

BINF 6210 Assignment 1

# Investigating the biodiversity and Ecological distribution of Actias Species

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Graphics: Canva



# Introduction and Background

The **Actias** genus, also known as luna moth or moon moth is a nocturnal species consisting of over 45 bINs.

They belong to the Order Lepidoptera, and the family Saturniidae.

This genus shows remarkable morphological genetic diversity and variation within and between species and at the rate new species are being classified, we can assume that there are some species within the genus that have likely been yet to be discovered, classified and barcoded.

The **Actias** spp. has been mainly described to inhabit North America, India, China, Japan, and many other countries in Southeast Asia (Chou, 2025).



Variation within the "Actias" Genus taken by Shawn Hanrahan

# Introduction and Background

## Life cycle of the *Actias* spp.



## Fun facts about *Actias* spp.

- These moths are nocturnal
- Adult moths only live for a week
- Adult moths lack functional mouth parts and a digestive system
- *Actias luna* (Luna moths) are one the largest moths in America, with an average wingspan of 5 inches
- The moon moth species have distinctive spiral tails at the end of their wings, these are used to disrupt the echolocation of their natural predator, the bat.

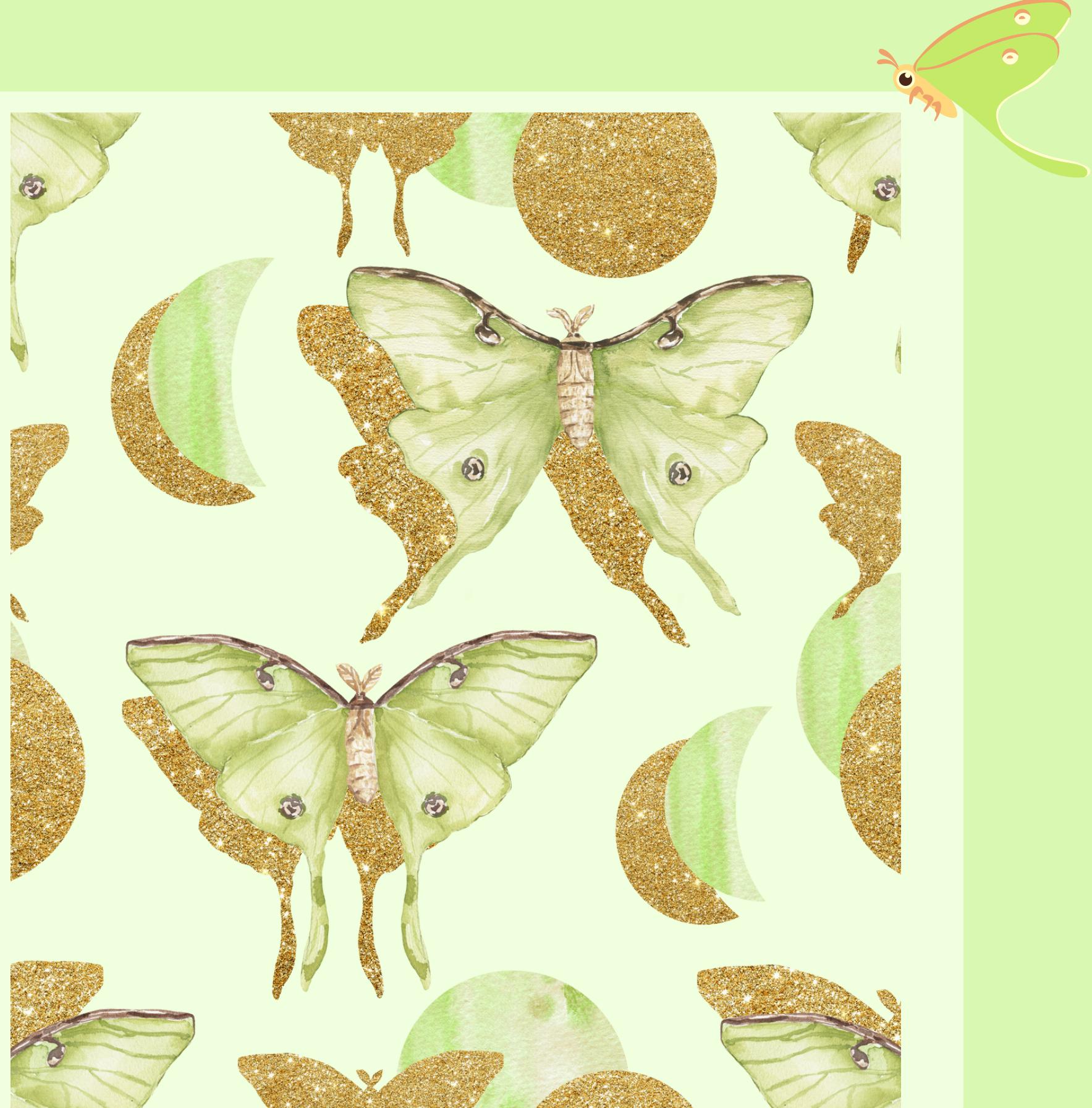
## How can we help?



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# Research questions

- Determining the ecological distribution of barcoded BINs on a global scale
- Determining what region has the most recorded BINs
- Investigating Species completeness for barcoded individuals in the *Actias* ssp.



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# There is a higher occurrence of BINs in East Asia compared to North America

Global Distribution of *Actias* spp.

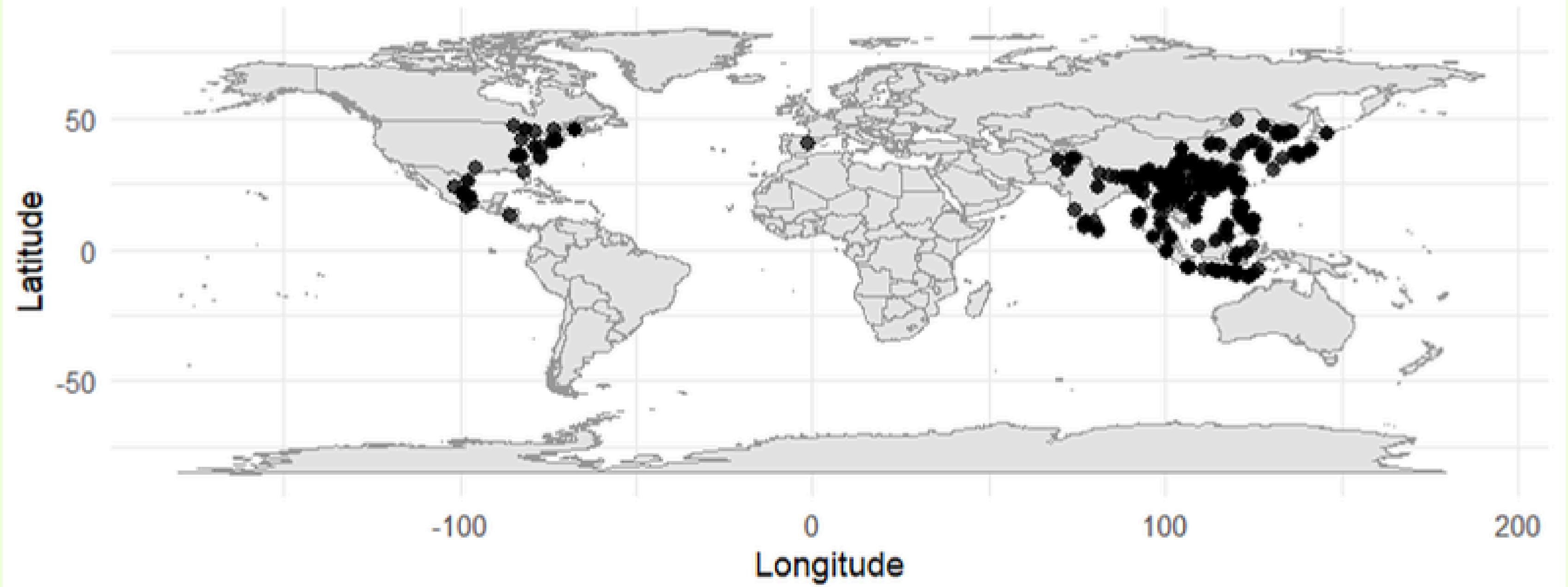


Figure1

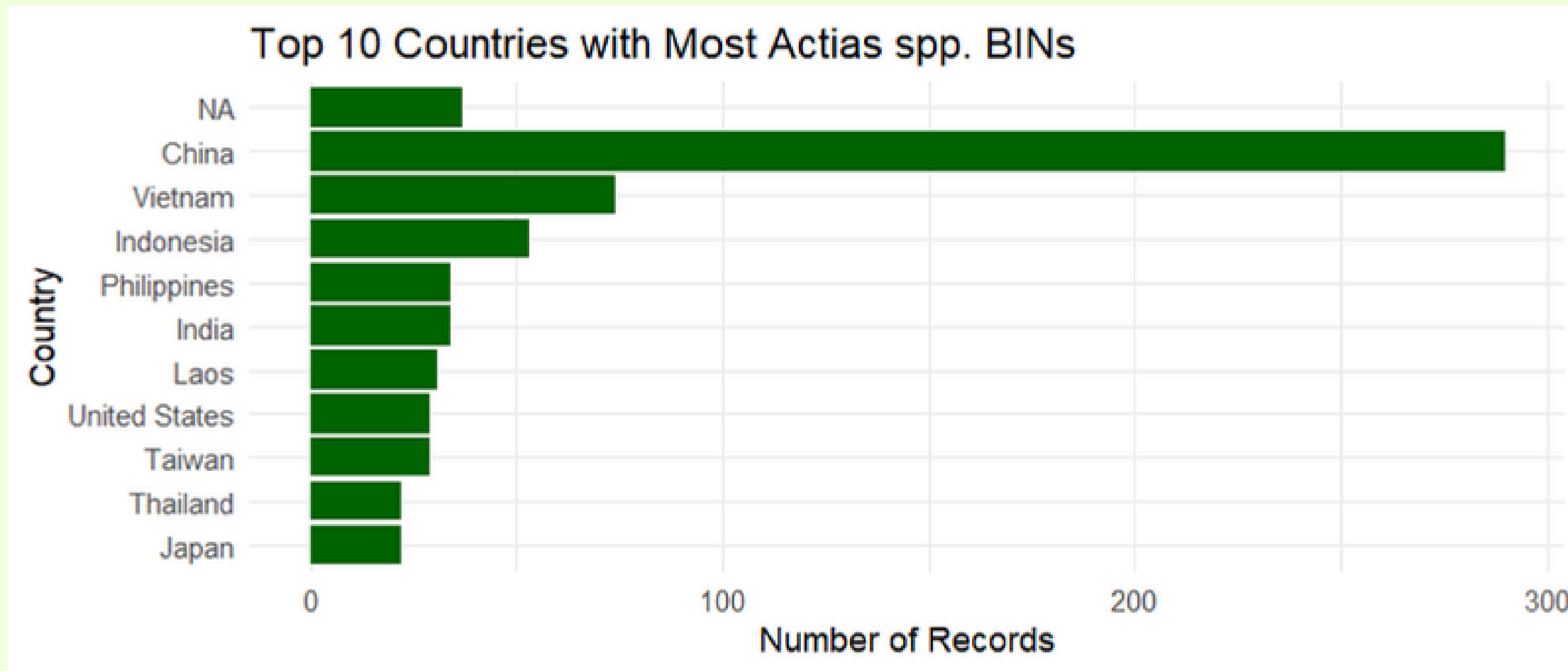
# **Figure 1 discussion**

**The Geographical distribution in figure 1 suggests that the *Actias* species is somewhat ubiquitous, as it is shown to occur from North America to East and South East Asia.**

**It also shows that the South East Asia is richer and more diverse based on the variety and quantity of barcoded BINs in the region.**

**More maps were constructed to properly visualize the distribution within North America, East and South East Asia respectively. These can be found in the R script file.**

# China has the most barcoded BINs in the dataset



**Figure 2**

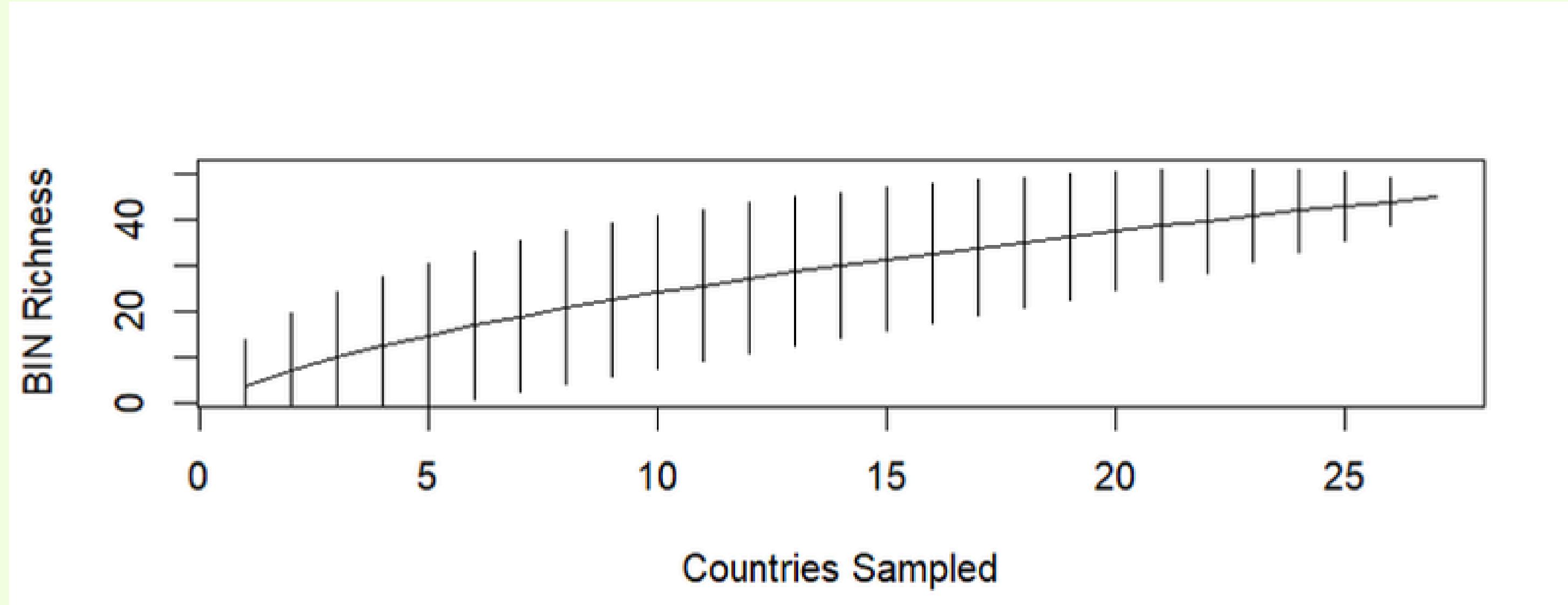
# **Discussion of figure 2**

**In figure 1, the global distribution of the barcoded BINs showed that the most barcoded species come from East Asia.**

**Figure 2 was used to determine the top 10 countries of 27 countries, contained the with the most barcoded species.**

**There are at lease quarter of a hundred barcoded BINs classified under NA due to the lack of country of origin and collection when it was uploaded to the database.**

# Species Accumulation curve shows that there are likely more species yet to be barcoded



The results shown in the species accumulation curve suggest that as more countries are sampled, the number of species or BINs increases.

# Why is East Asia shown to be more ecologically rich in *Actias* spp. BINs

Based on the figures shown, and visual analysis of the barcoded BINs on the BOLD data base, we can infer that the *Actias* spp. can be found in North America, all the way to East Asia. Though based on this analysis, there is more ecological diversity in East Asia.

Why could this be?

- Firstly, its best to assume that there are more species that haven't been barcoded, supported by the results of the species accumulation curve.
- Secondly, there could be sampling bias, meaning there are some regions that have an *Actias* spp. that simply hasn't been barcoded due to lack of interest from researchers

Thirdly, the diversity could be due to the climate and ecosystem present in East Asia. As stated by Grier (2025), the countries in the East Asia region are classified within the ASEAN region, an area that boasts rich biodiversity due to its latitudinal variations in temperature and precipitation. The region is home to vast tropical forests, temperate forests, large river basins and the 'coral triangle' reef.

In conclusion, there is more work to be done when it comes to determining and classifying new species, not only in the *Actias* Genus but also in the discovery of novel, yet to be identified and classified species



Jiuzhaigou landscape with green water in Sichuan, China

# Credits and Acknowledgement

- BOLD connect R" package from the bold system as suggested by Maddie to produce a geographical distribution map of my data set, although I couldn't figure out how to use it properly with my data set, so I used the in built ggplot2 and maps packages in my R library. I will go through online documentation provided by Package 'BOLDconnectR' and maintained by Sameer Padhye.
- I was having issues with my data set not recognizing columns. Stephanie let me know that the solution would be to put the column name in quotations as 'country/ocean' because when in doubt, use quotations. As she said "When in doubt use quotations.
- The code below only retrieved the number of objects in the 'country/ocean' rather than listing the variables assigned to countries. dfBOLDactias %>% count('country.ocean', sort = TRUE)
- I asked Maddie what she thought the issue was and she told me she had the same issue because her data set had a similar issue with the way the columns were named. She let me know I should've used the backwards quote (`) rather than the ('). After changing this, my code ran properly.
- I had issues with my column names in my data set being written as "country/ocean", and "province/state", I ended having to download the janitor package to format the columns my data frame into "country.ocean" and "province.state"
- I wanted to plot a global map of the distribution of the Actias species but my data set does not contain latitude and longitude values, Maddie and Bartek told me their data sets also only contained coordinate values and that they had to split them into longitude and latitude columns so below I am breaking my coordinate values to obtain my lat and long values to plot a global map

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