocodilus*, *Caiman latirostris* and *Melanosuchus niger* in dorsal view based pooled, non-allometric residuals. Significant differences are shown with underlined *p*-values.

MANOVA (Mahalanobis distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.002	0.000
C. yacare	**29.088**		0.000	0.000
C. latirostris	**152.094**	**115.148**		0.000
M. niger	**234.574**	**209.471**	**248.825**	
npMANOVA (*F*-values)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.001	0.001	0.001
C. yacare	**11.720**		0.001	0.001
C. latirostris	**48.550**	**87.810**		0.001
M. niger	**77.380**	**159.300**	**65.260**	
CVA (Mahalanobis distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**5.328**		0.000	0.000
C. latirostris	**12.212**	**10.660**		0.000
M. niger	**15.265**	**14.452**	**15.746**	
CVA (Procrustes distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**0.026**		0.000	0.000
C. latirostris	**0.078**	**0.071**		0.000
M. niger	**0.088**	**0.086**	**0.082**	
DFA (Mahalanobis distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**7.302**		0.000	0.000
C. latirostris	**15.152**	**15.526**		0.000
M. niger	**23.422**	**19.628**	**23.939**	
DFA (Procrustes distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**0.026**		0.000	0.000
C. latirostris	**0.078**	**0.071**		0.000
M. niger	**0.088**	**0.086**	**0.082**	

SUPP. TABLE 8. Statistical shape differences between the extant jacarean caimanine species *Caiman yacare*, *Caiman crocodilus*, *Caiman latirostris* and *Melanosuchus niger* in lateral view based Procrustes coordinates. Significant differences are shown with underlined *p*-values.

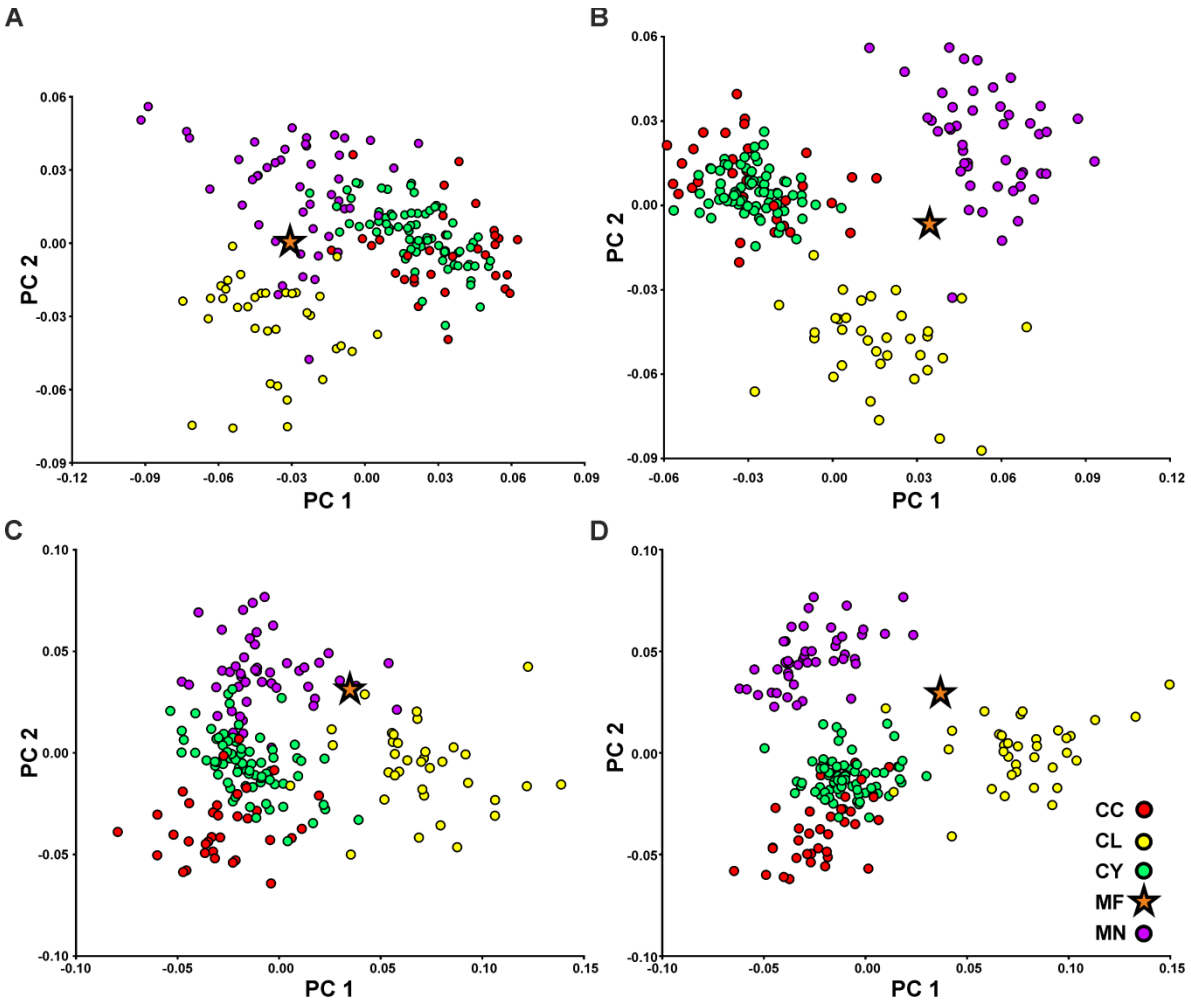
MANOVA (Mahalanobis distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**20.846**		0.000	0.000
C. latirostris	**152.129**	**110.340**		0.000
M. niger	**130.987**	**91.377**	**116.760**	
npMANOVA (*F*-values)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.001	0.001	0.001
C. yacare	**25.580**		0.001	0.001
C. latirostris	**54.430**	**59.890**		0.001
M. niger	**38.830**	**37.150**	**42.240**	
CVA (Mahalanobis distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**4.536**		0.000	0.000
C. latirostris	**12.289**	**10.476**		0.000
M. niger	**11.520**	**9.707**	**10.518**	
CVA (Procrustes distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**0.048**		0.000	0.000
C. latirostris	**0.107**	**0.086**		0.000
M. niger	**0.075**	**0.057**	**0.092**	
DFA (Mahalanobis distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**4.956**		0.000	0.000
C. latirostris	**15.198**	**12.089**		0.000
M. niger	**16.448**	**11.439**	**13.011**	
DFA (Procrustes distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**0.047**		0.000	0.000
C. latirostris	**0.107**	**0.086**		0.000
M. niger	**0.075**	**0.057**	**0.092**	

SUPP. TABLE 9. Statistical shape differences between the extant jacarean caimanine species *Caiman yacare*, *Caiman crocodilus*, *Caiman latirostris* and *Melanosuchus niger* in lateral view based un-pooled, non-allometric residuals. Significant differences are shown with underlined *p*-values.

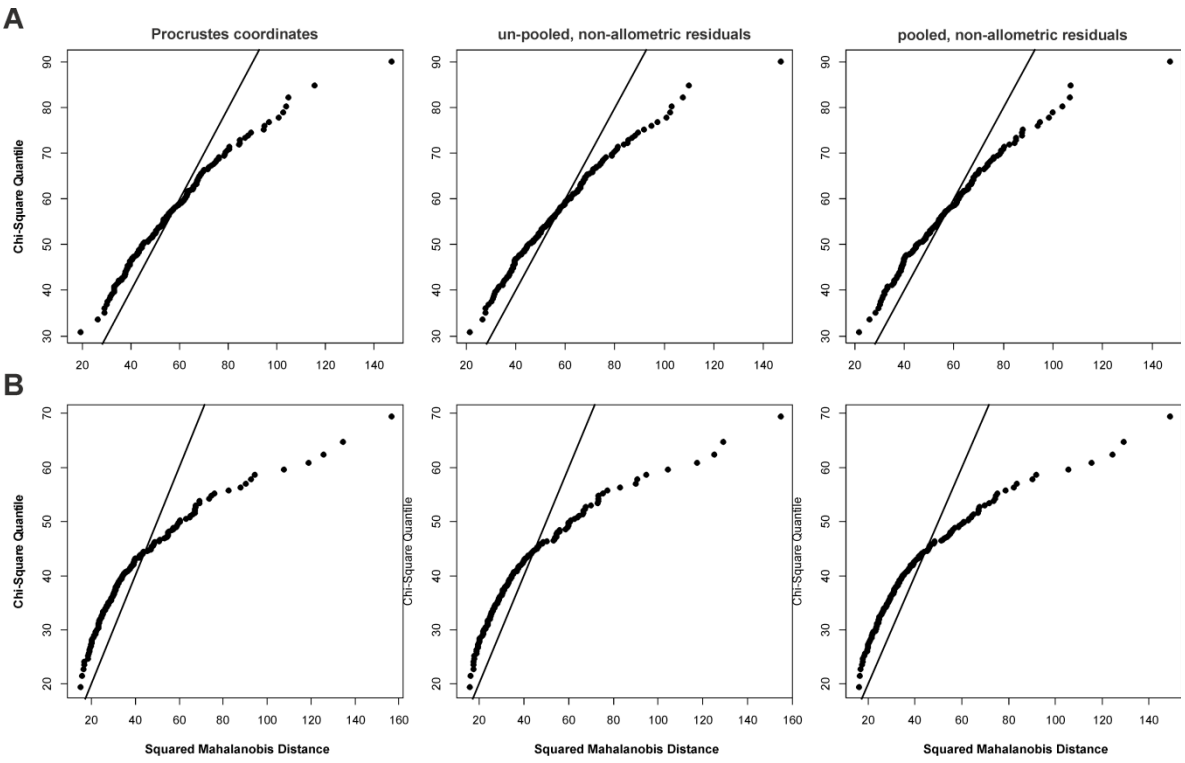
MANOVA (Mahalanobis distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**21.445**		0.000	0.000
C. latirostris	**169.797**	**125.247**		0.000
M. niger	**74.564**	**35.522**	**51.908**	
npMANOVA (*F*-values)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.001	0.001	0.001
C. yacare	**22.680**		0.001	0.001
C. latirostris	**66.650**	**81.090**		0.001
M. niger	**58.220**	**36.980**	**58.910**	
CVA (Mahalanobis distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**4.543**		0.000	0.000
C. latirostris	**12.544**	**10.835**		0.000
M. niger	**8.529**	**5.962**	**6.866**	
CVA (Procrustes distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**0.041**		0.000	0.000
C. latirostris	**0.104**	**0.087**		0.000
M. niger	**0.078**	**0.048**	**0.090**	
DFA (Mahalanobis distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**4.970**		0.000	0.000
C. latirostris	**15.968**	**12.127**		0.000
M. niger	**13.813**	**7.373**	**8.394**	
DFA (Procrustes distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**0.041**		0.000	0.000
C. latirostris	**0.104**	**0.087**		0.000
M. niger	**0.078**	**0.048**	**0.090**	

SUPP. TABLE 10. Statistical shape differences between the extant jacarean caimanine species *Caiman yacare*, *Caiman crocodilus*, *Caiman latirostris* and *Melanosuchus niger* in lateral view based pooled, non-allometric residuals. Significant differences are shown with underlined *p*-values.

MANOVA (Mahalanobis distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	*20.701*		0.000	0.000
C. latirostris	*163.472*	*124.991*		0.000
M. niger	*150.476*	*109.013*	*163.509*	
npMANOVA (*F*-values)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.001	0.001	0.001
C. yacare	**24.210**		0.001	0.001
C. latirostris	**78.070**	**94.840**		0.001
M. niger	**79.420**	**75.960**	**102.100**	
CVA (Mahalanobis distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**4.521**		0.000	0.000
C. latirostris	**12.693**	**11.075**		0.000
M. niger	**12.180**	**10.299**	**12.710**	
CVA (Procrustes distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**0.039**		0.000	0.000
C. latirostris	**0.109**	**0.089**		0.000
M. niger	**0.087**	**0.064**	**0.114**	
DFA (Mahalanobis distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**4.862**		0.000	0.000
C. latirostris	**15.955**	**12.343**		0.000
M. niger	**17.757**	**12.020**	**14.778**	
DFA (Procrustes distances)				
	C. crocodilus	***C. yacare***	***C. latirostris***	***M. niger***
C. crocodilus		0.000	0.000	0.000
C. yacare	**0.039**		0.000	0.000
C. latirostris	**0.109**	**0.089**		0.000
M. niger	**0.087**	**0.064**	**0.114**	



SUPP. FIGURE 2. Results of additional Principal Component Analyses. A) Dorsal view with non-allometric residuals. B) Dorsal view with pooled, non-allometric residuals. C) Lateral view with non-allometric residuals. D) Lateral view with pooled, non-allometric residuals. Red circle (*Caiman crocodilus*, CC), violet circle (*Melanosuchus niger*, MN), orange star (MCNC 243, MF), dark green circle (*C. yacare*, CY), yellow circle (*C. latirostris*, CL).



SUPP. FIGURE 3. Chi-Square Q-Q plots for cranial shape based on Procrustes coordinates (ProCoor), un-pooled, non-allometric residuals (RES) and pooled, non-allometric residuals (p-RES). A) Dorsal view and B) lateral view with non-allometric residuals. Normal distribution is shown as a straight line. Deviations of data points from this line in all plots indicate non-normal distribution.

Reference

Wilkinson PM, Rhodes WE. 1997. Growth rates of American alligators in coastal South Carolina. J Wildl Manage 61:397–402.