

# Abundance and $\alpha$ -diversity

October 18, 2019

# Count Data

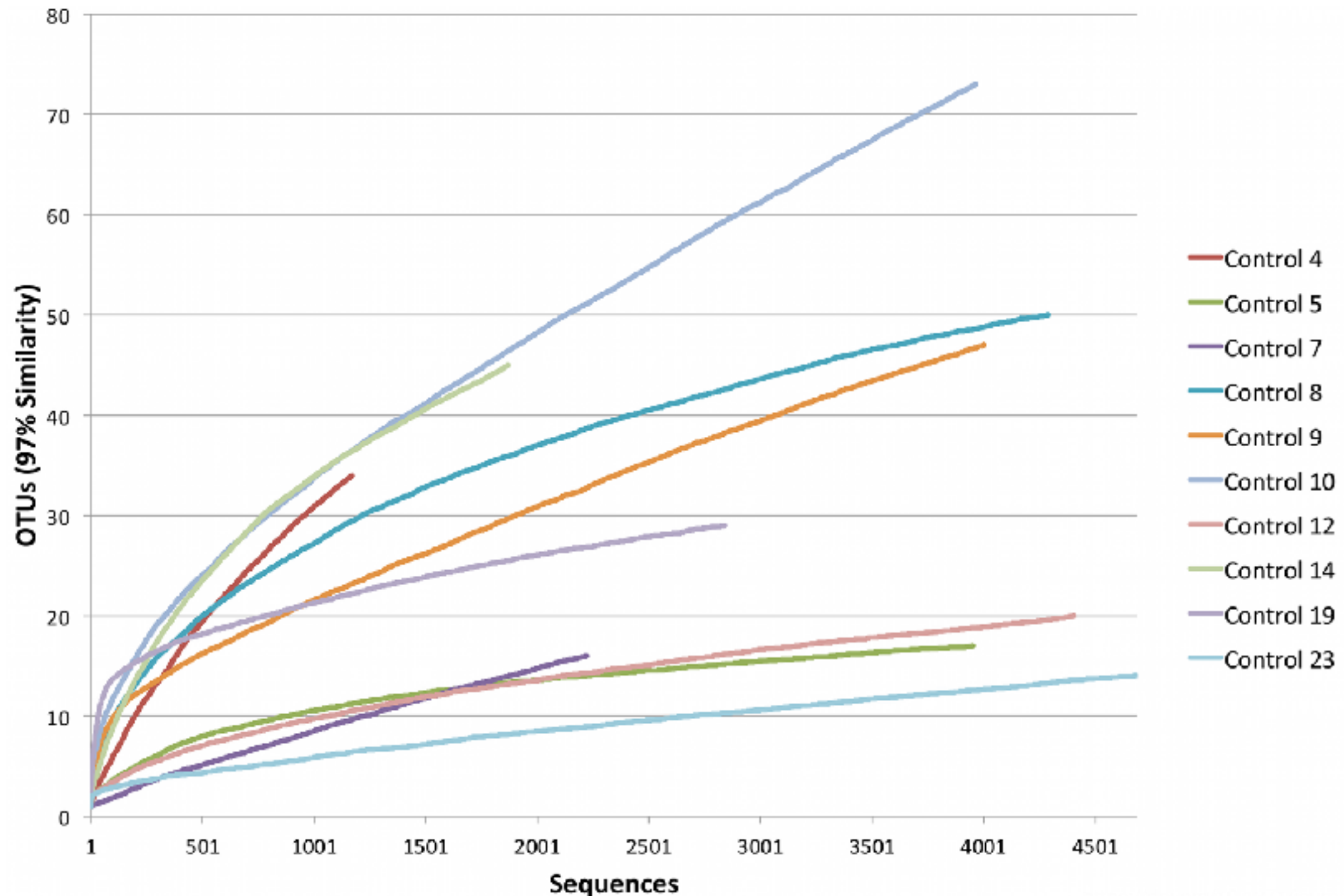
	OTU 1	OTU 2	...	Meta 1	Meta 2	...
Sample 1						
Sample 2						
...						
Sample N						

P

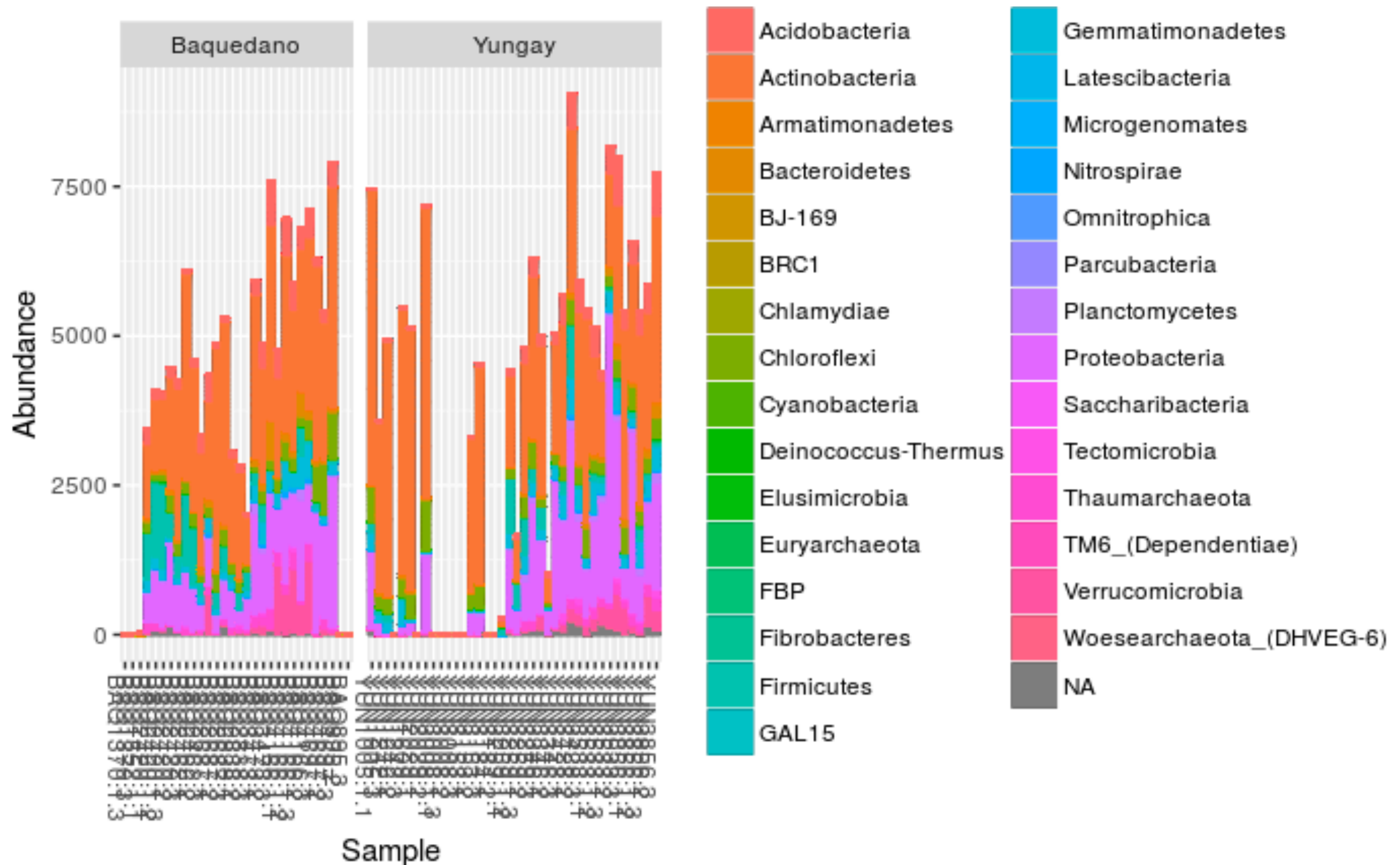
N

# **Exploratory Analysis and Quality Control**

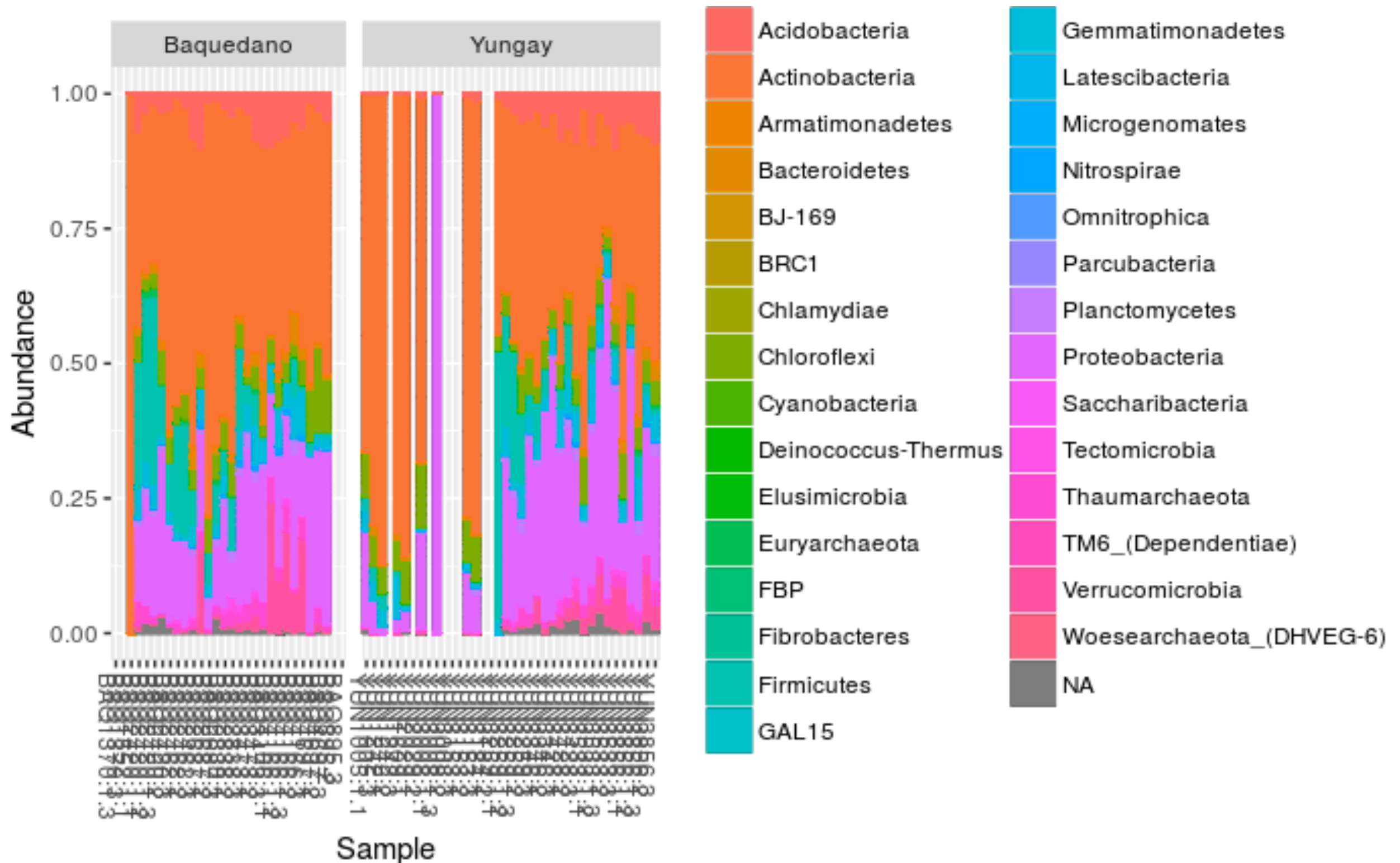
# Collector's Curves (aka rarefaction)



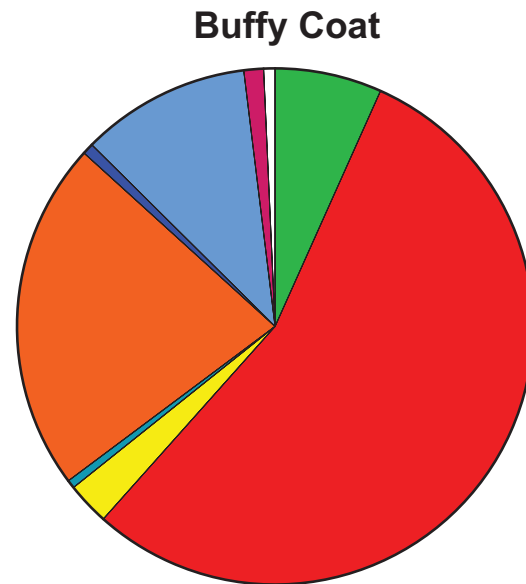
# Absolute Abundance



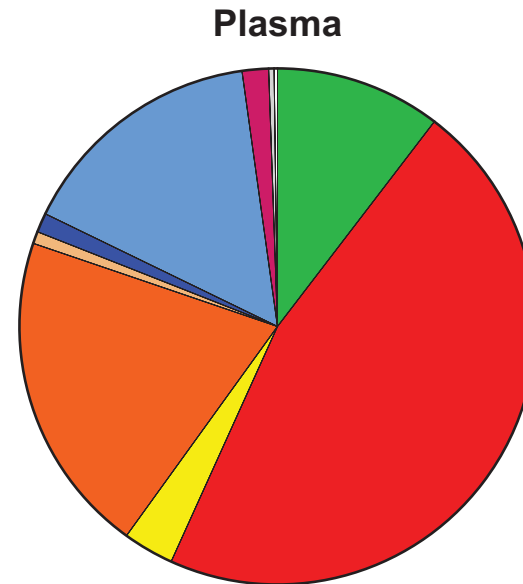
# Relative Abundance



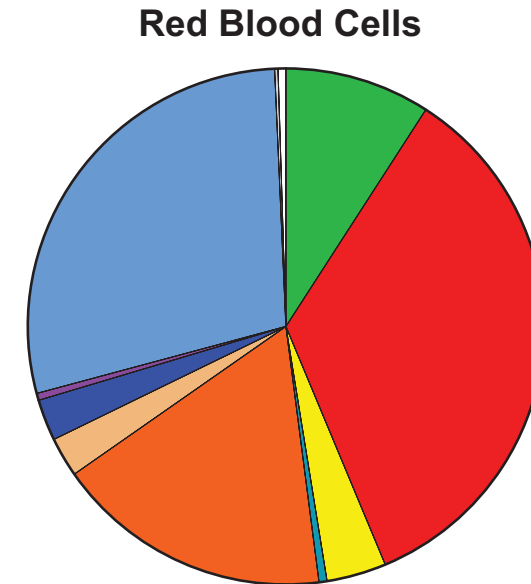
# Bad Figures: Pie Charts



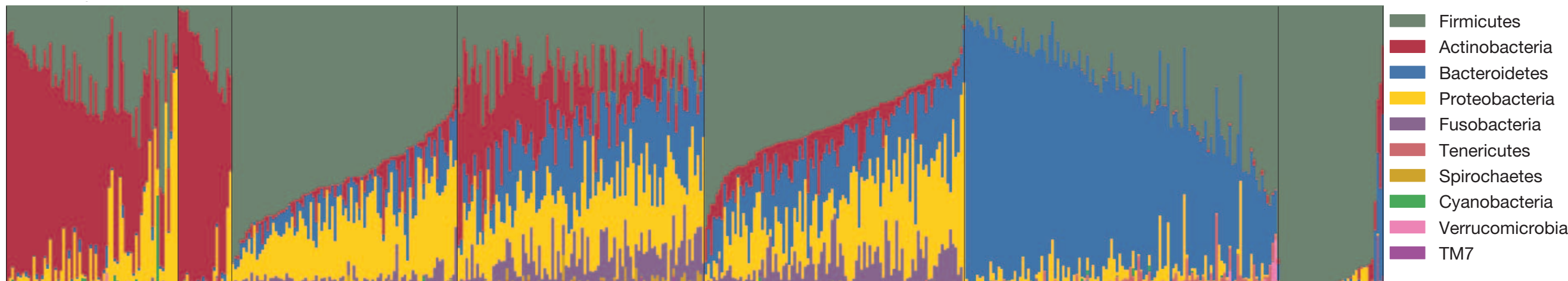
6.70% Actinobacteria  
54.89% Alphaproteobacteria  
2.68% Bacilli  
0.52% Bacteroidia  
21.94% Betaproteobacteria  
0.70% Flavobacteria  
10.63% Gammaproteobacteria  
1.23% Sphingobacteria  
0.71% Other (<0.40%)



10.40% Actinobacteria  
46.36% Alphaproteobacteria  
3.19% Bacilli  
20.27% Betaproteobacteria  
0.76% Clostridia  
1.21% Flavobacteria  
15.61% Gammaproteobacteria  
1.65% Sphingobacteria  
0.34% unclassified  
0.21% Other (<0.40%)



9.12% Actinobacteria  
34.59% Alphaproteobacteria  
3.74% Bacilli  
0.50% Bacteroidia  
17.35% Betaproteobacteria  
2.49% Clostridia  
2.59% Flavobacteria  
0.44% Fusobacteria  
28.48% Gammaproteobacteria  
0.21% unclassified  
0.49% Other (<0.40%)



# Diversity



# Diversity



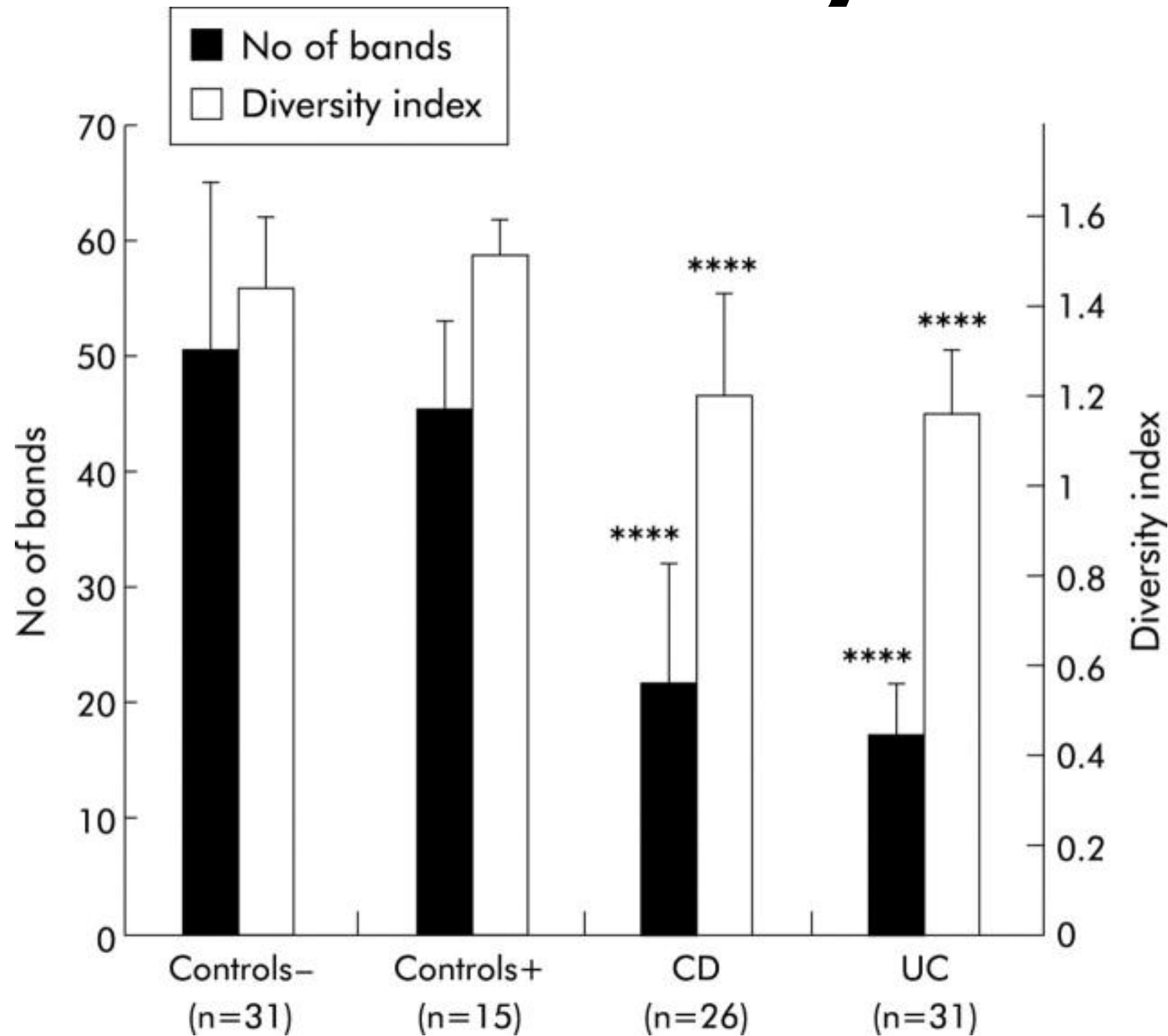
[https://upload.wikimedia.org/wikipedia/commons/4/4b/Amazon\\_Manauas\\_forest.jpg](https://upload.wikimedia.org/wikipedia/commons/4/4b/Amazon_Manauas_forest.jpg)

<https://en.wikipedia.org/wiki/File:Clearcutting-Oregon.jpg>

[https://upload.wikimedia.org/wikipedia/commons/a/a0/Tractors\\_in\\_Potato\\_Field.jpg](https://upload.wikimedia.org/wikipedia/commons/a/a0/Tractors_in_Potato_Field.jpg)



# Diversity



# Alpha Diversity

- Diversity within a sample
  - Richness: number of different species
  - Evenness: distribution of species (i.e. relative abundance)

# Richness



**Richness: 5**



**Richness: 10**

# Evenness

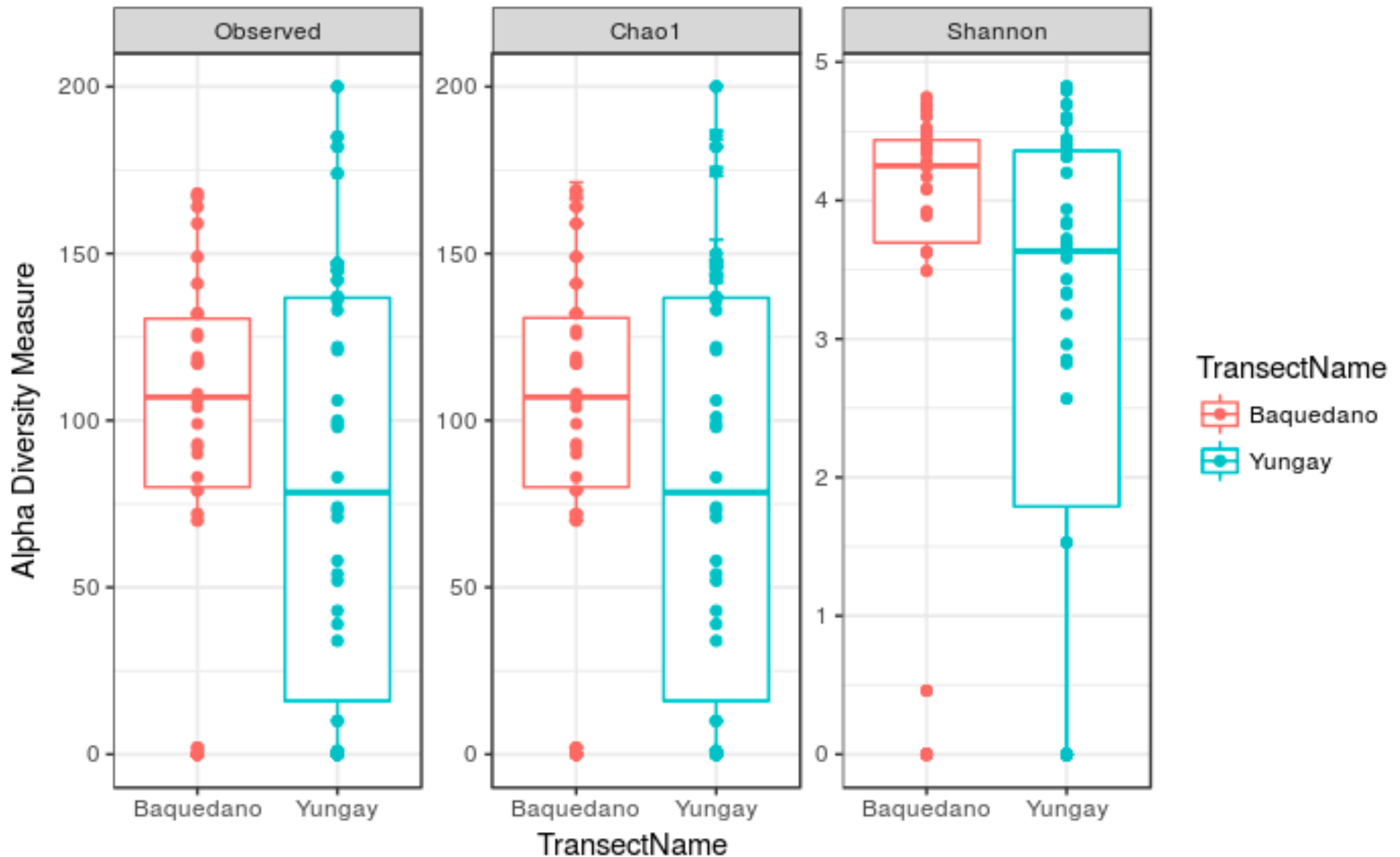


**Richness: 5**



**Richness: 5**

# Alpha Diversity Metrics



# Alpha Diversity Metrics

- Observed Richness

Counting

- Shannon (entropy)
- Simpson

Gambling

- Chao1
- ACE (abundance-based coverage estimators)

Weirdos

# Gambling Metrics

- Jar with 8 balls
- Shannon: How much would you bet that a randomly selected ball is red?
- Simpson: How much would you bet that two randomly selected balls are the same color?

	Jar 1	Jar 2	Jar 3	Jar 4
Red	8	5	2	1
Yellow	0	1	2	2
Green	0	1	2	2
Blue	0	1	2	3
Total	8	8	8	8



# Weirdo Metrics

- Chao1: How many species are present, and how many are observed only once or twice?
- ACE: How many species are present, and how many are observed less than 10 times?