Module "4": Assignment 1

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Assignment Details

Purpose

The goal of this assignment is to understand, apply, and interpret detection probability in estimating densities through distance sampling.

Task

Write R code to successfully answer each question below or write text to successfully answer the question.

Criteria for Success

- Code is within the provided code chunks
- Code chunks run without errors
- Code produces the correct result
    - Code attempts will get half points
    - Code that produces the correct answer will receive full points
- Text answers correctly address the question asked

Due Date

December 5 at midnight MST

Assignment Questions

All questions are worth 1 point unless otherwise specified.

Set-Up

We are going to need to load the community ecology package, `vegan`.

```r
library(vegan)
```

Species Accumulation Curves

For this section of the assignment, we are going to use a survey x species matrix for insects found on a plant.

```r
insects <- read.csv("../data_raw/insects.csv")
```

1. First, use the `specaccum()` function to prep the data for the species accumulation curve model.

```r
insects_sac <- specaccum(insects)
```

2. Next, fit a species accumulation model to the data.

```r
insects_sac_fit <- fitspecaccum(insects_sac, model = "asymp")
```
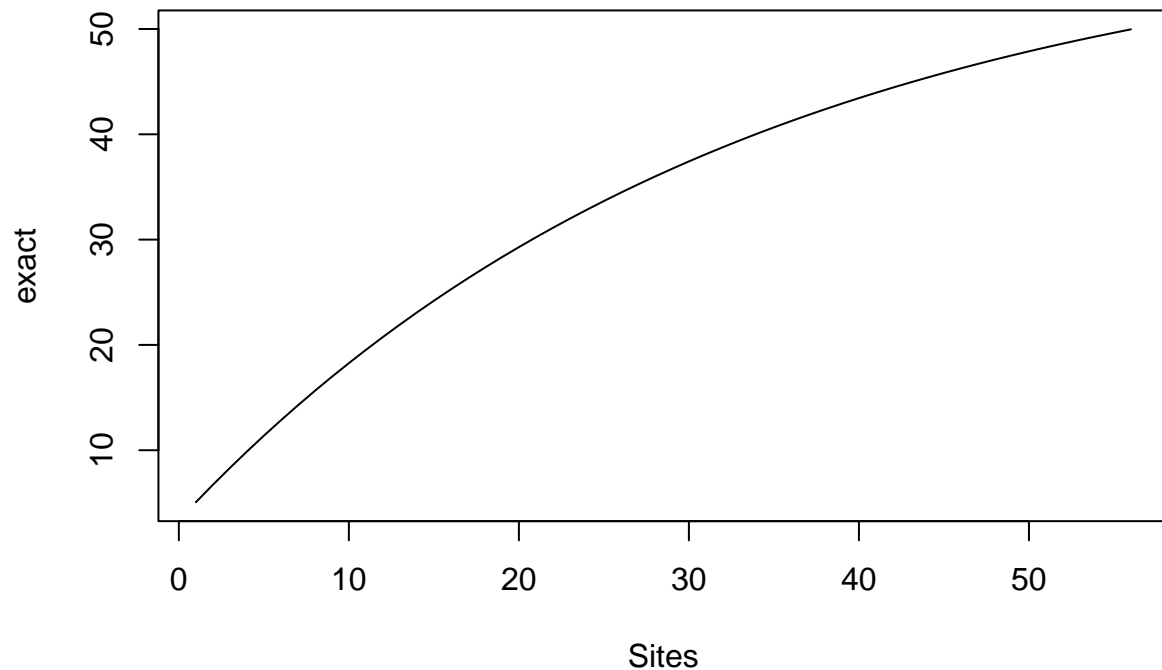
3. What is the predicted asymptote for this data?

```r
coef(insects_sac_fit)
```

```
##      Asym        R0       lrc
## 60.445437  3.357250 -3.497493
```

4. Let's plot species accumulation curve model.

```r
plot(insects_sac_fit)
```

5. Based on the predicted asymptote, the number of species we have in the dataset, and the plot you just made, what can we conclude? (2 points)

Answer:

Species Richness and Diversity Indices

For the rest of our calculations, we are going to compare 2 communities. I've written code below to create those communities.

```r
comm1 <- data.frame(species = c("DO", "DM", "SO", "SH", "SF", "PP", "PB", "BA"),
                    individuals = c(14, 89, 30, 12, 3, 3, 8, 23))
comm2 <- data.frame(species = c("DO", "DM", "SO", "SH", "SF"),
                    individuals = c(37, 32, 30, 44, 39))
```

Species Richness

6. Use code to calculate the species richness of each community. Which community is more species rich?

```r
nrow(comm1)
```

```
## [1] 8
```

```
nrow(comm2)
```

```
## [1] 5
```

Shannon Diversity Index

We are going to start with `comm1`.

7. Write a line of code to calculate the number of individuals in the first community. Use this to create the object `total_comm1`.

```
total_comm1 <- sum(comm1$individuals)
total_comm1
```

```
## [1] 182
```

8. Add a column to the `comm1` data frame with each species' proportion of the community.

```
comm1$prop <- comm1$individuals / total_comm1
```

9. Now add a column with the natural logs of the proportions.

```
comm1$ln_prop <- log(comm1$prop)
```

10. Add a column with the result of the proportion of the community multiplied by the natural log.

```
comm1$prop_lnprop <- comm1$prop * comm1$ln_prop
```

11. Calculate the Shannon Index for this community.

```
H_comm1 <- sum(comm1$prop_lnprop * -1)
```

12. Now that you've worked your way through calculating the Shannon Index for community 1, calculate it for community 2.

```
total_comm2 <- sum(comm2$individuals)
comm2$prop <- comm2$individuals / total_comm2
comm2$ln_prop <- log(comm2$prop)
comm2$prop_lnprop <- comm2$prop * comm2$ln_prop
H_comm2 <- sum(comm2$prop_lnprop * -1)
```

13. Which community is more diverse, according the the Shannon Diversity Index? How do you know? (2 points)

Answer:

Simpson Diversity Index

Fortunately, a lot of the work has already been done to calculate the Simpson Diversity Index. We only need to add a little bit more to get there.

14. Add another column to the `comm1` data frame that has the squared proportion.

```
comm1$prop_sq <- comm1$prop * comm1$prop
```

15. Calculate the Simpson Diversity Index for community 1

```
D1 = 1 - sum(comm1$prop_sq)
```

16. Now calculate the Simpson Index for community 2

```
comm2$prop_sq <- comm2$prop * comm2$prop
D2 = 1 - sum(comm2$prop_sq)
```

17. Do the values you've calculated for the Simpson Index corroborate your answer for which community is more diverse? Why or why not? (2 points)

Answer: