Biodiversity inventory of earthworms of Martinique through the use of DNA barcoding unveiled both native and introduced species

LISE DUPONT, CARLA-MARIE BRUNET, YOAN FOURCADE, SAMUEL JAMES, QUENTIN GABRIAC, MATHIEU COULIS

12th International Symposium on Earthworm Ecology - July 10-15, 2022

Remarkable island biodiversity

6.7% Earth's land area

20% biodiversity

Modified from Fernandez-Palacios *et al*. GECC0 2021

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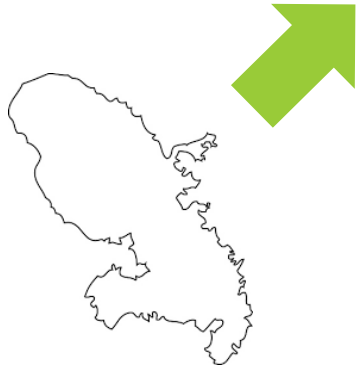

Cradles of evolutionary diversity

Museum of formely widespread lineages

Modified from Fernandez-Palacios *et al*. GECC0 2021

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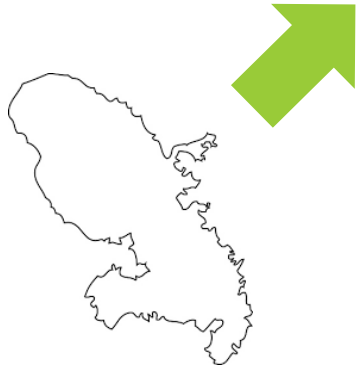

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Natural **VULNERABILITY** :

→ Founder events and small population sizes

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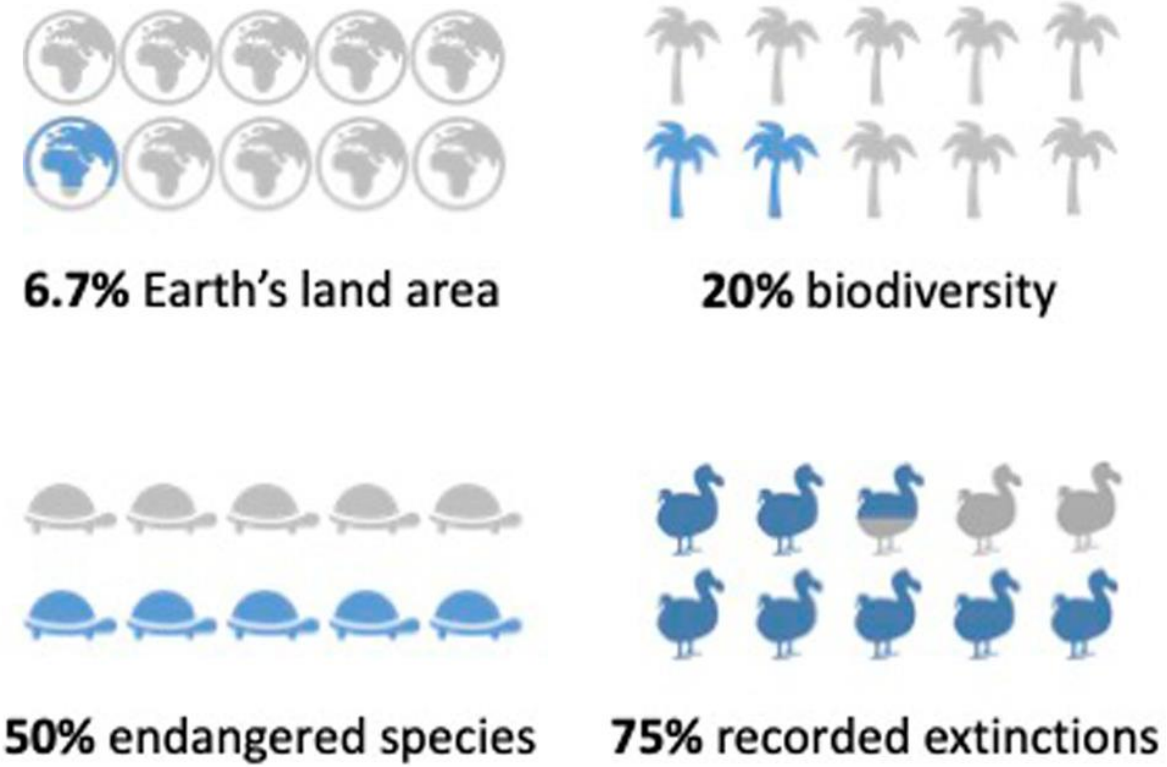

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20% biodiversity

50% endangered species

75% recorded extinctions

→ **Some species disappeared even before being discovered**

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The taxonomic gap in tropical earthworms

→ Wide discrepancy between our knowledge of earthworm diversity and the reality of it, especially in the **tropics.**

→ Even bigger taxonomic gap for species of earthworms living in **unexpected habitats** i.e. organic matter inside bromeliads (epithytic “soils”).

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Soil Biology & Biochemistry 92 (2016) 171–183

DNA barcoding reveals diversity patterns of earthworm communities in remote tropical forests of French Guiana

Thibaud Decaëns [a,*], David Porco [a], Samuel W. James [b], George G. Brown [c], Vincent Chassany [d], Florence Dubs [e], Lise Dupont [f], Emmanuel Lapied [g,h], Rodolphe Rougerie [i], Jean-Pierre Rossi [j], Virginie Roy [k]

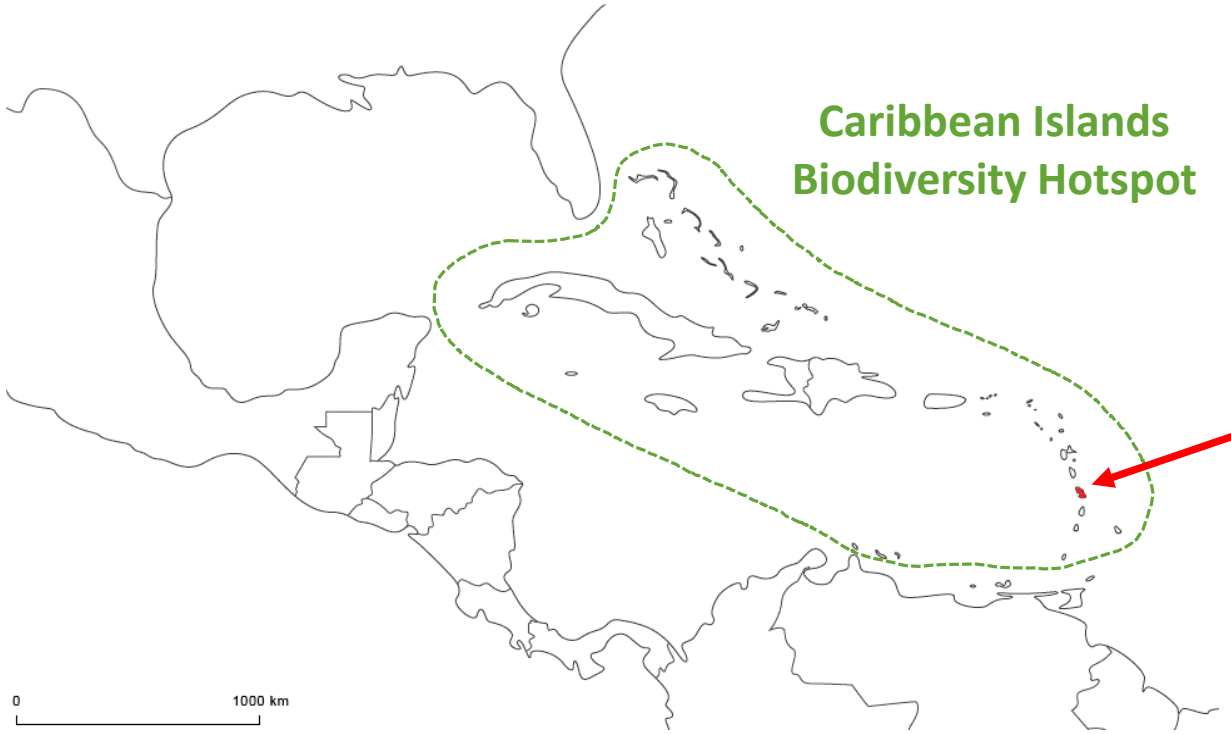
Applied Soil Ecology 164 (2021) 103932

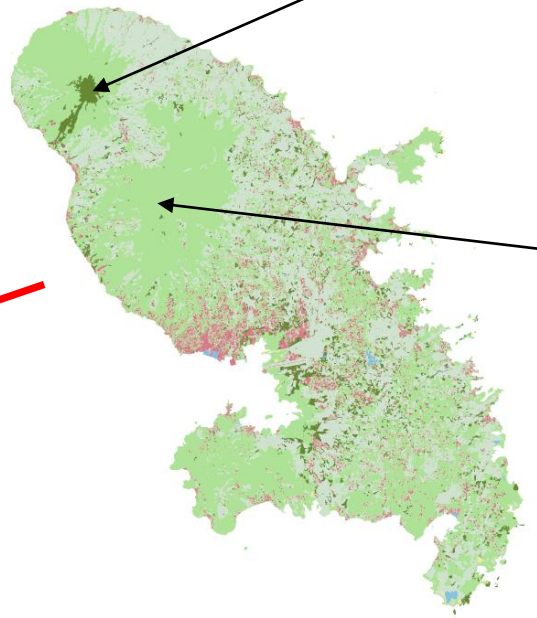
At each site its diversity: DNA barcoding reveals remarkable earthworm diversity in neotropical rainforests of French Guiana

Marie-Eugénie Maggia [a,*], Thibaud Decaëns [b], Emmanuel Lapied [c], Lise Dupont [d], Virginie Roy [d], Heidy Schimann [e], Jérôme Orivel [e], Jérôme Murienne [f], Christopher Baraloto [g], Karl Cottenie [a], Dirk Steinke [a,h]

DNA barcoding (Hebert *et al.*, 2003) : a solution for **accelerating the rate of species discovery.**

Earthworms from Martinique





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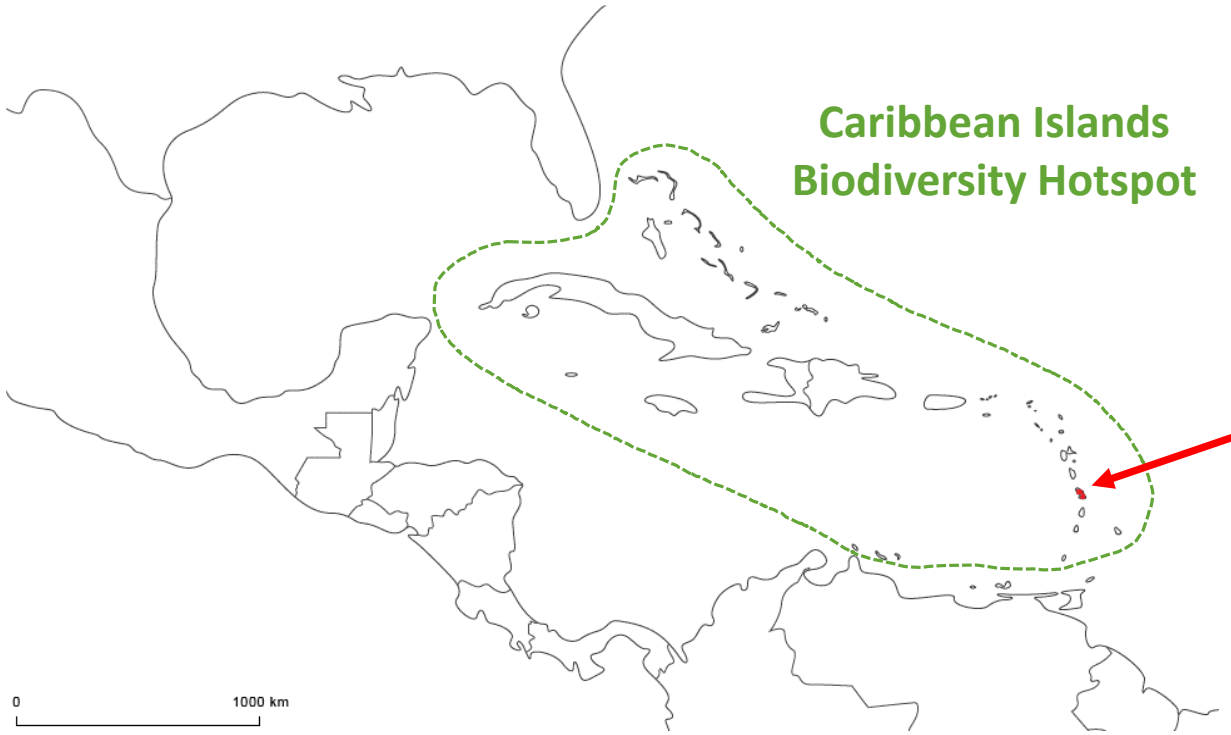
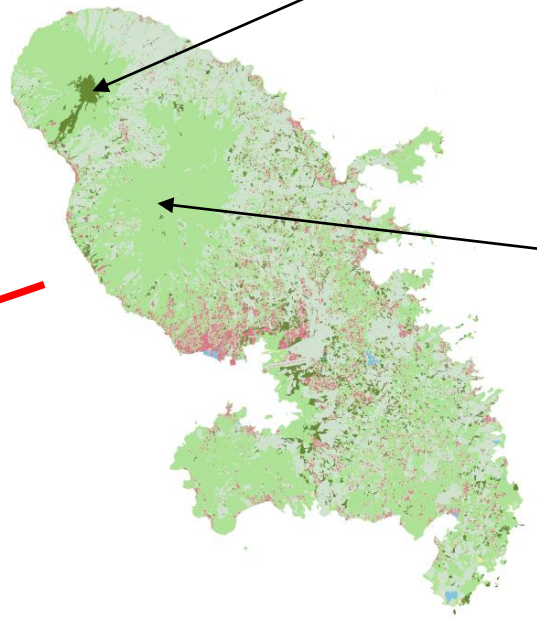


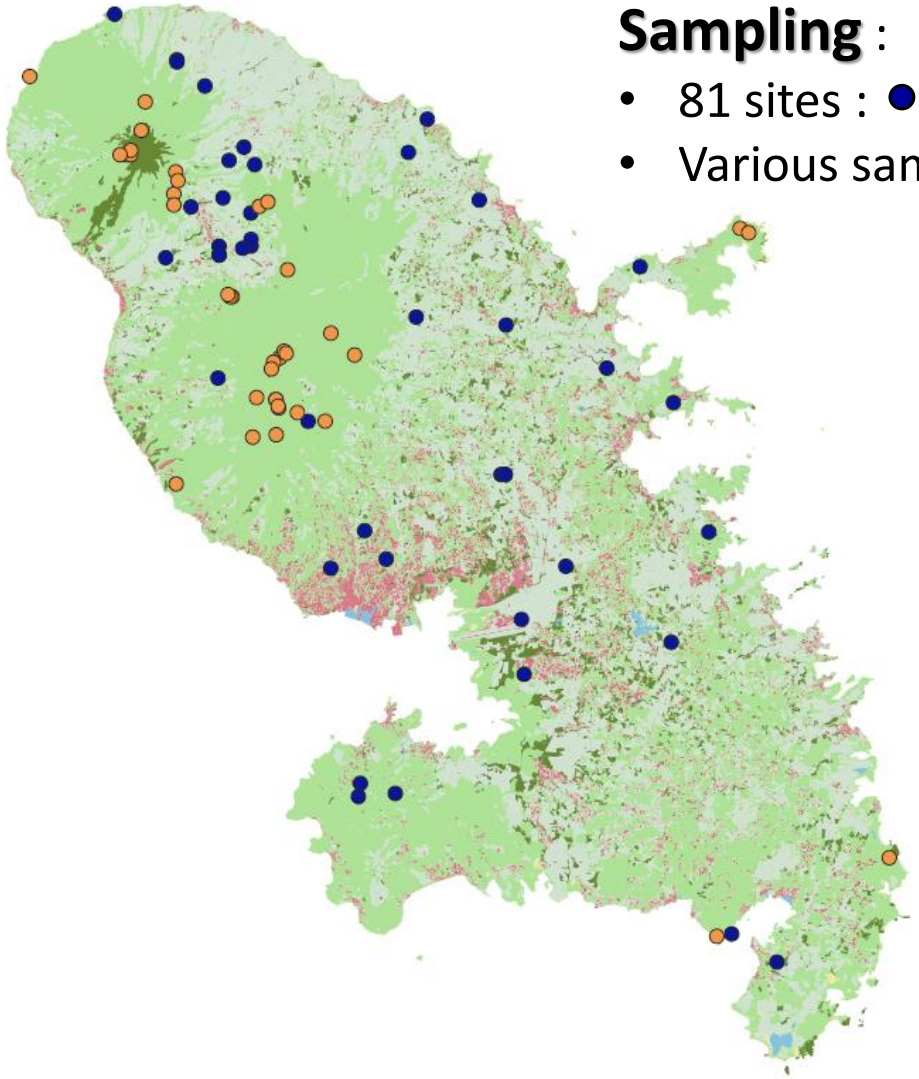


Aims :

→To evaluate the **global diversity** of earthworm species in Martinique through the use of DNA barcoding.

→To investigate the impact of landscape on the diversity of **arboricolous** earthworms.

DNA barcode library of earthworms from Martinique



Sampling :

- 81 sites : ● 43 anthropized (A), ○ 38 natural (N)
- Various sampling protocols (soil, litter, decaying trunks, epiphytic plants)

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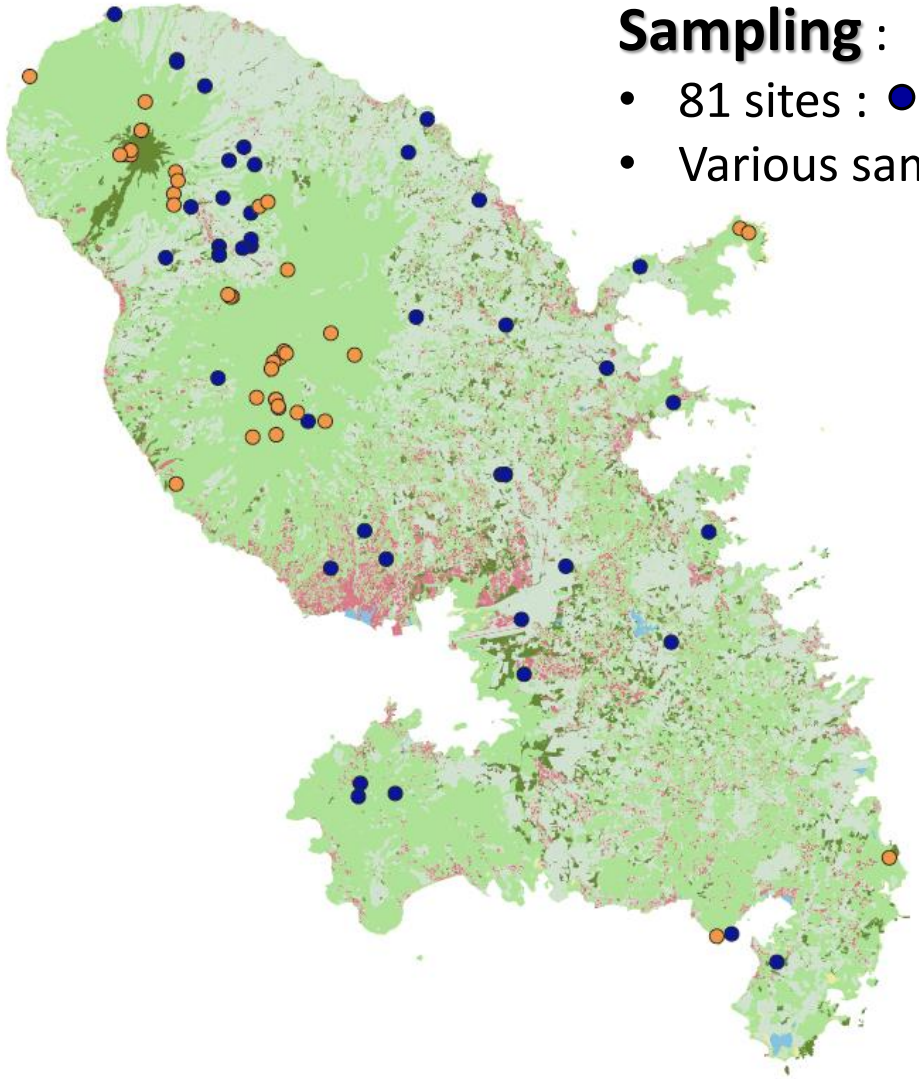

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Specimen identification

Morphological identification

↓

~ 35 morphotypes

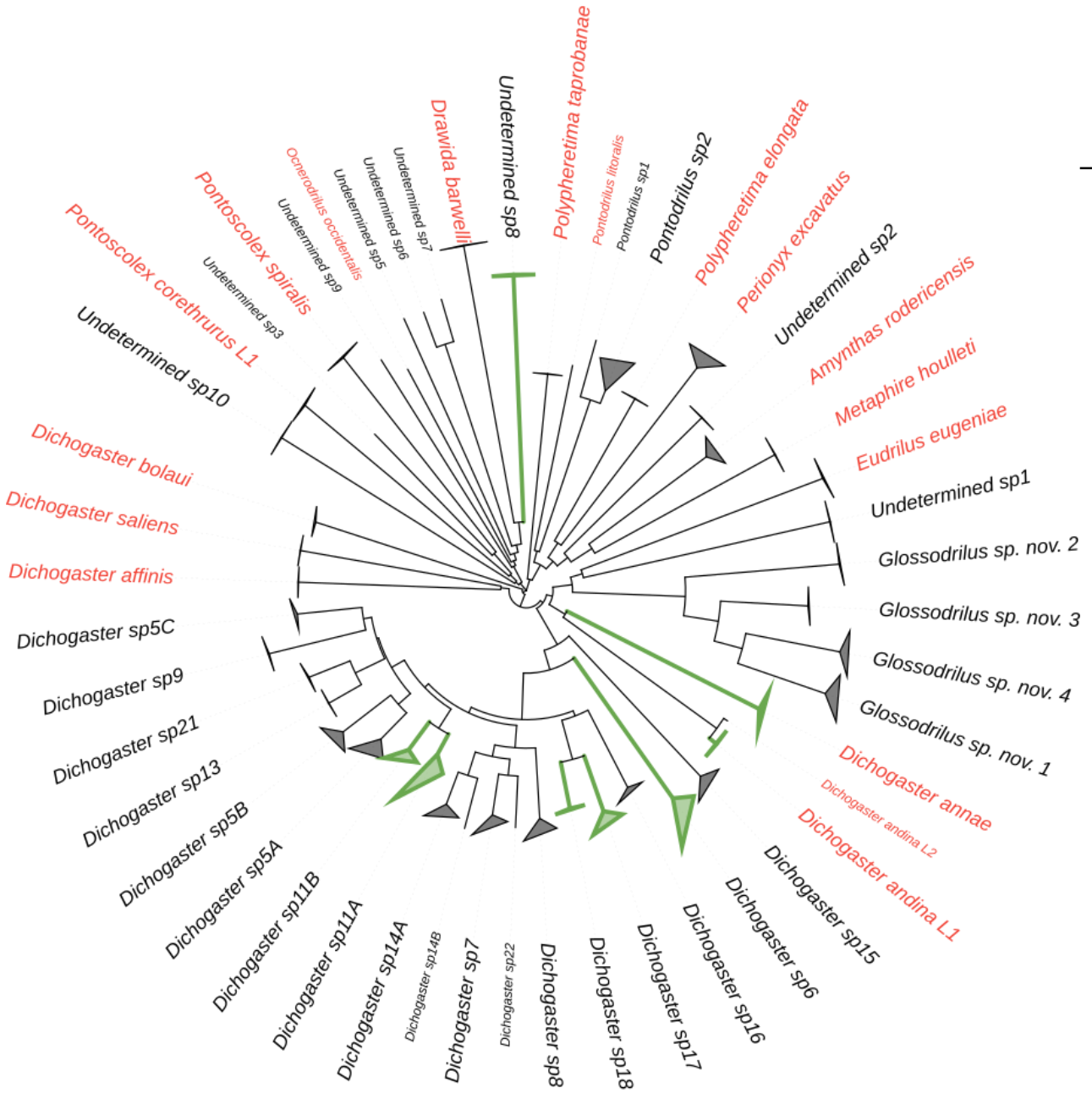
↓ ↑

DNA barcoding

→ sequencing of the mitochondrial gene cytochrome c oxidase I (**COI**)

→ Delimitation of Molecular Operational Taxonomic Units (**MOTUs**) using ASAP

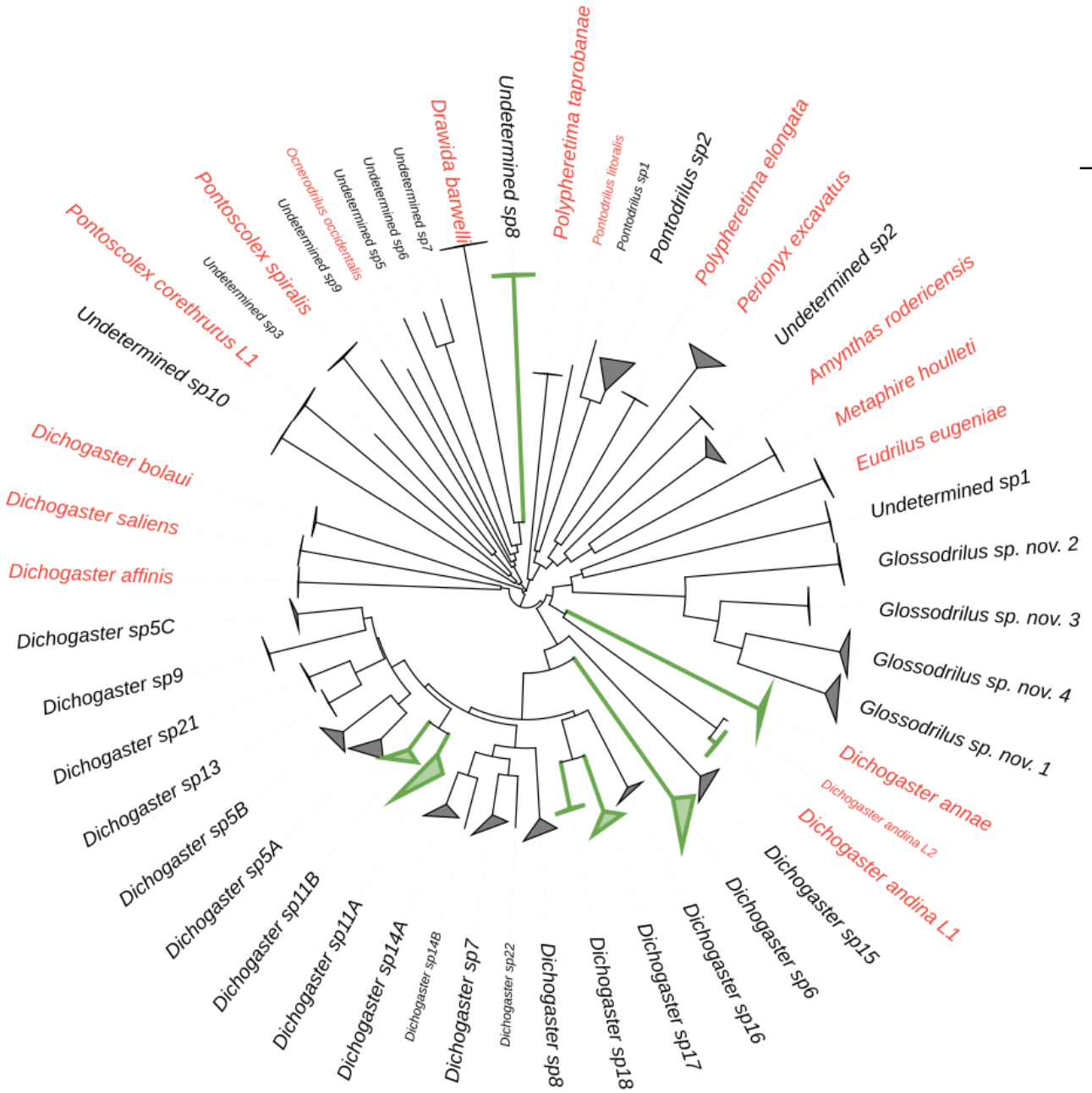
→ Querying the Barcode of Life Data Systems (**BOLD**)



High species diversity

→ 684 COI sequences

→ 50 MOTUS, 11 singletons



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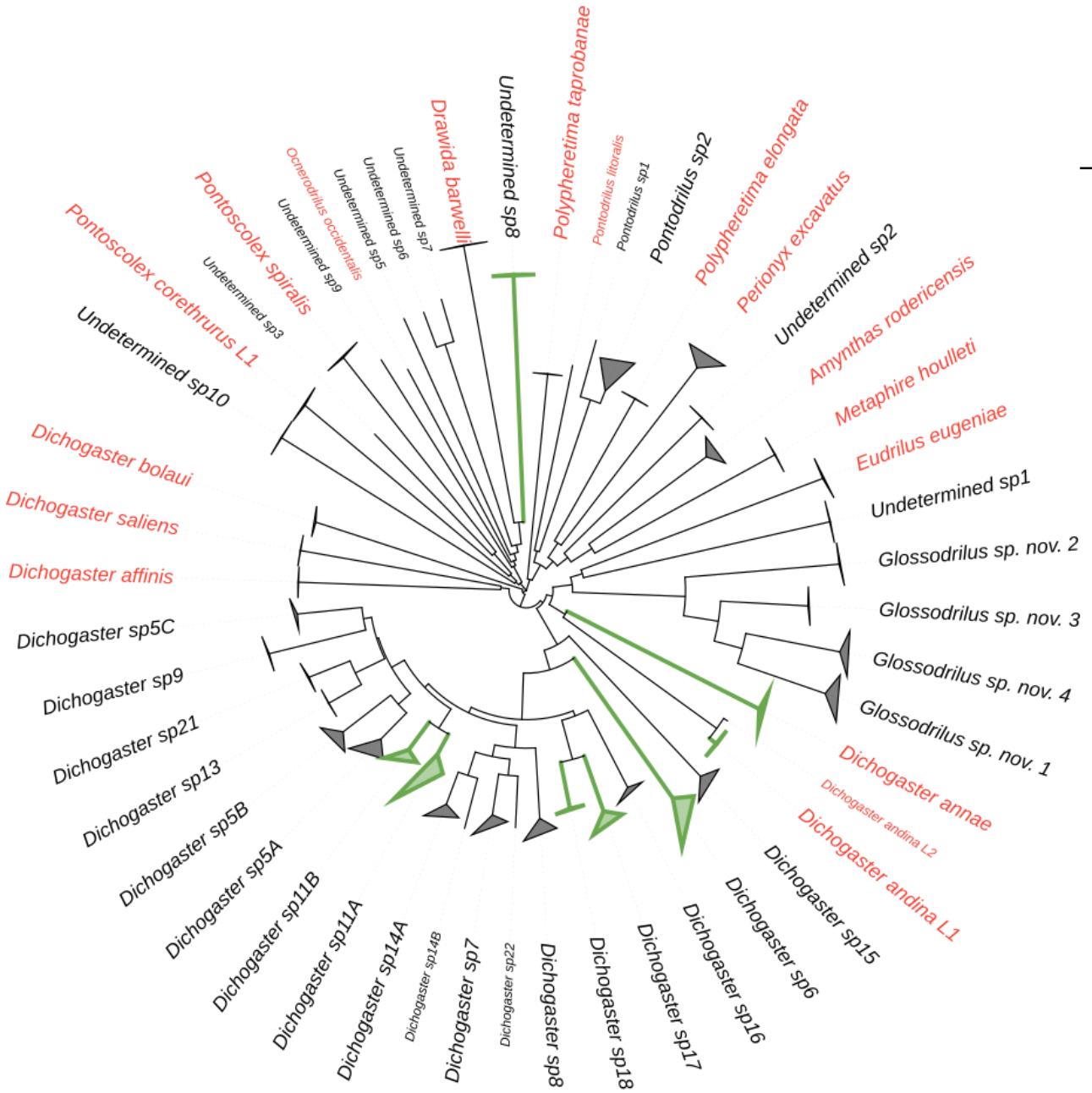
→ 17 **peregrine** species

→ Among the 33 native MOTUS :

potentially **new species**, some of which may be **endemic** to Martinique



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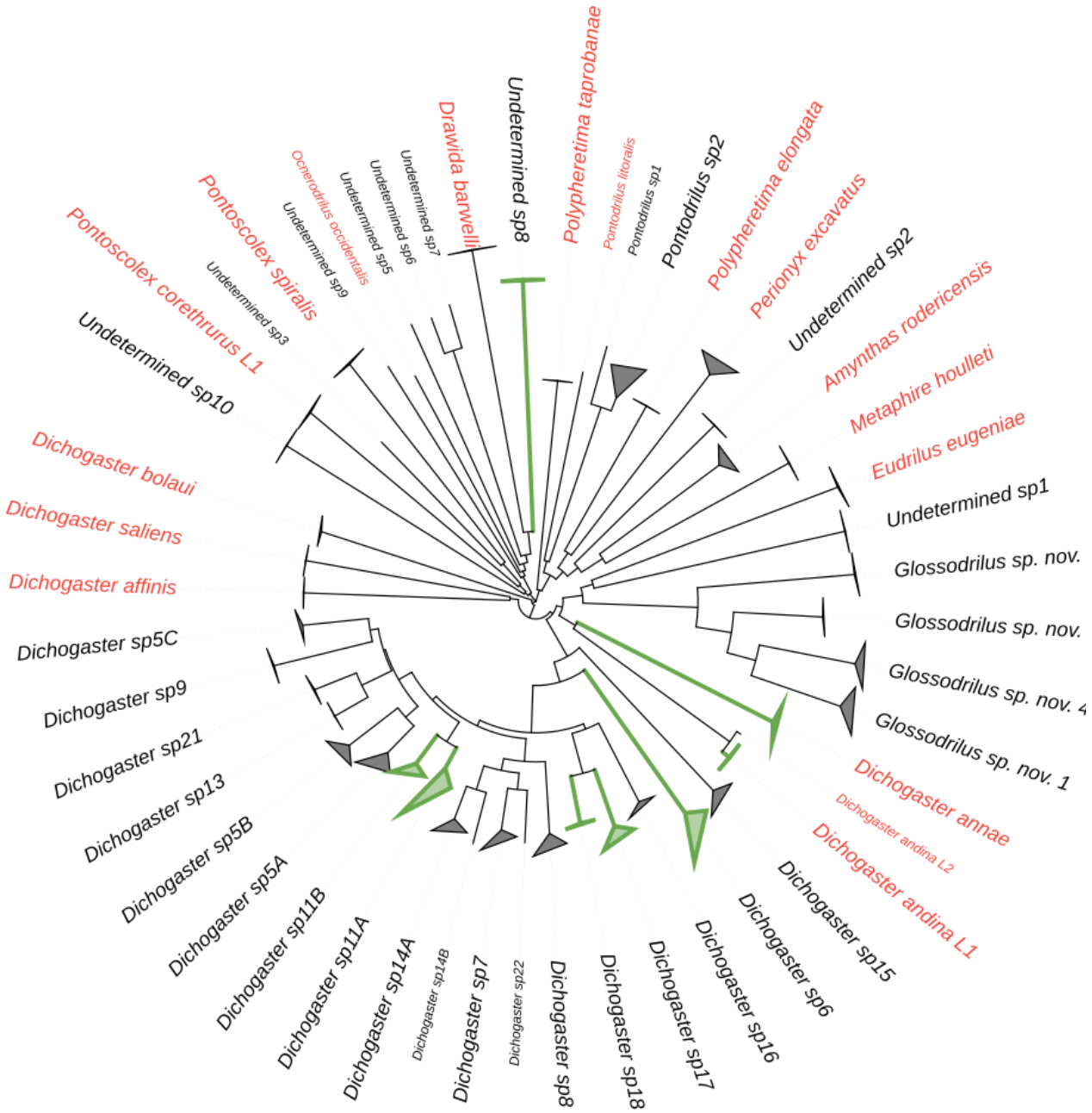
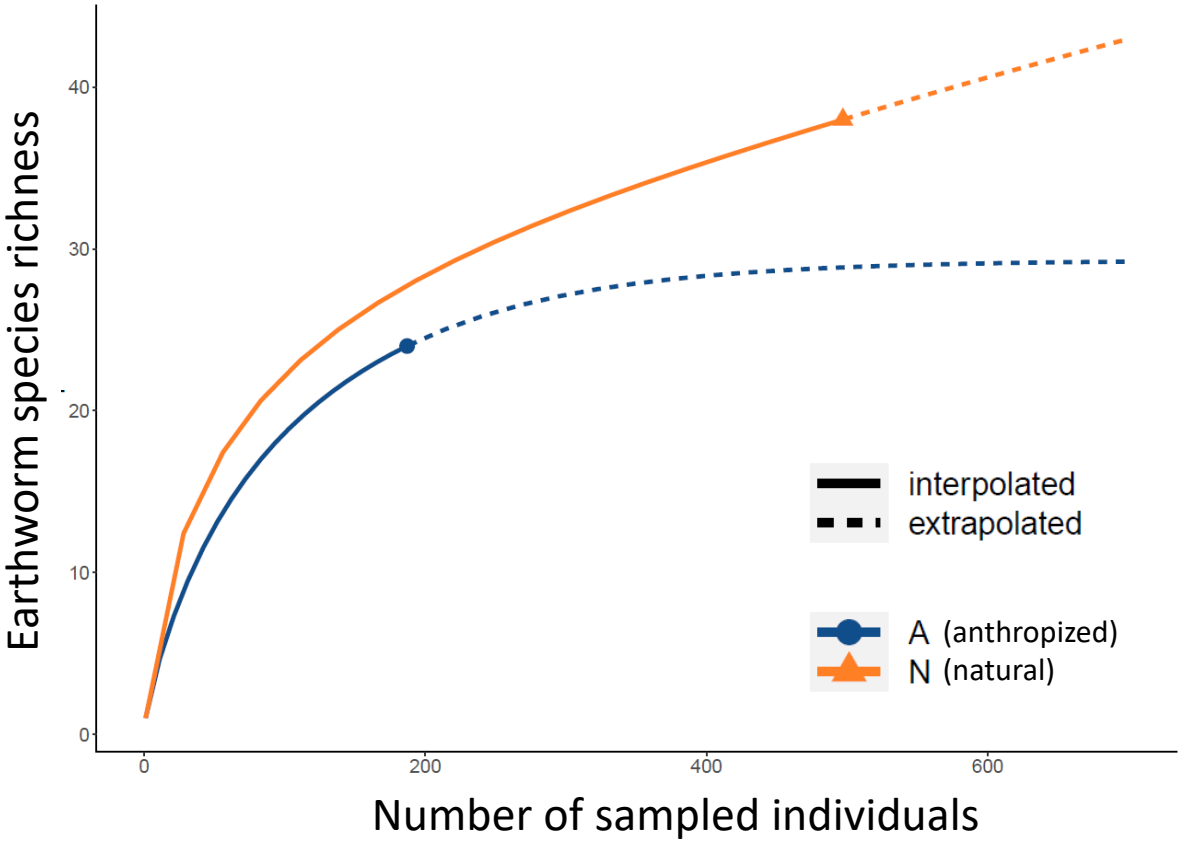
→ 8 **arboricolous species** including 6 that are potentially endemic

High species diversity



→ the sampling effort in natural environments is not yet sufficient



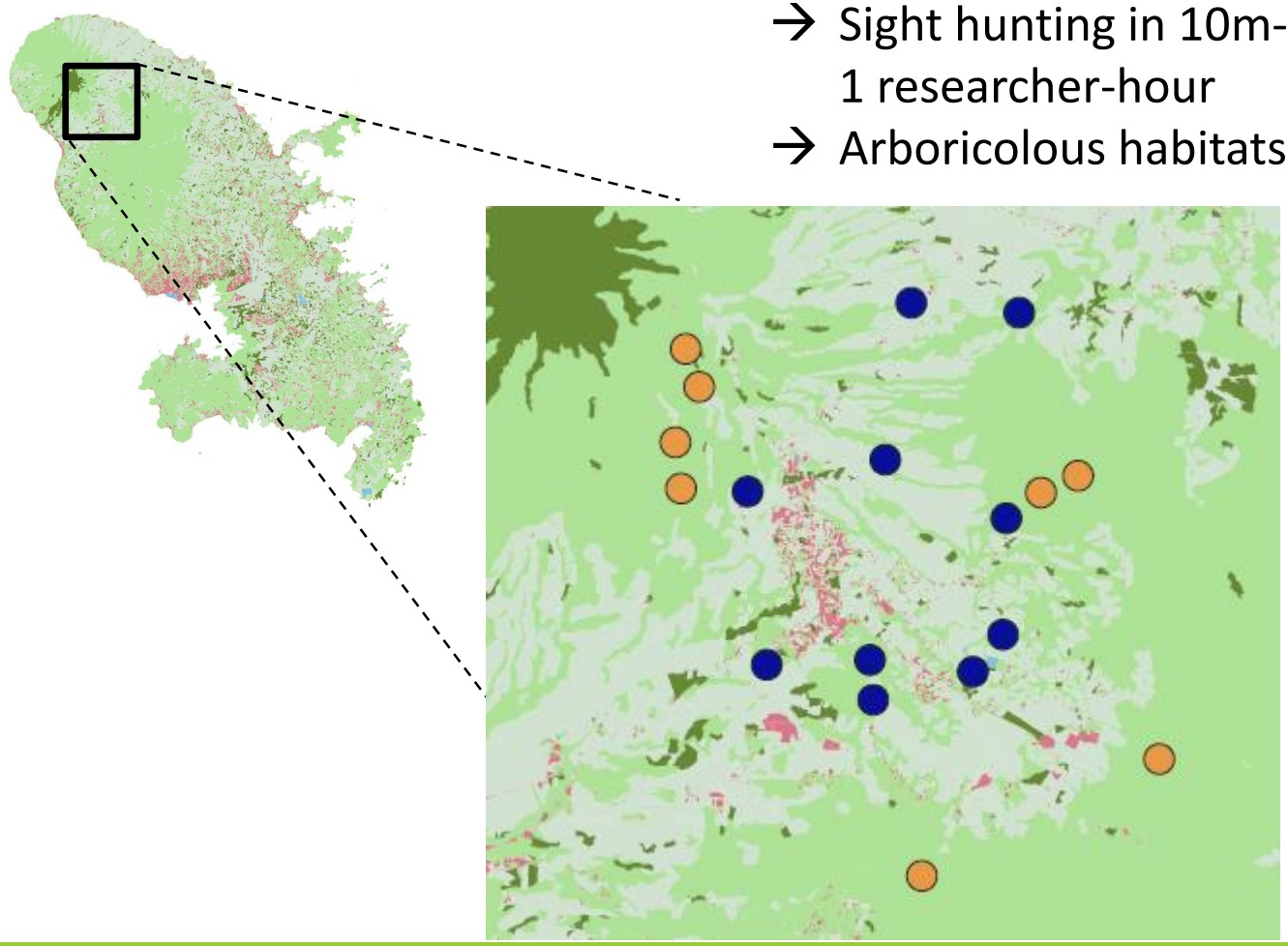
Impact of landscape on the diversity of arboricolous earthworms

Sampling using a standardized protocol :

→ 18 sites around the town of Morne-Rouge

→ Sight hunting in 10m-radius circle centered on a geolocated point, 1 researcher-hour

→ Arboricolous habitats



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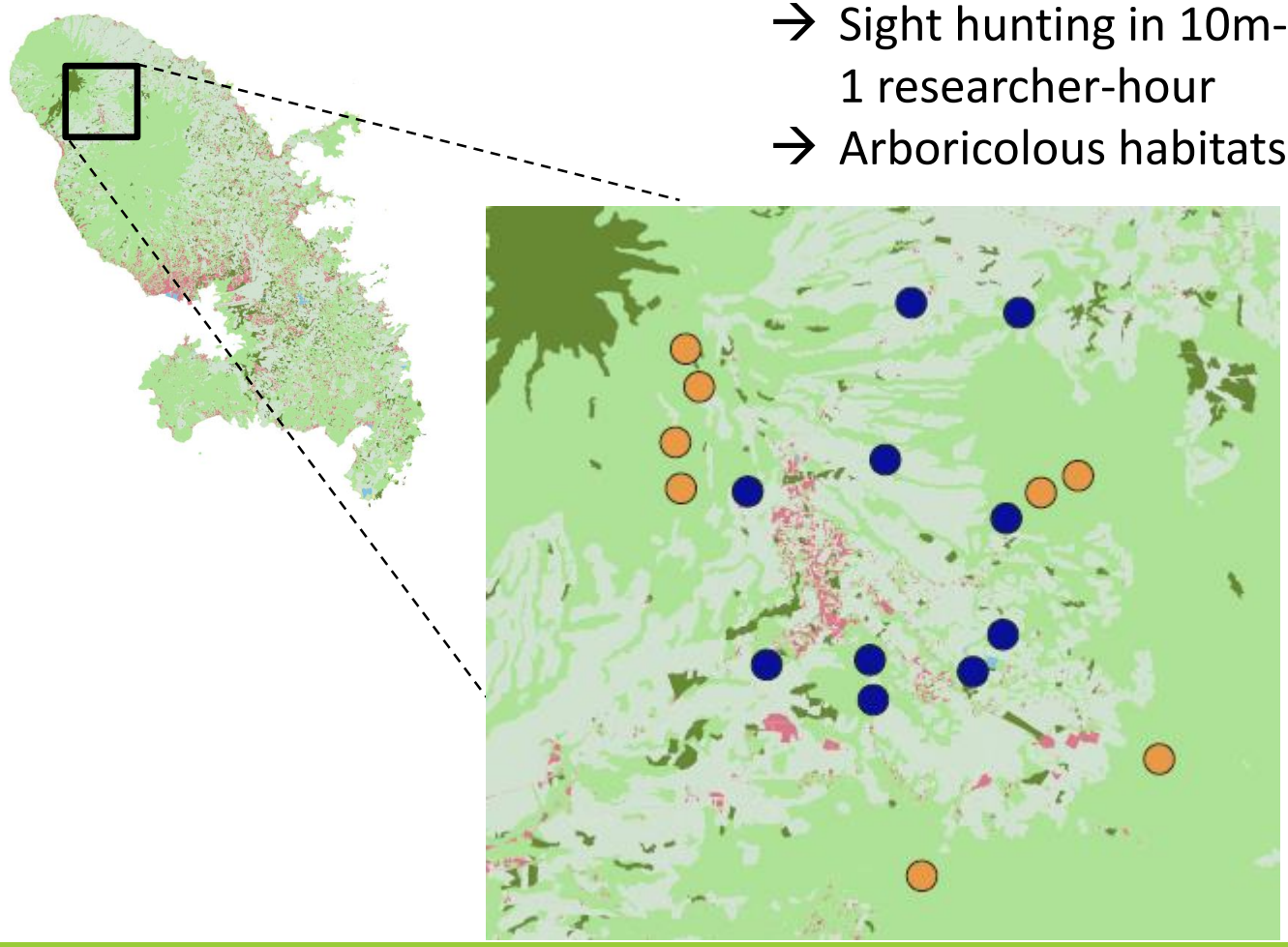

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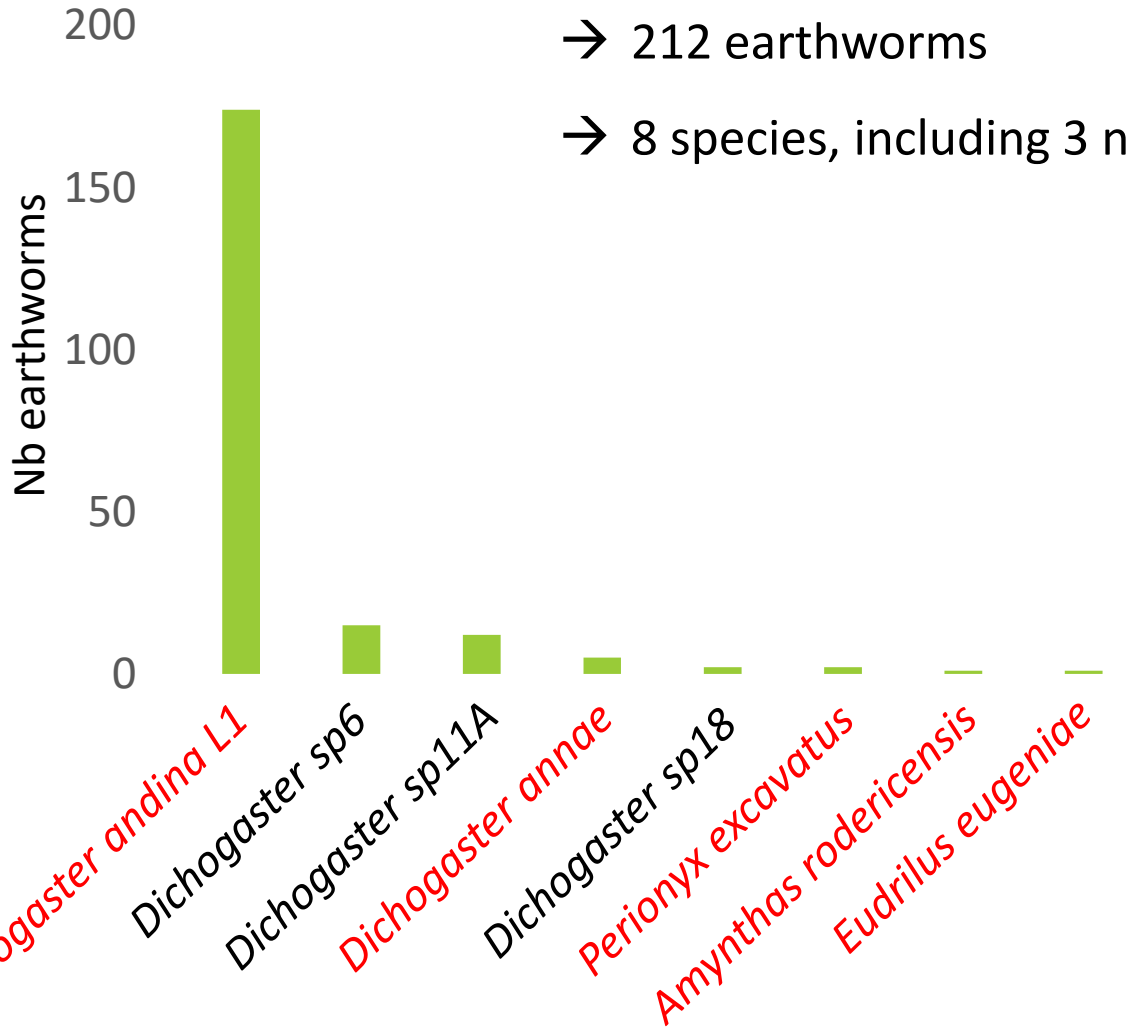
Landscape analysis :

→ At different buffer-zone scales (from 100 to 1000 m radius)

Few native species



→ 212 earthworms

→ 8 species, including 3 native ones

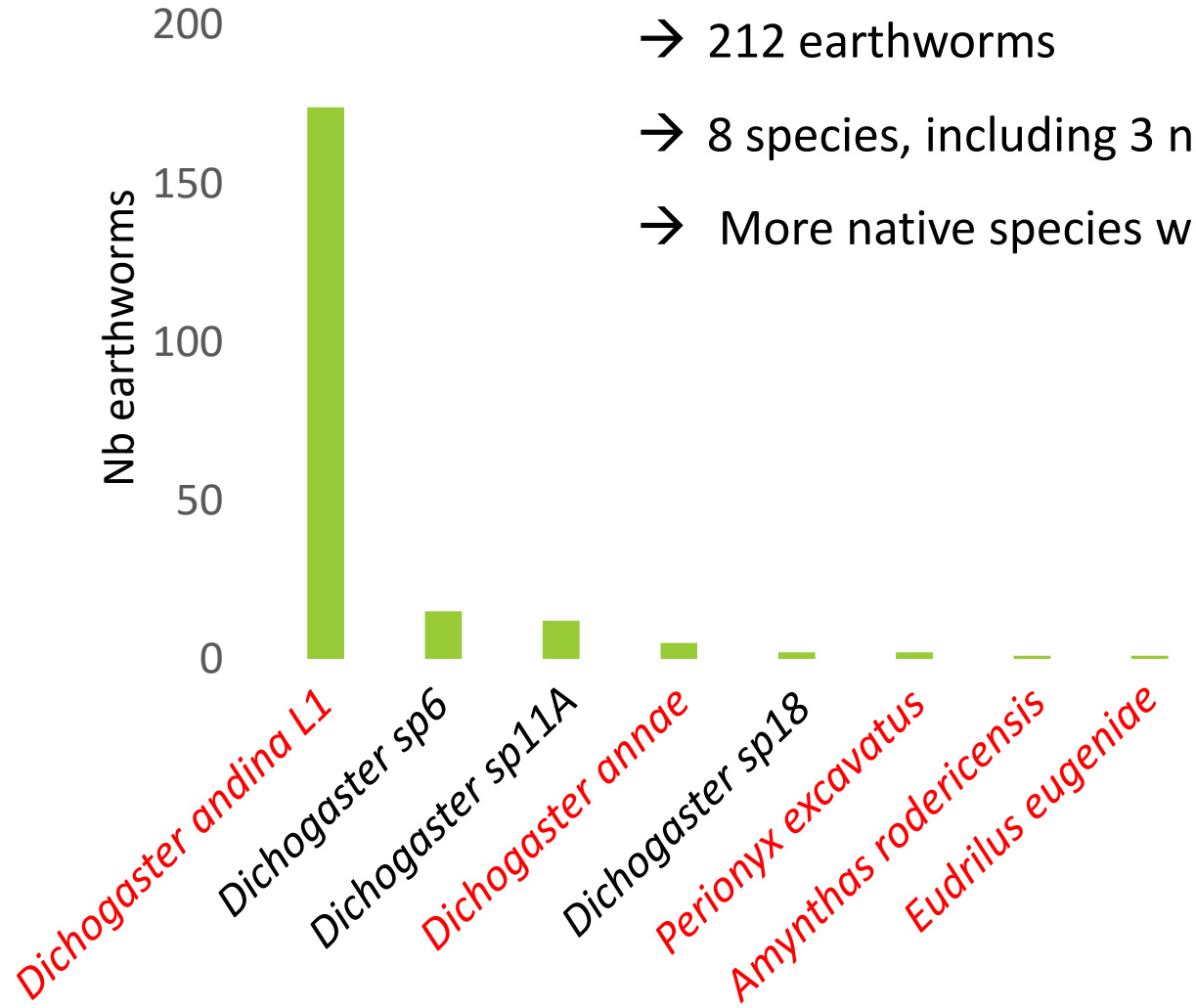
Dichogaster sp6 © M. Coulis

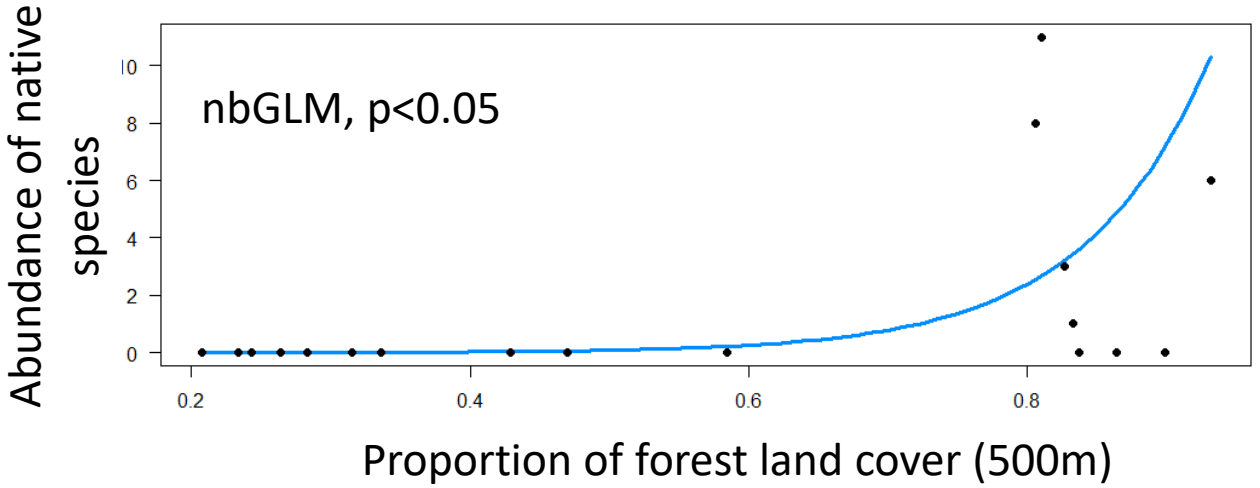
Few native species

→ 212 earthworms

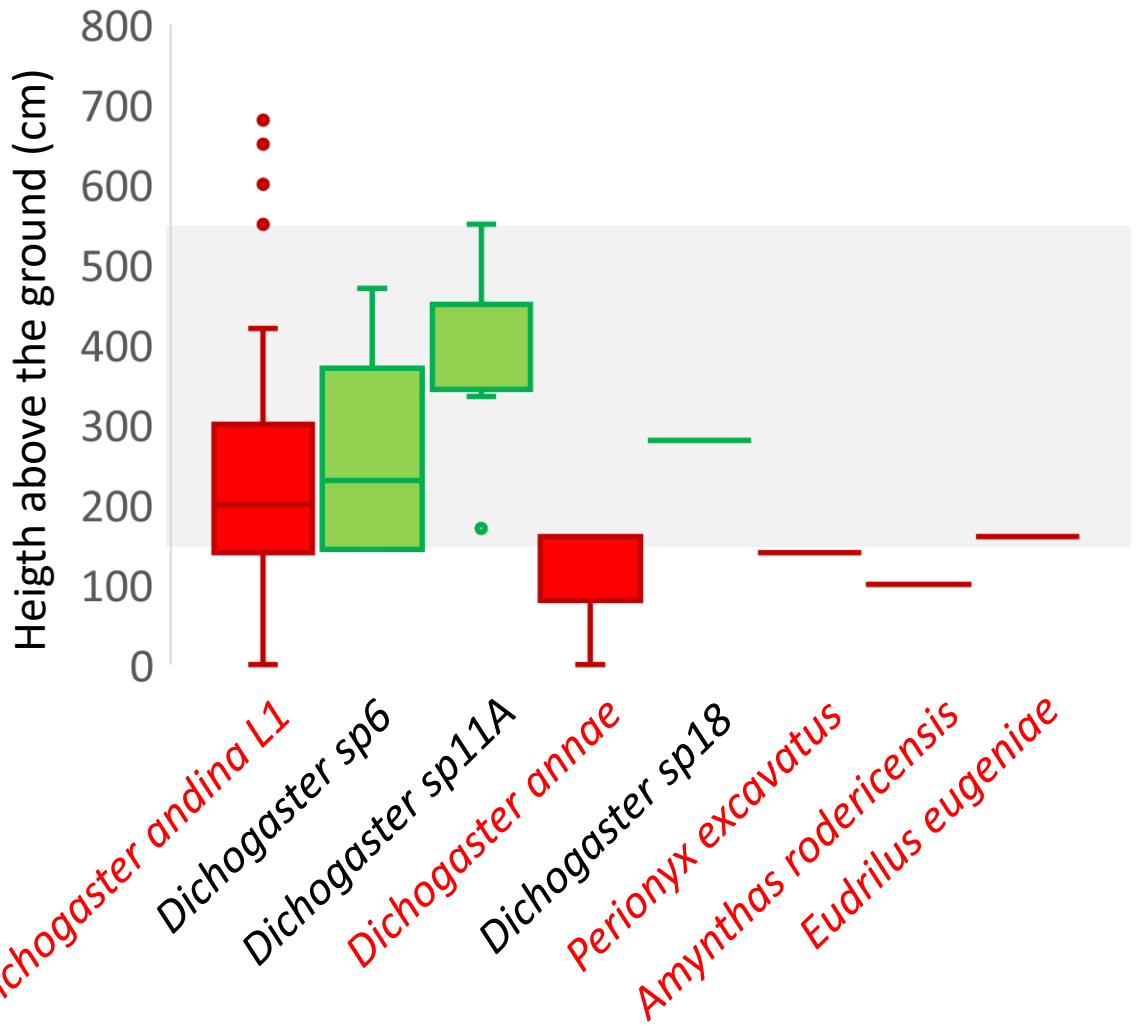
→ 8 species, including 3 native ones

→ More native species when proportion forest in 500m radius buffers > 75%





Omnipresence of a peregrine species



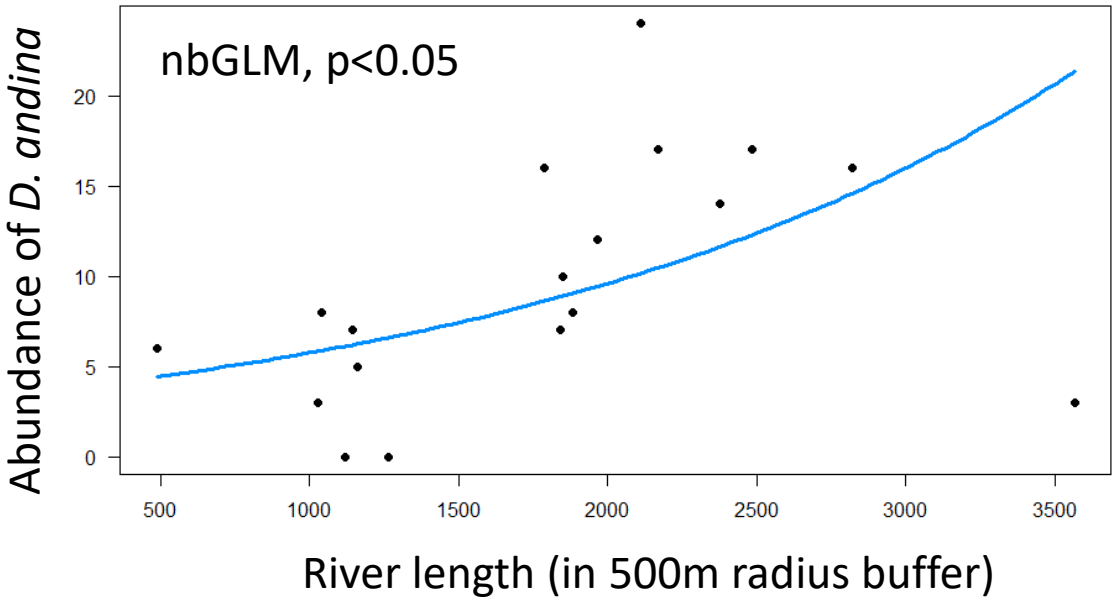
→ 82% of *Dichogaster andina*

→ found at every height above the ground

Has the potential to **outcompete** native species in anthropized habitats.

Dichogaster andina, invasive in Martinique ?


Dichogaster andina © M. Coulis



→ 203 individuals of the same COI haplotype

Recent founder effect and / or **clonal reproduction** *via* parthenogenesis ?

→ Rivers as potential vector of long distance **dispersal**?

Conclusion and perspectives

→ Constitution of a **DNA barcodes reference library** of earthworms from Martinique (684 seq)

→ Majority of **unknown species**

Specimens **morphological identification** (diagnostic characters)

Aim for future studies : Assigning unknown specimens to **known species**

Description of new taxa

Molecular phylogeny

Delineation of supra-specific groups

Phylogeography

Thank You

For Your Attention