CROCODILE SPECIALIST GROUP NEWSLETTER

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NEWSLETTER

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IUCN Species Survival Commission

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Cover: Female participants at the "International Theoretical and Practical Workshop on the Management and Conservation of Crocodylia in Latin America" (Mexico, February 2025) with Canelo, a 3.8 m long American crocodile (*Crocodylus acutus*). See pages 14-15. Photograph: Jorge Alexis Figueroa Hernández.

CSG Newsletter

The CSG Newsletter is produced and distributed by the Crocodile Specialist Group of the Species Survival Commission (SSC) of the IUCN (International Union for Conservation of Nature). The CSG Newsletter provides information on the conservation, status, news and current events concerning crocodilians, and on the activities of the CSG. It is available as a free electronic, downloadable copy from http://www.iucncsg.org/pages/Publications.html

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Editorial

It is with deep sadness that we report on the passing of a dear friend and colleague, Ivan Rubio Palacios. Alejandro and I independently first met Ivan in the early 1990s, where as a recent biology graduate he had begun advising caiman farms in Colombia. We extend our sincerest condolences to Ivan's wife and children. See page 4 for details.

On 3 March 2025, during a meeting of the National Board of Wildlife at Gir National Park, the Prime Minister of India Shri Narendra Modi announced a new project for Gharial conservation. At this stage it is unclear as to what this new initiative will entail, and we await further news from the region.

This year marks 50 years since the "Crocodile Conservation Project" was implemented by the Indian Government, to address conservation of *Crocodylus porosus*, *Crocodylus palustris* and *Gavialis gangeticus*. Researchers B.C. Choudhury, Sudhakar Kar and Lala Singh have been involved with the project since its beginnings in April 1975, and continue to be involved to this day. We acknowledge and congratulate them on their 50 years of contributions to this conservation program. The project has, and continues, to involve a multitude of researchers, government authorities, communities, and other stakeholders with the common goal of improving the status of these species in the wild.

In late March, an excellent article by Christy Plott Gilmore and Karen Giberson appeared on the CFDA (Council of Fashion Designers) website, entitled "The truth about exotic leather: Sustainability, conservation & economic impact". The CSG is well aware of the incentives for conservation and benefits for livelihoods that can be generated through the sustainable use of wild crocodilians, and has promoted sustainable use as a conservation tool accordingly. The authors rightly point out that exotic leather should not be considered the villain, but rather the lifeline that protects species and habitats and sustains livelihoods.

We alert readers to a recent publication [Khosa, N. and Nemutandani, K.R. (2025). Factors affecting Nile crocodile (*Crocodylus niloticus*) leather quality: A systematic review. Tropical Animal Health and Production 57(3): 126], which appears to have used artificial intelligence (AI) to a large extent in its preparation. A number of CSG members raised serious concerns on how this paper made it through the journal's review processes. Those concerns have been passed on to the journal/publisher, and we hope to report on the response in due course. The use of AI as a tool for scientific publishing has received attention, and it is recognised that it has the potential to enhance various stages of the publication process (eg creating abstracts and summaries). However, depending on the manner in which it has been used, the use of AI also raises ethical issues that may also need to be addressed.

The School of Wildlife Conservation (SOWC) at the African Leadership University (Rwanda) has developed a "Wildlife Economy Lessons Learned Series" to provide examples of case studies of different wildlife economy activities across Africa, including institutional arrangements, economic, social and environmental impacts, enabling conditions, challenges and opportunities, etc. The 4th case study in the series is based on crocodile farming at Padenga Agri Business, Kariba, Zimbabwe.

Key events scheduled in 2025 include:

- "Texas CrocFest" will be held at Crocodile Encounter, Angleton, Texas, on 7 June 2024. This will be the first time that the event will be held outside Florida, and organisers are preparing for good participation. Funds raised will go towards research on *Tomistoma schlegelii*.

- A symposium on "Management and Conservation of Crocodilians in the Face of the Challenges of the 21st Century" will be held under the auspices of the "XIV International Congress of Protected Areas", in Havana, Cuba, on 1-5 July 2025 (congresoapcuba@gmail.com). The objective of the symposium is to "promote the development of conservation and sustainable use actions for crocodile populations in Cuban ecosystems".

- At the 27th CSG Working Meeting (April 2024), a side meeting was convened with stakeholders involved in Siamese crocodile (*Crocodylus siamensis*) conservation. Yosapong Temsiripong, who participated through Zoom, indicated that there was interest in a workshop to allow for an exchange in experiences with respect to reintroduction of headstarted individuals to bolster and/or re-establish wild populations. We can now announce that the second Siamese Crocodile Regional Species Meeting will take place at Kasetsart University, Bangkok, Thailand, on 19-21 August 2025. With the theme "Siamese Crocodiles: Recovering Together", meeting organisers invite the participation of CSG members and other interested people (eg scientists, researchers, professors, veterinarians, university students, etc.). Activities include a field trip and a drone workshop. Information will be made available as it comes to hand.

- European Croc Network Meeting, Berlin, Germany, 1-2 August 2025. See page 4 for details.

- The Government of El Salvador will host a regional workshop on 24-26 September 2025, at the National Library of El Salvador, San Salvador. The aim is to update information on wild crocodilian populations in the Central America/Caribbean sub-region, and foster exchange on experiences and best practices for conservation and

sustainable management. An initial invitation from workshop organisers has been extended to CSG members, and further information will be disseminated as it becomes available.

- IUCN World Conservation Congress (WCC), Abu Dhabi, UAE, 9-15 October 2025. Note that membership of all specialist groups will be terminated at the end of the quadrennium, coinciding with the WCC. Following SSC procedures, after the WCC, the CSG Executive Officer will invite current members to re-join the CSG.

- 20th meeting of Conference of the Parties to CITES (CoP20), Samarkand, Uzbekistan, 24 November to 5 December 2025.

We remind CSG members that the 28th CSG Working Meeting will be held in Morocco, in May 2026. We anticipate that details will be available soon.

Alejandro Larriera and Charlie Manolis, *CSG Co-Chairs*.

European Croc Network Meeting (Berlin, 1-2 August 2025)

The 7th European Croc Network Meeting (ECNM) will be hosted by Berlin Zoo and Aquarium and the Leibniz Institute of Freshwater Ecology and Inland Fisheries and held on 1-2 August 2025, in Berlin, Germany. The theme is "Human Dimensions of Crocodylian Conservation". The meeting aims to facilitate collaboration and opportunities for people based in Europe who work with, or aspire to work with, crocodilians.

This the first ECNM to be hosted in Germany, and they look forward to welcoming those from the crocodilian community in Europe and further afield. Registration is now open on the ECNM website.

Please contact organisors at "eurocrocnetwork@gmail.com" for information on submission of abstracts for oral and poster sessions and workshops.

In Memoriam

Our friend Ivan Palacios (1962-2025) passed away in Barranquilla, Colombia, in March 2025. Ivan graduated from La Salle University (Bogota, Colombia), and began work with crocodilians during his university studies in 1988 and 1990. He went on to dedicate his professional working life to advising *Caiman crocodilus fuscus* farms within Colombia.

He carried out research on incubation and fertility techniques, including use of ultrasound methodology in *C. c. fuscus*. He was also involved with research on the isolation and identification of microorganisms in caiman eggs. In 2003, as Director of various studies in the chair of wild species at San Martin University Foundation, he received recognition for his research activities.

With government agencies, the Ministry of the Environment, and regional corporations, Ivan participated in crocodilian population surveys. In 2008 he published his first short story about how local communities in the Colombian Caribbean went from being illegal hunters of caiman to working on the conservation and sustainable use of the species. In 2018, he was an advisor to the first farm established in the city of Santa Cruz, Bolivia, based on captive breeding and ranching of *Caiman yacare*.

Ivan was also involved with international research on iguana trafficking and censuses on the Colombian Caribbean coast. He founded Ecofauna to conduct research and other studies and to train people in iguana conservation, together with the Regional Corporations of Atlantico and Bolivar on the Colombian Caribbean coast.

In 2012, he began working on Morrocoy (Red-footed tortoise; *Chelonoidis carbonarius*), which became the main focus of his work. Against all odds, he managed to establish the first Morrocoy farm in Colombia.

We extend our sincere condolences to Ivan's wife Melida and children Maria Camila and Sebastian.

Compiled by: Alvaro Velasco and Melida Perilla.

CSG Student Research Assistance Scheme

The Student Research Assistance Scheme (SRAS) and Fritz Huchzermeyer Veterinary Science Student Research Assistance Scheme (FHVS-SRAS) provided funding to 10 students in the January-March 2025 quarter (see below), and one application is currently under review.

1. Mason Scarpa (Austria; Project 25/1): Investigating host-associated and environmental microbiome roles in mercury detoxification strategies of French Guiana caimans.

2. Ramiro Ortiz (Argentina; Project 25/2): Physiological-molecular responses in *Caiman latirostris* to thermal stress: Adaptation strategies to climate change.

3. Stefany Reyes Hernandez (Mexico; Project 25/3): Endoparasites of the Crocodylia in the Encrucijada Biosphere Reserve, Chiapas, Mexico.

4. Aabhash Kaphle (Nepal; Project 25/4): Ecological monitoring and conservation of Mugger crocodile (*Crocodylus palustris*) in Ghodaghodi Lake Complex, Nepal.

5. Raziel Saez Euan (Mexico; Project 25/5): Evaluation of head shape of crocodiles in the Yucatan Peninsula, Mexico.

6. Bobby Greco (USA; Project 25/6): Assessing post-release success of head-started American crocodiles (*Crocodylus acutus*) in Lago Enriquillo, Dominican Republic.

7. Abril Tinoco Galeana (Guatemala; Project 25/7): Relationship between egg and hatchling size in a wild population of *Crocodylus acutus* in Izabal Nature Reserve, Guatemala.

8. Cristian Pizzigalli (Lithuania; Project 25/8): Investigating genetic diversity and connectivity in West African crocodile (*Crocodylus suchus*) populations.

9. Trevor Proctor (USA; Project 25/9): Sri Lankan human-crocodile conflict mitigation.

10. Jorge López Hernández (Mexico; Project 25/10): Nesting ecology of *Crocodylus moreletii* as an ecohydrological indicator in the Catazajá Lagoon, Chiapas.

The following reports, now posted on the CSG website, were submitted in January-March 2025 by SRAS applicants who have completed their studies:

- Project 18/6: Phoebe Griffith (UK). Post-release monitoring of headstarted Gharial in Chitwan National Park, Nepal. Download.

- Project 19/7: Siddhartha Regmi (Nepal). Communal nesting behavior of Gharial (*Gavialis gangeticus*) in Chitwan National Park, Nepal. Download.

- Project 19/8: Iago Silva Ornellas (Brazil). Phylogeography of *Caiman latirostris*: From history to conservation. Download.

- Project 19/11: Sofía Pierini (Argentina). Influencia de la antropización en la nidificación del yacaré overo (*Caiman latirostris*). Download.

- Project 19/16: Juan Moncada-Jiménez (Colombia). Phylogeography of the American crocodile, *Crocodylus acutus* (Crocodylia: Crocodylidae) in Colombia. Download.

- Project 20/2: Elyn Buitizon (Philippines).Ultrasonographic features of the liver, spleen and gall bladder of subadult Philippine Crocodile (*Crocodylus mindorensis* Schmidt, 1935) and Indo-Pacific crocodile (*Crocodylus porosus* Schneider, 1801). Download.

- Project 20/3: Celina Setias (Philippines). Ultrasonographic features of the urogenital organs in subadult Indo-Pacific crocodiles (*Crocodylus porosus*) and Philippine crocodiles (*Crocodylus mindorensis*). Download.

- Project 20/19: Washington Da Silva Mendonça (Brazil). Population trends and stress due to tourism with caimans in the Anavilhanas National Park, Central Amazonia. Download.

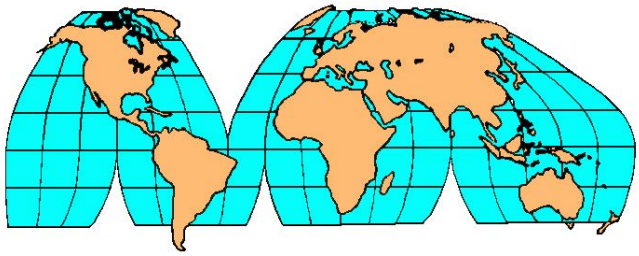
- Project 21/11: Rafael Sá Leitão Barboza (Brazil). From reproductive ecology to local ecological knowledge of a crocodilian, the Broad-snouted caiman (*Caiman latirostris*). Download.

- Project 21/12: Maryana Tavares de Souza (Brazil). Global distribution of crocodilians revealed by citizen scientists. Download.

- Project 24/11: Andreas Rani Agon (Indonesia). Density of Saltwater crocodile (*Crocodylus porosus*) and crocodile-human conflict in Menipo Natural Recreation Park, Kupang District, East Nusa Tenggara. Download.

Dr. Sally Isberg, *CSG Executive Officer (csg@wmi.com.au)*.

Regional Reports



South Asia & Iran

India

RESULTS OF ANNUAL CENSUS OF ESTUARINE CROCODILES IN THE RIVER SYSTEMS IN AND AROUND BHITARKARNIKA NATIONAL PARK/ SANCTUARY, ODISHA, INDIA (2025). The winter census of Estuarine crocodiles (*Crocodylus porosus*) has now been carried out in the river systems in and around Bhitarkanika National Park/Wildlife Sanctuary (BNP/WS; Figs. 1 and 2) in most years since 1976 (see Kar 2024; Table 1). The current census was conducted on 18-21 January 2025, and included river systems of Gahirmatha Wildlife Sanctuary and the Mahanadi deltaic areas. Twenty-two census teams were engaged to count the crocodile population in 54 segments of rivers/creeks involved. Surveys were carried out during the day (crocodiles >1.8 m; sub-adults, adults) and night [spotlight survey; crocodiles <1.8 m; hatchlings (<0.6 m), yearlings (0.6<0.9 m), juveniles (0.9<1.8 m)].

During this survey, 1826 crocodiles were counted, comprising 585 hatchlings (32.0%), 403 yearlings (22.1%),

328 juveniles (18.0%), 164 sub-adults (9.0%) and 346 adults (18.9%) (Table 1; Fig. 3). Most (1423; 77.9%) crocodiles were counted in Kanika Wildlife Range, which included forest blocks and rivers starting from Khola to Bhitarkanika-Pathasala confluence and beyond in Bramhani-Baitarani River systems. The remainder were observed in Rajnagar WL Range (274; 15.0%) and the Mahanadi Delta (Mahakalapada Wildlife Range 92; 5.0%; Gahirmatha Wildlife Range 37; 2.0%). Sixteen leucistic crocodiles ("Sankhua"; Kar 2023) were sighted during surveys.

Figure 1. Location of Bhitarkanika National Park/Wildlife Sanctuary.

Figure 2. Typical mangrove habitat of the Bhitarkanika River, shown here at high tide.

Figure 3. Male Estuarine crocodile (~4.5 m TL) basking on river bank.

A preliminary assessment of monitoring results (1976-2024) is presented by Kar (2024). The *C. porosus* population has clearly increased significantly over time, as a result of natural recruitment and the reintroduction of head-started crocodiles (N= 3008 between 1977 and March 2024). Over the 20-year period 2005-2024, Kar (2024) estimated the mean annual rate of increase as being around 2.45% p.a. In more recent years, the mean rate has slowed slightly, to around 2.2% p.a. for 2016-2022. The 2025 results are consistent with a greater slowing in population growth in 2022-2025, with a mean annual rate of increase of around 0.6% p.a. - long-term population monitoring will determine whether this trend towards stability continues.

Table 1. Estuarine crocodile counts in Bhitarkanika National Park/Wildlife Sanctuary, 1976-2025 (N= 38 surveys). H= hatchlings, Y= yearlings, J= juveniles, SA= sub-adults, A= adults, NH= total non-hatchling count, Total= total count (ie including hatchlings). *= yearlings counted as juveniles. See Kar (2024).

Year	H	Y	J	SA	A	NH	Total
1976	0	*	61	6	29	96	96
1985	0	*	118	13	34	165	165
1986	0	*	152	20	39	21	211
1989	0	*	213	32	58	303	303
1991	48	*	169	37	62	275	323
1993	115	*	179	53	67	299	414
1994	172	*	286	57	68	411	583
1995	208	*	323	60	69	452	660
1996	240	141	134	61	70	406	646
1997	191	184	151	63	71	469	660
1998	209	171	144	71	73	459	668
1999	198	166	152	82	74	474	672
2000	328	214	188	98	96	586	914
2001	391	258	246	105	98	707	1098
2002	467	327	282	117	137	863	1330
2003	404	360	181	121	162	824	1308
2004	531	306	210	127	184	827	1358
2005	681	290	169	107	207	773	1454
2006	657	283	197	122	203	805	1462
2007	503	368	259	135	232	994	1497
2008	538	343	231	143	261	978	1516
2009	538	375	264	148	271	1058	1596
2010	519	373	298	156	281	1108	1627
2011	531	377	304	166	292	1139	1670
2012	489	320	427	154	269	1170	1659
2013	486	356	396	128	295	1175	1661
2014	504	387	307	142	304	1340	1644
2015	511	380	317	149	308	1154	1665
2016	597	342	269	164	299	1074	1682
2017	608	334	266	172	302	1074	1682
2018	610	338	267	172	311	1088	1698
2019	619	349	273	178	325	1123	1742
2020	620	325	288	185	339	1137	1757
2021	593	367	320	152	336	1175	1768
2022	564	378	338	158	346	1220	1784
2023	569	388	325	166	345	1224	1793
2024	582	387	327	167	348	1229	1811
2025	585	403	328	164	346	1241	1826

Acknowledgments

I am thankful to the Chief Wildlife Wardens, Odisha and Wildlife Wardens of Athagarh Forest Division and the Bhitarkanika Mangrove (Wildlife) Division, Chandabali/ Rajnagar for extending support to conduct studies on ecology and biology, and also captive populations, of Estuarine crocodiles in Bhitarkanika Mangrove ecosystem since July 1975. CSG members have provided technical support and assistance during my 50 years of research on crocodiles in Bhitarkanika - I am grateful to all of them. People residing in the villages surrounding the National Park, especially in Dangamal, supported me wholeheartedly throughout my study and stay in Bhitarkanika. I am really thankful to one and all.

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Kar, S.K. (2024). Fifty years of successful implementation of Estuarine Crocodile Conservation and Research Programme in Bhitarkanika National Park, Odisha, India: An analysis. Crocodile Specialist Group Newsletter 43(3): 10-17.

Sudhakar Kar, *Former Senior Research Officer, Subhadra Nibas, Sampur, Bhubaneswar - 751003 Odisha, India*.

Latin America & the Caribbean

Dominican Republic

TRACKING THE AMERICAN CROCODILE NESTING SEASON (2025). The first monitoring of the nesting season of the American crocodile (*Crocodylus acutus*) in Lago Enriquillo was conducted on 28-30 January 2025. Lago Enriquillo, a hypersaline lake of around 380 km^2 in area (depending on water levels), lies within Lago Enriquillo and Isla Cabritos National Park (LEICNP). Isla Cabritos (1493 ha) is an island within Lago Enriquillo (see Fig. 1). Monitoring aimed to document the initial reproductive behaviours of the species, including nesting habitat selection and other key observations related to crocodile activity in the area (Fig. 2).

Crocodile den on Isla Cabritos

A crocodile den (33 cm height, 102 cm width, 123 cm depth; Fig. 3) was located at Punta Oeste, a nesting/basking beach on Isla Cabritos. The den was characterized as a single-entry flooded cave beneath a dried Buttonwood mangrove (*Laguncularia racemosa*) trunk, it was covered by saltwort (*Batis maritima*).

Thorbjarnarson (1989) stated that crocodiles in Lago

Figure 1. Lago Enriquillo, including Isla Cabritos. Red dots indicate nesting beaches.

Figure 2. Crocodile monitoring team of Lago Enriquillo and Isla Cabritos National Park: from left, back: Carlos José Sena (El Macho, park ranger), Wedys Mendez (park ranger); from left, front: Miguel Mendez Nova (Marro, park manager), Ramón Joel Espinal (interim head of Fauna Division); Onésimo Mendez (park ranger), Hector Trinidad (Radhame, park ranger), Wilson Mota (El Bronco, park ranger).

Figure 3. Crocodile den on Isla Cabritos, January 2025.

Enriquillo do not dig dens, likely due to unsuitable shoreline conditions or the relatively stable seasonal water levels. However, the first crocodile dens at Lago Enriquillo were identified by Cuban researcher Manuel Alonso Tabet in February 2019, who documented two dens in the La Charca area (Fig. 4).

Figure 4. Manuel Tabet taking measurements of crocodile dens at La Charca, February 2019.

Monitoring has been occurring at Isla Cabritos since 1967, and dens have never been reported there previously. This den is considered to have been dug by crocodiles, and represents the first one recorded on Isla Cabritos. The construction and use of dens by *C. acutus* have been widely observed across the species' range (Thorbjarnarson 1989). Medem (1981) noted that den construction varies depending on habitat type. Along rivers and lakes, dens are usually excavated in elevated banks and may have 1-3 entrances.

It is unlikely that the den serves as a permanent shelter for adult crocodiles given its dimensions, but could still be used temporarily when water levels allow. The presence of crocodile tracks at the den indicate some form of use. This aligns with Thorbjarnarson's (1989) findings, which suggest that dens serve various purposes, including thermoregulation, aestivation during prolonged droughts, and protection from natural predators or human threats. This discovery provides new insight into habitat use by *C. acutus* in Lago Enriquillo. Future studies should further investigate the function and prevalence of dens in the region.

Rescue of juvenile crocodiles

Two juvenile *C. acutus* (Fig. 5) were rescued near Boca de Cachón (see Fig. 1), located at the western shore of Lago Enriquillo, one in an irrigation canal 1.12 km from the lake (UTM 19Q 207772E, 2050267N) and the other in a wastewater discharge area 1.98 km from the lake (UTM 19Q 205895E, 2051928N). Both were measured, weighed, assessed for health condition, and marked by scute-clipping (Table 1).

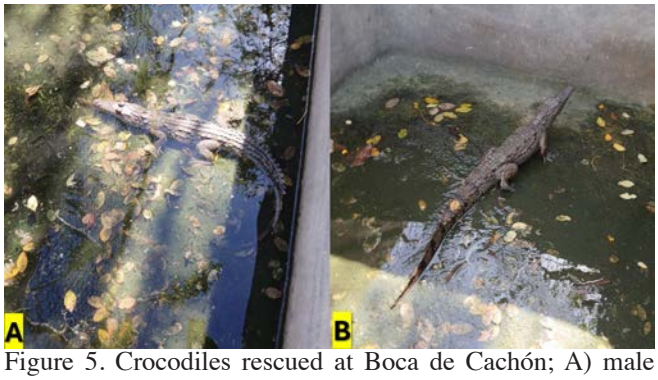

Figure 5. Crocodiles rescued at Boca de Cachón; A) male (marked 642); B) female (marked 641).

Table 1. Measurements of rescued crocodiles. Note: crocodiles 30<90 cm TL are considered to be "juveniles".

Measurement	Male	Female
Head length (HL; cm)	11.40	11.93
Snout length (SL; cm)	6.7	7.9
Snout-vent length (SVL; cm)	38.8	41.5
Total length (TL; cm)	73.5	77.9
Head width (HW; cm)	5.30	5.25
Tail girth (TG; cm)	17.8	16.4
Left hind foot (LHF; cm)	6.9	7.0
Bodyweight (BW; kg)	1.27	1.08

Further investigation at the wastewater discharge area revealed the presence of six additional crocodiles, similar in size to the two rescued crocodiles (Table 1). The presence of these crocodiles in the wastewater discharge area raises potential concerns that there may be deliberate removal of crocodiles from the lake and relocation, possibly for later illegal sale or consumption. One individual in Boca de Cachón had been identified previously for capturing crocodile hatchlings.

Due to the unsafe nature of the contaminated waters, the six crocodiles could not be rescued at the time. However, a monitoring operation has been established to ensure their presence until a proper rescue can be conducted.

The presence of crocodiles at these sites highlights a need for actions to prevent illegal removal of crocodiles from their natural habitat. Strengthened monitoring and law enforcement efforts in Boca de Cachón are recommended.

Nesting

At La Charca, evidence (tracks, diggings, test holes) of nesting attempts was recorded (Fig. 6). Unlike previous years, these were not found in the usual coral rubble but rather in lower sandy areas. Additionally, a new behavioural pattern was observed, namely adult crocodiles using Southern cattail (*Typha domingensis*) stands for resting and sheltering (Fig. 6). At all 8 known nesting beaches at Lago Enriquillo, except Playita (see Fig. 1), there was evidence of females beginning to look for places to nest.

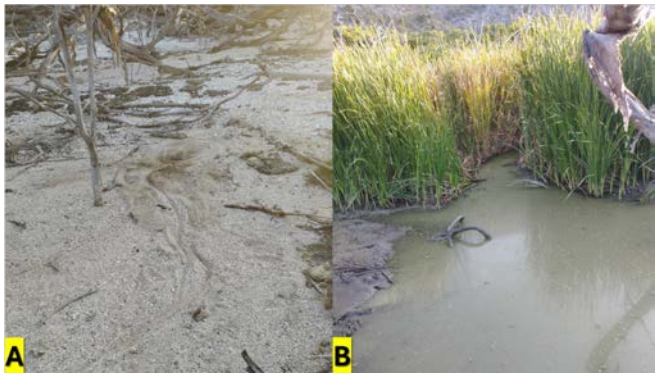

Figure 6. A) Evidence of beginning of nesting activity in La Charca (eg tracks, digging); B) *Typha domingensis* stands.

Figure 7. A. Freshly-laid nest at Isla Cabritos was laid on 20 February 2025; B. nest from Km 5 was at least one week old as evidenced by an "even" opaque band.

On 19-21 February 2025, the second monitoring of the *C. acutus* nesting season was conducted at Lago Enriquillo. Nine (9) nests were located; six at La Charca and one at Km 5 on the north coast, and two at Isla Cabritos (Fig. 1). The nest at Km 5 was laid around 11 February and the one from Isla Cabritos was laid on the night of 20 February (eggs were still covered in mucous) (Fig. 7).

Since 2020, nests have been found each year at four sites (Punta Oeste, Playita, La Charca, Km 5). Nests have not been located at El Muelle since 2022, nor were any nests located at Km 7 (at El Cantón) in 2024 (see Fig. 1).

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CELEBRATING WORLD WETLANDS DAY 2025: CONSERVATION ACTIONS IN LAGO ENRIQUILLO, DOMINICAN REPUBLIC. On 5 February 2025, the Ministry of Environment and Natural Resources, in collaboration with various institutions, commemorated World Wetlands Day at Lago Enriquillo and Isla Cabritos National Park. The event brought together teachers, students, fishermen, park rangers, and other key stakeholders under the theme "Protecting Wetlands for Our Common Future".

The event was attended by several distinguished guests, including: Paíno Henríquez (Minister of Environment); Carlos Batista (Vice Minister of Protected Areas, and Biodiversity); and, Marina Hernández (Director of Biodiversity) (Fig. 1). Also present were Sixto Incháustegui and Pablo Féliz from Grupo Jaragua, along with the Crocodile monitoring team of LEICNP and a veterinarian from the Biodiversity Directorate.

Figure 1. Crocodile monitoring team, Ministry of Environment officials and other authorities during commemoration of World Wetland Day 2025.

A major highlight of the event was the release of 12 American crocodile (*Crocodylus acutus*) hatchlings as part of the headstarting program implemented by the Crocodile monitoring team (Fig. 2). This initiative is carried out under the guidance of Robert Greco (Clemson University, USA), Marisa Tellez (Crocodile Research Coalition, Belize) and Sixto Incháustegui (Grupo Jaragua, Dominican Republic).

Figure 2. Some of the hatchlings released during the activity. Mean total length was 60 cm (range 58 to 63 cm), mean bodyweight was 604 g and age was around 8 months.

The hatchlings were released into a freshwater lagoon along the shores of the lake (Fig. 3). Prior to the release, a veterinarian from the Biodiversity Directorate conducted health assessments to ensure that all individuals were in optimal condition.

World Wetlands Day 2025 at Lago Enriquillo was a successful event, that raised awareness about wetland conservation while actively contributing to species recovery efforts. The participation of diverse stakeholders highlights the importance of collaboration in conservation initiatives.

Figure 3. Ramón Joel Espinal explaining how crocodiles should be released.

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Colombia

THE AMERICAN CROCODILE (*CROCODYLUS ACUTUS*) ESSENCE OF THE "AMPHIBIOUS CULTURE" FROM THE CARIBBEAN COAST, THE STORY OF HOW IT BECAME A CULTURAL ICON IN THE CITY OF BARRANQUILLA AND ITS CARNIVAL. The "amphibious culture" of the Colombian Caribbean region is a term adopted by the sociologist Orlando Fals Borda, that he used to refer to an aquatic lifestyle closely related to the riverine hydrology, that molded the ancient culture of the indigenous Zenú. This indigenous group was expert in transforming their territory by pre-Hispanic hydraulic engineering, that consisted of the creation of a vast net of terraces and drainages that allowed them to use aquatic resources and advanced agriculture systems, which in turn allowed for the nourishing of a growing civilization in the floodplains of the Magdalena, Sinú, San Jorge and Cauca Rivers. This ancient way of life has been adopted by present inhabitants of these regions, who have adapted themselves to the dynamic environmental changes between dry and wet periods, living on water resources during high waters and hunting, herding, and farming during the descent of the water levels.

The Alexander Von Humboldt Institute has defined Colombia as a country of wetlands (Jaramillo *et al*. 2023), amphibious by nature, because of the great number of hydrographic watersheds, each with at least one crocodilian species. Two crocodilians can be found in the Caribbean watershed drainages: the American crocodile, commonly called "caimán aguja" or "caimán de magdalena" (*Crocodylus acutus*); and, the Spectacled caiman, called "babilla" (*Caiman crocodilus fuscus*). *Crocodylus acutus* is a species that not only ecologically connects the water systems but also generates a cultural connection. It is part of a cultural legacy that has defined the coastal idiosyncrasy that relates to festivities, specially carnivals, that occur on the same dates in all of the main coastal cities of the Colombian Caribbean.

Carnivals on the Colombian Caribbean coast began during the Colonial period (Buelvas Aldana 2013). This celebration is a socio-cultural manifestation that had its origin in smaller celebrations in populations like Ciénaga (Magdalena), Corozal (Sucre), El Carmen de Bolívar, Mompox, Riohacha (La Guajira), Santo Tomás (Atlántico). In Barranquilla, El Carnaval de Barranquilla was born, declared by UNESCO as one of the world's Intangible Cultural Heritage of Humanity in 2003 (MinCultura 2002). In each one of these localities where the carnival was born, the icon of the caiman has always been present as it is a species that inhabits nearby rivers and wetlands, persisting in this cultural relation between humans and crocodilians.

Before the Spanish domain, the caiman was a symbol of the totem of power to the Caribbean indigenous tribes (Fig. 1). Before Spaniards "named" the Magdalena River, the largest river system of the northern Andes, it was known as "Karakalí" ("the great river of the caimans") by the Arawak-Carib. It was home to the American crocodile and a vast number of indigenous groups, many of which disappeared after Spanish colonisation. Archaeological evidence of this relationship comes from the high Magdalena River tribes from San Agustin, which vanished without any explanation, but left the largest collection of megalithic structures in Latin America. Several of these stone statues represent a shaman, covered by the skin of an American crocodile as a symbol of power, as the shaman could take from the animal special powers that defined a cultural hero (Cifuentes-Toro 2013).

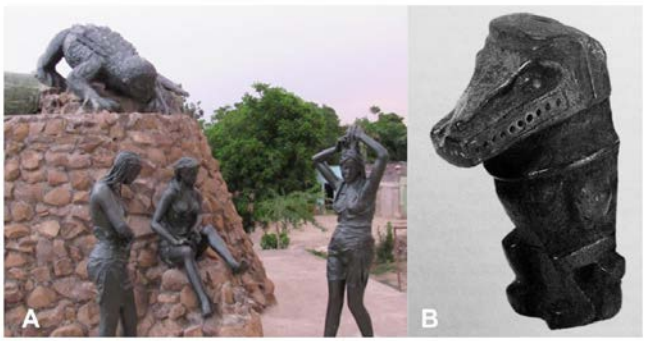

Figure 1. A) Sculpture depicting "Hombre Caimán" at Plato Magdalena. Photograph: Juan Salvador Mendoza. B) Archeological piece from Tayrona culture (Neguaje Period 200-900 a.C), with a zoomorphic motif of a crocodilian, depicting a shaman with an American crocodile mask. Image from: Legast (1987).

It is well known that the American crocodile was part of the prey items included by humans since prehistoric times in the Colombian Caribbean. Skeletal remains found in archeological sites show evidence of the species being consumed through cut marks on bones and the evidence of

having been cooked at high temperatures (Reichel-Dolmatoff 2016). Cranial bones, jaw bones, appendicular bones, vertebrae and osteoderms have been found as part of these remains (Álvarez-León and Maldonado-Pachón 2010), at nine archeological sites (Table 1).

As part of the folk culture of the Magdalena River, a mythical being appears - "El Hombre caimán" - an anthropomorphic representation of *C. acutus* involved in one of the Magdalena's principal myths, especially the town of Plato Magdalena from which this creature emerged (Fig. 1). Legend tells that a fisherman called Saúl Montenegro was obsessed with spying on women bathing nude in the Magdalena River. He did not want to be discovered and punished, so he visited a sorcerer who prepared a potion that would turn him into a caiman. This way he could hide underwater and continue to spy on the bathing women. The sorcerer had handed him a second potion that would allow him to return to his human form whenever he would need it, but this involved someone else to sprinkle the potion over the crocodile's body. He had to ask for a favour from one of his friends, who got scared when he saw his friend turned into a large crocodilian, and accidentally lost grip of the vase that contained the potion and only sprinkling the contents on the fisherman's head. He thus remained with the body of a crocodile and the head and hands of a man, and terrorized women that visited the river, who in turn never returned to bathe there. The caiman man spent the rest of his days swimming through the river, till he could reach the river mouth in Barranquilla. Till now fishermen who visit the area, are always hoping of finding the "Hombre caimán".

The human-crocodile interaction has had many different tones along history, as a top predator many stories narrate accidents with the species, in many cases lethal ones. The most famous of all accidents with the species is told by a Colombian folk song, composed in 1860 and finally published by musician Eulalio Melendez from Cienaga, Magdalena, in 1886. This composition, titled "El caiman", is one of Colombia's first musical pieces after achieving independence from Spain (Henriquez-Torres 2000). It is later made part of a traditional celebration each 20 January, a day on which a young girl died from a crocodile attack, and one of the verses from "El Caiman" tells the story:

Hoy, día de San Sebastián, cumple años Tomasita y este maldito animal se ha comido a mi hijitica! Mi hijita linda, ¿dónde está tu hermana?, ¡el Caimán se la comió!.

[Today, the day of Saint Sebastian, is Tomasita's birthday, and that damned animal has eaten my little girl! My dear daughter, where is your sister?, The caiman just ate her!]

The song reveals not only a tragedy, but an ancient African custom brought by the enslaved, that when an infant died people watched over the body for nine days, where they also prayed and sang. The music of "El Caiman" is also accompanied by a traditional dance that has been traced by folklorists to be part of an indigenous ritual of the Chimilias, an ancient tribe that dominated the Magdalena. The dance involves men and women, with a central character personified by a man who holds a caiman dummy, and dances imitating the movements of the animal, while being inside of the creature (Fig. 2) (Henriquez-Torres 2000).

Figure 2. A) Dance of the Caiman (Ciénaga Magdalena). Photograph: Juan Salvador Mendoza. B) Archeological gold piece. Image from: Reichel Dolmatoff (1988).

As part of the cultural melting pot that occurred in Colombia after the indigenous tribes were conquered by the Spaniards and Africans were brought from their homeland, new ways of assimilation of the cultural changes appeared through syncretism, combining beliefs and customs. As a result, many of the ancient indigenous practices that were once prohibited during Spanish rule and by the church, later began to be part of festivities and ritualized in traditional dances, and cult to saints.

Evidence of this relationship between humans and crocodiles appears not only in the archeological record but also in the

Table 1. Archeological sites with records from remains of consumed *Crocodylus acutus* in the Colombian Caribbean.

Archeological Site	Department	Estimated date	Author
Depresión Momposina	Sucre	II Century B.C. - 650 A.C.	Flórez-Correa (2018); Plazas *et al*. (1993)
Ciénaga Grande de Santa Marta	Magdalena	362 A.C.	Angulo-Valdéz (1978)
Isla de Salamanca	Magdalena	1200 A.C.	Murdy (1968)
Guajaro	Atlántico	3000 B.C.	Angulo-Valdéz (1978)
Rotinet	Atlántico	2000 B.C.	Angulo-Valdéz (1988)
Malambo	Atlántico	710 A.C	Angulo-Valdéz (1981)
Puerto Chacho	Bolívar	3300 B.C	Arévalo and Maldonado-Pachón (1990)
Zambrano	Bolívar	1000 A.C	Reichel-Dolmatoff (1991)
Momil	Córdoba	150 A.C	Reichel-Dolmatoff (1986)

oral traditions of the present day Chimila indigenous people. Anthropologist Gerardo Reichel Dolmatoff described this relation by putting together both archeological evidence and one of the legends from this tribe. In 1988, he described an archeological gold piece depicting a crocodilian with the face of a human inside its belly. Later, studying folk culture of the Chimila, he compiled one of the origin myths from the tribe that explained how the Chimilas learned to hunt and fish:

"A Chimila Indian, had a dream with a caiman, in this dream while he was walking through the beaches from the Magdalena River, he ate one of its eggs, after this he felt very afraid. People told him not to feel fear, as caimans were people too, but the native was very fearsome of being eaten by a crocodile, till the day came when he went with his brother to the river and the dream came true, he was eaten by a large crocodile, that swallowed him with his bow and arrow. When the man was inside the crocodile he felt hungry and thirsty and wanted to see the light. The angry animal left his underwater cave and said: who is pinching me from inside? The native kept pinching the animal's gut with his arrow, driving the crocodile mad, he had to cough, and opened his large mouth, at this moment the Indian used his arrow to maintain open its jaws and barely alive, could exit from inside the animal. Weak and sick, the Indian decided to go to the forest and heal. Then he returned to his tribe being fat, with prey in his sack, he brought monkeys, boars, rodents, and tapirs. Puzzled, the rest of his tribe followed him and asked him for the secrets of good hunting. They were amused by watching him attract wild animals by whistling. When they asked him about the secret, he answered that he had learned from the caiman while he had lived inside of the animal after he was swallowed".

In modern times the American crocodile is a totem, a symbol, of a rich indigenous past, though most of the present inhabitants of the caribbean ignore these stories, that make this species an important image used regularly in the celebration of Carnaval de Barranquilla (Figs. 3 and 4). As part of these cultural manifestations we can find in folklore evidence of the relationship with crocodiles in other songs and dances that express the potential dangers of having children play or sleep near waters where the species may inhabit. One of these stories takes place in Barranquilla and narrates how women washing their clothes in the small creeks nearby the city, had constant fear of being attacked by one of these animals, or that the species would prey on their young children that they often left bathing over a rock or sleeping under a nearby tree, and it was common for crocodiles to attack dogs and humans (Vengoechea Dávila 2005).

Figure 3. A) American crocodile represented in carnival float. B) Representations of American crocodiles as decorations over vehicles during carnivals. Photographs: John Jairo Gómez González.

Figure 4. A and B) Dance of the caiman represented in the Carnaval de Barranquilla in 2020. C) Representation of an American crocodile with a child as prey. D) Carnival in 2025. Photographs: John Jairo Gómez González.

Mijita, cuida a tu hermana que .... yo me voy a lavá ...
a ver si puedo gozá ..... el frescor de la mañana.
Mijita, ¿'nde está tu hermana? ... El caimán se la comió ...
¡Por lavá unos trapitos! .... ¡Sea por el amor de Dios!....

[Little girl, take care of your sister .... I'll be washing clothes
And see if i can enjoy the morning breeze
Little girl, where is your sister? The caiman ate her …
Only for I was washing clothes! .... By the love of god!]

One of the Carnaval de Barranquilla soundtracks is called "Se va el Caimán" composed in 1941 by Jose María Peñaranda who was born in Barranquilla (RegiónCaribe.org 2025). This song focuses on the legend of "El Hombre Caimán" from Plato Magdalena, and is also known internationally and translated into many languages:

Voy a empezar mi relato con alegría y con afán
Con alegría y con afán voy a empezar mi relato
En la población de Plato, se volvió un hombre caimán

Coro

Se va el caimán, se va el caimán ... Se va para Barranquilla
Se va el caimán, se va el caimán ... Se va para Barranquilla

[I am going to start with eager and happiness
With happiness and eager i will start to tell the story
In the town of Plato, a man turned into a caiman

Chorus

The caiman is leaving, the caiman is leaving
He is heading to Barranquilla
The caiman is leaving, the caiman is leaving
He is heading to Barranquilla]

The American crocodile also makes part of the sports idiosyncrasy of the city of Barranquilla, as many teams are called "Caimanes de Barranquilla". The baseball team has a trademark of the name, and other minor league teams have used the name "cocodrilos", but making allusions to the same

species (Fig. 5). Barranquilla has other toponyms allusive to the American crocodile, as a touristic harbour that receives the name "Caiman del Rio", a new space for the city that promotes tourism (Fig. 6). In this place you may find different commemorative anthropomorphic statues of the American crocodile, that represent street vendors and carnival characters with the image of bipedal caimans.

Figure 5. Sport team logos from Barranquilla: A) basketball. B) baseball. C) minor league basketball.

Figure 6. Tourist place caimán del río : A) restaurant. B) logo.

Concluding Remarks

The American crocodile (*Crocodylus acutus*), is an important species represented in the folklore and material culture of the Carnaval de Barranquilla. The story behind the importance of the species may be traced to pre-Hispanic times. Human crocodile relationships not only reflect conflict between both species but also a use of the species as a food source, as it is one of the common prey items to be found in archeological sites of the Colombian caribbean. This species is doubtlessly an icon of power, conferred to the representations of masks and hides worn by shamans from cultures such as San Agustin and Tayronas. It is important to trace the origins of today's festivity around this crocodile to ancient indigenous customs and legends such as traditional dance and myths from the Chimila indigenous tribes that reflect the origin of the carnival dances related to this species. Despite that today the American crocodile is a popular icon in pop culture and sports in Barranquilla it is a threatened species that finds in the city a source of pollution and habitat degradation. Environmental education may be one of the ways to contribute to the preservation of the species around the Magdalena River delta.

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Mexico

INTERNATIONAL WORKSHOP ON MANAGEMENT AND CONSERVATION OF CROCODYLIA IN LATIN AMERICA, CHIAPAS, MEXICO. On 19-22 February 2025, the International Theoretical and Practical Workshop on the Management and Conservation of Crocodylia in Latin America took place. The event was held in Suchiapa, Chiapas, Mexico, and was organized by the NGO COMAFFAS with the participation of national and international experts. The fundamental objective of the workshop was to reinforce the attendees' knowledge with regard to handling skills and research.

This event included both in-person and real-time virtual theoretical sessions. Practical sessions were conducted with individual crocodilians, where various management methodologies were presented, deepening the techniques of capture and restraint mastered by the instructors, as well as the study methods used for captive and wild populations. Daytime and nighttime field practice was carried out in the Grijalva River, within Sumidero Canyon National Park, with the aim of demonstrating the standardized methodology and working forms of the Morelet's Crocodile Monitoring Program (Sánchez-Herrera *et al*. 2011) adapted to the species that naturally occurs there. In this important locality, various conservation programs have been implemented for the American Crocodile (*C. acutus*). It is currently part of the MXRC5 Coordination Region of the National Monitoring Program for this species directed by CONABIO.

The workshop involved 40 attendees from 11 states of Mexico (Sonora, Nuevo León, San Luis Potosí, State of Mexico, Mexico City, Michoacán, Nayarit, Jalisco, Veracruz, Oaxaca, Chiapas) and 4 other countries. Among them, students and professionals in biology, veterinary medicine, etc. The in-person presentation sessions were led by instructors: Jerónimo Domínguez-Laso (COMAFFAS, Mexico), Helios Hernández-Hurtado (CUCOSTA-UDG/Reptilario Cipactli, Mexico), Gustavo Sosa-Rodríguez (GECC, Cuba), Etiam A. Pérez-Fleitas (GECC, Cuba), Yairen Alonso-Jiménez (GECC, Cuba), Sergio A. Viveros-Peredo (UMA El Colibrí de la Antigua, SERVIFAUNA, Mexico), Sergio A. Balaguera-Reina (UF/The Croc Docs (USA/Colombia) and Berenice García Reyes (COMAFFAS, Mexico). In addition, some speakers attended remotely: Alejandro Larriera (CSG Co-Chair, Argentina), Hesiquio Benítez Díaz (CONABIO/GEC-MEX, Mexico) and Yoamel Milián-García (University of Guelph, Canada) (Fig. 1).

Figure 1. Clockwise from top left; In-person and virtual attendees during the theory sessions of the Workshop: Online participation of Alejandro Larriera (CSG Co-Chair): Night monitoring in Sumidero Canyon National Park: Participation of Cuban specialists. Photographs: Berenice García and Jorge Figueroa.

We were pleased to see an increasing participation of women in these training events. For this workshop, there were two female instructors and 50% of participants were women (see Fig. 2).

It has been a great pleasure to have met the goals set for this event and to know that we continue to contribute to the training of new generations of crocodileros throughout Mexico, which is vital for the conservation of crocodilians.

Figure 2. Top: Female team with Canelo (3.8 m, *C. acutus*). Bottom: Participants and instructors with *C. acutus* and *Alligator mississippiensis*. Photographs: Jorge Figueroa.

We are very grateful to the instructors, speakers, participants, partner institutions, sponsors, and the event's working team. We also extend special thanks to Benoit Simard from the Institute of English and French "Frenglishtein", and to Miroslav Procházka from Crocodile Zoo Protivín, for the financial support for scholarships that helped some participants receive attend the workshop.

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Australia & Oceania

Australia

SALTWATER CROCODILE (*CROCODYLUS POROSUS*) WITH DENTAL ANOMALIES. On 25 June 2018, a deceased male Saltwater crocodile (*Crocodylus porosus*) was located in the Mary River, Northern Territory, Australia (12°54'26.3"S, 131°38'44.6"E). The specimen, estimated to have been approximately 4.7 m in length when alive, was found in an advanced state of decomposition and exhibiting postmortem bloating. The absence of apparent injuries or trauma suggested natural causes of death, possibly associated with senescence. Upon retrieval and preparation, the skull, measuring 63.0 cm head length (HL), revealed an unusual dental anomaly (Fig. 1).

Figure 1. Saltwater crocodile (63.0 cm HL) with teeth deformation. Photograph: Yusuke Fukuda.

Cranial examination uncovered a dental deformity characterized by the horizontal fusion of multiple teeth, including incisors, canines, and molars, within single sockets in the premaxilla, maxilla and dentary bones (Fig. 2). Notably, the 9-11th sockets each contained two teeth in the left dentary. Under each visible tooth was a "new" tooth that would eventually replace the former.

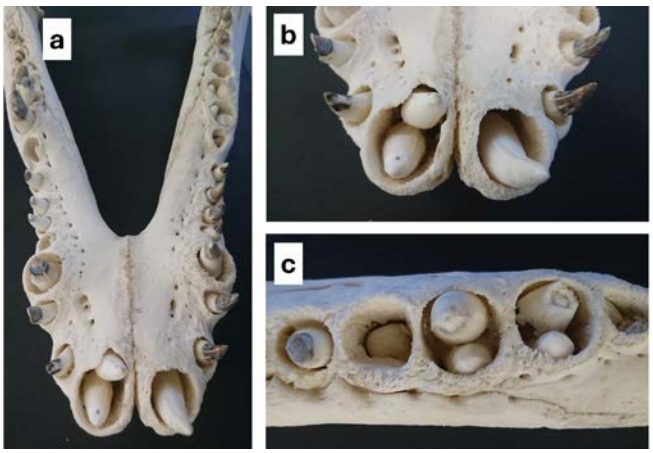

Figure 2. a) Dentary with the dental anomalies, b) malformed incisors, and c) 9-11th sockets containing two teeth each within single alveoli. Photograph: Yusuke Fukuda.

The crocodile management team had not encountered this unique dental morphology in over 25 years of field

experience, nor could similar reports be located in the literature. However, a 4.06 m male *C. porosus*, captured in Darwin Harbour, approximately 100 km west of the Mary River, on 2 July 2024, exhibited similarly deformed teeth in the second socket on the left dentary. The rarity of this dental anomaly needs further investigation to elucidate potential genetic, environmental or pathological factors that may have contributed to this distinctive cranial feature.

Acknowledgments

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SALTWATER CROCODILE (*CROCODYLUS POROSUS*) WITH UPPER SNOUT MISSING BUT HEALED. A female Saltwater crocodile (*Crocodylus porosus*) with significant rostral trauma was captured on 13 March 2024 in the Elizabeth River, Northern Territory, Australia (12°38'33.6"S, 131°05'41.3"E) as part of the crocodile safety program. The specimen, measuring 315 cm total length, 152 cm snout-vent length, and 41 cm head length, showed a substantial loss of the upper snout, including the complete absence of the premaxilla and approximately 60% of the maxilla (Fig. 1).

This injury resulted in the exposure of the corresponding lower jaw section, encompassing about 60% of the dentary, including the 1st to 9th teeth. The injury appeared fully healed, with a darkened integument on the exposed dentary, tongue, and gum, likely due to prolonged sun exposure.

The nasal cavity appeared fully closed in the cross-section surface of the amputated upper snout (Fig. 2). However, upon dissection (conducted at 27th CSG Working Meeting's Veterinary Workshop, Darwin, 14 April 2024), a 10 mm diameter opening was discovered on the ventral surface of the maxilla near the injury site, confirmed to be connecting to the nasal cavity (Fig. 2). This adaptation likely facilitated respiration and olfaction, as evidenced by the specimen's ability to locate bait in a trap when captured.

The case study indicates the remarkable resilience and adaptability of the species in surviving and adapting to severe cranial trauma. While the exact duration of survival post-injury remains unknown, the extent of healing and functional adaptation suggests a prolonged period of recovery and survival.

Figure 1. Female Saltwater crocodile with a major part of the upper snout missing. Note the darkened colour of the dentary and tongue. Photograph: Yusuke Fukuda.

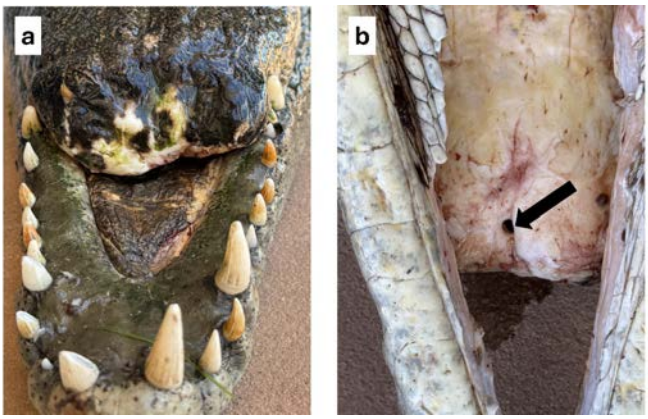

Figure 2. a) Healed injury site with no opening to the nasal cavity and b) opening in the ventral side of the maxilla near the injury. Photograph: Yusuke Fukuda.

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Papua New Guinea

SUSTAINABLE HARVEST OF WILD SALTWATER CROCODILE (*CROCODYLUS POROSUS*) ALONG THE MIDDLE SEPIK RIVER: A BALANCING ACT FOR ENVIRONMENTAL CONSERVATION AND DIRECT FINANCIAL BENEFITS TO RESOURCE OWNERS. Two species of crocodile occur in Papua New Guinea, the Saltwater crocodile (*Crocodylus porosus*) and the New Guinea Freshwater crocodile (*C. novaeguineae*). Both species were extensively exploited for their valuable skins from the 1950s until the early 1970s, causing their populations to decline across all of their coastal wetland habitats. In the mid-1970s, the PNG Government enacted the *Crocodile Trade (Protection) Act 1974* to protect its wild crocodile populations from extinction and to regulate the crocodile skin industry.

This management and conservation program was based on the principle of sustainable use, whereby traditional landowners could continue harvesting wild crocodiles under strict conditions such as: minimum and maximum size limits of wild-caught skins in trade (18 and 51 cm, respectively); licences for domestic sales and export of crocodile products; and, establishment of a monitoring program conducted by the Department of Environment and Conservation (DEC).

Over time, the exploitation of crocodiles in PNG has evolved from purely hunting them for their skins, to capturing juveniles for sale to commercial farms (ranching), and more recently to a commercial harvest of wild *C. porosus* eggs in the Middle Sepik River (Fig. 1).

Evolution of crocodile industry

In the late 1970s, with the aim of improving the quality of the skins being exported from PNG, DEC introduced the concept of "village ranching" for wild crocodiles. Under a PNG Government/UNDP/FAO project, hunters-gathers were encouraged to catch and raise young wild-caught crocodiles in small pens built out of bush materials (Fig. 2). The goal was to raise the crocodiles until they reached commercial size, and then slaughter them for their skins. However, due to the poor environmental conditions, sub-optimal raising conditions leading to high mortalities and slow growth rates, difficulties in obtaining enough food regularly, and the added logistical problems faced by government extension officers to regularly visit the farms situated in remote wetlands areas, many of these "wildlife ranchers" rapidly lost interest.

To prevent this pilot project from collapsing, DEC approached the two commercial poultry farms based in Port Moresby and Lae, respectively. These private entities had not only the financial and technical resources and know-how for commercial farming, but more importantly also the capacity to cost-efficiently feed large numbers of crocodiles by recycling poultry mortalities in their farms and utilising a large volume of poultry by-product (eg chicken heads and feet) produced through their processing plants. Under this new scheme, local hunters were still encouraged to source wild juvenile crocodiles, but instead of raising them they would maintain them in a holding pen for a short period of time before dispatching them to the commercial farms.

This, in a nutshell, is how Mainland Holdings Ltd (Lae) and Ilimo Farms Products Pty Ltd (IFP; Port Moresby) started the

Area of wild saltwater crocodile (*C.porosus*) eggs harvest in the Middle Sepik River - Kamindibit - Waniap

HAUNA VILLAGE, MIDDLE SEPIK RIVER

Figure 1. Sepik River area where egg harvesting occurs.

Figure 2. Village pen constructed with bush materials in Western Province.

commercial farming of crocodiles in 1980. In the early 1990s, when IFP unfortunately had to close its poultry operations, its crocodile farm followed suit. MHL is now the only remaining operator of a commercial crocodile farm in PNG.

In the late 1980s, instead of exclusively relying on the purchase of wild animals for stocking its farm, MHL Crocodile Farm introduced a captive breeding program. Its first batch of adult crocodiles were sourced from the now defunct government-owned "crocodile" sanctuary situated at Moitaka, in the National Capital District. Later, sub-adult crocodiles selected from farm stocks were transferred to breeding pens.

Up until 2003, the farm continued to charter small airplanes to pick up hundreds of wild hatchling and yearling crocodiles harvested in the Middle Sepik River (East Sepik Province) and Gulf Province. However, due to increasing costs for domestic air freight, compounded by the waning interest of the local villagers to continue hunting wild crocodiles in remote swamps, often far away from the villages, as well as the high biosafety risks of frequently introducing wild-caught animals into the farm, it soon became uneconomical to continue sourcing animals directly from the wild. For example, skin quality can be seriously affected by *Paratrichosoma* sp., a parasitic worm that burrows into the skin of crocodiles (Ashford and Muller 1978), crocodile meat can be infected by *Trichinella* sp., a roundworm responsible for zoonotic disease, and *Chlamydia* spp., a highly infectious bacterium, can cause high morbidity and mortality amongst hatchlings. To fill the "gap" left by the loss of the Live Purchase crocodiles (LPs), MHL Crocodile Farm turned to the Sepik River.

DEC has been conducting crocodile nest counts survey in the Middle Sepik River since 1981 (for *C. novaeguineae*) and 1982 (for *C. porosus*). Surveys were flown by helicopter during the peak of the breeding season, in early March for *C. porosus* and October for *C. novaeguineae*. Following a review of the monitoring program for both species, the use of habitat-weighted indices (Hollands 1987) were replaced by more applicable nesting indices in 1995 (Manolis 1995a, b).

Coinciding with monitoring activities, the first *C. porosus* egg harvest in the Middle Sepik River was carried out in 1985 (Table 1), with landowners being paid PGK2.50 and one chicken egg per viable crocodile egg. The first *C. novaeguineae* egg harvest was carried out in 1988, with landowners being paid PGK2.00 and one chicken egg per viable crocodile egg. Efforts were made to collect eggs from nests that were considered to have a high likelihood of flooding or predation. Eggs were sold and airfreighted to MHL Crocodile Farm, where they were incubated. Limited harvesting of *C. porosus* eggs by helicopter continued until 1998.

In 1993, during a Conservation Needs Assessment, the Sepik River region was identified as a "Very High Priority", reflecting its unique landforms, biota, cultural diversity and economic value. Indeed, in the Sepik River, many tribes share a special bond with wild crocodiles that inhabit their wetlands. These animals have a mystical symbolism deeply enshrined in the indigenous culture and ancient traditions. The "pukpuk" - or crocodile in Pidgin English - is at the heart of the male initiation, a rite of passage to adulthood. During the secretive ceremony held in a spirit house (or Haus Tambaran), the elders cut the skins of the "boys" in a pattern resembling the scales of a crocodile (Fig. 3). A local creation myth suggests the Sepik people descended from the crocodile and emerged from the river as humans to walk on land.

Figure 3. Man from Chambri Lakes with "crocodile" scars.

Table 1. Summary of Saltwater crocodile egg harvests, 1985-2024.

SEPIK SW CROCODILE EGG HARVEST 1985 - 2024

HARVEST YEAR	NESTS HARVESTED	% OF NESTS SURVEYED	VILLAGES	SUPPLIERS	TOTAL No OF EGGS	VIABLE EGGS	EGG PAYMENTS TO FARMERS	AVG COST/EGG	INFERTIILE / DEAD EGGS	% VIABLE EGGS	AVG CLUTCH SIZE	HATCHLINGS	AVG COST / HATCH	HATCHABILITY
1985	14	19.40			795	661			134	83.14%	56.79	134		20.3%
1986	17	23.90			1061	859			202	80.96%	62.41	202		23.5%
1987														
1988	13	16.10			793	647			146	81.59%	61.00	483		74.7%
1989	20	20.60			1329	1198			131	90.14%	66.45	1128		94.2%
1990	29	29.60			1613	1324			289	82.08%	55.62	1140		86.1%
1991														
1992	35	24.60			2066	1656			410	80.15%	59.03	1401		84.6%
1993														
1994	29	25.40			1726	1545			181	89.51%	59.52	1179		76.3%
1995														
1996	47	33.30			2722	2145			577	78.80%	57.91	1872		87.3%
1997														
1998	36	47.50			1983	1591			392	80.23%	55.08	1141		71.7%
2002	78		12	45	4381	3465	K20,790.00	K6.00	916	79.09%	56.17	3098	K6.71	89.4%
2003	159	76.20	28	81	9508	7817	K54,719.00	K7.00	1691	82.21%	59.80	5832	K9.38	74.6%
2004	215	46.50	24	98	12756	10261	K71,827.00	K7.00	2495	80.44%	59.33	8901	K8.07	86.7%
2005	205		22	88	12327	9787	K86,967.00	K8.89	2540	79.39%	60.13	7926	K10.97	81.0%
2006	291		30	122	17006	13491	K134,910.00	K10.00	3515	79.33%	58.44	9157	K14.73	67.9%
2007	215	59.07	26	118	13390	10946	K109,460.00	K10.00	2444	81.75%	62.28	9019	K12.14	82.4%
2008	268		32	124	12733	11790	K123,795.00	K10.50	943	92.59%	47.51	9672	K12.80	82.0%
2009	195	22.00	27	89	11297	8977	K98,747.00	K11.00	2320	79.46%	57.93	5370	K18.39	59.8%
2010	185	27.50	24	95	10411	8270	K90,970.00	K11.00	2141	79.44%	56.28	6504	K13.99	78.6%
2011	181	32.00	24	78	10193	7980	K87,780.00	K11.00	2213	78.29%	56.31	5871	K14.95	73.6%
2012	228	36.00	26	100	12798	10972	K120,692.00	K11.00	1826	85.73%	56.13	8693	K13.88	79.2%
2013	304	48.00	27	118	18026	15060	K165,660.00	K11.00	2966	83.55%	59.30	12459	K13.30	82.7%
2014	288	35.00	27	102	16474	14182	K156,002.00	K11.00	2292	86.09%	57.20	10581	K14.74	74.6%
2015	272	30.00	22	108	16408	13510	K148,610.00	K11.00	2898	82.34%	60.32	10550	K14.09	78.1%
2016 *	194	25.00			11382	8434	K112,374.00	K13.32	2948	74.10%	58.67	3949	K28.46	46.8%
2017	272		21	104	16363	13841	K185,371.00	K13.39	2522	84.59%	60.16	8691	K21.33	62.8%
2018	207		22	82	12007	10155	K136,329.00	K13.42	1852	84.58%	58.00	7755	K17.58	76.4%
2019	164		14	67	9149	8099	K142,888.00	K17.64	1438	88.52%	55.79	5818	K24.56	71.8%
2020	146		21	68	8574	7360	K129,596.00	K17.61	1214	85.84%	58.73	4662	K27.80	63.3%
2021	180		17	76	10711	9163	K166,404.00	K18.16	1548	85.55%	59.51	5414	K30.74	59.1%
2023**	108		14	45	6073	5296	K105,920.00	K20.00	777	87.21%	56.23	4026	K26.31	76.0%
2024	174		19	87	10172	8899	K177,980.00	K20.00	1273	87.49%	58.46	6448	K27.60	72.5%
							K2,627,791.00							

Alternate harvest years using helicopter

Canoe harvests period

low water level

low water level

* Introduction of cash / bank accounts pricing. Cash = PGK 13.00 vs. Bank account = PGK 15.00
** Payment in bank accounts only. Reduced quota to control stocking densities in the farm.

Sepik Wetland Management Initiative

In 1998, during monitoring of the *C. porosus* populations in the region, it was discovered that the El Niño drought that had seriously affected PNG the previous year, had badly devastated most of the prime crocodile nesting habitats. In some areas, more than 80% of the grassland had been burnt by the local landowners for hunting, cultivation or even during conflicts with their neighbours (Fig. 4).

Figure 4. Burned pandans in a survey site near Hauna village, October 1997.

This is how, at the initiative of the late Jack Cox, a group of concerned citizens in Ambunti founded the Sepik Wetland Management Initiative (SWMI; Fig. 5), a community-based organization. Since its establishment, SWMI has been actively promoting the rehabilitation and conservation of wetlands and crocodile nesting habitats in the Sepik River through various projects. These include: community awareness focused on the ecological and economic importance of protecting both the native fauna and flora in the wetlands; encouraging resource owners to develop a community management program (eg through sustainable harvest of crocodile eggs); and, monitoring and control of the spread of invasive species (eg salvinia, Java carp, bush morning glory, water hyacinth).

Figure 5. Work of SWMI

The main objectives pursued by SWMI are to link its

conservation projects with self-help community participation. In other words, to encourage local communities to actively participate in the rehabilitation of the degraded habitats, to preserve their still pristine wetlands while also encouraging them to sustainably utilize their natural resources. This multi-stakeholder approach also involves the participation of government agencies (eg Conservation and Environment Protection Authority, the district level government), some other non-government organizations (eg World Wildlife Fund, Pacific Island Ministries) and private companies (eg MHL).

During their initial awareness trip along the Middle and Upper Sepik River, the founding members of SWMI conducted a Participatory Rural Appraisal survey (Fig. 6). With the help of the local villagers, they methodically mapped and categorized all the local resources according to their economic, ecological and cultural importance (Fig. 7) (Cox 2002; Solmu 2002).

Figure 6. The PRA Way.

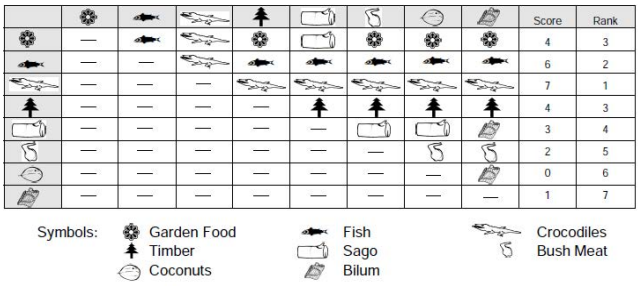

Figure 7. Stylized example of a Resource Importance Matrix. Ranking by Bagu villagers, 30 September 2001.

The landowners then decided what resources needed to be protected and how they wanted to do it. This participatory approach enabled SWMI to more closely involve the "grassroots" people in the practical implementation of their conservation project as well as proposing them avenues to improve their livelihoods.

One of the most common ideas suggested during these discussions was the introduction of a commercial harvest of wild *C. porosus* eggs. This is when MHL Crocodile Farm came on board with SWMI and the local communities. For this harvest to be sustainable, SWMI set up several rules: only 50% of the nests could be harvested (ie leaving the untouched nests and eggs to repopulate the swamps); local hunters must agree to no longer set baited hooks next to nests to catch (and kill!) breeding females; and, enforcement of a total ban on burning of the grassland - prime crocodile nesting habitat - during the dry seasons. Interestingly, Manolis (1995a, b) suggested that landowners had already recognised the benefits of not killing breeding females or collecting eggs for consumption, soon after the first harvests had begun.

For the Conservation and Environment Protection Authority (CEPA; formerly DEC) to more easily monitor the long-term impacts of the egg harvests on the wild crocodile populations, it was further agreed that the area covered would be restricted within the boundaries of the bi-annual aerial nest count surveys. SWMI would also conduct spotlight surveys after each breeding season (ie during dry season, in July, when water levels in the Sepik River and adjacent swamps are at their lowest, and when young crocodiles are congregating in the remaining waterways).

Over the years, SWMI has been technically and financially supported by several grants from WWF, UNDP/Global Environment Facility Small Grants Programme, Help Resources, University of Papua New Guinea, and of course, MHL Crocodile Farm.

In recognition of its positive impact on the sustainable crocodile management program and the economic development of rural communities in the Middle Sepik River, SWMI was a finalist for the Equator Initiative Prize Award organized by the UNDP in 2006 (see UNDP 2012).

Financial benefits to landowners

The first "commercial" egg harvest occurred in February 2002. At that time, there was no mobile phone network in PNG, and so all pre- and post-harvest logistics had to be organized either via landline or the local network of "missionaries' radio airwaves". Most of the villagers living in the remote wetlands were, of course, totally out-of-reach and therefore completely unprepared for the sudden arrival of the harvesting team.

Because of the remoteness and poor accessibility of the Sepik River, MHL had to organize the logistics for the harvest by airfreighting all the necessary camping gear, food supplies and packaging materials from Lae to Ambunti. From there, the harvest team comprising MHL senior employees as well as SWMI members assisted by Jack Cox, travelled up the Sepik River in a motorized canoe. They visited 12 villages (situated between Mowi - at the top end of the harvest area - down to Wagu Lake near Ambutni) and harvested 3465 viable eggs from 78 nests. Each viable egg was purchased for PGK6.00. A total of PGK20,907 (~$US5505) was paid to the 45 local suppliers.

Over the years, the numbers of eggs, participating villages and suppliers has gradually increased to reach a peak of 15,060 eggs harvested (304 nests, 27 villages and 118 suppliers) in 2013. The price paid per viable egg has also increased

significantly over time. While in 2003 MHL Crocodile Farm paid PGK7.00 per egg (~$US1.86), by 2023 this amount had gone to PGK20.00 (~$US5.50) per egg.

Since that first harvest in 2002, more than PGK2,627,000 has been disbursed amongst local landowners (Table 1). It should be noted that this amount does not include the expenses incurred for local labor (eg members of SWMI, boat skipper, clerks, local carriers, etc.), hire of canoes and outboard motors, purchase of fuel, accommodation in the villages - which represent another substantial source of income to the local economy.

As many local suppliers living in the remote wetlands had no access to the banking system, all payments had to be made in cash. Consequently, until 2021, MHL had to organize a special "payout" trip after the harvest. This second trip became not only very expensive (chartering a Kodiak airplane costing at least PGK20,000 per trip plus hire of canoes and outboard motor, purchase of fuel at Ambunti station, hiring of armed security guards, etc.), but is more critically a life-threatening hazard because of the endemic "law and order problems" affecting PNG.

Starting in the mid-2000s, the payout crew even ended up being escorted by armed policemen and security guards. After the mobile phone network extended its coverage beyond Ambunti station, the situation became a lot more concerning. For instance, in 2015 more than PGK150,000 (~$US53,000) was disbursed in cash from Kaminimbit village all the way to the remote May River. As PNG is still a developing country, travelling to these isolated areas is always very risky. There are no nationwide mobile emergency medical services or "SOS rescue" squads on stand-by and most of the rural aid-posts are either left unstaffed or always out-of-stock for the most basic medical supplies.

Figure 8. Sepik River Crocodile & Arts Festival. Photographs: Jerry Wana, SWMI.

In November 2016, prior to the pre-harvest awareness trip with SWMI, MHL Crocodile Farm decided to trial a special price of PGK15.00 per egg if the money was deposited into a bank account (versus PGK13.00 if by cash) as an incentive to encourage more of the regular suppliers to go cashless. By 2019, those prices were further increased to PGK20.00 and PGK16.00, respectively. This decision coincided with the increased popularity of the annual Sepik River Crocodile & Arts Festival, a cultural event held annually in Ambunti (Fig. 8), during which villagers are encouraged to display their traditional culture and traditions, particularly their ancestral beliefs and close relationship with crocodiles.

Members of SWMI also take this opportunity to "mock" demonstrate the harvest of wild crocodile eggs and explain how it benefits local communities as well as the protection of their wetlands. As the organizing committee of the festival has convinced more and more private sponsors to participate, it has also become an opportunity for several organizations to set up a "tent" for promoting their products and services. Amongst the most visited entities, a couple of banks and mobile phone networks (mobile banking) have been actively recruiting new customers.

During the 2023 egg harvest, MHL Crocodile Farm and SWMI therefore decided to only purchase wild eggs from suppliers who either had an active personal bank account or alternatively agreed to have the money deposited in a third party's account.

Unfortunately, due to adverse dry weather conditions in February 2023, the water levels in the Sepik River were unusually low, and prevented the local "croc egg harvesters" from safely reaching most of the nests. Together with some logistical constraints (none of the villages situated at the "top end" of the harvest were visited), the number of regular suppliers was significantly affected, with 46 suppliers from 13 villages, and only 5296 eggs harvested.

In 2024, MHL Crocodile Farm and SWMI managed to harvest almost 8900 fertile eggs (174 nests) from 19 villages and 87 suppliers (Fig. 9).

Challenges and future outlook

Around 2015-2016, when some animal welfare groups suddenly focused their attention on the use of exotic leathers and the welfare of animals raised in commercial farms, many crocodile farms experienced a drastic drop in demand for their skins. Additionally, to protect their reputation, quite a few key players in the luxury fashion industry decided to monitor the origin of their raw materials more closely. Farms based on captive breeding of CITES Appendix-I crocodilian species, and those farms that were unable to comply with the minimum best practices standards set by their customers, were the most affected.

The immediate chain reaction was an oversupply of skins sold at discounted prices flooding the global market. This sudden surge in the supply chain in turn inflicted more collateral damage on the already depressed market for wild crocodile skins exported from PNG, that already suffered from low prices being paid, ever-stricter skin grading standards imposed by tanneries, and the very high costs for domestic and international freight. MHL now remains the only active buyer and exporter of wild crocodile skins in PNG (E. Langelet, pers. comm., 2024)

As indicated in Table 1, the number of wild eggs purchased

Figure 9. Harvesting and transporting wild Saltwater crocodile eggs in the Middle Sepik River, February 2024.

by the farm regularly remained above 10,000 from 2004 until 2018 (the drop recorded in 2016 was due to a long drought that limited access to nests). However, because of the current economic conjuncture, it has become very important for MHL Crocodile Farm to carefully control the number of animals raised in their pens by setting up strict quotas and logistical conditions for the number of wild eggs harvested in the Middle Sepik River.

As a certified member of the International Crocodilian Farmers Association (ICFA 2024), the farm not only needs to comply with strict standards for good operating practices (eg animal health and welfare, housing, environment and traceability), but very importantly, it must also meet their customers' ever higher expectations regarding the quality of skins produced.

All these challenges, combined with the impact of climate change on the environment (eg more frequent and longer droughts periods, spread of invasive species) and the socio-economic evolution (eg development of mining and forestry projects) already affecting the Sepik River, are putting more pressure to find new solutions for the long-term sustainable use of crocodiles in PNG remaining economically viable for all the stakeholders.

In this regard, in May 2020, under a project funded by the South Pacific Regional Environment Program (SPREP), CEPA invited various stakeholders for a 2-day workshop to review and amend the current *Crocodile Trade Protection Act 1974* as well as presenting a draft Crocodile Management Plan 2021-2024. The draft document for the proposed Crocodile Trade (Protection) Regulations 2021was circulated amongst the participants and is now waiting for the National Parliament to be officially enacted.

Conclusions

In the mid-1970s, despite the challenging geographical remoteness of crocodile habitats in PNG, the underdeveloped land transport infrastructure, the high cost of air and sea transport, the lack of reliable telecommunications network, DEC wildlife officers still managed to successfully implement a unique sustainable use program for crocodile populations in PNG. It is a management program that has been acclaimed internationally in terms of wildlife conservation and rural community development.

In 2001, with the help of the late Jack Cox, a new approach of "grassroots" biodiversity conservation project was trialled in the Middle Sepik River. After 12 years of harvesting wild *C. porosus* eggs in collaboration with SWMI, we can confidently claim that this community-driven strategy has proven to be still enthusiastically supported amongst the local resource owners.

Unfortunately, this success story is now facing some potentially serious threats. Many of them beyond the direct control of the concerned stakeholders. Some of those pressing issues are:

- Human population growth encroaching on the wetlands, causing a loss of natural habitats and biodiversity.
- Environmental pollution and physical disturbances (eg regular traffic of barges along the waterways) created by new agroforestry (logging) and mining projects.
- The global economic downturn and large inventory of crocodile skins in warehouses of tanneries and leather goods manufacturers are putting further downward pressure on prices paid for skins and enticing buyers to apply more stringent skin grading standards. The current worldwide inflation is equally driving the cost of production and transport to higher levels.
- Some well-funded animal rights groups are actively engaging in negative public campaigns, trying to dissuade luxury brands from using exotic leathers in their products. Many of those extremist groups are totally rejecting the idea that well managed sustainable use programs have a

direct positive impact on the conservation and protection of wildlife and the economic development of many rural communities living in the wetlands (Note: to counteract this smear campaign and proving that crocodile farming and ranching are not synonymous with "animal cruelty", the industry has adopted stringent Good Operating Practices standards based on the latest technical knowledges and practices supported by scientific research).

- Chronic lack of financial and manpower capacity for CEPA wildlife officers to conduct monitoring and enforcement duties. The continuous decline of the PNG crocodile industry, experienced since the mid-2000s, has triggered a sharp decline of their operational revenues collected through the Crocodile Management Levy.

Under this fast-changing socio-economic environment, it is imperative for all the stakeholders to find new pragmatic solutions not only meeting the expectations of the landowners, who understandably aspire to improve their living standards - sometime by trying to make some quick-bucks by inviting foreign owned logging companies to clear-cut their virgin forest - but also for assuring the survival of the "pukpuk" (crocodile), a symbolic inhabitant of the Sepik River that has survived millions of years.

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East and Southeast Asia

Thailand

BUENG BORAPHET: A CRITICAL SITE FOR SIAMESE CROCODILE CONSERVATION IN THAILAND. The Siamese crocodile (*Crocodylus siamensis*) occurs, or formerly occurred, in freshwater wetlands throughout much of mainland Southeast Asia (Thailand, Laos, Cambodia, Vietnam) and the Sundaic islands of Java and Borneo (Platt *et al*. 2019). Over the past 50-70 years, wild *C. siamensis* populations have precipitously declined in the wake of illegal hunting for skins and meat, opportunistic killing because of perceived threats to humans and livestock, government-sponsored extermination programs, habitat loss, and over-collecting to stock commercial crocodile farms (Platt *et al*. 2019). Fewer than 1000 adult *C. siamensis* now survive in the wild, and most populations are small, fragmented, and of questionable viability (Platt *et al*. 2019). Moreover, the genetic integrity of the burgeoning captive population is potentially compromised by hybridization with Saltwater crocodiles (*C. porosus*) and to a lesser extent Cuban crocodiles (*C. rhombifer*) (Fitzsimmons *et al*. 2002; Starr *et al*. 2009; Lepbenjakul *et al*. 2017). Consequently, *C. siamensis* is now considered one of the most critically endangered crocodilians in the world (Platt *et al*. 2019).

In Thailand, *C. siamensis* was historically abundant and widely distributed in lowland regions (Taylor 1970), but most populations were extirpated as a result of direct persecution, habitat loss, and most importantly, collecting to stock crocodile farms (Platt *et al*. 2019). As in other range states, the few remaining wild *C. siamensis* populations in Thailand are small, of doubtful demographic and genetic viability, and persist in marginal habitats (Platt *et al*. 2019). Owing to its precarious conservation status, *C. siamensis* is now afforded legal protection as a critically endangered species under Thai law (Ratanakorn *et al*. 2021). The recovery of ecologically relevant populations of *C. siamensis* in Thailand is dependent on: 1) basic research to better understand various life history traits of this poorly-known crocodilian; 2) social science studies that facilitate a participatory conservation approach with local communities; and most critically, 3) reintroduction of genetically-pure crocodiles into appropriate habitats within the national protected area system (Platt *et al*. 2019; Ratanakorn *et al*. 2021).

To briefly summarize the conservation status of *C. siamensis* in Thailand, surveys conducted the 1990s found one or two adult crocodiles inhabiting Khao Ang Rue Nai Wildlife Sanctuary (KARNWS), a crocodile carcass was recovered in Yod Dome Wildlife Sanctuary, and crocodile tracks and dragmarks were observed in Phu Khieo Wildlife Sanctuary (Kreetiyutanont 1993; Ratanakorn *et al*. 1994; Platt *et al*. 2002). More recent follow-up work in KARNWS concluded that only a single large adult crocodile remains in the sanctuary (Chitchamnong *et al*. 2016). In 2002, a hatchling crocodile was discovered at Pang Sida National Park (PSNP), suggesting the existence of a small breeding population (Temsiripong 2007). Shortly thereafter (2005 and 2006), a reintroduction project initiated by the Royal Thai Forest Service and the Crocodile Management Association of Thailand released 20 crocodiles at PSNP, although subsequent monitoring by ranger patrols and camera trapping detected few of the reintroduced animals (Temsiripong 2007). The occurrence of *C. siamensis* in Kaeng Krachan National Park (KKNP) was first confirmed in 2001 (Platt *et al*. 2002) and subsequent studies determined at least four adult crocodiles inhabit the Phetchaburi River (Kanwatanakid-Savini *et al*. 2012; Chanpradub *et al*. 2023). However, successful reproduction (defined as nests that produce at least one hatchling; eg Platt *et al*. 2008) is not occurring at KKNP and the few nests found to date (<1 nest/year) contained only non-viable eggs (Kanwatanakid-Savini *et al*. 2012; Chanpradub *et al*. 2023).

As late as the 1970s, as many as 200 *C. siamensis* were thought to inhabit the wetlands of Bueng Boraphet (Groombridge 1982). However, this population was reportedly extirpated by illegal collecting, deliberate destruction of nests and eggs, and accidental drowning in fishing nets (Groombridge 1982; Platt *et al*. 2002). Van Dijk (1999) recognized the value of Bueng Boraphet as a potential reintroduction site for *C. siamensis* pending the successful mitigation of these threats. More recently, Ratanakorn *et al*. (2021) conducted a series of spotlight counts (Bayliss 1987) during 2017-2018 and observed 45 crocodiles along 38 kilometres of transects (encounter rate= 1.2 crocodiles/km of survey route). Based on these surveys, Ratanakorn *et al*. (2021) estimated a population of 17-37 *C. siamensis* (all size-classes) in the Bueng Boraphet wetlands.

Bueng Boraphet (15°41'N; 100°15'E) encompasses 224 km^2 of wetlands in Nakhon Sawan Province near the confluence of the Nan and Ping Rivers (Fig. 1). As such, Bueng Boraphet is considered the largest freshwater wetland in the Chao Praya River basin of central Thailand. The climate of this region is characterized as tropical monsoonal with a pronounced wet season (May-October) followed by a lengthy dry season (November through mid-May). Rainfall at Bueng Boraphet averages 1240 mm/year, most of which falls during the wet season (Chaichana and Choowaew 2013; Haq *et al*. 2017). Water depth in the wetlands is variable, depends on seasonal

rainfall, and averages 1.8 ± 0.7 m (Chaichana and Choowaew 2013; Haq *et al*. 2017).

Figure 1. Heavily vegetated wetlands in the Bueng Boraphet Non-hunting Area, Nakhon Sawan Province, Thailand. These wetlands are excellent habitat for Siamese crocodiles and represent an extremely important site for the future reintroduction of this critically endangered species.

King Rama VII developed the Bueng Boraphet wetlands in 1927 by flooding an extensive riverine swamp forest after constructing a series of dams, canals, embankments, and weirs to create spawning habitat and enhance local fisheries production (Chaichana and Choowaew 2013; Haq *et al*. 2017). In 1937, Bueng Boraphet was designated a Conservation Zone to forestall human settlement of the area (Haq *et al*. 2017), and in 1975, 106 km^2 of wetlands was declared a non-hunting area to protect the only known population of White-eyed River Martin (*Pseudochelidon sirintarae*), which is now believed to be extinct. Despite the designation of Bueng Boraphet as a Conservation Zone, by 2015 there were 31 villages (>32,000 people in 5000 households) surrounding the wetlands (Haq *et al*. 2017; Ratanakorn *et al*. 2021). Bueng Boraphet is important to local livelihoods as a source of fish, water for irrigation, and income from nature-based tourism. Furthermore, the Bueng Boraphet wetlands are considered critical habitat for resident and migratory birds and the area has been proposed as a Ramsar Site (Haq *et al*. 2017). However, as Haq *et al*. (2017) point out, Bueng Boraphet has never been specifically managed for wildlife conservation.

We conducted a rapid fact-finding mission to investigate the conservation status of *C. siamensis* in the Bueng Boraphet Non-hunting Area (BBNHA) on 23-24 December 2024. During this visit, we searched for crocodiles on foot and by boat in wetlands near the park headquarters and research station on the afternoon of 23 December and again on the morning of 24 December, and conducted a boat-borne nocturnal search for crocodiles on the night of 23 December (2100-2300 h) using handheld spotlights. Additionally, we interviewed government staff charged with managing the BBNHA and queried them about the current status of *C. siamensis*, origin and history of this population, and crocodile nesting and reproduction.

During our visit we encountered three adult *C. siamensis* with estimated total lengths (TL) of 2.3 m, 2.7 m and 3.0 m in the wetlands near the park headquarters (Fig. 2). These crocodiles are well-known to tour boat operators, habituated to humans, and each has been given a Thai name. These large adult crocodiles are easily approached and are therefore frequently photographed by tourists. The largest crocodile (most likely a male) is readily identified by cranial discoloration and scarring. We also observed two juvenile crocodiles with estimated TLs of 90 cm and 50 cm; the first was seen basking in a pond near the visitor center (Fig. 3), while the second was encountered in a canal near the research station during our spotlight survey. In addition to juvenile and adult crocodiles, we found what appeared to be an old nest mound on a canal bank and adjacent to a frequently used basking site (Fig. 4). The nest mound was positioned at the base of an *Acacia* tree on top of the canal bank (ca. 1.0 m above water-level of canal), measured ca. 1.0 m across × 0.4 m high, and consisted of clay soil with little organic matter (eg woody debris, vegetation, etc.). Given the physical condition of the mound, we assume the structure dated to the most recent nesting season (May-September 2024; for discussion of *C. siamensis* nesting phenology in Thailand, see Kanwatanakid-Savini *et al*. 2012).

According to Jiradej Boonmak (Superintendent of BBNHA and Director of Wildlife Conservation Division, Protected Area Regional Office 12), an estimated 28-35 non-hatchling crocodiles currently inhabit the Bueng Boraphet wetlands. The largest crocodile is the suspected male with distinctive cranial discoloration we observed near the visitor center. In 2021, this crocodile escaped from a nearby Buddhist temple and appeared shortly thereafter at BBNHA. Based on records maintained by the temple, the estimated age of this crocodile is 28-32 years-old. At least 11 other crocodiles are known to have been released into BBNHA, the most recent being in 2016. Most of these unauthorized translocations are attributed to the Buddhist practice of "merit release", whereby captive animals are liberated by a person in hopes of gaining karmic merit (Shiu and Stokes 2008). Because these translocated crocodiles almost certainly originated from commercial crocodile farms, the possibility that hybrid individuals were inadvertently released into the wild cannot be ruled out. That said, the risk of genetic contamination is probably minimal given the low levels of hybridization reported among captive stocks of *C. siamensis* in Thailand (Lepbenjakul *et al*. 2017).

To date, nesting has been confirmed on five occasions (one nest per annum) in BBNHA. No offspring were produced during the two initial attempts, as both clutches consisted of non-viable eggs, possibly because these females were young and reproducing for the first time (eg Platt *et al*. 2024b). The three subsequent attempts proved successful and a total of 19 hatchlings were counted in the vicinity of the nests. This must however, be regarded as a conservative estimate of reproductive success because other hatchlings undoubtedly escaped detection in the dense aquatic vegetation surrounding the nests.

In conclusion, the Bueng Boraphet wetlands support what is

Figure 2. One of three adult Siamese crocodiles encountered in the Bueng Boraphet Non-hunting Area during a brief reconnaissance on 23-24 December 2024. These crocodiles are habituated to humans and allow close approach for photography.

Figure 3. Juvenile Siamese crocodile encountered near the visitor center is evidence that successful reproduction is occurring among the crocodiles inhabiting Bueng Boraphet Non-hunting Area.

Figure 4. Old Siamese crocodile nest mound constructed on a canal bank near Bueng Boraphet Research Station. The mound was probably built during the 2024 nesting season (May-July).

without a doubt the largest population of wild *C. siamensis* surviving anywhere in Thailand. Most importantly, this appears to be the only population of *C. siamensis* in Thailand where successful reproduction is consistently occurring. As such, we consider the Bueng Boraphet wetlands to be critical for the long-term recovery of *C. siamensis* in Thailand. Furthermore, given the imperiled status of *C. siamensis* in other range states, Bueng Boraphet must be regarded as a globally significant site for the conservation of this endangered species. Given the large area of available habitat (>22,000 ha), we suggest the Bueng Boraphet wetlands could eventually host a population of 1000-2000 wild *C. siamensis*. In accordance with Ratanakorn *et al*. (2017), we recommend that rigorous monitoring of the *C. siamensis* population be initiated in the Bueng Boraphet wetlands. However, rather than using nocturnal spotlight surveys which are ill-suited for densely vegetated wetlands (Bezuijen*et al*. 2013; Platt *et al*. 2014), we recommend that annual nest counts be employed to monitor population trends. Nest counts are a valuable tool in crocodilian managements programs that have been successfully used to monitor populations of both hole- and mound-nesting species (reviewed by Platt 2021). Trends in nest count data provide a statistically rigorous means to assess the numerical response of populations over time (eg McNease *et al*. 1994). Furthermore, if the proportional representation of sexually mature females in the population can be determined, nest counts are also useful for estimating population size (Nichols 1987; Webb *et al*. 1989).

To this end, we recommend using fixed-wing or rotary unmanned aerial vehicles (UAVs or drones) to conduct annual surveys of crocodile nests in the Bueng Boraphet wetlands (Elsey and Trosclair 2016; Scarpa and Piña 2019; Platt *et al*. 2023). Crocodilian mound nests are conspicuous at low altitudes and should be easily detected in the open wetlands that characterize Bueng Boraphet. Based on our experience in Laos, rotary UAVs are preferable to fixed-wing models because the former can be operated at low altitudes and most importantly, are more maneuverable, allowing close inspection of suspected nest mounds (Platt *et al*. 2023). Given what is currently known about the reproductive phenology of *C. siamensis* in Thailand (Kanwatanakid-Savini *et al*. 2012), aerial nest surveys are best undertaken in late June or early July. Postponing surveys until later in the wet season increases the likelihood that nests may go undetected if submerged by monsoonal floodwaters.

Lastly, we follow Ratanakorn *et al*. (2017) and recommend the existing population of *C. siamensis* in Bueng Boraphet be augmented by the release of head-started crocodiles. Although an increase in the Bueng Boraphet crocodile population can be expected given that nesting is now occurring each year, augmentation with head-started animals will increase the recovery trajectory, and by doing so, decrease the vulnerability of the recovering population to stochastic events. Based on our experience in Laos (Platt *et al*. 2024a), we recommend releasing head-started juvenile crocodiles (TL ca. 100 cm) rather than adults, which tend to move widely upon release and could come into conflict with resident adults, disrupting local dominance hierarchies.

Crucially, those crocodiles selected for release should be: 1) genetically screened to ensure only pure *C. siamensis* are entering the wild (Lepbenjakul *et al*. 2017); and, 2) given a health examination by a qualified veterinarian to minimize the chances of introducing pathogens into the existing wild population (Calle *et al*. 2021).

Based on our experience successfully translocating *C. siamensis* in Laos, we suggest using a "soft-release" strategy to ease the transition of head-started crocodiles from captivity into the wild (Platt *et al*. 2024a). Soft-release strategies involve the temporary confinement of animals in enclosures at the release site, a practice designed to familiarize animals with local habitats, curtail post-release wandering, and increase the chances that stable territories will be established (Letty *et al*. 2007; Knox and Monk 2014). Although crocodilian-specific data appear lacking in the peer-reviewed scientific literature, pre-release confinement has been demonstrated to dramatically increase site fidelity among other translocated reptiles (Knox and Monk 2014; McCoy *et al*. 2014). In Laos, we typically place head-started crocodiles into temporary acclimation pens (constructed of bamboo and netting) during the late dry season (March) where they remain until the onset of the monsoonal rains (late May to June) before being liberated. Additional information on the soft-release process used for *C. siamensis* is provided by Platt *et al*. (2024).

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Steven G. Platt[1] and Manoon Pliosungnoen[2]: *[1]Wildlife Conservation Society-Cambodia Program, #21, Street 21, Tonle Bassac, Chamkarmon, Phnom Penh, Cambodia (splatt@wcs.org); [2]Wildlife Conservation Society-Thailand Program, 55/297 Muang Thong Thani Project 5, Bangphud, Pakkred, Nonthaburi, Thailand 11120 (mpliosungnoen@wcs.org).*

North America

USA

6TH PALMETTO ALLIGATOR RESEARCH AND MANAGEMENT SYMPOSIUM: NEW VENUE, RECORD TURNOUT. After the first five meetings were held at the Clemson University Baruch Institute of Coastal Ecology and Forest Science in Georgetown, South Carolina (2016-2023), the 6th Palmetto Alligator Research and Management Symposium (PARMS) convened at a new venue in March 2025, the Savannah River Ecology Laboratory (SREL) Conference Center near Aiken, South Carolina. The change in venue did nothing to dampen attendance, with the meeting attracting more than 90 people representing 11 US states, two countries, and a diversity of stakeholder interests. The conference center provided first-class facilities in a relaxed, bucolic setting, and we enjoyed the largest PARMS turnout to date (Fig. 1), with over 30 presentations on crocodilian research and management.

On the afternoon of Day 1 (27 March), the meeting was kicked off with a welcome from Dr. Gene Rhodes, Director of SREL, followed by five presentations on alligator biology and management and a Q & A session with legendary SREL herpetologist Dr. Whit Gibbons and and crocodilian biologist Dr. Lehr Brisbin (Fig. 2). The day concluded with a thrilling and entertaining keynote presentation by Dr. Steven Platt entitled "From Louisiana to Laos (and a few places in between): four decades of crocodilian research and conservation". In his talk, Steve regaled the crowd with stories of his days as an undergraduate and graduate student working with crocodilian greats Bob Chabreck (Louisiana), Grahame Webb (Australia) and John Thorbjarnarson (Belize), and his career thereafter as a professional crocodilian biologist in Central America, China, and throughout Southeast Asia. Following the keynote presentation, attendees adjourned for dinner at The Alley in downtown Aiken.

On Day 2 (28 March), 17 speakers presented talks on crocodilian biology and management, with an emphasis on American alligators but also other species including American crocodiles, Spectacled caiman and Indian Gharials. Topics included crocodilian diet, growth, morphometrics and colouration, physiology, stress, movement, habitat use, temperature-dependent sex determination, endocrinology, evolution, genetics, survival, aging, ecotoxicology, survey methodology, ranching and interactions with humans. The oral presentations were followed by a poster social where undergraduate and graduate students, agency biologists, and other professionals shared their research over refreshments in a relaxed atmosphere. In addition to the topics covered in oral presentations, posters also featured research on crocodilian osmoregulation, parasitism, predation, mortality, tag retention and behaviour (Fig. 3).

Figure 1. Majority of the PARMS 2025 attendees. Photograph: Travis DeVault.

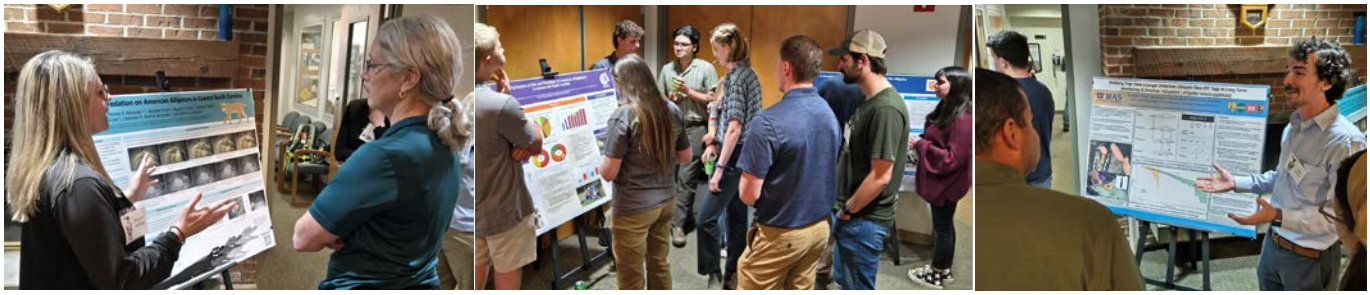

Figure 3. Students share their research during the the poster social. Photographs: Thomas Rainwater.

Figure 2. Whit Gibbons (top left) and Steve Platt (top right) and Jeff Lang (bottom left) and Lehr Brisbin (bottom right) catch up during a break. Photographs: Thomas Rainwater, and Gretchen Lang.

Figure 6. Alicia Wassmer shows off an impressive alligator carving she won during the silent auction. This large, three-piece work of art was generously donated by Lehr Brisbin. Photograph: Thomas Rainwater.

Figure 4. Top (from left): Ben Parrott, Mark Merchant and Chris Murray. Bottom: Thomas Rainwater (left) and Allan "Woody" Woodward (right). Photographs: Gretchen Lang and Miriam Boucher.

Figure 5. Masterpiece. Photograph: Thomas Rainwater.

Following the poster social, the meeting concluded with dinner, fellowship, and revelry where PARMS attendees enjoyed the early spring weather, music, sunset through the surrounding pine forest, an authentic Louisiana crawfish boil (Fig. 5) by Chris Murray (with close consultation by George Melancon and Mark Merchant), and a main course of smoked beef brisket, barbequed chicken, pulled pork, macaroni and cheese, baked beans, seasoned green beans, and lemon herb potatoes. The celebration of another successful meeting, reunion of friends and colleagues (Fig. 4), and the eager anticipation of what spring brings (a new field season!) carried on deep into the evening.

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FAMLIY, FRIENDS, AND COLLEAGUES CONVENE AT LOUIS GUILLETTE, JR. 10-YEAR MEMORIAL SYMPOSIUM. On 14-15 March 2025, over 70 people from four countries convened at the University of Florida (Gainesville, Florida, USA), to honour and remember Dr. Louis J. Guillette, Jr. ("Lou"), 10 years after his passing in 2015 (Fig. 1). Lou was a highly productive and impactful scientist and legendary mentor whose accomplishments have been described in detail elsewhere (Edwards *et al*. 2015; Heindel *et al*. 2015; Helbing *et al*. 2015; Iguchi 2015; Martinot 2015; Brazell 2015; Rainwater *et al*. 2015; Tyler 2015). From a crocodilian perspective, Lou is most recognized for identifying endocrine disruption in American alligators and linking this ground-breaking research to consequences on human health (Helbing *et al*. 2015). He also made significant contributions to the fields of alligator reproductive biology and ecotoxicology. Most importantly, Lou was a loving and devoted husband, father, and friend.

Figure 1. Dr. Louis J. Guillette, Jr. (1954-2015). Photograph: Guillette Lab.

The two-day symposium allowed family, friends, and colleagues, including several current and former CSG members, to reconnect and celebrate Lou's science and mentoring legacy. The number and diversity of symposium attendees, as well as the science and stories shared, 10 years after his passing were a testament to Lou's professional and personal impact.

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Recent Publications

Ajji M., J. and Lang, J.W. (2025). Gharial acoustic signaling: Novel underwater pops are temporally based, context-dependent, seasonally stable, male-specific, and individually distinctive. Journal of Anatomy (doi: 10.1111/joa.14171).

Abstract: Gharials (*Gavialis gangeticus*) produce a sudden, high amplitude, pulsatile, underwater sound called a POP. In this study, gharial POPs ranged from 9 to 55 ms, and were clearly audible on land and water, at ≥500 m. POPs were only performed underwater by adult males possessing a sex-specific, cartilaginous narial excrescence, termed the ghara. We recorded 130 POP events of seven wild adult males in 115 km stretch of the Chambal River during 2017-2019, using hydrophones and aerial mics. A POP event occurs when a male produces a single or double or triple POP, each with a specific duration and timing. A POP event was incorporated into a

complex, multi-modal breathing display, typically performed by each male during the breeding season. Key features of this novel gharial POP signal are documented here for the first time. These include its incorporation into a complex breathing display, its reliance on temporal rather than spectral elements, its dependence on a specific social context, its stability within an individual, and its individually distinctive patterning specific to a particular male. The breathing display consisted of sub-audible vibrations (SAV) preceding each POP, then a stereotyped exhalation-inhalation-exhalation sequence, concluding with bubbling and submergence. In our study, 96% of the variation in POP signal parameters was explained by POP signal timings (92%) and number of POPs (4%), and only 2% was related to spectral features. Each POP event was performed in a specific social setting. Two behavioral contexts were examined: ALERT and PATROL. In each context, male identities were examined using Discriminant Function Analysis (DFA). Within each context, each of the seven males exhibited distinctive POP patterns that were context-specific and denoted a male's identity and his location. POP signal features were stable for individual males, from 1 year to the next. Overall, the seven males showed POP patterns that were individually specific, with minimal overlap amongst males, yet these were remarkably diverse. The stereotypy of POP patterns, based on temporal versus frequency difference was best characterized statistically using DFA metrics, rather than Beecher's Information Statistic, MANOVA, or Discriminant Score computations. Our field observations indicated that audiences of gharial, located nearby, and/or in the distance, responded immediately to POPs by orienting in the signal direction. Extensive auditory studies of crocodylians indicate that their capacity for auditory temporal discrimination and neural processing in relation to locating a sound target is on par with that of birds. How the POP sound is produced and broadcast loudly in both water and air has received little study to date. We briefly summarize existing reports on ghara anatomy, ontogeny, and paleontology. Finally, preliminary observations made in a clear underwater zoo enclosure indicate that jaw claps performed entirely underwater produce POP sounds. Simultaneous bubble clouds emanating from the base of the ghara are suggestive of cavitation phenomena associated with loud high volume sounds such as shrimp snaps and seal/walrus claps. We discuss the likelihood that the adult male's ghara plays an essential role in the production of the non-vocal underwater POP, a sexually dimorphic acoustic signal unique to gharial.

Fachini, T.S., Godoy, P.L., Montefeltro, F.C. and Langer, M.C. (2025). Cranial morphology and phylogenetic reassessment of *Barreirosuchus franciscoi* (Crocodylomorpha, Notosuchia), a Peirosauria from the Late Cretaceous of Brazil. Anatomical Record 308(2): 736-769.

Abstract: With nearly 30 living species of relatively similar ecological traits, Crocodylomorpha is represented today by only a small fraction of its past diversity. The well-documented crocodylomorph fossil record has revealed more than 500 taxa, with much higher ecological and morphological diversity than their extant counterparts. An example of such astonishing diversity is the Late Cretaceous rocks of the Bauru Group (southeast Brazil), from which numerous taxa are known, belonging to the clade Notosuchia. These were predominantly terrestrial taxa, some of which exhibited traits associated with omnivorous or even herbivorous feeding behaviors, such as Sphagesauridae, whereas others were adapted to a carnivore diet, such as Baurusuchidae and Peirosauridae. Among these is *Barreirosuchus franciscoi*, originally described as a neosuchian (Trematochampsidae) but later interpreted as a peirosaurid notosuchian. Even though included in recent morphological and phylogenetic analyses, *B. franciscoi* still lacked a more detailed description. Here, we provide an in-depth description of the cranial elements of *B. franciscoi*, using data from computed tomography and a broad sample of comparative material, including living and fossil crocodylomorphs. Also, the neuro-cavities, including the endocast, nasopharyngeal duct, and the olfactory region, were digitally reconstructed. Finally, a new phylogenetic analysis recovered *B. franciscoi* nested within Peirosauria, forming the Itasuchidae clade with other potentially semiaquatic species: *Rukwasuchus yajabalajekundu*, *Pepesuchus deiseae*, and *Itasuchus jesuinoi*. The morphological and phylogenetic reassessment of *B. franciscoi* indicates a semiaquatic form, highlighting the ecological diversity of notosuchians from the Bauru Group as well as the capacity of notosuchians to explore a myriad of environments.

Scavezzoni, I., Johnson, M.M., Jouve, S. and Fischer, V. (2025). Functional and phylogenetic signals in the pectoral girdle of Thalattosuchia and Dyrosauridae (Crocodylomorpha). Anatomical Record 308(2): 412-573.

Abstract: Crocodylomorphs have colonized various environments from fully terrestrial to fully aquatic, making it an important clade among archosaurs. A remarkable example of the rich past diversity of Crocodylomorpha Hay, 1930 is the marine colonization undergone by several crocodylomorph lineages, particularly Thalattosuchia Fraas, 1901 during the Early Jurassic-Early Cretaceous, and Dyrosauridae de Stefano, 1903 during the Late Cretaceous-Early Eocene. Thalattosuchia represents the most impressive and singular marine radiation among Crocodylomorpha, occupying various ecological niches, before enigmatically disappearing in the Cretaceous. Dyrosauridae, on the other hand, is known for surviving the end-Cretaceous mass extinction in abundance but subsequently vanished. The evolutionary path undertaken by crocodylomorphs into the aquatic environments and the reasons for their disappearance outside marine extinction events during the Mesozoic remains a mystery. Despite a well-preserved fossil record, attention has primarily centered on craniodental adaptations, overlooking the swimming-related adaptations recorded in the postcranial skeleton. This research primarily involves a comprehensive examination of the pectoral girdle of the most representative members of Thalattosuchia and Dyrosauridae, highlighting their evolutionary trajectories over time. Additionally, this work aims to test the phylogenetic signal residing in the postcranial anatomy of Crocodylomorpha. As such, the most recent and complete Crocodylomorpha phylogenetic dataset has been repurposed: 42 new postcranial characters have been added and several others have been revised to address our phylogenetic question. We stress that postcranial anatomy constitutes an important tool supply to better understand the relations of extinct crocodyliforms, but also offers insights on their development, ecology, and biomechanics.

Beale, D.J., Nguyen, N., Dyall, T., van de Kamp, J., Bissett, A., Hewitt, L. and Small, A. (2025). Use of fecal microbiome to understand the impact of housing conditions on metabolic stress responses in farmed saltwater crocodiles (*Crocodylus porosus*). Frontiers in Veterinary Science 12: 1496946 (doi: 10.3389/fvets.2025.1496946).

Abstract: Understanding the impact of housing conditions on the stress responses in farmed saltwater crocodiles (*Crocodylus porosus*) is crucial for optimizing welfare and management practices. This study employed a multi-omics methodology, combining targeted and untargeted LC-MS for metabolite, lipid, and hormone profiling with 16S rRNA gene sequencing for microbiome analysis, to compare stress responses and changes in faecal samples of crocodiles housed in single versus group pens. Metabolic responses to a startle test were evaluated through multivariate analysis, and changes post-stress were examined. A total of 564 metabolic features were identified. Of these, 15 metabolites were linked to the cortisol biosynthesis pathway. Metabolite origin analysis showed that 128 metabolites originated from the host, 151 from the microbiota, and 400 remained unmatched. No significant differences in faecal corticosterone levels were observed between single and group pens. However, metabolic profiling revealed distinct differences in stress responses: single pen crocodiles exhibited downregulation of certain compounds and upregulation of others, affecting pyrimidine and purine metabolism pathways when compared to grouped pen crocodiles, linked to

altering energy associated induced stress. Additionally, faecal microbiome analysis indicated increased Firmicutes:Bacteroides (F:B) ratio in group-housed animals, suggesting greater stress. The study highlights that while traditional stress indicators like corticosterone levels may not differ significantly between housing conditions, metabolic and microbiome analyses provide deeper insights into stress responses. Single pens are associated with less metabolic disruption and potentially better health outcomes compared to group pens. These findings underscore the value of faecal microbiome and metabolomics in assessing animal welfare in farmed crocodiles.

Zhang, M., Luo, J., Luo, C., Zang, Y., Zeng, Y., Guo, H. and Xu, Y. (2024). Exploration of antioxidant peptides from crocodile (*Crocodylus siamensis*) meat using modern information technology: Virtual-screening and antioxidant mechanisms. Food Research International (https://doi.org/10.1016/j.foodres.2025.115789).

Abstract: To develop a safe, stable and easily absorbed new antioxidant peptide. The myofibrillar protein hydrolysates of Siamese crocodile meat were prepared and purified, their free radical scavenging and Fe^{2+} chelating ability were determined. The results showed that isolated component 3 of neutral protease hydrolysate (N_3) had the highest antioxidant activity. Subsequently, liquid chromatography-mass spectrometry was applied to appraise the amino acid sequences within the N_3 component, and 8 novel antioxidant peptides were screened by bioinformatics analysis, the antioxidant test proved that all 8 synthetic peptides had certain antioxidant activity. Among them, there was no significant difference in the DPPH radical scavenging capacity of GWDK, LWDK, ERWP, LGWK and LWAK ($P>0.05$), which were higher than that of DFRDY and WYRDD ($P<0.05$), the ABTS radical scavenging ability of DFRDY was similar to WYRDD ($P>0.05$), but remarkably stronger than that of the other 6 peptides ($P<0.05$). Finally, the binding mechanism of 8 novel peptides to Keap1 protein was explored through molecular docking, and it was found that hydrogen bonding and hydrophobic interaction were the primary forces that bind antioxidant peptides to Keap1 protein.

Bezeng, B.S., Ameka, G., Angui, C.M.V., Atuah, L., Azihou, F., Bouchenak-Khelladi, Y., Carlisle, F., Doubi, B.T.S., Gaoue, O.G., Gatarabirwa, W., Gitau, C., Hilton-Taylor, C., Hipkiss, A., Idohou, R., Kaplin, B.A., Kemp, L., Mbawine, J.S., Logah, V., Matiku, P., Ndang'ang'a, P.K., Nana, E.D., Mundi, O.N.N., Owusu, E.H., Rodríguez, J.P., Smit-Robinson, H., Yessoufou, K. and Savolainen, V. (2025). An African perspective to biodiversity conservation in the twenty-first century. Philosophical Transactions Royal Society B 380: 20230443.

Abstract: Africa boasts high biodiversity while also being home to some of the largest and fastest-growing human populations. Although the current environmental footprint of Africa is low compared to other continents, the population of Africa is estimated at around 1.5 billion inhabitants, representing nearly 18% of the world's total population. Consequently, Africa's rich biodiversity is under threat, yet only 19% of the landscape and 17% of the seascape are under any form of protection. To effectively address this issue and align with the Convention on Biological Diversity's ambitious '30 by 30' goal, which seeks to protect 30% of the world's land and oceans by 2030, substantial funding and conservation measures are urgently required. In response to this critical challenge, as scientists and conservationists working in Africa, we propose five recommendations for future directions aimed at enhancing biodiversity conservation for the betterment of African society: (i) accelerate data collection, data sharing and analytics for informed policy and decision-making; (ii) innovate education and capacity building for future generations; (iii) enhance and expand protected areas, ecological networks and foundational legal frameworks; (iv) unlock creative funding channels for cutting-edge conservation initiatives; and (v) integrate indigenous and local knowledge into forward-thinking conservation strategies. By implementing these recommendations, we believe Africa can make significant strides towards preserving its unique biodiversity, while fostering a healthier society, and contributing to global conservation efforts. This article is part of the discussion meeting issue 'Bending the curve towards nature recovery: building on Georgina Mace's legacy for a biodiverse future'.

Okafor, U.P., Allison, C.J., Asadu, G., Eze, E., Asuoha, G.C., Onah, G.N., Ngele, O.K., Ukeachusim, P.C., Ibenwa, C.N., Chukwuma, N.J. and Okwor, C.O. (2025). Influence of Igbo religious practices on conservation of biodiversity in Southeastern Nigeria. GeoJournal 90: Article 23.

Abstract: Religious and cultural practices are common instruments of the Traditional Ecological Knowledge (TEK) system of conservation and management of natural resources in many African societies. The influence of Igbo religious practices on conservation of biodiversity in Southeastern Nigeria has been studied. This research was carried out to investigate the various religious and cultural practices of the Igbo communities of Southeastern Nigeria that are useful in the conservation of biodiversity. A qualitative approach for data collection was adopted. Methodology of the study involves the use of In-dept interview (IDI), Focus Group Discussion (FGD) and site visitation. Findings show that Igbo religious practices are concerned with various plant species that are of great use in traditional religious practices such as nature worship, medicine and ritual purposes. The result from the IDI and FGD identified numerous plant species used in religious and cultural practices in Igbo religion such as Ogirisi tree (*Newboudia laevis*), Ogbu tree (*Ficus* spp.), Akpu tree (*Bombax baenopozense*), Ofo tree (*Detarium senegalense*), Aku inu tree (*Garcinia cola*), Oseoru (*Aframomum melegueta*), Omunkwu (*Elaeis guinensis*) leaf and Cola nut (*Cola nitida*) which are of particular significance in traditional religious practices. Result also indicate that these plant species are revered which help in their conservation in the study area. It was also found that the Igbo people respect traditional biodiversity conservation regulatory measures more than the government laws and policies because they were driven by local traditional institutions. This finding informed the suggestions that Government should partner with the Igbo traditional institutions in establishment of forest reserves, wildlife sanctuary and co-management of biodiversity conservation in order to meet the objectives of biodiversity conservation in Igboland.

Scribner, V. (2025). Natural enemies. History Today 75(2): 38-49.

Abstract: The article explores the challenges faced by British and Hessian soldiers during the American Revolutionary War due to the hostile environment of America. Soldiers encountered difficulties such as swamps, alligators, mosquitoes, and diseases like malaria and yellow fever. The text highlights the soldiers' struggles and the impact of the environment on their physical and mental health, contrasting it with the Rebels' narrative of natural superiority. The article provides insights into the soldiers' experiences and the harsh realities they faced in the New World.

Gama, G.M., Passos, L.F., Paglia, A.P. and Coutinho, M.E. (2025). Body condition and blood biochemistry of free-range *Caiman latirostris* in northeast Brazilian Atlantic Forest. Journal of Experimental Zoology A Ecological and Integrative Physiology (doi: 10.1002/jez.2897).

Abstract: The Atlantic Forest broad-snouted caiman (*Caiman latirostris*) inhabits regions within one of the world's most ecologically diverse ecosystems, yet few studies have explored the relationship between body condition, blood biochemistry, and environmental factors in the wild. Our study investigated the effects of sex, ontogeny, habitat, and environmental variables on the body condition and blood biochemistry of free-ranging caimans from

the state of Alagoas, Northeast Brazil. From 2020 to 2022, we captured 75 caimans across three sites in different seasons. Results revealed sex-specific responses to seasonal and Interannual weather changes, with females showing higher body condition in the wet season, while males peaked in the dry season. Elevated glucose, total protein, albumin, triglycerides, and fructosamine were linked to higher body condition and larger individuals, while elevated aspartate aminotransferase to low body condition. Seasonal rainfall influenced blood parameters, with the dry season associated with higher creatinine, calcium, and alanine aminotransferase levels, and the wet season with higher total protein, sodium, and potassium. Differences in glucose, alkaline phosphatase, and gamma-glutamyl transferase across sites pointed to physiological effects of human activities. Blood biochemical values varied widely, with some exceeding reported species ranges. These findings highlight the need to interpret physiological data within the context of local habitat and environmental conditions. Conservation strategies should go beyond species presence and habitat preservation, incorporating pollution control. Our study advances understanding of *C. latirostris* ecophysiology, offering valuable insights for the conservation and management of crocodilian populations in both wild and captive environments.

Brown, C.M., Bell, P.R., Owers, H. and Pickles, B.J. (2025). A juvenile pterosaur vertebra with putative crocodilian bite from the Campanian of Alberta, Canada. Journal of Paleontology (https://doi.org/10.1017/jpa.2024.12).

Abstract: Identifying feeding interactions in the fossil record remains a key challenge for paleoecologists. We report the rare occurrence of a conical, perforative bite mark in a cervical vertebra of an azhdarchid pterosaur, which we identified as a juvenile individual of *Cryodrakon boreas* Hone, Habib, and Therrien, 2019 from the Campanian Dinosaur Park Formation in Alberta, Canada. Based on comparative analysis of the dentition and ecomorphology of potential trace makers in the Dinosaur Park Formation, as well as the morphology of the trace, the most likely candidate is a crocodilian, although whether it was made as a result of scavenging or predatory behavior is unknown. Feeding interactions involving pterosaurs are rare globally, whereas crocodilian bite marks are not uncommon in Cretaceous terrestrial ecosystems. Given the opportunistic feeding style and known range of food items for both extant and extinct crocodilians, pterosaurs can be counted as a rare, but not surprising, component of at least some Cretaceous crocodilian diets.

De Silva, A. (2024). Crocodiles of Sri Lanka: A monograph. WILDLANKA 12(2): 246-39.

Abstract: This monograph consists of seven chapters. Chapter 1 lists all known modern crocodilian species and their distribution under the three Families: Alligatoridae, Crocodylidae, and Gavialidae. Includes brief accounts on: Behavioral features, Social signals and Communication, Reproduction, Thermoregulation, and details of Diet. Chapter 1 also records all aquatic habitats of crocodiles. Chapter 2 would be of interest for those who would like to know more details about the historical aspects of crocodiles. Documented details of crocodiles in Sri Lankan history and archeology. Under the subheading, Folklore, this chapter will discuss Proverbs and Folktale's and ends with answers to commonly asked questions about crocodiles. This chapter also provides conservation planners and managers with information on people's knowledge, attitudes, and aspects of revenge killing. Chapter 3 documents detailed accounts regarding the two crocodile species of the country, and includes details of the type specimens, population status, and natural history. Two interesting feeding habits of Muggers: 'Hierarchical or cooperative feeding' and 'herding, corralling or communal fishing" are documented, which reflect their social behaviour. Details of the biology, and site-selection for egg-laying from studies conducted by the author are provided. One of the most interesting and accurate observations of the Mugger nest, guard-burrow, and other habits of selecting the nest site was reported over 140 years ago by Parker (1880). This chapter includes recent incidents of crocodile attacks in the sea which became headline news for most of the printed media in Sri Lanka (in Sinhala, Tamil, and English). Chapter 4 is an important aspect for people as it concerns human-crocodile conflict. This chapter includes epidemiological aspects of crocodile attacks in a study conducted by the author of 150 cases of crocodile attacks, of which 50 were fatal. The author has personally investigated 131 cases that ranged from Matara (southern Sri Lanka) to Mankulum (northern Sri Lanka). The chapter includes detailed accounts of Traditional Treatment and Prevention of crocodile attacks, including important preventive methods such as the installation of Crocodile Exclusion Enclosures (CEEs) or 'kimbul kotuwa'. This chapter also includes recent initiatives taken by the Department of Wildlife Conservation to pay compensation to crocodile bite victims. Chapter 5 lists Threats to crocodiles, and deals with population trends over the years. Publications by several renowned Western naturalists, from 1672 to 1883, recorded that the species were 'very common', and 'teeming with crocodiles of prodigious sizes'. This information was also documented by local naturalists and data shows that large populations of both crocodile species existed in the country prior to their widespread slaughter in the years of the 20th century up to 1940, primarily for the global demand for tanned crocodile skin. In Sri Lanka, both crocodile species were nearly wiped out. Thus, the populations fell to critical levels around the late 1930s, and crocodile skin tanning factories had to close down after 10 years, as there were virtually no crocodiles left to harvest. Additionally, this chapter lists threats to crocodile eggs, hatchlings, and adults by various animals, via fishery-related threats, and revenge-killing, as most human-crocodile conflicts in Sri Lanka usually end when the victim's immediate family, relations, and/or friends kill the 'supposedly offending' crocodile, and oftentimes several other crocodiles as well. Killing for human consumption is also not uncommon. Chapter 5 also lists threats to the natural habitats of these reptiles. Chapter 6 focuses on the Conservation of crocodiles. The city of Mihintale, in the north-central Province, is home to the world's oldest wildlife sanctuary, dating back approximately 2200 years. Conservation measures taken during three distinct periods in the protection of crocodilians in the country are highlighted: a) The 'Ancient' period (3rd century BCE to 1505 ACE), b) The 'Colonial' period (1505 ACE to 1947), and c) The 'Contemporary' period (1947-2023). This includes aspects of Legislation and conservation status. The Fauna and Flora Protection Act (amended for the 5th time (No. 44 of 1964) includes protection for the Mugger (*Crocodylus palustris*) and the Saltwater crocodile (*Crocodylus porosus*). The chapter concludes with the notation of various Action Plans with relevance to the crocodiles of Sri Lanka.

Henke, S.E., Wester, D.B., Eversole, C., Huerta, J.O., Hilton, C.D. and Sladky, K.K. (2025). Analgesic efficacy of hydromorphone in American alligators (*Alligator mississippiensis*). Frontiers in Veterinary Science 12: 1520172.

Abstract: American alligators (*Alligator mississippiensis*) are maintained in zoos, aquaria, and farms for educational, research, and production purposes. The standard of veterinary medical care and welfare for captive reptiles requires managing pain and discomfort under conditions deemed painful in mammals. While analgesic efficacy and pharmacokinetic data for several reptile species are published, data with respect to analgesic efficacy in crocodilians are clearly lacking.The objective of this study was to determine the analgesic efficacy of hydromorphone in alligators. Female American alligators (N= 9; 57 months of age) were exposed to mechanical noxious stimuli at multiple anatomic sites using von Frey filaments ranging in size from 1.65-6.65 grams-force, and their behavioral reactions recorded. In order to evaluate analgesic efficacy, hydromorphone (0.5 mg/kg SC) was administered in the axillary region to the same alligators and the mechanical noxious stimuli were repeated and behaviors recorded. Administration of hydromorphone contributed to a range from 62-92% reduced avoidance reactions to mechanical noxious stimuli for two anatomic

sites (ie naris and lateral mandible, respectively). Alligators did not appear to experience clinically relevant respiratory depression, hypothermia, or other adverse reactions. Therefore, hydromorphone shows promise as an analgesic option to be administered under painful conditions in American alligators.

Murray, C.M., Coleman, T.S., Gabel, W. and Krauss, K.W. (2025). American alligators (*Alligator mississippiensis*) as wetland ecosystem carbon stock regulators. Scientific Reports 15(1): Article 3423.

Abstract: Blue carbon refers to organic carbon sequestered by oceanic and coastal ecosystems. This stock has gained global attention as a high organic carbon repository relative to other ecosystems. Within blue carbon ecosystems, tidally influenced wetlands alone store a disproportionately higher amount of organic carbon than other blue carbon systems. North America harbors 42% of tidally influenced global wetland area, which has been identified as a critical carbon stock in the context of climate change mitigation. However, quantified associations between vertebrate biota and carbon sequestration within ecosystems are in their infancy and have been incidental, given that microbial trophic levels are thought to drive nutrient dynamics. Here, we assess the relationship between American alligator (*Alligator mississippiensis*) demography and tidally influenced wetland soil carbon stock among habitats at continental, biogeographically-relevant, and local scales. We used soil core profile data from the Smithsonian's Coastal Carbon Network and filtered for continuous core profiles in tidally influenced wetland areas along the Gulf and Atlantic Coasts of the United States. Results indicate that American alligator presence is positively correlated with soil carbon stock across habitats within their native distribution. Further, American alligator demographic variables are positively correlated with soil carbon stock at local scales. These conclusions are concordant with previous findings that apex predators, through trophic cascade theory, play a key role in regulating soil carbon stock and that alligators are functional apex predators in carbon dynamics and a key commercialized natural resource.

Efenakpo, O.D., Nneji, L.M., Luiselli, L., Adeyi, A.O., Eniang, E.A., Akani, G.C., Battisti, C. and Agbons, A.M. (2025). Human-reptile cohabitation and the associated conservation dilemmas in Nigeria. Biodiversity (doi: 10.1080/14888386.2025.2450080).

Van Langevelde, F., Ezat, M.A., Molenaar, E. and Naguib, M. (2025). Data underlying the publication "Nile crocodiles in Lake Nasser, Egypt, are found close to fishermen's camps indicating potential conflicts". Wageningen University & Research (10.4121/0e245592-63a8-47e7-b7b8-0136082caa7e).

Abstract: In order to test the relative importance of anthropogenic and environmental variables determining the Nile crocodile distribution in Lake Nasser, Egypt, we conducted systematic crocodile counts at night in 2018. We surveyed about 30% of the shorelines. The survey lasted for 20 nights from August to October 2018, and each team covered approximately 45 km of shoreline per night. The survey started one hour after sunset and continued for about 5.5 hours each night. Crocodiles were detected through their eye reflections during the spotlight survey.

Malkani, M.S. (2025). Theropods, Ornithischians and Pterosaurs from South Asia-review with new taxa: A look at paleontology, stratigraphy and mineral potential of Pakistan. Open Journal of Geology 15: 22-68.

Abstract: Dinosaur discoveries from India have been known since 1844, while dinosaur discoveries from Pakistan have appeared recently since 2000. 3 large and 2 small theropod dinosaurs are known from Pakistan, while 11 large and 4 small theropods are known from India. Pakistani land uncovered many footprints and trackways of Jurassic small and large theropods, Jurassic ankylosaur and Cretaceous hadrosaur ornithischian dinosaurs, while Indian land uncovered a footprint of small and a footprint of large theropod and 1 footprint of stegosaur. Pakistan uncovered a Jurassic bone taxon of ankylosaur ornithischian based on heavily armored synapomorphies. Recently, Pakistan yielded 1 bone taxon and 1 ichno taxon of pterosaurs, while Indian land yielded 1 bone taxon of pterosaur. Pakistani land uncovered 14 bone taxa (and 2 ichno taxa) of herbivorous sauropod dinosaurs, 5 bone taxa (and 2 ichnotaxa) of carnivorous theropod dinosaurs, 1 bone taxon of ankylosaur and 2 (ichnotaxa) of ornithischian (ankylosaur and hadrosaurs) dinosaurs, 1 bone taxon (and 1 ichno taxon) of pterosaurs, 1 plesiosaur, 7 crocodiles, 1 snake, 1 bird, 11 mammals, 3 fishes, 7 invertebrates and 1 plant. This study fills a significant gap in the literature by bringing together paleontological records from an understudied geographical location, enhancing the global understanding of dinosaur paleobiogeography. Pakistan hosts Precambrian to recent sediments igneous and metamorphic rocks. Pakistan is rich in mineral resources/rocks, but it needs more attention for its development to fulfill local requirements and earn foreign exchange.

Darlim, G. and Höhna, S. (2025). The effects of cryptic diversity on diversification dynamics analyses in Crocodylia. bioRxiv (doi: https://doi.org/10.1101/2025.01.23.632920).

Abstract: Incomplete taxon sampling due to underestimation of present-day biodiversity biases diversification analysis by favouring slowdowns in speciation rates towards recent time. For instance, in diversification dynamics studies in Crocodylia, long-term low net-diversification rates and slowdowns in speciation rates have been suggested to characterise crocodylian evolution. However, crocodylian cryptic diversity has never been considered. Here, we explore the effects of incorporating cryptic diversity into a diversification dynamics analysis of extant crocodylians. We inferred a time-calibrated cryptic-species-level phylogeny using cytochrome b sequences of 45 lineages compared with the formally recognized 26 crocodylian species. Diversification rate estimates using the cryptic-species-level phylogeny show increasing speciation and net-diversification rates towards the present time, which is contrasting to previous findings. Cryptic diversity should be considered in future macroevolutionary analyses, however representation of cryptic extinct taxa represents a major challenge. Additionally, further investigation of crocodylian diversification dynamics under different underlying genomic data is encouraged upon advances in population genetics. Our case study adds to diversification dynamics knowledge of extant taxa and demonstrates that cryptic species and robust taxonomic assessment are essential to study recent biodiversity dynamics with broad implications for evolutionary biology and ecology.

Khanduri, M., Hölker, F., Sah, R., Hussain, S.A., Badola, R. and Candolin, U. (2025). Guiding aquatic reptile (chelonian and crocodylian) conservation in the face of growing light pollution: Lessons from experience. WIREs Water 12(1) (https://doi.org/10.1002/wat2.70003).

Abstract: Life on earth has evolved in response to the spatial, temporal, and spectral properties of natural light. However, with the advent of electricity and artificial lighting, the planet's nocturnal light environment has changed dramatically. This changing light environment is accompanied by altered behaviors in wild organisms, often resulting in drastic impacts on their fitness and population dynamics. Such effects have been demonstrated in a wide range of organisms, from plants to animals. However, there is a gap in our knowledge regarding freshwater reptiles. While extensive studies on sea turtles show alarming impacts of light pollution on their survival and recruitment, little is known about the effects on their freshwater counterparts and other aquatic reptiles, particularly crocodylians.

Yet, these species face high extinction risk from anthropogenic stressors. The current lack of knowledge of their responses to the growing global pervasiveness of light pollution is a barrier to their effective conservation. Moreover, their responses could translate into ecosystem-level alterations through top-down effects, as have been observed for other species. Here, we synthesize the existing knowledge of the responses of aquatic reptiles, particularly freshwater crocodiles and turtles, to light pollution and discuss existing mitigation strategies to safeguard these species against the new threat. Knowledge gaps and existing mitigation strategies need to be addressed to promote species conservation in the face of the novel stressor, including in developing countries.

Kuzmin, I.T., Sichinava, E.A., Mazur, E.V., Gombolevskiy, V.A., Sennikov, A.G. and Skutschas, P.P. (2025). Neurocranial anatomy of *Paralligator* (Neosuchia: Paralligatoridae) from the Upper Cretaceous of Mongolia. Zoological Journal of the Linnean Society 203(1) (https://doi.org/10.1093/zoolinnean/zlae177).

Abstract: Neurocranial features appear to be phylogenetically informative and key in assessing the still contentious relationships within Crocodylomorpha. However, the braincases of many non-crocodylian taxa are incompletely studied precluding the assessment of evolutionary modifications at the base of Crocodylia. Here, we describe the braincase osteology and neuroanatomy of the paralligatorid crocodylomorph *Paralligator* from the Upper Cretaceous of Mongolia based on computed tomography (CT)-scanning, segmentation, and 3D modelling of several specimens. The anatomy of the brain endocast, nerves, and the paratympanic pneumatic cavities of *Paralligator* is consistent with its phylogenetic position close to or at the base of Eusuchia. *Paralligator* shares a suit of neuroanatomical features with basal eusuchians and crocodylians reflecting the plesiomorphic condition for Crocodylia. In addition, differences in the brain endocasts between the larger-sized individuals of *Paralligator* and *Kansajsuchus* and the smaller *Shamosuchus* are consistent with ontogenetic changes in extant crocodylians. This suggests that members of the more basal clade Paralligatoridae and the crown-group Crocodylia share similar brain modifications during ontogeny. We also review the distribution of the mesethmoid in Crocodylomorpha and show its presence in several clades including Paralligatoridae and Dyrosauridae.

Pochat-Cottilloux, Y., Perrichon, G., Hautier, L., Rinder, N., Amiot, R., Raselli, I., Adrien, J., Lachambre, J., Fernandez, V. and Martin, J.E. (2024). Size, not phylogeny, explains the morphology of the endosseous labyrinth in the crown clade Crocodylia. Journal of Anatomy (https://doi.org/10.1111/joa.14170).

Abstract: The endosseous labyrinths are associated with several functions, including hearing and spatial orientation. Throughout their evolutionary history, crocodylomorphs have thrived in diverse environments, and the morphology of their endosseous labyrinths has been suggested as a proxy for inferring their lifestyle. However, the relationships between the shape of their endosseous labyrinths and ontogenetic and phylogenetic factors are difficult to interpret and have rarely been investigated in depth previously, particularly in terms of dataset size. Here, we present the most complete dataset to date on the endosseous labyrinths of extant crocodylians, including 111 specimens covering 22 species of different ontogenetic status (from hatchlings to adults). Using 3D geometric morphometrics, we show that allometry constitutes a major contributor of the shape variation of the crocodylian endosseous labyrinths and that the development of this structure is likely linked to the braincase conformation, in all extant genera. We also find a moderate phylogenetic signal, but only without considering the size effect, so it could not be translated into relevant discrete morphological characters. Based on these results, we discuss several remaining problems that prevent the inclusion of fossil forms with highly divergent lifestyles to study how ecological differences shaped the endosseous labyrinths of crocodylomorphs.

Ristevski, J., Molnar, R.E. and Yates, A.M. (2024). Reassessment of isolated reptilian teeth confirms the presence of ziphodont crocodylians during the Pliocene of New Guinea. Historical Biology (https://doi.org/10.1080/08912963.2024.2429585).

Abstract: The original publication on the Pliocene Otibanda Formation in Papua New Guinea briefly reported on crocodyliform fossils, including isolated teeth that were tentatively assigned to the notosuchian subclade Sebecosuchia. In this study, we reassess the crocodyliform material from the Otibanda Formation and provide the first detailed descriptions of the same, including the purported sebecosuchian teeth. Direct examination of these teeth confirms their ziphodont condition based on the labiolingual compression of the crowns and the presence of serrated mesial and distal carinae. In addition to the ziphodont teeth, there are also non-serrate conical teeth that are tentatively referred to an undetermined species of *Crocodylus* as well as fragmentary postcranial elements that we refer to as *Crocodylia incertae sedis*. Considering the geological age and geographical origin of the isolated ziphodont tooth crowns from Papua New Guinea, they are unlikely to belong to a sebecosuchian crocodyliform. Instead, it is more plausible that they are referable to Mekosuchinae, a highly diverse crocodylian clade inclusive of ziphodont forms that was prevalent on mainland Australia for most of the Cenozoic.

Wu, D., Gu, J. and Yu, J. (2025). Corrigendum: Influence of ecological restoration initiatives on emotional bonds between Indigenous Peoples and the Chinese alligator. Frontiers in Environmental Science 13 (doi: 10.3389/fenvs.2025.1563921).

This article is a correction: In the published article, there was an error in Figure 2 as published. In the Figure 2 displaying the means of different categories, the order of the x-axis labels, “Family Population Outflow Rate” and “Land Loss Rate,” was mistakenly swapped. However, this error does not affect the research conclusions for the following reasons:The research conclusions are based on regression analysis: The main findings are derived from the regression model, which provides robust statistical insights. The chart showing the means serves only as a descriptive visualization and does not influence the inferential results.The error does not change the data values: The values shown in the chart remain accurate; only the label order was incorrect. The revised chart still supports the original narrative: After correcting the label order, the chart continues to satisfy the statement in the paper: “The results of this analysis are shown in Figure 2. It can be seen that there are some differences in the respondents’ emotions toward the Chinese alligator in the different groups.” Thus, the integrity of the analysis and its interpretation remains intact.The corrected [Figure 2] and its caption **[Mean of emotions toward the Chinese alligator among different groups of respondents] appear below.

Pligersdorffer, C.C., Burke, P.M.J. and Mannion, P.D. (2025). Evaluation of the endocranial anatomy of the early Paleogene north African gavialoid crocodylian *Argochampsa krebsi* and evolutionary implications for adaptation to salinity tolerance in marine crocodyliforms. Journal of Anatomy (doi: 10.1111/joa.14213).

Abstract: *Argochampsa krebsi* is a gavialoid crocodylian from the early Paleogene of North Africa. Based on its recovered phylogenetic relationship with South American species, it has been inferred to have been capable of transoceanic dispersal, but potential anatomical correlates for a marine lifestyle have yet to be identified. Based on CT scans of a mostly complete and well-preserved skull, we reconstruct the endocranial anatomy of *Argochampsa* and compare it to that of other gavialoids. We demonstrate that *Argochampsa* possesses concave depressions on the internal surface of the prefrontals and lacrimals, which have been inferred to represent osteological correlates for salt glands in unequivocally marine metriorhynchoid thalattosuchian crocodyliforms. The presence of these salt glands suggests that *Argochampsa* likely frequented pelagic environments

and provides additional support for the capability of transoceanic dispersal within Gavialoidea. We also newly interpret osteological correlates for salt glands in the Miocene north African gavialoid *Sutekhsuchus dowsoni*, providing further support that saltwater tolerance was widespread and possibly ancestral in Gavialoidea, given that they have been previously reported in the Late Cretaceous-early Paleogene species *Eosuchus lerichei* and *Portugalosuchus azenhae*. In addition to these gavialoids, as well as metriorhynchids, we also identify these osteological salt gland correlates in the Paleocene northwest African dyrosaurid *Rhabdognathus aslerensis*, which represents another crocodyliform lineage thought to be capable of transoceanic dispersal. Given that dyrosaurids, gavialoids, and metriorhynchoids are distantly related lineages, the evolution of salt glands is likely a convergent ecological adaptation to the occupation of pelagic environments. Nevertheless, we demonstrate limited evaluation of the presence of these osteological correlates across Crocodyliformes, including within most extant species, such that it remains possible that they are much more widespread.

Utele, M., Gebeyehu, A. and Kaba, T. (2025). Gastrointestinal helminth of Nile crocodiles (*Crocodylus niloticus*), in Arba Minch Crocodile Ranch, Ethiopia. Scientific Reports 15(1): 3749.

Abstract: Parasites are among the major organisms that affect the health of crocodiles. A cross-sectional study was conducted from November 2021 to May 2022 aimed to determine the prevalence of gastrointestinal helminths of Nile crocodiles in Arba Minch Crocodile Ranch (AMCR), Ethiopia. A total of 322 fecal samples were collected using a random sampling technique. Standard parasitological tests were used to identify the gastrointestinal helminth parasite. Out of 322 fecal samples examined, 102(31.68%) were found positive for gastrointestinal helminths. Among the endoparasite eggs detected *Dujardinascaris* (18.01%) species was the most dominant species followed by *Trichinella* species (5.62%), polydeliphs (3.1%) and *Renifers* species (0.62%). There was a statistically significant difference(P= 0.0001) in the prevalence of helminth parasites between male (15.97%) and female (44.38%) crocodiles. Likewise, the prevalence of helminths between different age groups was determined with the highest prevalence in crocodiles of less than 8 years old (41.9%) and the lowest prevalence in crocodiles of age greater than 11 years (19.56%). It has been observed that the crocodile in the area of study had mixed infestation with more than one parasite. The study revealed that gastrointestinal parasites were prevalent in the ranch. Therefore, strict prophylaxis treatment and hygiene should be performed in the study area.

Smaga, C.R., Bock, S.L., Johnson, J.M., Paitz, R.T., Letter, A., Deem, V., Brunell, A. and Parrott, B.B. (2024). Maternal deposition of hormones and contaminants shape the gonadal transcriptome in American alligators. Proceedings of the Royal Society B. Biological Sciences 292(2039): 20242105.

Abstract: Environmental conditions influence the maternal deposition of hormones into eggs, which is hypothesized to adaptively modify developmental outcomes in offspring. However, most ecosystems harbour environmental contaminants capable of disrupting endocrine signaling, and maternal exposure to these compounds has the potential to further alter offspring traits. Studies rarely examine maternally derived hormones and contaminants along with offspring phenotypes, and we know little about their interrelationships and potential interactions. Here, we measure yolk concentrations of 24 endocrine-disrupting compounds (EDCs) and 28 steroid hormones along with gonadal transcriptomes from two populations of the American alligator (*Alligator mississippiensis*) that differ in reproductive development and exposure to EDCs. Using a network-based approach, we identify gene expression modules associated with hormones and contaminants independently, in combination, or by potential indirect influences of EDCs on maternal hormone deposition. We find that yolk concentrations of both 17β-oestradiol and etiocholanolone differ across populations and explain substantial variation in gene expression. We further provide evidence for the indirect effect of the pesticide, methoxychlor, on gonadal gene expression through its relationship with 17β-oestradiol. Our results reveal novel pathways by which maternal exposure to environmental contaminants interacts with hormone provisioning to affect offspring sexual development.

Elejalde-Cadena, N.R., Hernández-Juárez, E., Tapia-Mendoza, E., Moreno, A. and Bucio, L. (2025). Structural insights into ratite birds and crocodile eggshells for advanced biomaterials design. ACS Omega (https://doi.org/10.1021/acsomega.4c10850).

Abstract: Detailed analysis of particle size, morphology, elemental composition, crystalline structure, and thermal degradation behavior reveals significant differences between ratite and crocodile eggshells, showing their unique environmental adaptations and biological functions. Ratite eggshells, characterized by smaller particle sizes, present lower thermal degradation and are more suitable for applications requiring flexibility and resilience. In contrast, crocodilian eggshells have more extensive and denser particles, giving them a more uniform structure and therefore contributing to their higher thermal stability and mechanical strength. The variation in activation energy profiles between different parts of the eggshells indicates the complexity of their degradation processes. In this regard, ostrich eggshell presents more complicated, multistage thermal degradation patterns, and may be suitable for layered thermal stability applications. In contrast, the uniform degradation behavior of emu eggshells suggests its utility in systems where consistent thermal performance is essential. Similarly, the stable and predictable degradation profiles of river and swamp crocodile eggshells make them ideal candidates for environments requiring high durability and resistance to thermal cycling. This research highlights the natural design of eggshells and provides valuable guidance for the development of biomimetic materials. By mimicking the structural and thermal properties of these eggshells, it would be useful to create thermally stable and mechanical materials suitable for a wide range of industrial and biomedical applications.

Rainwater, T.R., Singh, R., Bock, S.L., Wilkinson, P.M., Platt, S.G., Song, B. and Bodinof Jachowski, C.M. (2025). Nest attendance by American alligators (*Alligator mississippiensis*) in coastal South Carolina. Herpetologica (https://doi.org/10.1655/Herpetologica-D-23-00037).

Abstract: Among the Crocodylia, maternal females of most species are known to attend their nests during the egg incubation period. However, the ecological and environmental factors driving nest attendance in these reptiles remain poorly understood. In 2019, we conducted a study in coastal South Carolina, USA, to examine temporal patterns of nest attendance by American alligators (*Alligator mississippiensis*), investigate the site and environmental factors influencing nest attendance, and characterize behaviors exhibited by attending females. We used automated game cameras to monitor American alligator nests throughout the incubation period and collected a suite of physical and environmental measurements at nest sites and associated habitat. Female attendance was modeled using generalized linear mixed-effects models with a binomial error distribution. Overall, nest attendance occurred for only a brief portion (1%) of the nesting period. The primary factors influencing nest attendance were day since oviposition, time of day, rainfall, and distance of nests to nearest water, with most attendance occurring during the first week postoviposition, at the end of incubation preceding hatchling emergence, at nighttime, shortly following rain events, and when nests were closer to water. Salinity of nearest water exhibited a weak effect, with the probability of nest attendance slightly decreasing as salinity increased. Maternal females exhibited four primary behaviors associated with nest attendance: crawling on the nest (16.2%), guarding the nest from a distance (62.2%), defending the nest (2.5%), and opening the nest and transporting young to water (19.0%), although temporal and behavioral patterns

of nest attendance varied among individual females. At 8 (80%) of 10 nests predated by Raccoons (*Procyon lotor*), the maternal female returned and attempted to repair the nest. Nest defense by female American alligators was low relative to the number of nest visits by egg and hatchling predators and other mammals. Collectively, our study reveals both environmental and nest site-level factors influence female nest attendance and, more broadly, demonstrates the importance of spatial and temporal scales of observation in studies of crocodilian maternal care.

Flood, P.J., Strickland, B.A., Kline, J.L. and Trexler, J.C. (2025). Habitat engineering by an apex predator generates spatial trophic dynamics across a temporal environmental stress gradient. Journal of Animal Ecology (https://doi.org/10.1111/1365-2656.14248).

Abstract: Ecosystem engineering is a facilitative interaction that generates bottom-up extrinsic variability that may increase species coexistence, particularly along a stress/disturbance gradient. American alligators (*Alligator mississippiensis*) create and maintain 'alligator ponds' that serve as dry-season refuges for other animals. During seasonal water recession, these ponds present an opportunity to examine predictions of the stress-gradient (SGH) and intermediate disturbance hypotheses (IDH). To test the assumption that engineering would facilitate species coexistence in ponds along a stress gradient (seasonal drying), we modelled fish catch-per-unit-effort (CPUE) in ponds and marshes using a long-term dataset (1997-2022). Stomach contents (n= 1677 from 46 species) and stable isotopes of carbon and nitrogen (n= 3978 representing 91 taxa) from 2018 to 2019 were used to evaluate effects of engineering on trophic dynamics. We quantified diets, trophic niche areas, trophic positions and basal-resource use among habitats and between seasons. As environmental stress increases, we used seasonal changes in trophic niche areas as a proxy for competition to examine SGH and IDH. Across long-term data, fish CPUE increased by a factor of 12 in alligator ponds as the marsh dried. This validates the assumption that ponds are an important dry-season refuge. We found that 73% of diet shifts occurred during the dry season but that diets differed among habitats in only 11% of comparisons. From wet season to dry season, both stomach contents and stable isotopes revealed changes in niche areas. Direction of change depended on trophic guild but was opposite between stable-isotope and stomach-content niches, except for detritivores. Stomach-content niches generally increased suggesting decreased competition in the dry season consistent with existing theory, but stable-isotope niches yielded the opposite. This may result from a temporal mismatch with stomach contents reflecting diets over hours, while stable isotopes integrate diet over weeks. Consumptive effects may have a stronger effect than competition on niche areas over longer time intervals. Overall, our results demonstrated that alligators ameliorated dry-season stress by engineering deep-water habitats and altering food-web dynamics. We propose that ecosystem engineers facilitate coexistence at intermediate values of stress/disturbance consistent with predictions of both the SGH and IDH.

Kwathai, M., Taemaitree, L., Roytrakul, S., Daduang, S., Klaynongsruang, S. and Jangpromma, N. (2025). Siamese crocodile serum hydrolysate peptides: Potent tyrosinase inhibitors and melanogenesis regulators for hyperpigmentation. International Journal of Biological Macromolecules (https://doi.org/10.1016/j.ijbiomac.2025.140582).

Abstract: Melanin safeguards cells from UV radiation, while also giving them colour (pigmentation). However, excessive melanin production (hyperpigmentation) can cause unwanted side effects such as skin freckles and food browning. As a result, there is a desire to control and in particular reduce melanin production. This study aims to identify bioactive peptides derived from *Crocodylus siamensis* serum that inhibit tyrosinase, which is a key enzyme in melanin production. We demonstrate hydrolysis of *Crocodylus siamensis* serum produces peptides that are potent inhibitors of tyrosinase. We demonstrate that alkaline hydrolysis is the most effective method (IC_{50}= 0.4323 ± 0.049 μg/μL) and use peptidomic analysis to identify two peptides, HG8 (HIVGRGAG) and RI10 (RNIKASHILI), that are as effective alone as the serum hydrolysate. Our results show that both peptides could inhibit cellular tyrosinase activity and reduce melanin accumulation by downregulating the expression levels of MITF, TYR, TRP1 and TRP2, which are key regulators of melanogenesis. The peptides also reduce the expression levels of Rab27A, MLPH, Myosin Va, Rab17 and gp100, suggesting they suppress melanosome maturation and transport. Furthermore, both peptides show antioxidant properties in B16F10 cells. These findings hold significant promise for the development of tyrosinase inhibitory peptides as therapeutic agents for hyperpigmentation.

Sena, M.V.A., Montefeltro, F.C., Marinho, T.S., Langer, M.C., Fachini, T.S., Pinheiro, A.E.P., Machado, A.S., Lopes, R.T., Pellarin, R., Sayao, J.M., Oliveira, G.R. and Cubo, J. (2025). Revisiting the aerobic capacity of Notosuchia (Crocodyliformes, Mesoeucrocodylia). Lethaia 57 (https://doi.org/10.18261/let.57.4.6).

Abstract: This study examines the metabolic rates of notosuchian crocodyliforms. Although predominantly composed of terrestrial forms, the group also encompasses the putatively semi-aquatic itasuchids. The notosuchian record is particularly rich in Brazil and Argentina, which provides a basis for understanding their ecology and physiology. This research expands a previous study that investigated the aerobic capacities of these organisms, considering blood flow rate (Q) in the femoral nutrient artery as a proxy to infer their maximal aerobic metabolic rates, critical for understanding peak aerobic performance during strenuous activities. Femoral nutrient foramina act as conduits for the major blood supply to the bone and are correlated with aerobic capacity, providing insights into the physiological capabilities of the studied taxa. This study revisits and expands upon a previous dataset by including additional taxa and provides more precisely adjusted mass-independent maximal metabolic rate predictions for the sample of Notosuchia. We incorporate data from a broader spectrum of extant tetrapods and employ Phylogenetic Eigenvector Maps (PEM) to refine our analyses. PEM allow the inclusion of an auxiliary predictor related to the response variable, alongside phylogenetic eigenvectors. The results indicate notosuchians possessed higher mass-independent maximal metabolic rates (MMRs) than extant Crocodylia, and lower than those of extant varanid lizards, which suggests an elevated aerobic capacity, enabling a more active lifestyle compared to extant crocodylians. The study addresses previous miscalculations for the body mass exponent on the MMR unit. We introduce Q values based on the nutrient femoral artery lumen area instead of the total area of the nutrient foramen, and provide a corrected MMR for *Crocodylus porosus*, allowing more accurate predictions of notosuchian aerobic capacities. This research reveals metabolic flexibility within crocodyliforms, with an elevated aerobic capacity allowing notosuchians to sustain vigorous activities, possibly related to their terrestrial adaptations and active foraging strategies.

Marquina-Blasco R., Morales-Flores D., Bartolomé-Bombín Á.D. and Montoya P. (2025). Herpetofaunal remains (Anura, Crocodylia, Testudines, Squamata) from the Late Miocene of the Crevillente Area (SE Spain): Palaeobiogeographical and palaeoecological implications. Rivista Italiana di Paleontologia e Stratigrafia 131(1): 85-115.

Abstract: In the present work we describe the palaeoherpetofaunal remains from the Crevillente 2 (MN11) and Crevillente 15 (MN12) sites (Crevillente, Alicante, Spain), which is a key area for understanding the faunal turnovers during the Late Miocene. Crevillente 2 has yielded a diverse assemblage composed of anurans (*Pelophylax* sp.), crocodylians (Crocodylia indet.), lizards (cf. Scinciformata indet. 1 and 2, cf. *Timon* sp., Lacertidae indet. 1 and 2, *Ophisaurus* s.l. sp., and *Pseudopus* sp.) and ophidians (Colubridae indet. 1 and 2, *Neonatrix* sp., and Viperidae indet. Oriental

morphotype). The probable presence of *Timon* is discussed; if confirmed, it would be the oldest occurrence of the genus. The faunal composition is consistent with that from other coeval Iberian sites. The assemblage includes European autochthonous taxa (Lacertidae and *Ophisaurus* s.l. sp.) and taxa that likely arrived from Asia or North America during the Oligocene-Miocene transition or the Early Miocene, such as *Pseudopus*, Oriental vipers and, probably, *Neonatrix*. The studied assemblage in Crevillente 15 is limited to turtles (*Paleotestudo* sp. and Testudines indet.) and crocodylians (Crocodylia indet.). At both localities, the surrounding landscape must have been dominated by open habitats with patches of forest/shrubland formations close to water bodies. The application of the Herpetological Ecophysiological Groups method to Crevillente 2 indicates that the mean annual rainfall must have been higher than currently recorded in the area.

Kay, D.I. (2024). Dental Alveoli and the Evolution of Complex Dentititions in Tetrapods: Patterns, Trajectories, and Implications. PhD thesis, Oklahoma State University, Stillwater, Oklahama, USA.

Abstract: Modern mammals and crocodylians both exhibit thecodont dentitions, wherein teeth are implanted in bony sockets in the jaws. These sockets support the dentition by acting as an anchoring attachment for the periodontal ligament. In rodents, it has been shown that alveoli directly cause cusp offset, meaning the jaw is responsible for a critical aspect of tooth crown shape. Despite the apparent importance and variability of this structure, there is a lack of anatomical, evolutionary, and functional work regarding alveoli. I addressed the goal of investigating the evolutionary relationship between alveoli and tooth crowns by establishing alveolar anatomy knowledge, further exploring the alveolar-molar relationship in rodents, and documenting alveolar growth in crocodylians. I used micro-computed tomography (μCT) imaging to generate the high-resolution three-dimensional datasets necessary to visualize and measure the internal skeletal anatomy of alveoli in wet-preserved, frozen, and osteological specimens of extant crocodylians and mammals, analyzing relevant measurements in a phylogenetic context to test hypotheses regarding alveolar anatomy evolution. I find that alveolar anatomy has substantial differences between crocodylians and mammals, with crocodylians exhibiting mammal-like alveoli in the mesial portion of the jaw, and a unique anatomical configuration of a thick layer of bone in the distal portion of the tooth row. In rodents, I find that the tractability of the established alveolar-cusp offset trend is not preserved across ontogeny, unless open root morphology is present to serve as an embryonic anatomical analogue. Looking into a relatively undescribed system, I find that extant crocodylians exhibit positively allometric alveolar trough thickness, and the ontogenetic completion pattern of alveoli in heterodont vs. homodont species is different, suggesting a possible relationship between alveoli and tooth shaping, with functional implications relevant to feeding. Overall, this study finds that alveoli have complex anatomical patterns and relationships with dentitions in extant mammals and crocodylians. Using these conceptual foundations on alveolar evolutionary morphology in mammals and extant crocodylians, I can address evolutionary questions involving the evolution of mammal-grade dentitions in non-mammalian groups using notosuchians as a natural experiment to further elucidate the evolutionary relationship between tooth crowns and their hard tissue support structure.

Pooley, S. (2025). Research on the Nile crocodile (*Crocodylus niloticus*) in Ndumo Game Reserve. African Journal of Wildlife Research 55(sp1) (doi:10.3957/056.055.0142).

Abstract: My paper provides historical background on human interactions with Nile crocodiles in the Ndumo region from the 1890s, through to formal conservation in Ndumo Game Reserve from *c*. 1951. Serious population declines in the 1950-60s led the Natal Parks Board (NPB) to prioritize crocodile research and conservation here. I give an account of the work of Tony (A.C.) Pooley from 1962 to 1974, a foundational period for croc research and conservation in South Africa. In this period, Ndumo became renowned for crocodile natural history research and conservation. Pooley's outreach work and discoveries shifted public narratives to more favourable representations of crocodiles. The paper utilizes available data to offer a history of crocodile populations from *c*.1962 to 2023. Post-NPB croc work is included, from 1988 to the present. This paper concludes with a brief reflection on current management challenges.

Rath, L., Dash, S.K., Mohapatra, R., Patnaik, A., Ashaharraza, K. and Maharana, S. (2025). Exploring the human dimensions of gharial conservation in the Mahanadi River, India. Wildlife Research.

Abstract: The gharial is a critically endangered freshwater riverine crocodilian distributed in few Indo-Gangetic Rivers and the Mahanadi River. With very few individuals remaining, the species in the Mahanadi River is on the verge of extirpation and requires conservation attention for their continuous existence. While essential ecological information is available here to an extent, the human dimensions of gharial conservation is completely overlooked. Therefore, we aimed to examines the dependencies of local people on the Mahanadi River and their perceptions of gharial conservation. Opportunistic method was used to select the respondents, and an open and close-ended questionnaire was used for the survey. Descriptive statistics and logistic regressions were used for data analysis. The Mahanadi River played crucial role in respondents' life where they depended on the river both tangible and intangible ways including to earn livelihoods, everyday sanitation and minerals extraction. Most of the respondents perceived gharial negatively which could be attributed to their lack of awareness. However, age, awareness, incentives influenced respondents to positively perceive gharial conservation in the Mahanadi River. The study also observed how lack of awareness negatively affecting the gharial conservation in the Mahanadi River as people perceived equal threat to gharials in line with muggers and saltwater crocodiles. The finding can be taken into consideration to promote awareness among the local for gharial with warning information on muggers and saltwater crocodiles in the Mahanadi River. That may be useful for gharial conservation.

Ogorode, I.O., Vincent-Akpu, I.F. and Babatunde, B.B. (2025). Crocodile farming - a tool for sustainable development in coastal communities: A case study of Emede and Esanma captive breeding sites, Delta State, Nigeria. Open Access Library Journal 12: e12892.

Abstract: This study investigates the benefits of crocodile farming and ranching in Emede and Esanma Kingdoms, Delta State, Nigeria. A mixed-method approach was used, combining survey, key informant interview, and questionnaire methods. The results show that crocodile farming provides employment opportunities, income generation, and conservation benefits for the local communities. A total of 27 crocodiles were bred in captivity, with 16 Nile crocodiles and 11 Dwarf crocodiles. The study also reveals that the communities are aware of the crocodile farms and have benefited from them. However, the chi-square analysis suggests that the variables are likely independent, indicating no significant difference between the observed and expected data. The study concludes that crocodile farming and ranching can be a sustainable and profitable venture for coastal communities, with potential economic and conservation benefits.

Efenakpo, O.D., Nneji, L.M., Luiselli, L., Adeyi, A.O., Eniang, E.A., Akani, G.C., Battisti, C. and Agbons, A.M. (2025). Human-reptile cohabitation and the associated conservation dilemmas in Nigeria, Biodiversity (doi: 10.1080/14888386.2025.2450080).

Larasati, F., Setiawan, Y. and Kusrini, M.D. (2025). Potential habitats of Siamese crocodiles and False Gharials in East Kalimantan for

conflict resolution. Media Konservasi 30(1): 154-171.

Abstract: Concerns in crocodiles sustainability have long been overlooked, due to humans fear of its ferocity and unresolved human-crocodile conflicts. The Siamese crocodile (*Crocodylus siamensis*) and False gharial (*Tomistoma schlegelii*) are considered threatened by the IUCN red list because of their limited range and declining populations. In this study we developed habitat suitability model for both species and overlaid with anthropogenic factors to mitigate conflict between crocodiles and human in Mesangat-Suwi Wetland, East Kalimantan, Indonesia. We collected species presence from 2018-2023, measured environmental variables, interviewed 100 respondents, and mapped all information with Maximum Enthropy program (MaxEnt). Results showed that different factors influenced the habitat distribution for each species. Specifically, distance from swamps was affected the most for both crocodiles. Our model found that the potential habitat was much smaller than the non-potential ones due to humans' intrusion. Much of the Mesangat-Suwi area was covered in high-conflict zones between humans and crocodiles, endangering both species even more. Hence, serious actions were urgently needed to resolve the conflict, either by prevention and mitigation actions, to ensure human-crocodile coexistence in East Kalimantan.

Hoffman, D.K., Goldsmith, E.R., Houssaye, A., Maidment, S.C.R., Felice, R.N. and Mannion, P.D. (2025). Evolution of growth strategy in alligators and caimans informed by osteohistology of the late Eocene early-diverging alligatoroid crocodylian *Diplocynodon hantoniensis*. Journal of Anatomy (doi: 10.1111/joa.14231).

Abstract: Among living crocodylians, alligatoroids exhibit a wide range of body sizes and a biogeographic distribution that spans tropical-to-subtropical climates. The fossil record of alligatoroids, however, reveals even greater diversity, including multiple examples of gigantism and a broader distribution that extends into polar latitudes. Osteohistological studies on extant alligatoroids show that living alligators and caimans both exhibit seasonal growth, with roughly comparable growth rates. However, alligators and caimans diverged from one another over 60 million years ago; the dearth of studies on extinct alligatoroids makes it unclear if the shared condition in extant taxa reflects convergent responses to rapid climatic changes in the recent past or represents the ancestral condition in alligatoroids. Additionally, sample sizes are often limited to one or two individuals, especially in extinct crocodylians, obscuring any intraspecific variation present. To address this uncertainty, we conducted the largest monospecific osteohistological study of an extinct crocodylian to date, based on a sample of nine femora, providing unique insight into the intraspecific variation in growth of the early-diverging alligatoroid *Diplocynodon hantoniensis* from the late Eocene of the UK. The bone microanatomy of *D. hantoniensis* shows moderate compactness, with a well-defined medullary cavity, and osteohistological features that are generally consistent with those of extant alligatoroids. Samples vary greatly along a continuum in the degree of remodelling and vascularity, highlighting both the importance of evaluating intraspecific variation and limitations of basing histological assessments on singleton samples. Ontogenetic assessment indicates that our sample captures a range of skeletally immature to mature individuals, approximately corresponding to femoral size, but with notable exceptions possibly driven by sexual dimorphism. Body size estimates for *D. hantoniensis* (1.2-3.4 m) fall within the typical range of living American alligators (*Alligator mississippiensis*). Reconstruction from cyclical growth marks indicates a similar overall growth rate between *D. hantoniensis* and *A. mississippiensis*. As in extant alligatoroids more generally, this is determinate, seasonally-controlled growth. Femoral circumference scales positively with femoral length in *D. hantoniensis*, demonstrating similar allometry to *A. mississippiensis*. This differs from some other extant crocodylians (eg *Crocodylus niloticus* and *Crocodylus johnstoni*) and suggests conservation of allometric relationships in alligatoroids. This in-depth look into an early diverging alligatoroid indicates that seasonality and growth rates present in extant members were established near the base of the clade. Furthermore, it highlights the importance of including larger samples of singular species in order to capture potential variation when making clade-wide interpretations.

Cajiao-Mora, K., Dutton, H.R., Jacobs, F.J., Beytell, P.C., Netherlands, E.C., DuPreez, L.H. and Bullard, S.A. (2025). Supplemental description of *Stephanoprora ornata* Odhner, 1902 (Digenea: Echinochasmidae) infecting the Nile crocodile, *Crocodylus niloticus* (Crocodylidae) from Namibia with emendation of *Mesorchis* Dietz, 1909 and a phylogenetic analysis. Journal of Helminthology 99: e20.

Abstract: The synonymies of the echinochasmid genera *Mesorchis* Dietz, 1909 and *Monilifer* Dietz, 1909 with *Stephanoprora* Odhner, 1902 remain contentious and unresolved with morphology. To explore the matter, we herein provide a supplemental description of the type species of *Stephanoprora*, *Stephanoprora ornata* Odhner, 1902, based on specimens we collected from the intestine of a Nile crocodile *Crocodylus niloticus* Laurenti, 1768 (Crocodylia: Crocodylidae) captured in the Kavango River, Namibia. No nucleotide information was available previously for *S. ornata*. Morphology plus *28S* and *ITS2* phylogenetic analyses suggested *Stephanoprora* is a monotypic genus that can be differentiated from other genera by having 26 collar spines. *Stephanoprora* differs from *Mesorchis* by the number and distribution of collar spines (26 [2 dorsal spines, 12 lateral spines, 12 corner spines] vs. 22 [2 dorsal spines, 12 lateral spines, 8 corner spines] in *Mesorchis*), length of the pre-pharyngeal oesophagus, pharynx position posterior to collar (vs. pre-pharyngeal oesophagus short, pharynx anterior to or at level of corner spines), and testes shape (elongate-ovoid, irregular in outline vs. ovoid, atypically elongated). Our *28S* and *ITS2* phylogenies recovered the new sequence of *S. ornata* (having 26 collar spines) sister to all remaining echinochasmid sequences, representing species that have 20-24 collar spines. *Echinochasmus* Dietz, 1909 and *Mesorchis* were recovered as paraphyletic. We retain *Monilifer* as a junior subjective synonym of *Echinochasmus* based a suite of morphological features related to body shape and genitalia and because the designated type for *Monilifer* was reassigned to *Echinochasmus*. We accept 25 species of *Mesorchis*.

Recharte, M., Lee, P.C., Vick, S-J. and Bowler, M. (2025). Polling the public to select flagship species for tourism and conservation-A 'Big Five' for the Peruvian Amazon? Ecology and Evolution 15(2): e70983.

Abstract: Flagship species are used to promote conservation and tourism. Africa's famous 'Big five' have become marketing flagships that fundraisers and tourism promoters emulate globally. Species can be selected systematically for marketing using characteristics such as colour, size or behaviour, but this approach can overlook unique animals or homogenise selections. Alternatively, polling the public can reveal existing preferences for animals directly. We used questionnaires with tourists in the Peruvian Amazon to identify existing biases for species and rank them for suitability for tourism and conservation marketing. Polling revealed several species that would not be considered good flagship candidates using systematic methods based on species characteristics. 'Free listing' tourists expressed preferences at inconsistent taxonomic levels. The response 'monkeys' (infraorder Simiiformes) was highest ranked, followed by 'jaguar' (*Panthera onca*), 'Amazon dolphin' (*Inia geoffrensis*), 'sloths' (suborder Folivora), and 'caiman' (subfamily Caimaninae) and 'birds' (class Aves). When ranking from a preselected shortlist, jaguar, Amazon dolphins and sloths (represented by *Bradypus variegatus*) remained popular, while vote splitting within higher taxonomic levels, in particular monkeys, made room for green-winged macaw (*Ara chloropterus*) and anaconda (*Eunectes murinus*). When asked about their willingness to pay for excursions or donate to conservation, tourists were overwhelmingly more likely to quote larger figures for jaguars than any other species, but results for other

species were more homogenous. Some popular taxonomic groups are diverse in Amazonia; up to 14 monkey species may be present at some sites Amazonia, alongside several hundred bird species. A Big five strategy obscures this diversity. Using physical characteristics as selection criteria underplays diversity and overlooks popular taxa-notably sloths for the Amazon. A strategy of polling the public to select popular species as flagships more directly identifies salient species for marketing and efficiently considers existing biases. However, diversity will trump a Big five approach in megadiverse areas.

Barham, K.E., Frère, C.H., Dwyer, R.G., Baker, C.J., Campbell, H.A., Irwin, T.R. and Franklin, C.E. (2025). Climate-induced shifts in crocodile body temperature impact behavior and performance. Current Biology (doi: 10.1016/j.cub.2025.01.033).

Abstract: The increase of energy in the climate system caused by anthropogenic climate change is expected to disrupt predictable weather patterns and result in greater temperature extremes. As a result of these climate shifts, El-Niño Southern Oscillation (ENSO), which drives predictable periods of hot/dry and cool/wet across the Pacific, is expected to increase in variability and magnitude. These changes will significantly impact ectotherms, whose performance across a range of behaviors is dependent on local environmental temperatures. As such, we must understand the way individuals experience climate conditions and how changes in their body temperature (T_b), whether through climate or modification of their thermoregulatory mechanisms, affect their performance. Laboratory studies have shown that estuarine crocodile (*Crocodylus porosus*) diving and swimming performance is reduced above 32°C-33°C, temperatures commonly exceeded across their natural range. By monitoring T_b and diving activity in 203 free-ranging estuarine crocodiles over 15 years, we show that the T_b of crocodiles has increased alongside rising air temperatures since 2008, reflecting the climatic shifts caused by the ENSO cycle. As ambient temperatures rose, crocodiles experienced more days close to critical thermal limits (32°C-33°C), at which temperatures the duration of dives was reduced and the prevalence of active cooling behavior was elevated. This study demonstrates that crocodiles are susceptible to multi-year fluctuations in ambient temperature, which requires them to undertake concomitant changes in behavior. They are already close to their physiological thermal limit, but the impact of future predicted rises in temperature remains unknown.

Colston, T.J., Pirro, S. and Pyron, R.A. (2025). The complete genome sequences of 101 species of reptiles. Biodiversity Genomes (https://doi.org/10.56179/001c.129597).

Abstract: We present the complete genome sequences of 101 species of reptiles (four testudines, one crocodilian and 96 squamates) including the complete genome of one type specimen. Illumina sequencing was performed on DNA extracted from wild-caught specimens. The reads were assembled using a *de novo* method followed by a finishing step. The raw and assembled data are publicly available via Genbank.

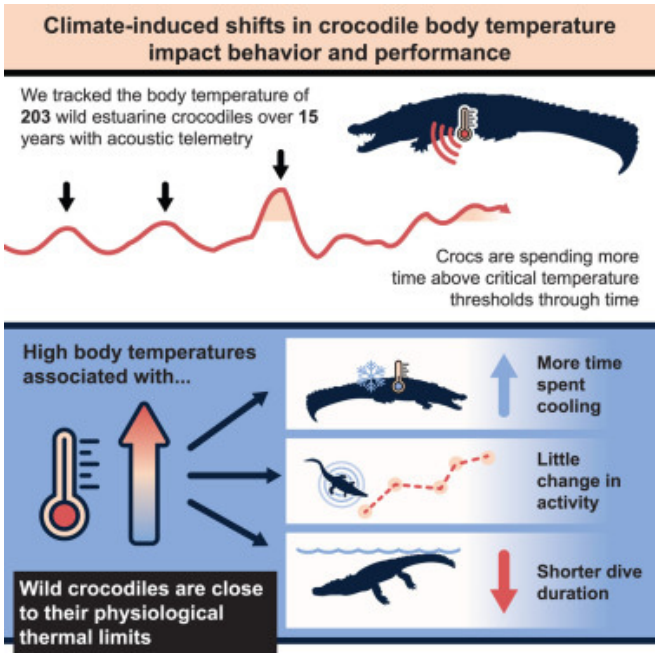
Mauger, C. (2025). Les écailles de crocodile naissent par compression. Pour la Science 2(568): 13b.

Ivory II, A.A., Hallett, M.T., Scheffers, B. and Johnson, S.A. (2024). Vertebrate diversity in stormwater sewer systems of Alachua County, Florida. Urban Naturalist 11(75): 1-18.

Abstract: As urbanization continues, animals are increasingly compelled to navigate human-altered environments. Here we investigate wildlife use of stormwater sewer systems (SSS), a widespread, subterranean environment resulting from urbanization. We used camera traps to reveal how wildlife exploit subterranean pathways, shedding light on their presence within this anthropogenic context in Alachua County, Florida. From February to May 2023, we documented a total of 35 species of vertebrates within SSS, including amphibians, reptiles, and birds, although mammals dominated our sample. Raccoons and Southeastern Myotis accounted for more than half of all observations, signifying their prevalence and widespread presence within SSS. Our research offers a comprehensive exploration of vertebrate diversity within an unconventional urban habitat and provides valuable insights into the relationship between SSS and species utilization patterns. Ultimately, our research lays the groundwork for future studies and informs the development of ecologically conscientious urban planning strategies.

Karn, R.C. and Laukaitis, C.M. (2025). A broad genome survey reveals widespread presence of secretoglobin genes in squamate and archosaur reptiles that flowered into diversity in mammals. Genome Biology and Evolution (doi: 10.1093/gbe/evaf024).

Abstract: Secretoglobins (SCGBs) are a superfamily of small, dimeric, cytokine-like proteins found originally in the reproductive tracts and airways of mammals. Most SCGB research has focused on respiratory diseases in humans and laboratory animal models but knowledge of their biological functions is sparse. We report here a broad survey of Scgbs, the genes that encode SCGBs, in animal genomes. We tested the view that they are uniquely mammalian in origin and distribution, hoping that understanding their distribution would shed light on their evolutionary history and perhaps point to putative biological functions. Rather than being uniquely mammalian, we found many different SCGBs in turtles, crocodilians, lizards and birds, suggesting they existed in the Carboniferous period (approximately 320 MYA) when the sauropsids evolved in the amniote lineage. We identified no SCGBs in amphibians or fishes, suggesting that this characteristic originated in an amniote ancestor. Amniotes include sauropsid and synapsid lineages and three subfamilies of SCGBs (SCGB2A, SCGB3A, and SCGB1C) are found in both sauropsid and synapsid lineages. Uteroglobin (SCGB1A), the first identified SCGB protein, is uniquely mammalian, having appeared in monotremes. The SCGB subfamilies including Androgen-binding proteins (ABPs; SCGB1B, SCGB2B) are first seen in metatherians. This complex distribution suggests that there is an as-yet-undiscovered basic function of secretoglobins shared by all amniotes.



Ó Mórdha, C. (2024). Assessment of the American Crocodile (*Crocodylus acutus*) Population in Ambergris Caye, Belize. MRes

thesis, University College Cork, Cork, Ireland.

Abstract: American crocodiles (*Crocodylus acutus*) have the second largest global distribution of all extant crocodilians, ranging from South Florida through Hispaniola, Cuba, and Jamaica, along the Caribbean coast from southern Mexico to Venezuela, and along the Pacific coast from Mexico to Peru. The species is considered Vulnerable by the IUCN throughout its range, with habitat loss currently a major threat facing the species in parts of its range, including Belize. In Belize, *C. acutus* is found throughout the coastal zone. Ambergris caye, the country's largest and most densely populated caye, is inhabited by *C. acutus*, but its present status there is poorly understood. The aim of this study was to address these data gaps by assessing the status and life history of *C. acutus* on Ambergris caye and comparing this information with that from other areas within the species' range to inform the development of a local American crocodile management plan. During 19 nocturnal eyeshine surveys covering 171.5 km of shoreline on Ambergris caye carried out between May and September 2023, 199 American crocodiles were observed, an encounter rate of 1.16 crocodiles/km consisting of 22% adults, 10% subadults, 16% juveniles, 22% yearlings/hatchlings and 30% whose size class could not be determined. These results were similar to those of previous surveys carried out in 2010-2011, but with a higher encounter rate in 2023, suggesting a stable, if not slowly increasing, population. Crocodile nests were located by visiting previously identified nest sites, conducting additional surveys by boat and drone, and utilising social media to investigate reports of nesting activity by residents. A total 9 nests were found during the study. More than half (56%) of these were concentrated along the sand banks adjacent to the caye's three sewage treatment ponds. Utilizing the 13 years of crocodile capture data (n= 865) collected by ACES Wildlife Rescue in Ambergris caye, this study investigated growth rates, morphometrics, and sexual size dimorphism of the local crocodile population. Analysis revealed the growth rate (total length [TL]) of 115 crocodiles averaged 0.045 ± 0.027 cm/day. The growth rates found in adults differed by sex, with females (n= 20) exhibiting a slightly lower average growth rate (0.039 ± 0.028 cm/day) compared to males (n= 47) (0.048 ± 0.028 cm/day); however, the difference was not statistically significant. Notably, as total length (TL) increased with age, growth rates slowed more significantly in females than in males, with no significant relationship observed between TL and growth rates in males. Morphometric analysis encompassed 332 juveniles (TL<120 cm), 25 female sub-adults (120≤ TL<180 cm), 31 male sub-adults (120≤ TL<180 cm), 40 female adults (TL≥180 cm) and 62 male adults (TL≥180 cm). Allometric relationships between TL and dorscal cranial length (DCL), snout length (SL), snout-vent length anterior (SVLa) and snout-vent length posterior (SVLp) revealed both positive and negative associations, all of which followed linear regressions. The dorsal cranial length to cranial width ratio (DCL: CW) of 2.7 to 4.2 indicates a broad-snouted skull morphotype akin to that observed in other island populations of *C. acutus* in the Yucatan region. The sexual dimorphism index of 1.07 toward males suggests a relatively minor disparity between the TL of males and females on Ambergris caye, indicating less pronounced sexual dimorphism compared to other populations of *C. acutus*. The sex ratio 2.39(M):1.0(F) was biased towards males. While Ambergris caye, likely the most human-populated caye in Belize, faces increasing development, pollution, and human-crocodile interactions, it may harbor one of the largest and most stable American crocodile populations in the country. The encounter rate of 1.16 on Ambergris caye is notably higher than that reported for nearby Turneffe atoll (0.34 in 2009) and the Belizean cayes overall (0.43 in 2000), suggesting this population is among the most robust in Belize. However, the study's findings indicate that insufficient nesting habitat could pose a risk to the long-term stability of the population if not addressed through targeted conservation efforts. To mitigate this risk, it is imperative to conduct annual surveys to ascertain long-term population trends. Additionally, implementing protective measures for nests and intensifying surveys within the Bacalar Chico National Park and Marine Reserve to investigate nesting activity are vital steps in formulating a robust species management plan. Addressing these research gaps will not only enhance our understanding of the ecology of *C. acutus* in Belize but also inform targeted conservation efforts essential for safeguarding this population's viability and ecological role in the region.

Piras, I.M., Nevarez, J.G., Stevenson, L., Bell, F., Ilia, G., Peters, S., Slawski, D. and Kelly, P.A. (2025). The pathogenesis of West Nile virus-associated lymphohistiocytic proliferative cutaneous lesions of American alligators (*Alligator mississippiensis*). Veterinary Pathology (doi: 10.1177/03009858251317481).

Abstract: "Pix" is one of the most common skin defects that reduce the quality of crocodilian leather. The name is derived from their resemblance to pit marks made by an ice pick. Histologically, each "pix" is associated with a focal dermal accumulation of immune cells, specifically lymphocytes and histiocytes. Consequently, these defects have been termed lymphohistiocytic proliferative cutaneous lesions (LPCLs). In farmed American alligators (*Alligator mississippiensis*), LPCLs have been associated with seropositivity against West Nile virus (WNV) and the presence of viral genome in the skin. Despite this association, the nature and pathogenesis of LPCLs remain unclear. Using immunohistochemistry and in situ hybridization, we unravel the microanatomy of LPCLs of alligators and localize WNV genome within the lesions. Our results show that LPCL lesions consist of *de novo* follicular aggregates of lymphocytes segregated into B- and T-cell zones, like tertiary lymphatic follicles of mammals and birds. Furthermore, the presence of WNV genome was highlighted by *in situ* hybridization in the macrophages of LPCLs, gut-associated lymphoid tissues, and the spleen. Our results suggest that LPCLs may form in American alligators' skin as part of a generalized lymphofollicular proliferation, likely as an immune response against WNV infection.

Cainelli, J., Cordero, T., Parachú Marcó, M.V., Hilevski, S. and Siroski, P. (2025). Egg windowing and plastic culture system in *Caiman latirostris* embryos, improving hatching success and offer potential management applications. Zoo Biology (https://doi.org/10.1002/zoo.21892).

Abstract: The shell of crocodilian eggs is highly fragile, especially during the early stages of development, making them susceptible to cracking during laying or collection, often resulting in embryo mortality. While numerous studies have explored various techniques for artificially incubating eggs to improve hatching success, particularly concerning issues with eggshells, there is limited information available on this topic for crocodilians. The objective of this research was to assess the hatching and survival success of cracked eggs using the windowing method and *ex ovo* incubation of *Caiman latirostris* embryos in a culture vessel. We used fertile eggs with cracked shells for the windowing eggs (WE) and *ex ovo* incubation (EE) treatments, and fertile noncracked eggs shell as control treatment. To ensure contamination-free incubation, all eggs were cleaned with alcohol. In the WE treatment, an eggshell section was removed, while in the EE treatment, embryos were removed from the eggshells. Each treatment was incubated in a culture vessel containing an aqueous antimicrobial solution at 31 ± 1°C. After 38 days of incubation in the culture vessel, the hatching success rates were as follows: 66.67% for WE, 0% for EE, and 100% for the control. Subsequently, the survival of hatchlings from the WE and control groups was 100%. The results suggest that incubation in artificial culture vessels enhances the viability and hatching success of *C. latirostris* cracked eggs. It works as an effective antimicrobial barrier maintaining sterile conditions and does not interfere with embryonic development. Moreover, the WE method offers unique possibilities for the monitoring of developmental studies and other manipulations of crocodilian embryos. However, the EE method is not advisable, as it does not reproduce the conditions inside the egg.

Dille, M., Cramberg, M., DeLeeuw, H., Pick, E., Thompson, M. and

Young, B.A. (2025). On the fila olfactoria and the cribriform region of the Crocodylia. Journal of Morphology 286(2): e70036.

Abstract: In mammals the fila olfactoria, fascicles of axons coursing from sensory neurons in the olfactory epithelium to the glomeruli of the olfactory bulb, not only have a topographic projection pattern but also serve as routes for cerebrospinal fluid (CSF) drainage from around the brain. Les is known about the fila olfactoria in nonmammalian taxa. This work explores the fila olfactoria of the American alligator (*Alligator mississippiensis*) using a combination of gross dissection, histology, Diffusible Iodine-based contrast-enhanced computed tomography, latex corrosion casting, and India ink tracers. In Crocodylians, as in other nonmammalian vertebrates, the fila olfactoria courses through a foramen in the nasal capsule rather than an ethmoidal cribriform plate. In *Alligator* this foramen is filled by dense connective tissue; prominent perineural spaces extend through the connective tissue, effectively making it perforate like the cribriform plate. Latex or India ink introduced into the cranial CSF pass through the dense connective to reach the submucosa of the olfactory epithelium, suggesting that Crocodylians have the same cranial CSF drainage pattern as mammals. In Alligator, the fila olfactoria is asymmetric, with more fascicles entering the ventral and lateral surfaces of the olfactory bulb than the dorsal or medial surfaces. If individual fascicles of the fila olfactoria are traced in Alligator, a clear topographic projection emerges; with medial and lateral polarity maintained between olfactory epithelium and olfactory bulb, and a rostral-caudal polarity projecting as dorsal-ventral on the olfactory bulb.

Allen, R.C., Chin, K., Zawaski, M., Bevitt, J.J. and Smiglewski, W. (2025). Determining whether a phosphatic concretion containing a Cretaceous juvenile crocodylian is a coprolite or a non-fecal concretion. Scientific Reports 15(1): 6436.

Abstract: Phosphatic concretions in terrestrial settings are often identified as coprolites based upon their biotic contents and high phosphorus levels. However, recent discoveries have shown that non-fecal origins of fossiliferous phosphatic concretions are more common than originally recognized. Confusion about the taphonomic origin of phosphatic concretions can lead to erroneous paleobiological and paleoenvironmental interpretations, so a set of criteria would be useful to evaluate whether a phosphatic concretion is a coprolite. Here we describe a phosphatic concretion containing a small crocodylian from the Upper Cretaceous Hell Creek Formation and assess its origin, formation, and paleobiological implications. We conducted neutron computed tomography (CT) on the skull-bearing portion of the concretion, and analyzed the geochemical composition of the concretion with electron microprobe, μ-XRF, and fusion ICP-OES. In this study, the completeness and distribution of the skeletal elements present a stronger case for a non-fecal origin. This scenario suggests minimal transport after death and deposition. Neutron CT analysis of the crocodylian skull supports its referral to *Brachychampsa montana*, and allows inferences regarding body length, age, and dietary habits. Although coprolites and non-fecal concretions can be difficult to differentiate, unique features can reflect differences in origin that offer different types of taphonomic and paleobiological information.

Anahid, M., Mahnam, K. and Saffar, B. (2025). Improving the antimicrobial activity of RP9 peptide through theoretical and experimental investigation. Biochemistry and Biophysics Reports 41 (https://doi.org/10.1016/j.bbrep.2025.101953).

Abstract: Future threats to humanity may stem from the rise of antimicrobial resistance, which has compromised the effectiveness of existing antibiotics. Antimicrobial peptides possess the ability to directly eliminate pathogens and cancer cells, generally without the development of resistance. Among these peptides is RP9 (RGSALTHLP), derived from the white blood cells of crocodiles. In this research, three mutations were initially designed: LR-mut (RGSALTHLR), KR-mut (RGSAKTHLR), and WP-mut (RGSAWTHLP). The physicochemical characteristics of these peptides were assessed, revealing that KR-mut exhibited the most favorable biophysical properties. Subsequently, 20 molecular dynamics simulations were conducted for all peptides in pure water and at four different octanol concentrations (30%, 50%, 70%, and 100%) to evaluate their biophysical attributes. The findings from the 4000 ns molecular dynamics simulations revealed that the KR-mut exhibited reduced values of RMSD, the radius of gyration, solvent accessible surface area, and RMSF, while simultaneously showing an increased number of hydrogen bonds and interactions with water molecules. This peptide also showed the lowest free energy of solvation and the highest solubility across various octanol concentrations compared to the other peptides. The results obtained from the biophysical assessments and molecular dynamics simulations were consistent, resulting in the conclusion that KR-mut is expected to exhibit superior antibacterial activity compared to both the other mutated peptides and the wild type peptides. These theoretical findings were validated through experimental minimum inhibitory concentration (MIC) tests on gram-negative *Escherichia coli* and gram-positive *Staphylococcus aureus*. The outcomes of this study suggest that molecular dynamics simulations can effectively predict changes in the bactericidal efficacy of peptides at varying octanol concentrations, potentially enhancing the speed and efficiency of antimicrobial peptide design while reducing associated costs.

Harzhauser, M., Göhlich, U.B., Gross, M. and Vasilyan, D. (2024). The last crocodylian in Central Europe? A new occurrence from the late Middle Miocene of the Vienna Basin (Austria). Historical Biology (https://doi.org/10.1080/08912963.2025.2466048).

Abstract: We present a new record of a crocodylian osteoderm from the Middle Miocene (Sarmatian) of the Vienna Basin (Austria) and summarise the current knowledge of Sarmatian occurrences of crocodylians. Our data extend the stratigraphic range of crocodylians in Central Europe by about 1 my compared to previous estimates. The obvious decline of fossils in the late Middle Miocene deposits is discussed as a result of the strong reduction of wetland habitat during increased aridity, which in addition reduced fluvial transport of potential fossils into coastal marine depositional environments. Both factors resulted in considerable preservational bias and render it difficult to define the timing of the final extirpation of crocodylians from Central Europe. Other than a decline in temperature, increased seasonality during the late Middle Miocene might have been crucial for the retreat of these reptiles by extending the cool period during which the animals brumated.

Debruyn, G., Choi, S., Dobson, J.L., Maudens, Y., De Clerck, K., Shawkey, M.D., Zhang, S. and D'Alba, L. (2024). Convergence in biomineralization patterns across animal eggshells. Faraday Discussions (doi: 10.1039/D5FD00028A).

Abstract: Shelled eggs are key components of animal reproduction on land, evolving independently in distant lineages of terrestrial animals including nematodes, gastropods, annelids, arthropods and chordates. They perform critical functions such as the exchange of gases between embryo and the environment, desiccation avoidance and protection from harmful radiation, microbial infection and mechanical damage. A core mechanism behind eggshell multifunctionality is the incorporation of biominerals (mainly calcium carbonate and calcium phosphate) into the shell. Very little is known about eggshell structure in invertebrates, but some recent pioneer studies have proposed that similar mineralization patterns may have evolved convergently in eggshells of pulmonate gastropods, some insects, and vertebrates. However, because a detailed characterization of the structural and chemical composition of invertebrate eggshells is not available, it has not been possible to test this hypothesis. Here, we use computed tomography, electron microscopy, electron backscatter diffraction analyses, atomic force

microscopy, spectroscopy, and histochemistry to characterize and compare microstructure and chemical composition of pulmonate gastropod, insect and vertebrate eggshells. These techniques revealed the universal presence of an organic matrix in mineralized eggshells. However, disparities in the distribution of calcium throughout the shell, crystallographic orientation that appears random in invertebrates (but not vertebrates), and presence of different calcium types including the rare and unstable vaterite highlight divergence whose functional significance should be the subject of future study.

Hedge, J., Tucker, R.T., Makovicky, P.J. and Zanno, L.E. (2025). Fossil eggshell diversity of the Mussentuchit Member, Cedar Mountain Formation, Utah. PLoS ONE 20(2): e0314689.

Abstract: The first fossil eggshell from the Cenomanian-age Mussentuchit Member of the Cedar Mountain Formation was described over 50 years ago. In the half-century since, oodiversity of this rock unit has been limited to a single, taxonomically unstable ootaxon, currently formulated as *Macroelongatoolithus carlylei*. Recently, there has been a renewed effort to recover and describe the macrofauna of the Mussentuchit; however, these advances are limited to the body fossil record. Here, we examine the range of eggshells present in the Mussentuchit Member and assess the preserved biodiversity they represent. Gross morphological and microstructural inspection reveals a greater diversity of eggshells than previously described. We identify six ootaxa: three Elongatoolithidae oogenera (*Macroelongatoolithus, Undulatoolithus, Continuoolithus*), eggs laid by oviraptorosaur dinosaurs; two oospecies of *Spheroolithus* laid by ornithopod dinosaurs; and *Mycomorphoolithus kohringi*, laid by a crocodylomorph. The diversity of Elongatoolithidae in the Mussentuchit requires a co-occurrence of at least three putative oviraptorosaurs, the oldest such phenomenon in North America. The occurrence of the crocodylomorph oogenus *Mycomorphoolithus* is the first recognized occurrence outside of Europe, and the youngest yet documented. This new ooassemblage is more representative of the known paleobiodiversity of Cenomanian-age strata of Western North America and complements the body fossil record in improving our understanding of this crucial - yet poorly documented - timeslice within the broader evolution of the Cretaceous Western Interior Basin.

Serrano-Martínez, A., Luján, A.H., García-Pérez, A. and Fortuny, J. (2025). New data on the inner skull cavities of *Diplocynodon tormis* (Crocodylia, Diplocynodontinae) from the Duero Basin (Iberian Peninsula, Spain). Fossil Record 28(1): 67-77.

Abstract: Inner skull cavities provide key characters to elucidate taxonomic, phylogenetic, and palaeobiological inferences in reptiles. Herein, an integral description of the extinct alligatoroid *Diplocynodon tormis* is presented based on its holotype, recovered from the Middle Eocene site of "Teso de la Flecha" (Salamanca, Spain). It is an almost complete skull only missing some bones of the posterior part of the basicranium. A computed tomography (CT-scan) allowed the creation of a 3D model that includes the paranasal air sinuses in association with the nasal cavity, the dorsal region of the forebrain, including the cerebral hemispheres and the olfactory tract and the bulbs, the maxillary and mandibular branches of the trigeminal nerve, and the nasopharyngeal duct. Based on this, an anatomical description is provided and compared with both extant and extinct members of Alligatoridae and Crocodyloidea, including the previously published neuroanatomical description of one of the paratypes of this species. Neurosensorial (such as olfactory ratio and visual acuity) and cognitive capabilities (such as Reptile Encephalization Quotient) were estimated for the holotype and paratype of *D. tormis* and compared to those of other crocodylians. The inner skull cavities of *D. tormis* are similar to those of other crocodylians. Interestingly, the polarity of some characters in their brain, paranasal sinuses, and pharyngotympanic sinus system support its position as a basal alligatoroid. Neurosensorial and cognitive estimations also concur with a medium-sized basal alligatoroid. Nonetheless, further studies including other fossil crocodylians are required to better understand the evolutionary patterns of the inner skull cavities that have been relevant during the evolution of this successful archosaurian lineage.

Mohanta, U., Das, A., Pradhan, A.P. and Srya, S. (2025). Why is the Mahanadi River not a conducive habitat for large reptiles, especially Crocodilia. Pp. 63-73 *in* Mahanadi River: The Environmental Challenges and Way Forward, ed. by J.P. Bhatt and A.K. Mishra. Springer Nature Singapore: Singapore.

López Tuberquia, N.P. (2025). Análisis de las causas de admisión y procedencia de fauna silvestre en la oficina territorial Panzenú (Corantioquia) e importancia de la afectación de extracción antropogénica de su hábitat natural. BSc thesis, Universidad de Antioquia, Caucasia, Antioquia, Colombia.

Resumen: Este trabajo de grado se enfocó en analizar los factores de extracción de fauna silvestre en la jurisdicción de la Oficina Territorial Panzenú de CORANTIOQUIA entre enero y junio de 2024. Durante este periodo, se analizaron 53 casos de ingreso de fauna que fueron registrados, abarcando municipios como Caucasia, El Bagre, Nechí, Tarazá, Valdivia y Zaragoza. La metodología implicó crear una base de datos detallada utilizando informes técnicos, el aplicativo "fauna" y actas de control. Con análisis cuantitativo en Microsoft Excel para evaluar la distribución temporal, patrones de extracción y frecuencia de factores de extracción como la tenencia o mascotismo, tráfico, desplazamiento, y accidentes. Complementariamente, mediante QGIS se georreferenciaron los registros para identificar y visualizar los puntos críticos de extracción y concentración. El estudio reveló que el tráfico ilegal de fauna fue el principal factor de extracción, afectando a 44 individuos, seguido por desplazamiento de individuos de su hábitat (27 casos), tenencia ilegal (14 casos), accidentes (11 casos) y caza furtiva (4 casos). Las familias de aves y mamíferos Psittacidae, Caviidae respectivamente y reptiles como hicotea (*Trachemys callirostris*) y babilla (*Caiman crocodilus*) fueron los más impactados, con registros de fauna concentrados en Caucasia. El análisis evidenció que los picos de captura para factores como el tráfico, tenencia o mascotismo ocurren durante la Semana Santa, relacionados con prácticas culturales y tráfico ilegal, concluyendo la necesidad urgente de implementar estrategias de conservación que fortalezcan la presencia institucional y sensibilización comunitaria.

Abstract: This degree work focused on analyzing the factors of wildlife extraction in the jurisdiction of the Panzenú Territorial Office of CORANTIOQUIA between January and June 2024. During this period, 53 cases of fauna entry that were registered were analyzed, covering municipalities such as Caucasia, El Bagre, Nechí, Tarazá, Valdivia and Zaragoza. The methodology involved creating a detailed database using technical reports, the "fauna" application and control reports. With quantitative analysis in Microsoft Excel to evaluate temporal distribution, extraction patterns and frequency of factors. Additionally, the records were georeferenced using QGIS to identify and visualize the critical points of extraction and distribution. The study revealed that illegal wildlife trafficking was the main extraction factor, affecting 44 individuals, followed by displacement (27 cases), illegal possession (14 cases), accidents (11 cases) and poaching (4 cases). The families Psittacidae, Caviidae, and reptiles such as hicotea (*Trachemys callirostris*) and babilla (*Caiman crocodilus*) were the most impacted, with records concentrated in Caucasia. The analysis showed that capture peaks occur during Holy Week, related to cultural practices and illegal trafficking, concluding the urgent need to implement conservation strategies that strengthen institutional presence and community awareness.

Basyal, C., Neupane, B., Dhami, B., Adhikari, B., K.C., N., Poudel, S., Adhikari, A. and Griffith, P. (2025). Factors influencing the habitat selection of Gharial (*Gavialis gangeticus*) and threats to its conservation in the Narayani River of Chitwan National Park,

Nepal. Under review (doi: 10.22541/au.174013065.50249180/v1).

Abstract: The Gharial is a critically endangered freshwater crocodylian. Research on Gharials in Chitwan National Park has predominantly focused on the Rapti River; however, the Narayani River also harbors a significant potential habitat. This study assessed habitat factors associated with Gharial occurrences and conservation threats along the Narayani River. In March 2022, we conducted a boat-based daylight survey within a 50-km segment of the Narayani River. We assessed the habitat characteristics at stations spaced at 500 m intervals along the river and wherever we spotted Gharials. We analyzed the habitat factors influencing the Gharial occurrence using binomial logistic regression. We conducted a threat survey, interviewing 155 Narayani River-dependent households within 1 km of the riverbank. We gathered local knowledge of Gharial threats in the study area and later analyzed it to identify the perceived major anthropogenic threats to Gharials. We detected 33 Gharials in total, with an encounter rate of 0.66 Gharials per km. Only two of the 10 habitat variables examined, river water depth and water temperature, showed significant associations in Gharial habitat selection. Most of the Gharials were detected at 2-3 m of water depth and 19˚C of water temperature. Although not statistically significant, most of the individuals were sighted when there was 25-30˚C air temperature, river width of 200-300 m, on sandy riverbanks with a flat topography and riverbank slope of 0-30˚. Similarly, a greater proportion of observations occurred in locations with no invasive alien plant species and no observed anthropogenic threats. People perceived gillnet fishing, dam impact, and human disturbances as major anthropogenic threats to Gharials and their habitat. Moreover, people perceived gillnet fishing, dam impacts, and human disturbances as major anthropogenic threats to Gharials and their habitat. We highly recommend preserving river confluences, maintaining sandbanks, and eliminating the use of gillnets.

Tardieu, L., Driscoll, M.A. and Jones, K.R. (2025). Neo-tropical species production: a sustainable strategy for climate change adaptation in neo-tropical regions. BMC Veterinary Research 21(1) (doi: 10.1186/s12917-025-04558-6).

Abstract: This opinion piece clarifies the impact of climate change on animal production in the Latin America and Caribbean (LAC) region and proposes a sustainable solution. Anthropogenic climate change has resulted in higher ambient temperatures, rainfall, humidity, storms and desertification. These events have direct and indirect effects on conventional animal performance and this piece will highlight the impact of increased temperatures on their welfare, health and production in the LAC. Alternative species such as neo-tropical wildlife animals have been proposed as climate resilient animals for use in the LAC, as they are well adapted to the climate and environment in the tropics. Some of these animals include capybara, lappe, agouti, caiman, cocrico and collared peccary. Neo-tropical animal production has the potential to produce nutritious meat, quality leather, reduce pollution and serve as a form of sustainable production. These animals can be inserted into a sustainable production system as their feed resources can be supplied through the use of local feedstuff, they also require less water and energy for maintenance, as they are well adapted to the high temperature and humidity in comparison to domesticated animals such as cattle, pigs and chickens. Finally, the key challenges including the legal use of the animals throughout the year, lack of technical experience and limited knowledge on the biology of these animals are discussed.

Simoncini, M.S., Marques, T.S., Bassetti, L.A.B., Lara, N.R.F., Pierini, S.E., Camargo, P.B., Verdade, L.M. and Piña, C.I. (2025). Stable isotope analysis:A tool for certifying captive or wild caiman leather origin. Aquatic Conservation: Marine and Freshwater Ecosystems 35: e70104.

Abstract: Tools to discriminate products from captive and wild sources will improve wildlife sustainability, and stable isotopes of carbon and nitrogen can be potentially useful for this. In this study, we evaluated $\delta^{15}N$ and $\delta^{13}C$ in *Caiman latirostris* skins from captive individuals (from Argentina and Brazil), wild individuals (from Argentina), and leathers (from tanned skins) from both captive and wild individuals (from Argentina). In addition, we compared the isotopic signatures of caiman claws from both wild and captive caimans from Brazil. The main goal of this study was to evaluate the possible differences in the variability of $\delta^{15}N$ and $\delta^{13}C$ between skins, leathers, and claws from wild and captive animals. We found that skins, leathers and claws from the wild individuals had a larger $\delta^{15}N$ and $\delta^{13}C$ variability compared to samples from captive animals. In addition, tanning did not affect $\delta^{15}N$ and $\delta^{13}C$ variability. We can thus distinguish skins and leathers from wild and captive animals, which will be useful in governing conservation measures especially in regions where hunting is banned and/or where only farmed individuals can be traded.

Mittal, S. (2025). Crocodile skin gets a makeover. Newton 1(1): 100031.

Abstract: Writing in Nature, Michel Milinkovitch and colleagues reveal a unique mechanical process behind the development of crocodile head scales. Skin appendages, such as feathers, hair, and scales, enable animals to adapt to diverse environments. Typically, spatial patterns of skin appendages develop genetically through chemical interactions, such as so-called Turing reaction-diffusion-type chemical dynamics. Crocodile head scales (that is, the scales covering their face and jaws) pose an exception. Unlike the scales of other reptiles and the crocodile's own body scales, the irregular polygonal shapes of crocodile head scales form as the result of a mechanical process. However, the nature and origin of this physical phenomenon is unknown. Now, Michel Milinkovitch and colleagues at the University of Geneva show in a Nature paper that the pattern of head scales of Nile crocodiles arises via a compressive-folding process. The researchers used *in ovo* injections of epidermal growth factor protein to produce crocodile embryos with convoluted and amplified folding patterns and performed light-sheet microscopy and numerical simulations. They identified the edges of crocodile head scales as inward skin folds produced when the skin grows faster than the underlying tissue, forcing the skin to fold. They found that differential material properties, in particular stiffness, of the dermis and epidermis skin layers are also important factors. The researchers hypothesize that differences in growth rate and material properties of their skin may explain the diversity of head scale patterns among crocodilian species. This study proves how simple mechanistic models can represent details of pattern formation without the need to consider all genetic parameters.

Anahid, M., Mahnam, K. and Saffar, B. (2025). Improving the antimicrobial activity of RP9 peptide through theoretical and experimental investigation. Biochemistry and Biophysics Reports 41: 101953.

Abstract: Future threats to humanity may stem from the rise of antimicrobial resistance, which has compromised the effectiveness of existing antibiotics. Antimicrobial peptides possess the ability to directly eliminate pathogens and cancer cells, generally without the development of resistance. Among these peptides is RP9 (RGSALTHLP), derived from the white blood cells of crocodiles. In this research, three mutations were initially designed: LR-mut (RGSALTHLR), KR-mut (RGSAKTHLR), and WP-mut (RGSAWTHLP). The physicochemical characteristics of these peptides were assessed, revealing that KR-mut exhibited the most favorable biophysical properties. Subsequently, 20 molecular dynamics simulations were conducted for all peptides in pure water and at four different octanol concentrations (30%, 50%, 70%, and 100%) to evaluate their biophysical attributes. The findings from the 4000 ns molecular dynamics simulations revealed that the KR-mut exhibited reduced values of RMSD, the radius of gyration, solvent accessible surface area, and RMSF, while simultaneously

showing an increased number of hydrogen bonds and interactions with water molecules. This peptide also showed the lowest free energy of solvation and the highest solubility across various octanol concentrations compared to the other peptides. The results obtained from the biophysical assessments and molecular dynamics simulations were consistent, resulting in the conclusion that KR-mut is expected to exhibit superior antibacterial activity compared to both the other mutated peptides and the wild type peptides. These theoretical findings were validated through experimental minimum inhibitory concentration (MIC) tests on gram-negative *Escherichia coli* and gram-positive *Staphylococcus aureus*. The outcomes of this study suggest that molecular dynamics simulations can effectively predict changes in the bactericidal efficacy of peptides at varying octanol concentrations, potentially enhancing the speed and efficiency of antimicrobial peptide design while reducing associated costs.

Portier, K. and Senior, M. (2025). Editorial: Exploring anesthetic risk: Challenges and solutions in veterinary medicine. Frontiers in Veterinary Science 12 (doi: 10.3389/fvets.2025.1587332).

Abstract: The field of veterinary anesthesia is continually evolving, yet anesthetic risk remains a critical concern for veterinarians and pet owners alike. While the need for surgical interventions continues to grow, so does the necessity to refine anesthetic protocols, minimize complications, and enhance patient safety.No surgical/ anesthetic intervention is completely benign, and so to enhance patient safety we need to evaluate the potential benefit of an intervention with the risk. Understanding anesthetic risk, in simple terms, means understanding the possibility of something bad happening related to anesthesia, and that something bad normally means a morbidity or a fatality. Assessing anesthetic risk involves multiple factors, including species-specific responses, drug interactions, and pre-existing conditions.The studies presented in this research topic explore anesthetic risk through a breadth of topics including providing information on the efficacy and safety of drugs in uncommonly anaesthetized/ exotic species, uncommon complications in commonly anaesthetized species using commonly administered drugs, structured risk assessment methods, and novel strategies for mitigating adverse effects.One of the significant challenges in veterinary anesthesia is the assessment of pain and analgesic efficacy across diverse species. The study on hydromorphone administration in American alligators (https://doi.org/10.3389/fvets.2025.1520172) sheds light on pain management in reptiles, a field where research remains limited. By demonstrating the efficacy of hydromorphone with minimal adverse effects, this research expands our knowledge of species-specific analgesia and highlights the importance of tailored pain management strategies in non-mammalian patients. In wildlife and conservation medicine, anesthesia is essential for capture and both medical and research purposes. The study on snow leopard immobilization with ketamine-xylazine (https://doi.org/10.3389/fvets.2025.1492640) provides valuable insights into the physiological responses of free-ranging animals under emergency conditions. The documented safety and efficacy of this anesthetic combination reinforce its viability in field settings, offering a benchmark for future anesthetic protocols in large wild felids. Anesthetic-induced complications remain a significant concern, as evidenced by the case report on hyperkalemia in a domestic cat under general anesthesia (https://doi.org/10.3389/fvets.2024.1398128). The suspected link to propofol infusion syndrome (PRIS) highlights the importance of vigilance in recognizing and managing intraoperative metabolic disturbances. This case serves as a reminder of the unpredictable nature of anesthetic reactions and the need for continuous monitoring and preparedness for rapid intervention.Risk assessment tools play a vital role in pre-anesthetic evaluations. The introduction of the CHARIOT scoring system for equine anesthesia (https://doi.org/10.3389/fvets.2024.1384525) provides a structured approach to predicting peri-anesthetic morbidity and mortality. While the study indicates that CHARIOT demonstrates moderate predictive accuracy, refining and validating risk assessment tools remains an ongoing priority to enhance anesthetic safety in horses. Pharmacological formulations significantly impact anesthetic safety, as illustrated by the study on etomidate in propylene glycol in minipigs (https://doi.org/10.3389/fvets.2024.1376604). The observed adverse effects, including hemolysis and laryngeal edema, raise concerns about the formulation's suitability. This study underscores the necessity of evaluating drug formulations across different species to mitigate unforeseen complications. Long-term analgesic management also warrants careful consideration. The study on enflicoxib, a COX-2 selective NSAID, explores its efficacy and safety in managing osteoarthritis in dogs (https://doi.org/10.3389/fvets.2024.1349901). The sustained analgesic benefits and lack of significant adverse effects over an extended period suggest that enflicoxib may offer a viable long-term pain management solution for osteoarthritic canine patients.Lastly, the comparative study of propofol and alfaxalone on canine electrocardiographic parameters highlights the potential cardiac effects of anesthetic agents (https://doi.org/10.3389/fvets.2023.1330111).The findings suggest that both drugs prolong the QTc interval, raising concerns about their proarrhythmic potential. This research underscores the importance of selecting anesthetic agents based on individual patient risk profiles, particularly in animals with pre-existing cardiac conditions. Together, these studies contribute to a more comprehensive understanding of anesthetic risk across a range of species and clinical scenarios. By addressing key challenges in anesthetic management, from species-specific analgesia to risk assessment tools and pharmacological considerations, this research topic fosters advancements in veterinary anesthesia. Moving forward, continued research and interdisciplinary collaboration will be essential to refining anesthetic protocols, minimizing risks, and enhancing patient outcomes in veterinary medicine.

Cajiao-Mora, K., Dutton, H.R., Jacobs, F.J., Beytell, P.C., Netherlands, E.C., DuPreez, L.H. and Bullard, S.A. (2025). Supplemental description of *Stephanoprora ornata* Odhner, 1902 (Digenea: Echinochasmidae) infecting the Nile crocodile, *Crocodylus niloticus* (Crocodylidae) from Namibia with emendation of *Mesorchis* Dietz, 1909 and a phylogenetic analysis - Corrigendum. Journal of Helminthology 99: e44.

Zemaitis, K.J., Rainwater, T.R., Moore, Y., Andrews, K.M., Parrott, B.B. and Byers, J.E. (2025). Site-specific ontogenetic drivers of mercury concentrations in American alligators. Environmental Toxicology and Chemistry (doi: 10.1093/etojnl/vgaf060).

Abstract: Contaminant body burdens are determined by complex interactions between contaminant inputs into the environment, local ecological dynamics, and organismal ontogeny. Although a naturally occurring element, mercury (Hg) is a potent neurotoxin, commonly assessed in contaminant body burdens. Anthropogenic activity has impacted its spatial distribution, resulting in regional 'hotspots' with elevated Hg concentrations. Due to the propensity of methylated Hg to bioaccumulate within individuals over time and biomagnify across trophic levels, long-lived apex predators can carry substantial body burdens in affected ecosystems. Still, the role of an organism's ontogeny and habitat in shaping individual Hg concentrations, especially within and across species, is not well understood. We assessed total Hg, carbon (δ13C), and nitrogen (δ15N) isotopic ratios in whole blood samples (n= 133) across three distinct habitats in the Southeastern U.S. to investigate how size and dietary shifts in the American alligator (*Alligator mississippiensis*) influence Hg accumulation. Mercury concentrations were approximately 8-fold higher in alligators inhabiting the Okefenokee Swamp, Georgia (mean= 0.62 mg/kg) compared to those inhabiting coastal habitats (Jekyll Island, Georgia and Yawkey Wildlife Center, South Carolina). Whereas individual size and nitrogen isotope signatures generally displayed positive relationships with Hg concentrations, model selection approaches revealed these relationships varied across populations, likely in response to site-specific differences in environmental Hg concentrations and life history attributes of the alligators. Collectively, our findings demonstrate that although

Hg concentrations in *A. mississippiensis* are highly influenced by differences between sites, diet and body size can sometimes additionally affect individual variation within populations, suggesting that organismal ontogeny interacts with site-specific contamination and ecological factors to affect Hg body burdens.

Sun, K., Li, M., Wang, Z., Sun, S., Yang, J., Wu, X. and Pan, T. (2025). Habitat integrity challenges for the Chinese alligator amid land occupation by human: Pathways for protection. Ecology and Evolution 15(3): e71113.

Abstract: Effective conservation of endangered species necessitates not only the preservation of core habitats but also the enhancement of landscape connectivity. As a critically endangered Crocodylia, the Chinese alligator (*Alligator sinensis*) strongly relies on the fragmented wetland habitat of the lower area of the Yangtze River. The integrity of its habitat needs evaluating, and the connectivity restoring plan needs designing. In this study, we estimated the suitability of the habitat in the lower area of the Yangtze River using a Maxent model. Then, the potential ecological corridors between each nature reserve were selected by the least-cost path and circuit theory methods, and the landscape connectivity was analyzed. The results showed that the highly suitable habitat had a low integrity and was fragmented into small pieces by residential areas, farmland, and mountain areas. Four priority ecological corridors (ie Xiadu-Hongxing, Changle-Zhongqiao, Zhongqiao-Shuangkeng and Hongxing-Shuangkeng) were selected. The land occupation of humans seriously impacts the integrity of the Chinese alligator, and the unsuitable forest and artificial landscapes along the corridors indicate the need for a massive habitat restoration project. The landscape connectivity of the habitat needs to be progressively restored to provide more possibilities for the dispersal of the Chinese alligator.

Siddiqui, R., Alvi, A., Alqassim, S., Alharbi, A.M., Alhazmi, A. and Khan, N.A. (2025). Epigenetics and gut microbiome of reptiles can reveal potential targets to improve human health and performance. Discover Bacteria 2: Article Number 4.

Abstract: It is widely acknowledged that the gut microbiome plays a crucial role in both human and animal health. Nutrition, genetic predisposition, environmental factors, and epigenetic alterations significantly influence the microbiome and its interactions with the host. Epigenetic modifications include DNA methylation, histone modification and regulation of non-coding RNAs. Given the ability of reptiles to survive, thrive and adapt over millions of years, it is logical to be associated with their robust immune system and unique gut microbiome/epigenetic alterations, and it is a worthy area of investigation. As up to 80% of the immune system resides in the gut, the reptilian gut microbiome represents a unique potential resource for discovery of novel molecules that impact the host epigenome. Herein, we discuss the role of epigenetics and the gut microbiome, with a focus on long-lived reptiles such as crocodiles. Finally, epigenetic gut microbial modulation strategies are deliberated upon.

Campbell, M.A., Udyawer, V., White, C., Baker, C.J., Kopf, R.K., Fukuda, Y., Jardine, T.D., Bunn, S.E. and Campbell, H.A. (2025). Quantifying the ecological role of crocodiles: a 50-year review of metabolic requirements and nutrient contributions in northern Australia. Proceedings of the Royal Society B (https://doi.org/10.1098/rspb.2024.2260).

Abstract: The ecological roles of large predators are well recognized, but quantifying their functional impacts remains an active area of research. In this study, we examined the metabolic requirements and nutrient outputs of the estuarine crocodile population (*Crocodylus porosus*) in northern Australia over a 50-year period, during which the population increased from a few thousand to over 100 000 individuals. Bioenergetic modelling showed that during this period, the crocodile population's annual prey consumption increased from <20 kg km^{-2} in 1979 to approximately 180 kg km^{-2} in 2019. Further, the prey consumption increase was accompanied by a significant dietary shift from predominantly aquatic prey (approx. 65% in 1979) to a terrestrial-based diet (approx. 70% in 2019). A substantial portion of these terrestrial-derived nutrients was excreted into the water, significantly increasing the input rates of nitrogen (186-fold) and phosphorus (56-fold). The study shows that, despite being ectothermic, the high biomass of crocodiles within the environment generated nutrient inputs comparable to terrestrial endothermic predator populations. While crocodiles are apex predators, they are not considered to influence ecosystems in the same manner that large-bodied endothermic predators do. However, in the oligotrophic freshwater systems of northern Australia, the large volume of crocodile biomass is likely to impact the ecosystem through top-down and bottom-up processes.

Zeller, K., Mouquet, N., Garcia, C., Dezecache, G., Maille, A., Duboscq, J., Morino, L. and Bonnet, X. (2025). Danger versus fear: A key to understanding biophobia. People and Nature (doi: 10.1002/pan3.70009).

Abstract: Which animals do people fear most, and why? Exploring animal fears in humans is crucial for understanding reactions in the face of danger, addressing both innate and learned determinants. Because of the central role they are thought to have played in primate evolution, most studies have focused on the fear of snakes. Other studies that have looked at a wider range of animals have either focused on a limited number of species and/or sampled participants from a narrow range of geographical locations. To overcome these shortcomings, we developed an immersive online survey based on animal images matches, during which participants had to choose the animal they feared most. With responses from 17,353 participants from all continents, we were able to rank 184 species (mammals, reptiles, birds, arthropods and amphibians) on a fear scale. Our results showed that images of dangerous animals elicited frequent and rapid fear responses. However, danger alone was not sufficient to explain fear, as harmless animals also reached high fear scores. Fear responses varied with participants' age, geographical region of residence and level of declared biophobia. The discrepancy between actual levels of danger and declared fears in humans may be due to social transmission and increasing disconnection from natural environments. This study highlights the need to consider a wide range of animal species to identify and understand people's fear of certain species, integrating the complex relationship between ecological danger and socio-cultural influences.

Mendes Campitelli, L.M., Pereira Lopes, K., Lemos de Lima, I., Batista Ferreira, F., Delfim Isidoro, N., Magalhães Ferreira, G., Fioravanti Ponce, M.C., de Oliveira Ferreira, M.C., Silva Mendes, L., Ribeiro Marcelino, P.H., Morais Neves, M., Klein, S.G., Fonseca, B.B., Costa Polveiro, R. and Vieira da Silva, M. (2025). Methodological and ethical considerations in the use of chordate embryos in biomedical research. International Journal of Molecular Sciences 26(6): 2624.

Abstract: Animal embryos are vital tools in scientific research, providing insights into biological processes and disease mechanisms. This paper explores their historical and contemporary significance, highlighting the shift towards the refinement of in vitro systems as alternatives to animal experimentation. We have conducted a data review of the relevant literature on the use of embryos in research and synthesized the data to highlight the importance of this model for scientific progress and the ethical considerations and regulations surrounding embryo research, emphasizing the importance of minimizing animal suffering while promoting scientific progress through the principles of replacement, reduction, and refinement. Embryos from a wide range of species, including mammals, fish, birds, amphibians, and reptiles, play a crucial experimental role in enabling us to understand factors such as substance toxicity,

embryonic development, metabolic pathways, physiological processes, etc., that contribute to the advancement of the biological sciences. To apply this model effectively, it is essential to match the research objectives with the most appropriate methodology, ensuring that the chosen approach is appropriate for the scope of the study.

Azlin, S.U.N.K., Husairy, N.F.M., Fraser, C., Zahli, N.I.U., Akmal, M.N. and Salleh, A. (2025). Pathology of an unusual outbreak of fatal disease associated with mycobacterial and *Pseudomonas aeruginosa* infections and intracytoplasmic inclusion bodies in juvenile spectacled caimans (*Caiman crocodilus*). Journal of Comparative Pathology 218: 19-25.

Abstract: The spectacled caiman (*Caiman crocodilus*) is a common crocodilian species used for exhibition in zoos and for luxury leather and meat production. We investigated unusual mortality among juvenile spectacled caimans in a zoo in Malaysia over a 2-year period. Clinical signs included inappetence, poor body condition, dehydration and ocular lesions. Necropsy findings included integumentary, respiratory and renal abnormalities. Histopathological analyses revealed necrotic plugs and intracytoplasmic eosinophilic inclusion bodies in epidermal keratinocytes, granulomatous lesions in the lungs and liver and gout crystals in the kidneys. Acid-fast, beaded, rod-shaped bacteria were identified in the granulomatous lesions using Ziehl-Neelsen staining. Microbiological investigations identified *Pseudomonas aeruginosa* as the predominant pathogen, while mycobacteriosis was also detected and poxvirus infection was suspected. However, due to the lack of suitable samples, molecular diagnosis was challenging. These findings emphasize the multifactorial nature of disease in captive spectacled caimans and the need for enhanced management strategies to mitigate health risks and preserve population viability.

Saunders, L. and Jukes, S. (2025). Learning to live with Dungalaba: Embracing indigenous knowledge practises for respectful coexistence with Saltwater crocodiles in the Northern Territory. Australian Journal of Environmental Education (doi:10.1017/aee.2025.3).

Abstract: In this paper, we focus on a particular example of human-wildlife conflict involving Dungalaba (Dungalaba, Saltwater Crocodile, *C. porosus* - this paper will interchange between the various names of the species. It is preferred to us various names as we would like to acknowledge the various ways in which people come to understand and recognise the species) (Saltwater Crocodile) in the Northern Territory, Australia. We seek to both better understand and improve relationships with such potentially dangerous animals, positioning this as an educational endeavour. Drawing upon interviews with a small number of relevant stakeholders, we utilise storytelling as a method for informing contemporary relationships with Dungalaba. The method of storytelling has been used effectively by Indigenous Australians for thousands of years to pass teachings of our older people for the benefit of future generations. During interviews, research participants told stories of their lived experiences, which informed the creation of narratives that depict current relationships of conflict and past relationships of harmony. We discuss these narratives and how they may educate for respectful interactions and mutually beneficial coexistence between humans and Dungalaba. This paper contributes to the growing body of work that embraces Indigenous ways of knowing for improved environmental relations. Furthermore, this paper offers specific possibilities for the use storytelling as a tool within crocodile safety education programs within the Northern Territory.

Laut, S., Poapolathep, S., Khidkhan, K., Klangkaew, N., Phaochoosak, N., Wongwaipairoj, T., Giorgi, M., Escudero, E., Marin, P. and Poapolathep, A. (2025). Pharmacokinetic characteristics of tolfenamic acid in freshwater crocodiles (*Crocodylus siamensis*). Animals 15(5): 684.

Abstract: The present study was undertaken to characterize the plasma kinetic disposition of tolfenamic acid (TA) in freshwater crocodiles. In total, 15 freshwater crocodiles were used in the experiment and randomly divided into three groups, with TA administered at 2 mg/kg body weight (b.w.) intravenously (IV) or at 2 or 4 mg/kg b.w. intramuscularly (IM). Blood samples were collected at predetermined times up to 168 h after IV or IM drug administration. Plasma concentrations of TA were determined using validated high-performance liquid chromatography with a UV detector and then analyzed based on the non-compartmental method. The maximum concentration values of TA were 3.03 μg/mL and 6.83 μg/mL following IM administration at a dose of 2 mg/kg b.w. or 4 mg/kg b.w., respectively. The elimination half-lives were 21.89 h (2 mg/kg; IV), 17.74 h (2 mg/kg; IM), and 13.57 h (4 mg/kg; IM). Following IV administration, the volume of distribution and clearance were 1.58 L/kg and 50.04 mL/h/kg, respectively. The absolute IM bioavailability was 71.0% at a dose of 2 mg/kg b.w. and 92.63% at a dose of 4 mg/kg b.w. The average ± SD of plasma protein binding of TA was 26.15 ± 4.93%. Good bioavailability levels and favorable plasma concentrations of TA were obtained in freshwater crocodiles after IM administrations, considering that this is the preferred route of drug administration in freshwater crocodiles. Multi-dose and pharmacodynamic studies are needed to better establish the safety and efficacy of using TA in this crocodilian species.

El-Degwi, E.S., AbdelGawad, M.K., Radwaan, S.E., Sliem, R.E., Sileem, A. and Elhady, S.I.A. (2025). Evolutionary trend of the broad-snouted crocodile from the Eocene, Early Miocene and recent ones from Egypt. Scientific Reports 15(1): 9159.

Abstract: Skulls are a critical part of the crocodile through which we can distinguish between the different genera and species. Most of the crocodiles which previously studied from the Eocene-Oligocene to the Miocene times in Egypt were concerned with the identification of the genus and sometimes on the species without a detailed focusing on the evolution, comparing between them and trying to determine the ancestor or the closest species of them to the living crocodile in Egypt. The only known living species of *Crocodylus* in Egypt is *Crocodylus niloticus* which inhabits Lake Nasser in Aswan, southern of Egypt. From the Cenozoic era, broad snouted crocodiles diversity had been reported in Egypt. About 35 million years ago, through the Eocene epoch, the crocodilian fossils from Fayum provided evidence of the diversity of crocodile species including *Crocodylus articeps* and *Crocodylus megarhinus*. In addition to that, throughout the Early Miocene epoch, from about 18 million years ago, in Wadi Moghra Egypt crocodilian fossils demonstrate another diversity, extended to the first appearance of *Rimasuchus lloydi* which placed inside the Osteolaeminae later. By various measurements and carefully morphological examination of the different species recorded from Egypt, it was found that there are high levels of variation in morphology of the skulls including their dimensions, and the sutures shapes especially between premaxilla and maxilla ventrally and also between maxilla and palatine, as well as the extension of the maxillary ramus of the ectopterygoid. Using cluster analysis, it is proven that Eocene *Crocodylus* is the ancestor to all known broad snouted species recorded from Egypt since the Eocene time. The closest species to the Eocene specimen is the living *Crocodylus niloticus*. That in fact make that most of the broad snouted crocodiles in Egypt are endemic.

Vaghashiya, P., Chauhan, D. and Vyas, R. (2025). Nesting and parental care by a disabled Mugger crocodile (*Crocodylus palustris*) and a record of a congenital defect in a hatchling from Junagadh, Gujarat, India. Reptiles & Amphibians 32: e22290.

Orlov, N.L., Borisovna Ananjeva, N., Prokopeva, A.N., Petrov, D.M.

and Boeskorov, G.G. (2025). Unexpected discovery of southern reptile remains in Yakutia, Eastern Siberia, Russia. Russian Journal of Herpetology 32(1) (doi: https://doi.org/10.30906/1026-2296-2025-32-1-53-59).

Abstract: Human bone remains and varied tool complex including palma were discovered by the Central Yakut archaeological expedition of the Institute of Humanitarian Research and Problems of Indigenous Peoples of the North, Siberian Branch of the RAS. Palma, a long knife-like blade attached to a shaft is a piercing and cutting weapon of the Siberian peoples. Its handle was covered with pieces of skin on the sides. A comparative study of the structure of integument fragments based on collections from the Zoological Institute of the Russian Academy of Sciences and other institutions allows identifying the pieces of skin as belonged to a Chinese alligator (*Alligator sinensis* Fauvel, 1879).

Kwame Ameade, E.P., Korley Attuquayefio, D., Gbogbo, F., Adusei-Sarkodie, J., Yeboah Ofori, B., Gbedema, S. and Adom, E. (2025). Animals traded for traditional medicine in Ghana: Their zootherapeutic uses and implications for biodiversity conservation. Journal of Ethnobiology and Ethnomedicine 21(1): 21 (doi: 10.1186/s13002-024-00717-5).

Abstract: The use of animals for zootherapeutic purposes has been reported worldwide, and with the patronage of complementary and alternative medicines being on the ascendency, the trade and use of animal parts will only escalate. Many more of these animals used in traditional medicine will be pushed to extinction if policies for their sustainable use and conservation are not formulated. There have been studies across the world which assessed the trade and use of animals in traditional medicine including Ghana. However, all previous Ghanaian studies were conducted in a few specific cities. It therefore makes it imperative for a nationwide study which would provide more comprehensive information on the trade and use of animals in traditional medicine and its conservation implications. Using direct observation and semi-structured questionnaires, data were collected from 133 vendors of animal parts used in traditional medicines in 48 markets located across all 16 administrative regions of Ghana. Analysis of the data showed that the trade in wild animal parts for traditional medicine was more prevalent in the urban centres of Ghana. Overall, 75 identifiable animal species were traded on Ghanaian traditional medicine markets. Using their relative frequency of citation values, chameleons (*Chamaeleo* spp.; 0.81), lions (*Panthera leo*; 0.81) and the West African crocodile (*Crocodylus suchus*; 0.67) were the most commonly traded animals in Ghana. Majority of the vendors (59.1%) indicated that their clients use the animal parts for medicinal purposes mainly for skin diseases, epilepsy and fractures, while clients of 28.2% of the vendors use the animal parts for spiritual or mystical purposes, such as protection against spiritual attacks, spiritual healing and money rituals. Up to 54.2% of the animals were classified as Least Concern by IUCN, 14.7% were threatened, with 51.2% of CITES-listed ones experiencing a decreasing population trend. This study also found that 68.5% of the traded animal species are not listed on CITES, but among those listed, 69.6% are classified under Appendix II. Considering the level of representation of animals of conservation concerns, the harvesting and trade of animal parts for traditional medicine must be regulated. This call is even more urgent since 40.0% of the top ten traded animals are mammals; a class of animals with long gestation periods and are not prolific breeders.

López-Rojas, J.J., Santiago, D.H., Solé, M. and Lourenço-de-Moraes, R. (2025). Amphibians and reptiles exhibit different ecological and evolutionary spatial patterns in the Amazon Basin. Ecology and Evolution 15(3): e70677.

Abstract: Understanding spatial variability in ecological and evolutionary patterns is key to Amazonian biodiversity conservation. This study examined taxonomic, phylogenetic, and functional diversity across amphibians and reptiles, assessing the influence of elevation, interrelationships among metrics, and distribution across five Amazon Basin ecoregions, exploring the "cradle" (speciation) and "museum" (lineage preservation) hypotheses. We analyzed 1011 amphibian species from three lineages and 828 reptile species from four lineages. Integrating distribution maps, phylogenies, and trait data, we calculated phylogenetic (PD), functional (FD), and taxonomic (TD) diversity, including mean phylogenetic (PDmntd) and functional (FDmntd) distance to the nearest taxon. We examined spatial regressions between diversity metrics and elevation, assessed correlations among metrics, and compared diversity metrics across ecoregions for each lineage. Diversity metrics across amphibian and reptile lineages reveal distinct geographical patterns related to elevation. Anurans exhibit higher PD, FD, and TD in the western Amazon, while squamates show hotspots at low altitudes. Testudines are linked to major rivers, and crocodilians display high PD near the equator. Anurans and squamates show elevated PDmntd and FDmntd in the Andes, whereas testudines are found in cratonic regions. Significant correlations and notable differences among ecoregions were found, especially in the Andes and low regions of the Amazon Basin. This study highlights the diverse eco-evolutionary patterns among amphibian and reptile lineages in the Amazon Basin, each exhibiting distinct hotspots distributed across ecoregions. The findings align with the cradle-museum hypothesis, suggesting that some regions serve as centers of ongoing diversification, others preserve ancient lineages, or serve as both. The cradle-museum hypothesis should be carefully analyzed, as each taxon presents a distinct pattern. This research underscores the necessity for targeted conservation strategies tailored to distinct ecological and evolutionary dynamics across ecoregions.

Johnson, S.A., Dutton, H.J., Woodward, A.R., Giuliano, W.M. and Ober, H.K. (2025). Managing conflicts with wildlife: Living with alligators. EDIS 2025(2), Gainesville, FL (https://doi.org/10.32473/edis-uw393-2025).

Abstract: As one of the largest reptiles in North America, alligators are situated at the top of the food chain. In general, alligators do not pose a threat to people. However, alligators can pose potential dangers to people in some situations. In this publication, we present some facts about alligators, describe their potential threats to people and pets, and provide suggestions on how to cope with these risks. Our target audience includes anyone living in or visiting the geographic range of American alligators.

Bartolomé Carretero, A. (2024). Enriching the Lives of Reptiles: An Ethologically Informed Approach. PhD thesis, Valencia University, Valencia, Spain.

Mpakairi, K. and Mhlanga, I. (2025). Crocodile farming at Padenga Agri Business in Kariba, Zimbabwe. ALU SOWC Wildlife Economy Lessons Learned Series: Case study #4. African Leadership University: Kigali, Rwanda.

Santos Fleischmann, A., Rabelo, R., Tregidgo, D., Benitz, T., Viana, F., de Lima Franco, D., Hercos, A., Maranhão, L., Bicudo, T., Camelo, P., Costa, A., da Silva Costa, J., Lopes, J., Oler, J., Pedro, J.P., Pereira, H., Silva, P., Torralvo, K., Xavier, R., Zumak, A., Custodio, L., Torres, A.C., Meireles, B., Gomes, M.C., Glorize, M., Coelho, Y., Costa, D., Franca, F., Hymans, D., Lopes, K., Mendel, B., Mendes, D., Mendes, R., Gomes, R., Paim, F., Pinto, A., Prestes, A., Sarmento, C., Silva, A.C., Silva, F., Marmontel, M. and Valsecchi do Amaral, J. (2025). Unprecedented social-ecological impacts of the 2023 extreme drought in the Central Amazon. EarthArXiv (https://doi.org/10.31223/X5HH88).

Abstract: While the 2023 record-breaking drought led to widespread social-ecological impacts across Amazonia, local impacts of such

extreme events are rarely described in detail. Here we leverage a large interdisciplinary data collection related to social and ecological impacts in the Central Amazon. Compound hazards (reduced river water levels, lack of rainfall, high water/air temperatures, river erosion and fire smoke) led to major impacts, including an unprecedented mortality of 209 river dolphins and blooms of the potentially ichthyotoxic *Euglena sanguinea* phytoplankton. Fish kills in lakes and changes in caiman relative abundance along floodplain channels were observed, as well as lower-than-usual production of flowers and fruits in floodplain trees. Impaired river transportation was the main socio-economic impact, affecting important value chains such as the arapaima fishery and manioc flour production, and also access to healthcare, drinking water and urban markets. Our results also show the contrasting impacts between rural and urban populations, with the latter presenting a higher resilience throughout the event. Continuous records of impacts like those presented here are fundamental to guide future disaster management policies in Amazonia. This is particularly important to help vulnerable remote people and ecosystems during extreme events, which are likely to increase in the near future.

Gren, E.C.K., Pruett, J.A., Wood, J.P. and Patton, T.M. (2025). Communal nesting behaviour of female American alligators, *Alligator mississippiensis* (Daudin, 1801) in southeastern Oklahoma, USA. Herpetology Notes 18: 215-219.

Bravo, G.G., Pol, D., Leardi , J.M., Krause, J.M., Nicholl, C.S.C., Rougier, G. and Mannion, P.D. (2025). A new notosuchian crocodyliform from the Early Palaeocene of Patagonia and the survival of a large-bodied terrestrial lineage across the K-Pg mass extinction. Proceedings of the Royal Society B. Biological Science 292(2043) (doi: 10.1098/rspb.2024.1980).

Abstract: Sebecid notosuchians are the only terrestrial crocodyliforms to survive the Cretaceous-Palaeogene extinction, 66 Ma, which eliminated large-bodied species (above approximately 5 kg) in terrestrial ecosystems. Early sebecid evolution is unclear due to the scarcity of remains from both sides of the boundary. We present the stratigraphically earliest post-extinction notosuchian record, from the lower Palaeocene Salamanca Formation of Patagonia. *Tewkensuchus salamanquensis* n. gen. n. sp. has unique features, including a skull roof with elevated lateral margins, and an accessory peg and socket articulation between the postorbital and posterior palpebral. Our phylogenetic analysis allies *Tewkensuchus* with a clade of predatorial crocodyliforms from the Eocene of Europe (and possibly of Africa, as *Eremosuchus* may also belong to this clade). This clade forms the sister taxon of South American sebecids. We name Sebecoidea for this more inclusive clade of Eurogondwanan notosuchians and suggest that its spatial distribution reflects earlier diversification and dispersal events, which are only partially known. We estimate a body mass of around 300 kg for *Tewkensuchus*, one of the largest known notosuchians. Phylogenetic optimization of notosuchian body size change reconstructs a Cretaceous-Palaeogene boundary-crossing sebecoidean lineage with an estimated mass between 332 and 443 kg. This provides the first support for the survival of a large-bodied terrestrial vertebrate lineage across the K-Pg boundary.

Iskakov, M. . (2025). Images of exotic animals in Russian paremiology. International Journal of Artificial Intelligence 1(2): 123-126.

Abstract: The article explores how exotic animals such as elephants, crocodiles, monkeys, camels, tigers, lions, and parrots are symbolized in Russian proverbs and sayings. By analyzing their meanings, origins, and cultural functions, the study demonstrates how foreign influences have shaped Russian linguistic and cognitive frameworks. The findings reveal that exotic animals serve as metaphorical tools to express exaggeration, insincerity, foolishness, endurance, danger, strength, and mimicry in Russian paremiology.

Shuaibu, K.,, Shaibu, O.G. and Abu, S. (2025). Africa traditional medicine practice in health-care among Igala speaking tribe of Nigeria. Journal of Health and Human Movement 3: 209-224.

Abstract: This study discusses the features and potentials as well as the limitations and challenges of traditional medicine practices among the Igala tribe in Kogi state. The specific objectives of this study were to examine the features of Igala traditional medicine, to determine the potentials and prospects of Igala traditional medicine, to examine the challenges of Igala traditional medicine and to determine strategies for enhancing the health benefits of Igala traditional medicine. The study depends largely on the use of structured and unstructured interviews and qualitative literature review, documentary analysis and key informant interview. This study established that traditional medicine is laden with potentials; however, its modicum of practice among the Igala tribe is plagued with multiple limitations and challenges that undermine its acceptance in modern health care practices. These include the perception that it is found on mysticism, superstition, deity, magic, supernatural powers, as well as its association with witchcraft, sorcery and wizardry. These limitations and challenges have made it the most rudimentary, informal, closed and its public acceptance is low. It also lacks adequate governmental recognition and support; as alternative medicine. However it continues to be relied upon by a majority of indigenous Igala populations, especially those in rural areas who are mainly poor with low literacy level and owing to inadequate allopathic health services and facilities. The work posits that despite these limitations and challenges, traditional medicine is suitable and effective in the treatment of diseases and illnesses. Hence, it is an important component of healthcare among the Igala speaking tribe justifying the need for its development.

Folly, H., Thaler, R. and Alves da Silva, L. (2025). Predation on *Pristimantis pluvian* (Anura: Strabomantidae) by *Paleosuchus trigonatus* (Crocodylia: Alligatoridae) in the Brazilian Amazon. Revista Latinoamericana de Herpetologia 8(1): 154-157.

Abstract: Crocodilians are apex predators with a generalist diet, consuming a wide variety of invertebrates and vertebrates. In this study, we describe a predation event of the frog *Pristimantis pluvian* by a juvenile *Paleosuchus trigonatus* in the municipality of Paranaíta, Mato Grosso, Brazil, in August 2020. This observation represents the first record of a crocodilian preying on a species of the genus *Pristimantis*, and the fifth amphibian species confirmed as prey of *P. trigonatus*. During the dry season, *P. pluvian* becomes more terrestrial, while in rainy season it presents more arboreal behavior (vocalization sites). This seasonal shift in microhabitat use likely facilitates predations such as this one described herein, which occured during the dry season. Additionally, this scenario suggests that the consumption of small sized amphibians, including other *Pristimantis* species, by *P. trigonatus* may be more common than previously documented, especially among juvenile caimans.

Resumen: Los cocodrilos son depredadores ápice con una dieta generalista amplia, consumiendo una gran variedad de invertebrados y vertebrados. En este estudio, presentamos un evento de depredación de la rana *Pristimantis pluvian* por un juvenil de *Paleosuchus trigonatus* en el municipio de Paranaíta, estado de Mato Grosso, Brasil, en agosto de 2020. Esta observación representa el primer registro de un cocodrilo depredando una especie del género *Pristimantis* y la quinta especie de anfibio confirmada como presa de *P. trigonatus*. Durante la estación seca, *P. pluvian* se vuelve más terrestre, mientras que en la temporada de lluvias presenta un comportamiento más arbóreo (sitios de vocalización). Este cambio estacional en el uso del microhábitat probablemente facilita depredaciones como la descrita aquí, ocurrida en la estación seca. Además, este escenario sugiere que el consumo de anfibios de pequeño tamaño, incluidas otras especies de *Pristimantis*, por

P. trigonatus puede ser más común de lo que se ha documentado previamente, especialmente entre los caimanes juveniles.

Rivas, L.R., Wallace, R.B. and Gallapa, G. (2025). Herpetofauna of the Great Tectonic Lakes of Exaltación, Beni Department, Bolivia. Reptiles & Amphibians 32: e21473.

Abstract: The Great Tectonic Lakes of Exaltación is a little-explored region of the Beni Department in Bolivia. During a multidisciplinary scientific expedition, we documented the herpetofauna of this part of the floodplains of the Llanos de Moxos and the Cerrado, confirming the presence of 25 amphibian species (Anura) and 40 reptilian species (Testudines, Crocodylia, and Squamata), and estimated species richness of 30 amphibians and 56 reptilian species for the region. Most reported species have wide distributions in the lowlands, except for *Leptodactylus* cf. *gracilis*, a species with a restricted distribution in the southern ecoregions of Bolivia. Two threatened turtle species (*Podocnemis unifilis* and *Chelonoidis denticulatus*) categorized as Vulnerable were present, as well as other larger reptilian species such as the Black Caiman (*Melanosuchus niger*) and the Spectacled Caiman (*Caiman yacare*).

Boatman, A.K. Kudzin, G.P., Rock, K.D., Guillette, M.P., Robb, F., Belcher, S.M. and Baker, E.S. (2025). Novel PFAS in alligator blood discovered with non-targeted Ion Mobility-Mass Spectrometry. bioRxiv (https://doi.org/10.1101/2025.03.20.644452).

Abstract: Per- and polyfluoroalkyl substances (PFAS) are a large and growing class of chemicals gaining global attention due to their persistence, mobility, and toxicity. Given the diverse chemical properties of PFAS and their varying distributions in water and tissue, monitoring of different matrices is critical to determine their presence and accumulation. Here, we used a platform combining liquid chromatography, ion mobility spectrometry, and high-resolution mass spectrometry (LC-IMS-HRMS) for non-targeted analysis (NTA) to detect and identify PFAS in alligator plasma from North Carolina (5 years, 2018-2022) and Florida (2021 only). Structures for 12 PFAS were elucidated, including 2 novel structures, and an additional 34 known PFAS were detected. Three of these compounds were previously unreported in environmental media. More PFAS were detected in NC alligators than FL and no novel PFAS were detected in FL gators. Quantitative analysis of 21 of the known PFAS revealed that plasma concentrations did not change over the 5 year study, indicating that exposure is ongoing.

Abedin, I., Singha, H., Singh, S., Mukherjee, T., Kim, H-W. and Kundu, S. (2025). Riverine realities: Evaluating climate change impacts on habitat dynamics of the Critically Endangered Gharial (*Gavialis gangeticus*) in the Indian landscape. Animals 15(6): 896.

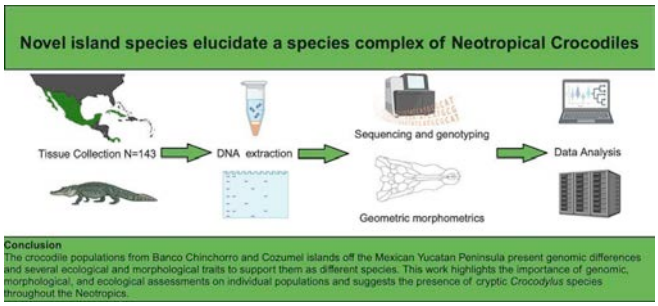
Abstract: The endemic and critically endangered gharial, *Gavialis gangeticus*, experienced a severe population decline in its range. However, conservation efforts, notably through the implementation of "Project Crocodile" in India, have led to a significant recovery of its population. The present study employs an ensemble Species Distribution Model (SDM) to delineate suitable habitats for *G. gangeticus* under current and future climatic scenarios to understand the impact of climate change. The model estimates that 46.85% of the area of occupancy is suitable under the present scenario, with this suitable area projected to increase by 145.16% in future climatic conditions. States such as Madhya Pradesh, Uttar Pradesh, and Assam are projected to experience an increase in habitat suitability, whereas Odisha and Rajasthan are anticipated to face declines. The study recommends conducting ground-truthing ecological assessments using advanced technologies and genetic analyses to validate the viability of newly identified habitats in the Lower Ganges, Mahanadi, and Brahmaputra River systems. These areas should be prioritized within the Protected Area network for potential translocation sites allocation. Collaborative efforts between the IUCN-SSC Crocodile Specialist Group and stakeholders are vital for prioritizing conservation and implementing site-specific interventions to protect the highly threatened gharial population in the wild.

Andreia Garcês, P.I. (2025). Wildlife under threat: Uniting forensic science and conservation practice to safeguard biodiversity. Natural Resources Conservation and Research 8(1): 11285.

Abstract: The illegal wildlife trade significantly threatens global biodiversity, driving many species toward extinction and disrupting ecosystems. This transnational crime is fueled by high demand for wildlife products such as ivory, rhino horns, and pangolin scales and is exacerbated by weak enforcement and global trade networks. Conservation efforts aim to mitigate this crisis through habitat protection, anti-poaching initiatives, and public awareness campaigns. In recent years, wildlife forensic science has become an important tool in addressing wildlife crimes. By leveraging techniques such as DNA analysis, radiocarbon dating, and histopathology, forensic science aids in species identification, origin tracing, and criminal prosecution. This paper explores the intersection of illegal wildlife trade, conservation strategies, and forensic science, highlighting their synergistic potential to curb wildlife trafficking. Case studies illustrate how forensic evidence has been instrumental in dismantling smuggling operations and informing conservation policies. The paper also addresses challenges such as resource limitations and the need for international collaboration. Strengthening the integration of conservation efforts and forensic science is imperative to protect endangered species and promote biodiversity conservation.

Avila-Cervantes, J., Charruau, P., Cedeño-Vázquez, J.R., Bui, H-N., Venegas-Anaya, M., Vargas, M., López-Luna, M.A., González-Cortés, H., Macías-Díaz, D.A., Pérez-Flores, J.S., Barrios-Quiroz, G., Salazar, J.M., McMillan, W.O. and Larsson, H.C.E. (2025). Novel island species elucidate a species complex of Neotropical crocodiles. Molecular Phylogenetics and Evolution 207 (https://doi.org/10.1016/j.ympev.2025.108341).

Abstract: The evolutionary history of Neotropical crocodiles has remained elusive. They inhabit a broad geographic range with populations spanning from coastal, inland, and insular locations. Using a selection of natural insular, coastal, and one inland population of *C. acutus*, coastal *C. moreletii*, and the single surviving population of *C. rhombifer*, we discovered a remarkable genetic diversity for the group. Moreover, geometric morphometric results of skull shapes shows that these crocodylus species span a morphological cline. We recovered a high genetic differentiation between *C. moreletii*, *C. rhombifer*, and five clusters of *C. acutus*. The genetic and geographic differences among the C. acutus clusters were used to suggest these may be a species complex. Several ecological, morphological and genetics traits are identified in the well-studied populations from Banco Chinchorro and Cozumel islands off the Mexican Yucatan Peninsula to support discrete species designations for these populations. This work suggests the presence of rapid, recent evolution of several cryptic *Crocodylus* species throughout the Neotropics.



Kubale, V., Best, A., Mai, S., Smale, T., Alibhai, A., Perez, W., El-Gendy, S.A.A., Alsafy, M.A.M., Sturrock, C.J. and Rutland, C.S. (2025). Anatomy, histology, aetiology, development and functions of cartilago cordis: A systematic review. Cells Tissues Organs (doi: 10.1159/000544776).

Abstract: The cartilago cordis is a structure present within the cardiac skeleton of some, but not all, vertebrate species. This systematic review compared the presence, structure, and function of the cartilago cordis from published works covering all vertebrate species. Literature searches were conducted to obtain information relating to the anatomical location, morphology, prevalence, number of structures, development, and function. The cartilago cordis was most commonly composed of hyaline cartilage but its location within the cardiac skeleton, anatomical, and histological structure varied between species. The cartilago cordis has not been documented in every vertebrate species, or every individual within each species, but it is present in 68 vertebrates including an amphibian, and some mammals, reptiles, and birds. The function of the cartilago cordis is unknown, but theories have ranged from an adaptive mechanism to support cardiac tissue through to roles in conduction and contraction, especially in areas of high mechanical stress. Possible links between the presence of a cartilago cordis and cardiac pathologies were also identified. The cartilago cordis varied in prevalence, structure, and location; further research is required to understand the function and development. In addition, it is possible there are more vertebrate species containing cartilago cordis than presently known about given its varying prevalence and sometimes small size.

Paulina-Carabajal, A., Mendez, A.H., Ulloa-Guaiquin, K., Irazoqui, F. and Lee, Y-N. (2025). A Mesozoic dino-feast: Multiple teeth marks on a sauropod dinosaur bone from the Upper Cretaceous of Patagonia and evidence on theropod feeding behavior. Publicación Electrónica de la Asociación Paleontológica Argentina 25(1): 16-30.

Abstract: Marks left by teeth on bones are evidence for inferring trophic interactions. In carnivorous dinosaurs, such evidence is rare in the fossil record. We present here the description of a fragment of sauropod appendicular bone, which exhibits teeth marks consistent with multiple trace makers. The specimen MPM-PV-19111 comes from Cretaceous rocks outcropping at Cerro Fortaleza locality (Cerro Fortaleza Formation, Campanian-Maastrichtian), Santa Cruz Province, Argentina. It preserves three faces, two bearing grooves, and a third bearing shallow pits. There are about 100 scars (we identified at least 99 grooves and 19 pits), with the grooves mainly oriented more or less perpendicular to the main axis of the bone. These grooves have a width ranging from 1 to 3.5 mm, and generally narrow distally. The pits and punctures are circular to subcircular and variable in diameter (1.5-4 mm). The feeding traces are attributable to theropod dinosaurs -abelisaurids and megaraptorids were recorded in the same formation- of mid to large body size, notosuchid crocodyliforms, and a possible indeterminate small mammal. The teeth marks are considered post-mortem based on the lack of healing on the surrounding bone. The high number of teeth marks suggests both repeated high-power bites in a restricted area (gnawing-like behavior?) and multiple producers, probably biting the bone at different moments since smaller-sized animals would intend to avoid the larger ones. This study aims to describe and interpret the possible origin of the bite marks preserved on this Cretaceous sauropod bone.

Resumen: Las marcas de dientes en los huesos son evidencias utilizadas para inferir interacciones tróficas. En los dinosaurios carnívoros, esta evidencia es rara en el registro fósil. Describimos aquí un fragmento de hueso apendicular de saurópodo que exhibe marcas de dientes consistentes con múltiples productores de trazas. El especimen MPM-PV-19111 proviene de rocas del Cretácico aflorantes en la localidad de Cerro Fortaleza (Formación Cerro Fortaleza, Campaniano-Maastrichtiano), Provincia de Santa Cruz, Argentina. Conserva tres caras, dos con surcos y una tercera con "pits" poco profundos. Hay aproximadamente 100 impresiones (identificamos al menos 99 surcos y unos 19 "pits"), con surcos más o menos perpendiculares al eje principal del hueso. Los surcos varían de 1 a 3,5 mm de ancho y generalmente se estrechan distalmente. Los pits son circulares a subcirculares y de diámetro variable (1,5-4,00 mm). Estas trazas de alimentación son atribuibles a dinosaurios terópodos -abelisáuridos y megaraptóridos se registraron en la formación- de tamaño mediano a grande, cocodrilos notosúquidos y un posible pequeño mamífero indeterminado. Las marcas se consideran post-mortem debido a la ausencia de cicatrización del hueso circundante. El elevado número de marcas de dientes indica tanto mordidas fuertes y repetidas en un área restringida (¿comportamiento similar al de roer?), como también múltiples productores que probablemente mordieron el hueso en diferentes momentos, ya que los animales de menor tamaño intentarían evitar a los más grandes durante el proceso. Este estudio tiene como objetivo describir e interpretar el posible origen de las marcas conservadas en el ejemplar.

Laut, S., Poapolathep, S., Khidkhan, K., Klangkaew, N., Phaochoosak, N., Wongwaipairoj, T., Giorgi, M., Marin, P., Escudero, E. and Poapolathep, A. (2025). Pharmacokinetic evaluation of meloxicam following intravenous and intramuscular administration in *Crocodylus siamensis*, a freshwater crocodile. The Veterinary Journal (https://doi.org/10.1016/j.tvjl.2025.106342).

Abstract: The pharmacokinetics of meloxicam (MLX) remain largely unexplored in reptiles, particularly in Siamese crocodiles (*Crocodylus siamensis*). This study characterized the pharmacokinetic profiles of MLX following intravenous (IV) and intramuscular (IM) administration in Siamese crocodiles. Fifteen Siamese crocodiles were divided into three groups (n= 5) using a randomization procedure according to a parallel study design. MLX was administered IV at 0.2 mg/kg b.w. or IM at two different doses (0.2 mg/kg b.w. or 0.4 mg/kg b.w.). Plasma concentrations of MLX were measured using a validated high-performance liquid chromatography method with UV detection. The pharmacokinetic parameters were analyzed using a non-compartment model. The elimination half-life ($t_{1/2\lambda z}$) was long for all administration routes, with values of 132.34 hr (IV), 121.35 hr (IM 0.2 mg/kg b.w.), and 181.44 hr (IM 0.4 mg/kg b.w.). The volumes of distribution (Vd) and clearance (Cl) after IV administration were 104.59 mL/kg and 0.55 mL/hr/kg, respectively. Based on these results, there was an extended $t_{1/2\lambda z}$ of MLX in this species of freshwater crocodiles, highlighting significant differences in drug disposition compared to other reptilian and non-reptilian species. The findings contribute to an understanding of MLX pharmacokinetics in this animal species, and emphasize that the selection of the optimal dose of MLX should be considered based on disposition kinetics, efficacy, safety, and species-specific differences. Further investigation is required to identify the effective plasma concentration, which is critical for establishing the appropriate dose for the management of pain and inflammation.

Guimarães, A. (2024). Aquatic reptiles as model organisms to evaluate environmental pollution and biomonitoring. Pp. 1-11 *in* The Handbook of Environmental Chemistry. Springer: Berlin, Heidelberg.

Abstract: The increasing contamination of aquatic ecosystems by heavy metals, persistent organic pollutants (POPs), endocrine-disruptor chemicals (EDCs), and microplastics presents a significant challenge for biodiversity conservation and environmental management. In light of these challenges, aquatic reptiles, such as turtles and crocodilians, are valuable model organisms for biomonitoring due to their unique physiology, bioaccumulation abilities, and site fidelity. This chapter highlights the biological and ecological traits that make these animals effective for detecting pollutants and analyzing their chronic impacts. Aquatic reptiles are particularly vulnerable to biomagnification, as they accumulate toxins like mercury, lead, and organochlorine pesticides in their

tissues, offering insights into environmental health. Noninvasive sampling methods enable ongoing monitoring without harming individuals, which is crucial for threatened species. Integrating aquatic reptiles into biomonitoring programs is essential for guiding public policies, mitigating pollution, and protecting aquatic ecosystems and biodiversity. This chapter advocates for a broader application of aquatic reptiles in biomonitoring programs to address the intertwined challenges of chemical contamination and global climate change.

Pan, T., Miao, J., Sun, K., Nie, H., Luscombe, N.M., Li, W., Zhang, S., Yang, L., Wang, H., Zhou, Y., Tu, G., Shu, Y., Zhang, B. and Wu, X. (2025). Genomic insights and the conservation potential of captive breeding: The case of Chinese alligator. Science Advances 11(14): eadm7980.

Abstract: Despite 40 years of conservation of the critically endangered Chinese alligator (*Alligator sinensis*), the genomic underpinnings of its status remained uncharted. Genome sequencing data of 244 individuals uncovered relatively low overall genomic diversity/heterozygosity and long runs of homozygosity, with captive populations exhibiting higher heterozygosity and smaller inbreeding coefficients compared to wild individuals. The decreased level of inbreeding in the captive population demonstrates the contribution of the large captive breeding population. The estimated recent effective population size was around a few dozen. To combat challenges of inbreeding depression and reduced adaptability, we used genome-wide SNP-based kinship analysis on captive populations to enable a genome-informed breeding program that minimizes inbreeding. Long-term field monitoring revealed that the Chinese Government greatly advanced the conservation of *A. sinensis* through conservation measures and reintroduction programs. Our research enriches the understanding of the Chinese alligator's genetic landscape, offering invaluable genomic resources for breeding and conservation strategies.

Jolly, H. and Stronza, A. (2025). Insights on human-wildlife coexistence from social science and Indigenous and traditional knowledge. Conservation Biology 39: e14460.

Abstract: Much work on human-wildlife conflict focuses on safeguarding wildlife from humans and vice versa, protecting humans, their crops, livestock, and property from wildlife, and mitigating negative, sometimes lethal encounters. The emphasis is on conflict, a framing that reinforces human-nature dualisms and instills the notion of humans and wild animals as adversaries. Although human-wildlife interactions are sometimes negative, they can also be neutral, coadaptive, and mutually beneficial. They can demonstrate coexistence. Conservationists have tended to overlook or simplify such relations. They have either failed to define coexistence or characterized it as the outcome of externally driven conservation strategies. Conflict has been perceived as the norm, with coexistence a distant ideal. This way of seeing ignores the many ways people have coexisted with wildlife and coadapted with wild animals in multispecies landscapes for generations. We encourage greater attention to Indigenous and traditional experiences and knowledge, and seeing how coexistence can be a norm, which sometimes includes negative interactions and conflict. Scholars in geography, anthropology, animal studies, philosophy, Indigenous studies, and multispecies ethnography offer insights into how paying attention to coexistence can reshape understanding of human-wildlife interactions that decenters humans, and actively supports ethical conservation. Contributions from social scientists include focusing on relational ways of thinking and seeing that the lives of humans and other beings are intertwined and not governed solely by conflict.

Molina-López, A.M., Pasciu, V., Baralla, E. and Gómez-Baena, G. (2025). Advances in methods of biochemical assessment and diagnosis of animal welfare in wildlife. Frontiers in Veterinary Science 12 (doi: 10.3389/fvets.2025.1602735).

Abstract: Factors contributing to stress or the application of deficient methods to ensure animal welfare could negatively affect various aspects of animal physiology. This is especially significant for endangered species, as it may increase their susceptibility to zoonotic diseases, which can have a direct impact on both public health and biodiversity conservation (Sonnega & Sheriff). This research topic aims to compile articles on the latest scientific advances in the development and validation of new diagnostic methods for the early identification of biomarkers, which will be determinant in predicting early alterations in animal welfare. Main parameters for monitoring animal welfare in wildlife Thyroid hormones (THs) are related to the endocrine regulation of body temperature and can be considered indicators of animals' metabolic and nutritional state (Pasciu *et al*.). THs, like others such as cortisol, can be affected by environmental conditions, so, monitoring them during different times of the year will provide relevant information (Pasciu *et al*.; Supanta *et al*.). Pasciu *et al*. conducted a review on the TH metabolites in feces (FTMs) of wild ungulates, examining both the different methods used for their assay and their fluctuations related to individual or environmental variables, to identify common trends between species. These Authors found that FTM levels were higher in colder periods, decreasing with age, and were unrelated to sex, food quality, animal behavior, anthropogenic disturbance, and body condition. Furthermore, FTMs were high especially in developing animals, confirming the importance of TH levels in individual growth. The importance of validating analytical techniques in each matrix and animal species was also emphasised. Authors concluded that non-invasive assays for determining FTMs can represent a promising tool to evaluate animal response to environmental modifications and their adaptive capacity.The effect of isolation on the welfare of captive Asian elephants (*Elephas maximus*) has been studied. Supanta *et al*. assigned a body condition score to each animal, and blood samples were taken to analyze muscle enzymes, liver enzymes, lipids, and metabolic function. The study confirmed that during this period the animals' physical activity was reduced, decreasing the creatine kinase (CK) and increasing the aspartate aminotransferase and alkaline phosphatase. CK is associated with cellular activity, exercise, muscle damage, or trauma. Additionally, the decrease in the intake of bananas and sugar cane was associated with a reduction in triglyceride levels and a lower number of animals in the obese category. In a subsequent study, Supanta *et al*. took blood and fecal samples to measure fecal glucocorticoid metabolites (FGCM) and to evaluate oxidative stress in serum through the determination of malondialdehyde (MDA) and 8hydroxy-deoxyguanosine (8-OHdG), along with stress leukograms. They observed an increase in FGCM levels, as well as the heterophil/lymphocyte (H/L) ratio, a measure affected by cortisol. Serum 8-OHdG, an indicator of DNA oxidative damage, also increased over time, while monocytosis and lymphopenia further suggested alterations in immune function due to stress. In contrast, serum MDA declined, possibly in response to reduced roughage and supplement intake. These results highlighted the need of implementing contingency plans to improve the management of elephant enclosures, such as maintaining adequate physical activity, ensuring that the health and welfare needs of these animals are met when there is any interference in the tourism industry. Seabird species could serve as sentinels of marine ecosystems and establishing baseline clinical parameters could provide useful information to apply in the conservation and recovery of wildlife. For example, in the marine environment, acute phase proteins (APP) and haptoglobin (HP) can provide information about the health of marine mammals exposed to oil or other contaminants. Therefore, Lee *et al*. established baseline reference parameters for serum protein electrophoresis, APP including serum amyloid A (SAA) and HP, and biochemistry parameters in the Rhinoceros auklet (*Cerorhinca monocerata*). SAA and HP, among other biomarkers, are used to monitor inflammation in birds. These authors indicate that SAA could be an indicator of inflammation and potential subclinical diseases. They did not observe sex differences in the plasma values studied. When comparing plasma triglyceride levels with other

species, it has been observed that Rhinoceros auklet shows higher levels during egg-laying and breeding season, probably due to dietary differences between species. Gut microbiome has emerged as a novel biomarker for assessing animal welfare. Its composition and relationship with the host can reflect health status, stress levels, and emotional states. According to the review by Sonnega & Sheriff, techniques for assessing behavior in wild animals are becoming essential tools for evaluating welfare. Indicators such as activity levels, vocalizations, and aggression offer valuable insights into the emotional and physical states of these animals. However, to ensure their accuracy, behavioral metrics need to be validated using other welfare-related measures, such as stress physiology. The gut microbiome provides a wealth of information about physiology (energy metabolism, thermal regulation, fat deposition, immune function, hormonal regulation) and its influence on host behavior. Beale *et al*. employed a multi-omics approach in feces to assess stress in farmed saltwater crocodiles (*Crocodylus porosus*). They explored the relationship between glucocorticoids, metabolites, and gut microbiota, in a non-invasive manner. The authors found no significant differences in fecal glucocorticoid levels in crocodiles housed individually or in groups. However, metabolic profiling unveiled unique stress responses: crocodiles housed individually exhibited alterations in the levels of specific compounds, which influenced pyrimidine and purine metabolic pathways associated with stress related to energy demand, in comparison to those housed in groups. Furthermore, analysis of the fecal microbiome suggested elevated stress levels in group-housed crocodiles, potentially driven by dominance hierarchies that could induce anxiety in subordinate animals.In summary, the previously mentioned reports highlight the importance of conducting a comprehensive assessment of animal welfare, taking into account behavioral, physiological, and environmental parameters such as housing conditions, weather circumstances, food availability, or environmental pollution, among others. Omics techniques are positioned as key tools in the identification of new biomarkers. It is essential to use validated techniques for each species, preferably non-invasive methods, and to incorporate novel biomarkers for welfare evaluation, to ensure correct interpretation and application in species conservation programs.

Hong J.S., Chen, M.Y. and Zhao, J.H. (2025). Microbial diversity and composition on the surface of Chinese alligator eggs with different phenotypes during artificial incubation. Frontiers in Microbiology 16 (doi: 10.3389/fmicb.2025.1567353).

Abstract: The internal and external environments affect the Chinese alligator (*Alligator sinensis*) eggs during the incubation period. This study aimed to explore the composition, diversity, and function of microorganisms on the surface of Chinese alligator eggs with different phenotypes during artificial incubation, providing a theoretical basis for improving the hatching success rate of Chinese alligator eggs. The development of high-throughput sequencing technology has enabled microbial DNA sequencing. In this study, the microbial community on the surface of Chinese alligator eggs (42 samples) was analyzed via 16S rRNA sequencing. The microbial profiles significantly varied among Chinese alligator eggs with a clean, shiny, crack-free surface (G group) and those with a dirty, dull, cracked surface (B group). The composition and abundance of microorganisms markedly varied between the B and G groups. The predominant bacterial taxa on the surface of Chinese alligator eggs were Proteobacteria, Actinobacteria, Firmicutes, and Bacteroidota, with Proteobacteria exhibiting the highest abundance. The abundance of Actinobacteria and Firmicutes in the G group was greater than that of the B group. Moreover, the abundance of Proteobacteria and Bacteroidota in the B group was greater than that of the G group. These findings indicate that the structure and diversity of microbial communities significantly varied on the surface of Chinese alligator eggs with different phenotypes during the incubation period and that different developmental stages of the eggs are dependent on microbes. The findings of this study provide a novel perspective on microbial dynamics during the incubation of Chinese alligator eggs and provide a scientific basis for the optimization of artificial incubation environments in the future.

López-Rojas, J.J., Santiago, D.H., Solé, M. and Lourenço-de-Moraes, R. (2025). Amphibians and reptiles exhibit different ecological and evolutionary spatial patterns in the Amazon Basin. Ecology and Evolution 15(3): e70677.

Abstract: Understanding spatial variability in ecological and evolutionary patterns is key to Amazonian biodiversity conservation. This study examined taxonomic, phylogenetic, and functional diversity across amphibians and reptiles, assessing the influence of elevation, interrelationships among metrics, and distribution across five Amazon Basin ecoregions, exploring the "cradle" (speciation) and "museum" (lineage preservation) hypotheses. We analyzed 1011 amphibian species from three lineages and 828 reptile species from four lineages. Integrating distribution maps, phylogenies, and trait data, we calculated phylogenetic (PD), functional (FD), and taxonomic (TD) diversity, including mean phylogenetic (PD_{mntd}) and functional (FD_{mntd}) distance to the nearest taxon. We examined spatial regressions between diversity metrics and elevation, assessed correlations among metrics, and compared diversity metrics across ecoregions for each lineage. Diversity metrics across amphibian and reptile lineages reveal distinct geographical patterns related to elevation. Anurans exhibit higher PD, FD, and TD in the western Amazon, while squamates show hotspots at low altitudes. Testudines are linked to major rivers, and crocodilians display high PD near the equator. Anurans and squamates show elevated PD_{mntd} and FD_{mntd} in the Andes, whereas testudines are found in cratonic regions. Significant correlations and notable differences among ecoregions were found, especially in the Andes and low regions of the Amazon Basin. This study highlights the diverse eco-evolutionary patterns among amphibian and reptile lineages in the Amazon Basin, each exhibiting distinct hotspots distributed across ecoregions. The findings align with the cradle-museum hypothesis, suggesting that some regions serve as centers of ongoing diversification, others preserve ancient lineages, or serve as both. The cradle-museum hypothesis should be carefully analyzed, as each taxon presents a distinct pattern. This research underscores the necessity for targeted conservation strategies tailored to distinct ecological and evolutionary dynamics across ecoregions.

Canessa, S., Moehrenschlager, A., Ewen, J.G. and Converse, S.J. (2025). Self-sustaining populations are a conservation vision, not an operational objective. Conservation Science and Practice 2025: e70033.

Abstract: It is common for species conservation plans to identify the establishment or maintenance of a "self-sustaining population" as an objective. However, this statement vaguely conflates different formulations and interpretations of population viability, management costs, and cultural preferences for non-invasive population management. Hidden value judgments and assumptions about these components can create disagreement and conflict among partners. Thus, although a simple statement about "achieving self-sustaining populations" can be a powerful strategic vision, evoking important shared values, it will not be effective as an operational objective for conservation decision making. Best practices in decision making emphasize the importance of fundamental objectives that are clear, unambiguous, and operational. Conservation planners may be better served by replacing the self-sustaining concept with better-defined fundamental objectives using quantitative statements about viability and clearly laying out ecological, economic, and cultural values.

Clutterbuck, S. (2025). Reptile anaesthesia. Pp. 110-125 *in* Veterinary Nursing of the Wild, Exotic and Unusual, ed. by S. Clutterbuck. Cambridge Scholars Publishing: UK.

Olsson, A. (2025). Nursing management of crocodile anaesthesia. Pp. 27-40 *in* Veterinary Nursing of the Wild, Exotic and Unusual, ed. by S. Clutterbuck. Cambridge Scholars Publishing: UK.

Markowska, M., Vonhof, H.B., Groucutt, H.S., Breeze, P.S., Drake, N., Stewart, M., Albert, R., Andrieux, E., Blinkhorn, J., Boivin, N., Budsky, A., Clark-Wilson, R., Fleitmann, D., Gerdes, A., Martin, A.N., Martínez-García, A., Nicholson, S.L., Price, G.J., Scerri, E.M.L., Scholz, D., Vanwezer, N., Weber, M., Alsharekh, A.M., Al Omari, A.A., Al-Mufarreh, Y.S.A., Al-Jibreen, F., Alqahtani, M., Al-Shanti, M., Zalmout, I., Petraglia, M.D. and Haug, G.H. (2025). Recurrent humid phases in Arabia over the past 8 million years. Nature (doi: 10.1038/s41586-025-08859-6).

Abstract: The Saharo-Arabian Desert is one of the largest biogeographical barriers on Earth, impeding dispersals between Africa and Eurasia, including movements of past hominins. Recent research suggests that this barrier has been in place since at least 11 million years ago. In contrast, fossil evidence from the late Miocene epoch and the Pleistocene epoch suggests the episodic presence within the Saharo-Arabian Desert interior of water-dependent fauna (for example, crocodiles, equids, hippopotamids and proboscideans), sustained by rivers and lakes that are largely absent from today's arid landscape. Although numerous humid phases occurred in southern Arabia during the past 1.1 million years9, little is known about Arabia's palaeoclimate before this time. Here, based on a climatic record from desert speleothems, we show recurrent humid intervals in the central Arabian interior over the past 8 million years. Precipitation during humid intervals decreased and became more variable over time, as the monsoon's influence weakened, coinciding with enhanced Northern Hemisphere polar ice cover during the Pleistocene. Wetter conditions likely facilitated mammalian dispersals between Africa and Eurasia, with Arabia acting as a key crossroads for continental-scale biogeographic exchanges.

Azlin, S.U.N.K., Husairy, N.F.M., Fraser, C., Zahli, N.I.U., Akmal, M.N. and Salleh, A. (2025). Pathology of an unusual outbreak of fatal disease associated with mycobacterial and *Pseudomonas aeruginosa* infections and intracytoplasmic inclusion bodies in juvenile spectacled caimans (*Caiman crocodilus*). Journal of Comparative Pathology 218: 19-25.

Abstract: The spectacled caiman (*Caiman crocodilus*) is a common crocodilian species used for exhibition in zoos and for luxury leather and meat production. We investigated unusual mortality among juvenile spectacled caimans in a zoo in Malaysia over a 2-year period. Clinical signs included inappetence, poor body condition, dehydration and ocular lesions. Necropsy findings included integumentary, respiratory and renal abnormalities. Histopathological analyses revealed necrotic plugs and intracytoplasmic eosinophilic inclusion bodies in epidermal keratinocytes, granulomatous lesions in the lungs and liver and gout crystals in the kidneys. Acid-fast, beaded, rod-shaped bacteria were identified in the granulomatous lesions using Ziehl-Neelsen staining. Microbiological investigations identified *Pseudomonas aeruginosa* as the predominant pathogen, while mycobacteriosis was also detected and poxvirus infection was suspected. However, due to the lack of suitable samples, molecular diagnosis was challenging. These findings emphasize the multifactorial nature of disease in captive spectacled caimans and the need for enhanced management strategies to mitigate health risks and preserve population viability.

Wang, C., Li, C., You, F., Zhou, Y., Tu, G., Liu, R., Yi, P., Wu, X. and Nie, H. (2024). Multi-omics analysis of gut microbiome and host metabolism in different populations of Chinese alligators (*Alligator sinensis*) during various reintroduction phases. Ecology and Evolution 15(4): e71221.

Abstract: Reintroduction plays a significant role in the self-maintenance and reconstruction of wild animal populations, serving as a communication bridge between captive and wild animals. The Chinese alligator (*Alligator sinensis*) is a distinct and endangered reptile species found in China. The mechanisms by which artificially bred Chinese alligators adapt following their release into the wild remain poorly understood. This study aims to elucidate the alterations in gut microbiomes and metabolic phenotypes of Chinese alligators during their reintroduction. During the Chinese alligator's reintroduction, Fusobacterium and *Cetobacterium* became more abundant, while typical pathogens declined significantly. The gut type of the Chinese alligator changed from *Acinetobacter* to *Cetobacterium*. The construction of the gut microbial community was dominated by neutral (random) processes and shifted towards deterministic processes with the progression of reintroduction. In terms of species function, reintroduction significantly upregulated the expression of host immune-related genes and significantly decreased the expression of gut bacterial pathogenic genes and antibiotic resistance genes. Metagenomic and metabolomic KEGG enrichment analyses indicate that glucoside hydrolase families 13 and 23-alongside glycolysis and gluconeogenesis pathways-may play pivotal roles in energy metabolism, host-pathogen interactions, and homeostasis maintenance for Chinese alligators. Differential metabolite analysis identified significant upregulation of metabolites related to neuroendocrine immune modulation and significant down-regulation of anti-inflammatory metabolites during Chinese alligator reintroduction. Association analysis showed that there were significant co-metabolic effects between microorganisms and metabolites, which coordinated host adaptive interaction. This study provides insights into the synergistic mechanisms of host adaptation and wild environment adaptation for Chinese alligators.

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