Talk Outline

• Introduction
• Working Hypothesis
• Methods
  – Study System
  – Quantification of Sampling Effort
  – Computer Simulation Experiment
• Results
• Conclusions & Implications
Species’ Range Size Distributions

# of Species vs. Range Size

Gaston, 2003
Species’ Range Size Distributions

Mean of Range Size Distribution

# of Species

Range Size
Species’ Range Size Distributions
Species’ Range Size Distributions

Mean of Range Size Distribution 1

Mean of Range Size Distribution 2

# of Species

Range Size
Means of Range Size Distributions for Vascular Plants

Morueta-Holme, et al. 2013
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A quantitative model that relates the effects of sampling effort to bias in estimates of the mean of range size distributions.

\[ \text{(Working Hypothesis)} \]

Where \( P_m \) is the probability of not discovering a species, \( d \) is detectability, \( Ci \) is sampling effort, \( AOO \) is geographic range size measured as area of occupancy.
Working Hypothesis

longitude

latitude

x

x

x

x

x

x

x
Working Hypothesis

Sampling Effort
Bias in Estimates of the Mean of Range Size Distributions is defined as:

\[(\text{Mean Range Size of discovered species} - \text{Mean Range Size of all species})\]
Working Hypothesis

Sampling Effort
• **Prediction 1**: As mean sampling effort increases, the bias in the estimate of the mean of range size distributions will decrease.
Aggregation in Sampling Effort
Working Hypothesis

- **Prediction 2**: As spatial aggregation in sampling effort increases, the bias in the estimate of the mean of range size distributions will increase.
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Quantification of Sampling effort

- 986,107 herbarium specimen records used
- Collector Days = unique combinations of collector name and collection date (Sheth, et al. 2012)
Quantification of Sampling effort

longitude

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latitude

10 km

10 km
Quantification of Sampling effort
Quantification of Sampling effort
Quantification of Sampling effort

Mean Collector Days

Relative Frequency of 100 x 100km cells

0.00 0.05 0.10 0.15 0.20 0.25 0.30 0.35

Mean Sampling Effort

-4 -2 0 2 4

Andes: 113 grid cells
Amazon: 157 grid cells
Quantification of Sampling effort

Mean Collector Days

Spatial Aggregation in Collector Days
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Computer Simulation Experiment
Computer Simulation Experiment
Computer Simulation Experiment
Computer Simulation Experiment
Computer Simulation Experiment

100,000 Species
Bias in Estimates of Mean Range Size is defined as:

\[
\text{Bias} = \left( \text{Mean Range Size of discovered species} - \text{Mean Range Size of all species} \right)
\]
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Prediction 1: As mean sampling effort increases, the bias in the estimate of the mean of range size distributions will decrease.
**Prediction 1:** As mean sampling effort increases, the bias in the estimate of the mean of range size distributions will decrease.
**Prediction 2**: As spatial aggregation in sampling effort increases, the bias in the estimate of the mean of range size distributions will increase.
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Conclusions

• **Mean sampling effort** is higher in the Andes than Amazonia.

• **Spatial aggregation** of sampling effort is lower in the Andes than Amazonia.
Conclusions

• **Mean sampling effort** has a negative relationship with bias in estimates of the mean of range size distributions.

• **Spatial aggregation** in sampling effort has a positive relationship with bias in estimates of the mean of range size distributions.
Implications

• Current descriptions of geographic variation in RSD (Morueta-Holme, et al. 2013) and the density of narrowly distributed plant species across the Neotropics (Myers, et al. 2000; Pimm, et al. 2014) may be more fiction than substance, and should be regarded as highly tentative at best.
Acknowledgments

• David Bogler
• Burgund Bassuner
• The Center for Conservation and Sustainable Development
• 2014 REU interns at the Missouri Botanical Garden.
• National Science Foundation.
Questions?