

New findings of *Phelsuma grandis* and *P. laticauda* (Sauria: Gekkonidae) at the southern edge of the range of the endangered *Phelsuma serraticauda* in eastern Madagascar

Nicolas Dubos^{1,2}, Nicola Piludu¹, Raphali Rodlis Andriantsimanarilafy¹, Joseph Christian Randrianantoandro^{1,*}
& Franco Andreone²

The gecko genus *Phelsuma* currently comprises 52 described species (Uetz, 2013), most of them occurring on south-western Indian Ocean islands. The Golden-dust Day Gecko *Phelsuma laticauda* (Boettger, 1880; Fig. 1) is a non-gluer species commonly found in humid regions of northern Madagascar. The Madagascar giant day gecko *Phelsuma grandis* (Gray, 1870; Fig. 2) is the largest known species within this genus, with a maximal total length of 30 cm (Rocha et al., 2010). Both species' ability to colonise and thrive in degraded habitats is well known, and they are commonly found in primary forests as well as anthropogenic habitats (e.g., banana and coffee plantations; Andreone et al., 2003; Glaw and Vences, 2007). *P. laticauda* and *P. grandis* are categorised as Least Concern by the International Union for the Conservation of Nature (IUCN; Gerlach, Ineich and Vences, 2011; Ratsouvina, Glaw and Rakotonirafy, 2011). The species were naturally endemic to Madagascar and colonised several locations across the world. Introduced individuals of *P. laticauda* were found in French Polynesia, Comoros and Seychelles (Ota and Ineich, 2006; Rocha et al., 2009), *P. grandis* was found in Florida (Krysko, Hooper and Sheehy, 2003), and both species were recorded in the Mascarenes and Hawaii (Allison, 2002; Cole, 2007; Rocha et al., 2007).

The two species were observed between 9–13 December 2008 during a survey (Randrianantoandro et al., 2012). The observation sites were located in

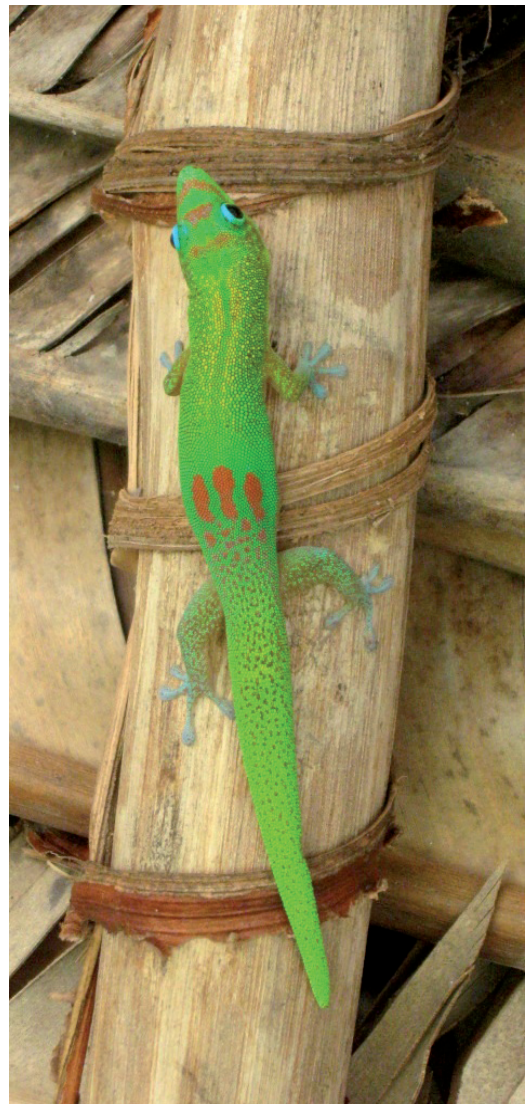


Figure 1. Dorsal view of an adult *Phelsuma laticauda* on a *Ravenala*-made shelter in Analamalotra, eastern Madagascar. Photo: C. Randrianantoandro.

¹Madagasikara Voakajy, B.P. 5181, Antananarivo (101), Madagascar

²Museo Regionale di Scienze Naturali, Via Giolitti, 36, I-10123 Torino, Italy

* Corresponding author, crandrianantoandro@gmail.com

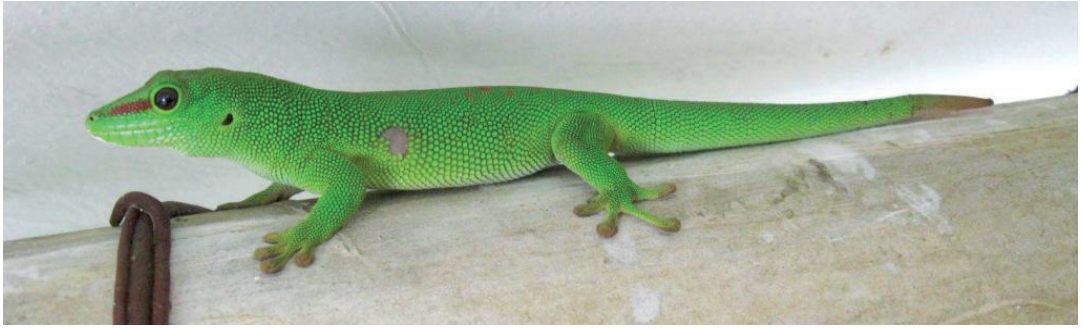


Figure 2. Lateral view of an adult *Phelsuma grandis* on artificial support in Analamalotra, eastern Madagascar. Photo: C. Randrianantoandro.

Analamalotra (18°4'0" S - 49°23'0" E; 15 m a.s.l.) and Toamasina (18°10'03" S - 49°24'11" E; 12 m a.s.l.), at 280 km distance from the natural range of *P. laticauda* and 340 km from the one of *P. grandis* (Fig. 3). A total of 38 individuals of *P. laticauda* (34 adults and two juveniles in Analamalotra; two adults in Toamasina), and seven of *P. grandis* (three adults and one juvenile in Analamalotra; two adults and one juvenile in Toamasina), were observed on natural (i.e., *Cocos nucifera* and *Ravenala madagascariensis*) and artificial supports (i.e., on the walls of houses and containers; see Fig. 2). Several individuals of four autochthonous *Phelsuma* species were observed in proximity (i.e., one *P. lineata*, one *P. madagascariensis* and three *P. quadriocellata*).

Individuals taken from the species' natural range are known to be kept in captivity in Toamasina by international traders before exportation to other countries, an activity in which many Malagasy herps are involved (Andreone *et al.*, 2013). Individuals of both *P. grandis* and *P. laticauda* have escaped captivity and new populations have recently been observed in the north of Toamasina (Pearson and Raxworthy, 2009). Gehring, Ratsavina and Vences (2010) also reported the presence of *P. laticauda* around Lac Ampitabe, 40 km south of Toamasina. Another finding of this species was reported in Maroantsetra (Gehring, *et al.*, 2010; Fig. 3). We confirm the suspected range expansion of the two species around Toamasina. Further monitoring is therefore needed between Toamasina and the north-eastern coastal region of Madagascar.

The range of the two species already overlaps in the northern edge with the distribution of *P. serraticauda*, which is categorised as Endangered by the IUCN (Randrianantoandro *et al.*, 2011). The newly-discovered populations of *P. laticauda* and *P. grandis* reveal

sympatry in the southern edge of *P. serraticauda*. Both *P. laticauda* and *P. grandis* are known to be adaptable and aggressive competitors (Ratsavina, Glaw and Rakotondrazafy, 2011). Sympatry in *Phelsuma* species

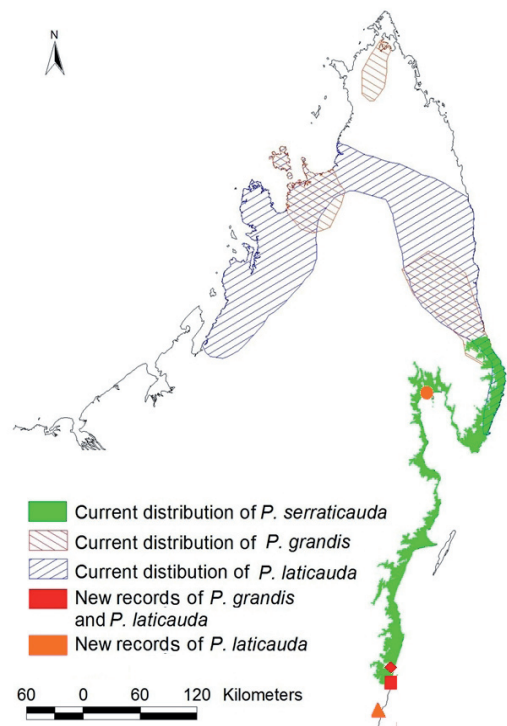


Figure 3. Distribution of *Phelsuma serraticauda*, *P. grandis* and *P. laticauda* in northern Madagascar. The red square and the red diamond are the new localities reported in this paper and by Pearson and Raxworthy (2009), respectively; the orange closed circle and the orange triangle represent localities reported by Gehring *et al.* (2010) and Gehring, Ratsavina and Vences (2010), respectively.

may cause competition and shifts in habitat use that might harm the less adaptable *P. serraticauda* (Harmon, Harmon and Jones, 2007). Moreover, the larger *P. grandis* may pose a risk of predation (Garcia and Vences, 2002) and was already cause of concern when found within the natural range of other *Phelsuma* species (e.g., Buckland, 2009; Dubos, 2013). The presence of *P. laticauda* and *P. grandis* would probably increase the existing threats to the species in the region, namely illegal collection, population fragmentation, and habitat loss (Randrianantoandro et al., 2011). Given the status of *P. serraticauda* and the lack of conservation measures, we recommend further monitoring of *P. laticauda* and *P. grandis* to be prioritised in the Toamasina District.

Acknowledgements. We thank the Darwin initiative and Cleveland Metroparks Zoo for funding, Madagascar Fauna Group, Parc Ivoloina for collaboration, Ministry of Environment and Forests for research permit. We also thank Jean Noël and Justin Simon Randria for the data collection. We are grateful to Frank Glaw for providing useful comments that improved the manuscript. ND and NP would like to thank the staff at Madagasikara Voakajy for the opportunity of working with the team.

References

- Allison, A. (2002): New record of *Phelsuma madagascariensis* in Hawaii. Available at: http://www.phelsumania.com/public/articles/biogeography_hawaii.html. Last accessed on 16 August 2013.
- Andreone, F., Glaw, F., Nussbaum, R.A., Raxworthy, C.J., Vences, M., Randrianirina, J.E. (2003): The amphibians and reptiles of Nosy Be (NW Madagascar) and nearby islands: a case study of diversity and conservation of an insular fauna. *Journal of Natural History* **37**: 2119-2149.
- Andreone, F., Loarie, S.R., Pala, R., Luiselli, L.M., Carpenter, A.I. (2013): Trade and exploitation of amphibians and reptiles: a conservation overview. *Atti dell'Accademia delle Scienze di Torino. Classe di Scienze Fisiche, Matematiche e Naturali* **146**: 85-93.
- Buckland, S. (2009): In Nos geckos suivent fatalement le dodo. *Scope* **1058**. Available at: <http://www.lemauricien.org/wes/090520/ev.htm>. Last accessed on 16 August 2013.
- Cole, N. (2007): Invasive Alien Species. Newsletter Mauritian Wildlife Foundation **9**: 5.
- Dubos, N. (2013): New locality record for *Phelsuma grandis* (Sauria: Gekkonidae) in Reunion, in sympatry with the critically endangered *Phelsuma inexpectata*. *Herpetology Notes* **6**: 309-311.
- Garcia, G., Vences, M. (2002): *Phelsuma madagascariensis kochi* (Madagascar Day Gecko). *Diet. Herpetological Review* **33**: 53-54.
- Gehring, P.S., Crottini, A., Glaw, F., Hauswaldt, S., Ratsvoavina, F.M. (2010): Notes on the natural history, distribution and malformations of day geckos (*Phelsuma*) from Madagascar. *Herpetology Notes* **3**: 321-327.
- Gehring, P.S., Ratsvoavina, F.M., Vences, M. (2010): Filling the gaps – Amphibian and reptile records from lowland rainforests in eastern Madagascar. *Salamandra* **46**: 214-234.
- Gerlach, J., Ineich, I., Vences, M. (2011): *Phelsuma laticauda*. In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.1. Available at: www.iucnredlist.org. Last accessed on 16 August 2013.
- Glaw, F., Vences, M. (2007): A field guide to the amphibians and reptiles of Madagascar. Third edition. Cologne, Vences & Glaw Verlag, 495 pp.
- Harmon, L.J., Harmon, L.L., Jones, C.G. (2007): Competition and community structure in diurnal arboreal geckos (genus *Phelsuma*) in the Indian Ocean. *Oikos* **116**: 1863-1878.
- Krysko, K.L., Hooper, A.N., Sheehy, C.M. (2003): The Madagascar giant day gecko, *Phelsuma madagascariensis grandis* Gray 1870 (Sauria: Gekkonidae): a new established species in Florida. *Florida Scientist* **66**: 222-225.
- Ota, H., Ineich, I. (2006): Colonization of the Gold Dust day gecko, *Phelsuma laticauda* (Reptilia: Gekkonidae), in Moorea of the Society Archipelago, French Polynesia. – *Current Herpetology* **25**: 97-99.
- Pearson R.G., Raxworthy, C.J. (2009): The evolution of local endemism in Madagascar: watershed versus climatic gradient hypotheses evaluated by null biogeographic models. *Evolution* **63**: 959-967.
- Randrianantoandro, J.C., Noël, J., Hobinjatovo, T., Bollen, A., Freeman, K.L.M., Jenkins, R.K.B. (2012): Suivi du gecko *Phelsuma serraticauda* (Squamata: Gekkonidae) dans la région Atsinanana, dans l'est de Madagascar. *Madagascar Conservation Development* **7**: 17-22.
- Randrianantoandro, J.C., Raxworthy, C.J., Ratsvoavina, F., Glaw, F. & Rabibisoa, N. (2011): *Phelsuma serraticauda*. In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.1. Available at: www.iucnredlist.org. Last accessed on 16 August 2013.
- Ratsvoavina, F., Glaw, F., Rakotondrazafy, N.A. (2011): *Phelsuma grandis*. In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.1. Available at: www.iucnredlist.org. Last accessed on 16 August 2013.
- Rocha, S., Posada, D., Carretero, M.A., Harris, J. (2007): Phylogenetic affinities of Comoroan and East African day geckos (genus *Phelsuma*): Multiple natural colonisations, introductions and island radiations. *Molecular Phylogenetics and Evolution* **43**: 685-692.
- Rocha, S., Rösler, H., Gehring, P.S., Glaw, F., Posada, D., Harris, D.J., Vences, M. (2010): Phylogenetic systematics of day geckos, genus *Phelsuma*, based on molecular and morphological data (Squamata : Gekkonidae). *Zootaxa* **2429**: 1-28.
- Rocha, S., Vences, M., Glaw, F., Posada, D., Harris, D.J. (2009): Multigene phylogeny of Malagasy day geckos of the genus *Phelsuma*. *Molecular Phylogenetics and Evolution* **52**: 530-537.
- Uetz, P. (2013): The Reptile Database. Available at: <http://www.reptile-database.org>. Last accessed on 16 August 2013.