Analysing the Phenology and Migration of *Panacea prola* under climate change

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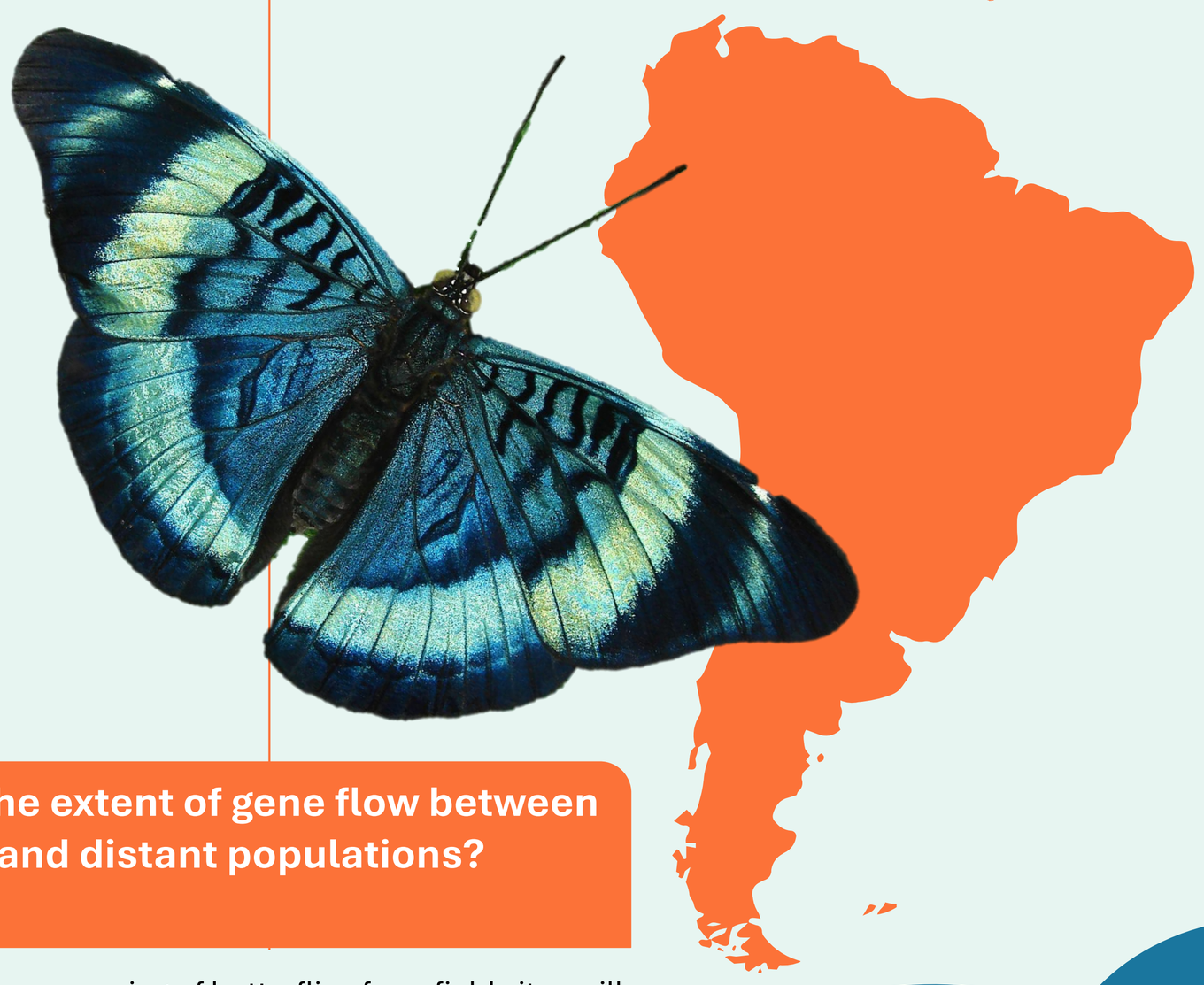
Panacea prola, commonly known as Red Flasher or Prola Beauty, has been observed making seasonal mass-movements north-east for the past 5 years at Finca Las Piedras field station, Peru[1].

Why study insect migration?

- Migration behaviour is an example of seasonal plasticity. Understanding how butterflies respond to seasonal fluctuations in environmental conditions can help us understand how they may respond to anthropogenic climate change.
- Seasonal mass-movements of insects have important implications for ecosystem functioning.
- Butterfly migration may be common in the tropics[2]. Seasonal movements of *P. prola* may be just one example of a prevalent yet little-studied phenomenon in the tropics.



1. Where does the migratory population originate from?

❖Stable isotope analysis will be used to determine the natal origins of the migratory population of *P. prola*.

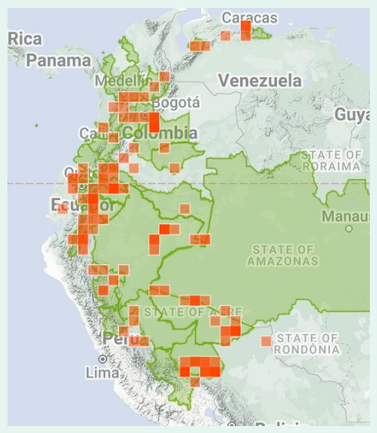
1. Hydrogen and Oxygen isotopes naturally vary in the landscape.
2. Caterpillars feed on plants with a particular isotopic signature.
3. Butterfly tissues contain the same isotopic signature as the landscape where they fed as larvae.
4. The isotopic signature of the butterfly tissue is matched to the isotope map, to find the origins of the butterfly.

2. Does the distribution of *P. prola* vary seasonally?

❖The distribution of *P. prola* in the dry season and the wet season will be mapped using GIS.

❖*P. prola* occurrence data from iNaturalist, GBIF, and museum collections will be used to map these distributions.

❖This will allow us to determine how distributions may vary seasonally with climate data.



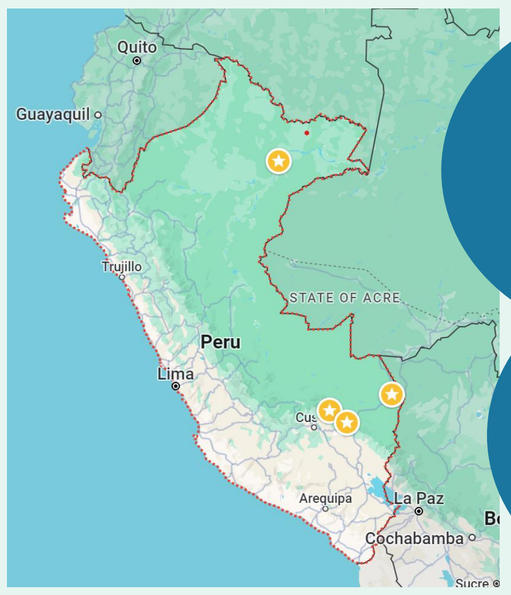
3. What is the extent of gene flow between local and distant populations?

❖Whole genome sequencing of butterflies from field sites will be used to determine whether there is gene flow between local and distant populations.

❖A higher degree of genetic variation would be expected if populations are migrating and mixing.

Field sites:

- Finca Las Piedras Research Station, Madre De Dios.
- Quince Mil, Madre De Dios.
- Manu National Park.
- Iquitos.



Can you help us?

P. prola is thought to be highly seasonal, but abundance data can be biased by a lack of systematic data collection in the rainy season. We are looking for people to help with the following:

❖Have you seen mass movements of *P. prola*? Where and when?

❖Have you noticed a large number of individuals during certain months of the year?

❖Do you systematically monitor butterfly abundance (including *P. prola*) in your local area?

❖Could you add *P. prola* observations to iNaturalist throughout the year, including during the rainy season?

Any and all help will be acknowledged and greatly appreciated!
Please contact me at j.c.stewart@qmul.ac.uk

Ayúdanos y participe en este proyecto!

Se supone que hay gran variación estacional en la abundancia de *Panacea prola* en la Amazonía, pero hay pocos estudios con colección sistemática de datos de abundancia durante todo el año, particularmente en la época de lluvia.

Buscamos gente (investigadoras/investigadores, estudiantes, otros interesadas/os) para ayudarnos con lo siguiente:

•Has observado movimientos migratorios masivos de *Panacea prola*? En donde? Cuando?

•Has observado picos en abundancia durante ciertas épocas del año?

•Estás haciendo monitoreo sistemático de abundancia de mariposas en tu area local? Pudieras compartir datos o muestras?

•Pudieras añadir tus observaciones de Panacea prola a iNaturalist durante todo el año, incluso en la época de lluvia?

Cualquier información, ayuda o colaboración que pudieras compartir te agradeceríamos!
Favor contactarme en j.c.stewart@qmul.ac.uk

References:
1. Gallice, G., Mattea, R., & Stoiser, A. (2020). First evidence for an Amazonian insect migration in the butterfly Panacea prola (Lepidoptera: Nymphalidae). *bioRxiv*, 2020.09.01.277665. https://doi.org/10.1101/2020.09.01.277665
2. Chowdhury, S., Zalucki, M. P., Amano, T., Woodworth, B. K., Venegas-Li, R., & Fuller, R. A. (2021). Seasonal spatial dynamics of butterfly migration. *Ecology Letters*, *24*(9), 1814–1823. https://doi.org/10.1111/ele.13787
3. Prola Beauty | *Panacea prola* | Photos © Florida Museum, by Ryan G. Fessenden
4. *P. prola* resting on leaf. Available at: https://www.sangay.eu/en/fiche-papillon/017-Nymphalidae/005-Biblidinae/005-Ageroniini/003-Panacea/005-prola+/amazonica
5. *P. prola* observations iNaturalist. Available at: https://www.inaturalist.org/observations?place_id=any&subview=map&taxon_id=423866