

# Wetland Bird Analysis

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```
library(mobr)
```

```
## Warning: replacing previous import 'dplyr::filter' by 'stats::filter' when  
## loading 'mobr'
```

```
## Warning: replacing previous import 'dplyr::lag' by 'stats::lag' when loading  
## 'mobr'
```

```
library(dplyr)
```

```
##  
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':  
##  
##   filter, lag
```

```
## The following objects are masked from 'package:base':  
##  
##   intersect, setdiff, setequal, union
```

```
library(broom)
```

Read in data

```
dat <- read.csv('./data/filtered_data/clean_bird_dat.csv')  
comm <- read.csv('./data/filtered_data/clean_bird_comm.csv')  
row.names(comm) <- comm[, 1]  
comm <- comm[, -1]
```

```
#head(dat)  
#head(comm)
```

```
dim(dat)
```

```
## [1] 186 122
```

```
dim(comm)
```

```
## [1] 186 55
```

```
#Q1: is bird diversity higher in wetlands and uplands
```

```
#div <- calc_biodiv(comm, dat$uni_id_date, effort = 5, extrapolate = TRUE)
dat$S <- rowSums(comm > 0 )
dat$S_PIE <- calc_SPIE(comm)
```

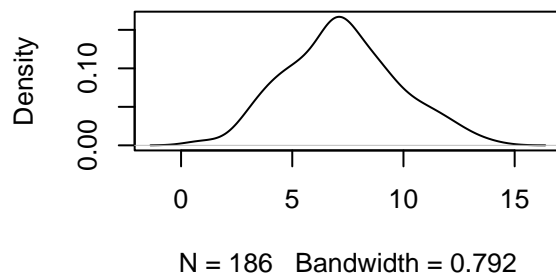
```
## Warning in calc_PIE(x, replace = replace): NA was returned because the sample
## contains one or zero individuals.
```

```
## Warning in calc_SPIE(comm): NA was returned because PIE = 1. This happens in
## samples where all species are singletons.
```

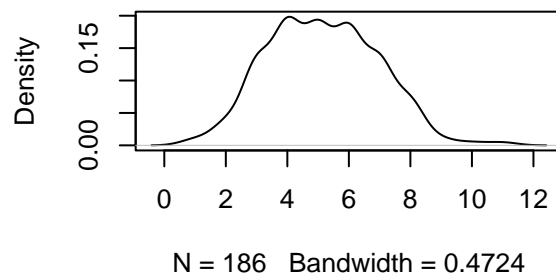
```
dat$N <- rowSums(comm)
dat$S_n <- apply(comm, 1, rarefaction, 'IBR', effort = 5, extrapolate = TRUE,
  quiet_mode = TRUE)
```

```
par(mfrow=c(2,2))
plot(density(dat$N))
plot(density(dat$S))
plot(density(dat$S_n))
plot(density(dat$S_PIE, na.rm = TRUE))
```

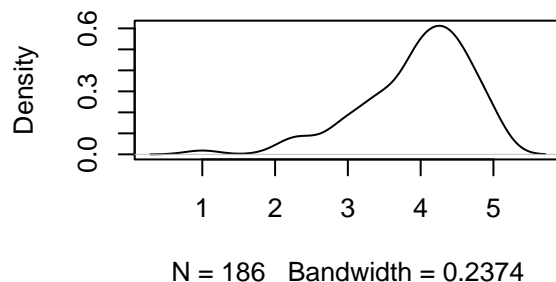
**density.default(x = dat\$N)**



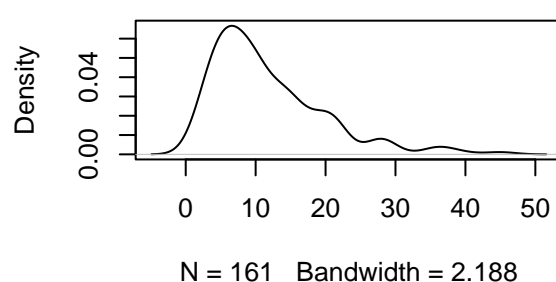
**density.default(x = dat\$S)**



**density.default(x = dat\$S\_n)**



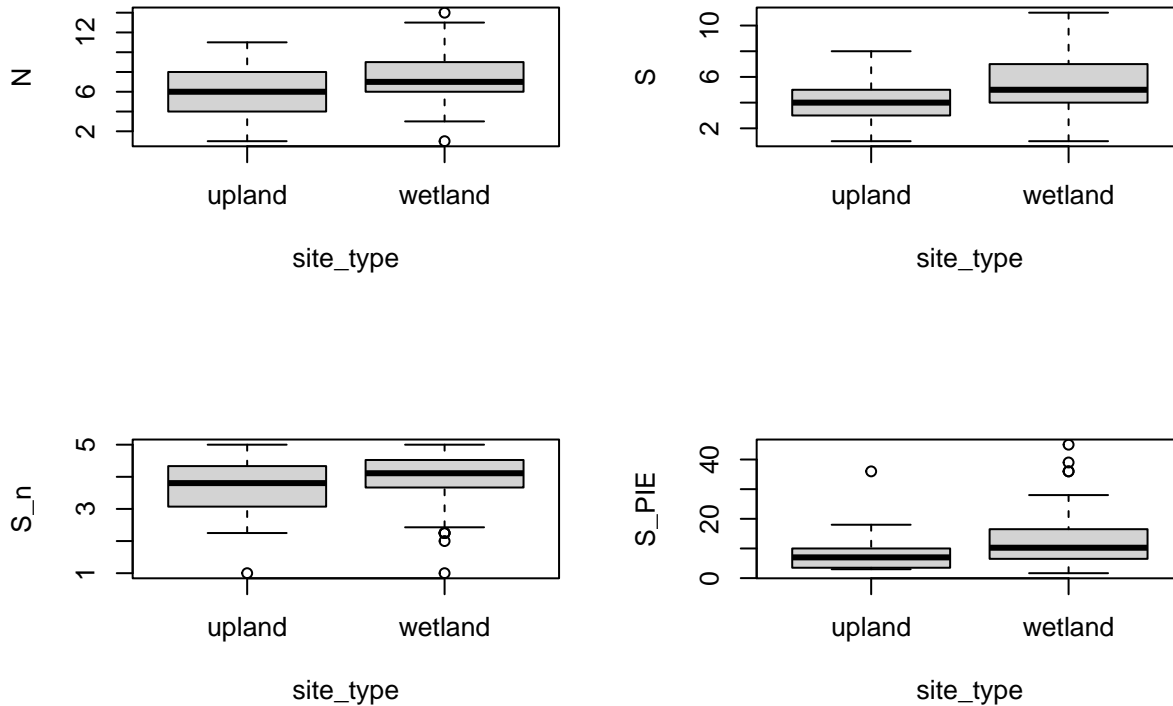
**density.default(x = dat\$S\_PIE, na.rm = TRUE)**



```

par(mfrow=c(2,2))
boxplot(N ~ site_type, data = dat)
boxplot(S ~ site_type, data = dat)
boxplot(S_n ~ site_type, data = dat)
boxplot(S_PIE ~ site_type, data = dat)

```



```

div_mods <- list()
div_mods$N <- lm(N ~ site_type + site + block, data = dat)
div_mods$S <- lm(S ~ site_type + site + block, data = dat)
div_mods$S_n <- lm(S_n ~ site_type + site + block, data = dat)
div_mods$S_PIE <- lm(S_PIE ~ site_type + site + block, data = dat)

lapply(div_mods, summary)

```

```

## $N
##
## Call:
## lm(formula = N ~ site_type + site + block, data = dat)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -7.0243 -1.6671 -0.2296  1.7256  5.9757
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)

```

```

## (Intercept)          6.5843      0.5215  12.625 < 2e-16 ***
## site_typewetland     1.3149      0.4531   2.902 0.00416 **
## sitestono            1.5177      0.4807   3.157 0.00186 **
## block                -0.2321      0.1174  -1.977 0.04960 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.412 on 182 degrees of freedom
## Multiple R-squared:  0.08628,    Adjusted R-squared:  0.07121
## F-statistic: 5.728 on 3 and 182 DF,  p-value: 0.00091
##
##
## $S
##
## Call:
## lm(formula = S ~ site_type + site + block, data = dat)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -4.9414 -1.2271  0.0536  1.0586  5.0586
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      4.4690     0.3610  12.378 < 2e-16 ***
## site_typewetland  1.1031     0.3136   3.517 0.000551 ***
## sitestono        1.4044     0.3328   4.220 3.85e-05 ***
## block            -0.1725     0.0813  -2.122 0.035180 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.67 on 182 degrees of freedom
## Multiple R-squared:  0.1389, Adjusted R-squared:  0.1247
## F-statistic: 9.782 on 3 and 182 DF,  p-value: 5.139e-06
##
##
## $S_n
##
## Call:
## lm(formula = S_n ~ site_type + site + block, data = dat)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -3.2008 -0.3290  0.1024  0.4524  1.3089
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      3.75933    0.15709  23.932 < 2e-16 ***
## site_typewetland  0.34681    0.13646   2.541 0.011873 *
## sitestono        0.50386    0.14479   3.480 0.000628 ***
## block            -0.06820    0.03537  -1.928 0.055388 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.7264 on 182 degrees of freedom

```

```
## Multiple R-squared:  0.08875,    Adjusted R-squared:  0.07373
## F-statistic: 5.908 on 3 and 182 DF,  p-value: 0.0007203
##
##
## $S_PIE
##
## Call:
## lm(formula = S_PIE ~ site_type + site + block, data = dat)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -12.026  -5.107  -1.876   3.893  34.239
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      7.5343     1.8324   4.112 6.31e-05 ***
## site_typewetland  3.6876     1.6067   2.295  0.02305 *
## sitestono        4.7258     1.5971   2.959  0.00356 **
## block           -0.1152     0.3910  -0.295  0.76864
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 7.736 on 157 degrees of freedom
## (25 observations deleted due to missingness)
## Multiple R-squared:  0.1024, Adjusted R-squared:  0.08529
## F-statistic: 5.973 on 3 and 157 DF,  p-value: 0.0006998
```

```
lapply(div_mods, anova)
```

```
## $N
## Analysis of Variance Table
##
## Response: N
##           Df Sum Sq Mean Sq F value    Pr(>F)
## site_type   1  41.96  41.961    7.2138 0.007904 **
## site        1  35.28  35.275    6.0643 0.014724 *
## block       1  22.72  22.725    3.9067 0.049604 *
## Residuals 182 1058.66   5.817
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## $S
## Analysis of Variance Table
##
## Response: S
##           Df Sum Sq Mean Sq F value    Pr(>F)
## site_type   1  30.60  30.601   10.9775 0.001127 **
## site        1  38.65  38.654   13.8662 0.0002616 ***
## block       1  12.55  12.554    4.5034 0.0351799 *
## Residuals 182 507.35   2.788
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## $S_n
```

```

## Analysis of Variance Table
##
## Response: S_n
##           Df Sum Sq Mean Sq F value    Pr(>F)
## site_type   1  2.885   2.8850   5.4670 0.020466 *
## site        1  4.507   4.5066   8.5399 0.003915 **
## block       1  1.962   1.9620   3.7179 0.055388 .
## Residuals 182 96.044   0.5277
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## $S_PIE
## Analysis of Variance Table
##
## Response: S_PIE
##           Df Sum Sq Mean Sq F value    Pr(>F)
## site_type   1  346.6   346.56   5.7911 0.0172690 *
## site        1  720.5   720.53  12.0403 0.0006723 ***
## block       1    5.2    5.20   0.0868 0.7686358
## Residuals 157 9395.4   59.84
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```