The Herpetological Bulletin 174, 2025: 15–22
RESEARCH ARTICLE

https://doi.org/10.33256/hb174.1522

A headstarting programme for the Critically Endangered Manapany day gecko *Phelsuma inexpectata* on Réunion Island

MARKUS A. ROESCH[1,2*], CHLOÉ BERNET[1], ARTHUR CHOEUR[1,3], ANTOINE GUILLOUX[1], NICOLAS HUET[1], MARION NEYMEYER[1], MICKAËL SANCHEZ[1], SÉBASTIEN DERVIN[1] & JÉRÉMIE SOUCHET[1]

[1]Association Nature Océan Indien, 97429 Petite-Ile, La Réunion, France
[2]CIBIO - InBIO, University of Porto, 4485-661 Vairão, Portugal
[3]Université de La Réunion, UMR ENTROPIE, 97400 Saint-Denis, La Réunion, France

[*]Corresponding author e-mail: markus.roesch@cibio.up.pt

ABSTRACT – The Manapany day gecko *Phelsuma inexpectata* has experienced drastic population declines over the past decade in its native range on Réunion Island. We detail the establishment of a headstarting programme aimed at improving juvenile survival. Between January 2021 and November 2022, 40 wild-caught hatchlings were raised in captivity until they reached adult size and then reintroduced into their original populations. Geckos were kept in outdoor exo-terrariums within a predator-proof facility. To ensure a consistent food supply for captive geckos, we set up captive breeding of the tropical house cricket, *Gryllodes sigillatus*. The geckos developed well in captivity and all 40 geckos reached adulthood. Our headstarting programme represents the first local captive management initiative for a *Phelsuma* gecko.

INTRODUCTION

The islands of the Western Indian Ocean are home to a remarkable diversity of endemic herpetofauna (Glaw & Vences, 2007; Cheke & Hume, 2008; Augros, 2019; Labisko et al., 2022). These insular endemic populations are particularly vulnerable to threats and extinction due to the small areas they inhabit and their low capacity to recover from environmental pressures (Hawlitschek et al., 2011; Fernández-Palacios et al., 2021). Conservation efforts in the region have played a vital role in protecting several threatened herpetofauna species through initiatives such as island restoration and species reintroductions (Cheke & Hume, 2008; Russell et al., 2016; Roesch et al., 2022). For species facing greater risks of extinction, local captive breeding programmes have been implemented, successfully establishing assurance populations for taxa such as ploughshare tortoises (Walker et al., 2015) and many species of amphibians (Rakotoarisoa et al., 2024). However, similar local programmes have not been implemented for other groups, such as lizards.

The Manapany day gecko *Phelsuma inexpectata* Mertens, 1966, is endemic to Réunion Island (21° 06’ S, 55° 36’ E) in the Western Indian Ocean and is classified as Critically Endangered by the IUCN (Sanchez, 2021). It is a medium-sized diurnal gecko, reaching a total length of up to 130 mm in males and 110 mm in females (Probst, 2002; M.A. Roesch, unpublished data). It consumes insects, nectar and fruit, and inhabits trees and rocks in pockets of remnant coastal habitat. *Phelsuma inexpactata* is found mainly in native palms, pandanus trees and rock crevices, which are important egg-laying sites for this species. Additionally, it occurs in urban gardens, often found in ornamental plants (Sanchez & Caceres, 2019; Choeur et al., 2022). The *P. inexpectata* distribution is locally restricted to the south of the island and its global population is severely fragmented into small, isolated sub-populations (Sanchez & Caceres, 2019). The species faces severe threats from habitat loss due to intensive agriculture, urban development and invasive alien species (Sanchez, 2021), which is further exacerbated by climate change (Dubos et al., 2022).

On Réunion Island, conservation efforts for *P. inexpectata* are directed by a species action plan, detailing actions such as habitat restoration, community engagement in conservation activities and targeted research (Sanchez & Caceres, 2019). This species action plan is supported financially by the DEAL (La Direction de l’environnement, de l’aménagement et du logement) and co-ordinated by the local organisation Nature Océan Indien (NOI). Despite these efforts, population monitoring over recent decades indicates a continued decline in distribution, population size and abundance (Bour et al., 1995; Sanchez & Probst, 2011; Sanchez, 2021). Since 2015, intensive demographic studies of two of the last five remaining populations in remnant natural habitat confirm this decline, primarily driven by a low survival rate amongst juveniles (Choeur, 2021). While the reason for this remains unclear, the lack of recruitment results in an ageing population with no replacement of older geckos. Population viability analyses have shown that without further management action, these two populations will likely become extinct in the next few years (Choeur, 2021).

Headstarting is a captive management tool often employed for species vulnerable to predation or starvation during early life stages, and aims to assist in increasing juvenile survival and boosting the number of breeding individuals (Alberts, 2007; Escobar et al., 2010). To safeguard the two *P. inexpectata* populations, a headstarting programme was initiated by the local organisation Nature Océan Indien (NOI), to improve juvenile survival by rearing them in captivity until adult size,

then reintroducing them into their original populations. Here, we present a comprehensive overview of the establishment of the headstarting programme for *P. inexpectata*. We detail the setup of our captive facility, husbandry practices and release procedures, and report on our challenges. As the first headstarting initiative for a *Phelsuma* gecko, our work aims to provide a case study to inform and guide future effective captive management programmes of threatened *Phelsuma* species across the region.

CAPTIVE CARE METHODOLOGY

Institutional and regulatory requirements

Our headstarting programme closely adhered to the IUCN Species Survival Commission guidelines for the use of ex-situ management in species conservation (IUCN/SSC, 2014). These guidelines offer comprehensive recommendations for evaluating the suitability, relevance and requirements of ex-situ management programmes as effective tools for conservation support. In line with this, we first conducted an extensive feasibility and risk assessment, detailing regulatory obligations and framing the sampling protocol, husbandry method and release procedures (Sanchez, 2020; Sanchez & Choeur, 2020a; 2020b; Choeur, 2021). Stakeholders in this project included government authorities, researchers and local organisations, whose feedback helped to refine the methods and to acquire funding.

We received approval for our headstarting programme in compliance with French national and local regulations. This process required securing a competency certificate for the captive care of *P. inexpectata*, an authorisation to construct and open a dedicated facility for housing non-domestic animals, and an exemption from the prohibition on capturing, transporting and reintroducing individuals of a protected species into the wild.

Construction of captive facility

We built a predator-proof outdoor enclosure at the NOI premises to house 40 exo-terrariums (Fig. 1). We selected this site due to its proximity (~3 km) to the source gecko populations, ensuring similar climatic conditions and minimising transport duration for captured individuals. Réunion Island has hot and humid austral summers from November to April (mean monthly temperature: 26 °C, mean monthly precipitation: 146 mm) and a dry austral winter from May to October (22 °C, 96 mm; Météo France, 2021). The enclosure measured 6 m long × 5 m wide × 2.5 m high and was built from welded metal bars covered with metal mesh (mesh size 1 cm × 2 cm) as the primary barrier against predators (Fig. 1A). The metal mesh was anchored in concrete on the ground to prevent access of larger predators such as domestic cats *Felis catus*, black rats *Rattus rattus* and musk shrews *Suncus murinus* (Fig. 1B). To protect against smaller animals such as invertebrates and reptiles, we added a 25% shade netting (mesh size 1 mm × 2 mm) on top of the metal mesh, ensuring it was securely fastened to prevent any gaps through which unwanted animals might enter, or escape if a gecko broke free from its exo-terrarium. As an additional precaution, two small INRA mammal traps (BTT Mécanique, Roche-Lez-Beaupré, FR) were placed inside the enclosure

Figure 1. Predator-proof captive facility built for the *Phelsuma inexpectata* headstarting programme - **A.** Outdoor enclosure covered in metal mesh and shade netting, **B.** Metal mesh firmly anchored in concrete to prevent ground-level intrusions, **C.** Interior arrangement of exo-terrariums within the enclosure. Left: north-east, centre: north-west and right: south-east directions, and **D.** Exo-terrariums furnished with live plants to simulate natural habitats.

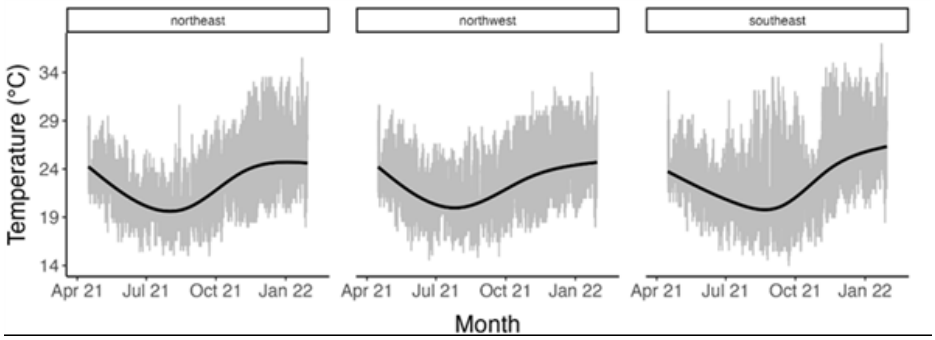

Figure 2. Temperature measurements for each shelving unit of exo-terrariums oriented in different directions from April 2021 to January 2022. Grey bars represent measurements every 30 mins and solid black line indicate the mean temperature.

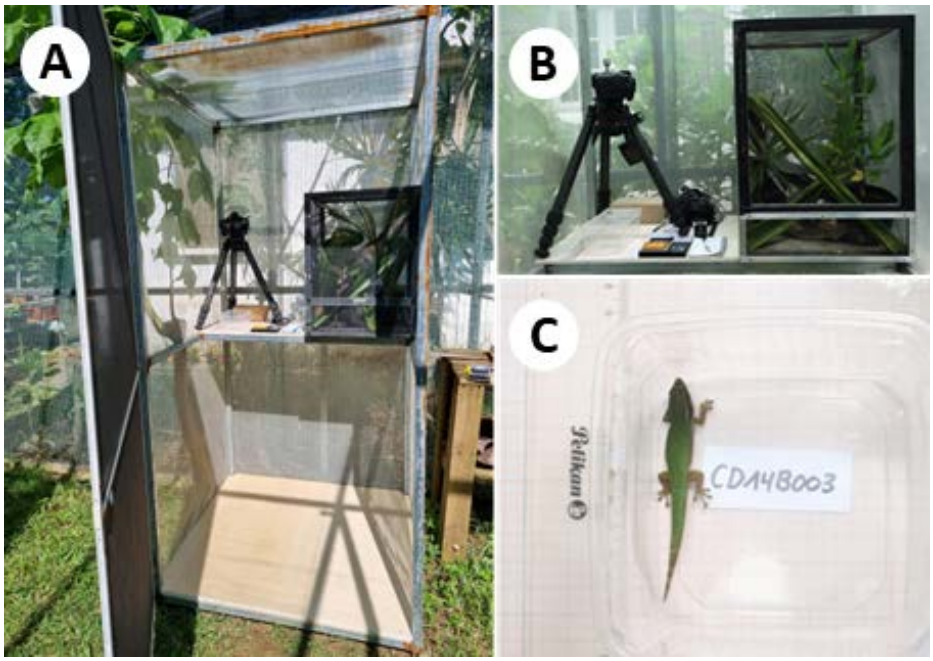

Figure 3. Handling cage designed for conducting monthly health monitoring and morphometric measurements - **A.** Setup of handling cage, **B.** Shelf accommodating exo-terrarium and equipment during manipulation, **C.** Measurement of *Phelsuma inexpectata* individual

to capture any potential rodent intruders. We also regularly cleared vegetation around the enclosure to prevent it from contacting the structure, minimising the risk of predator incursions.

Inside the enclosure, we constructed shelves from welded metal bars to hold the exo-terrariums and ensure they remained elevated and isolated from the walls and ground. Three separate shelving units were installed in the north-west, north-east and south-east directions, accommodating a total of 40 exo-terrariums (Exo Terra®, 45 cm long x 45 cm wide x 60 cm high, 121.5 L volume) arranged in two rows (Fig. 1C). The bottom row was positioned 30 cm above the ground, and below this row, we applied heavy lithium grease to the shelves to prevent ants from accessing the exo-terrariums, particularly the tropical fire ants *Solenopsis geminata*, an invasive alien species which are known to prey on young geckos (Sanchez & Caceres, 2019). We renewed the lithium grease regularly to maintain its function. We cropped grass constantly inside the enclosure to prevent contact with the shelf of the bottom row.

As *P. inexpectata* is mainly arboreal, we equipped exo-terrariums with plants found in its natural habitat. This consisted of live native plants such as *Scaevola taccada, Dictyosperma album, Dracaena reflexa* and *Pandanus utilis* (Choeur et al., 2023), obtained from the NOI plant nursery to ensure they were free from pesticides. We provided additional shelter using fresh leaves of non-native *Furcraea foetida* and dried palm leaves (Fig. 1D). Before being placed insides the exo-terrariums, all plant materials were quarantined on a separate empty shelf for at least two weeks to confirm that no ants or other potentially dangerous insects were present in the soil substrate or on the leaves. No chemical treatments were applied to the plants or materials used. Each exo-terrarium included a small water bowl and housed a single gecko to allow for closer monitoring and to minimise the risk of intraspecific aggression. We also set up iButtons (DS 1923-F5, Maxim Integrated) in some of the exo-terrariums to monitor daily temperature (Fig. 2). These measurements were crucial for assessing thermal conditions that could impact the geckos' health and overall well-being.

Figure 4. *Phelsuma inexpectata* eggs and hatchling - **A.** Newly laid eggs (in the centre) with pinkish white colour, older egg (at the back, failed to hatch) in faded white colour and stained, and egg scars (in the front right) of hatched eggs, **B.** Net installation on a laying site containing a newly hatched gecko

The enclosure also included a handling cage (100 cm long × 100 cm wide × 210 cm high), allowing us to enter and safely conduct monthly health assessments and morphometric measurements while preventing gecko escape. We constructed the handling cage from welded metal bars covered with fiberglass mesh (mesh size 1 mm × 1 mm) and fitted it with an insect screen swing door (Windhager EXPERT) (Fig. 3A). The floor was made of a natural fibre composite panel (Xyltech®), and we installed a shelf at a height of 1 m using the same material, to hold the exo-terrarium and equipment during manipulation (Fig. 3B & C).

Gecko breeding monitoring and capture of hatchlings in the wild

We monitored eggs in the two source populations throughout the 2020/2021 breeding season. In these populations, egg-laying begins between August and September, with hatching occurring from November to April. Female *P. inexpectata* lay one or two eggs, and use communal nesting sites (Choeur et al., 2022). Eggs are glued (Osadnik, 1984) to leaf axes and cavities in *Pandanus* trunks, and in rock crevices.

We began weekly egg searches in October 2020, with full-day surveys, and intensified the monitoring to daily morning checks from November 2020 to April 2021, lasting 2–4 hours, to identify laying sites and newly laid eggs. We marked and revisited all laying sites found, distinguishing recently laid eggs (pinkish white in colour, recorded photographically) from older eggs (faded white and often stained) (Fig. 4A). By the end of the monitoring, we recorded a total of 41 eggs across seven laying sites, including four rock cavities, two *P. utilis* trunk cavities, and one *P. utilis* leaf axis, with individual sites containing between two and 13 eggs. Near suspected hatching dates, defined by the colouration of the eggs and the time passed from detection (M.A. Roesch, pers. obs.), we protected laying sites found in cavities with mosquito nets to contain the hatchlings. We attached nets to the substrate using Patafix®, a non-toxic, removable adhesive, adjusting each net to cover the entire site with one corner loosely tied for easy retrieval of the geckos. After installing the nets, we checked laying sites daily in the early morning to locate any hatchlings from the previous 24 hours. Hatchlings used the nets for sunbathing, making them easy to spot (Fig. 4B). Based on our intensive monitoring, incubation period was 82 ± 11 days (mean ± SD, n = 21) calculated from the day of egg deposition until the day of hatching.

Table 1. Results of *Phelsuma inexpectata* egg monitoring for the 2020/2021 breeding season and size of geckos on day of hatching, from two wild populations on the south coast of Réunion Island. SVL = snout-vent length

Source population	No. of egg laying sites	No. of eggs	Hatching success (%)	Hatchling SVL (mm)	Hatchling weight (g)
				Mean ± SD (n)	
A	2	12	50	24.13 ± 0.28 (6)	0.43 ± 0.03 (6)
B	5	29	83	23.99 ± 0.16 (18)	0.42 ± 0.03 (18)
All	7	41	66.5	24.03 ± 0.20 (24)	0.43 ± 0.03 (24)

Table 2. Size categories of P*helsuma inexpectata*, their corresponding age classes, and the sizes of *Gryllodes sigillatus* used for feeding. These values were used as a guide, as individual growth rates varied. The size of the cricket provided approximately matched the width of the gecko's head. SVL = snout-vent length

Phelsuma inexpectata SVL (mm)	Gecko age class (months after hatching)	*Gryllodes sigillatus* abdomen length (mm)
< 25	0	< 2
25–30	1–3	2–4
30–35	3–5	4–6
35–40	4–8	6–8
> 40	7–18	8–10

The hatching success rate of the two populations were 50% and 83%, respectively (Table 1). We successfully caught 24 hatchlings from netted laying sites by gently directing them to the open corner of the mosquito nets, allowing them to jump into a transport box. Once all geckos had hatched, we removed the nets to restore the sites to their original states. We captured 16 additional hatchlings by hand directly from vegetation during the monitoring. These hatchlings came from laying sites that were either difficult to access for monitoring or unknown and were generally only a few days old. This was determined either by observing an open navel, indicating recent hatching, and by comparing their size and weight to that of hatchlings captured at accessible laying sites. This allowed us to assign relatively precise ages to these juveniles.

Gecko care

We fed young geckos in the morning three times per week, to meet their higher energy needs for growth, while adults received food twice a week to avoid excess weight gain that is common in captivity. Each feeding session included 2–4 invertebrates per gecko, which we provided only on warm, dry days when the geckos were active. On colder, rainy days, we offered only non-invertebrate food since the geckos' metabolism slows down in these conditions, making it difficult to hunt invertebrates, while soft, liquid sugar-based food is more easily ingested (Lei & Booth, 2014).

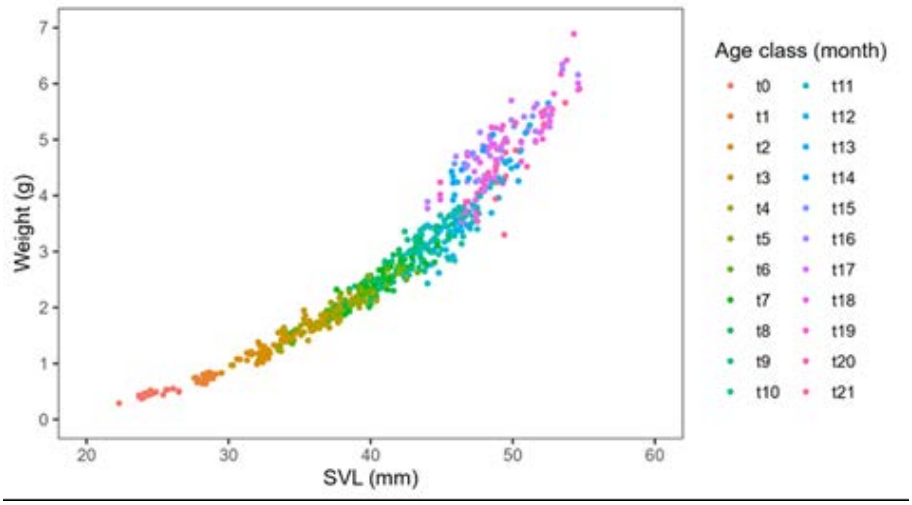

Figure 5. Monthly measurements of snout-vent length (SVL) and weight, showing the growth of *Phelsuma inexpectata* individuals in captivity, age class t0 = time at hatching

Live invertebrates were placed freely in the exo-terrariums for the geckos to catch themselves. We fed the geckos primarily with *Gryllodes sigillatus*, adjusting the cricket size to match the developmental stage of each gecko (Table 2). We initiated cricket breeding two months prior to catching any geckos to ensure sufficient food supply was available. Detailed information on the cricket breeding is included in the Supplementary Material. We also provided isopods *Porcellio scaber* and fruit flies, *Drosophila* spp. collected from the NOI compost area. Isopods are rich in calcium (Becker et al., 2005) and are commonly found in the source population habitat, while the small, active fruit flies stimulate the hunting instincts of young geckos. In addition to invertebrates, and to diversify the diet, once a week we also provided home-made fruit puree, as well as natural food sources from native trees found in the geckos' natural habitat, including flowers from *S. taccada*, pollen from *Latania lantaroides* and fruit from *P. utilis*. Every two weeks, we enriched the fruit puree with calcium powder and vitamins (Zoo Med ReptiVite® with D3) to support the geckos' healthy growth.

We conducted regular inspections of the exo-terrariums and misted them with fresh water daily in the early morning to provide water for both the plants and geckos. Each week, we cleaned the exo-terrariums by removing dead leaves and uneaten invertebrates that were too large for the geckos to consume. Additionally, we replaced any plants that had outgrown the exo-terrariums. We performed visual checks of geckos daily and conducted monthly morphometric measurements to monitor health and development of all individuals. Additionally, pictures taken during the measurements allow for post-release identification of the geckos due to their individual colour patterns.

DEVELOPMENT IN CAPTIVITY AND RELEASE OF ADULTS

Gecko development

Morphometric measurements from the first day in captivity to the release date revealed that, at least initially, *P. inexpectata* invested in length growth over weight gain (Fig. 5). This growth pattern aligns with observations in other lizard species, such as the European sand lizard *Lacerta agilis* (Dudek et al., 2015) or the Tokay gecko *Gecko gecko* (Alif Fauzi & Hamidy, 2022). Throughout captivity, none of the geckos displayed external parasites, such as mites, or experienced unexplained weight loss or a decline in appetite.

One female gecko, at an age of about 11 months, developed the metabolic bone disease osteomalacia, which was quickly stabilised through an increased administration of ReptiVite®. This age corresponds to the onset of maturity in females when they begin producing unfertilised clutches (M.A. Roesch, pers. obs.). While the gecko was left with permanent spine deformities, it did not experience difficulties in egg production and deposition, since it later produced and laid unfertilised eggs twice in its exo-terrarium. The laying of unfertilised eggs is common in young female geckos (M.A. Roesch, pers. obs.). The affected gecko was declared healthy and considered fit for release into the wild by the veterinarian as no long-term negative effects were evident, and was released at approximately 20 months old.

Release procedures

In order to strengthen the two coastal populations, geckos were to be released back into their original habitats. Both soft and hard release procedures of adults into the wild were considered. Soft-release cages provide a controlled environment where captive individuals can habituate to their new surroundings to search for food and learn to evade predators (Knox & Monks, 2014; Sacerdote-Velat et al., 2014). Additionally, strict invasive alien species control in a soft release setup might improve initial post release survival. However, due to the release site's topography, small area, closed canopy and logistical constraints, constructing larger cages for a soft release was not feasible. Control of invasive alien species has been ongoing in the habitat of the two source populations for over a decade. Efforts to remove invasive plant species and reintroduce native vegetation began in 2012. Predator control, initiated in 2016, has targeted the removal of *F. catus*, *R. rattus*, *S. murinus* and red-whiskered bulbuls, *Pycnonotus jocosus* (Sanchez & Caceres, 2019).

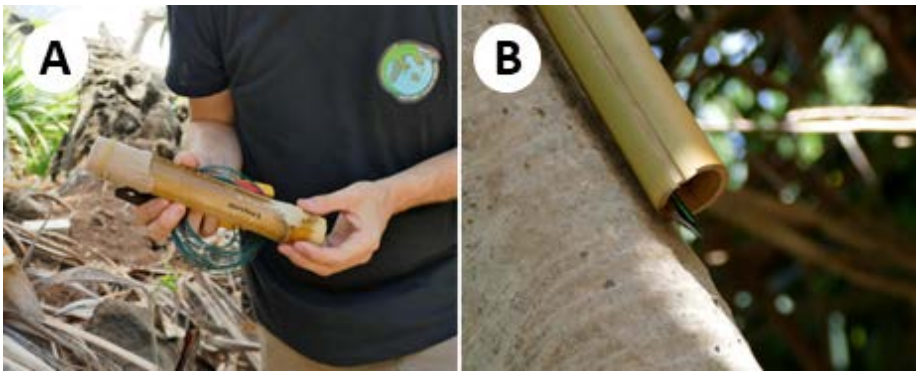

Figure 6. Release of adults in the wild- **A.** Individuals placed in bamboo tubes for transport to the release site, **B.** Bamboo tube attached to a *Pandanus* utilis tree with *Phelsuma inexpectata* emerging from the tube

During the headstarting programme, predator control efforts were intensified to prepare the sites for gecko releases. Cage traps and small mammal traps were deployed and operated throughout the headstarting programme, while targeted poison baiting against *R. rattus* was conducted immediately before, during and after gecko releases, closely following local regulations on the administration of poison bait.

We made three separate hard releases. The first of which was in December 2021 and involved releasing nine individuals (7 females, 2 males) into a source population after approximately 10 months in captivity; the purpose was to determine post-release survival of young adults. The second and third releases, at both source populations, were staggered to facilitate intensive post-release monitoring and occurred between September and November 2022. During these two events, we released 30 geckos (20 females, 10 males) that had been in captivity between 18 to 21 months. During handling for one of these releases, a gecko escaped unnoticed, hiding under a *F. foetida* leaf when this was removed from the exo-terrarium. Although we located the individual the following day, it had already been attacked and consumed by fire ants. Survival in captivity was therefore 100% up until the day of release, with 39 geckos (97.5%) successfully released into the wild.

For the release, each gecko was placed individually in a bamboo tube for transport to the release site. The tubes were sealed with a piece of cotton fabric and a rubber band to minimise stress and protect the geckos during transport (Fig. 6A). Individuals were released onto *P. utilis*, a key plant species for *P. inexpectata* (Choeur et al., 2023). We selected mature *P. utilis* plants that were fruiting or located near fruiting individuals at the time of release. Upon arrival at the site, each bamboo tube was secured to a pre-selected tree, and the cotton fabric was removed. This allowed the geckos to exit the tube at will (Fig. 6B). The released individuals were closely monitored using a Capture-Mark-Recapture (CMR) protocol with photo-identification (Bernet & Roesch, 2023) over an extended period to assess the programme's effectiveness, which is still ongoing. The initial CMR monitoring intervals following each release (T) were T+1 week, T+2 weeks, T+3 weeks, T+4 weeks, T+2 months, T+3 months and T+6 months, after which monitoring was incorporated into the seasonal surveys.

DISCUSSION

Our headstarting programme for *P. inexpectata* has shown promising initial results. Through our cricket breeding, we ensured a consistent food supply. Geckos maintained good development in captive care, and we achieved high survival rates of hatchlings. The higher number of females released compared to males is a favourable result that offsets the predominance of males observed in the source populations (Choeur, 2021) and boosts the breeding female population. Our headstarting results are particularly important, as the survival of wild *P. inexpectata* may increasingly rely on captive management and translocations to areas with future climate suitability (Dubos et al., 2022). In addition to supporting hatchling survival, our headstarting programme has strengthened our education and awareness initiatives and facilitated research on *P. inexpectata*, which will inform and enhance conservation efforts in the wild.

We faced some challenges during the setup of our programme. One of our key focus points was biosecurity, with efforts to build a predator-proof captive facility. While our enclosure successfully excluded invasive vertebrates, it did not exclude fire ants (*S. geminata*) from the exo-terrariums resulting in the predation of an escaped gecko during release preparation. To address this, we recommend using localised poisoned ant-bait that is not accessible by geckos, in addition to the isolation of the shelves using heavy lithium grease. One gecko developed osteomalacia, possibly due to limited sun exposure in its exo-terrarium, an overly conservative administration of ReptiVite® during growth, or due to the demands of egg production at maturity. We have since adapted the shelving inside the enclosure to north-east and south-east directions to maximise sun exposure for all exo-terrariums. Furthermore, while nets were effective for capturing hatchlings at laying sites, they may have deterred females from returning. This disruption could impact breeding, as female *P. inexpectata* exhibit strong site fidelity and communal nesting behaviours (Choeur et al., 2022) warranting further investigation. Alternative capture methods should be tested, and continued breeding monitoring is essential to assess long-term impacts.

This project is ongoing, and is expected to continue for several years. We strongly recommend combining

headstarting with ex-situ breeding in order to increase the number of geckos that can be released. Exhaustive post-release monitoring is in progress to evaluate the project's long-term impact. In parallel, restoration activities in the habitat of *P. inexpectata* and invasive species control will continue, while also addressing emerging threats such as invasive ants (Souchet et al., 2024) and the invasive lizard *Calotes versicolor* (Souchet & Coquis, 2025), to ensure that *P. inexpectata* populations are self-sustaining.

ACKNOWLEDGEMENTS

We thank all staff and interns at Nature Océan Indien for logistical and administrative support; the board members of Nature Océan Indien at the time for their invaluable efforts in the preparation of this project; the Interessengruppe Phelsuma and Exo Terra® for providing equipment for the captive facility; Jo Hoarau for helping with the construction of the facility; CNPN France, CSRPN of Réunion Island, DEAL of Réunion Island, all members of the COPIL/COTECH for their valuable input on the planning and realisation of the project; and all reviewers for their comments and feedback on the manuscript. This project was supported by the Conservatoire du Littoral and was funded by the European FEDER grant number 20200750-0026223 and the French government grant number 2120. This project was carried out under permit numbers: 2020-3540/SG/DRECV, 2020-3541/SG/DRECV and DEAL/SEB/UBIO/2021-02.

REFERENCES

Alberts, A.C. (2007). Behavioral considerations of headstarting as a conservation strategy for endangered Caribbean rock iguanas. *Applied Animal Behaviour Science* 102(3–4): 380–391.

Augros, S. (2019). *Atlas des Amphibiens et des Reptiles Terrestres de l'Archipel des Comores*. Muséum national d'Histoire naturelle, Paris; Biotope, Mèze, 224 p. (Inventaires & biodiversité; 13). ISBN : 9782856538852.

Becker, A., Ziegler, A. & Epple, M. (2005). The mineral phase in the cuticles of two species of Crustacea consists of magnesium calcite, amorphous calcium carbonate, and amorphous calcium phosphate. *Dalton Transactions* 10: 1814–1820.

Bernet, C. & Roesch, M.A. (2023). Suivi démographique et spatial des populations de Gecko vert de Manapany (*Phelsuma inexpectata*) des falaises littorales de Petitelle – suivis de 2020 à 2022. Rapport Nature Océan Indien, La Réunion. 22 p.

Bour, R., Probst, J.-M. & Ribes, S. (1995). *Phelsuma inexpectata* Mertens, 1966, le lézard vert de Manapany-les-Bains (La Réunion): données chorologiques et écologiques (Reptilia, Gekkonidae). *Dumerilia* 2: 99–124.

Cheke, A. & Hume, J. (2008). *Lost Land of the Dodo: An Ecological History of Mauritius, Réunion & Rodrigues*. Yale University Press, 464p. ISBN 9780300141863.

Choeur, A. (2021). Conservation du gecko vert de Manapany (*Phelsuma inexpectata*) et du puffin du Pacifique (*Ardenna pacifica*). Approche multispécifique pour la conservation des falaises littorales du sud de l'île de La Réunion. PhD Thesis. Université de La Réunion. https://theses.hal.science/tel-03597660v1.

Choeur, A., Clémencet, J., Le Corre, M. & Sanchez, M. (2022). Evidence of seasonal reproduction, laying site fidelity, and oviposition synchronicity in the critically endangered endemic Manapany Day Gecko (*Phelsuma inexpectata*) from Réunion Island (western Indian Ocean). *Salamandra* 58(2): 116–122.

Choeur, A., Clémencet, J., Le Corre, M., Roesch, M.A. & Sanchez, M. (2023). Intra-annual variations of microhabitat use and movements of a critically endangered arboreal day gecko endemic to Réunion Island: Implications for conservation. *Amphibia-Reptilia* 44(2): 139–152.

Dubos, N., Montfort, F., Grinand, C., Nourtier, M., Deso, G., Probst, J.-M., Razafimanahaka, J.H., Andriantsimanarilafy, R.R., Rakotondrasoa, E.F., ... & Crottini, A. (2022). Are narrow-ranging species doomed to extinction? Projected dramatic decline in future climate suitability of two highly threatened species. *Perspectives in Ecology and Conservation* 20(1): 18–28.

Dudek, K., Sajkowska, Z., Gawałek, M. & Ekner-Grzyb, A. (2015). Using body condition index can be an unreliable indicator of fitness: A case of sand lizard *Lacerta agilis* Linnaeus, 1758 (Sauria: Lacertidae). *Turkish Journal of Zoology* 39: 182–184.

Escobar, R.A., Besier, E. & Hayes, W.K. (2010). Evaluating headstarting as a management tool: Post-release success of green iguanas (*Iguana iguana*) in Costa Rica. *International Journal of Biodiversity and Conservation* 2(8): 204–214.

Fauzi, A.M. & Hamidy, A. (2022). First report of growth rate juvenile tokay gecko (*Gekko gecko* Linnaeus, 1758) during twenty-four weeks in captive breeding facility. *Jurnal Biologi Indonesia* 18(2): 177–181.

Fernández-Palacios, J.M., Kreft, H., Irl, S.D.H., Norder, S., Ah-Peng, C., Borges, P.A.V., Burns, K.C., de Nascimento, L., Meyer, J.-Y., Montes, E. & Drake, D.R. (2021). Scientists' warning - The outstanding biodiversity of islands is in peril. *Global Ecology and Conservation* 31: e01847.

Glaw, F. & Vences, M. (2007). *A Field Guide to the Amphibians and Reptiles of Madagascar,* Third Edition. – Köln, Vences & Glaw, 496 pp. ISBN 9783929449037.

Hawlitschek, O., Brückmann, B., Berger, J., Green, K. & Glaw, F. (2011). Integrating field surveys and remote sensing data to study distribution, habitat use and conservation status of the herpetofauna of the Comoro Islands. *ZooKeys* 144: 21–79.

IUCN/SSC (2014). Guidelines on the Use of Ex Situ Management for Species Conservation. Version 2.0. Gland, Switzerland: IUCN Species Survival Commission. https://portals.iucn.org/library/node/44952.

Knox, C.D. & Monks, J.M. (2014). Penning prior to release decreases post-translocation dispersal of jewelled geckos. *Animal Conservation* 17: 18–26.

Labisko, J., Maddock, S.T., Rocha, S. & Gower, D.J. (2022). Cryptic Lineages among Seychelles Herpetofauna. In: *Cryptic Species*, 1st ed., 242–280 pp. Monro, A.K. & Mayo, S.J. (Eds.). Cambridge University Press. ISBN

9781009070553.
Lei, J. & Booth, D.T. (2014). Temperature, field activity and post-feeding metabolic response in the Asian house gecko, *Hemidactylus frenatus*. *Journal of Thermal Biology* 45: 175–180.
Météo France (2021): Temperatures and precipitions on Rzunion Island. Données Publiques de Météo-France. URL https://donneespubliques.meteofrance.fr/. Accessed on 27 April 2021.
Osadnik, G. (1984). An investigation of egg laying in *Phelsuma* (Reptilia: Sauria: Gekkonidae). *Amphibia-Reptilia* 5(2): 125–134.
Probst, J.-M. (2002). *Faune indigène protégée de l'île de La Réunion*. Nature & Patrimoine.
Rakotoarisoa, J.C., Rakotoarison, A., Rasoanantenaina, S., Robsomanitrandrasana, E., Edmonds, S.S.S., Soamiarimampionona, J., Tsimialomanana, E., Wolf, S. & Edmonds, D. (2024). Captive breeding reveals insights into the ecology and reproductive biology of 11 little-known Malagasy frog species. *Zoo Biology* 44: 24–35.
Roesch, M.A., Mootoocurpen, R. & Cole, N.C. (2022). Size precision, difference and record of Günther's Gecko, *Phelsuma guentheri* (Squamata: Gekkonidae), in Mauritius. *Herpetology Notes* 15: 513–517.
Russell, J.C., Cole, N.C., Zuël, N. & Rocamora, G. (2016). Introduced mammals on Western Indian Ocean islands. *Global Ecology and Conservation* 6: 132–144.
Sacerdote-Velat, A.B., Earnhardt, J.M., Mulkerin, D., Boehm, D. & Glowacki, G. (2014). Evaluation of headstarting and release techniques for population augmentation and reintroduction of the smooth green snake. *Animal Conservation* 17: 65–73.
Sanchez, M. (2020). Elevage transitoire du gecko vert de Manapany (*Phelsuma inexpectata*). Partie 2: Caractérisation de la structure d'élevage, zootechnie et suivis de l'élevage. Financement programme FEDER, DEAL.
Sanchez, M. (2021). *Phelsuma inexpectata*. The IUCN Red List of Threatened Species. e.T17450049A17450059. Accessed on 20 February 2025.
Sanchez, M. & Caceres, S. (2019). Plan national d'actions en faveur des Geckos verts de La Réunion *Phelsuma borbonica* et *Phelsuma inexpectata*. NOI/ONCFS pour la DEAL Réunion, 173 p.
Sanchez, M. & Choeur, A. (2020a). Elevage transitoire du gecko vert de Manapany (*Phelsuma inexpectata*) dans le cadre du programme FEDER LITTOREHAB. Partie 1: Etude de faisabilité. Financement programme FEDER, DEAL.
Sanchez, M. & Choeur, A. (2020b). Elevage transitoire du gecko vert de Manapany (*Phelsuma inexpectata*) dans le cadre du programme FEDER LITTOREHAB. Partie 3: Protocoles de prélèvement, de réintroduction et de suivi. Financement programme FEDER, DEAL.
Sanchez, M. & Probst, J.-M. (2011): Distribution and conservation status of the Manapany day gecko, *Phelsuma inexpectata* MERTENS, 1966, an endemic threatened reptile from Réunion Island (Squamata: Gekkonidae). *Cahiers Scientifiques de l'Océan Indien Occidental* 2: 13–28.
Souchet, J. & Coquis, A. (2025). Observation of a *Phelsuma laticauda* predated by a *Calotes versicolor* on Réunion Island. *Bulletin de la Société Herpétologique de France*, 186: 1–4.
Souchet, J., Vaslet, V., Ducros, J., Bernet, C. & Roesch, M.A. (2024). La fourmi envahissante *Anoplolepis gracilipes*, une menace pour le gecko endémique de l'île de La Réunion, *Phelsuma inexpectata*? *Bulletin de la Société Herpétologique de France* 185: 1–7.
Walker, R., Lewis, R., Mandimbihasina, A., Goode, E., Gibbons, P., Currylow, A. & Woolaver, L. (2015). The conservation of the world's most threatened tortoise: The ploughshare tortoise (*Astrochelys yniphora*) of Madagascar. *Testudo* 8(2): 68–75.

Accepted: 31 March 2025

Please note that the Supplementary Material for this article is available online via the Herpetological Bulletin website: https://thebhs.org/publications/the-herpetological-bulletin/issue-number-174-winter-2025