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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 km² (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

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

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.

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.

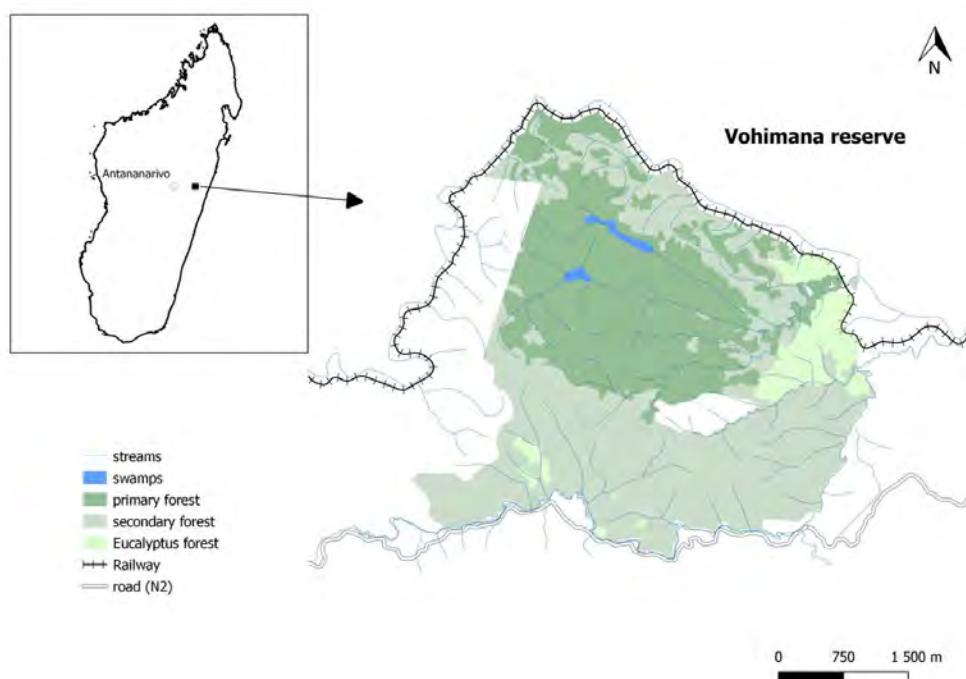


Figure 3. Map of Vohimana reserve.

The equipment used consisted of a digital Lotek Biotrack receiver, a Lotek hand-held antenna, and a Lotek PicoPip long-life tag transmitter. 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 °C, 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

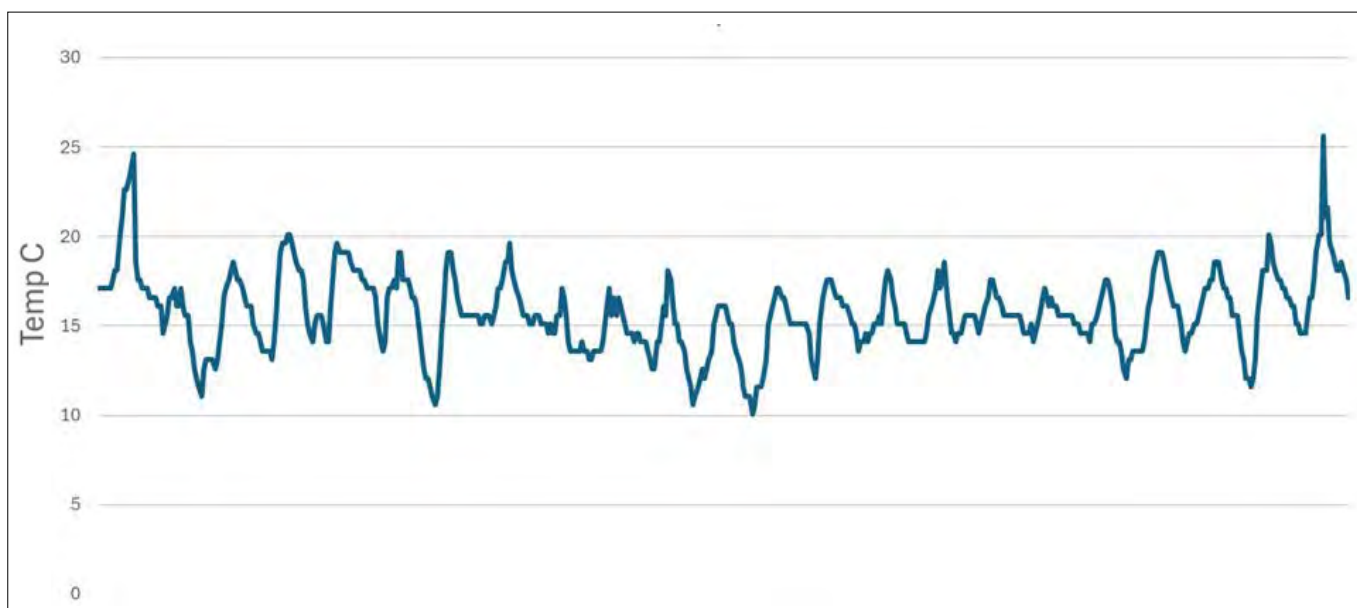


Figure 7. Hourly temperature records from the data logger mounted on a harness fitted to one female, covering the first 23 days of monitoring (June/July 2025).

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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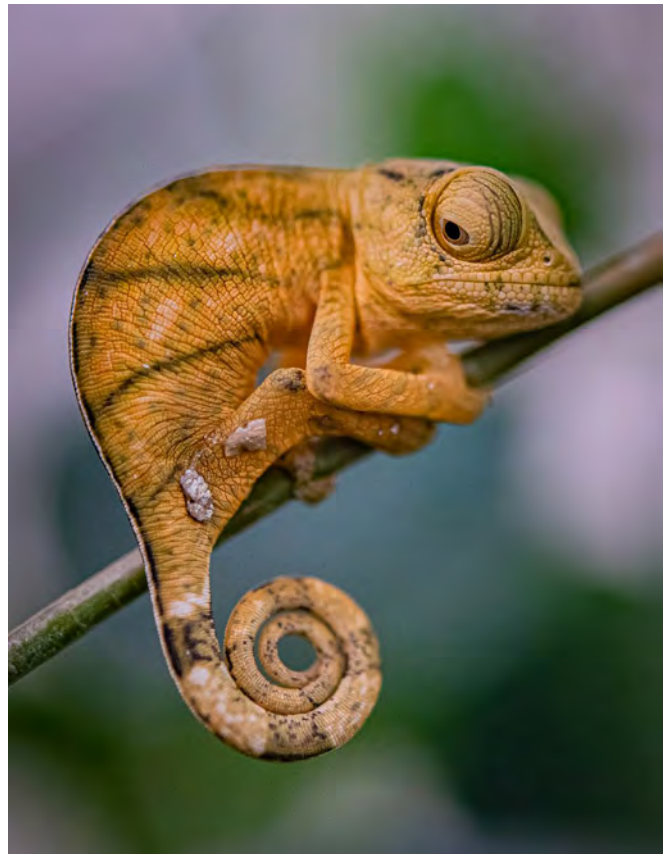


Figure 8. Captive bred baby Parson's Chameleon. Reptile experts at Chester Zoo have become the first in the UK to breed this rare species (photo: Chester Zoo).