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FRONT COVER: Adult female Parson's Chameleon *Calumma parsonii* (photo: Chester Zoo, UK).

INSIDE FRONT COVER: A bucolic scene of wheatfields and Amersham Old Town, England, UK (photo: Chris Gleed-Owen).

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The status and conservation of the smooth snake in England

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Introduction

The smooth snake *Coronella austriaca* is the rarest and most geographically restricted of Britain's three native species of snake, the others being the adder *Vipera berus* and the grass snake *Natrix helvetica*. The species is widely distributed throughout much of Europe and western Asia but, in Britain, is restricted to a limited range in southern England.

Since the late 1970s there has been a considerable body of research within the UK (e.g. Spellerberg & Phelps, 1977; Goddard, 1984; Pernetta, 2009; Reading, 2012) and elsewhere, that has provided a good understanding of the species' ecology and behaviour. The species is non-venomous, feeding on predominantly reptile and small mammal prey. Smooth snakes are ovoviviparous, typically having a maximum of 15 young. Smooth snakes occur at low population densities and maintain small home ranges. As an ectotherm, its range and habitat use is strongly influenced by the need for an environment that allows effective thermoregulation.

This paper outlines the content of a talk given in October 2025. At the time of writing, there are a number of analyses due to be published that will update information regarding the status of the smooth snake in England. It is our intention to provide an updated and referenced publication once these are available. To that end, this paper will not attempt to provide up-to-date data or details of the outcomes of the approaches that are being described.

Global and European distribution and status

Smooth snakes are widely distributed across the western Palearctic, ranging from northern

Figure 1. Smooth snake *Coronella austriaca* (photo: Howard Inns, ARC).

Spain and Portugal eastwards towards Kazakhstan and northern Iran, and from the UK to southern Scandinavia and southwards to the Mediterranean coast including Greece and Italy. The species inhabits a wide range of dry, well-drained environments, including rocky slopes, woodland clearings, heaths, meadows, sandy quarries and mountainous terrain.

Globally (Crnobrnja-Isailović et al., 2017) and at a European level (Bowles et al., 2025), Red List assessments for *C. austriaca* have listed the species as being of Least Concern, this being due to the wide distribution of the species and lack of evidence of rapid, large-scale declines. However, the global assessment does indicate that the species is in decline in parts of its range.

Reports for the European Union (with the most recent publicly available report covering the period 2012–2018) provide assessments for smooth snake status for 22 different member states, across eight biogeographic regions, yielding 48 separate assessments. Of these eight (17%) were Favourable, 28 (58%) Unfavourable-inadequate, four (8%) Unfavourable-bad and eight (17%) were Unknown. When collated at the regional level, only two biogeographic regions achieved Favourable status. This demonstrates that although extinction risk at a continental scale is considered low, the species is experiencing difficulties in many parts of Europe.

Distribution and status in Britain

In Britain, the smooth snake is confined to heathland habitats in southern England with the species currently found in the counties of Dorset, Hampshire and Surrey, with reintroduced populations in West Sussex and Devon. Historically the species also occurred in Berkshire and Wiltshire.

Estimating national population size has proven difficult due to the species' secretive behaviour and patchy distribution, with estimates ranging from 1,000–3,000 to 'between 26,656 and

Figure 2. Heathland in southern England (photo: Paul Edgar, ARC).

53,312' (Goddard, 1984; Braithwaite et al., 1989). These values are all open to challenge, and range-based metrics offer a more reliable framework for assessing status. The Extent of Occurrence (EOO) in England has been estimated at approximately 4,206 km² and covers 32 ten-kilometre squares (JNCC, 2019). The Area of Occupancy (AOO), based on occupied one-kilometre squares, was approximately 395 km².

Applying IUCN Red List criteria at the national level (Foster et al., 2021) identified the smooth snake as being Endangered in England and Great Britain. This is based on its small AOO, limited EOO and severe fragmentation and continuing decline in habitat quality. It is considered that the species has shown a significant historical decline with heathland declining by over 80% since 1800.

Conservation assessment and progress towards species recovery

In 2017, ARC undertook a rapid condition assessment of 130 extant sites based on expert judgement to evaluate habitat extent, quality and management pressures. While this exercise was primarily designed to help target conservation action, the results showed that nationally only 14% of sites were considered in good condition, while 68% were moderate and 18% were poor.

Other approaches for assessing conservation status, include the use of the Species Recovery Curve (Natural England, 2025). Through this, the smooth snake is considered to be at Stage 6, defined as "Recovery solutions trialled", indicating that while key conservation actions are known and have been tested, they have not yet been implemented at sufficient scale to secure long-term recovery.

Work has been undertaken to define the Favourable Reference Values for smooth snake in England through the Article 17 reporting process and by ARC and Natural England. Based on these, assessments of the range, populations and habitats are Unfavourable. Values from the most recent national status assessment are not publicly available at the time of writing, however the published report (Natural England, 2026) concluded that "the overall conservation status of smooth snake is Unfavourable-inadequate, but the trend shows the species improving".

Threats, pressures and conservation responses

Historically in England the main threats to the species were habitat loss and fragmentation resulting from housing development, road construction, post-war agricultural intensification and forestry planting; collectively these led to a significant loss of heathland. Collecting for the pet trade and persecution may also have contributed locally.

Figure 3. Population density of *Coronella austriaca* indicated by number of 1 km squares containing verified records per 10 km square between 2014 and 2023. Darker shading indicates more 1 km squares with records (source: ARC).

Today, much of the habitat occupied by smooth snakes is within designated protected areas, and the species has been legally protected in Britain since 1975. While this has reduced many of the historic pressures, threats persist. Habitat fragmentation remains a fundamental issue, with small and isolated populations being intrinsically more vulnerable to chance extinctions or pressures caused by public access or domestic cats.

Heathland succession remains an ongoing issue. Without active management, pine and birch encroachment, bracken and invasive species such as rhododendron can shade out ground-level vegetation and impact on a reptile's ability to thermoregulate. A key feature of conservation work for smooth snakes is therefore the management of trees and scrub to maintain, expand and to link areas of suitable, open habitat.

Conversely, over-management can be equally harmful. Grazing, pig rooting, cutting or burning, or mechanical methods such as cutting and rolling, can remove essential vegetation structure and even cause direct mortality. It is important to manage the scale and intensity of such management, and to monitor their impacts, to avoid detrimental effects on smooth snake populations.

Wildfire represents one of the most serious current threats to smooth snakes causing both direct mortality and long-term damage to habitat suitability. Conservation management seeks to manage fire risks through putting in place firebreaks and through effective liaison with the Fire Service.

Conservation work for this species has occurred since the 1960s, involving a range of voluntary, statutory and professional organisations. Reintroduction programmes have formed an important part of the conservation strategy. The species has been reintroduced successfully to 13 sites in Surrey, West Sussex and Devon, restoring it to parts of its former range.

The Snakes in the Heather (SiTH) project (2019–2024), led by ARC with significant funding from the National Lottery Heritage Fund, was designed to raise public awareness about conservation, promote community relationships, engage volunteers and develop guidance and technical support for conserving reptile species. The focus was on heathlands and specifically on smooth snake conservation.

Longer-term there are significant uncertainties around the effects of a changing climate – both on the ecology and behaviour of smooth snakes and on their habitats and prey - and from emerging disease threats e.g. snake fungal disease, caused by *Ophidiomyces ophiodiicola*.

Monitoring, modelling and future directions

Improving species monitoring to provide a better understanding of status, trends and conservation needs will be key to future conservation. Approaches for standardising survey effort have been suggested, e.g. through ARC's National Reptile Survey. In addition, further species recording effort is needed to explore the wider distribution and occurrence of the species away from fixed survey transects.

Habitat condition, considering both extent and quality, is a key parameter for assessing status and guiding conservation management. Species distribution modelling (SDM) is increasingly used to predict habitat suitability and guide management. This has been trialled for smooth snakes through the SiTH project (Ward, 2024).

Remote sensing technologies, including satellite imagery, drones and LIDAR, provide powerful tools for assessing topography and vegetation structure at scale, and should be further developed. A LIDAR analysis in the New Forest suggests that only around 25% of heathland there offers suitable structural conditions for smooth snakes (Gent et al., 2024).

Conclusion

The smooth snake is considered Endangered in England, but the causes of its decline are known and the actions needed for its conservation understood. Co-ordinated action at scale, supported by improved monitoring and surveillance, are feasible and would provide the opportunity to secure this species into the future.

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Rescuing and recovering a Darwin's frog stronghold

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Darwin's frogs (*Rhinoderma rufum* and *R. darwinii*) are unique amphibians due to their remarkable form of parental care, in which males brood and rear tadpoles within their vocal sac. The southern Darwin's frog (*R. darwinii*) (Fig. 1) occurs in both Chile and Argentina, whereas the northern Darwin's frog, or "sapito vaquero" (*R. rufum*), historically had a distribution restricted to Chile's Coastal Range (Soto-Azat et al., 2013). The latter species, however, has not been observed since 1981 and is currently classified as Critically Endangered (Possibly Extinct), while *R. darwinii* is listed as Endangered (IUCN SSC ASG, 2018). Both species face major threats, including habitat loss and degradation, chytridiomycosis (*Bd*) and climate change (IUCN SSC ASG, 2018).

Parque Tantauco, a 250,000-acre privately protected area in southern Chile's Chiloé Archipelago, has been an important refuge for *R. darwinii*; until 2022, *Bd* was inferred to be absent based on intensive monitoring of wild amphibians (Valenzuela-Sánchez et al., 2026). In addition, this protected area – particularly its southernmost sector at the locality of Inio – harboured the largest known contemporary populations of *R. darwinii*, with densities

Figure 1. A Southern Darwin's frog *Rhinoderma darwinii* from Parque Tantauco, Chiloé Archipelago, southern Chile.

approaching an order of magnitude higher than those observed in other well-monitored populations (Soto-Azat et al., 2013; Valenzuela-Sánchez et al., 2022). In 2023, we detected *Bd* infection in *R. darwinii* and syntopic amphibians for the first time in Parque Tantauco (Valenzuela-Sánchez et al., 2026). Between 2023 and 2024, the abundance of *R. darwinii* declined by more than 90% in two previously stable local populations that had been monitored using capture-recapture methods since 2014 (Valenzuela-Sánchez et al., 2026).

In response to the emergency caused by the invasion of *Bd* into Parque Tantauco, the "Alianza Tantauco" was formed, comprising the NGO Ranita de Darwin, the Zoological Society of London (ZSL), Fundación Parque Tantauco, Zoo Leipzig, Universidad Andrés Bello, Universidad de Concepción, Zoológico Nacional del Parquemet and the IUCN SSC Amphibian Specialist Group. Alianza Tantauco initiated its first emergency action with a rescue mission to prevent the imminent extinction of the remaining *R. darwinii* populations in Parque Tantauco by transferring frogs to ZSL London Zoo under loan from the Chilean authorities. Captive survival-assurance colonies are often the only chance to preserve a species or population at imminent risk of extinction, and, if successful, can play an important role in efforts to recover species or populations in threat-ameliorated habitats (Tapley et al., 2024). In October 2024, fifty-three *Bd*-negative frogs—including 12 males carrying developing tadpoles—were transported from Inio to London, travelling approximately 13,000 km via combined sea, land and air routes.

At London Zoo, a dedicated, climate-controlled, biosecure facility was developed for *R. darwinii*, designed to replicate environmental conditions in Parque Tantauco. All frogs were active and clinically healthy on arrival. By January 2025, eleven of the males had successfully brooded 33 metamorphs. In December 2024 we observed the first egg-laying at London Zoo and several males have since succesfully brooded clutches of eggs laid in captivity, which is a very encouraging sign for the establishment of a viable captive survival-assurance colony which will, in time, be pivotal to the recovery of populations in Parque Tantauco.

In January 2025, Alianza Tantauco carried out a second rescue operation of *R. darwinii* from Parque Tantauco, establishing a captive survival-assurance colony of 32 *Bd*-free individuals at the Universidad de Concepción's breeding station within the species' native range. This station has focused on the ex-situ conservation of *R. darwinii* for over 15 years in close collaboration with Zoo Leipzig.

The captive survival assurance colony at London Zoo will not only provide individuals for conservation releases, but will also be used to improve our understanding of chytridiomycosis and to develop strategies to mitigate its impacts.

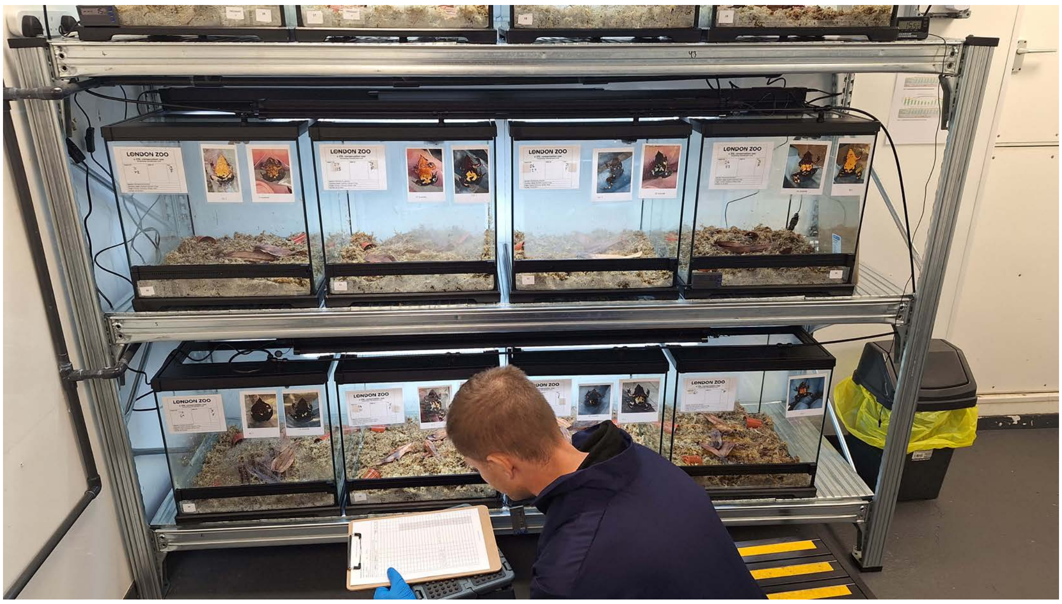

Figure 2. Bio-secure facility for Darwin's frogs *Rhinoderma darwinii* from Parque Tantauco at ZSL London Zoo. Co-author Daniel Kane records monitoring information.

In-situ, we are implementing biosecurity measures and trialling disease mitigation using exclusionary fences to prevent contact between *R. darwinii* and co-occurring amphibians that may act as *Bd* reservoirs. These actions are complemented by ongoing population and epidemiological monitoring to assess whether *Bd* is spreading beyond the Inio sector to other areas of Parque Tantauco. In the medium term, we plan to develop a decision-analytical model to guide the selection of optimal recovery strategies for *R. darwinii* within Parque Tantauco. Together, our ex-situ and in-situ efforts aim to reverse recent losses and restore Parque Tantauco as a long-term stronghold for *R. darwinii*, ensuring the persistence of abundant and stable populations of this unique species across the park.

Acknowledgements
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A pioneering study of grass snake ecology in southern England, 1958-1962

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Figure 1. A pair of grass snakes (male: right; female: left) photographed soon after emergence from hibernation in Kent. Note the diminished yellow collar in the larger female (photo: Brett Lewis).

On 21 October 1980 the senior author (RES) presented the results of a detailed study of the grass snake that had been carried out in Dorset between 1958–1962. This research built on research on the adder carried out by the second author (IP) and utilised some of the same methods of that work (Prestt, 1971). Although some of the findings were later summarised in the third New Naturalist volume on British Amphibians and Reptiles (Beebee & Griffiths, 2000), a comprehensive report was not published until over 60 years after the work had been completed (Stebbings et al., 2025).

About 500 grass snakes were individually marked during surveys carried out on a near-daily basis during the spring and summer months. Data were obtained on seasonal and daily activity, breeding behaviour, egg laying and hatching, feeding and population characteristics.

Figure 2. Hatchlings collected earlier in the day being released in the evening after processing in August 1962. Hatchlings were released into cover at dusk to protect them from predation by peafowl which went to roost at sundown.

The population is likely to have comprised about 1,000 adult snakes. These displayed wide-ranging movements over a large area, with three snakes moving at least 4 km straight line distance. There was a slight female bias in captures of adult snakes, but equal numbers of male and female hatchlings. Females spent longer in hibernation (mid-September–early April) than males (late September–late March). Females usually sloughed their skins once per year just prior to egg laying, while males sloughed twice, around the end of May and in mid-August. Death feigning occurred in 27% of males and 34% of females. Dissection of dead snakes to determine the presence of spermatozoa in males, and eggs or egg scars in the oviducts of females, suggested that although males can reach sexual maturity at 30 cm they are unlikely to achieve successful matings at that size. Nearly all females of at least 70 cm had laid eggs at least once. Between April and May males used up about two-thirds of their stored fat reserves, presumably in mating activity when little feeding occurred. In contrast, the fat reserves of females were depleted from May to July when eggs were maturing.

Females congregated at a longstanding sawdust heap to lay eggs which occurred in the second half of June on the south-facing sunny side of the heap. Snakes penetrated the sawdust heap to a depth of 20–50 cm, either by pushing into the substrate or using existing small mammal burrows. Temperature measurements at the egg-laying site in early August ranged from 28.1–36.8 °C. Palpation of females suggested that clutch sizes varied between 9 and 29 eggs, with larger females laying larger clutches. Most hatching occurred between 5–25 August, with larger hatchings emerging first. Females grew faster than males, and snakes of 70 cm length were estimated to be 13 years old (males) and 10.5 years old (females). In addition to accidental deaths due to farm and road vehicles and grass mowing, there was also deliberate persecution and killings by humans. Avian predators included kestrels, buzzards and marsh harriers, with ornamental peafowl picking off large numbers of hatchlings at the sawdust heap.

Dissection of dead snakes and regurgitations of live snakes revealed that the primary food items were toads. Other amphibians and fish were also taken in much smaller numbers, as were small mammals and – in one instance – nestling nightingales. No food was consumed prior to sloughing or by gravid females about to lay eggs. Snakes less than 30 cm long were observed feeding on toad tadpoles and metamorphs.

Although other long-term studies of grass snakes have shown that climate change may be resulting in shifts in distribution and reduced annual survival, our data suggest that the start and end of seasonal activity has changed little over 60 years in southern England. A visit to the study site in March 2025 (over 60 years later) revealed that much of the study area remained intact. Although trees are taller, the areas of woodland and ponds remain similar in size. However, the original sawmill has been redeveloped, and areas of rough grassland are now paddocks with livestock. Although a prime egg-laying site has been destroyed, possibly along with some hibernacula, suitable habitat and a food supply of toads remains. These may be continuing to support a population of grass snakes, albeit in lower numbers than when the original study was carried out.

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Calumma parsonii: A journey with the largest chameleon on the planet. From zoo to field

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Introduction

The Parson's chameleon is endemic to the rainforest in eastern and northern Madagascar and belongs to the *Calumma* genus, which is comprised of medium and large bodied species occupying a range of habitats. *Calumma parsonii* is the largest chameleon species in the world by weight, with a total length of up to 695 mm (Tessa et al., 2017). A population decline of close to 30% over 15–18 years has resulted in a Near Threatened categorisation by the IUCN red list (Jenkins et al., 2011). This decline is driven at a large scale by habitat loss through deforestation and slash-and-burn agriculture, but more concentrated declines are believed to have been led by localised removals of adult individuals for the illegal pet trade. Historically, they have been found in the eastern part of Madagascar over an estimated range of 39,800 km^2 (Jenkins et al., 2011), in an increasingly fragmented habitat which may be unable to support large populations of this species without dispersal and interbreeding. Further, as a long-lived species (10–12 years) in the wild (Tessa et al., 2017) and with generation lengths of 5–6 years (Jenkins et al., 2011), it is paramount to further the understanding in their movement patterns and home ranges, detailing micro-habitat use and habitat preference (key for effective thermoregulation and UV exposure; Edmonds et al., 2018 ; Nordberg & Schwarzkopf, 2019), as well as identifying key aspects of behavioural ecology such as perching, feeding, mating and egg-incubating behaviours. This updated data could inform conservation management and habitat protection strategies (Crane et al., 2021), resulting in more efficient protection of this cryptic species and help to understand its long-term prospects (Jenkins et al., 2011).

Figure 1. Home range of *Calumma parsonii* (Jenkins et al., 2011).

Live surveys have identified that *C. parsonii* are easier to encounter in the summer, than in the winter. It is believed this species roost in elevated canopies, outside of reach of surveyors (Jenkins et al., 2011), reducing ease of data collection. Radiotelemetry is a popular tool which allows for the tracking of wild reptiles (Price-Rees & Shine, 2011; Van Winkel & Ji, 2014) regardless of accessibility to surveyors or seasonal variations in visibility. However, very few studies currently have evaluated the possibility of using radiotelemetry on chameleons due to their unique morphological and behavioural adaptations. The tall, laterally compressed bodies of chameleons, added to the unusual range of motion in their limbs, mean that designing a suitable harness for them provides unique challenges compared to when designing for a more morphologically conserved lizard. While some studies have been carried out using radiotelemetry on mid-sized chameleons e.g. *Trioceros* sp. (Chiaverano et al., 2014; Shirk, 2012), very few have investigated the larger species of the family. The one-plan approach to conservation, integrating ex-situ and in-situ research, is now well-emphasised in herpetology (Traylor-Holzer et al., 2019). While a trial of largely untested equipment and methodology on wild chameleons with little possibility to intervene if it does prove unsuitable is not ethical, a zoo setting provides a controlled environment to explore possible methods.

The first aim of this project is to establish the most appropriate method of attaching a harness and transmitter to a large chameleon species to enable radiotelemetry studies to be carried out using an ex-situ population. The secondary aim is to deploy these methods in the wild, allowing to further understand the patterns of activity and habitat selection for different ages in this species, and to give a better understanding of methods for studying this species in the wild.

Ex-situ trials

Ex-situ, ten institutions globally care for 27 individuals (12.13.1; ZIMS, 2025), with 13 individuals (4.9.0) housed at Chester Zoo, UK. Following several successful ex-situ breeding events over several years, seven individuals (1.6.0) aged between 1 year and 4 months through to 12 years and 10 months were selected as study subjects to trial two different attachment types, which would allow for the securing of a transmitter. A series of these attachments with dummy transmitters (of the same weight and shape as harnesses to be used in the wild) were constructed: a bead belt and a polyurethane (PU) harness (Fig. 2). The trial bead belts weighed 4-4.30 g and the PU harnesses weighed 4.3-4.5 g with dummy transmitters attached.

Ahead of handling of the animals to deploy the harnesses, observations were carried out by behavioural scientists at Chester Zoo, to determine baselines of behaviours, body postures, space use and social proximities. Data were collected over different phases between November 2023 and April 2025, designed to account for environmental changes throughout the seasons (temperature and photoperiod). These changes may dictate the timing of key behaviours such as mating and thermoregulation, and a key aim of this project was to identify an attachment style which would not affect these behaviours.

Figure 2. A bead belt (left) and PU harness (right) attached onto *Calumma parsonii* individuals at Chester Zoo.

During the ex-situ trial phase, both harness types were adapted following initial failed attempts at securing the harnesses. Keepers involved in the handling and monitoring of the animals were asked to rate each attachment type from 1 to 5 according to a series of questions, summarised in Table 1. When asked about their experiences, both keepers confirmed neither type of transmitter attachment caused prolonged stress or appeared to affect their behaviour (observed during routine checks) beyond the immediate handling. Further, some breeding attempts were observed by the behavioural scientists between the male and females wearing both types of attachment, suggesting the attachments did not impede on breeding behaviour in this case.

Throughout the later attachment periods, there were some occasions where the attachments were found by keepers detached from the animal, or where the attachments had to be removed by keepers as they had shifted from their original placement. However, following several successful attachments, the harnesses were validated as safe and suitable to be deployed in the wild.

In-situ deployment

The primary habitat in the Vohimana Reserve (a private reserve managed by the NGO L'Homme et l'Environnement) is mainly composed of vertically oriented trees with few horizontal branches. This structure is observed in low Pandanus trees on hilltops and in taller trees along riverbanks. Trees with more horizontally oriented branches are mostly restricted to river edges; such trees are believed to provide more suitable habitat for heavy, large-bodied Parson's chameleons.

Table 1. Ratings from a Parson's chameleon keeper at Chester Zoo, involved in the handling and monitoring of the individuals included in the study.

	Bead belt	PU harness
Ease of fit	2	4
Ease of removal	5	5
Behavioural repertoire	5	5
Handling time during fitting	2	4
Shedding ability	4	5
Post-fit adjustment ability	3	3
Total	**25/35**	**30/35**

Degraded habitats are also present within the reserve and consist of extensive monoculture eucalyptus plantations (used for charcoal production) as well as cultivated tree species, including Ravintsara *Cinnamomum camphora* for essential oil production and fruit trees such as avocado, jackfruit and mango.

The field team was comprised of Olivier Marquis, Jay Redbond, Benjamin Drouet, Michael Ramalanjaona, Liantsoa Nourally and Angelinah Rene de Roland as well as the reserve guides.

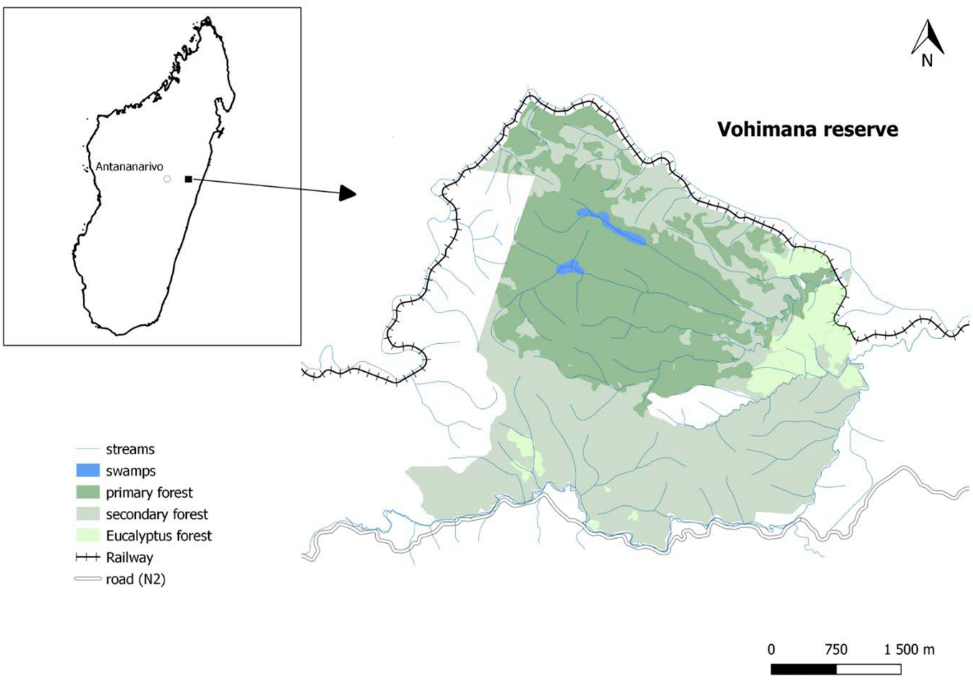

Figure 3. Map of Vohimana reserve.

The equipment used consisted of a digital Lotek Biotrack receiver, a Lotek hand-held antenna, and a Lotek PicoPip long-life tag transmitted. This model of transmitter is estimated to have a battery life of 13 months.

Once in the field, the PU harness was chosen as the attachment of choice over the bead belt, which was mostly due to the ease of attachment of the ibutton data logger, as well as the ease of adjusting the attachment to the body size of the wild individuals to reduce handling time. The transmitter and the data logger were similar in weight (2.75 g and 3.11 g respectively), resulting in a total weight of 12 g including the harness. The data logger and transmitter were attached to the harness in the field.

The target sample size was initially set at five adult females in primary forest to access breeding and egg information. If this target could not be achieved, the alternative was to deploy transmitters on two adult males and three adult females in primary forest. This adjustment was primarily constrained by the limited number of transmitters available and the number of females found. The field team had eight days to achieve the target number and ratio, which was attempted through day and night surveys. During handling of found individuals, health assessments, weights and measurements were also taken, supervised by a veterinarian. A total of five males and three females were found throughout the expedition, allowing the team to tag the target number of individuals of each sex.

Throughout the field expedition, students and reserve wardens were trained on the handling of the Lotek equipment, and each tagged individual was tracked daily in the daytime. GPS location was recorded daily, and used for daily behavioural observations of resting, hunting and relocating behaviours. Additional information surrounding the tree type and height of the individual from the ground was also recorded to increase understanding of space use in wild individuals of this species.

Two individuals (1.1) were found within primary habitat, in different locations but within the same tree species (*Syzygium jambos*). The next three individuals (1.2) were located within the secondary habitat in closer proximity to human villages (Fig. 4).

Preliminary findings

Early findings from the expedition revealed a preference of individuals for fruiting trees, specifically avocado, jackfruit, mango, Japanese plum and rose apple trees. This confirmed a preference for dense vegetation with horizontal branching and large leaves. Eucalyptus trees, for example, do not seem to prove suitable for *C. parsonii* due to the lack of horizontal branches and robust density.

Figure 4. Map of the survey and catchment areas. The grey lines represent the river, the red triangles represent human village sites, blue circles represent successfully tagged males, and pink diamonds represent successfully tagged females. The white circles represent additional individuals that were found during the fieldtrip. Relais was a primary habitat site, while Sandrasoa was classified as secondary habitat, consisting of mostly mango and avocado tree plantations around a village.

Figure 5. Female in-situ with harness and radio transmitter attached.

Figure 6. Female in-situ with harness and radio transmitter and datalogger attached.

Movement was found to be very limited during the first month in the majority of the individuals with a little movement within the tree but often the specimens would remain in the same tree. This is likely typical of winter behaviour due to the temperature drop.

At each sighting, air temperature, humidity and ultraviolet index were recorded, with an average of 19.6 ºC, 83.8% humidity and 0.08 UVI.

Limitations

This project constitutes the first of its kind in trialling these types of harness attachments in wild Parson's chameleons, following an ex-situ trial. This resulted in a small sample size of five individuals due to limited equipment availability across both primary and secondary habitats.

Future directions

The results of this expedition will enable the use of telemetry data to inform habitat protection decisions. Preliminary findings suggest that Parson's chameleons may show a preference for degraded habitats, which should therefore be considered for inclusion within protected areas. Expanding this research to additional populations and across different seasons will improve understanding of the species' ecology and habitat requirements. Furthermore, future

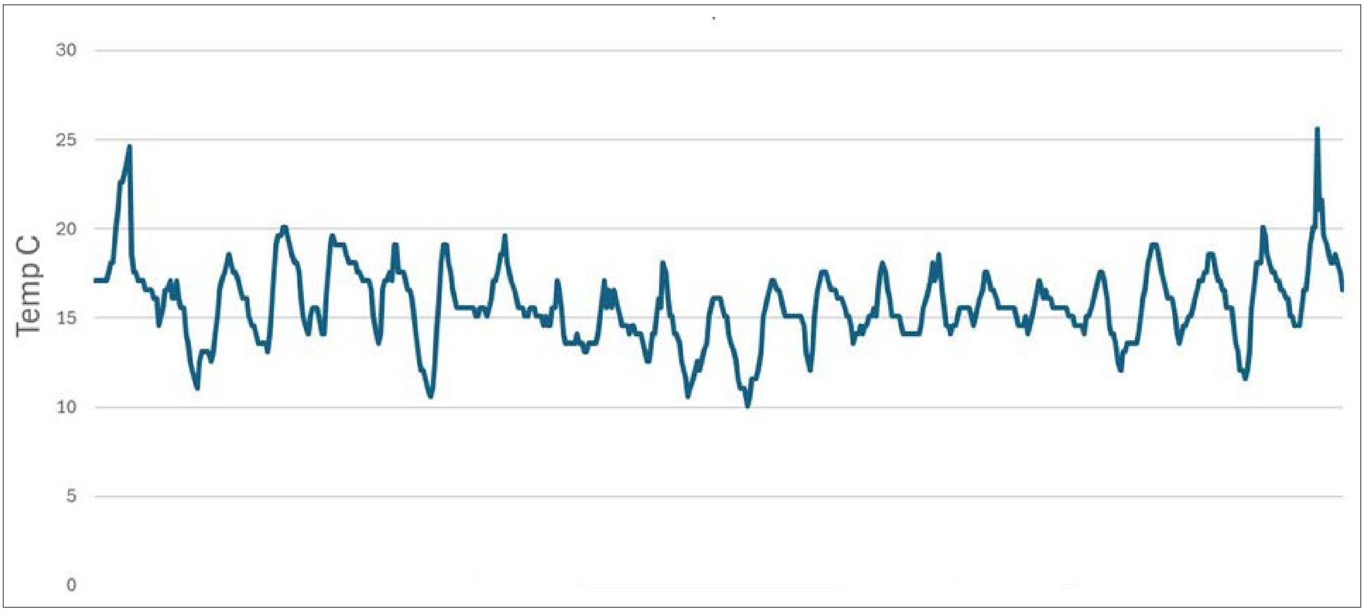

Figure 7. Hourly temperature records from the data logger mounted on a harness fitted to one female, covering the first 23 days of monitoring (June/July 2025).

studies could explore the integration of emerging technological advances, such as GPS nano-tags, to enhance data collection. A central objective of the project team is also to incorporate these research initiatives into the local community, promoting engagement and conservation awareness.

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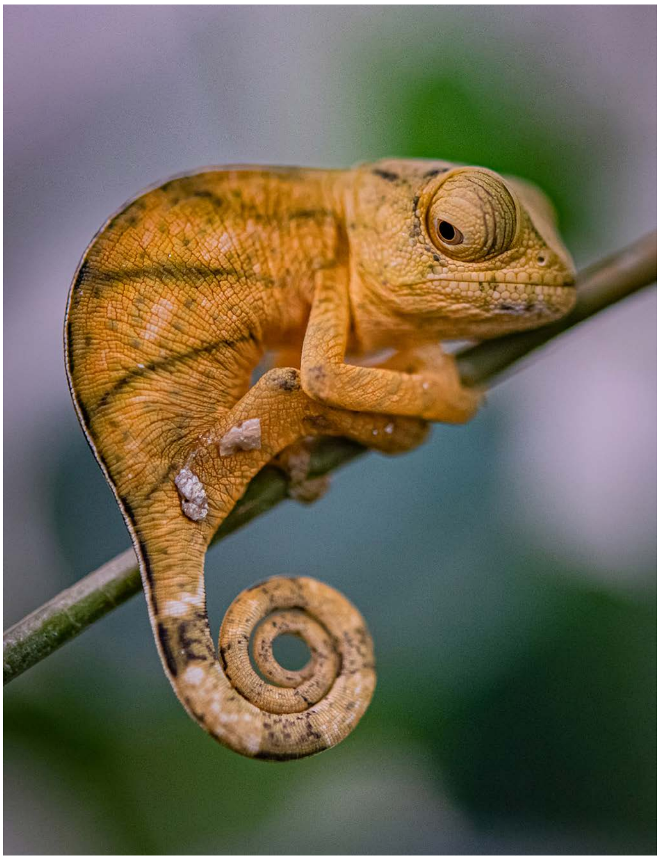

Figure 8. Captive bred baby Parson's Chameleon. Reptile experts at Chester Zoo have become the first in the UK to breed this rare species (photo: Chester Zoo).

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