CROCODILE SPECIALIST GROUP NEWSLETTER

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NEWSLETTER

VOLUME 45 Number 1
JANUARY 2026 - MARCH 2026

IUCN Species Survival Commission

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Cover: Sub-adult Siamese crocodile (*Crocodylus siamensis*) amongst *Salvinia molesta* weeds, Mesangat Wetland, Kalimantan, Indonesia. Photograph: Agata Staniewicz.

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

CSG members are aware of the IUCN Red List of Threatened Species, which aims to assess the global risk of extinction faced by individual species. Since 2020, the IUCN Green Status of Species (GSS) has been an optional part of Red List assessments. GSS aims to complement the Red List and provide a measure of a species' conservation success. The latest GSS for a crocodilian was carried out in 2025 on the Gharial (*Gavialis gangeticus*) by Jailabdeen AjjiM, Babu Lamichhane, Phoebe Griffith and Jeff Lang, resulting in a Species Recovery Score of 19% (15-26%) and a "Critically Depleted" recovery category (AjjiM *et al*. 2025). These values reflect the widespread loss of functional Gharial sub-populations. Despite the results of this assessment, it is clear that Gharial would be in a much worse situation today, and possibly extinct, if not for the conservation actions that have been, and continue to be, taken.

The Red List assessment for the Black caiman (*Melanosuchus niger*), carried out in 2023, has been published on the RL website. The previous assessment for *M. niger*, published in 2000, was "Lower Risk/conservation dependent (LR/cd)" under Version 2.3. The current listing of "Least Concern" reflects the changes in classification based on the current standard (Version 3.1). We extend our thanks to all assessors, reviewers, contributors and the CSG Red List team for their tremendous efforts in completing this assessment.

R.J. Rao and Rishikesh Sharma have compiled a bibliographic compendium of wildlife conservation and research in the National Chambal Sanctuary in India. Sections cover crocodiles, turtles, birds, aquatic mammals, conservation management, theses and study reports. The compendium is available from the CSG website.

Members may be interested to know that the Understanding Coexistence Working Group of the Human-Wildlife Conflict & Coexistence Specialist Group (HWCCSG) has developed a definition of "Human-Wildlife Coexistence", as "a dynamic state in which humans and wildlife co-occur in resilient communities and ecologically viable populatons, sustained in socially acceptable ways through just institutions and fair processes that enable co-adaptation, adaptive management, and negotiated solutions to keep negative impacts or conflicts at acceptable levels" (HWCCSG 2026).

In a recent press release, Collective Fashion Justice alleged that the CSG had received payments from industry donors for favourable Red List assessments for certain crocodilian species. Anyone who knows anything about the Red List assessment process will understand that there is absolutely no evidence to support these allegations, which are considered both false and misleading. In 2011, Perran Ross, CSG Red List Authority (RLA), provided a summary of the IUCN process and how CSG intended to assess crocodilians for Red Listing at that time (Ross 2011). The current RLA, Sally Isberg, has provided an updated summary to inform members of the current process, and to address these unfounded allegations (see pages 4-7).

I (CM) was invited to give short presentation (Crocodile as Functional Analogue for Sea Turtle Conservation) at a workshop entitled "Sustainable Use of Sea Turtles: Pathways, Challenges, and Cultural Perspectives", convened at the 44th International Sea Turtle Society Symposium (Hawaii, 1 March 2026). Unfortunately, due other commitments I was unable to attend in person, but presented through Zoom, and was unable to participate with further discussions. This workshop was significant, as it represented what is possibly the first dedicated discussion on the potential for sustainable use of sea turtles. The workshop highlighted that conservation and use of sea turtles can coexist. Organisors recognised the success that has been achieved by the CSG through SU as a conservation tool with crocodilians, and had invited myself, ex-CSG Chair Grahame Webb and ex-SULi Chair Rosie Cooney to contribute to the workshop deliberations through our collective experiences.

Following the end of the IUCN quadrennium (November 2025), CSG was advised that all existing members would be automatically renewed on the IUCN portal. It appears that this is still an ongoing process, with some members reporting that they are listed for the 2026-2029 quadrennium, and others reporting that they have not yet been included. The CSG Executive Officer will advise when existing members are all on the system, and when new members can access the portal to input their details and formally register as an IUCN member.

The 28th CSG Working Meeting will be held in Morocco, in May 2026. Organisors are monitoring the current situation in the Middle East, but do not feel that it will impact Morocco and preparations for the meeting. A meeting of the CSG Steering Committee will take place on 12 May, and agenda papers are being posted on the CSG website as they come to hand. Details on submission of abstracts, registration, venue, accommodation, veterinary workshop and field trips, etc., are available on the meeting website. We look forward to seeing many of you in Morocco.

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

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 three students in the January-March 2026 quarter (see below), and one application is currently under review.

1. Isabella Domingos de Oliveira (Brazil; Project 26/1): Habitat use and distribution of Dwarf caimans in an urban Atlantic forest in northeastern Brazil.

2. Ethan Shealy (USA; 26/2): Development of an epigenetic age estimation tool in the American alligator.

3. Usman Olatunji (Nigeria; 26/3): Genetic characterization of herpes virus in African Nile crocodile in Oyo State, Nigeria.

The following SRAS reports were submitted in January-March 2026, and have now been posted on the CSG website:

1. Brinky Desai (India; 19/13): Understanding reproductive profiles of Mugger crocodiles using non-invasive fecal hormone metabolite measurements within the human-dominated habitat of central Gujarat. Download.

2. Julio Guiterrez-Ramirez (Mexico; 19/14): Evaluation of the translocation of *Crocodylus moreletii* at Yum Balam, Quintana Roo, Mexico. Download.

3. Line Skipper Jensen (Denmark; 19/20): Hippopotamus (*Hippopotamus amphibius*) and Nile crocodiles (*Crocodylus niloticus*) in Maasai Mara. Download.

4. Tank Rawal (Nepal; 20/23): Assessing human-crocodile conflict, people's perception and raising awareness for the conservation of Muggers of Ghodaghodi, Nepal. Download.

5. Devon Viljoen (South Africa; 21/4): Non-invasive body condition monitoring and relationships between thermal responses and behaviour in captive and wild Nile crocodiles (*Crocodylus niloticus*). Download.

6. Noah Riccio (USA; 22/12): The crocodile's dilemma: Observing distinctive parental and social behaviors in captive crocodilians. Download.

7. Camila Chacón (Argentina; 23/3): Gene expression patterns of lipid metabolism as biomarkers of environmental pollution in *Caiman latirostris*. Download.

8. Mónica Pérez (Mexico; 23/8): Genetic flow between insular and mainland Caribbean crocodiles: allopatry, forced hybridization, or continuous flow? Download.

9. Albert Wilken (South Africa; 23/10): The suitability of census techniques for the management of threats to crocodilian populations. Download.

10. Barthira Rezende de Oliveira (Brazil; 23/14): Reproductive ecology of the Black caiman (*Melanosuchus niger*) in the Araguaia National Park, Tocantins, Northern Brazil: An initial approach. Download.

11. Diana Marcela Caro-Martínez (Mexico; 24/1): Microplastic characterization in stomach contents of the American crocodile (*Crocodylus acutus*) from Cozumel, Mexico. Download.

12. Maria Luiza Leal da Silva (Brazil; 24/3): Abundance and distribution of the broad-snouted caiman (*Caiman latirostris* Daudin, 1802) in an urban fragment of the Atlantic Forest in northeastern Brazil. Download.

13. Ana Maria Saldarriaga (Colombia; 24/9): Monitoring reintroduction success of *Crocodylus intermedius* in Colombia: A hope for recovering the species. Download.

14. Fernando Paulino Alvarenga (Brazil; 24/12): Potential distribution and ecological niche divergence among evolutionary units of *Caiman latirostris*. Download.

15. Mason Scarpa (Austria; 25/1): Investigation of the host and environmental-associated microbiome to the mercury detoxification strategies of two *Caiman* species in French Guiana. Download.

16. Jose Rodolfo Mañon-González (Mexico; 25/14): Occupancy models of two sympatric crocodilian species on the coast of Chiapas. Download.

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

Crocodilian Red List Authority Update 2026

Since 1964, the IUCN Red List of Threatened Species has become the IUCN flagship program that aims to categorise the risk of global extinction for all known species of animal, plant and fungi. As of early 2026, over 172,600 species had been assessed for the Red List, with over 28% listed in a 'threatened' category, although this number only represents a fraction of the world's known species (IUCN Red List 2026). The first crocodilian Red Data summaries were produced by Rene Honegger (1975) following the first CSG Working Meeting in 1971 (Siroski 2021). Each crocodilian species has since been assessed multiple times as the Red List process has evolved.

The program has been very successful with general society becoming familiar with the Red List threatened categories, even if they are not aware of how they are derived. The threatened categories include species that are Critically Endangered (CR), Endangered (EN) and Vulnerable (VU). However, there are other categories that accommodate species that are either not threatened [Least Concern (LC)] or Near Threatened, extinct (Extinct in the Wild or Extinct), are unable to be assessed (Data Deficient), or are yet to be assessed [Not Evaluated (NE)]. Intuitively, those species in the threatened categories are referred to as requiring higher conservation priority but that does not mean that those not in the threatened categories require less attention or management to maintain their conservation status.

As of March 2026, of the 23 species of crocodilians that have been assessed, 7 are listed as CR, 1 as EN and 3 as VU

(Table 1). There are also 12 species listed as LC. Two species are listed as NE, although assessments are currently being drafted. No crocodilians have been listed in the extinct or data deficient categories.

To determine what Red List category is appropriate, criteria are applied according to the "Guidelines for Using the IUCN Red List Categories and Criteria" (Version 16; IUCN Standards and Petitions Committee 2024). These criteria cover five broad indices of extinction risk:

A. Reduction in population size
B. Limited geographic range
C. Small population size combined with other risk factors (decline, population structure)
D. Extremely small population size
E. Quantitative analysis indicating risk of extinction

Each criterion has detailed components and sub-criteria with objective, quantitative thresholds for each category. The "Guidelines" provide definitions of terminology specific to the Red List, outline how the criterion are applied, the quality of data required, as well as a number of case histories and precedent to guide their application (Ross 2011). Further to the "Guidelines", maps are also required to be produced according to the "Mapping Standards and Data Quality for the IUCN Red List Spatial Data" (IUCN SSC Red List Technical Working Group 2024).

It is important to note that the Red List only considers mature individuals of a species throughout its global range. In this context, mature individuals are considered to be those "capable of reproduction" (IUCN Standards and Petitions Committee 2024). This is particularly noteworthy for researchers conducting field surveys, as the total population number cannot be considered in the Red List assessment. Instead, only the breeding individuals are included so reporting these either as a subset of the data, or as a percentage, assists when including your results in Red List assessments. While Red List assessments are conducted on a global scale, that is across the species entire range, regional or national assessments are becoming commonly used by Governments and other institutions to evaluate local extinction risk of species. There are additional considerations when adjusting global assessments to these local contexts as provided within the "Guidelines for Application of IUCN Red List Criteria at Regional and National levels" (IUCN 2012).

To achieve these global assessments for each species, a Red List Authority (RLA) is appointed, generally under the

Table 1. Latest Red List assessments for crocodilians (23 species). Facilitators for 16 assessments were: Perran Ross (8), Sally Isberg (1), Sergio Balaguera-Reina (1), Sally Isberg & Perran Ross (3), Sally Isberg & Sergio Balaguera-Reina (2), Sally Isberg, Perran Ross & Sergio Balaguera-Reina (1). Authors and reviewers were associated with more than 70 institutions. **Osteolaemus tetraspis* assessment currently underway includes *O. afzelii* and *O. osborni*, as the latter species have yet to be formally recognised by IUCN; [1]CSG Chair, [2]CSG Executive Committee, [3]CSG Red List Authority Co-ordinator.

Last Assessed	Published	Species	Status	Authors	Reviewers
2018	2019	*A. mississippiensis*	LC	R. Elsey, A. Woodward, S. Balaguera-Reina	S. Isberg, P. Ross[2], C. Manolis[2], G. Webb[1]
2017	2018	*A. sinensis*	CR	H.X. Jiang, X.B. Wu	S. Isberg, C. Manolis[2]
2016	2019	*Ca. crocodilus*	LC	S. Balaguera-Reina, A. Velasco	S. Isberg, C. Lippai[2], G. Webb[1]
2019	2020	*Ca. latirostris*	LC	P. Siroski, L. Bassetti, C. Piña, A. Larriera[2]	S. Isberg, P. Ross[2,3], L. Verdade, G. Webb[1]
2019	2020	*Ca. yacare*	LC	Z. Campos, A. Llobet, W. Magnusson, C. Piña	S. Isberg, P. Ross[2,3]
2020	2022	*C. acutus*	VU	T. Rainwater, S. Platt, P. Charruau, L. Sigler, J. Cedeño-Vázquez, S. Balaguera-Reina, J. Thorbjarnarson	C. Manolis[2], G. Webb[1]
2017	2018	*C. intermedius*	CR	S. Balaguera-Reina, A. Espinosa-Blanco, R. Antelo, A. Seijas, M. Morales-Betancourt	P. Ross[2,3]
2016	2017	*C. johnstoni*	LC	S. Isberg, S. Balaguera-Reina, P. Ross[2,3]	R. Somaweera, M. Brien, C. Limpus, Y. Fukuda, G. Webb[1], C. Manolis[2]
2012	2016	*C. mindorensis*	CR	M. van Weerd, C. Pomaro, J. de Leon, R. Antolin, V. Mercado	C. Banks, R. Manolo
2020	2023	*C. moreletii*	LC	S. Platt, L. Sigler, T. Rainwater, J. Cedeño-Vázquez, A. Villegas	C. Manolis[2], A. Larriera[2], G. Webb[1]
2017	2019	*C. niloticus*	LC	S. Isberg, X. Combrink, C. Lippai[2], S. Balaguera-Reina	S. Childes, P. Ross[2,3], M. Shirley, G. Webb[1]
2018	2019	*C. novaeguineae*	LC	G. Solmu, C. Manolis[2]	S. Isberg, P. Ross[2,3]
2009	2013	*C. palustris*	VU	B.C. Choudhury, A. de Silva	M. Böhm, B. Collen, M. Ram, P. Ross[3], T. Dacey[2], G. Webb[1]
2019	2021	*C. porosus*	LC	G. Webb, C. Manolis, M. Brien, S. Balaguera-Reina, S. Isberg	L. Taplin, Y. Fukuda, R. Manolo, A. de Silva, R. Whitaker
2022	2022	*C. rhombifer*	CR	W. McMahan, R. Targarona, R. Soberon, M. Tabet	C. Manolis[2], A. Larriera[2], C. Stevenson
2012	2012	*C. siamensis*	CR	M. Bezuijen, B. Simpson, N. Behler, J. Daltry, Y. Temsiripong	C. Manolis, R. Stuebing
2017	2019	*G. gangeticus*	CR	J. Lang, S. Chowfin, P. Ross[2,3]	A. Bashyal, B.C. Choudhury, I. Gill, S. Isberg, G. Mallapur, R. Rao, C. Stevenson, G. Vashistha, G. Webb[1]
2013	2014	*M. cataphractus*	CR	M. Shirley	G. Webb[1], T. Dacey[2]
2023	2025	*M. niger*	LC	R. Botero-Arias, S. Hernández-Rangel, J. Thorbjarnarson, W. Magnusson, R. da Silveira	R. Mangione, C. Manolis[1]
1996	1996	*O. tetraspis*	VU	Crocodile Specialist Group	
-	-	*O. afzelii*	*		
-	-	*O. osborni*	*		
2018	2019	*P. palpebrosus*	LC	W. Magnusson, Z. Campos, F. Muniz	S. Isberg, K. Vliet, G. Webb[1]
2018	2019	*P. trigonatus*	LC	Z. Campos, W. Magnusson, F. Muniz	S. Isberg, G. Webb[1]
2022	2023	*T. schlegelii*	EN	K. Shaney, B. Shwedick, B. Simpson, A. Pine, B. Sideleau, C. Stevenson	C. Manolis[2], A. Larriera[2], G. Webb[1]
-	-	*C. suchus*	-	First Red List assessment underway	
-	-	*M. leptorhynchus*	-	First Red List assessment underway	

umbrella of an IUCN SSC Specialist Group, although for some species, standalone RLAs can be appointed. A RLA co-ordinator (RLAc) is formally appointed through the SSC to oversee and coordinate the assessments of the species under their remit (IUCN Red List 2026). The RLAc is required to complete formal training as a Global Red List Assessor, including passing a rigorous examination.

For crocodilians, the RLA is the Crocodile Specialist Group. From the late-1990s, John Thorbjarnarson was acting in the role of RLAc, although documentation on an official SSC appointment cannot be found. Following John's passing, Perran Ross was appointed as the RLAc in 2010 (CSG 2010), after which Sally Isberg was appointed in 2021. In 2025, to assist the RLAc and create an avenue of succession, the position of Deputy RLAc was created, with Sergio Balaguera-Reina being appointed to the role. Colin Stevenson and Clare Wilkie are also current members of the CSG Red List team.

Ross (2011) provided a summary of the process that the CSG undertakes when conducting Red List assessments. While the framework has not changed considerably, it was considered timely to provide an update on CSG Red List processes, as follows:

- Action Plans are updated roughly every 10 years for each crocodilian species and published on the CSG website. Action Plan authors are assigned based on who is working on the species at the time and/or who has relevant experience on the species. Given the continual updating process, the main role of Action Plan authors is to include any recent population trends that may have occurred since the last publication as well as outlining any changes to threats that may be impacting the species.

- To ensure policy alignment, draft Red List assessments are based on the published Action Plan. As such, the Action Plan authors are also asked to be the authors of the Red List assessment. Additional authors/assessors are added where appropriate, with particular consideration to those who can contribute indigenous and local knowledge (ILK). Others are included as contributors depending on their level of contribution similar to any scientific publication. From the most recent crocodilian Red List assessments available, there is only one Red List account published with a single author (*Mecistops cataphractus*) with all others having between two and seven authors (Table 1).

- Once information has been input, the RLAc applies the Red List criteria according to the "Guidelines". The resulting category is then disseminated to the assessment team to discuss and verify the determination.

- Once the assessment team has reached consensus on the Red List category, the final draft of the assessment is submitted for review, which has always, with the exception of *Crocodylus mindorensis*, included a member of the CSG Executive Committee and in 59% of cases the CSG Chair as well (Table 1). There was one case (*C. porosus*) where the lead author was also the CSG Chair (Grahame Webb), so the assessment was reviewed by five independent reviewers from four countries. In only one case was there a single reviewer (*C. intermedius*; Perran Ross) with all other Red List assessments having between two and nine reviewers (Table 1).

- The final stage is to upload the assessment and mapping information onto the IUCN's Species Information System (SIS). The CSG has requested the IUCN Red List Unit to limit SIS access to the RLAc and Deputy RLAc alone to allow governance oversight. During the writing and review stages, Word and Excel templates developed by the CSG RLA team are used for easy dissemination, editing and progress tracking between the assessment versions with the authors, reviewers, etc.

- Once submitted to SIS, the IUCN Red List Unit do the final external review and compliance check to ensure the consistency, quality and standard required to meet the "Guidelines". If not satisfied, the Red List Unit requests further information or clarification from the RLAc prior to acceptance for publication. It generally takes between 6-12 months between submission to SIS and publication of the assessment on the IUCN Red List of Threatened Species website.

- If there is a challenge to a species assessment, formal petitions are received by the IUCN Red List Unit. When a formal petition is received, the IUCN Red List Unit acts as the initial receiving body, validates the petition's basis, facilitates communication between the petitioner and the RLA, and ensures adherence to the "Procedure for Handling of Petitions against Current Listings on the IUCN Red List of Threatened Species" (IUCN Red List Standards and Petitions Committee 2024). No formal petitions have been received for any crocodilian Red List assessment.

In summary, for the 23 crocodilian Red List assessments currently on the IUCN Red List website:

- all assessment teams were unanimous about the assigned Red List category at the time of submission to the IUCN Red List unit;
- all assessments passed the compliance and assessment checks of the IUCN Red List Unit and were published on the Red List website;
- no complaints have been received by the CSG or the CSG RLAc from the authors, contributors, other CSG members, general public or anyone else that a crocodilian species has been incorrectly assigned to a Red List category; and,
- no formal petitions have been lodged with the IUCN Red List unit about any crocodilian species being incorrectly assigned to a Red List category.

The role of the RLAc or a Red List team member is entirely voluntary. By sheer coincidence, the previous and current CSG RLAc's were, or are, the CSG's Executive Officer. However, the roles and responsibilities of the CSG Executive Officer do not, and never have, included RLA responsibilities.

Despite each assessment taking an estimated 40+ hours of RLA time, no payment for services is provided by the CSG, CSG donors, IUCN, SSC or any other source. Instead, the RLAc and Red List team members act either in their own private capacity, or if their employer allows, carry out their duties within their regular employment role.

Furthermore, being an Action Plan author, or a Red List assessor, reviewer, contributor or compiler are also all voluntary roles within the CSG framework. The 23 current Red List assessments for crocodilians have involved 61 assessors and 33 reviewers. Like the RLAc (see above), no payments have been made from any source to any of these people who have contributed their expertise to Red List assessments. Each person has acted in their own private capacity or as part of their normal employment duties.

There has been some expenditure from CSG core funds attributed to the RLA, including costs of travel for the RLAc to attend IUCN Red List Unit training sessions (Perran Ross and Sergio Balaguera-Reina, USA, 2017) and to conduct Red List workshops (Perran Ross, Cote d'Ivoire, 2015; Sally Isberg, Cote d'Ivoire, 2024). In addition, small amounts of CSG funds were used to pay for postgraduate students to enter references into the SIS database platform. Other requests for RLA funding have been proposed, including RLA team members attending mapping training courses and/or paying for mapping consultants. Although these funds have not yet been required, the CSG Executive Committee reserves the right to resource the CSG Red List team as appropriate to meet its obligations to the IUCN and SSC.

At present, there are 8 Red List assessments underway, including *C. mindorensis*, *C. palustris*, *C. suchus*, *Osteolaemus* spp., *M. cataphractus* and *M. leptorhynchus*. The RLA team are also beginning to undertake Green Status of Species training to complement the Red List assessments.

If you are interested in being considered for the CSG RLA team, please contact Sally Isberg (sally@crocresearch.com.au).

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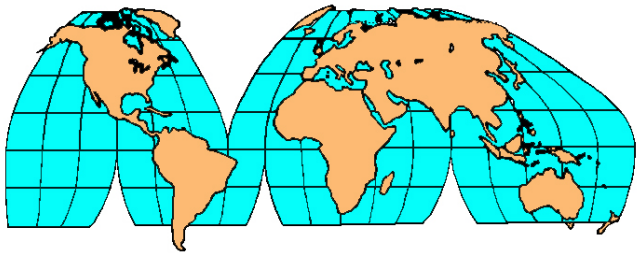
Dr. Sally Isberg, *CSG Red List Authority Co-ordinator (sally@crocresearch.com.au).*

Regional Reports



South Asia & Iran

Nepal

INTERVIEW-BASED RECORDS OF GHARIAL (*GAVIALIS GANGETICUS*) SIGHTINGS IN THE BABAI RIVER IN THE BUFFER ZONE OF BARDIYA NATIONAL PARK, NEPAL. Gharial (*Gavialis gangeticus*) occur in the Rapti and Narayani Rivers in Chitwan National Park (CNP), and the Babai and Karnali Rivers in and around Bardiya National Park (BNP) in the southern lowlands of Nepal (Lang *et al*. 2019). The Gharial population in the Babai River is one of the six "major subpopulations" across the species' range (Lang *et al*. 2019). There is updated information available for the Gharial population residing in the fully protected 46-km stretch of the Babai River inside BNP, including total counts (Khadka *et al*. 2008; Acharya *et al*. 2017; Bashyal *et al*. 2021) and nesting/reproduction (Bashyal *et al*. 2019, 2024). However, information on the occurrence of Gharials in stretch of the Babai River outside the protected area is largely lacking.

The protected stretch of the Babai River is bound by an irrigation weir at Parewa Odar, just outside the core protected

area of BNP from where water is channeled into the irrigation canal all year round (Figs. 1 and 2; Bashyal *et al*. 2021). Water level is very low in the river downstream of this weir except during the monsoon season (June-September).

Figure 1. Irrigation weir at Parewa Odar on the Babai River, just outside the core protected area of Bardiya National Park. Photograph: Ashish Bashyal/Biodiversity Conservancy Nepal.

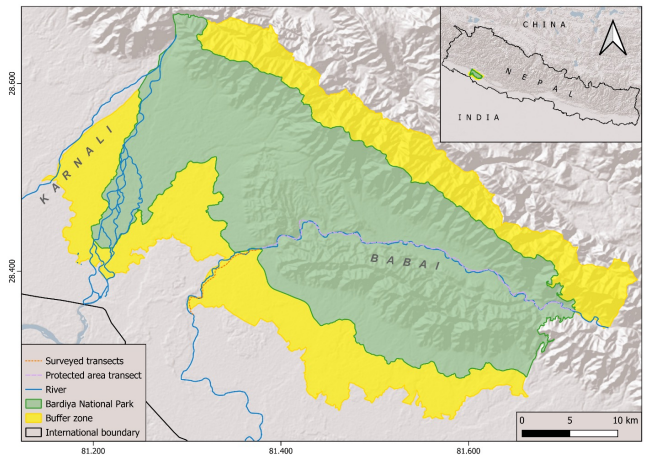


Figure 2. Bardiya National Park, showing protected stretch of the Babai River (dashed pink line) and surveyed stretch within the buffer zone (red dashed line).

We conducted extensive Gharial surveys in the protected stretch of the Babai River during winter (December-February) between 2017 and 2021 (Bashyal *et al*. 2021, 2024). However, surveys couldn't be conducted during winter due to low water levels, and conducting surveys in the monsoon when water levels were higher was not possible due to risks of flooding. Therefore, local residents living in the villages flanking the Babai outside the core protected area, were interviewed in this pilot study to record any sightings of Gharials between 2017 and 2021.

BNP is located in Bardiya district of Lumbini Province in southwestern Nepal, covering an area of 968 km^2 along with a buffer zone of 507 km^2. More than half of the population living in the buffer zone of the BNP belong to the Indigenous Tharu community. Local communities are primarily engaged in subsistence farming, cattle rearing and fishing.

Figure 3. Local field assistant Chotram Tharu (left) interviewing local woman (third from left), Babai River, March 2021. Photograph: Ashish Bashyal/Biodiversity Conservancy Nepal.

Open-ended questionnaire surveys were conducted to locals living along the Babai River in the buffer zone of BNP (~12 km) in March 2021 (Figs. 2 and 3). This short questionnaire was designed to build a database on Gharial sightings in the stretch of Babai River along the buffer zone by collecting information from local riverine communities, and to assess the willingness of local communities to participate in citizen science programs. Prior informed consent of respondents was taken before administering the survey. Data were systematically compiled and analyzed in MS Excel.

A total of 76 respondents was interviewed from various villages (Table 1). The average age of respondents was 37.6 ± 13.51 years, with an almost equal representation of males and females. More than 80% of respondents were involved in agriculture and at least 95% of respondents visited the Babai River in varying frequencies ranging from daily to bimonthly, mostly for firewood collection, bathing, fishing, boulder collection and livestock grazing (Table 1).

Key results can be summarised as:

- More than 70% of respondents claimed they could distinguish Gharials from Muggers, which also occur in the Babai River, however a slightly lower percentage (65.3%) correctly recognized Gharial when cross-examined (Table 1).
- Less than one third of respondents (31.6%) claimed to have seen Gharials in the Babai River, with most sightings (54.2%) occurring two years ago.
- There were no Gharial sightings between February 2020 and 2021.
- Almost all respondents (91.7%) had seen a single Gharial during one encounter (Table 1).
- More than 70% of Gharials sighted were larger individuals (>2 m TL), in either the sub-adult or adult categories and less than 20% were yearlings (Table 1).
- All Gharial sightings occurred during the monsoon (June-September) and post-monsoon (October-early November).
- All respondents that were interviewed were interested in participating in citizen science program on Gharials in their localities.

Table 1. Responses from questionnaire surveys on Gharial sightings in the unprotected stretch of the Babai in the buffer zone of Bardiya National Park in March 2021. 'N' represents sample sizes.

	Variables	Respondents	Categories	N	%
1	Sex of respondents	76	Male	35	46.1
			Female	41	53.9
2	Education of respondents	75	Illiterate	38	50.7
			Up to Grade 10	33	44.0
			Above Grade 10	4	5.3
3	How often do you visit Babai River?	74	Daily	28	37.8
			Weekly	6	8.1
			Fortnightly	3	4.1
			Monthly	4	5.4
			Bimonthly	30	40.5
			Yearly	3	4.1
4	Do you recognise Gharial?	75	Yes	54	72.0
			No	21	28.0
5	Did respondents recognise Gharials correctly? (assessed by interviewer based on respondent's answer)	75	Yes	49	65.3
			No	26	34.7
6	Have you seen Gharials in the Babai?	76	Yes	24	31.6
			No	52	68.4
7	How many years ago did you see Gharial in the Babai?	24	2	13	54.2
			2.5	1	4.2
			3	5	20.8
			3.5	1	4.2
			4	3	12.5
			6	1	4.2
8	How many Gharials have you seen in one encounter?	24	1	22	91.7
			2	2	8.3
9	Size classes of Gharials sighted?	23	Yearling	4	17.4
			Juvenile	2	8.7
			Sub-adult	7	30.4
			Adult	10	43.5
10	Season of Gharial sightings?	24	Monsoon	14	60.9
			Post-monsoon	10	43.5
11	Are you interested in citizen science programs on Gharials?	76	Yes	76	100.0
			No	0	0.0

A very small percentage of respondents had seen Gharials in the Babai River in the buffer zone, which is partly expected given the small population that exists there (N= 18 in 2019) and their restricted distribution (Bashyal *et al*. 2021). Many of the Gharials sighted were either sub-adults or adults, which is reasonable given that larger Gharials are seen relatively more easily than smaller ones. It is also likely that the sub-adults and adults seen could be resident Gharials of Parewa Odar (which is the closest known localities of Gharial presence) (Fig. 4). All sightings reported by respondents occurred between June and early November corresponding to high water levels in the Babai River.

Findings from this pilot study showed that: (1) Gharials occur in the stretch of the Babai outside the core protected area mostly seasonally and probably in low numbers; (2) information collected via questionnaire surveys could be helpful in rapid assessment of Gharial sightings in sites where population surveys couldn't be/haven't been conducted; and, (3) given the willingness of locals to participate in Gharial

Figure 4. Gharials and Muggers basking at Parewa Odar, on the Babai River, just below the irrigation weir. Photograph: Ashish Bashyal/Biodiversity Conservancy Nepal.

citizen science program, implementation of a citizen science approach could be considered. Interviewing more locals covering villages further downstream outside of the buffer zone and conducting foot surveys by walking along the riverbanks could provide more information on Gharial total counts and distribution.

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India

‘REAR AND RELEASE’ PROGRAM LAYS FOUNDATION FOR RECOVERING ESTUARINE CROCODILE POPULATION IN BHITARKANIKA NATIONAL PARK/ WILDLIFE SANCTUARY, ODISHA, INDIA. In January 2026, the winter census for Saltwater crocodiles (*Crocodylus porosus*) was conducted in the river systems of Bhitarkanika National Park/Wildlife Sanctuary (Fig. 1). Survey results comprised 531 hatchlings, 442 yearlings, 365 juveniles, 167 sub-adults and 353 adults (Table 1). Of the total of 1858 crocodiles sighted, most (1424; 76.6%) were in Kanika Wildlife Range (which included potential Forest Blocks and rivers starting from Khola to Bhitarkanika-Pathasala confluence and beyond in Bramhani-Baitarani River systems), followed by Rajnagar WL Range (292; 15.7%), Mahakalapada Wildlife Range (99; 5.3%) and Gahirmatha Wildlife Range (43; 2.3%).

Figure 1. Bhitarkanika National Park/Wildlife Sanctuary.

The “rear and release” program implemented since 1975 has resulted in the release of 3008 crocodiles around 1 m total length between 1977 and 2024 into Bhitarkanika wetlands (Kar 2024). The collection of eggs from the wild was reduced after 1995, with lower numbers being collected after 1995 for subsequent incubation and rearing in captivity.

Nest numbers in the wild have increased from average of 4.9 nests per year in 1975-1994, to 122 nests per year in 2022-2023 (Kar 2024). The increasing numbers of hatchlings

Table 1. Estuarine crocodile counts in Bhitarkanika National Park/Wildlife Sanctuary, 1976-2026 (N= 39 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. Source: Kar (2024) and Kar (2025).

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
2026	531	442	365	167	353	1327	1858

over time is also indicative of the increasing contribution of natural recruitment into the *C. porosus* population. A detailed analysis of the recovery of this population is in Kar (2024).

Clearly, the FAO/UNDP, Government of India and state Forest Department (Bustard 1975) program is a success story in Bhitarkanika. Of additional significance, Bhitarkanika National Park/Wildlife Sanctuary holds the largest wild *C. porosus* population amongst regional range states, and represents over 75% of the total Indian population.

Figure 2. Known nesting female (approx. 3.2 m) and male (approx. 4 m) *C. porosus* basking close together. Photograph: Sudhakar Kar.

The population also supports around 16 “partially white” crocodiles (known locally as “Sankhua”) (Kar 2023).

Figure 3. One of the largest, and considered to be the oldest, male *C. porosus* (approx 5.8-6.1 m) in Bhitarkanika, which has been sighted by the author since July 1975. Photograph: Bijay Das.

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UPDATE ON STATUS OF CRITICALLY ENDANGERED GHARIAL (*GAVIALIS GANGETICUS*) IN GANDAK RIVERSCAPE IN BIHAR, INDIA. The Gharial (*Gavialis gangeticus*), a critically endangered crocodilian native to South Asia, has experienced severe range contractions over the past century primarily due to hunting for skins and trophies, followed by egg harvesting, river regulation, habitat alteration, and incidental capture in fisheries. Once widely distributed across the Indus, Ganges, Brahmaputra, and Mahanadi River systems, the species now persists in only a few river stretches in India and Nepal. The Gandak River is a vital transboundary Himalayan tributary of the Ganga, where long-term conservation actions have supported population recovery through Wildlife Trust of India's (WTI) ongoing Gandak Gharial Recovery Project implemented with the Environment, Forest and Climate Change Department, Government of Bihar since 2014. The project has successfully reversed the decline of the Gharial population in the Gandak River, facilitating its transition towards a recovering and increasingly self-sustaining population.

The project monitors the Gharial population in the Gandak River annually. In 2026, the winter survey was conducted between 23 January and 1 February to assess the population status of the species. A boat-based visual encounter survey covered an approximately 315-km stretch of river, following standardized monitoring protocols used in previous years to ensure comparability of results. The river was divided into 2-km segments as sampling units for recording habitat co-variates and species data. Surveys were conducted during daylight hours, when basking activity was highest, and individuals were classified into size classes based on total length (TL): hatchlings (<60 cm), yearlings (>60 to ≤120 cm), juveniles (>121 to ≤180 cm), (sub-adults >180 to ≤270 cm) and adults (>270 cm) (Hussain 2009) - based on observable morphological characteristics.

A total of 433 Gharials was recorded during the survey, with an average encounter rate (Gharials sighted per km of surveyed river length) was 1.37 Gharials/km. Altogether, 80% of the river segments were occupied by Gharials. Kernel density analysis of sightings revealed a clear high and moderate concentrations in the upper and middle sections of the river, while downstream reaches showed a relatively sparse population (Fig. 1). The size-class composition of the Gharial population recorded during the survey in 2026 showed a predominance of younger individuals in the population (yearlings 29%, juveniles 31%), with sub-adults and adults accounting for 25% and 15%, respectively (Fig. 2).

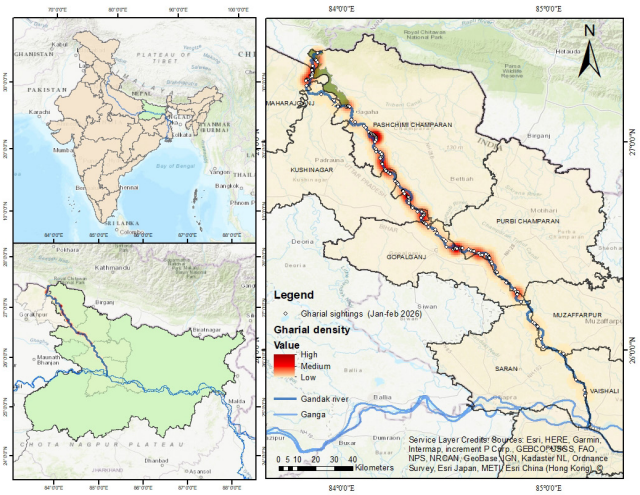

Figure 1. Kernel density map showing the spatial distribution of Gharials sightings along the Gandak River.

Figure 2. Female Gharial basking along the riverbank, with extensive mustard farming in background. Photograph: Shantam Ojha.

The survey recorded six adult male Gharials that exhibited well-developed gharas. Congregations of male and female Gharials were observed at 3-4 locations (Fig. 3), indicating these areas as potential breeding sites for the upcoming nesting season.

Figure 3. Congregation of Gharials of different size classes basking together. Photograph: Shantam Ojha.

During the survey, 12 Mugger crocodiles (*Crocodylus palustris*) were also recorded (Fig. 4), with most sightings restricted to the upper reaches of the river along the Sohagi Barwa Wildlife Sanctuary stretch in Uttar Pradesh state.

Figure 4. Mugger crocodile basking with a sub-adult Gharial in Sohagi Barwa Wildlife Sanctuary. Photograph: Shantam Ojha.

Population Recovery of Gharials in Gandak

Despite not being a protected area, the ~320-km stretch of the Gandak River in India has emerged as an important distribution range for the recovery of Gharial over the past decade. Early observations indicated the presence of only a small remnant population in the river. A multi-species survey conducted in 2010 reported approximately 15 individuals (Choudhary 2010). This survey subsequently formed the basis for initiating a dedicated Gharial Recovery Project in 2014-15, which involved the release and monitoring of 30 captive-born and reared sub-adult Gharials (27 females, 3 males) (Sinha *et al*. 2018). In addition, 55 Gharials were released in the river within Sohagi Barwa Wildlife Sanctuary landscape under the Endangered Species Project of the Uttar Pradesh Forest Department during 2018-19 (Sinha *et al*. 2020).

The project first detected Gharial nesting sites in 2016. However, erosion of nests due to sudden increase in river flow was also recorded. These increases were attributed either due to release of water from the upstream barrage at the Indo-Nepal border or to excessive precipitation in the upper catchments. Such events were identified as a key cause of breeding failures in the river. Subsequently, conservation interventions under the Gandak Gharial Recovery Project focused on nest detection, monitoring and protection as the central strategy. This approach actively involved local fisher and farming communities in reporting nesting activity and monitoring nests during the breeding season. Community members have been trained and engaged as "nest watchers", assisting the project team in identifying nesting females, locating potential nesting sites, detecting nests, and monitoring and protecting them from threats such as riverbank erosion and anthropogenic disturbances.

This participatory approach has significantly improved nest detection rates and breeding success, while also ensuring active community engagement in protection of the species against direct threats such as electrofishing. Since 2016, 53 nests have been protected, resulting in the successful emergence of 875 hatchlings that were assisted for safe movement into the river. The population recovery efforts have enhanced the conservation prospects of the species in the Indo-Nepal transboundary Gandak River (Sinha *et al*. 2020), with current results further strengthening the population.

Rivers in India, particularly within the Ganga Basin, support a minimum of 3037 Gharials (WII-GACMC 2025). The Chambal River, a major tributary of the Ganga, supported at least 2097 individuals in 2023. The same report documented only 108 individuals in the Gandak River. However, in the Gandak River, Panda *et al*. (2023) reported 192 Gharials in the post-monsoon survey of 2019, 206 in the post-monsoon survey of 2020, and 139 during the pre-monsoon survey of 2021. These estimates are considerably lower than the numbers monitored by Wildlife Trust of India over the years (Fig. 5). The variation in counts may partly be attributed to differences in survey periods and survey coverage. Basking activity shows seasonal peaks and varies across size classes, with temperature identified as a key covariate influencing basking behavior (Choudhary *et al*. 2018) hence, consequently, affecting detectability during surveys.

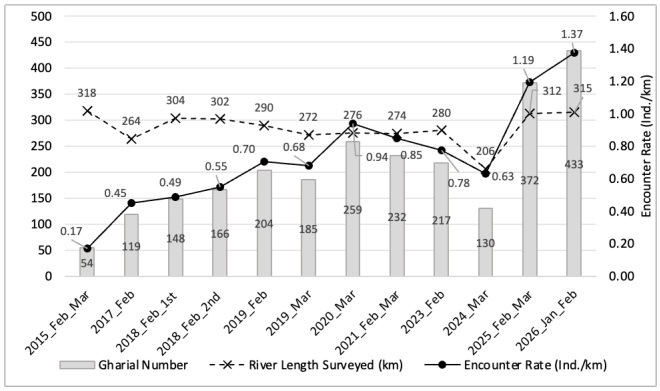

Figure 5. Relative abundance of Gharial, 2015-2026, as monitored by Wildlife Trust of India.

Furthering Conservation Efforts

The 2026 winter survey will be supplemented with follow-up surveys at identified Gharial breeding congregation sites, with a focus on securing nests and strengthening nest monitoring and protection.

The *in-situ* efforts are planned to be supplemented by *ex-situ* conservation measures to further strengthen the long-term conservation of the Gharial in the Gandak River. In this regard, a Memorandum of Understanding (MoU) has been signed with the Department of Environment, Forests and Climate Change, Government of Bihar for the establishment of an Incubation-cum-Nature Interpretation Centre, which will support future conservation initiatives for Gharials and other aquatic reptiles. The proposed facility will provide infrastructure for controlled incubation of vulnerable eggs, rearing of hatchlings during early life stages, and conservation education activities aimed at increasing public awareness about the species and its riverine habitat.

In parallel, community consultations are being conducted in villages to facilitate the Department of Environment, Forest and Climate Change to get free, prior informed consent from approximately 80 villages located along an approximately 140-km stretch of the river. This stretch has been approved by the State Board for Wildlife for notification as a Conservation Reserve to strengthen protection and management of key Gharial habitats. Villagers have expressed support for the establishment of the reserve. Once implemented, these measures are expected to provide stronger protection for critical nesting habitats and support long-term recovery of the species in the Gandak River system.

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UPDATE ON GHARIAL RECOVERY IN THE MAHANADI RIVER, INDIA. The Gharial (*Gavialis gangeticus*) inhabits the southern edge of its range in Odisha's Mahanadi River. In 2019, Odisha's Forest, Environment and Climate Change Department (FECCD) launched the "Species Recovery of Gharial in the River Mahanadi" project. The initiative focuses on building a self-sustaining population within Satkosia Gorge, an ideal habitat featuring deep pools and sandbars. The project integrates captive breeding at Nandankanan Zoological Park, India, phased reintroductions, habitat assessments, establishment of no-fishing zones, and active community engagement.

During the period 2019-2025, 26 telemetry-tagged Gharials (9 M, 17 F; 1.5 to 3.85 m TL; 5 to 16 years of age) were released into protected stretches of the river in age- and sex-balanced batches (Paul 2019; Nair 2023). Tracked by postgraduate researchers using VHF and satellite transmitters, monitoring has yielded vital ecological insights, including that Gharials prefer deep pools (diving up to 6 m in quiet zones and 12 m in areas with human activity), and rely heavily on sandbars for basking and nesting. Currently, 9 adults are actively being tracked, while six tags stopped transmitting after a few days.

Despite these efforts, survival remains a significant challenge. There have been 11 confirmed mortalities (4M, 7F; 1.6-3.5 m TL), primarily due to fishing activities (6 net entanglements, 3 from blast fishing), alongside one Mugger crocodile interaction and one fatal infection. A total of 22 Gharials (2.6-4.1 m TL; hatchlings and yearlings excluded) was recorded during the January 2026 census, including the above 9 transmitter-tagged adult Gharials. The 2018-19 census had recorded a count of 8 sub-adult and adult Gharials.

A major milestone of the project is the revival of natural breeding after a 40-year pause. A total of 160 hatchlings has been recorded within no-fishing zones (28 in 2021, 32 in 2022, 35 in 2023, 35 in 2024, 30 in 2025). This success

signals reduced human disturbance and a viable path toward population recovery.

Mitigating threats through community involvement has been central to this progress. A 10-km no-fishing zone, compensation for damaged fishing nets, rescue operations, inclusion of "Kumbhira Bandhu" (Friend of the Crocodile) from the local community and a reward program for safely releasing entangled Gharial hatchlings have strengthened conservation outcomes. Furthermore, community surveys indicate a positive shift in local attitudes. Awareness campaigns are helping residents distinguish harmless Gharials from more dangerous crocodile species and are linking community livelihoods to peaceful coexistence.

To ensure the long-term persistence of Gharials in the Mahanadi River, a focused set of ecological and social interventions is required.

- Priority should be given to expanding protected river stretches by increasing no-fishing zones and enforcing restrictions on fishing and boating in key Gharial habitats to reduce disturbance and mortality.
- Continued and enhanced monitoring using advanced satellite telemetry should be undertaken to track a larger number of individuals over longer periods, enabling adaptive management based on robust ecological data.
- Genetic monitoring should be incorporated to maintain adequate genetic diversity and prevent inbreeding, with future releases guided by genetic assessments (see Sharma *et al*. 2021).
- Strengthening community-centred conservation through livelihood alternatives, compensation mechanisms and sustained outreach will be crucial for building local stewardship and reducing conflict.
- Integrating Gharial conservation into state and national river management and biodiversity policies will ensure long-term institutional support and alignment with broader conservation and sustainable development goals.

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Latin America & the Caribbean

Brazil

SYMPOSIUM AND ROUNDTABLE ON BRAZILIAN CROCODILIANS AT THE XI BRAZILIAN CONGRESS OF HERPETOLOGY. The XI Brazilian Congress of Herpetology (BCH), organized by the Brazilian Society of Herpetology, took place in August 2025 in Manaus, Brazil. The event drew around 1000 attendees, including students at various levels of training, researchers, and members of the scientific community. Within this Congress, two special activities were organized by members of Crocodylia Brasil - a group dedicated to promoting and executing scientific research, teaching, outreach, and training activities for the preservation, conservation, and management of all crocodilian species in Brazil. The symposium "Crocodilians in Brazil - From Rarity to Abundance: Science, Management and Education for Conservation" moderated by Ronis Da Silveira and the roundtable "What Future Do We Want for Brazilian Crocodilians? Current Affairs and Perspectives", led by Luís Bassetti, were both successful. Together, these sessions, aligned with the institutional mission, and provided a comprehensive and forward-looking overview of the conservation status of these species in the country.

The symposium established the current context by analyzing the remarkable conservation success that has allowed caimans to transition from being considered rare to exhibiting abundant populations in various biomes. This achievement, however, presents new challenges for coexistence and management. Jozelia Maria de Sousa Correia opened the presentations with a reflection on the growing and transformative female leadership in this field, highlighting how female scientists are enriching the discipline with unique perspectives and promoting more inclusive and ethical science, fundamental for the future of the area.

Environmental education emerged as a key tool for this new phase. Yhuri Cardoso Nóbrega presented a successful model focused on the Broad-snouted caiman in the Atlantic Forest, demonstrating how demystifying these species to society is the foundation for harmonious coexistence. Complementing this approach, sustainable management models that have directly contributed to population recovery were explored. Luís Bassetti discussed the benefits of the farming system in southeastern Brazil, which has alleviated poaching pressure and generated opportunities for research and ecotourism. In parallel, Eduardo da Silva Borges presented the ranching or egg collection model for the Pantanal caiman, a system that integrates local communities and landowners into a productive chain that actively values and protects nesting habitats. Finally, Diogo de Lima Franco shared Mamiraua's pioneering experience harvesting Black caiman in a community-based manner.

As a natural continuation of this assessment, the roundtable projected the path forward. Tomas Hrbek established a crucial scientific foundation, emphasizing the role of genetics and genomics in identifying evolutionary lineages, monitoring population health, and predicting their resilience to global threats. The robustness of national research was highlighted by Thiago Costa Gonçalves Portelinha, who mapped the network of working groups in universities and NGOs, whose scientific production underpins advances in conservation and public policies.

From the practical application of this knowledge, Marcos Coutinho shared the lessons from two decades of community-based management in the Amazon, presenting a concrete case of socio-bioeconomics where the sustainable use of the Black caiman and the Spectacled caiman has been a pillar for conservation. The hopeful recovery case of the Black caiman was analyzed in depth by Robinson Botero-Arias, who proposed it as a benchmark for assessing the conservation status at the South American level, advocating for the unification of criteria for more effective management.

Finally, by way of conclusion, Pablo Siroski introduced a critical reflection by contrasting the Brazilian conservation model, historically based on prohibition and protected areas, with the economic management strategies of other countries. His analysis raised the strategic dilemma, questioning the best path to reconcile conservation with local socio-economic development in the immediate future and to assign it a homogeneous value across different cultural, social, and economic scenarios.

Of notable impact during the end of both events was the exhibition of educational posters featuring all the world's crocodilian species with their respective Portuguese names. This initiative, led by Bruce Shwedick and developed through a collaborative effort by Crocodylia Brasil members and Caimasul - Brazil´s Exotic Food, provided valuable educational resources that were distributed free of charge to participants. The posters received very positive feedback from attendees, serving as both an important reference material and a highlight of the knowledge-sharing activities.

The impact of these sessions within the Congress was, in a word, spectacular. For the first time, crocodilians occupied a position of prominence, attracting the largest audience among all the symposia and roundtables at the event, which ran in parallel with 12 others dedicated to different herpetological taxa. This achievement goes beyond numbers; it symbolized a historic moment of unification and dialogue for the community. For the first time, all regional groups involved with crocodilians in Brazil "had a voice" and were able to express their regional reality in the same forum. It was a space of genuine inclusion where, significantly, stakeholders with previous disagreements managed to meet and dialogue. Although some conflicts from past years persist, the fact that all sectors converged in this space marks a turning point and a monumental advance for our field of study.

In conclusion, the symposium-roundtable sequence not only left a clear and unified technical conclusion but also demonstrated the maturity and vitality achieved by the crocodilian specialty in Brazil. The future of these species will depend on our ability to maintain this collaborative spirit, integrating diverse scientific leadership, robust environmental education, legally structured sustainable management, and the application of the most advanced genetic and ecological knowledge. The discussion on management models, especially in the Amazon, remains open, but the consensus indicates that the integration of scientific, traditional, and business knowledge, together with the active inclusion of local communities, will be the key to designing the prosperous future of coexistence we want for these iconic species and the ecosystems they inhabit. These successful events at the BCH are becoming a tradition, marked by growing participation and enthusiasm that clearly reflects the expanding interest in these species throughout the country. The remarkable growth and establishment of numerous specialized groups across Brazil have been so significant that there are now active discussions proposals about organizing a dedicated national congress specifically for crocodilian researchers and conservationists.

Luis Bassetti, Robinson Botero-Arias, Ronis Da Silveira and Pablo Siroski.

Dominican Republic

UPDATE FROM DOMINICAN REPUBLIC: CROCODILE SURVEY IN NOVEMBER 2025 AND MONITORING OF 2026 NESTING SEASON AT LAGO ENRIQUILLO. Here, we provide an update on activities carried out at Lago Enriquillo, Dominican Republic, with the American crocodile (*Crocodylus acutus*).

Translocations

On 11 May 2025, 49 *C. acutus* hatchlings (mean of 27.86 cm TL, 52.17 g BWt) were hatched between 22 April and 2 May 2025. Those hatchlings were assisted by the Crocodile Monitoring Team at time of hatching (ie taken out of eggs), and kept in an enclosure for 1.5 months, allowing for the yolk scar to heal completely (Fig. 1), while waiting for the team from Santo Domingo to return to Lago Enriquillo.

The hatchlings were released in a secluded area in La Trocha del Corral, Lago Enriquillo, that had no signs of human impact and which was considered suitable "hatchling" habitat, including food availability, access to fresh water, and rocks/stones (called "yeso") where hatchlings can hide (Fig. 2).

Crocodile Survey

During the November 2025 survey, 23 *C. acutus* were counted (18 adults, 2 sub-adults, 3 juveniles), of which two juveniles (means of 53 cm TL, 27 cm SVL, 440 g BWt) were recaptured. The healthy development of these crocodiles is a

Figure 1. Approximately 2-week old *C. acutus* hatchling with healed umbilical/yolk scar.

Figure 2. Rocks/stones (called "yeso") where hatchlings can hide, especially during first two months of life.

positive sign, as it suggests that current translocation area in Lago Enriquillo is favourable for the growth and survival of the species.

Nesting Season

The first period of monitoring of the 2026 *C. acutus* nesting season in Lago Enriquillo was on 28-29 January 2026. During afternoon surveys, recent tracks and signs of excavation were recorded in the La Azufrada-La Charca area, indicating that females were actively exploring and selecting suitable sites for nesting. During the night-time survey, high activity of previously released juveniles was observed in the Los Borbollones area, where four juveniles and one sub-adult were recorded. The latter was identified as a male (81 cm TL, 520 g (Fig. 3).

The second period of monitoring was on 24-26 February 2026. Fifteen active nests were recorded, distributed across three nesting beaches and all showing evidence of fertility. Additionally, females were observed guarding the nesting areas.

Figure 3. Sub-adult *C. acutus* captured at Los Borbollones on night of 28 January 2026.

For all nests, coordinates, distance to water, and terrain slope were recorded, along with environmental variables associated with nest location. For 7 nests, the depth to the first egg was measured [mean depth= 24.0 ± 8.04 cm (SD), range 5 to 30 cm; Fig. 4]. Camera traps were also installed at 6 nests at La Charca (Nests 1, 2, 4 and 7) and Km 5 (Nests 1 and 4) to monitor female behaviour during the incubation period and to document the hatching process (Fig. 5).

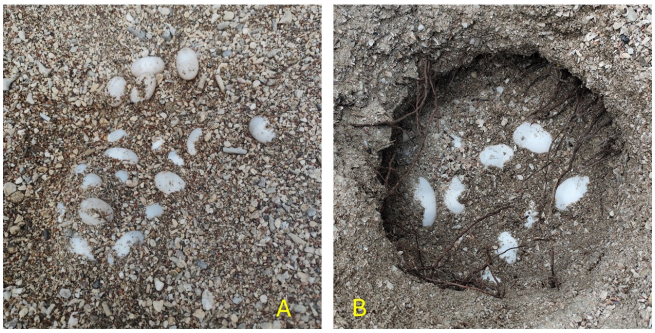

Figure 4. A) Nest LC2604 at La Charca (depth to first egg= 5 cm). B) Nest LC2601 at Km 5 (depth to first egg= 27 cm).

Figure 5. Camara traps installed at *C. acutus* nests at La Charca and Km 5.

This year, nesting began around three weeks earlier than usual, indicating a very promising start to the 2026 season.

These results highlight the importance of continuous monitoring and the ongoing commitment to the conservation of this species.

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East & Southeast Asia

Indonesia

THE EVOLVING CONSERVATION OF KALIMANTAN CROCODILES. Kalimantan Province of Indonesia comprises approximately 75% of the island of Borneo, and maintains a diverse fauna. Formerly as much as 90% of Kalimantan was forested (Inger 1966), but after decades of timber harvesting and plantation development only a fraction of the forests now remains. Lowland areas have been transformed into a mosaic of plantation agriculture and newly-developed human settlements (Gaveau *et al*. 2016). Extensive wetlands of East Kalimantan have also been affected by El Niño (ENSO) droughts and resultant fires, and by drainage of wetlands and peatlands for development oil palm plantations.

Forest and wetland conservation originally developed on a Western colonial Totally Protected Area (TPA) "model" (eg conservation of "wilderness" where hunting is prohibited). TPAs traditionally were intended to conserve a significant portion of Rare, Threatened or Endangered (RTE) species. However, the results of these efforts towards biodiversity conservation have not been consistently successful (Wu 2008). Furthermore, as the allocation of large TPAs ended, alternative conservation models have been taken up to conserve biodiversity outside protected areas.

However, as revenue streams from the timber industry waned in Kalimantan, they were supplanted by a more profitable substitute in the form of oil palm (*Elaeis guineesis*), and extensive plantations developed rapidly over broad areas of degraded ex-timber concessions. By mid-2024, oil palm plantations in East Kalimantan had replaced about 1.5 million hectares of formerly forested lands, with a projected 2024 production of 4.59 million tons of Crude Palm Oil (Indonesian Business Post 2024).

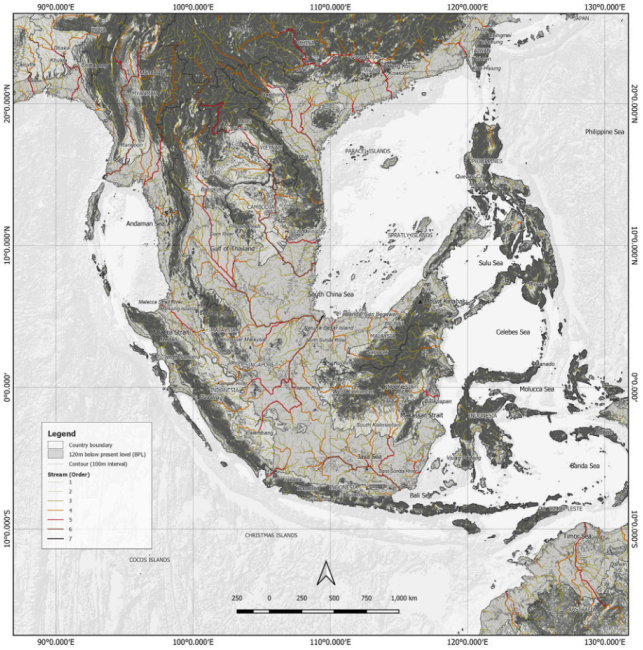

Figure 1. Sundaland region of Southeast Asia (after Fig. 6 in Cheng and Faidi 2025).

As plantations expanded, conservationists observed rapid declines of terrestrial vertebrates such as the Orangutan (*Pongo pygmaeus morio*), as well as of aquatic species such as crocodiles. Three species of crocodilian occur in Kalimantan - Saltwater crocodile (*Crocodylus porosus*), Siamese crocodile (*Crocodylus siamensis*) and Tomistoma (*Tomistoma schlegelii*). These species also face an uncertain future, especially as Kalimantan wetlands burned during ENSO events such as in 1982-83 and 1997-98 (Stuebing 2019). Since the late 1970s, with the exception of *C. porosus*, *C. siamensis* and *T. schlegelii* populations have reportedly declined, although empirical data on populations of wetland species remain limited. Perhaps the resilience of past crocodylomorphs may also be exhibited in the Anthropocene, as in the past, when such semiaquatic generalists persisted through environmental crises, such as that of the end-Cretaceous mass extinction (Melstrom *et al*. 2025).

Biology, distribution and status

The genus *Crocodylus* appears to have originated in Africa around the Miocene (Brochu 2000) and is now broadly distributed over the "Sundaland" region of Southeast Asia. Sundaland is a biogeographical region corresponding to a larger landmass exposed over the last 2.6 million years during periods when sea levels were lower (Fig. 1).

- *Crocodylus porosus*

  Crocodylus porosus is the most widespread species in Southeast Asia, including Kalimantan (Indonesia), Malaysian Borneo (Sarawak, Sabah) and Brunei. Based on molecular studies, *C. porosus* appears to have originated in India (Oaks 2011), but its current range extends from the east coast of India, across Southeast Asia to the Solomon

Islands and northern Australia. Although previously assumed to be a single species, recent molecular work implies a much more complicated scenario (Brochu and Sumrall 2020).

In the Sundaland, *C. porosus* was first documented in 1688 from several specimens (subsequently lost) from Thailand (Ross *et al*. 1995). It is the most widely encountered, resilient and dangerous of the Bornean crocodilians, and continues to pose a threat to riverine villagers and subsistence fishermen in the lower reaches of Kalimantan's rivers (Gani *et al*. 2022; Sideleau *et al*. 2022). Frequent incidents have perpetuated widespread anxiety locally about the presence of crocodile species anywhere that they are encountered in Kalimantan.

Intensive trade in *C. porosus* skins prior to the 1970s led to a decline in all populations (Webb *et al*. 2010, 2020, 2021) including those in Southeast Asia. As a result of this historical overexploitation, in 1979 the global population of *C. porosus* was listed on CITES Appendix I, with the exception of Papua New Guinea. In 1992, the Indonesian population of *C. porosus* was transferred to CITES Appendix II, but the populations outside West Papua and Papua Provinces were managed as if they were on Appendix I (ie use restricted to captive breeding), reflecting the status of those populations at the time.

The lower reaches of Kalimantan's tidal rivers, including upstream areas under tidal influence, are prime habitat for *C. porosus* (Ruslan *et al*. 2023). Survey methodologies to produce reproducible indices of abundance for *C. porosus* populations have been tested and refined over many decades (see Webb *et al*. 2010). Routinely employed wherever populations of *C. porosus* occur, including in both Indonesian Kalimantan and Malaysian Borneo, population surveys produced reasonably accurate assessments of conservation status (Whitaker 1984; Sah and Stuebing 1996; Stuebing 2002). Similar surveys have also been used in the study of crocodilian populations in West/Central Africa (eg Shirley *et al*. 2009) and Central and South America (eg Da Silveira *et al*. 1997; Bolaños Montero *et al*. 2019).

Females build nests of succulent grasses and broadleaf herbaceous material fully exposed to the sun, and subsequently guarding then opening nests to assist hatchlings to reach the water. Females remain near the hatchlings for several weeks (J. Jong, pers. comm.). In Sabah, hatchlings feed upon seasonal surges of juvenile prawns entering lower portions of brackish during the early months of the year (Stuebing *et al*. 1992).

Saltwater crocodiles can survive even in highly degraded or mixed-use landscapes (Stuebing 2002). Other species are assumed to rapidly decline or disappear, although it is clear from surveys over the past 20 years that freshwater RTE species can and do survive outside of what have been assumed to be their "original" habitats or ecological communities (Behler *et al*. 2018; Staniewicz *et al*. 2018; Sudrajat and Salleh 2019).

- *Crocodylus siamensis*

Kalimantan's only recognized species of freshwater crocodile is the Siamese crocodile (*Crocodylus siamensis*). Initially identified with a collection of *C. porosus* from Thailand in 1688, the specimens were subsequently designated as a separate species (Ross *et al*. 1995). Throughout Thailand and the rest of Indochina, populations of *C. siamensis* are severely depleted (Ilhow *et al*. 2015; Platt *et al*. 2019), although historically *C. siamensis* enjoyed a considerably more extensive distribution, even as late as the Pleistocene. Systematic studies suggest that *C. siamensis* is a sister species of the Mugger (*Crocodylus palustris*) (Oaks 2011). Like the Mugger, *C. siamensis* inhabits inland freshwater swamps, but the latter is not known to travel overland during droughts or to be associated with neritic or brackish habitats.

By 1992, based on surveys in Thailand, Cambodia, Laos and Vietnam, *C. siamensis* was thought to be virtually extinct in the wild, and in 1996 it was accorded the IUCN Red List status of "Critically Endangered" (Jelden *et al*. 2014). However, this assessment preceded the formal confirmation of the existence of a breeding population of *C. siamensis* in Kutai Timur, East Kalimantan (Behler *et al*. 2018; Muslim and Suba 2021). This discovery also implied that the species probably still occupied a much more extensive geographic area in Kalimantan (Kurniati *et al*. 2007). Surveys at several other sites in East Kalimantan revealed the high probability that other populations occur, including in Lake Jempang (Tanjung Isui) and several other sites in West and Central Kalimantan wetlands (Frazier 2000; Cox *et al*. 1993; Kurniati *et al*. 2005).

Within the Mesangat wetland in Kutai Timur (00°31'06"N, 116°41'47"E; Fig. 2), *C. siamensis* is rarely encountered during the day as it typically seeks shelter in dense clumps of aquatic vegetation. At night it is more easily detected as it enters areas of open water in search of a variety of invertebrate and vertebrate prey (Behler *et al*. 2018).

Figure 2. Aerial (drone) view of Abang area in Mesangat Wetland, 2008. Photograph: REA Conservation/James Pasaribu.

Figure 3. Camera trap image of Siamese crocodile basking on old nest mound, Mesangat Wetland. Photograph: REA Conservation/Agata Staniewicz.

Figure 4. Female Siamese crocodile at nest, Abang area of the Mesangat Wetland, 2018. Photograph: Photograph: REA Conservation/Brian Martin.

Behler *et al*. (2018) reported that female *C*. *siamensis* in Mesangat construct tethered floating nests composed of succulent and/or fibrous vegetation such as grasses, into which eggs are deposited above the water line (Fig. 3). However, in May 2018 a female *C*. *siamensis* was encountered at her nest on dry land at the boundary of Mesangat Wetland and the PT. Cipta Dewi Mandiri Estate (Fig. 4).

Based upon captive *C*. *siamensis* in Samarinda, East Kalimantan, mating occurs from March to May, and females lay their eggs in October-November (Kurniati *et al*. 2007, Behler *et al*. 2018). Parental care has not yet been observed in Kalimantan *C*. *siamensis*.

Attacks on humans by *C*. *siamensis* are extremely rare, and not fatal. Only a single incident has been reported (in 2012), involving a local fisherman from Desa Kelinjau Hulu who accidentally trod on an adult *C*. *siamensis* (impaled by a fishhook lodged in its jaw), following which the crocodile delivered a muscle-shredding bite to the fisherman's lower leg. The fisherman recovered within about six weeks (Suimah, pers. comm. 2012). Until 2025, there were no further reports of crocodile attacks in the Mesangat Wetland.

- Tomistoma

Tomistoma schlegelii is one of two members of the Family Gavialidae (Figs. 5-7). Formerly known as the "False Gharial", it is also termed the "Sunda Gharial". The type locality for *T*. *schlegelii* is recorded as an oxbow lake of the Karau River in southeastern Central Kalimantan (Anonymous 1688). In Kalimantan, it is known as "buaya supit", "buaya senyolong", or in Kutai Timur, "limbawan" (colloquially translated as the "furtive" or "sneaky" crocodile). Studies by Staniewicz (2011) and Staniewicz *et al*. (2018) confirmed that at least in East Kalimantan it is sympatric with *C*. *siamensis* in some areas.

Tomistoma are generally associated with lowland freshwater habitats, with a preference for forested peat swamps in Peninsular Malaysia (Simpson 2014), Sarawak (Stuebing *et al*. 1998, 2004) and various locations in Kalimantan (Stuebing *et al*. 2006, 2015). In both the Sg Senyiur River and the Mesangat wetland (Kutai Timur), *T*. *schlegelii* nests have been encountered in peat swamps or other flooded forests, where they were constructed on elevated or dry stream banks, at the base of a tree (Yayasan Ulin field data, 2010) (Figs. 6 and 7).

Unlike Kalimantan's other crocodilians *T*. *schlegelii* is only infrequently observed during the day, primarily along meandering rivers in lowland sites. Because of its preference for densely vegetated habitats such as peat swamp forests, adults often lie submerged for extended periods (R. Stuebing, pers. obs.) so that traditional survey methodologies are not suitable. In the Mesangat wetland, where the species has been monitored since 2009, adult Tomistoma are less visible because of their preference for flooded swamp forests as compared to areas of open water preferred by *C*. *siamensis* (Staniewicz *et al*. 2018). Tomistoma can remain submerged for long periods in shallow (<1 m depth) tributaries of dense swamp forest habitats and are only rarely observed out of the water (Bezuijen *et al*. 2001).

Attacks by *T*. *schlegelii* on humans are extremely rare (Sideleau *et al*. 2022), and the details of these incidents can be imprecise, especially where the identity of the species responsible was assumed rather than confirmed.

The Red List status of *T*. *schlegelii* has varied between Critically Endangered, Data Deficient (Stuebing *et al*. 2004), Vulnerable (Bezuijen *et al*. 2010), and most recently

Figure 5. Young Tomistoma (60 cm TL). Photograph: Yayasan Ulin/Agata Staniewicz.

Figure 6. Tomistoma with nest, Mesangat wetland. Photograph: Yayasan Ulin/Brian Martin.

Figure 7. Tomistoma nest, Upper Sg Senyiur River, East Kalimantan, 2010. Photograph: REA Conservation/ Stephan Wulffraat.

Endangered (Shaney *et al*. 2023), based mainly on records from Sumatra and Kalimantan. Simpson (2014) searched for the species at numerous sites in Peninsular Malaysia, but failed to encounter any individuals in the wild.

- Other

Ross (1990), on the basis of fragmentary material from old museum specimens, resurrected *Crocodylus raninus* in Kalimantan. However, this "species" was subsequently determined by Behler *et al*. (2018) to be consistent with specimens of *C. siamensis* from the Mesangat wetland. Furthermore, efforts to locate living specimens fitting the description of *C. raninus* have not been successful and DNA results are still pending (Vliet *et al*. 2024), and so validity of the species is highly unlikely.

However, a potential unconfirmed crocodile species may exist in the high elevations of Kayan Mentarang National Park, that is revered as a "totem" animal by many of the local communities. A strong phylogeographic break has also been suggested between *C. siamensis* on the SE Asian mainland consistent with the existence of a remnant population in East Kalimantan reflecting a history of past fragmentation between Borneo and the SE Asian mainland (Gratten 2003). Local residents (Long Alango, Data Dian, Long Bagun), as well as bush pilots flying the upper Mahakam River, have suggested that a third freshwater crocodile species exists in remote portions of this watershed. In the late 1990s, while one of the authors was working in several sites in the Kayan, Pujungan, Bahau and upper Mahakam Rivers, the existence of a small crocodilian species (ca. 3 m TL) was reported several times from swift rocky rivers in Kayan Mentarang National Park (in what is now North Kalimantan) (R. Stuebing, field data).

This species has been observed along a river with prominent karst outcrops near Long Bagun along the headwaters of the Mahakam River. So far, no specimens or photographic images have been obtained, nor have specimens been physically documented. The Kenyah Dayak tribes of the area oppose the disturbance of the purported species, which is a spiritual or totem species. Interestingly, a reintroduced population of *C. mindorensis* in the southern Philippines has recently been reported to inhabit caves in karst habitats (Binaday *et al*. 2020).

Paleohistory and distributions of Kalimantan freshwater crocodilians

The characteristics of terrestrial and aquatic habitats in Kalimantan have undergone substantial changes through the Quaternary. Cyclic patterns have been caused by global fluctuations in climate and sea levels and the extent of wetlands. The island of Borneo was joined to continental Asia for about half of the last 250,000 years. Within the general confines of the Sunda Shelf, Kalimantan has undergone periods of significant expansion and contraction of wetland versus savannah habitat since the late Miocene (DeBruyn *et al*. 1993; Cheng and Faidi 2024; Voris 2000).

Although the distribution of *C. siamensis* during these events remains to be documented, Mid-Pleistocene fossil remains have been discovered in northern Thailand (Lauprasert *et al*. 2019). Outside of Sundaland, fossils of extinct *Tomistoma* species have been found in Miocene as well as in Quaternary deposits in Taiwan and Japan (Cho and Tsai 2023). It would be valuable to explore whether these *Tomistoma* fossils reflect earlier dispersal events, or if they

represent now-extinct offshoots of the modern *T. schlegelii*. Their presence in Taiwan and Japan implies the genus was once more widespread across island Southeast Asia, with Borneo likely acting as a refugium.

Periodic changes in biomes from forests to savannah or freshwater swamps (and back again) potentially created extensive habitats appropriate for *T. schlegelii*, and perhaps suitable for sympatric *C. siamensis* as currently seen at sites in Kalimantan, such as Lake Mesangat (Behler *et al*. 2018; Staniewicz *et al*. 2018) and Tanjung Isui (Resit Sozer, photographic evidence). Blackwater and peat swamp habitats extended northern and eastern regions of Kalimantan into southwestern Sabah (northeastern Malaysia), including probable connections with Palawan in the southern Philippines (Chua *et al*. 2015). These freshwater and/or peat swamps could easily have served as reservoirs for *Tomistoma* populations from the Miocene onwards.

Cranbrook and Piper (2013) described fossils of *Hippopotamus* (= *Hexaprotodon*) evidently from late Pliocene to Middle Pleistocene ex-wetland deposits in Indonesian Borneo. This fossil evidence is an indicator of wetland habitats also potentially suitable for *T. schlegelii* and *C. siamensis* over a long series of geological cycles, beginning approximately 21 Mya ago and evolving towards the formation of habitats that include freshwater and peat swamps (Morley 2012).

Paleogeographic assessment of the Mahakam River basin provides the best evidence of the persistence of ancient wetlands in the Southern Sunda shelf. This portion of Kalimantan contains at least 76 seasonal lakes and their associated wetlands that cover an area exceeding 15,000 km^2. Included are numerous smaller wetland sites such as Lake Mesangat (>120 km^2) in Kutai Timur. Water depths in Lake Mesangat fluctuate from 1.0 to 4.0 m, spreading over vast areas of the wetland, whose extent depends on the intensity and duration of seasonal rains.

Based on Pleistocene maps and the projected location of ancient riverine systems over broad areas of Sundaland (Voris 2000; Cheng and Faidi 2024), Tomistomine species are also likely to have been divided for millennia by separate drainages and their associated wetlands. It is highly likely from both historical as well as recent records (Stuebing *et al*. 2006) that the geographical distribution of *T. schlegelii* during the Pleistocene extended over what is currently eastern Sumatra and all of present Kalimantan. Thus, the present habitat of *Tomistoma* (and perhaps more than a single species) probably reflects only scattered remnants of a much broader and preexisting paleogeographic distribution (Stuebing *et al*. 2006). The assumption that more than one species of *Tomistoma* may exist in Kalimantan is based on morphological differences as well as a partial genetic analysis (Kurniati *et al*. 2005; R. Sommerlad, pers. comm.) as several river drainages in Kalimantan that *Tomistoma* is likely to have occupied have geographically separate orientations; that is, both east (into the Sunda Shelf) or west into the Sulawesi Sea.

Recent advances in environmental DNA (eDNA) techniques offer a potential pathway for reconstructing paleodistributions and past ecological networks, even in regions like Kalimantan where fossil data are sparse. Integrating eDNA from sediment cores in peatlands or oxbow lakes could provide direct molecular evidence of historic crocodilian presence and reveal broader spatial distributions across fluctuating wetland ecologies during the Holocene (Hofreiter *et al*. 2015; Capo *et al*. 2021).

Additionally, there is increasing paleoecological support for the hypothesis that the persistence of crocodilians in Kalimantan was facilitated by microrefugia - topographically buffered locations that retained moist, stable conditions during climatic extremes. These refugia may have served as long-term sanctuaries, especially for taxa such as *Tomistoma* that require permanent freshwater systems (Keppel *et al*. 2012).

Discussion: Conservation Status Assessments

The use of "specific protected" or "original distributions" as a basis for assumptions on which to base conservation strategies may fail to work in practice, since distributions of several RTE species are known to extend across broad "mixed use" habitats (shared with human communities) in Malaysian Borneo and Indonesian Kalimantan (Stuebing 2005, 2019). This situation is particularly relevant to private concessions, such as the vast land leases allocated for agricultural plantations in Kalimantan - that are inclusive of "original" habitats and/or historical species distributions. The element of successful adaptation or "survivability" by RTE species occasionally within the most egregiously altered human habitats is routinely ruled out, but needs to be assessed. This matter was discussed in detail some decades ago (Caughley and Gunn 1996) and occasionally resurrected (Wu 2008a, b), but has yet to be taken seriously. The opinion persists that, by default, any overlap of freshwater crocodile habitats with wetlands significantly altered by human exploitation are too degraded or disturbed to support viable breeding populations of crocodilian species in Indonesia (Shaney *et al*. 2019; Larasati *et al*. 2025). Based on observations several human-altered habitats in Mesangat, Sg Senyiur and Hulu Belayan, the opinion that RTE crocodiles do not survive in these localities is not accurate.

However, the conservation status of crocodilian species has traditionally been determined through the IUCN Red List of Threatened Species. These assessments may be based on published studies on distribution, abundance and existing threats, assumed to be based upon broad-based and in depth, direct observations by professional researchers. While this may be the case, it is not guaranteed except for survey methodologies appropriate to assess conservation status for individual species of Crocodilidae or Gavialidae. Accurate assessment of conservation status, especially for RTE species in many instances, remains more art than science. The notion a species is "rare", may also indicate that more effort is required to investigate details of its habitat more carefully, as well as to understand the behaviour of the species within

that preferred habitat. Improved assessments of status frequently require much more work than initially assumed to be sufficient. For example, in 2008, in a conversation with the senior author, Mr. Tarto Sugiarto, a crocodile farmer from Balikpapan, East Kalimantan, expressed astonishment when it was suggested that *T. schlegelii* was listed as Endangered; Pak Tarto replied emphatically that the species was "the most common crocodile (sic) in Kalimantan".

Methodologies for crocodilian population surveys were developed in northern Australia by Harry Messel and his team (see Webb 1997, 2020). These have generally worked well to derive population indices for many riverine species of crocodilian worldwide. In contrast, assessments of crocodile populations that inhabit the dense vegetation of wetland and peat swamps or within submerged forests that obscure visibility (specifically) and eyeshines, are more problematic. Specifically, cryptic behaviour in Kalimantan (and Sumatran) freshwater species presents persistent difficulties for accurate estimation of population status. Knowledge of the geographic range of *C. porosus* is extensive compared to that of *C. siamensis* or *T. schlegelii*, partly because of their conspicuous sightability along relatively exposed habitats (eg tidal mudbanks).

In Indochina, long assumed to be the original "core" range of *C. siamensis*, areas of potentially suitable habitat are high (46% of the landscape), although only a small proportion of these sites lie within designated reserves [perhaps as limited as 11% of the total land area (Ihlow *et al*. 2015; Platt *et al*. 2019]. However, it can be assumed that in Kalimantan, areas of suitable habitat can be much more extensive, even if restricted to the 18,000 km^2 of the Mahakam Lakes Region (Living Lakes Network 2025). If we assume that breeding populations of *C. siamensis* and *T. schlegelii* lie scattered over these vast wetlands, a significant underestimation of population numbers is possible (Fahrig 2020).

Nevertheless, areas proven to have breeding populations of *C. siamensis* and *T. schlegelii* have been declared to be much smaller (Shaney *et al*. 2019). This situation may stem from the use of "established" spotlight survey methodologies employed for detection of *C. porosus* that are probably far less effective for detecting *C. siamensis* and *T. schlegelii*. In the case of *T. schlegelii* in densely vegetated habitats of lowland swamp forests, poor visibility and cryptic behaviour may not allow meaningful relative densities to be obtained. Detection may be complicated further by issues of access by researchers to search isolated geographic sites, of which there are thousands of hectares in the wetlands of Kalimantan.

Thus, we might logically conclude that at least some of the problems of achieving accurate determinations of conservation status can be attributable to use of time sensitive "traditional" but limited survey protocols, broadly influenced by externally acquired "colonial science". A brevity of regional inexperience can also potentially influence the accuracy of an assessment via collection of relevant empirical field data obtainable from numerous sites and including in-depth consultation with local communities in Kalimantan, as well as from local crocodile farmers.

Although assessments of the distributions over the last several decades may have been assumed to be generally accurate, factual information on historical - including paleogeographic distributions - are relevant. Statistical modeling contributes additional insights, but accuracy on a much finer scale still depends on the behaviour of the species and the length of engagement in the field by researchers. It is not uncommon for erroneous assumptions to be repeated, even recently in Larasati *et al*. (2025), although additional detailed information is available from local publications or communities.

Expansive zones of postulated human-crocodile conflict, although of concern, nevertheless may not include actual information on the relationship between the crocodiles and local communities. In Kalimantan, subsistence fishermen have little or no interest in crocodiles apart from an occasional entanglement with their nets or removal that attempt to feed upon bait fish from local "rawai" (similar to "trot line) style fishing gear.

The current system employed to determine the conservation status of crocodilians in Kalimantan needs more attention to local sources of information. Currently, the assessments are hampered by a lack of direct evidence and misleading "data" leading to what may represent broad brush preservationist notions of little relevance in effective conservation management. Recent status assessments of at least two species (*C. siamensis* and *T. schlegelii*) have been incomplete or in error, because of the omission of paleogeographic as well as local distributional data. Assessments strongly influenced by the assumption of extinction of species whose behaviour is cryptic, and continues to shown resilience in "degraded" habitats where they may be assumed to have disappeared. Field surveys by Hellen Kurniati and the present authors indicate that the actual area of distribution for both *T. schlegelii* and *C. siamensis* covers a much more extensive area of Central, South and East Kalimantan than has been previously assumed (Kurniati 2007; Kurniati *et al*. 2005). Even in areas of intense human activity such as the PT. REA Kaltim Plantations of the Middle Mahakam, and upper Belayan and Senyiur watersheds *T. schlegelii* encounters continued to occur during the past decades into the present (REA Kaltim Conservation Department and Yayasan Ulin, field data). The cryptic behaviour of *T. schlegelii* in particular, unsurprisingly referred to in the local language as the *buaya senyolong* or, "sneaky" crocodile", makes an accurate determination of its actual abundance or density - or disappearance - a daunting task.

The era of large conservation set asides is over, despite the long running discussion of "Single Large Over Several Small" (SLOSS) options (Wu 2008a). Industries with large, often vast footprints on the landscape, such as plantation agriculture in Kalimantan, must shoulder the burden of landscape level biodiversity conservation, especially of Endangered species. There is now proof that such industries can remain profitable, and perhaps more so by integrating science and inserting empirically-derived conservation decisions into

their agricultural operations (Kasper *et al*. 2024). It has been demonstrated in East Kalimantan that endangered species can survive, even thrive, within altered, multi-use landscapes. Both the process and its success are further enhanced by simultaneous participation of local, endemic village communities though co-management. It goes without saying that all currently practiced certification regimes such as the Roundtable on Sustainable Palm Oil (RSPO) and Indonesian Sustainable Palm Oil (ISPO) emphasize the importance to some degree of community ownership, which can be linked to conservation of local biodiversity.

The revision of a species' conservation status may result in some unexpected consequences. For example, the revision of the Red List status of *T. schlegelii* from Vulnerable (assessed in 2011) to Endangered (assessed in 2022) has meant difficulties in the acquisition of research permits. There is a tendency for government agencies to deny research permits for certain species, including *T. schlegelii*, when categorised as "Endangered" and, based on that alone, that stringent protection is mandatory and that field research efforts can be significantly curtailed. Such procedures have been documented in detail by Shaney *et al.* (2016) for studies of *T. schlegelii* in Sumatra, Indonesia.

The lack of integration between local ecological knowledge (LEK) and formal conservation assessments remains a critical oversight. Fisherfolk and Dayak communities in East Kalimantan possess long-term familiarity with crocodilian behavior and distribution patterns, often across multiple generations. Systematic inclusion of LEK in survey design and spatial modeling could significantly improve the resolution of presence/absence data, especially in understudied or "data-deficient" river basins (Brook and McLachlan 2008; Turvey *et al*. 2014; Sheil and Lawrence 2004). It is often assumed that the density of an RTE species, its relative abundance and detectability are inversely correlated with the degree of human disturbance of a particular landscape. In reality, cryptic species like *T. schlegelii* may persist in low numbers but occupy larger ranges than previously thought, sustained by tolerance to certain types of disturbance and anthropogenic wetland mosaics such as flooded oil palm concessions or abandoned fish ponds (Bicknell *et al*. 2015; Burton *et al*. 2012; Gardner *et al*. 2008).

Conclusion: What next?

Clearly additional progress must be made to refine our approach for maximum accuracy in defining and ensuring the conservation status of RTE species. In most cases, the assessments should be based on observations of resident scientists, not the helicopter visions of occasional visitors. The logical outcome of this view, especially in reference to field research on freshwater crocodilians in Kalimantan, is to accentuate and expand the work of local scientists which must be augmented by inputs from local communities. Current inaccuracies may also be magnified within the international" scientific community by a preference for what may referred to as "colonial science" (de Vos and Schwartz 2022).

Practical recommendations include developing and validating survey methods more properly tailored for low-visibility wetlands; funding regional genetic surveys to clarify intraspecific variation; recognizing the ecological value of "disturbed" habitats in conservation planning; including community and crocodile farmer knowledge in status assessments; and, encouraging RSPO/ISPO to integrate site-specific biodiversity baselines. Furthermore, the narrative power of crocodilians - revered in many Bornean cultures as ancestral spirits or forest guardians - remains an underutilized tool in community-driven conservation messaging. These symbolic frameworks may serve as compelling entry points for participatory conservation models that honor both cultural heritage and ecological integrity.

Strengthening evaluations of conservation status for cryptic reptiles like Kalimantan's freshwater crocodilians should not only center on improving detection methodologies, but also address the governance frameworks that discourage open-access data sharing. Regional databases that integrate academic findings, community reports, and even industrial environmental impact assessments could bridge this gap, fostering a more decentralized and inclusive conservation model.

An additional practical recommendation is the establishment of a precautionary, *research-enabling conservation status framework* for cryptic crocodilians, particularly *T. schlegelii* and *C. siamensis*, in Indonesia. While the IUCN Red List appropriately evaluates global extinction risk, its application at national or subnational levels may unintentionally restrict field access, delay permit approvals, and discourage long-term ecological research on species already limited by detectability (Shaney *et al*. 2016; Costello *et al*. 2014). We recommend that national management authorities decouple the Red List status category from research permitting thresholds, allowing standardized, low-impact surveys to proceed under a precautionary research licence framework. Such an approach would reduce the paradox whereby species classified as Endangered or Critically Endangered become increasingly "data deficient" due to regulatory barriers, a problem previously documented for Tomistoma in Sumatra (Shaney *et al*. 2016) and more broadly for cryptic taxa in tropical landscapes (Gardner *et al*. 2008; Fahrig 2020). Facilitating sustained research access is essential for empirically evaluating population trends over relevant generational timescales, rather than inferring decline from habitat change alone.

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East & Southern Africa

South Africa

NDUMO GAME RESERVE: A CROCODILE SANCTUARY UNDER THREAT. Once one of South Africa's pre-eminent protected areas for Nile crocodiles (*Crocodylus niloticus*), and the site of pioneering crocodile research and conservation efforts in the country, Ndumo Game Reserve (NGR) in northern KwaZulu-Natal Province has been illegally occupied and utilised for 16 years, with irrigated fields spreading across the former ancestral crocodile breeding grounds. This article briefly places the reserve in national context for crocodile conservation, before recounting it's importance for crocodiles and crocodile conservation in the region, concluding with recent estimates of crocodile population decline, and an account of the state of this 100-year-old game reserve and Ramsar Site.

The majority of wild Nile crocodile populations in South Africa are in decline, and the species is classified as "Vulnerable" given an estimated >30% decline over the past three generations (Bates *et al*. 2014). This is attributed primarily to habitat transformation and persecution (SASA 2023). The abundance and distribution of the species are significantly reduced from their historical states, with the wild population estimated at around 4000 adults in 2023 (Pooley 2025b). While illegal offtake is assumed to be low, it is known to impact on the NGR. A survey of local communities found that the killing of crocodiles was widely approved of, and they are eaten and used for medicinal and magical purposes (Pooley *et al*. 2020).

The NGR crocodile population is one of three in the country which is transboundary, being situated near the confluence of the Usuthu and Phongolo Rivers where they combine to become the Rio Maputo flowing northward into Mozambique (SASA 2023). This adds another level of uncertainty and

lack of control over the fate of these crocodiles which use NGR, particularly in winter, as protected basking grounds. In the past, the Phongolo floodplain inside the reserve was an important nesting area in the summer months.

NGR (Fig. 1) was proclaimed as a protected area (provincial game reserve) in 1924, celebrating its centenary as one of the continent's oldest game reserves in 2024 (Pooley 2025a). It was primarily established to protect its rivers and lakes, sheltering a large hippopotamus population, and is famous for its bird diversity and large concentrations of waterfowl. Nile crocodiles inhabit these wetlands, sharing them with local people and their livestock, which results in occasional attacks.

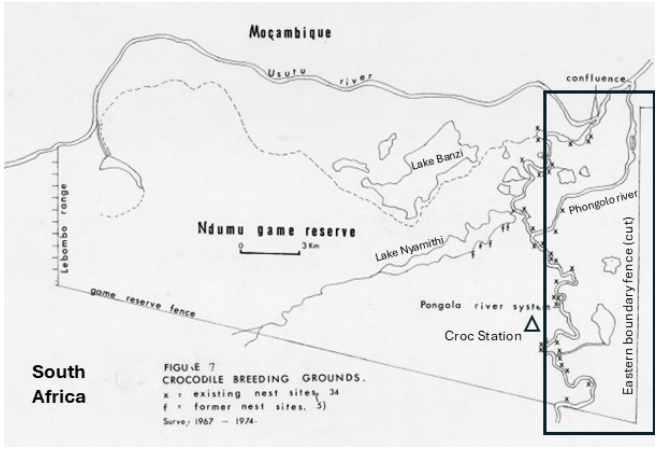

Figure 1. Map of Ndumo Game Reserve c.1980 based on Tony Pooley's map of nesting sites (x= existing; f= former). The rectangular overlay indicates the approximate area of the Phongolo floodplain and area being illegally farmed and grazed inside the reserve.

In the 1960s, Tony Pooley set up an Experimental Crocodile Restocking Station on the Phongolo floodplain inside the reserve, going on to restock regional crocodile populations in protected areas, conduct observations of wild and captive crocodiles, and undertake impactful outreach work with tourists and the media. These efforts were partly driven by an observed decline in Ndumo's adult crocodile population through the 1960s ,given widespread hunting outside the reserve in South Africa and neighbouring Swaziland and Mozambique (Pooley 1982a,b). Over the next 30 years, populations recovered, reaching a peak of 833 individuals counted (estimated absolute abundance of 1066) in 1993.

For a variety of reasons, possibly including the return of Mozambican farmers to the floodplains north of the reserve after the cessation of the civil war in their country (Calverley 2009), declines were again noted. After no survey counts between 1995 and 2006, in 2007 only 766 crocodiles were counted. In 2008, the eastern fences of the reserve, next to the Phongolo floodplain part of the reserve, were cut by disgruntled local communities angry at the lack of (promised) development assistance from the Government, and illegal farming of the floodplain commenced. Since then, fields have replaced crocodile nesting habitat, fishes are illegally gill-netted, and crocodiles have been found dead in snares. The reserve's crocodile population declined by 38% between 1993 and 2009 (Pooley 2025b). Crocodile nesting grounds are no longer patrolled by field rangers of the provincial conservation authority, Ezemvelo KZN Wildlife (henceforth Ezemvelo), as it is too dangerous for them.

Calverley's studies (Calverley 2013; Calverley and Downs 2014) and subsequent Ezemvelo surveys reveal a 5-fold population decrease over the 30 years since 1993, and show an aging population structure. This may be because crocodiles formerly nesting in NGR, are now nesting in Mozambique, where food supply may be better now (there is gill-netting inside NGR), and the historical NGR nesting grounds are being farmed.

Hanekom (2023) conducted aerial surveys between 2013 and 2023. These showed an alarming, if not surprising, decline in estimated abundance of adult crocodiles, from just over 500 to less than 300 in 2023 (see Pooley 2025b). This is lower than the worst pre-restocking estimates for NGR.

Hanekom's project to study the spatial ecology of the Nile crocodile in both northern KwaZulu-Natal and southeastern Mozambique will hopefully reveal more about what is going on in this transfrontier system (Hanekom 2023).

NGR was listed as a Ramsar Site, a wetland of international importance, in 1997. After the eastern reserve fences were cut in 2008, repaired, then definitively removed in 2010, illegal activities on the Phongolo floodplain section of the reserve began in earnest. These activities seemed to pick up alarmingly around 2020-21 (Fig. 2), and a group of us, including concerned natural and social scientists, began publicising the situation in the national media.

Figure 2. Illegal farming on the Phongolo floodplain inside Ndumo Game Reserve, 2023.

Efforts to work through Ramsar Africa and Ramsar South Africa to catalyse action for NGR, have proven ineffective. In 2022, Ramsar South Africa stated that NGR was not a priority site for the country, apparently on the basis of outdated evidence. I submitted an update report, which they lost, but finally in 2024, based (possibly) on another update report supplied, they acknowledged that NGR is a threatened site (Pooley 2025c).

However, Ramsar cannot intervene or advise on solutions for threatened Ramsar Sites unless asked by the host country, and in this case through South Africa's designated wetlands authority, the Department for Forestry, Fisheries and the Environment (DFFE). The process is so entangled in bureaucracy it is currently hard to see how any timely decision or request will emerge (see Pooley 2025c, 2026, in press). We had hoped that the >6 years-delayed Ramsar Site update report from DFFE would materialise in time for Ramsar COP15 in Zimbabwe in July 2025, but this never happened.

Recently, it was discovered that yet another report requested by DFFE before submitting its Ramsar update report was delivered by Ezemvelo KZN Wildlife in August 2025, but had to be resubmitted in a new, online format, for which training was required to facilitate it. Training happened in February 2026, and as of mid-March 2026, Ezemvelo considered that it had resubmitted this report, but DFFE has yet to confirm this. Even if, and when, the Ramsar report is completed and submitted, it is unclear whether action will be taken to resolve the situation at Ndumo.

In the interim, illegal farming is ploughing up the floodplains inside the reserve, once the heartland for hippopotamus and the nesting grounds for crocodiles. Trees are being cut, cattle grazed and fishes illegally netted. Once the third-largest and third-most important sanctuary for wild crocodiles in South Africa, with its extensive winter basking and protected nesting grounds, NGR now has a questionable future as a haven for these reptiles. Crocodiles are persecuted outside of NGR, having almost disappeared from the Phongolo floodplain upstream of the reserve (South Africa's most biodiverse floodplain, only protected within NGR).

It seems a sad state of affairs that a 100-year-old game reserve and Ramsar Site, with a distinguished tradition of crocodile conservation and research, and the potential to continue to be a place to educate and inspire tourists and local communities with the impressive presence, complex behaviour and ecological importance of Nile crocodiles, is being allowed to be destroyed in plain sight.

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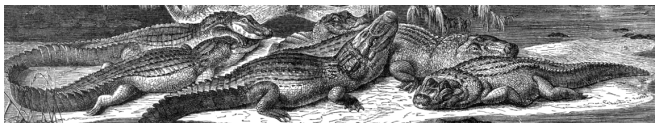


Recent Publications

AjjiM, J., Lamichhane, B.R., Griffith, P. and Lang, J. (2025). *Gavialis gangeticus* (Green Status assessment). The IUCN Red List of Threatened Species 2025: e.T8966A896620252.

Botero-Arias, R., Hernández-Rangel, M., Thorbjarnarson, J.B., Magnusson, W.E. and Da Silveira, R. (2025). *Melanosuchus niger*. The IUCN Red List of Threatened Species 2025: e.T13053A512056.

HWCCSG (Human-Wildlife Conflict & Coexistence Specialist Group) (2026). What is human-wildlife coexistence? Briefing Paper by the IUCN SSC Human-Wildlife Conflict & Coexistence Specialist Group (https://www.hwcb.org/).

Ranade, A.V., Bernhardt, G.V., Srinivas, M., Gowda K.M., D., Ahmad, F., Ebby, S., Karim, A., Khan, N.A., Jose, J., Ramachandran, G., Marzook, H. and Qaisar, R. (2026). Gut microbiome- targeted intervention ameliorates structural and transcriptomic changes in the kidney of hindlimb unloaded mouse model. Animal Microbiome 8(1).

Abstract: The human body is adapted to Earth's gravity, but space microgravity significantly alters kidney function, with the hindlimb unloaded (HU) mouse model serving as a valuable tool for studying these effects. During space travel, changes in gut microbiota can lead to health-related issues. In this study, we explored the protective role of crocodile gut microbiome media on kidney health in a HU mouse model, given the known impact of space travel on gut microbiota and related health issues. Male C57BL/6 mice (four months old) were divided into a ground-based control group (GC), HU mice fed with distilled water (HU), and HU mice fed with crocodile bacterial conditioned media (HU-CP). All groups were maintained in a controlled environment for three weeks. At the end of the experiment, mice were euthanized, kidney tissues were dissected for histopathological examination and transcriptomic analysis. Statistical analysis was performed using one-way ANOVA followed by Tukey's multiple comparison test, with $p<0.05$ considered significant. Transcriptomic analysis revealed distinct gene expression profiles across GC, HU, and HU-CP groups, with HU-CP inducing both unique (4325 genes) and differential (975 genes) expression compared to HU group. The treatment partially restored glomerular morphology, reduced inflammation, and reversed gene expression alterations associated with oxidative stress, apoptosis, fibrosis, and inflammation. The crocodile bacterial conditioned media demonstrated potential therapeutic benefits in mitigating renal injury induced by simulated microgravity in HU mice. Further research is needed to elucidate the specific mechanisms involved and explore the potential clinical applications of this approach.

Donzé, G., Perrichon, G., Vincent, P., Therrien, F. and Martin, J.E. (2026). Comparative endocranial anatomy in the crocodylians *Leidyosuchus canadensis* and *Stangerochampsa mccabei* from the upper Cretaceous of Alberta, Canada. Journal of Anatomy.

Abstract: Crocodylians evolved a high variety of rostral morphologies during their evolutionary history, highlighting the strong links between morphological plasticity and environmental and ecological parameters. Two Late Cretaceous alligatoroids, the mesorostrine *Leidyosuchus canadensis* Lambe, 1907, and the brevirostrine *Stangerochampsa mccabei* Wu *et al*. 1996, from Alberta, Canada, preserve a large groove-shaped recess on the posterior part of the maxilla that has not been documented in other alligatoroids. Despite the potential phylogenetic and paleoecological significance of this neurovascular feature, internal and endocranial structures remain under-explored among stem alligatoroids. The endocranial morphology, including the paratympanic sinus system of *Leidyosuchus canadensis* and *Stangerochampsa mccabei*, was compared to those of extant crocodylians and of the extinct alligatoroid *Diplocynodon ratelii* based on computed tomography data. The Cretaceous alligatoroids share endocranial features, such as a posteroventral neurovascular projection of the labiolateral canal that connects to the groove-like recess at the posterior edge of the maxilla and a paratympanic sinus system most similar to those of small-bodied and young extant crocodylians, suggesting that these pedomorphic features may reflect the ancestral crocodylian condition. Future phylogenetic studies should consider internal and endocranial characters alike to improve our understanding on the relationships among crocodylians.

Williams, A.R., Diven, S.S., Meaza, I. and Wise Sr, J.P. (2026). It's a gator tale: Alligator lung cells resist hexavalent chromium-induced DNA repair inhibition and chromosome instability. Journal of Trace Elements in Medicine and Biology 93.

Abstract: Hexavalent chromium [Cr(VI)] is an environmental pollutant that is widely distributed across several ecosystems, such as the aquatic environment, due to human activities. The American alligator (*Alligator mississippiensis*) is a top predator in the aquatic ecosystem that can inhale environmental contaminants, including Cr(VI), through airborne deposition, water surface exposure, and resuspended particles from contaminated sediments. Although Cr(VI) is a well-known human carcinogen, its health effects in alligators remain poorly understood. We exposed alligator lung cells to zinc chromate for 24 h or 120 h. Cytotoxicity was measured with a colony formation assay. Genotoxicity was measured with a chromosomal aberration assay and the neutral comet assay. To assess DNA repair activity, RAD51 and RAD51D foci were measured using immunofluorescence. Our data showed Cr(VI) induced cytotoxicity and genotoxicity in alligator lung cells. DNA double strand breaks were elevated following both 24 and 120 h exposures with similar levels at both time points. The amount of chromosome damage increased following 24 h exposure but was reduced after 120 h exposure. We found in contrast to human lung cells, alligator lung cells had active DNA repair at both timepoints. In this study, we evaluated the cytotoxic, genotoxic, and DNA repair response effects of particulate Cr(VI) in alligator lung cells after acute (24 h) and prolonged (120 h) exposures. These data indicate alligators have evolved protective measures against DNA damage induced by Cr at the cellular or molecular levels, which likely leads to protection against other chemical carcinogens that cause DNA double strand breaks. These findings inform chemical carcinogenesis in humans and support the use of alligators as sentinel species for monitoring the health impacts of Cr(VI) contamination in aquatic environments.

Corrigendum to "Rainwater, T.R., Georgitis, W.S., Sideleau, B.M. and Platt, S.G. (2025). Remarkable survival by a scuba diver from an American alligator attack. Wilderness & Environmental Medicine".

In the original article published online, the authors used the terminology "decompression sickness" to describe the hazard faced by the alligator attack victim from a rapid ascent from the river bottom. Shortly after the article appeared online, a reader brought to the journal's attention that "pulmonary barotrauma and subsequent arterial gas embolism," not decompression sickness, is the correct description of the hazard. The authors made the corresponding corrections in the article and thanked the reader in the Acknowledgments for pointing out this error.

Wang, Y., Li, B., Zhou, Y., Zheng, Y., Hong, H., Tan, Y. and Luo, Y. (2026). Maillard reaction of crocodile (*Crocodylus siamensis*) meat peptides with prebiotic oligosaccharides: Conferring improved flavor and antioxidant activity. Available at SSRN.

Abstract: The development of crocodile meat peptides (CMP) represents an effective strategy to enhance the added value of crocodile meat. However, the inherent flavor defects and unstable antioxidant activity of CMP severely limit its further application in the food industry. In this study, CMP was glycosylated with different prebiotic oligosaccharides via the Maillard reaction (MR) to improve its flavor properties and antioxidant activity. Sensory evaluation and electronic nose analysis consistently indicated that MR significantly improved the flavor profile of CMP, with XOS-modified products showing the best results in terms of inhibiting fishy odors and enhancing overall aroma, exhibiting distinct roasted and caramelized scent characteristics. Antioxidant activity assays revealed that that all CMP-Maillard reaction products (CMP-MRPs) exhibited significantly higher antioxidant capacities than the unmodified CMP ($p<0.05$), with XOS-modified product showing the most prominent improvement. Specifically, the DPPH radical

scavenging activity, reducing power, ferrous ion chelation capacity, and total antioxidant capacity of XOS-modified CMP-MRPs were 1.69-14.25 times higher than those of CMP-Heated. Amino acid composition analysis showed that MR led to a significant reduction in the relative contents of several hydrophobic amino acids in CMP, thereby weakening bitter- and fishy odor-associated structural features and contributing to the overall improvement of flavor characteristics. These findings demonstrate that oligosaccharide-mediated MR, particularly with XOS, effectively enhances both the flavor and antioxidant properties of CMP, offering a new approach for the high-value utilization of crocodile meat and functional peptide ingredient development.

Torralvo, K., Silva, F.P., Elias, M.A. and Rabelo, R.M. (2026). Sex ratio of black caiman (*Melanosuchus niger*) hatchlings in a sample of the wild managed population from the Mamirauá Reserve, Central Amazon. Acta Amazonica 56: e56bc24281

Abstract: Sex determination in crocodilians is dependent on environmental temperature, in which extreme temperatures favor the development of females, while intermediate temperatures favor males. Understanding such temperature dependence in light of current climate change is urgent, as males are the main targets in species' sustainable management. Here we analyze the sex ratio of newly-hatched Black caiman (*Melanosuchus niger*) hatchlings from a wild managed population in Central Amazonia. We captured 86 newly-hatched hatchlings and determined their sex through histological analysis of the gonads. We identified 58% males and 42% females among the 86 hatchlings analyzed (male-to-female ratio of 25:18) We identified 58% males and 42% females among the 86 hatchlings analyzed (male-to-female ratio of 25:18) suggesting that the sex ratio of Black caiman hatchlings in 2023 in the area was relatively balanced. This balance contrasts with expectations of a female bias under recent warming conditions and indicates the potential recruitment of males into the population, which is essential to ensure population equilibrium and the long-term viability of harvest quotas.

Resumo: A determinação do sexo em crocodilianos é dependente da temperatura do ambiente, com temperaturas extremas produzindo fêmeas e temperaturas intermediárias produzindo machos. Entender essa dependência da temperatura diante dos alertas atuais de mudanças climáticas é urgente, uma vez que os machos são os principais alvos do manejo sustentável da espécie. Nesse estudo, nós analisamos a proporção sexual de filhotes de jacaré-açu (*Melanosuchus niger*) recém-eclodidos em uma população silvestre e manejada na Amazônia Central. Capturamos 86 filhotes recém-eclodidos e determinamos o sexo por análise histológica das gônadas. Nós identificamos 58% de machos e 42% de fêmeas entre os 86 filhotes analisados (razão macho-fêmea de 25:18), o que sugere que a proporção sexual dos filhotes de jacaré-açu eclodidos em 2023 na área foi relativamente equilibrada. Esse equilíbrio contrasta com nossas expectativas de um viés feminino devido ao aquecimento ambiental recente e indica o recrutamento potencial de machos para a população, o que é essencial para garantir o equilíbrio populacional e a viabilidade de cotas de manejo a longo-prazo.

Szegszárdi, M., Ősi, A. and Rabi, M. (2026). Cretaceous crocodyliform reconciles conflicting evidence on the Mesozoic paleogeography of Europe during the Gondwana-Laurasia split. Scientific Reports 16(1).

Abstract: Inferred biotic exchanges between Europe and Africa during the Cretaceous have been used to support the hypothesis that the complete separation of Europe from Gondwana postdated the split of the remaining Laurasian landmasses from Gondwana. Under this framework, Europe, conceptualized as part of a proposed 'Eurogondwana', is thought to have maintained biogeographic connections with Africa well into the Cretaceous. A key piece of evidence underpinning this hypothesis has been the crocodyliform Doratodon carcharidens from the Late Cretaceous of Europe, previously interpreted as closely related to Gondwanan taxa. However, the material attributed to this species is fragmentary, and its skeletal anatomy-critical for phylogenetic inference-remains poorly understood. Here we describe a new partial skull of *Doratodon carcharidens* which represents some of the most complete material of 'Gondwanan' taxa in the European Cretaceous. Our updated phylogenetic analysis unexpectedly and robustly places *D. carcharidens* among the Laurasian clade Paralligatoridae and reveals that morphological similarities to Gondwanan ziphosuchians, such as ziphodont dentition, are the result of remarkable ecomorphological convergence rather than shared ancestry. By reinterpreting the systematic position of further taxa representing biogeographic enigma, such as *Ogresuchus furatus*, our phylogeny implies a major role of the primary breakup of Pangea into Laurasia and Gondwana for crocodyliform divergence. A critical reassessment of the purported evidence for 'Gondwanan' fish and tetrapod immigrants in Europe reveals that it is largely based on highly fragmentary and sporadic specimens, as well as weakly supported phylogenetic hypotheses. Given the sparse and uneven Jurassic and Cretaceous fossil record in both Europe and Africa, it remains plausible that taxa previously interpreted as Gondwanan dispersers instead represent vicariant relicts. Our results conflict with recent paleobiogeographic scenarios, highlight the absence of compelling evidence for the Eurogondwana hypothesis and instead support a primary Gondwana-Laurasia split.

Rungarunlert, S., Phonarknguen, R., Rawangchue, T. and Assawasuparerk, K. (2026). Anti-metastatic effects of crocodile blood powder through E-cadherin activation and matrix metalloproteinase inhibition in hepatocellular carcinoma cells. Asian Pacific Journal of Cancer Prevention 27(1): 183-192.

Abstract: Crocodile blood is a rich and valuable source of bioactive compounds derived from natural products. Crocodile blood powder (CP) has garnered significant attention for its potential applications in human health treatment. This study aimed to investigate the effect of CP on the invasion and metastasis of hepatocellular carcinoma (HepG2) cells. We analyzed the protein content of CP using MS/MS techniques. The effects of CP on cell proliferation, apoptosis, metastasis, and invasion were assessed using immunofluorescence, a wound healing assay, a transwell invasion assay, and Western blot analysis, respectively. The findings indicated that CP could inhibit the proliferation of HepG2 cell lines. Additionally, CP increased caspase-3 expression, inducing apoptosis in HepG2 cells. CP treatment also reduced metastasis and invasion of HepG2 cells. Immunofluorescence and Western blot analyses revealed that CP upregulated E-cadherin expression, while downregulating MMP-2 and MMP-9 expression. Overall, this study demonstrated that CP inhibits HepG2 cell proliferation and promotes apoptosis. Furthermore, CP suppresses metastasis and invasion by increasing E-cadherin expression and downregulating MMP-2 and MMP-9. Thus, CP may serve as a promising candidate for hepatocellular carcinoma therapy.

Silva, V.L.B., Silva, A.C.S., Gonçalves, J.N.A., Smaniotto, N.P., Úngari, L.P., Pulcherio, R.S.L., Bortolini, J., dos Santos Ferraz, R.H., Strüssmann, C., Vieira, T.S.W.J., da Costa Vieira, R.F. and de Campos Pacheco, R. (2026). Morphological and molecular detection of *Hepatozoon* species in amphibians and reptiles from Mato Grosso, Midwest Brazil. Brazilian Journal of Veterinary Parasitology 34(4): e012125.

Abstract: The *Hepatozoon* genus is composed of hemoparasites widely distributed, though their diversity and phylogeny remain poorly understood in the Brazilian herpetofauna. We aimed to characterize *Hepatozoon* species infecting the blood and spleen of amphibians and reptiles in Mato Grosso, Midwestern Brazil, using morphological and molecular tools. In total, 146 animals from 19 species (8 amphibians and 11 reptiles) were evaluated.

Giemsa-stained blood smears revealed *Hepatozoon*-like inclusions in 35 individuals (8 amphibians and 27 reptiles), including new infection records in the anurans *Boana raniceps* and *Trachycephalus typhonius*, and the snake *Eunectes notaeus*. Morphological analysis revealed diverse morphotypes. Molecular analysis of the 18S rRNA gene identified six haplotypes in *Rhinella diptycha*, *Ameiva ameiva*, *Boa constrictor*, *Epicrates crassus*, *E. notaeus*, and *Caiman yacare*. Phylogenetic analyses revealed clustering with clades linked to *H. musa* and *H. caimani*, suggesting the presence of potentially novel lineages. These findings highlight the high genetic diversity of *Hepatozoon* in the region and emphasize the value of integrative approaches in parasitological research.

Resumo: O gênero *Hepatozoon* é composto por hemoparasitos amplamente distribuídos, embora sua diversidade e filogenia permaneçam pouco compreendidas na herpetofauna brasileira. Nosso objetivo foi caracterizar as espécies de *Hepatozoon* que infectam o sangue e o baço de anfíbios e répteis no Mato Grosso, Centro-Oeste do Brasil, utilizando ferramentas morfológicas e moleculares. No total, 146 animais de 19 espécies (8 anfíbios e 11 répteis) foram avaliados. Esfregaços de sangue corados com Giemsa revelaram inclusões semelhantes a *Hepatozoon* em 35 indivíduos (8 anfíbios e 27 répteis), incluindo novos registros de infecção nos anuros *Boana raniceps* e *Trachycephalus typhonius*, e na serpente *Eunectes notaeus*. A análise morfológica revelou diversos morfotipos. A análise molecular do gene 18S rRNA identificou seis haplótipos em *Rhinella diptycha*, *Ameiva ameiva*, *Boa constrictor*, *Epicrates crassus*, *E. notaeus* e *Caiman yacare*. As análises filogenéticas revelaram agrupamentos com clados ligados a *H. musa* e *H. caimani*, sugerindo possíveis novas linhagens. Esses achados destacam a alta diversidade genética de *Hepatozoon* na região e enfatizam o valor de abordagens integrativas na pesquisa parasitológica.

Kopij, G. (2026). Herping the African continent: Alien amphibians and reptiles in the sub-Saharan Africa. Preprints.

Abstract: Introduction of species consists today one of the most important problem of nature conservation. Special attention is paid to alien vascular plants and vertebrates. In the Afrotropical Region (sub-Saharan Africa), avian and mammalian introductions have attracted the attention of many researchers and was recently reviewed, but there is a lack of such comprehensive review of alien amphibians and reptiles. The presented paper constitutes an attempt to overview the status, distribution, threats introduced herp species to sub-Saharan Africa since he second half of the 18th century. This review includes 21 amphibian (including 10 established) and 57 reptile (including 19 established) species introduced to sub-Saharan. The introduced amphibians are representatives of Urodela (n= 4 spp., none established) and Anura (n= 17 species, incl. 10 established). Introduced reptiles species belonged to the following orders: Testudines (n= 11 species, incl. 6 established), Sauria (n= 32 spp., incl. 29 established), Serpentes (n= 13 spp., incl. 2 established) and Crocolylia (1 sp. not established). Most species introduced to sub-Saharan Africa which subsequently developed viable populations originated from the Afrotropical (35%), Malagasy (27%) and Oriental (27%) regions. However, the proportions of introduced species which failed to establish viable populations were quite different: Nearctics (25%), Afrotropics (22%), and Neotropics (17%); Malagasy 11%, Oriental Region only 6%. First introduction of alien herp species, ie *Gehyra mutilate* and *Ptachadena mascareniensis*, in Africa took place in 18th century. By the end of 19th century, four other species have been introduced and in the two last decades of that century - 5 species. Similarly, in 20th century, most introduction were made in the last two decades, when an exponential growth of introduction begun and lasts till present. This growth has been caused by an increase in international trade and herp pet industry, especially in South Africa. Stowaway and pet trade are the most common pathways of introductions. Few factors determine the successful establishment of introduced alien herp species in sub-Saharan Africa, viz.: the behavioural and morphological traits, propagula pressure, climate and habitat overlap, and presence of potentially competing species. The impact of alien herps in sub-Saharan Africa on the local biodiversity is not well-investigated. Negative effects have been, however, evidenced for species such as *Sclerophrys gutturalis*, *Agama agama*, *Hemidactylus frenatus*, *Trachemys scripta* (competition); *Xenopus laevis*, *Sclerophrys gutturalis*, *Rhinella marina*, *Lycodon aulica* (predation); *Xenopus laevis*, *Python sabae* (hybridization); *Xenopus laevis*, *Palea steindachneri* (diseases and parasites). In comparison with other continents (Europe and North America) the number of introduced and established herp species in sub-Saharan Africa is relatively low, possibly because the Afrotropical region is saturated with herps which can potentially compete and prey on the alien species, preventing their successful establishment. Madagascar, the Mascarenes and other small islands in the Malagasy Region have the highest number of introduced herp species in sub-Saharan Africa. However these numbers are still much lower than those recorded for instance in the Greater Caribbean, probably for the same reasons as in the mainland.

Flores, S.A., Dwyer, R.G., Parsons, S. and Potvin, D.A. (2026). Roars, rumbles, and resonance: A systematic review and meta-analysis of crocodylian acoustic signals. Ecology and Evolution 16: e72494.

Abstract: Crocodylians are highly vocal reptiles, possessing a complex acoustic signalling system including vocal and non-vocal signals used for courtship, mating, mediating conflict, and providing maternal care. Despite this, research on crocodylian acoustic signalling remains infrequent, with methodologies and terminology varying widely across studies. Here, we systematically review the literature and standardise crocodylian acoustic signal descriptions, measurements, and terminology to establish a consistent foundation for future research. The compiled dataset included 22 publications, with 623 acoustic signalling observations and 53 distinct parameters measured across various species, life stages, and contexts. The American alligator (*Alligator mississippiensis*) was the most frequently studied species and distress calls the most commonly recorded signal type. Significant variation existed in parameters measured across studies, with dominant frequency, call duration, and fundamental frequency the most common. We synthesised acoustic parameters from available publications into comparable values and units, and provide these as a centralised database along with a standardised ethogram including representative spectrograms, and a glossary of commonly used terms facilitating clearer cross-species comparisons. Significant foundational level data gaps were identified with many species lacking defined repertoires, and notably, underwater acoustic signalling was rarely incorporated. We recommend shifting future research focus from distress calls to include a wider range of spontaneously produced acoustic signals, by individuals of known sex and life stage. The inclusion of a broader set of underrepresented acoustic parameters will also enable better cross-species comparisons, and identification of encoding in crocodylian acoustic signals. We further promote the reanalysis of existing data incorporating these key parameters, along with increased collaborative efforts, to add valuable insights informing conservation without requiring additional fieldwork. Such strategies will support future research into crocodylian acoustic communication and guide the development of more effective monitoring techniques such as passive acoustic monitoring and machine learning as tools for conservation and management of crocodylians.

Schwarz, D., Mielke, M., Handschuh, S., Herrel, A., Lemell, P., Da Cunha, L. and Konow, N. (2026). Beyond mammals: the evolution of chewing and other forms of oropharyngeal food processing in vertebrates. Biological Reviews.

Abstract: Oropharyngeal food processing exhibits a remarkable diversity among vertebrates, reflecting the evolution of specialised 'processing centres' associated with the mandibular, hyoid, and

branchial arches. Although studies have detailed various food-processing strategies and mechanisms across vertebrates, a coherent and comprehensive terminology is lacking. Here, we provide a synthesis, including a unified terminology for the intricate complexity of vertebrate oropharyngeal processing. Among gnathostomes, mandibular food processing predominates, ranging from discrete bites to rhythmic, cyclic chewing facilitated by precise tongue mechanics in aquatic and terrestrial environments alike. By contrast, some taxa have abandoned oropharyngeal processing entirely, relying instead on post-oesophageal strategies such as gastric milling and chemical digestion. Interestingly, teleost (bony) fishes illustrate the evolutionary trade-off between increased jaw protrusion for prey capture and reduced mandibular processing capacity. They compensated for this trade-off by developing derived processing behaviours early in their evolutionary development. Through the re-evolution of mandibular chewing, they succeeded in utilising all three known processing centres. Mastication is a specialised, dimensionally complex form of unignathic mandibular chewing (i.e. chewing restricted to the lower jaw) exclusive to mammals. However, our findings demonstrate that dimensionally complex forms of mandibular chewing have arisen independently multiple times and are widespread among gnathostomes. Notably, diverse taxa, including elasmobranch stingrays, Australian lungfish, sirenid salamanders, various songbirds, herbivorous turtles, and the tuatara, exhibit complex jaw movements combining arcuate, longitudinal, and sometimes transverse components enabled by specialised jaw joints, suspensions, and intracranial motions ('cranial kinesis'). From a comparative, functional-morphological perspective, mammalian mastication may best be characterised as dimensionally complex chewing mediated by the secondary or temporomandibular joint. By contrast, analogous dimensionally complex non-mammalian chewing involving motions confined to the primary or quadrate-articular jaw joint qualifies as pseudomastication. Both mastication and pseudomastication resemble functional masticatory behaviours, while those incorporating intracranial motions and movements of the jaw suspension belong to distinct categories. Our anatomical analysis highlights the convergent evolution of dimensionally complex chewing among gnathostomes and emphasises the importance of comprehensive studies on jaw development and function to deepen our understanding of the evolution of oropharyngeal processing.

Honegger, R.E. (2025). Alligatoren-schlachten im Amazonenstrom - Die dokumentation des Schweizer herpetologen Gottfried Hagmann. Sekretär 25(1): 26-49.

Summary: The targeted extermination of alligators as competitors to the imported cattle by the large landowners from Belem has a long tradition in the archipelago off the mouth of the Amazon. After Alfred Russel Wallace in 1848 and around 1900, the two Swiss naturalists Emil August Goeldi and Gottfried Ludwig Hagmann from the Museu Paraense Emílio Goeldi (MPEG) in Pará also witnessed such actions. The life and herpetological work of Gottfried Hagmann is analyzed. Three and a half years after his employment at the museum, Hagmann had already fallen out of favor with Goeldi personally and was therefore no longer employed at the museum. Now working as a supervisor on a cattle farm on the island of Mexiana, he continued his research in his spare time and produced numerous publications. On his trip to Switzerland in 1910 he donated numerous herpetological specimens to the Natural History Museum in Strasbourg and various living reptiles to Basel Zoo (where his father Gottfried Karl Hagmann was director). Among them was an unknown sheath-eyed snake, which the Basel herpetologist Jean Roux described and named *Helicops hagmanni* Roux, 1910 in honor of Gottfried Hagmann. In the same year, Hagmann returned to Brazil. He acquired the Taperinha estate near Santarém, where he tried his hand as a planter and again researched the Amazon's fauna. His house and laboratory became a research base for European entomologists. From 1914, Hagmann, together with his wife Julia, set up a private meteorological station there, which soon gained national importance. In 1927, he was appointed chief meteorologist by the Brazilian government. Gottfried Hagmann died of heart failure at the Museu Paraense Emílio Goeldi in 1946. Surprisingly, neither Goeldi nor Hagmann gave a personal assessment of the slaughter of caimans, which was contemptuous of the creatures. For better or worse, both researchers depended on the large landowners and the rubber barons, the so-called Pará elite; Hagmann's livelihood was sometimes threatened. This elite made it possible for the Museu Paraense Emilio Goeldi to concentrate on collecting and studying the Amazon fauna and flora. Given Emil August Goeldi's commitment against the mass export of stuffed hummingbirds, especially to England (1894) and against the persecution of white herons and red ibises for their decorative feathers for European hat fashion (1897), it is surprising that he felt differently about crocodiles, which also had a negative connotation in the Old World until modern times. From today's perspective, his indifference and that of his assistant towards the slaughter of crocodiles is incomprehensible.

Agne, S., Arnold, P., Belle, B., Straube, N., Hofreiter, M. and Glaw, F. (2026). Mitogenomic Crocodylia phylogeny and population structure of *Crocodylus porosus* including the extinct Seychelles crocodile. Royal Society Open Science 13: 251546.

Abstract: This study investigates the phylogenetic relationships of extant crocodiles and the population structure of the saltwater crocodile (*Crocodylus porosus*). We combined mitochondrial genomes from museum specimens with genetic data from modern samples to reconstruct the evolutionary history of the saltwater crocodile and clarify the identity of the extinct Seychelles crocodile. Mitochondrial genomes were sequenced for 11 museum specimens of *Crocodylus halli*, *C. niloticus*, *C. novaeguineae*, *C. palustris* and *C. porosus*, including the Seychelles crocodile. In addition, the mitochondrial control and ND4 regions were analysed for 187 and 13 C. porosus individuals, respectively. This study provides the most comprehensive *Crocodylus* phylogeny to date, establishes the phylogenetic placement of the extinct Seychelles crocodile as a distant population of the saltwater crocodile and provides no mitochondrial support for *C. halli* as a distinct species from *C. novaeguineae*. Nineteen haplotypes were identified among *C. porosus* samples, showing no clear mitochondrial geographic structure. However, this probably reflects the limited resolution of mitochondrial DNA rather than true genetic homogeneity, consistent with nuclear genomic studies revealing strong regional differentiation. Our results highlight the need for conservation strategies that recognize the broad genetic connectivity of *C. porosus* populations rather than emphasizing subspecies distinctions.

Nie, H., You, F., Wang, S., Xu, Y., Li, S., Zhan, J., Zhang, Y., Liu, P., Wen, Y., Zhou, Y., Zhang, S. and Wu, X. (2026). The effect of hibernation on reproduction performance of *Alligator sinensis*, Chinese Alligator is not limited to maintenance of matural follicle, but also involves the fundamental resource of germ cells. Animal Reproduction Science.

Abstract: Hibernation, acknowledged as a survival strategy under low-temperatures, is regarded as exert a substantial impact on reproductive performance. However, numerous enigmas remain concerning the underlying mechanisms of this interaction. Ultrasound scanning was employed to quantify follicle numbers, and assay of plasma neurotransmitters and steroid hormones were conducted to elucidate the dynamic correlations between follicle development and endocrine fluctuations during the hibernation period, encompassing onset of hibernation (OH), deep hibernation (DH), and ending of hibernation (EH). The findings demonstrated that a cycle of follicular development commenced prior to the OH, and an additional cycle of yolk deposition occurred subsequent to hibernation. Furthermore, a notable correlation was identified between the quantity of follicles larger than 20 mm (PF, the one closest to mature size) and the plasma GABA/glutamine concentration. This strongly suggests that the maintenance of follicles nearing maturity might be associated with the fluctuations of neurotransmitters during hibernation. The RNA-

seq results indicate that the down-regulation of GABA receptors in PF may imply a reduced neurotransmitter responsiveness, a phenomenon that is temporally congruent with the hibernation period. We postulate that this phenomenon might function to prevent excessive cell proliferation and apoptosis, potentially facilitating their continuous existence during hibernation. The findings from MeRIP-seq in conjunction *in vitro* molecular responses following sh-METTL3 treatment, further indicate that the suppression of oocyte recruitment into vitellogenic growth during hibernation is correlated with the M6A methylation modification. Additionally, the corresponding results imply that, beyond the initiation and recruitment of primordial follicles, the ovarian reserve may also been potentially influenced by the hibernation depth through crucial biological events such as double-strand breaks (DSBs) and the synapsis of homologous chromosomes during oogenesis.

Paiva, A.L.S., Godoy, P.L., dos Santos, D.M., Langer, M.C. and Mannion, P.D. (2026). Phylogenetically-informed estimates of notosuchian (Archosauria, Crocodylomorpha) body size and the challenges of inferring macroevolutionary patterns in extinct groups. Paleontology.

Abstract: Notosuchian crocodylomorphs were predominantly active terrestrial predators, exhibiting a wide range of ecomorphological specializations and body sizes. Given that body size plays an important role in the life history of vertebrates, its accurate estimation for notosuchians is crucial for understanding macroevolutionary and macroecological patterns in the group. Yet, reconstructing body size of fossil species with no living representatives is challenging, as demonstrated previously for Notosuchia, as well as other taxonomic groups. Here, we estimated the total body length of 40 Cretaceous-Cenozoic notosuchian species using a phylogenetic Bayesian inference approach that accounts for non-independence of taxa, based on cranial and femoral measurements from near-complete crocodylomorph specimens. Our results reveal notable discrepancies between estimates based on crania and femora, with skull length providing more robust estimates. We suggest that femoral length is more strongly influenced by factors such as locomotion, limb posture, and ecological habitat, all of which vary across Notosuchia (and Crocodylomorpha more broadly). Nevertheless, the sizes of both skeletal regions are significantly correlated with total body length in notosuchians. Larger body sizes in notosuchians are typically associated with a more semi-aquatic lifestyle, likely due to selective pressures associated with this ecology. Our findings also suggest that notosuchians from freshwater habitats and with less specialized diets were less affected by the Cretaceous-Palaeogene mass extinction event, allowing some lineages to persist and ultimately thrive in its aftermath.

Kntayya, S.K. (2025). Landscape Genetics and Habitat Viability of the Estuarine Crocodile (*Crocodylus porosus*) in Sabah: Conservation Management of an Apex Predator. PhD thesis, Cardiff University, Cardiff, UK.

Abstract: The estuarine crocodile (*Crocodylus porosus*), an apex predator and an integral component of Sabah's biodiversity, faces increasing pressures from habitat loss, human-wildlife conflict, and environmental changes. This thesis provides a comprehensive study of *C. porosus* populations in Sabah, integrating demographic, genetic, spatial, and viability analyses to inform effective conservation strategies. Surveys conducted across 10 rivers revealed variability in population densities and size-class distributions, with fragmentation limiting genetic flow among populations. Spatial movement analyses, using GPS telemetry, highlighted sex-specific differences in home range patterns, the importance of oxbow lakes and tributaries as critical habitats, and potential avoidance of anthropogenic structures such as bridges. Genetic analysis of 100 tissue samples using 16S, CytB, ND2 and D-loop markers revealed that while the overall genetic diversity of *C. porosus* in Sabah remains high, individual river populations exhibited low diversity, with the Paitan River identified as a genetic hotspot. Population Viability Analysis (PVA) simulations using Vortex projected that the overall metapopulation could persist over the next century, but this is heavily dependent on the Kinabatangan River population. Many smaller river populations, including those in Padas and Labuk, showed alarming trends toward decline or local extinction, emphasizing the need for targeted conservation efforts. The findings stress the importance of habitat restoration, enhancing connectivity, and managing human-crocodile conflict to support population recovery and sustainability. Additionally, the thesis highlights the need for non-lethal strategies to mitigate conflict and the development of wildlife-friendly infrastructure to reduce habitat fragmentation. By synthesizing insights across ecological, genetic, and spatial scales, this research provides a robust framework for understanding and managing *C. porosus* populations in Sabah. The results underline the critical role of habitat quality, genetic diversity, and ecological connectivity in ensuring the long-term viability of this species. This thesis offers actionable recommendations for conservation, aiming to preserve *C. porosus* as a vital component of Sabah's unique biodiversity and a key contributor to the ecological balance of its riverine ecosystems.

Dutton, H.R., Jacobs, F.J., Beytell, P.C., Netherlands, E.C., DuPreez, L.H. and Bullard, S.A. (2026). New genus and species of Liolopidae Odhner, 1912 (Platyhelminthes: Digenea) infecting Nile crocodile, *Crocodylus niloticus* (Laurenti, 1768) (Crocodilia: Crocodylidae) in the Kavango River, Namibia. Journal of Parasitology 112(1): 21-27.

Abstract: The intestine of a large adult (male) Nile crocodile, *Crocodylus niloticus* (Laurenti, 1768) (Crocodilia: Crocodylidae) from a site (18°08'24.5"S, 21°40'58.4"E) on the Kavango River (Namibia) was infected by *Ngubuvangandu francoisjacobsi* Dutton and Bullard n. gen., n. sp. (Digenea: Liolopidae). The new genus and species differs from all other liolopids by the combination of having a linguiform body that is ~3 times longer than wide, a weakly muscular ventral sucker (with pre- and post-ventral sucker distances equal), lobed testes that nearly span the intercecal space and that occupy the posterior one-third of the body, a posterior testis that occupies the space between the tips of the posterior ceca, an ovary abutting the anterior testis, a vitellarium that extends anterior to the ventral sucker (not reaching cecal bifurcation), and a uterus that traverses the intercecal space immediately anterior to the anterior testis. We herein reassign two previously named crocodilian liolopids formerly of *Dracovermis* Brooks and Overstreet, 1978 to the new genus: *Ngubuvangandu brayii* (Baylis, 1940) Dutton and Bullard, 2024 (infecting the west African slender snouted crocodile, *Mecistops cataphractus* Cuvier, 1825 in the Congo River) and *Ngubuvangandu rudolphii* (Tubangui and Masilungan, 1936) Dutton and Bullard, 2024 (infecting the saltwater crocodile, *Crocodylus porosus* Schneider, 1801 in the Philippines). The phylogenetic analysis recovered the new genus sister to *Liolope* Cohn, 1902. That clade was sister to *Harmotrema* Nicoll, 1914, with *Dracovermis* sister to the clade and *Paraharmotrema* Dutton and Bullard, 2022, sister to all liolopids analyzed. This result demonstrates that the crocodilian liolopids are paraphyletic, rejecting the notion that natural groups of liolopids can be defined by the definitive host they infect (ie no evidence of phylogenetic host specificity of liolopid genera/lineages). This is the first liolopid described from the Nile crocodile and only the second liolopid species described from an African crocodilian.

Pierini, S.E., Simoncini, M.S., Larriera, A., Bauso, J., Scarpa, L.J. and Piña, C.I. (2026). Environmental challenges influencing maternal care and nesting success in the Broad-snouted caiman. Global Ecology and Conservation.

Abstract: Maternal care and nesting success are critical components of the reproductive cycle in crocodilians, and are strongly influenced by environmental conditions. We studied the effects of environmental factors on maternal care and nesting success in the

Broad-snouted Caiman (*Caiman latirostris*), and we described the behavioral patterns of females. Using camera traps, we monitored 64 nests in forest, savanna, and marsh habitats across different levels of anthropogenic disturbance in Santa Fe, Argentina, over four nesting seasons (2018-2022). Regarding maternal care behavior, we identified nest defense, hatching assistance, and protecting unhatched eggs, in addition to the same patterns previously observed in captivity (nest construction, egg-laying, nest maintenance, and guarding the nest). Maternal care was more frequently observed in marsh nests. However, maternal care did not significantly vary in response to anthropogenic disturbances, nor across nesting seasons. Overall, 38% (24 out of 64) of the nests were successful, and success was positively associated with maternal care. Most unsuccessful nests occurred in savanna areas, where nests were often affected by flooding and predation by feral pigs (*Sus scrofa*). These findings contribute to a better understanding of the reproductive strategies of the Broad-snouted caiman and highlight the need for further research on the costs and benefits of maternal care.

Melkersson, K-G., Hodik, M., Staxäng, K., Hakizimana, P., Li, H. and Rask-Andersen , H. (2026). A transitional desmosome/tonofibril network may relay mechanical strain to epidermal nerve terminals with high fidelity and sensitivity in the Cuban crocodile (*Crocodylus rhombifer*): An ultrastructural study. Frontiers in Cellular and Developmental Biology14: 1739378.

Abstract: Crocodilians are well endowed with multiple cutaneous receptors and specializations, such as integumentary sensory organs (ISOs), which provide formidable mechanical sensitivity despite their protected shield. We investigated the free intraepidermal nerve terminals, focusing on the desmosomes, transitional desmosomes (TDs), corneodesmosomes (CD), and the tonofibril (TF) network that potentially act as force transducers to activate the mechanoreceptors. Two Cuban crocodiles (*Crocodylus rhombifer*) were analyzed using light and transmission electron microscopy (TEM) after glutaraldehyde fixation and decalcification. Discoid nerve terminals were richly enclosed by an epidermal force-transmitting system (eg pressure and vibration) through a rigid network of diverse desmosomes and CDs. TDs were anchored to keratinocyte's cytoskeletons via a dense meshwork of intermediate filaments or TFs, creating a continuous, mechanically-linked web connecting nerve terminals in the epidermis to the stratum corneum. The cutaneous receptors were innervated by myelinated and unmyelinated neural complexes surrounded by thin-walled mesothelial cells. Here, we describe for the first time the ultrastructure of TDs in the crocodile skin with diverse expression of CDs that may focus and amplify force via a tonofibril system "hugging" the receptor. Corneocytes, granular keratinocytes, and nerve endings function as a single integrated system. Thereby, mechanical strain is gathered from a relatively large area of the epidermis and concentrated onto the small surface of the discoid receptor. This may ensure that any deformation of the surrounding corneocytes is efficiently and reliably transferred to the nerve membrane, allowing the crocodile to detect very subtle stimuli. The crocodile system appears to have a far more structured and specialized adaptation for high-fidelity mechanosensation than that of humans.

Hughes, A.C., Marshall, B.M., Challender, D.W.S., Edwards, D.P., Eskew, E.A., Lockwood, J.L., Morton, O., Malsch, K., Fukushima, C., Hinsley, A., Nijmanvn, V., Meiri, S., Baruch-Mordo, S., Tlusty, M.F., Oyanedel, R., Jürgens, J., Pironon, S., Pavitt, A.T., Demirel, N., Brown, M.R.C., Tallowin, O.J.S. and Burgess, N.D. (2026). The true scope of global wildlife trade is obscured by data gaps. EcoEvoRxiv.

Abstract: Overexploitation of wildlife is a major driver of biodiversity loss. International wildlife trade is regulated and monitored at local, national, regional and global scales through a variety of mechanisms, including Multilateral Environment Agreements (MEAs), with CITES playing a key role. Whilst databases and systems are available to measure, monitor, and manage legal trade, the data for species that fall outside the scope of existing MEAs are both limited and highly fragmented. Illegal trade further complicates efforts to monitor and manage wildlife trade, and under-regulation creates 'grey-areas' of purportedly legal trade. Here, we review available wildlife trade monitoring programs to assess how complete is our understanding of international wildlife trade. We find that far more species are in international legal trade than are regulated through international agreements. We found that 24,331-42,385 animal species, including at least 22.3-42% of described vertebrate species, are in international trade. When including plants, this number increases to at least 102,056 species in use and trade. However, the US-specific LEMIS dataset, despite being only national in scope, frequently had higher diversity of species in trade than global databases. This highlights the current fragmentation and incompleteness of global wildlife trade data. Yet, whilst the US is the only country to make national level data available publicly, most countries have programs to control wildlife collection and import, which could be modified to monitor trade. Standardised collation of wildlife trade data would enable more sustainable trade of wildlife globally.

Zhao, J., Tellez, M., Shuai, Y., Tu, G., Zhou, Y., Yi, P., Xu, Z., Kuris, A. and Wu, X. (2026). Morphological and molecular characterization of *Brevimulticaecum sinensis* sp. nov. (Nematoda: Ascaridoidea) from *Alligator sinensis* (Crocodilian: Alligatoridae). International Journal for Parasitology: Parasites and Wildlife 29.

Abstract: *Brevimulticaecum sinensis* sp. nov. is a novel species belonging to the genus *Brevimulticaecum* (Nematoda: Heterocheilidae). It was detected in the stomach of a carcass of a Chinese alligator (*Alligator sinensis* Fauvel, 1879; Crocodilian: Alligatoridae) at the National Nature Reserve of China Alligator, Anhui Province, China. This study investigated the morphological and molecular characteristics of the isolated *B. sinensis* sp. nov. Herein, light and scanning electron microscopy, DNA sequencing, and histological analyses were performed for *B. sinensis* sp. nov. Notably, microscopy revealed novel taxonomic features of *B. sinensis* sp. nov. Additionally, the sequences of the internal transcribed spacer (ITS), cytochrome oxidase I (COI), and small subunit DNA (18S) segments of *B. sinensis* sp. nov. were 892, 655, and 885 bp, respectively. To the best of our knowledge, this is the first study providing molecular data showing the affiliation of this *Brevimulticaecum* species with the family Heterocheilidae. The histological analysis revealed the pathology of *B. sinensis* sp. nov. infection in *A. sinensis*. Overall, the findings of this study provide novel geographic and infection records of *B. sinensis* sp. nov., with it being added to nematode species that infect crocodiles.

Madhushanka, S., Weerasekara, D.S., Perera, M. and Ranawana, K.B. (2026). Nest attendance and hatching care in wild Marsh crocodile (*Crocodylus palustris*) in Kochchipathana Tank, Yala, Sri Lanka. Sri Lankan Journal of Biology 11(1): 43-50.

Abstract: This study investigates the behavior of wild marsh crocodiles (*Crocodylus palustris*) in Yala, Sri Lanka, focusing on nesting behavior and intruder dynamics using a trail camera. A burrow near Kochchipatana Tank was monitored over 72 days, documenting the frequency of four distinct behaviors: nest guarding (GR), burrow digging (DI), entry into the burrow (MO), and chasing intruders (CS). guarding behavior (GR) was the most frequent, with 133,880 occurrences, while CS was the least observed. Behavioral changes before and after hatching revealed a significant decline in GR post-hatching, though statistical analysis using Chi-Square tests showed no significant difference in behavioral frequencies between the two stages. Monitoring nest intruders recorded 12 species, including predators like the gray mongoose (*Urva edwardsii*) and domestic animals such as cats (*Felis catus*) and dogs (*Canis familiaris*), highlighting potential anthropogenic pressures on the nesting site. These findings emphasize the critical role of

nest guarding in reproductive success and point to the need for targeted conservation strategies to mitigate the impacts of human and predator interference. Future research should explore the long-term effects of environmental stressors and intruder interactions on reproductive success.

Prondvai, E., Horváth, K., Price, S.W., Gutowski, O. and Beale, A. (2026). United by chewing: Hunter-Schreger band-like pattern and wavy enamel in a fossil crocodile suggest functional convergence with mammals and dinosaurs. Proceedings: Biological Sciences 293(2064).

Abstract: Tooth enamel of most mammals shows alternating light and dark bands, called Hunter-Schreger bands (HSB), in longitudinal sections caused by decussating bundles of prisms, the unit building blocks of mammalian enamel. HSB are thought to increase resistance to abrasive food and mitigate crack propagation and hence are considered a mammalian adaptation to high-efficiency mastication. Using traditional microscopy techniques as well as X-ray diffraction computed tomography (XRD-CT), here we report for the first time the presence of HSB-like features in the tooth enamel of a non-mammalian amniote, *Iharkutosuchus*, an extinct herbivorous crocodile with strong heterodonty and a unique chewing mechanism. XRD-CT showed that the enigmatic HSB-like pattern in *Iharkutosuchus* enamel, which lacks mammal-like decussating prisms, has a purely crystallographic origin. Iharkutosuchus teeth also exhibit wavy enamel, a well-known structure in herbivorous ornithopod dinosaurs with shearing-type mastication. The unexpected finding of both enamel features in this herbivorous crocodile speaks for their role in high-efficiency chewing. However, the profoundly different structural background of mammalian and crocodilian HSB demonstrated here and the phylogenetic distribution of both HSB and wavy enamel indicate nanostructure-scale convergences, highlighting the importance of mastication-related challenges in driving dental evolution of amniotes.

Alibardi, L. (2026). The developing alligator tongue undergoes a soft form of cornification associated with intermediate filament keratins. Journal of Anatomy.

Abstract: Little is known on the keratinisation and cornification in the alligator tongue. This process has been studied during late and pre-hatching embryonic stages, using histochemical, immunolabelling and electron microscopy. The study revealed that PAS-positive, Alcian blue and Blue Nile Sulphate reactive glycoprotein/glycolipids are produced and accumulated in the corneous layer of the lingual epithelium before hatching. Also, Intermediate Filament Keratins (IFKs) but not Corneous Beta Proteins (CBPs) are synthesised in the tongue epithelium. Alligator IFKs have variable composition and cysteine content, 0.1%-1.1%, and few contain 2.5%-4.9% cysteine, and participate in the formation of a hard-corneous layer. These keratins also contain numerous hydrophobic amino acids, in particular leucine and valine, suggesting that they are partially hydrophobic. The predicted cross-reactivity with the IFK-antibodies here employed suggests that these antibodies can recognise some alligator IFKs. Light and transmission electron microscopy show that the stratified corneous layer is formed by narrow alpha-corneocytes storing peripheral corneous material and a central electron-pale and likely glycolipid core. Numerous membrane coating granules 0.1-0.2 µm in diameter and reactive to silver-methenamine reaction for glycoproteins are accumulated and merge with keratin bundles along the plasma membrane or are extruded among pre-corneous keratinocytes. Corneocytes of 0.1-0.2 µm in thickness pile up on embryonic tongue before hatching, forming the stratum corneum, but they do not accumulate detectable CBPs, the prevalent proteins instead present in alligator scales and claws. Whether CBPs are later produced in juveniles and adult alligator tongue to mechanically strengthen the lingual epithelium is unknown but it is hypothesised that the presence of cysteine-rich IFKs may contribute to the hardness of the tongue corneous layer.

Feng, H., Li, Y., Shen, T. and Zhao, H. (2026). On the origin and evolution of sweet taste mediated by Tas1r2-Tas1r3 in vertebrates. Integrative Zoology.

Abstract: Sweet taste is a crucial chemosensory modality for detecting natural sugar compounds, which are primarily derived from angiosperms. In vertebrates, excluding birds, sweet taste is typically mediated by the Tas1r2-Tas1r3 heterodimer, and the receptor function often reflects dietary adaptations to sugar-rich diets. To gain insight into early vertebrate dietary transitions, we identified Tas1r genes in 58 vertebrate species and one outgroup and conducted functional assays in 10 representative species spanning six major clades, including one coelacanth, two amphibians, one squamate, two turtles, two crocodilians, and one mammal. Cell-based assays showed that only the desert tortoise and American alligator exhibited detectable responses to natural sugars via Tas1r2-Tas1r3, while all other tested species showed no response. To trace the evolutionary origin of sweet taste perception, we reconstructed ancestral Tas1r2 and Tas1r3 receptors for tetrapods, amniotes, and sauropsids. Functional assays of these ancestral receptors revealed no sugar sensitivity. Integrating our results with previously published data, we conclude that Tas1r2-Tas1r3-mediated sweet taste likely originated in amniotes and did not exist in earlier-diverging vertebrates such as cartilaginous fishes, bony fishes, and amphibians. These findings suggest that sweet taste arose independently in vertebrate lineages after the origin of angiosperms, and likely represents lineage-specific adaptations to angiosperm-derived dietary resources.

Indriani, S., Petcharat, T., Andriani, C., Benjakul, S., Nalinanon, S., Karnjanapratum, S., Srisakultiew, N. and Pongsetkul, J. (2026). Extraction techniques, structural features, and functional properties of collagenous derivatives from unconventional animal sources: a review. Collagen & Leather 8: Article 9.

Abstract: Collagenous derivatives (collagen, gelatin, and collagenous hydrolysate (CH)) are extensively used across the food, biomedical, and pharmaceutical industries. Traditionally, these have been sourced from porcine, bovine, and fish due to their ready availability and biocompatibility. However, conventional collagenous derivatives face ongoing challenges regarding sustainability, resource intensity, and socio-cultural perceptions. This has led to the exploration of alternative collagenous derivatives from unconventional sources, with a primary focus on evaluating their potential for yields, extractability, and functional properties, all of which are fundamental for future scale-up and alternative applications. This review summarizes alternative collagenous derivatives from unconventional animals, including amphibians, mollusks, echinoderms, insects, unconventional fish and byproducts, and reptiles. Their structures, extraction techniques, functional properties, and potential applications are comprehensively summarized, showcasing their ability to complement or even surpass conventional sources in specific uses. Additionally, the challenges and prospects for industrial application, emphasizing the sustainability of meeting growing collagen demand and encouraging further research into these promising alternative sources, were discussed. Unconventional collagenous derivatives demonstrate excellent and unique characteristics as alternatives to conventional ones. Type I collagen from amphibians, reptiles, and mollusks had superior thermal stability. Unconventional gelatin and CH also possess various bio-functionalities that can enhance their potential applications. The relatively low extraction yield could be addressed by increasing the concentration of chemicals or extraction time and incorporating green technology without causing an adverse impact on the quality. These findings indicate the potential applications of unconventional collagenous derivatives as food ingredients and supplements.

Corrigendum to: Do Val, H.G.P., Passos, L.F., de Barros, J.M., Webb, G. and Coutinho, M.E. (2026). Thermal ecology and embryonic development in black caiman's (*Melanosuchus niger*, Spix 1758. Journal of Thermal Biology.

The authors regret the writing of duplicated information regarding temperature nest variation, in the paper as follows "In 2019 mean nest temperature was 31.6 ± 1.65ºC (N= 17 sets of records; range 28.5ºC-34.2ºC) and significantly higher than the mean ambient temperature of 27.0 ± 5.94ºC (N= 17; range 18.8ºC-35.1ºC). In 2024, mean nest temperature was 31.6 ± 1.57ºC (N= 2590 records; range 27.2ºC-35.9ºC) and ambient temperature 27.2 ± 3.6ºC (N= 2590; range 21.3ºC-40ºC), hence almost identical to 2019. The mean difference between ambient and nest temperatures was 5.2ºC in 2019 and 4.4ºC in 2024. In the two nests examined in 2019 mean ambient temperature was 27 ± 5.94ºC (N= 17; range 18.8ºC-35.1ºC), which was significantly lower than the mean clutch temperature of 31.6 ± 1.65ºC (N= 17; range 28.5ºC-34.2ºC, for the same period. In the 2024 data, mean ambient temperature was 27.2 ± 3.6ºC (N= 2590; range 21.3ºC-40ºC) which is not significantly different from 2019, but significantly lower than the mean nest temperature 31.6 ± 1.57ºC (N= 2590; range 27.2ºC-35.9ºC), which was identical to the 2019 mean nest temperature. The mean difference between ambient and nest temperatures in 2019 (5.2ºC) was similar to that in 2024 (4.4ºC)."

The corrected and summarised information should be presented as: "In the two nests examined in 2019 mean ambient temperature was 27 ± 5.94°C (N= 17; range 18.8ºC-35.1°C), which was significantly lower than the mean clutch temperature of 31.6 ± 1.65°C (N = 17; range 28.5ºC-34.2°C, for the same period. In the 2024 data, mean ambient temperature was 27.2 ± 3.6 °C (N= 2590; range 21.3ºC-40°C) which is not significantly different from 2019, but significantly lower than the mean nest temperature 31.6 ± 1.57°C (N= 2590; range 27.2ºC-35.9°C), which was identical to the 2019 mean nest temperature. The mean difference between ambient and nest temperatures in 2019 (5.2°C) was similar to that in 2024 (4.4°C)."

Rath, L.P., Mohapatra, R.K., Dash, S.K., Khan, A., Kumar, N., S.K., Nair, M.V. and Maharana, S. (2026). Diving behaviour of a critically endangered crocodilian: ecological drivers and conservation implications. European Journal of Wildlife Research 72: Article 23.

Abstract: This study explores the diving behaviour of the critically endangered Gharial (*Gavialis gangeticus*) to understand how these airbreathing aquatic reptiles utilise river depth for foraging, avoidance to disturbance, thermoregulation and energy conservation. Four captive-bred adult Gharials (1 M:3 F; body lengths 345-384 cm) were introduced into the Mahanadi River, India, and radio-tracked for an average of 114±53.5 days using Argos-enabled FASTGPSDIVE transmitters. These devices recorded key parameters, including dive depth, duration, submergence time, and dive intervals, across spatial and temporal scales. The average dive depth was 2.56±2.20 m with shallow dives (0.75-1.75 m) occurring most frequently (52.67%). Deep dives (>10 m) were rare (0.3%) but notable. Dive frequency peaked between 0600 and 1200 h, while dive depth and duration were highest in winter, with maximum values of 12.75 m and 34 min, respectively. Larger individuals tended to dive deeper, and Gharials in disturbed areas (outside the Protected Area (PA)) exhibited greater dive depths than those within (inside PA). Submergence time was higher at night (24%) than during the day (20%) (MWT, $p<0.006$). The interval between dives was longest during the rainy season (85.90±2.27 min) and shortest in winter (61.97±1.39 min) (KWT, $p<0.001$). This research has broad implications, particularly for understanding the minimum ecological flow requirement in the river to sustain the critically endangered Gharials, at a time when increasing infrastructure development and climate change have affected river ecosystems. We acknowledge the limitations of a very small sample size and recommend interpreting the results with caution when planning conservation measures.

Farias, B.D.M., Müller, R.T., de Bem, F.P., von Baczko, M.B., Desojo, J.B. and Soares, M.B. (2026). Filling a key gap in growth patterns of Pseudosuchia through the osteohistology of *Dynamosuchus collisensis* (Ornithosuchidae: Archosauria). Royal Society Open Science 13(2): 252042.

Abstract: Ornithosuchidae are among the least studied pseudosuchians from a histological perspective. We present the first long-bone osteohistological data for the ornithosuchid *Dynamosuchus collisensis*, based on mid-diaphyseal thin sections of the humerus and femur, supplemented by a rib. The long bones show cortices dominated by highly vascularized woven-parallel complex and parallel-fibred bone, with three well-defined annuli and a fourth incipient one near the periosteal margin. Medullary expansion occurs through endosteal resorption, and secondary osteons in formation are present. The rib displays lower vascularization, suggesting reduced growth rates in axial elements. Open neurocentral sutures, the absence of an EFS and the lack of peripheral slowdown in cortical deposition indicate that the holotype was skeletally immature, and probably sexually immature, at the time of death. This suggests that the individual had not yet reached its maximum body size and would probably have attained a larger size, consistent with a role as a top-tier predator in Carnian ecosystems. These features support sustained rapid growth, contrasting with the predominantly slow growth of late-diverging crocodylomorphs and more closely resembling early loricatans and poposauroids. Because Ornithosuchidae occupy an early-diverging position within Pseudosuchia, these data support the hypothesis that fast growth may represent a plesiomorphic condition within the clade.

Mikula, P. (2026). Caiman nests as small-scale biodiversity hotspots. Proceedings of the Royal Society B 293: 20250108.

Adler , K.A., Gore, M.L. and Wilkinson, C.E. (2025). The gendered costs of human–wildlife conflict: A global systematic review. Ambio.

Abstract: Human-wildlife conflict is a pressing worldwide issue with consequences that are experienced differently across groups of people. Societal expectations and gender norms ensure that the consequences of these conflicts have nuanced, gender-dependent implications. We conducted a systematic literature review on human-wildlife conflict to synthesize gendered costs. We examined six cost types: economic, physical, psychological, social, conservation management participation, and wildlife crime, and found that these costs varied significantly by gender. We also found that costs have gendered consequences for how people perceive the wildlife involved in these conflicts. We identify a range of opportunities and entry points for managers, researchers, and policymakers interested in reducing costs associated with human-wildlife conflict by more directly accounting for gender.

Sitthiangkool, P., Poapolathep, A., Klangkaew, N., Phaochoosak, N., Wongwaipairoj, T., Marín, P., Giorgi, M., Lebkowska-Wieruszewska, B., Perez-Lopez, M. and Poapolathep, S. (2026). Pharmacokinetic characteristics of florfenicol in freshwater crocodiles (*Crocodylus siamensis*) after intramuscular administration. Animals 16: 631.

Abstract: Florfenicol (FFC) is widely used to treat bacterial infections in veterinary medicine; however, its pharmacokinetic characteristics in reptiles remain limited. This study investigated the pharmacokinetic profiles of FFC after intramuscular (IM) injection at doses of 20 or 30 mg/kg body weight (b.w.) in freshwater crocodiles (*Crocodylus siamensis*). A sample of 10 healthy crocodiles was randomly divided into two groups (n= 5 for each group) according to a parallel study design. Blood samples were obtained from pre-dose to 168 h post-administration. Plasma FFC concentrations were quantified using high-performance liquid chromatography with diode array detection (HPLC-DAD) and analyzed by non-compartmental analysis. The mean maximum plasma concentrations

of FFC were 4.05 μg/mL and 6.11 μg/mL for the 20 and 30 mg/kg b.w. doses, respectively. The mean elimination half-lives of FFC were long but not significantly different (51 h). The average plasma protein binding was 37.15%. Based on the pharmacokinetics/pharmacodynamics (PK/PD) index, a single dose of FFC via IM elicited plasma concentrations above the MIC90 values reported for several susceptible bacterial pathogens. Consequently, both dose levels provided plasma exposure consistent with previously reported reference MIC values. However, further PK/PD and multiple-dose investigations are needed to refine species-specific dosage regimens.

Yanish, Y., Piombino-Mascali, D., Rosendahl, W., Chen, S., Oras, E. and Tarasenko, M. (2026). An Egyptian mummified crocodile from the Kyiv-Pechersk Lavra National Preserve (Ukraine): Archaeological and morphological considerations. Archaeologia Lituana 26: 246-261.

Abstract: This study presents the first examination of an Egyptian mummified crocodile from the collection of the Kyiv-Pechersk Lavra National Preserve (Ukraine). Archival research established that the specimen was donated to the Archaeological Museum at St. Volodymyr's University in 1860 by Dr. Joseph Shkuratovsky who likely obtained it in Upper Egypt in the mid-19th century. The mummy had never been studied by Egyptologists, bio-archaeologists, or zoologists. Radio-carbon dating and chemical analysis of embalming substances were conducted using standard protocols. The radiocarbon results suggest a Ptolemaic Period origin (332-30 BC), although possible reservoir effects may have influenced the date. Beyond presenting this unique find to a wider audience, a key objective was to explore possible morphological criteria for distinguishing the Nile crocodile (*Crocodylus niloticus*) from the West African crocodile (*Crocodylus suchus*), both sympatric species present in ancient Egypt. Drawing on Etienne Geoffroy Saint-Hilaire's early observations and subsequent morphometric data, the structure of the external mandibular fenestra in this specimen was examined and compared to other examples, both modern and archaeological. The fenestra of the examined specimen exhibits features more typical of *C. suchus*. However, it is of importance to note that crocodile mummies cannot be assumed to represent *C. suchus* without a robust series of genetically confirmed specimens. Thus, the present observations are preliminary and should be regarded as a working hypothesis to be tested against other larger, well-documented datasets and utilizing DNA analyses. Morphological examination also revealed evidence that the crocodile was intentionally killed - likely by a single, precise stab wound to the neck - and that the injury was carefully concealed, suggesting a broader and more deliberate practice of sacrificial killing than previously recognized. This study contributes new archaeological, historical, and morphological data to the growing body of research on animal mummification in ancient Egypt, while underscoring the need for further work on species identification criteria.

Steel, M., Wicke, K. and Mooers, A. (2026). Properties of biodiversity indices that model future extinction risk. arXiv.

Abstract: The loss of biodiversity due to the likely widespread extinction of species in the near future is a focus of current concern in conservation biology. One approach to measure the impact of this extinction is based on the predicted loss of phylogenetic diversity. These predictions have become a focus of the Zoological Society of London's 'EDGE2' program for quantifying biodiversity loss and involves considering the HED (heightened evolutionary distinctiveness) and HEDGE (heightened evolutionary distinctiveness and globally endangered) indices. Here, we show how to generalise the HED(GE) indices by expanding their application to more general settings (to phylogenetic networks, to feature diversity on discrete traits, and to arbitrary biodiversity measures). We provide a simple and explicit description of the mean and variance of such measures, and illustrate our results by an application to the phylogeny of all 27 extant crocodilians. We also derive various equalities for feature diversity, and an inequality if species extinction rates are correlated with feature types.

Ortiz, R.N., Zamboni, L.P., Tentor, F.R., Larriera, A., Siroski, P.A. and Parachu Marco, M.V. (2026). Long-term assessment of reproductive parameters of broad-snouted caiman populations in agroecosystem areas of central-northern Santa Fe, Argentina. Journal of Zoology.

Abstract: Anthropogenic activities such as agriculture and keeping livestock have significantly modified natural ecosystems, transforming them into agroecosystems and contributing to habitat loss and species decline. In Argentina, agricultural expansion has been accompanied by increased use of agrochemicals, raising concerns about their impact on biodiversity. These chemicals can affect organisms directly during application or persist in the environment, potentially disrupting reproduction. Our study focuses on *Caiman latirostris* populations, a species whose distribution overlaps with croplands. We conducted a comprehensive long-term spatial and multi-temporal analysis of some reproductive parameters in *C. latirostris* in 2000-2018, using six nesting areas located in central-northern Santa Fe, Argentina. This analysis integrated geospatial tools to assess the impact of agrochemical exposure on reproduction. Nest monitoring data from the Proyecto Yacare conservation program were integrated with geospatial datasets through the Google Earth Engine (GEE) platform, utilizing AI tools to evaluate environmental disturbances of each nesting area and its perinesting environment. This assessment incorporated web feature geoservices (WFS), vegetation indices (NDVI) temporal series, and land use/land cover. Reproductive parameters, including hatching success, the percentage of non-viable embryos, infertile eggs, and neonate malformations, were analyzed in relation to the proximity of agricultural activities. Results revealed a significant decline in hatching success, accompanied by an increase in the proportion of non-viable embryos and infertile eggs in the nests, particularly in nesting areasassociated with agricultural activities. The integration of geotechnologies provided a comprehensive evaluation of the spatial and temporal aspects of the impacts of agricultural expansion on *C. latirostris* reproduction. These findings suggest that chronic exposure to agrochemicals is a plausible factor contributing to the decline in reproductive success, with broader implications for conservation in agroecosystems. This study highlights the utility of geotechnologies in monitoring environmental changes and their effects on wildlife. Our results also offer a scalable approach to assess anthropogenic impacts on other species and ecosystems, providing critical insights for conservation strategies.

Lima Gorza, L., Correia Marcelino, S.A., Cardoso Nobrega, Y., Nogueira de Carvalho, M.P., Coutinho, M.E., Campos Tavares, G. and Pierezan, F. (2025). 4. Principais doenças infectoparasitárias em crocodilianos. Pp. 69-104 *in* Sanidade e Doenças em Cefalópdes, Anfíbios, Quelônios de Água Doce e Crocodilianos. Cadernos Técnicos de Veterinária e Zootecnia No. 114 (December 2025).

Sarmiento-Marina, Y. (2026). Occurrence of atypical coloration phenotype in *Crocodylus acutus* of the Cañón del Sumidero National Park, Chiapas, Mexico. Zootaxa 5759(3): 343-346.

Omori, A.M., de Souza Suguiura, A.M., da Silva Campos, Z.M., de Camargo, Z.P., Itano, E.N. and Ono, M.A. (2026). Serological evidence of paracoccidioidomycosis infection in pantanal caimans (*Caiman yacare*). Veterinary Research Communications 50(3): 203.

Abstract: Paracoccidioidomycosis (PCM) is a systemic mycosis of medical and veterinary importance. Infection by fungi of the genus *Paracoccidioides* has been reported in several animal species but has not yet been described in reptiles. This study aimed to investigate serological evidence of *Paracoccidioides* infection in wild caimans

(*Caiman yacare*) from the Brazilian Pantanal, Mato Grosso do Sul, a region endemic for PCM. Serum samples from 50 free-ranging caimans were analyzed by ELISA and immunodiffusion using gp43 and exoantigen, respectively. Anti-gp43 antibodies were detected in 30% of the samples by ELISA, whereas no reactivity was observed by immunodiffusion. No significant differences were found between males and females, indicating similar exposure to the pathogen. To our knowledge, this is the first report of serological evidence of *Paracoccidioides* infection in caimans, expanding the known host range of this pathogen.

Paixão, G.M.X., Martinelli, A.G., Marsola, J.C.A., Hechenleitner, E.M., Nava, W.R., Chiappe, L.M., Jussiani, E.I., Rozadilla, S., Kaluza, J. and Pinheiro, F.L. (2026). Fossil evidence of exceptionally large egg-clutches sheds light on reproductive diversity in Late Cretaceous crocodyliforms from Brazil. Journal of Vertebrate Paleontology.

Abstract: The Upper Cretaceous units of the Bauru Group have provided a comprehensive fossil record of eggs and nests belonging to different reptilian clades, such as turtles, crocodyliforms, and dinosaurs. Here, we report the discovery of several egg-clutches from the Adamantina Formation (Bauru Group), cropping out in the city of Presidente Prudente (São Paulo State, Brazil). The new discovery represents three egg clutches, totaling 83 eggs, plus numerous isolated eggshells. The spatial arrangement of the eggs within the clutches is like that observed in different species of extant crocodyliforms, an arrangement that results from the construction of a relatively narrow hole within a substrate mixed with leaf litter. An important feature of one of the clutches (MPM 447) is that it contains a large number of eggs (at least 47), thus representing the largest Mesozoic crocodyliform egg clutch ever found. SEM images of the external surface revealed a high pore density, suggesting that thicker and more porous eggs facilitate water loss, compensating for deposition in more humid settings. The set of attributes converges with structures described for crocodyliforms. In connection with studies conducted on the Bauru Group, the correlation with Notosuchia elucidates broader aspects of the adaptation of this clade, which includes organisms specialized in both terrestrial environments and more humid habitats. The new discovery shows new evolutionary implications for one of the world's most diverse fossil crocodylomorph faunas, revealing more complex and successful reproductive habits with potential adaptations to occasionally wetter environments.

Barbini, L., Burke, P.M.J., Caddeo, I., Romano, M. and Mannion, P.D. (2026). Endocranial anatomy of the earliest cretaceous European neosuchian crocodyliform *Pholidosaurus purbeckensis* provides new evidence for the ecological evolution of Pholidosauridae. Journal of Anatomy.

Abstract: The neosuchian crocodyliform clade Pholidosauridae had a near-cosmopolitan distribution, spanning the Late Jurassic to the early Paleocene. Representatives of the group inhabited aquatic environments, ranging from freshwater to potentially fully marine forms. The phylogenetic placement of Pholidosauridae within Neosuchia remains debated: whereas most analyses place it as closely related to Dyrosauridae, some studies argue for a closer relationship with Goniopholididae. One skeletal region that could shed light on both the phylogenetic position of Pholidosauridae, as well as how it achieved its broad distribution, is the internal cranial anatomy, which has been shown to document morphological features with both an ecological and phylogenetic signal in other crocodyliforms. However, a natural endocast is currently the only available information on the internal cranial anatomy of a pholidosaurid. Here, we present new insights into the internal cranial anatomy of *Pholidosaurus purbeckensis*, based on CT-scan data of material from the lowermost Cretaceous Purbeck Limestone Group, southern UK. Overall, the endocranial anatomy of *P. purbeckensis* is more similar to that of goniopholidids than dyrosaurids, especially the morphology of the olfactory tract and the cerebrum, which might represent a phylogenetic rather than ecological signal. However, this might merely reflect retention of the 'standard' crocodyliform skull and endocranial shape in pholidosaurids and goniopholids, rather than necessarily a close relationship, with the cranial anatomy of dyrosaurids instead representing an apomorphic departure from this morphology. We identify paired dorsolateral expansions in the olfactory region of the skull of *P. purbeckensis*, which have been interpreted as osteological correlates of nasal salt glands in some marine thalattosuchians, dyrosaurids, and extinct gavialoid crocodylians. If this interpretation is correct, it would suggest a higher tolerance for saltwater than previously hypothesised in *Pholidosaurus*, which would provide support for oceanic capabilities early in the evolution of Pholidosauridae that potentially enabled the group's near-cosmopolitan distribution. Finally, we demonstrate external cranial anatomical variation amongst specimens attributed to *P. purbeckensis*, particularly in contemporaneous French remains provisionally referred to this species. However, this might best be regarded as individual variation: we therefore tentatively support the attribution of this material to *P. purbeckensis* pending the much-needed revision of the type species of *Pholidosaurus*, *P. schaumburgensis*, from the earliest Cretaceous of Germany.

Donzé, G., Perrichon, G., Vincent, P., Therrien, F. and Martin, J.E. (2026). Comparative endocranial anatomy in the crocodylians *Leidyosuchus canadensis* and *Stangerochampsa mccabei* from the upper Cretaceous of Alberta, Canada. Journal of Anatomy.

Abstract: Crocodylians evolved a high variety of rostral morphologies during their evolutionary history, highlighting the strong links between morphological plasticity and environmental and ecological parameters. Two Late Cretaceous alligatoroids, the mesorostrine *Leidyosuchus canadensis* Lambe, 1907, and the brevirostrine *Stangerochampsa mccabei* Wu *et al*., 1996, from Alberta, Canada, preserve a large groove-shaped recess on the posterior part of the maxilla that has not been documented in other alligatoroids. Despite the potential phylogenetic and paleoecological significance of this neurovascular feature, internal and endocranial structures remain under-explored among stem alligatoroids. The endocranial morphology, including the paratympanic sinus system of *Leidyosuchus canadensis* and *Stangerochampsa mccabei*, was compared to those of extant crocodylians and of the extinct alligatoroid *Diplocynodon ratelii* based on computed tomography data. The Cretaceous alligatoroids share endocranial features, such as a posteroventral neurovascular projection of the labiolateral canal that connects to the groove-like recess at the posterior edge of the maxilla and a paratympanic sinus system most similar to those of small-bodied and young extant crocodylians, suggesting that these pedomorphic features may reflect the ancestral crocodylian condition. Future phylogenetic studies should consider internal and endocranial characters alike to improve our understanding on the relationships among crocodylians.

Taemaitree, L., Tankrathok, A., Roytrakul, S., Phongsiri, K., Boonmark, C., Mongkhammee, N., Daduang, S., Klaynongsruang, S. and Nisachon Jangpromma (2026). Identification and functional characterization of cytoprotective crocodile-derived peptides against oxidatively stressed human keratinocytes. ACS Omega 11(8): 13743-13755.

Abstract: Oxidative stress-induced cellular damage is a primary contributor to pathological conditions such as accelerated skin aging. Consequently, there is a strong demand for efficacious antioxidants. Herein, we investigate the cytoprotective properties of *Crocodylus siamensis* white blood cell extracts and peptides derived from them against H_2O_2-induced oxidative damage in HaCaT keratinocytes. The extracts show no cytotoxicity, restore cell viability by 3-fold relative to oxidatively stressed cells, and reduce apoptosis. Notably, two enriched peptides - NV10 and RI10 - demonstrated superior cytoprotective efficacy under oxidative stress. These peptides

scavenge intracellular ROS (~60% reduction), modulate Keap1-Nrf2 pathway components at mRNA levels (downregulating Keap1, upregulating Nrf2), and suppress apoptosis via regulation of caspase and Bcl-2 mRNA expression. Molecular docking predictions suggest that the peptides bind to Keap1, a negative regulator of Nrf2, thereby providing a potential mechanism for Nrf2 pathway activation. These findings suggest that the identified peptides are potential candidates for therapeutic development in skin protection applications.

Somaweera, R., Alam, S., Azmiri, K.Z., Ahmed, S., Zakir, T., Ali, Y., Hassan, T., Theunissen, D., Groenewold, S.A., Chowdury, M.M.R., Rana, M.S., Beri, P. and Udyawer, V. (2026). What is home? Post-release movements of captive-reared and translocated mature Saltwater crocodiles in Bangladesh. Wildlife Research.

Abstract: The ability of animals to exhibit homing behavior, returning to familiar locations using spatial memory, is central to understanding movement ecology, conservation planning, and the success of reintroduction programs. Despite this, little is known about the homing behavior of mature captive-reared crocodiles once released into the wild. This study investigated post-release movements of captive-reared, wild-caught, and translocated saltwater crocodiles (*Crocodylus porosus*) in Bangladesh's Sundarbans mangrove ecosystem, with the aim of assessing homing tendencies and how movement patterns differ among release types. Five mature crocodiles were monitored, including three captive-reared individuals, one wild-caught and released, and one wild-caught translocated animal. Satellite telemetry and continuous-time state-space modeling were applied to estimate daily movements and home range sizes across tracking periods of 53-127 days per individual. Movement patterns varied substantially among individuals. The translocated crocodile exhibited the greatest daily movements (up to 34.3 km/day) and an expansive home range (2,515 km^2), consistent with previously documented strong homing and exploratory responses to translocation. In contrast, captive-reared and wild-caught released crocodiles moved shorter daily distances and maintained smaller, more defined home ranges (14.2-125 km^2). Importantly, captive-reared crocodiles showed no indication of homing toward prior husbandry sites, despite long-term captivity. Mature captive-reared crocodiles were able to establish ranges in the wild without showing fidelity to former captive or husbandry sites. In contrast, the pronounced exploratory behavior of the translocated crocodile underscores the challenges associated with adult translocations. These findings highlight the potential of releasing subadult and adult captive-reared crocodiles as a viable conservation strategy to bolster wild populations while avoiding the high predation risks of juvenile releases. At the same time, they emphasize the importance of carefully considering release sites and incorporating measures such as soft-release protocols to mitigate homing behavior in translocated animals. The results provide an evidence base for refining crocodile reintroduction and restocking efforts across their range.

Omoghene, O.I., Rhoda, B-A.D., Oghenekevwe, R.M., Iyamu and Arinze, O. (2026). Ecotourism and crocodile management in the Niger Delta: Community engagement and educational strategies for sustainable conservation. African Research Reports 2(2): 137-149.

Abstract: The study investigates how ecotourism relates to crocodile management in the Ughelli-Warri Metropolis of Nigeria's Niger Delta, focusing on Small Mangrove Parks such as Falcorp Mangrove Park and Jorgan Resort. Using a mixed-methods approach that included park visits with interviews, school outreach, and online questionnaires, data were collected from 50 participants comprising national park stakeholders, academic researchers, ecotourism professionals, and 11 secondary school students. A 30-item questionnaire assessed perceptions of the role of ecotourism, challenges in crocodile management, and educational needs. Descriptive analysis revealed that 81.82% of respondents viewed crocodile management as important for ecotourism, 63.64% had never visited a national park, 27.27% believed crocodile management is not well integrated into ecotourism, 76% identified wildlife conservation as a key benefit of ecotourism, and 60% agreed that ecotourism supports crocodile conservation. The findings show low engagement and limited access to ecotourism opportunities despite strong recognition of conservation needs. Respondents - especially students - supported incorporating ecotourism into education, and major challenges such as inadequate funding and poor public awareness were identified.The study concludes by recommending educational programs, increased community participation, and greater government support, emphasizing that collaborative efforts are essential to advancing sustainable ecotourism that promotes conservation and local economic development.

González-Desales G.A., Mañón-González, J.R., Zarco-González, Z., Perera-Trejo, E.E., Charruau, P., Mandujano-Camacho, H.O. and Monroy-Vilchis, O. (2026). Is *Caiman crocodilus chiapasius* at risk?: Distribution, habitat degradation, and population trends. Journal for Nature Conservation.

Abstract: Effective wildlife conservation requires understanding current threats and anticipating future habitat changes to implement timely mitigation and prevention measures. This study evaluates the current population status of the *Caiman crocodilus chiapasius*. We investigated its potential distribution and conducted a multi-temporal analysis of habitat modification between 1980 and 2020, with projections for 2040 and 2060. We determined the local and national population status through a retrospective analysis of scientific literature, unpublished data, and technical reports. Using species distribution models, we identified priority areas for the conservation of *C. c. chiapasius*. The main factors that influence the probability of presence are the distance to mangroves, the average temperature in the wettest quarter, and the precipitation in the driest month and in the coldest quarter. The analysis of land use changes reveals a significant loss of native vegetation, especially mangroves, due to the advance of agriculture and human settlements. Projections indicate that this trend will continue towards 2040 and 2060. Through the Relative Abundance Index, we observed a decline in caiman populations in Chiapas. The relative abundance has decreased significantly from 1996 to the present, with negative values projected for 2040 and 2060, and individuals of all size class (since neonates to adults) were observed. Effective conservation will require protecting and restoring wetland habitats, maintaining ecological connectivity, and enforcing land-use regulations more rigorously in and around protected areas.

Fortner, J.D., Sellers, K.C., Middleton, K.M. and Holliday, C.M. (2026). Biomechanics of the intramandibular joint in *Alligator mississippiensis*. Journal of Anatomy.

Abstract: Tetrapod vertebrates possess skulls composed of variably articulating bones which they use to apprehend, process, and ingest food. Natural selection must therefore optimize craniomandibular sutures for load resistance, but sutural patency is required for normal craniofacial development to occur. While mammals seemingly escaped this constraint in their mandible by simplifying it into a single bony element (ie the dentary), sauropsids retain a composite mandible with a prominent, and occasionally flexible, intramandibular joint (IMJ) separating the rostral, dentigerous elements from the caudal elements onto which the jaw muscles insert. How sauropsids simultaneously construct a mandible robust enough for feeding that nevertheless maintains sutural patency for proper growth is a biomechanical paradox of keen interest to functional morphologists. Sauropsids may either passively reduce IMJ strain by expanding IMJ complexity or actively by using isometric contraction of specialized jaw muscles to resist excursion. American alligator (*Alligator mississippiensis*) mandibles possess a rather complex IMJ that must accommodate extreme magnitude and highly dynamic loads during feeding. Importantly, they also possess large m. intramandibularis (mIM) and m. pterygoideus ventralis

(mPTv) muscles that may reduce IMJ strain during feeding, making them an ideal taxon to investigate the effect of joint morphology and muscle activity on IMJ and mandibular strain. We therefore constructed several 3D finite element models of *Alligator* mandibles with varyingly shaped IMJs to test the effect of IMJ orientation, complexity, and differential muscle activity on mandibular bending deformation and joint strain. Simple planar IMJs, regardless of orientation, reduce positive sagittal bending and medial wishboning deformation, and increase inversion of each hemimandible's dorsal margin. Changes in bending deformation during bilateral bites as the joint surface was reoriented from rostrally sloped to Vertical to caudally sloped are partially attributable to changes in joint surface area, though bending deformation is sensitive to both bite point location and joint orientation during unilateral bites. Increasing IMJ surface area reduces IMJ strain magnitudes, with a highly complex IMJ experiencing the most uniform and lowest magnitude joint ligament strains. Differential activation of mIM and mPTv do not significantly reduce IMJ strains but do affect mandibular bending deformation, suggesting that available joint surface area, and not isometric muscle contraction, is the greatest variable controlling IMJ strains in adult *Alligator*. Instead, mIM may significantly control bite point reaction forces due to its very long moment arm, whereas mPTv indirectly reduces medial wishboning by pulling the caudal elements against the pterygoid buttress, inducing a powerful, laterally directed reaction force on the caudal elements. However, while sauropsids appear susceptible to medial wishboning owing to the prominent medially directed pull of their jaw muscles, overall relationships between IMJ form and flexibility are unclear, as groups with complex intramandibular sutures may be akinetic (eg crocodylians) or kinetic (eg varanids). Further research will clarify IMJ morphological diversity and disparity among reptiles and divulge form-function relationships of this critical, but underappreciated, aspect of their feeding apparatus.

Saunders, L.D., Alterator, S., Jukes, S. and Schutt, S. (2026). Experimenting with thought ritual as an indigenous methodology in educational research: Stories from Larrakia Country. Australian Journal of Environmental Education.

Abstract: This article describes how relational processes of telling and listening to stories were central to the establishment of a doctoral project by a Larrakia traditional owner working with Indigenous and non-Indigenous supervisors. The project explores the topic of education about living with crocodiles, a totem animal for the Larrakia people. The first stage of the project involved a week-long visit by the research team to Larrakia Country, Northern Territory, in order to develop relationships with Larrakia people and Country, and to gain cultural permission prior to gathering data. Stories from the visit are recalled and their significance analysed using the Indigenous research methods Thought Ritual and Storying. The stories shared during the trip are shown to involve more than simple capture and retell; instead, through close listening and deep reflection on meaning, stories proved to be the main conduit for demonstrating respect, exchanging knowledge and building relationships. We argue for the value of such story-based approaches to education about crocodiles, including the reframing of crocodile-human relations as part of a web of connections with Country and all that live in/on it - a shift in perspective personally experienced by the research team during their visit.

Rao, R.J. and Sharma, R.K. (2026). A Bibliographic Compendium of Wildlife Conservation and Research in the National Chambal Sanctuary, India. Compilation Report submitted to Madhya Pradesh Forest Department, Bhopal, M.P. 1-30, India. Available on CSG website.

Naik, T. (2026). Crocodile: The unique creature. International Journal of Wild Life Science 3(1): 7-10.

Abstract: Crocodiles are opportunistic carnivores. Understanding crocodile feeding habits is important to appreciate their role in the ecosystem. By understanding their feeding behaviours, anatomy, digestion and diet, we can protect them and their habitats. Juveniles prefer small fishes, crustaceans, insects, etc., while the adults feed on a large variety of invertebrates and vertebrates, including mammals, birds, reptiles and large fishes.

Ricketts, J.B., Brianne, D., Letter, A., Ford, R., Steen, D.A. and Deem, V.R. (2026). An apparent case of Pb toxicosis in an American crocodile *Crocodylus acutus* in South Florida, USA. Endangered Species Research 59: esr01474.

Abstract: Although the impacts of lead (Pb) poisoning are well known for many species, there are few studies on the topic relevant to American crocodiles *Crocodylus acutus* in Florida, USA, where they are protected under the Endangered Species Act. When an American crocodile died during a recent capture event, we conducted a field necropsy and collected relevant samples for analysis. The crocodile displayed clinical signs of Pb toxicosis (eg missing teeth), and stomach contents contained 22.42 g of Pb, comprising 23 air-rifle pellets, and 1 weight used for angling, as well as green iguana (*Iguana iguana*) claws. Liver and scute samples contained Pb concentrations of 78.06 ppm (wet weight basis) and 0.35 ppm (wet weight basis), respectively. We suggest that Pb toxicosis contributed to the death of this American crocodile, likely following consumption of a fishing weight as well as at least 1 green iguana that had been shot with Pb pellets; this observation represents the first apparent case of mortality associated with Pb toxicosis for this threatened species, but other individuals are likely being impacted.

Miao, J., Sun, K., Chen, J., Fan, G., Xia, T., Zhou, Y., Tu, G., Yu, Z., Wu, X. and Pan, T. (2026). Nest-site preference in captive Chinese alligators *Alligator sinensis*. Endangered Species Research 59: esr01476.

Abstract: Nest site selection occupies an extremely important place in the life history of reptiles and directly influences population persistence and reproductive success. Therefore, understanding this behavior is essential for the conservation of the endangered Chinese alligator *Alligator sinensis*. To investigate nest-site preferences in captive breeding environments, we surveyed 210 artificial nests across 3 breeding sites with varying management practices. Principal component analysis revealed 4 major environmental gradients (cumulative variance explained: 75.75%), with distance to water, slope length, and canopy cover contributing most to the first component (location factor), while bank height, slope angle, and platform area defined the second component (topographic factor). Habitat selection analysis showed that alligators significantly avoided nests with higher bank elevations (Vanderploeg= 0.757, $p<0.001$) and steeper slopes (Vanderploeg= 0.839, $p<0.001$). The best-fit generalized linear mixed model identified bank height (odds ratio= 0.383, p= 0.040) and platform area (odds ratio= 1.123, p= 0.095) as key predictors of nest utilization, with an area under the ROC curve of 0.751 and overall accuracy of 70.7%. These findings provide a scientific basis for improving the design of artificial nests, which can enhance reproductive efficiency in captive Chinese alligators and support habitat restoration efforts.

Pritz, M.B. (2026). Early development of the habenula. Brain Mechanisms.

Abstract: Many reports have investigated the development of the habenula. One largely unexplored area of study is the time between identification of the unitary habenula and its division into two nuclei. This time in embryogenesis is considered significant because events during this interval likely shape the habenula as well as its subsequent subdivisions. This developmental period between stages 14 and 21.5 was investigated in *Alligator mississippiensis*.

Using immunohistochemical techniques the following sequence of events was found. Early in development between stages 16.5 and 18.5, proliferating and multiplying cells were found in the ventricular zone whereas differentiating and migrating cells were located in the mantle zone. Later, between stages 19.5 and 21, this zone of proliferating and dividing cells decreased whereas the area of differentiating and migrating cells expanded. Acquisition of cell identity, as reflected by calretinin expression, occurred just before habenular subdivision at stage 22. Injections of a retrograde tracer abutting the ependyma of the habenula between stages 17 and 21.5 directly investigated cellular migration. At stage 17, a few migrating cells were present in the middle of the mantle zone. Beginning with stage 18.5 and continuing through stage 21.5, additional labeled cells were present in the mantle zone and more processes were labeled. From stage 17 to stage 20, cells were oriented radially. However, at stage 21.5, some cells were positioned tangentially. These observations form the basis for future studies to determine the mechanisms that underlie these processes and influence subdivision of the habenula into its two major nuclei.

Cidade, G.M., Godoy, P.L., Amavet, P., Cossette, A., Solórzano, A., Bona, P., Angulo-Bedoya, M., Balaguera-Reina, S.A., Rabi, M., Pires-Farias, I., Figueiredo, R.G., Ezcurra, M.D., Bittencourt, P.S., Brochu, C.A. and Roberto, I.J. (2026). The phylogenetic nomenclature of Caimaninae (Crocodylia: Alligatoroidea). Historical Biology.

Abstract: Caimaninae is one of the main clades within alligatoroid crocodylians. Its extant diversity encompasses six species in three genera - *Caiman*, *Melanosuchus* and *Paleosuchus* - and is largely native to South America; the fossil record, in contrast, reveals a far greater diversity, extending from the Late Cretaceous and, although concentrated in South America, also showing notable fossils from Central America, North America and the Caribbean. Systematic and taxonomic research on Caimaninae began in the 18th century, with phylogenetic-based systematics, taxonomy and nomenclature being applied since the 1980s. Following the publication of the International Code of Phylogenetic Nomenclature (PhyloCode), a cojoined effort by Caimaninae systematists to standardise the phylogenetic systematics and nomenclature of the group was required, which is the objective of this paper. Herein, we provide phylogenetic definitions for seven clade names: Caimaninae, Bottosauria (new clade name), Caimanini (new clade name), Jacarea, Purussauria (new clade name), Purussauridae (new clade name) and Nettosuchidae. Detailed information on each clade is provided, including taxonomic and evolutionary history, composition, fossil record, divergence dates, characteristics and previous phylogenetic studies. Our intention with this effort is to provide a stable framework on which to base further research on the diversity of the group at several levels, and to encourage the use of phylogenetic nomenclature in Crocodylia.

Alibardi. L. (2026). Review. Cell biology and immunohistochemical evidence of the transition between an aquatic to a terrestrial-waterproof epidermis in the archosaurian alligator. Journal of Experimental Zoology B. Molecular and Developmental Evolution.

Abstract: The present review summarizes studies on the morphology and cell biology of the developing epidermis in the alligator as an example of archosaurian reptile. From an initial, two-layered epidermis, numerous suprabasal keratinocytes are produced at late stages of embryonic development, some days before hatching. The soft embryonic epidermis contains mucous granules, cysteine-poor IF-keratins and trichohyalin-like proteins produced from genes located in different chromosomal loci, including the EDC (Epidermal Differentiation Complex). These proteins contribute to the mild keratinization of the embryonic epidermis, resembling that of amphibians. The embryonic epidermis is composed from 3 to 4 layers of epidermal layers that are shed before hatching. The 3rd or 4th layer of the embryonic epidermis begins to accumulate Corneous Beta Proteins (CBPs), marking the transition into the definitive corneous epidermis with the production of spindle-shaped beta-cells. The latter accumulate large amount of CBPs, some lipids droplets and, in some areas also melanosomes, giving rise to a relatively hard and impermeable stratum corneous with a patterned pigmentation. The presence of Sox-oxidase in differentiating and maturing beta-cells, catalyzes the formation of numerous disulphide bonds, likely binding IFKs and CBPs in addition to their electrostatic interactions. Intra- and inter-molecular bonds contribute to hardening the corneous material, forming the definitive corneous layer. The latter, with the incorporated lipids allows to post-hatching, juveniles and adult alligators to withstand the freshwater contact and also the dry conditions of the terrestrial environment where they live. The evolution of numerous EDC proteins and CBPs mixed with lipids confers specific adaptive characteristics to the skin in this reptile.

Konvalina, J.D., Quintana-Ascencio, P.F., Trauth, S.E., Banks, R.K. and Hoffman, E.A. (2026). Coastal and inland American alligators (*Alligator mississippiensis*) diverge along physiological axes in response to a salinity gradient. Journal of Evolutionary Biology.

Abstract: Ecotypes often occupy an environmental gradient, which can lead to divergence in physiological traits between ecotypes. We tested the hypothesis that alligators from inland and coastal environments have physiologically and genetically diverged from one another by exposing coastal and inland alligators to hypo-osmotic (0 PSU), iso-osmotic (10 PSU) and hyper-osmotic (20 PSU) salinities. For each alligator, we measured natremia before and after exposure, one behavioral trait, 10 histological traits, and gene expression levels in the liver and kidney. We found little evidence supporting population genetic differentiation between coastal and inland alligators yet found significant physiological divergence between the two ecotypes. Coastal alligators exhibited slightly elevated natremia across salinity treatments both pre- and post-trial and there were large structural differences between the ecotypes in both the kidney and liver tissues. Broadly, the metabolic features of the liver were decreased and the osmoregulatory abilities of the kidney were increased to a greater extent in the coastal alligators than in the inland alligators, especially at high salinities. This was also reflected in the gene expression data, where most DEGs were involved in metabolic pathways. Together, these findings suggest that coastal alligators maintain sodium balance through a combination of increased renal processing capacity and a slightly elevated natremia set point. Overall, we found that the salinity gradient used in our study elicited contrasting physiological responses between alligators from coastal and inland environments.

Yoo, J., Harris, D., Penn, J., Stannard, C. and Fannin, J.M. (2026). The effect of tactile experience on preferences and willingness to pay: A case study of alligator hide. Journal of Sensory Studies 41(2): e70111.

Abstract: Multiple studies have experimentally investigated the influence of tactile attributes on consumer perception and preferences. Focusing on craft kits (earrings, luggage tag, and keychain) made from different types of leather including alligator and cowhide, this study is one of the first to measure the effect of tactile experience on consumer perception and willingness to pay (WTP) for a textile product. The analysis utilizes a Discrete Choice Experiment. Responses (n=145) were gathered from 12 events geared toward crafters. We implement a split-sample experiment where respondents to either the control group or tactile group had an opportunity to physically touch kits. Tactile experience increases perception of quality (overall, workability, desirability) and WTP for alligator hide ($49-$122) and beginner ($-17 to $6), though others (production method, location, scale size) are unchanged. After applying a certainty-adjustment to control for potential hypothetical bias, WTP is insignificant, and evidence of differences in preference with or without tactile experience diminishes. While we still observe an effect of tactile experience (marginal effects for beginner), it

varies considerably with the particular product characteristic and may be more muted than previously shown, though more case studies are needed. These findings highlight the importance of accounting for hypothetical bias when evaluating sensory interventions, and suggest that tactile marketing may nonetheless be effective in enhancing consumer perception and demand.

Ledoux, L., Platt, S.G., McFee, W.E. and Rainwater, T.R. (2025). *Alligator mississippiensis* (American alligator). Diet. Herpetological Review 56(2): 199-200.

Platt, S.G. and Rainwater, T.R. (2025). *Alligator mississippiensis* (American alligator). Leucism. Herpetological Review 56(2): 200-201.

Chen, X., Evans, T.G., Jeschke, J.M., Griffith, P., Jahnig, S.C. and He, F. (2026). Global assessment of alien freshwater megafauna reveals complex socio-economic impacts. One Earth.

Abstract: Freshwater megafauna, such as sturgeons, large salmonids, carp, turtles, and crocodilians are often introduced to regions outside their native ranges due to their high economic value (eg for aquaculture and sport fishing) and their charisma (eg as ornamental species and pets). These introductions can be harmful for native biodiversity and for the people that rely on healthy freshwater systems, particularly for food and livelihoods. Although the impact of these introductions on biodiversity have been assessed, our understanding of the ways in which they affect people's lives remains limited. We used a novel impact scoring system together with several established frameworks to produce the first global dataset on the beneficial and detrimental impacts of alien freshwater megafauna on people, with impacts structured by their magnitude and type. Introduced freshwater megafauna provide various benefits, such as food and recreational opportunities - for example, they are an important source of food for local communities, can be farmed and sold commercially, and can be used for recreational opportunities (eg sport fishing). However, they can also have complex detrimental impacts on people. For example, they can deplete populations of the native species that they consume or compete with, in turn causing economic hardship and reduced food security for local people who rely on these native species for trade and food. This can cause changes to the ways in which these local people behave and interact. These detrimental impacts often affect people who neither introduce freshwater megafauna nor benefit from their introduction. Clear communication of these detrimental impacts on people is needed, as the introduction of freshwater megafauna is likely to continue in the future for their perceived economic benefits.

Balaguera-Reina, S.A., Liberato, E.B., Daykin, B.L. and Mazzotti, F.J. (2026). The invasive spectacled caiman (*Caiman crocodilus*) in Florida, United States: Invasion timeline, insights, and implications for Everglades restoration. Frontiers in Amphibian and Reptile Science.

Abstract: The spectacled caiman (*Caiman crocodilus*) is a crocodylian native to Central and South America that has been introduced and established (reproducing in the wild) in several insular (ie Cuba, Puerto Rico, San Andres) and continental (ie Florida) areas out of its native range. The hypothesized impacts associated with spectacled caiman invasion are numerous, including competition with other native aquatic predators (ie American alligators/American crocodiles), predating upon sensitive species (ie *Nerodia* sp.), and causing overall food web structure modifications. Nonetheless, the lack of ecological studies testing these hypotheses limits quantification of those impacts. This review focuses on what we have learned about spectacled caiman's biology, ecology, distribution, and ecological impacts in the past 45 years since establishment in South Florida, United States (US), management approaches so far implemented, and the future of its management in the context of Everglades restoration. Spectacled caiman rapid establishment in South Florida can be attributed to a presumably large initial population (at least couple of pairs), small-sized reproductive specimens, broad adaptability to various habitats, and favorable temperatures. Recent observations suggest that spectacled caiman distribution may expand further within protected areas/natural habitats (ie Everglades National Park), which would make management and control more difficult, increasing the risk of potential harmful effects on sensitive ecosystems (ie wilderness areas). We present insights into spectacled caiman's habitat, seasonal dynamics, and influence in trophic interactions within native aquatic communities in South Florida. We also discuss the implications of spectacled caiman management and control in Everglades restoration and the potential effects of hydrological restoration on the future of this invasive species. The objective of this research was to provide up-to-date pieces of information on spectacled caiman ecology, management, and policy, including new data on nesting and potential trophic interactions collected through monitoring and participatory research. We also highlight knowledge gaps and research priorities for future studies to better assess spectacled caiman impacts on the invaded ecosystems.

Brochu, C.A., Drumheller, S.K., Campisano, C., Tekle, G., Getachew, T., Head, J.J., Platt, N.C. and Leaphart, D. (2026). Lucy's peril: A Pliocene crocodile from the Hadar Formation, north-eastern Ethiopia. Journal of Systematic Palaeontology 24(1).

Abstract: We herein describe a new crocodile, *Crocodylus lucivenator* sp. nov., from palaeoanthropological sites in the Pliocene Hadar Formation in north-eastern Ethiopia. It shares derived features and plesiomorphic states with two Pleistocene species of *Crocodylus* from East Africa. Conversely, *C. lucivenator* bears a midline boss on the dorsal surface of the rostrum similar to those of modern Neotropical crocodiles and late Miocene crocodiles from Libya and Kenya. A boss is also present on Pliocene specimens from Kanapoi in Kenya previously referred to *C. thorbjarnarsoni*. Some *C. lucivenator* also have a more substantial prenarial rostrum than other Palaeoafrican *Crocodylus*, though not to the same extent as in extant *Crocodylus*, and its expression is variable. Phylogenetic analysis supports a close relationship between *C. lucivenator*, Kanapoi *Crocodylus*, *C. anthropophagus*, *C. thorbjarnarsoni*, and fossils from the Turkana Basin previously misreferred to *C. checchiai*. A close relationship with Neoafrican *Crocodylus* is rejected, reinforcing a comparatively recent arrival for Neoafrican *Crocodylus* in East Africa. *Crocodylus lucivenator* and the Kanapoi form are very similar, but an exclusive relationship is not unambiguously supported in our analysis. The phylogenetic placement of the Palaeoafrican clade depends on how one regards the prenarial rostrum, and positions outside crown *Crocodylus* or close to the Neotropical clade can be equally optimal. One mandible preserves pathological structures consistent with injuries sustained during intraspecific combat. *Crocodylus lucivenator* appears to have been the only crocodylian in the Hadar Formation, while coeval deposits in the Turkana Basin preserve as many as four species. The reason for this disparity is unclear.

Wang, Z., Xie, J., Li, J., Yang, K., Wei, Y., Wang, B., Wang, L., Wu, X., Ren, L., Li, W., Pan, T., Melo, K. and Dai, Z. (2026). Learning from Yangtze alligators: A framework for agile and ecologically interactive spine-legged robots. Biomimetic Intelligence and Robotics.

Abstract: A central challenge in bio-robotics is to create machines that can integrate into and illuminate natural ecosystems. The Chinese Yangtze Alligator - a critically endangered species exhibiting exceptionally agile spine-leg coordination honed by its terrestrial-aquatic transition - offers a unique model to address this challenge. Yet, existing alligators-like robots fail to capture such biological fidelity due to insufficient actuation, simplified mechanics, and the absence of adaptive control policies. Here, we introduce the Spine-

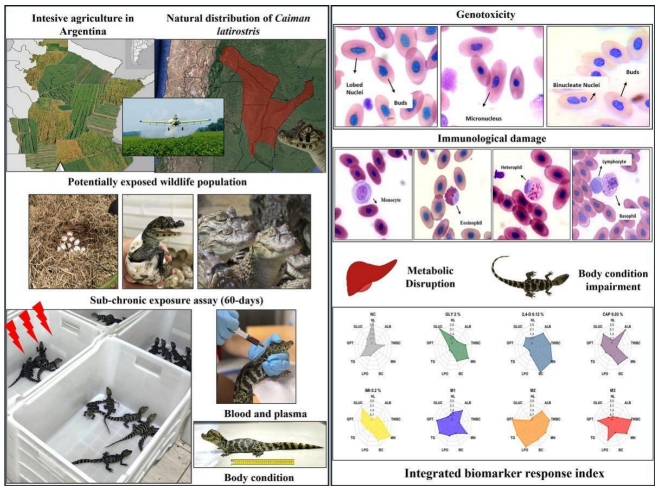
Legged Adversarial Imitation and Reinforcement Learning (SLAIR) framework, which for the first time leverages deep reinforcement learning to master this coordination. By retargeting biological motion data from Yangtze alligators and integrating impedance control to produce natural compliance, our controller achieves adaptive spine-leg coordination in a custom 24-DOFs robot. A variational autoencoder (VAE) generalizes across terrain, while a dual-critic architecture robustly fuses imitation and task rewards. This enables agile locomotion (0.32 m/s, 360° turns in 3.5 s) with a 46.7% reduction in cost of transport. Crucially, the robot's biomimetic fidelity was validated in the field, where it elicited natural curiosity and approach behavior from wild Yangtze alligators - demonstrating its potential as a transformative tool for conservation biology.

Moffitt, S., Koussayer, B., Buller, K., Moore, M.G., McLaughlin, M., Stoehr, J., Schlub, R., Doarn, M. and Troy, J. (2025). Alligator assault: A systematic literature review and case series at a Florida Level 1 trauma center. Eplasty 25: e38.

Abstract: Alligator bites are a rare occurrence, though some literature on injurious human-alligator interactions exists. This report details 3 cases of alligator bite-related wounds with characteristic extensive tissue damage and subsequent reconstruction. We also review the literature on caring for this specific population. The authors present a systematic literature review on alligator bite-related sequalae and care. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines were followed throughout the systematic literature review. The authors also present a case series of patients wounded by alligators who each presented to a large tertiary academic center on the west coast of Florida. Early debridement, prophylactic antibiotics, soft tissue reconstruction, and interdisciplinary care are the main tenets of care for patients who sustain alligator bites. Case 1 was a 53-year-old man with a left upper extremity bite with significant neurovascular damage and near transradial amputation who underwent emergent revascularization. After multiple attempts at limb salvage, the patient underwent formal transradial amputation. Case 2 was a 77-year-old woman with bites to her left upper and lower extremities, with concern for lower extremity Morel-Lavallée lesion. The lower extremity wound was reconstructed with lateral gastrocnemius muscular and fibularis longus musculocutaneous flaps and split-thickness grafting; ultimately, transradial amputation was necessary for the upper extremity after evidence of devascularization. Case 3 was a 34-year-old man with a facial injury and skull fracture. After initial operative repair of the facial nerve and soft tissue lacerations, the patient required later revision with cranioplasty and temporalis coverage because of a draining wound. All 3 patients survived their severe injuries. This case series represents a unique set of patients maimed by alligators and their subsequent surgical management. Recommendations from the literature review include an interdisciplinary approach, early operative investigation and initiation of broad-spectrum antibiotics, and to consider a staged reconstruction for these injuries.

Chacón, C.F., Martinez, T., Tonini, E., Moleón, S.M., Siroski, P.A., Poletta, G.L. and López González, E.C. (2026). Physiological disruption, genotoxicity, and body condition impairment in *Caiman latirostris* yearlings exposed to environmentally relevant pesticide concentrations. Science of The Total Environment 1025.

Abstract: Wild populations of *Caiman latirostris* in South America are potentially exposed to complex mixtures of pesticides used in agricultural practices. These contaminants can disrupt physiological processes, including reproductive success and breeding performance. This study evaluated the effects of 60-day sub-chronic exposure in caiman yearlings to four commercial pesticide formulations: glyphosate (GLY; 2%), 2,4-dichlorophenoxyacetic acid (2,4-D; 0.12%), imidacloprid (IMI; 0.2%), chlorantraniliprole (CAP; 0.03%), and mixtures: M1 (GLY 1% + 2,4-D 0.06%), M2 (IMI 0.1% + CAP 0.015%), and M3 (M1 + M2) compared to a negative control (NC) group. Blood samples were collected after exposure to analyze the frequency of micronuclei (FMN), lipoperoxidation levels, hematological and biochemical parameters, as well as body condition (BC). Our outcomes revealed significant disruptions across key physiological systems, including genotoxicity, higher lipoperoxidation, immune cell alterations, shifts in metabolites (triglycerides, albumin, total protein, glucose, cholesterol, lactate dehydrogenase) and hepatic enzyme activities (glutamate pyruvate and glutamate oxaloacetate transaminases), alongside impairment in BC in mixtures compared to NC and their respective individual components. The Integrated Biomarker Response index further revealed that mixtures, particularly M2 and M3, elicited the most complex and amplified physiological disruptions. These findings suggest that agrochemical mixtures compromise the capacity of this species to respond to adverse environmental conditions, potentially reducing fitness and reproductive performance, thereby threatening the viability of wild populations. Our study highlights the value of biomarker-based assessments for understanding pesticide impacts on wildlife, recognizing the organism as an integrated system that may exhibit distinct responses to contaminant mixtures.



Rachuene, P. (2025). Relationship Between Morphometric Traits and Predictive Models for Skin Length in Slaughtered South African Nile Crocodiles (*Crocodylus niloticus corviei*). MSc thesis, University of Limpopo, South Africa.

Abstract: Nile crocodiles are common in South Africa, reaching up to 6m in total length. The quality and yield of crocodile skins plays a significant role in it price determination. Hence, the aim of this study was to determine the relationship between the total skin length and measurable skin traits viz skin weight (SW), skin thickness (ST), neck total length (NTL), neck width at the top (NWT), neck width at the middle (NWM), belly width (BW), belly length (BL), total tail length (TTL), tail length from the middle (TLM), and tail width (TLW). The first objective was to determine the phenotypic relationship between total skin length and measurable skin traits of the Nile crocodile. The second objective was to establish a model for predicting the total skin length of the Nile crocodile from measurable skin traits. A total of 180 crocodile skins from 35 months old Captive-bred Nile crocodiles, sourced from Lalele Crocodile Farm, were used for data collection. Data was analysed via Statistical Package for Social Sciences (SPSS), software version 29.0. The first objective was achieved using Pearson's correlation. The second objective was achieved using simple linear regression and multiple regression analysis. Correlation results indicated that TSL was correlated with SW (0.81), NTL (0.37), BW (0.75), BL (0.79), TTL (0.87), TLM (0.78), TLW (0.48), NWM (0.60), NWT (0.51) at $p<0.01$ and ST (0.17) at $p<0.05$. Regression findings showed that, as a single trait, TTL was the best predictor of TSL, as shown by the highest coefficient of determination (0.76) and RMSE (31.98). Furthermore, regression analysis showed that model 1 (TSL = 16.35 + 4.68SW + 1.28ST + 1.03BL + 0.39BW + 0.81TTL + 0.13TLM - 0.25TLW + 0.21NTL + 0.19NWT - 0.14NWM) had

the highest coefficient of determination (R^2= 0.90) and the lowest residual mean square error (RMSE= 14.28) and would reliably predict TSL of Nile crocodiles. The results suggest there is a positive relationship between the total skin length and measurable skin traits of Nile crocodile and improving these traits might improve TSL. Skin traits such as SW, NTL, NWT, BW, BL, TTL, TLM, TLW, and ST may be used to improve TSL. TTL may be used to easily predict TSL. These findings may aid in better management and selection for breeding of Nile crocodiles for improved skin yield and quality.

Gunathilaka, W.D.C.N., Rodrigo, B.K.P.D., Jayasekara, E.G.D.P. and Mahaulpatha, W.A.D. (2026). Seasonal and daily variations of Mugger crocodile (*Crocodylus palustris*) behaviors in Wilpattu National Park. Pp. 141 *in* Proceedings of the 30th International Forestry and Environment Symposium of the Department of Forestry and Environmental Science. University of Jayewardenepura: Sri Lanka.

Abstract: Out of two crocodile species present in Sri Lanka, the Mugger crocodile (*Crocodylus palustris*) is a Near Threatened freshwater crocodile species, inhabiting freshwater bodies, ponds, and irrigation canals around the island. These large carnivorous reptiles play a crucial role in maintaining their natural ecosystems. The present study aimed to assess all behaviors of Muggers across the dry and wet seasons and times of the day. Areas in and around the Wilpattu National Park were selected as study sites. The crocodile survey was conducted from September 2024 to August 2025, covering wet (October-February) and dry (March-September) seasons. Point counts along road transects were conducted using a jeep. An ethogram was created after thoroughly observing the behaviors. All the behaviors were documented at the first site during morning, midday, and evening. Eight different behaviors (basking, feeding, floating, gaping, high walk, resting on land, submerged, swimming) were analyzed to examine the significant differences using the chi-squared test across time of the day and between two seasons. Throughout the year, 231 crocodile sightings were recorded, and wet season sightings (150) were higher than the dry season (81). The reason might be the decline in water levels and the confinement of crocodiles to a small area during the dry season. Activity budget of each behavior was recorded as basking (21.40%), feeding (0.87%), floating (24.89%), gaping (9.17%), high walk (3.06%), resting on land (13.10%), submerged (5.24%), and swimming (22.27%). There was a significant difference (p= 0.003) in Mugger behaviors during the time of day due to environmental variations, as ectotherms. Behavioral patterns also showed significant seasonal differences (p= 0.04). When both seasons and time of the day were considered simultaneously, there was a significant difference (p= 0.01) in all behaviors, as they had changed their behaviors with preferable environmental conditions. The results highlight the shifting of behaviors strongly influenced by seasonal changes and times of the day. These findings provide pivotal insights that guide future management and conservation strategies for crocodiles by highlighting how their behavioral responses are shaped by environmental changes. Such knowledge is important for mitigating human-crocodile conflict and safeguarding the crocodile population under changing environmental conditions.

Luyen, N.T.T., Hoa, L.T., Xuan, P.N.T., Huong, D.T.L., Quan, T.L. and Du, N.H. (2025). The nutritional profile of crocodile (*Crocodylus siamensis*) bones cultivated for leather production in Vietnam. Vietnam Journal of Chemistry.

Abstract: This study was focused on the nutritional composition of crocodile bone, a by-product of crocodile leather production. The proximate composition analysis demonstrated that the nutritional composition of crocodile headbones (BH) and spine bones (BS), as well as bone extract (BE), the water-soluble portion of the crocodile bone, were found respectively, as follows: 20.22%, 23.89%, and 62.8% protein; 13.66%, 15.22%, and 48.00% collagen; 23.47%, 17.15%, and 20.71% carbohydrate; 0.020%, 0.067%, and 0.280% fat; and 24.90%, 27.14%, and 0.95% minerals. Moreover, the profile analysis of amino acids, fatty acids, mono-carbohydrates, vitamins, and minerals in three samples, as above-mentioned, was also performed. The BH and BS contained significantly higher levels of bone-essential minerals, including Ca, P, K, necessary for collagen production, and Mg, which helps enzymes convert vitamins to facilitate calcium absorption. Aspartic acid, which has a specific beneficial effect on bone regeneration, collagen-essential amino acid, including hydroxyproline and glycine, and amino acids beneficial for bone development, such as glutamic acid, proline, and α-alanine were found in high proportions in BH, BS, and BE samples. Vitamin K2, optimizes calcium use in the body, was found in BH, BS, and BE in concentrations of 7.02, 3.42, and 1.06 ppm, respectively. Finally, vitamin D1 and D2, and essential trace elements such as manganese, copper, zinc, iron, and selenium were found in BH and BS samples in parts per million levels. In conclusion, crocodile bone and its extracts are well-suited for incorporation into the development of functional foods aimed at enhancing or maintaining bone health.

Eniang, E.A., Petrozzi, F., Fa, J.E., Luiselli, L. and Eniang, I.E. (2026). Seasonal flooded forests and shifting bushmeat dynamics in West Africa: Opportunistic consumption of snakes and other reptiles in Itu wetlands, Nigeria. Wetlands 46: 33.

Abstract: Seasonally flooded forests in tropical West Africa are highly dynamic ecosystems that sustain biodiversity and rural livelihoods. This study investigates how flood cycles shape bushmeat harvesting strategies in Itu, southern Nigeria, focusing on reptiles - especially snakes - as alternative protein sources during inundation periods. From 2016 to 2024, we conducted standardized surveys across 185 km² of floodplains and river channels, combining direct field observations, community informant reports, and market monitoring. Results indicate a 62% increase in wildlife captures following floods, primarily driven by an 87% rise in snake harvests relative to pre-flood periods. These results were statistically significant using a Generalized Linear Model with a Poisson error distribution and a log-link function. While terrestrial mammals dominate hunting returns in the dry season, flooding reduces access to terrestrial habitats, prompting a dietary shift toward more visible and vulnerable reptiles. The African water snake (*Grayia smithii*) was the most frequently captured species, and dwarf crocodiles (*Osteolaemus tetraspis*) were also regularly taken by local fishers. Cultural perceptions shaped harvesting practices: venomous cobras (*Naja nigricollis* and *Naja melanoleuca*) were generally avoided despite their abundance. Interestingly, also the number of hunted manatees (*Trichechus senegalensis*) increased heavily by wet season. These findings highlight the adaptability of local subsistence strategies to seasonal ecological constraints and socio-economic pressures. With climate change expected to intensify flooding regimes and mammal populations continuing to decline, opportunistic reptile hunting is likely to gain importance as a food source.

Bazie, Y., Basson, B.E. and Ky, J.C. (2026). Dondo-yikôlè et la construction identitaire chez les Sanan de Toa (Burkina Faso). Revue Internationale De La Recherche Scientifique Et De l'Innovation 4(2): 245-265.

Abstract: Dondo-yikɔlɛ est un ensemble de trois mares abritant des crocodiles sacrés. Il est situé à l'intérieur de la ville de Toa (Tougan) au Burkina Faso. Cet article vise à montrer la place du patrimoine culturel Dondo-yikôlè dans la construction de l'identité de la société san de Toa (Tougan), en nous appuyant sur son histoire liée à la fondation du village de Toa, son culte, ses interdits et les rapports de la communauté san avec cet héritage. Dans la conduite de cette étude, nous avons adopté comme méthodologie l'approche qualitative mixte axée non seulement sur l'exploitation des ouvrages, des thèses, des mémoires et des articles, mais aussi sur les enquêtes orales. À travers un questionnaire, les enquêtes ont été menées auprès des riverains et des personnes-ressources. Il ressort de cette étude que Dondo-yikɔlɛ est un héritage culturel qui existe depuis la

fondation du village. Un culte est voué à ces crocodiles sacrés qui sont venus d'un village voisin (Dounkou), témoignant d'une relation étroite entre ce site et les populations. En tant que site hérité des ancêtres fondateurs du village, les descendants s'identifient à lui, d'où le culte qui lui est voué. Ces sites sont en pleine dégradation. Une dégradation due à l'érosion, à l'ensablement et à l'action des riverains, ce qui met en danger la vie des crocodiles qui y vivent. Des mesures méritent d'être entreprises afin de préserver ce patrimoine culturel identitaire des populations.

Translation done by Editor:

Abstract: Dondo-yikɔlɛ is a group of three ponds inhabited by sacred crocodiles. It is located within the town of Toa (Tougan) in Burkina Faso. This article aims to demonstrate the role of the Dondo-yikôlè cultural heritage in shaping the identity of the San society of Toa (Tougan), drawing on its history linked to the founding of the village of Toa, its cult, its taboos, and the relationship of the San community with this heritage. In conducting this study, we adopted a mixed-methods qualitative approach, focusing not only on the analysis of books, theses, dissertations, and articles, but also on oral interviews. Through a questionnaire, interviews were conducted with local residents and key informants. This study reveals that Dondo-yikôlè is a cultural heritage that has existed since the founding of the village. A cult is dedicated to these sacred crocodiles, which came from a neighboring village (Dounkou), testifying to a close relationship between this site and the local people. As a site inherited from the village's founding ancestors, the descendants identify with it, hence the cult devoted to it. These sites are rapidly deteriorating. This degradation is due to erosion, siltation, and the actions of local residents, which endangers the lives of the crocodiles that live there. Measures must be taken to preserve this cultural heritage, so central to the identity of the local population.

Pantelides, A., Upchurch, P., Mannion, P.D., Gravanis, E., Henderson, D.M. and Kyriakidis, P. (2026). ENHYDROSS: A new mechanistic model supports the trans-oceanic dispersal capability of terrestrial vertebrates. Ecology and Evolution.

Abstract: Many terrestrial vertebrates, both extinct and extant, have widespread or even global distributions. Although vicariance (eg through continental fragmentation, sea-level changes) explains some of these patterns, others seemingly require long-distance trans-oceanic dispersal. A key but underexplored factor in this debate is the biological feasibility of such dispersal based on an organism's physiology and biomechanics. We introduce ENHYDROSS, a new mechanistic energetic model that estimates optimal swimming speed and minimum cost of transport for any vertebrate. These allow us to estimate maximum swimming distances and durations. We tested ENHYDROSS on two mammals (elephant, polar bear) and five reptiles, including the Aldabra giant tortoise, saltwater crocodile, ostrich, and two extinct non-avian dinosaurs (*Lambeosaurus* and *Rapetosaurus*). For the extinct dinosaurs, we used a broad range of basal metabolic rates to account for different thermophysiological hypotheses. The model's estimates for extant animals align with observed data, while cases of underestimates can be attributed to the effects of ocean currents, as evidenced by estimated passive drifting distances and times under predominantly mild and intermediate currents. ENHYDROSS generally predicts greater swimming capacity than previously proposed models due to assumptions like thermoneutrality, resulting in lower minimum cost of transport. Applying our model to test the feasibility of extinct dinosaur dispersal between Africa and Europe during the Cretaceous via the Alboran route (the oceanic corridor separating Iberia from Morocco), we found that both hadrosaurs and titanosaurs could plausibly complete the journey, particularly under favorable conditions such as low sea levels, stepping-stone islands, and higher fat reserves. Hadrosaurs showed slightly better swimming efficiency. Dispersal was especially feasible during the early-middle Albian (112.5-107.5 Ma) and latest Cretaceous (72.5-66 Ma), but was unlikely during periods of high sea levels (97.5-77.5 Ma). These results support the possibility of trans-oceanic dinosaur dispersal across distances of up to ~560 km.

Balaguera-Reina, S.A., Brandt, L.A., Daykin, B.R., Briggs-Gonzalez, V.S., Bonilla-Liberato, E.D. and Mazzotti, F.J. (2026). Refinements in the use of the American alligator as indicator of Everglades ecosystem status. Ecological Indicators 185.

Abstract: An important part of large-scale ecological restoration is having long-term monitoring indicators that can be used to document when restoration is successful. Equally important is the ability to communicate those responses to managers and decision makers. Within Everglades (Florida, United States) restoration, the South Florida Ecosystem Restoration Task Force adopted a suite of 11 ecological indicators to be used to communicate to Congress progress towards restoration through a universally understood stoplight reporting system. The American alligator (*Alligator mississippiensis*) is one of the chosen indicators because of its representativeness of the ecosystem, clear responses to hydrological changes, and measurable ecological traits. Since being monitored as indicator, much has been learned both about alligators'' responses to restoration and how to quantify/report on those responses. This manuscript provides an update on both the science used to assess alligator status in the context of Everglades restoration and the use of the stoplight restoration reporting tool to match the new updates. We focused this study on two alligator metrics: abundance and body condition and describe how we have updated/adjusted four aspects of the assessment and reporting: 1) the statistical approach used to estimate abundance and body condition, 2) the quantitative target cutoffs used to indicate restoration and the way they are defined, 3) the decision-rules used for stoplight reporting, and 4) the stoplight scoring based on adjusted targets. New quantitative targets for abundance and body condition were defined as ≥78.9 alligators/km^2 and ≥10% increase in the median allometric elevation estimated in the reference period per management unit. The methodological advances presented in this manuscript will provide researchers with a better understanding of the variation of abundance and body condition metrics due to hydrological change derived from restoration. It will also help managers to comprehensively track progress towards restoration with a more direct translation between alligator population estimations and the stoplight communication tool.

Roth II, T.C., Krochmal, A.R. and Powers, A.S. (2026). Evolution of reptilian brains and cognition Pp. 245-265 *in* Evolution of Nervous Systems, Third Edition, ed. by J.H. Kaas and S. Herculano-Houzel. Elsevier.

Abstract: Years of conceptual bias have resulted in the assumption of simplicity of the reptile brain and, by extension, the behavioral and cognitive abilities of reptiles. This oversimplified view, combined with the paucity of experimental assays designed with the reptilian umwelt in mind, has led many to accept that reptiles are behaviorally simple organisms, incapable of anything but stereotyped behaviors and basic learning. However, as reptiles are now being subject to experimental scrutiny in their own context, and in light of a modern understanding of the evolution of the brain, it appears that reptiles may possess the capacity to use a suite of intricate, advanced cognitive processes. Indeed, many of the neurological processes that support higher-order cognitive abilities in birds and mammals are also utilized in the reptilian taxa to support and control identical or at least similar behavior and are often commonplace and highly conserved across vertebrate taxa as a whole. Thus, combining reptile-specific behavioral approaches with concurrent investigations of anatomical, biochemical, or cellular components of cognition is central to understanding the presence and complexity of, and mechanisms behind, complex cognition in reptiles. This approach not only allows a more accurate understanding of the cognitive abilities of reptiles but is also important for an evolutionary perspective on the origins and maintenance of complex cognition within

vertebrates. Given the location of reptiles within the evolutionary history of vertebrates, evaluating the cognitive abilities of reptiles, and particularly, in comparison to those of other vertebrates, stands to provide both insight into the evolution of cognition and context for future comparative studies of complex cognition.

VKM, Hermansen, J.S., Eldegard, K., Grainger, M., Kopatz, A., Mauvisseau, Q., Rueness, E.K. and Star, B. (2026). Non-detriment finding for Cuban crocodiles (*Crocodylus rhombifer*). VKM Bulletin 2026:07. Norwegian Scientific Committee for Food and Environment: Oslo, Norway.

Finger, Jr., J.W., Hamilton, M.T., Ka, C., Elsey, R., Kelley, M. and Mendonca, M. (2026). Temporal stability in American alligator (*Alligator mississippiensis*) white blood cells following capture and handling stress. Canadian Journal of Zoology.

Abstract: Determining the physiological effects of stressors on organisms is essential to understand how human activities may impact environmental health. American alligators (*Alligator mississippiensis*, Daudin, 1802) are long-lived, top trophic carnivores inhabiting aquatic environments in the southeastern USA. Because of this, they may serve as important indicators of environmental health. Capture or trapping of crocodilians, including alligators, may be a dangerous and arduous task both for those capturing the crocodilian and the crocodilian itself, possibly affecting the parameters used to evaluate stress/health in an individual. To better characterize how capture and trapping of crocodilians affect physiological parameters, we investigated the effect of capture on white blood cell counts at four distinct time points. The majority of WBC counts, except for basophils, were unaffected ($p>0.05$) by capture stress for up to 2 hours following initial capture. These results provide further support that crocodilian WBCs are temporally stable parameters that are useful for investigating exposure to long-term stressors.

White, D. and Fukuda, Y. (2026). Post-hatching parental care by a wild male *Crocodylus porosus* Schneider, 1801 in Australia. Herpetology Notes 19: 161-164.

Correction on: by Castelli, L., García-Amado, M.A., Rudolf, C. A., Contreras, M., Espinosa-Blanco, A.S. and Godoy-Vitorino, F. (2025). Microbial diversity in the critically endangered Orinoco crocodile (*Crocodylus intermedius*): influence of body site and *Helicobacter* spp. on microbiota composition. Frontiers in Microbiology.

An incorrect Funding statement was provided. The funder National Institutes of Health, NIGMS # PR-INBRE P20GM103475-22 and PR-CMS 1P20GM156713-01, to Filipa Godoy Vitorino was erroneously included.

The correct statement is:

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The original version of this article has been updated.

Lacerda, G.M.C., do Carmo, G.M., Ailán-Choke, L.G., Paiva, F., Tavares, L.E.R., de Araújo-Filho, J.A., Ribeiro, L.C. and Pereira, F.B. (2026). Further description and first genetic characterization of *Oswaldofilaria bacillaris* (Nematoda: Onchocercidae) infecting the Pantanal caiman (*Caiman yacare*), with insights into the phylogeny of *Oswaldofilaria*. Acta Parasitologica 71(2).

Abstract: *Oswaldofilaria bacillaris* is the type species of the genus, but its morphology remains little known and partially contradictory. Moreover, there are no genetic data and scanning electron microscopical observations on the species, like in most *Oswaldofilaria* spp. The phylogenetic relationships among *Oswaldofilaria* spp. are practically unknown. This study aimed to evaluate the detailed morphology of *O. bacillaris*, provide its first genetic characterization, and discuss the phylogenetic relationships within *Oswaldofilaria*. Parasites infecting the body cavity of *Caiman yacare* in Pantanal wetlands, Mato Grosso do Sul, Brazil, were collected and processed for morphological studies using light and scanning electron microscopy. Genetic characterization was based on partial sequences of 18S and 28S rDNA. A phylogeny was reconstructed based on 28S sequences including all *Oswaldofilaria* available. Nematodes were assigned to *O. bacillaris* mainly based on the oral opening markedly displaced ventrally. Males had seven pairs of caudal papillae encircling the cloaca, and their two most posterior pairs were hardly visible, which is also characteristic in other congeners. Moreover, a delicate area rugosa previously unreported in the species was observed. *Oswaldofilaria bacillaris* formed a monophyletic assemblage with the congeners, being sister to *O. chabaudi*, and *O. petersi* was basal, these last two parasites of lizards. The present findings strengthened the specific diagnosis of *O. bacillaris* and elucidated the morphological contradictions. The phylogeny reinforced the hypotheses that *Oswaldofilaria* emerged in lizards and colonized crocodilians by host switch, and reduction in number of caudal papillae in males is a derived feature.

Burke, P.M.J. (2026). The Internal Cranial Anatomy of Gavialoidea and Implications for Crocodylian Evolutionary History. PhD thesis, University College London, UK.

Abstract: Crown group Crocodylia comprises ~ 28 extant species of alligators, caimans, crocodiles, and gharials. Gharials are represented by two extant species, *Gavialis gangeticus* and *Tomistoma schlegelii*, characterised by their longirostrine skull forms and restricted to freshwater environments in Asia. Conversely, their fossil record displays a cosmopolitan distribution, with sister taxa separated by oceanic barriers. With greater taxon sampling and a revised approach to character formulation and scoring, the topologies recovered in recent morphological phylogenetic analyses align with molecular analyses, with *Gavialis* and *Tomistoma* more closely related to one another than to any other extant crocodylian. Nevertheless, a temporal incongruence remains, wherein several stratigraphically early fossil species are recovered within crown-group Gavialoidea. One feature neglected from phylogenetic analyses and considerations of its biogeographic reconstructions pertains to the internal cranial anatomy. Using computed tomography, the internal anatomy of 42 crocodylians, including 19 gavialoids, was reconstructed with 53 new morphological characters formulated and incorporated into a phylogenetic analysis under Maximum Parsimony; however, the temporal incongruence remains. Using Bayesian inference, the total character matrix (384 characters) was subsequently partitioned into; internal cranial anatomy; external cranial anatomy and postcranial characters. Results show that the internal cranial anatomy evolves over 0.3 times faster than the external cranial and postcranial traits, with the rates of the internal cranial anatomy traits showing stasis in Gavialoidea, implying gavialoids were not resilient to extinction, and accelerating selection in Alligatoroidea and Crocodyloidea, which corroborates their diversification from the Paleogene, comparative to Gavialoidea. Additionally, the evaluation of the internal cranial anatomy also reveals a plethora of variation in morphology, such as concave depressions on the internal surface of the prefrontals in many extinct gavialoids. These results highlight the importance of the evaluation of internal anatomy, with new insights on the evolutionary history of Crocodylia.

Yuen, N.K.Y. (2026). Mosquito-borne viral infections: veterinary diagnostic approach with a One Health perspective. Journal of Clinical Microbiology.

Abstract: The diagnosis of mosquito-borne viral infectious diseases can be challenging, in part due to the complexity of antibody cross-reactivity between many of these viruses. This is further complicated by the unpredictable nature of climatic variability affecting disease transmission, exotic virus incursion, and the potential emergence of new strains of viruses with increased virulence. A thorough understanding of virus biology, locally relevant transmission patterns, and principles of diagnostic tests is required for the investigation of suspected clinical cases. This review provides guidance for veterinarians, researchers, and policy-makers on the diagnosis and management of alphavirus and orthoflavivirus infections in animals with a One Health perspective, including interpretation of laboratory results. Biosecurity and biosafety considerations and the zoonotic potential of mosquito-borne infections are also discussed.

Dyt, K. (2026). Crocodiles, dragons, and species fluidity in Vietnam. Pp. 71-96 *in* Water Powers: Sacred Aquatic Animals of the Asia-Pacific, ed. by A.P. Rots, F. Durney, L. DeWitt Prat and S. Åman. University of Hawai'i Press: USA.

Johnson, A.A. (2026). The snake, the crocodile, and the king: Nautical technology and supernatural potencies in Angkor. Pp. 97-120 *in* Water Powers: Sacred Aquatic Animals of the Asia-Pacific, ed. by A.P. Rots, F. Durney, L. DeWitt Prat and S. Åman. University of Hawai'i Press: USA.

Darmanto and Persoon, G. (2026). Crocodiles are watching: Spirits, social order, and ecological transformation on Siberut Island, Indonesia. Pp. 254-278 *in* Water Powers: Sacred Aquatic Animals of the Asia-Pacific, ed. by A.P. Rots, F. Durney, L. DeWitt Prat and S. Åman. University of Hawai'i Press: USA.

Izidio, M.E., de Araújo, E.V., Haase, M.V., Sayão, J.M. and Oliveira, G.R. (2026). Dental histology of *Guarinisuchus munizi* (Crocodylomorpha, Dyrosauridae). Historical Biology.

Abstract: *Guarinisuchus munizi*, a Paleocene dyrosaurid crocodyliform from the Maria Farinha Formation (Paraíba Basin, Brazil), survived the Cretaceous-Palaeogene mass extinction. While macromorphology suggests piscivory, its dietary flexibility remains unclear. This study presents the first histological analysis of *G. munizi* dentition, examining 11 teeth from multiple available specimens (10 isolated, one from jaw fragment) using standard thin-section techniques. Enamel thickness ranges from 0.05-0.13 mm, with thinner enamel (~0.05 mm) indicating soft-tissue piercing and thicker enamel (~0.13 mm) suggesting dietary versatility including hard-shelled prey. Hunter-Schreger bands (HSB) in enamel enhance fracture resistance under polarised light. Dentine deposition rates (von Ebner Incremental Width, VEIW: 3-42 μm) show high variability, exceeding uniformity in most crocodyliforms and likely reflecting environmental sensitivity to seasonal water temperature and resource fluctuations in the Paraíba Basin. This metabolic flexibility underscores Dyrosauridae's post-K-Pg adaptive capacity. Combined enamel microstructure and growth-line variation suggest functional differentiation and individual diversity. Our findings demonstrate dental histology's value for reconstructing extinct crocodyliform palaeoecology, establishing a foundation for dyrosaurid research.

Prestes, A. and Torralvo, K. (2026). Opportunistic predation of the golden tegu lizard (*Tupinambis teguixin*) by the rufescent tiger-heron (*Tigrisoma lineatum*) near the black caiman (*Melanosuchus niger*) nest. Ornithology Research 34: Article 17.

Abstract: The record of unusual prey in opportunistic predation events can reveal the dietary flexibility of some aquatic bird species and contribute to the identification of potential prey present in the environment. This study presents the first recorded predation of a golden tegu lizard (*Tupinambis teguixin*) by the rufescent tiger-heron (*Tigrisoma lineatu*m). The event occurred near a black caiman (*Melanosuchus niger*) nest that was being monitored by camera traps, allowing for a complete photographic record of the predation. The predation lasted approximately eight minutes and may have been influenced by the lizard's exposure, as it was unable to access the black caiman nest, which was protected by a wire mesh installed to prevent predation during the nest monitoring period at the Mamirauá Sustainable Development Reserve, Amazonas, Brazil. The golden tegu lizard (*T. teguixin*) is one of the main predators of black caiman (*M. niger*) eggs, responsible for up to 46% of egg predation in this species' nests in várzea environments in Central Amazonia. Although predation of lizards by the rufescent tiger heron is uncommon, this interaction may occur more frequently than previously thought in Central Amazonia. This record expands knowledge on the trophic ecology of the rufescent tiger-heron and adds a new predator to the golden tegu, one of the main consumers of black caiman eggs in the Amazon.

Miranda, G., Ríos, N. and Hubert, N. (2026). New mitogenomic resources for the *Caiman yacare* (Daudin, 1802) from Bolivia. Ecology and Evolution 16: e73336.

Abstract: This study addresses the evolutionary state of a newly discovered population of *Caiman yacare* outside the western edge of its range in Bolivia by providing new mitochondrial genomic resources. Despite their conservation importance, few complete mitochondrial genomes have been generated for South American crocodilians, and most of those available originate from captive individuals, thereby limiting their utility for conservation and taxonomic applications. To bridge this gap, we generated complete mitochondrial genomes for six wild individuals from this newly discovered population in Bolivia. These data complement previously available sequences and provide essential resources for conservation and forensic applications. Mitogenomes were assembled and annotated using MEGAHIT and MitoZ. Species delimitation analyses using five independent methods revealed seven mitochondrial lineages (MOTUs) within the genus *Caiman*, while *C. yacare* itself formed a single MOTU with two phylogroups of distinct geographic distributions. All six new genomes clustered within the Madeira phylogroup. Phylogenetic and coalescent analyses suggest that this newly documented population retains high haplotypic diversity despite being located at the margin of the species range distribution. This study provides the first mitogenomes of wild *C. yacare* and contributes valuable data for understanding population structure, lineage divergence, and for informing management strategies.

Córdoba-Tovar, L., Marrugo-Negrete, J. and Díez, S. (2026). First evidence of arsenic and mercury bioaccumulation and associated genotoxic effects in *Caiman crocodilus* in a mining-affected river in the Colombian Pacific. Science of the Total Environment 1029.

Abstract: As a keystone species in tropical freshwater ecosystems, *Caiman crocodilus* (Linnaeus, 1758) serves as a valuable bioindicator for assessing genetic damage in polluted environments. This study examined mercury (Hg) and arsenic (As) bioaccumulation in caudal scutes and blood across various age groups, alongside the evaluation of genotoxic effects using the micronucleus (MN) assay. Among adults, subadults and juveniles (n= 16), Hg concentrations in the scutes ranged from 41.8 to 535 µg/kg with a median of 145.0 µg/kg, while in blood they ranged from 32.5 to 472.9 µg/L and a median of 131.7 µg/L. The median concentrations of As in blood were 1.0 µg/L, whereas in scutes they were below the limit of quantification (LOQ) established in the analytical methods. Females exhibited slightly higher Hg levels in both scutes (162.0 µg/kg) and blood (131.7 µg/L) compared to males (scutes: 145.0 µg/kg; blood: 118.4

µg/L), although these differences were not statistically significant (p>0.05). Subadult individuals had significantly higher blood Hg concentrations than juveniles (U= 9; p= 0.03; n= 9). Neonates (n= 6), the median Hg concentrations were 303.1 µg/kg and 109.6 µg/L in scutes and blood, respectively. The MN assay revealed evidence of genotoxic damage. Although the mean MN frequency in large individuals (excluding neonates) was low (0.3), nuclear buds (NB, 9.8) and binucleated cells (BC, 1.4) were more prominent. A negative trend was observed between Hg concentrations and the frequency of MN, NB, and BC, whereas As showed a positive correlation with BC (r= 0.38, p= 0.28). Additionally, 37.5% of the individuals exhibited poor body condition (Elsey condition factor <1). These findings support the potential of *C. crocodilus* as an effective sentinel species for assessing genotoxic effects linked to environmental pollution. Moreover, this study contributes valuable data to pollution monitoring efforts in the Colombian Pacific region, which have largely focused on toxic metal(loid) analysis in fish to date.

Ulloa-Guaiquin, K., Belen von Baczko, M., Desojo, J.B. and Paulina-Carabajal, A. (2026). Complex rostral neurovascular anatomy of *Riojasuchus tenuisceps* (Archosauria: Pseudosuchia) and implications for trophic hypotheses in ornithosuchids. The Anatomical Record.

Abstract: Ornithosuchids are distinctive pseudochian archosaurs from the Late Triassic whose feeding habits remain debated. Previous paleoneurological and histological studies provided limited information about their paleobiology. To address this, we analyzed the craniofacial neurovascular anatomy of *Riojasuchus tenuisceps* to infer its functional and ecological implications and to reassess hypotheses about ornithosuchid feeding behavior. The holotype and a referred specimen were studied. The snout of PVL 3828 was analyzed using micro-computed tomography, enabling digital reconstruction of the rostral neurovascular system. We applied a quantitative framework, including ordinary least squares regressions and principal component analysis, to compare neurovascular patterns across Triassic pseudosuchians (eg Erpetosuchidae, Gracilisuchidae, and Loricata). The premaxilla exhibits a complex internal anatomy, with neurovascular canals connecting to external foramina. Our results reveal a foramen density significantly higher than the group's baseline, a configuration that differs from other pseudosuchians and resembles the mechanosensory systems of extant crocodilians and some birds. These findings indicate that *R. tenuisceps* may have used its snout for tactile prey detection, protection from mechanical forces during feeding, or to maintain a high vascular supply. Combined with biomechanical and osteological data, this supports a wading-foraging behavior rather than scavenging or active terrestrial hunting, highlighting a sophisticated resource partitioning and an underestimated ecological diversity among Triassic pseudosuchians.

Arimoro, F.O., Dore, M.P. and Ikomi, R.B. (2026). Demographic skew and market dynamics reveal unsustainable trade and conservation risks of the West African Dwarf Crocodile.

Abstract: The West African dwarf crocodile (*Osteolaemus tetraspis*), classified as Vulnerable by the IUCN and listed under CITES Appendix I, is increasingly threatened by unregulated trade and habitat degradation. This study investigated the trade dynamics of the species across Delta and Edo States, Nigeria, focusing on market structure, trade routes, seasonal trends, and size-class composition. Market surveys, semi-structured interviews, and ecological observations were employed to examine trade dynamics of the West African dwarf crocodile from 2019 to 2021 identified nine key markets, with Ugbenu emerging as the primary hub, recording 1818 individuals over 105 market days. Trade was dominated by mid-sized, sexually mature crocodiles (101-120 cm), while juveniles (0-20 cm and 21-40 cm) were scarcely represented, suggesting depletion of older cohorts. The trade is economically motivated and gendered, with middlewomen controlling over 80% of market flow, sourcing from remote riverine communities. Hunting methods included wire traps, baited hooks, and burrow excavation, raise ecological and welfare concerns. Findings highlight unsustainable exploitation and underscore the need for urgent conservation measures, including legal enforcement, harvest regulations, and community-based monitoring aligned with CITES and IUCN guidelines.

Gour, R. and Whitaker, N. (2026). Multiscale habitat modeling to improve spatial prioritization for mugger crocodile conservation in riverine landscapes. Ecological Applications.

Abstract: Assessing the species distribution and their detectability is crucial, holding wide-ranging implications for effective conservation planning and management initiatives. Although species-habitat relationships are inherently scale-dependent, few studies apply robust multivariate approaches to optimize spatial scale selection. We developed a scale-optimized habitat suitability model for the Mugger crocodile (*Crocodylus palustris*) using binomial generalized linear models, evaluating each predictor across multiple spatial scales within the Cauvery River Basin (CRB) in southern India. Model selection based on the lowest Akaike information criterion scores identified the multiscale modeling as the best performing approach. Most predictors showed the strongest associations at finer (500 m) to moderate (1000-2000 m) scales, while a subset of topographic and hydrological variables was retained at broader scales (8000 m), showing the importance of incorporating scale heterogeneity in riverine species modeling. Key variables influencing the potential distribution of Muggers across the CRB include isothermality, radius of gyration area-weighted mean of wetland, distance to roads, and terrain wetness, indicating Mugger prefer stable temperature, low disturbance, and localized patches but well-distributed wetland habitats. The multiscale model estimated 2209.5 km^2 of potentially suitable habitat across the CRB of which only 38.12% lies within the existing protected area network. Integrating the best performing model into a systematic conservation planning framework that maximizes species target while minimizing human impacts, the solution identified 990 km^2 of priority regions, including five high-priority areas with a total area of 540 km^2, outside the current protected network. The study offers a robust and resource-efficient approach to habitat delineation and conservation prioritization, improving the performance of suitability modeling across spatially varying environmental factors.

Hernández, C.M., Stott, I., Koons, D.N. and Salguero-Gómez, R. (2026). Density dependence impacts our understanding of population resilience. American Naturalist 207(5).

Abstract: Current metrics of demographic resilience (eg resistance, recovery) summarize how populations respond to the frequent, varied disturbances that ecological systems experience. Much of the application of these metrics has focused on the potential response of populations represented by time-invariant, density-independent structured population models to hypothetical disturbances. Here, we show that density dependence has profound and complex impacts on our understanding of resilience. We examine resilience measures in a flexible structured model with five vital rate parameters (juvenile survival, adult survival, juvenile progression, adult retrogression, and adult reproductive output) with density dependence operating on one vital rate at a time. Depending on which vital rate was subject to density effects, existing measures of demographic resilience (compensation, resistance, and recovery time) either increased or decreased with population density. Moreover, the density-independent model under-predicted the recovery time of the corresponding density-dependent model, with a greater offset for species with longer generation times and higher iteroparity. Our findings demonstrate the importance of underlying nonlinear processes when examining demographic resilience, particularly if we hope to predict how natural populations will respond to real disturbances.

Luo, H., Shen, Z., Jian, Y., Wang, M., Luo, S., Wang, J., Nan, L., Tang, L.I., Rehman, M.U. and Carbonero, F. (2026). Editorial: Unravelling the wildlife gut microbiome: The crucial role of gut microbiomes in wildlife conservation strategies. Frontiers in Microbiology.

Abstract: The aim of the Frontiers in Microbiology Research Topic "Unravelling the Wildlife Gut Microbiome: The Crucial Role of Gut Microbiomes in Wildlife Conservation Strategies" was to collate state-of-the-art articles in the field related to the dynamic interactions within wildlife gut microbiomes to expand scientific understanding by integrating microbiome research with wildlife conservation efforts to devise and refine strategies, and to enhance survival and ecosystem health. This Research Topic in Frontiers in Microbiology, titled "Unravelling the Wildlife Gut Microbiome: The Crucial Role of Gut Microbiomes in Wildlife Conservation Strategies", aimed to bring together state-of-the-art articles on dynamic interactions within wildlife gut microbiomes. By integrating microbiome research with conservation efforts, the aim was to expand scientific understanding, develop and refine conservation strategies, and ultimately improve wildlife survival and ecosystem health. The 23 original articles and 2 summary articles gathered in this Research Topic have expanded our knowledge of the role of the wildlife microbiome.Many external factors, including seasonal shifts, dietary changes, social density, and environmental pollutants, drive dynamic changes in the gut microbial communities of wildlife. Schweikhard *et al*. (2025) observed that variations in the seasonal diet of captive Coquerel's sifakas lead to alterations in the makeup of their fecal microbial populations, with notable differences between summer and winter samples. Although these compositional changes occurred, the general diversity of the intestinal microbiota stayed consistent when frozen foliage was supplied during the winter months. These findings indicate that dietary management can support the preservation of a stable microbial community framework, even when seasonal dietary modifications are required. Liu *et al*. (2025) reported coordinated seasonal shifts in both bacterial and fungal communities of wild Francois' langurs, with mucin-degrading *Akkermansia* dominating in summer and plant biomass-degrading *Cercophora* enriched in winter, highlighting complementary microbial strategies for seasonal dietary adaptation. Botsidou *et al*. revealed that skin, but not gut, microbial communities in Antarctic fur seals were sensitive to social density, with high-density colonies exhibiting lower skin microbial diversity and enrichment of pathogenic phyla, indicating that host-microbe interactions vary by body site and environmental exposure. Jiang *et al*. (2025) reported that the web-footed shrew maintains a stable, specialized diet of benthic macroinvertebrates and fish, with a gut microbiota dominated by Proteobacteria and enriched in genes related to fatty acid metabolism, illustrating how diet-microbiome coevolution facilitates semi-aquatic niche adaptation. New microbiome insights can directly promote conservation practice and the development of non-invasive tools for population management. Zhai *et al*. (2025) demonstrated that a 20-day pre-release environmental acclimation protocol in Kaluga sturgeon optimizes digestive enzyme activity, immune function, and gut microbiota stability, providing a concrete framework to enhance post-stocking survival in hatchery-reared fish. Forehand *et al*. (2025) showed that while captivity alters the gut microbiome of head-started lizards, the microbiome rapidly converges to a wild-type state within two months post-release, suggesting that captive-induced microbial changes are transient and do not pose a long-term barrier to reintroduction success. The study on Amur tigers by Hu *et al*. (2025) introduced a novel non-invasive method that integrates age-associated gut microbial biomarkers with microsatellite-based kinship analysis to construct accurate family pedigrees. Their results demonstrate that this method could be used to the utility of microbiomics for informing conservation genetics and population management. The dietary specialization, developmental transitions, and adaptation to extreme environments are important for exploring the co-evolutionary dynamics between hosts and their microbiomes. 2025) employed a dual-omics strategy, merging 16S rRNA gene sequencing with untargeted metabolomic profiling, to conduct a comprehensive comparative analysis of the gut microbial communities and metabolic landscapes across two distinct pangolin species. This approach underscores the utility of integrating taxonomic microbial composition with functional metabolic insights to enhance species-tailored health evaluations. The intricate connections between gut microbiota and various disease conditions, ranging from infectious diseases to oxidative stress-related disorders, are vital to explore microbiome-targeted interventions for health management. Zhang *et al*. (2025) consolidated existing research on gut microbial imbalance as a pivotal factor in animal diarrhea, elucidating the processes through which advantageous microorganisms preserve intestinal balance and assessing microbiota-focused treatments as alternatives to antibiotics. Karamendin *et al*. (2025) uncovered that fatal H5N1 avian influenza in swans correlates with significant microbial disruption marked by a predominant presence of *Campylobacter* and *Fusobacterium*, indicating a widespread disturbance in the host-microbe balance that could exacerbate disease outcomes. Wang *et al*. (2025) established that *Bacillus subtilis* from yaks mitigates oxidative stress and liver damage induced by D-galactose in mice by adjusting the gut microbiota, enhancing microbial diversity, and triggering the Keap1/Nrf2 antioxidant mechanism, emphasizing the curative value of probiotics adapted to specific hosts. Qin *et al*. (2026) discovered a connection between microplastic ingestion, gut microbial disturbance, and diminished antioxidant function in broiler chickens, exposing a new route through which environmental contaminants affect host well-being by altering the microbiome. Research on Orinoco crocodiles by Castelli *et al*. (2025) indicated that *Helicobacter* spp. colonization is linked to decreased bacterial diversity and changes in community makeup, such as an increase in possible pathogens, highlighting how particular bacterial colonization influences microbial ecosystem dynamics and health in a highly threatened reptile species. Overall, the articles in the present Research Topic collectively emphasize the importance of gut microbiota in promoting intestinal inflammation and maintaining host health benefits in wildlife. These studies shed light on novel therapeutic strategies for various health conditions, including animal diarrhea, gut microbial dysbiosis, oxidative stress, and liver injury. The findings underscore the significance of understanding the intricate relationships between these microbial communities and their animal hosts for developing innovative and effective therapeutic interventions in wildlife. Recent research has focused on these interactions, revealing notable differences in the composition and functional roles of microbiomes among various species and habitats. However, there are still obstacles in our understanding of their broader ecological effects and their potential applications in conservation efforts. This strategy effectively addresses the escalating issue of antibiotic resistance and facilitates the advancement of personalized medical treatments. However, identifying the specific alternatives to antibiotics responsible for the observed effects presents a considerable challenge. Taken together, the present Research Topic highlights the dynamic interactions of wildlife gut microbiomes with their environment and conservation contexts. It also introduces novel concepts for additional studies in this area, offering practical management approaches to improve wildlife conservation. Further investigation is needed to broaden scientific knowledge by combining microbiome studies with conservation initiatives, enabling the development and improvement of strategies that boost survival rates and ecosystem health.

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