Kotzebue Phytoplankton Community Composition in September-October 2019

Mariam Moreno

13 May 2024

```r
library(tidyverse)
```

```
## Warning: package 'tidyverse' was built under R version 4.3.2
```

```
## Warning: package 'tidyr' was built under R version 4.3.3
```

```
## Warning: package 'readr' was built under R version 4.3.3
```

```
## Warning: package 'dplyr' was built under R version 4.3.3
```

```
## Warning: package 'stringr' was built under R version 4.3.3
```

```r
library(openintro)
```

```
## Warning: package 'openintro' was built under R version 4.3.2
```

```
## Warning: package 'airports' was built under R version 4.3.2
```

```
## Warning: package 'cherryblossom' was built under R version 4.3.2
```

```
## Warning: package 'usdata' was built under R version 4.3.2
```

```r
library(dplyr)
library(ggplot2)
library(readr)
```

Aim 2: Enumerate and Identify Phytoplankton

Null hypothesis: Each site will have a different dominant phytoplankton species.

Alternative hypothesis: Both sites will have the same dominant phytoplankton species.

The data is displayed as stacked barplots, one for each site. Different colors represent different phytoplanton identified from lagoon and shore samples from 2019. I anticipate to see each sample site to have a different phytoplankton species dominate the community composition given the differences in locations (the lagoon is closed off and the shore is coastal). I will use an ANOVA test to determine if both sites have different or the same dominant phytoplankton species.

```r
kotz_samples <- read.csv("kotz_samples.csv")

kotz_samples
```
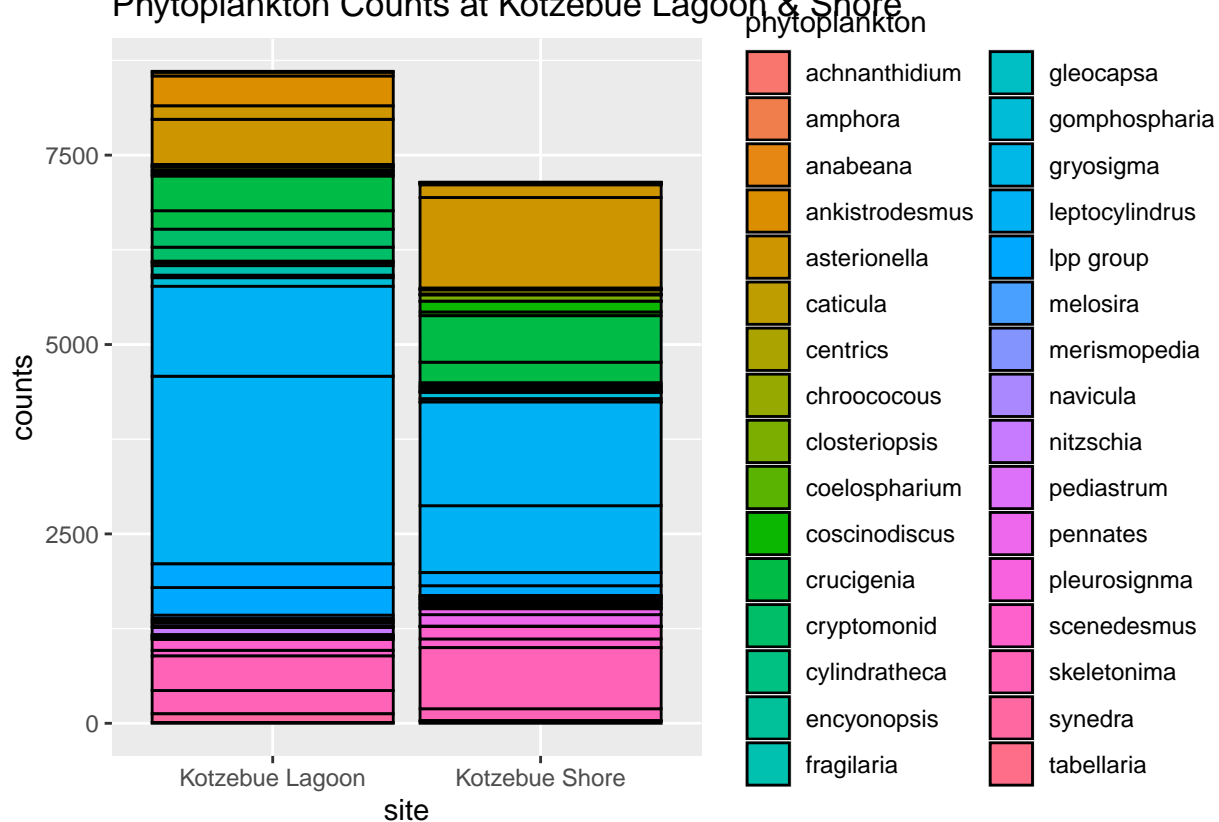
```
##        date            site   phytoplankton counts
## 1  9/11/2019 Kotzebue Lagoon    asterionella    596
## 2  9/11/2019 Kotzebue Lagoon  leptocylindrus   2478
## 3  9/11/2019 Kotzebue Lagoon      skeletonima    308
## 4  9/11/2019 Kotzebue Lagoon       lpp group     366
## 5  9/11/2019 Kotzebue Lagoon       nitzschia     94
## 6  9/11/2019 Kotzebue Lagoon   ankistrodesmus    396
## 7  9/11/2019 Kotzebue Lagoon      scenedesmus     76
## 8  9/11/2019 Kotzebue Lagoon    cylindratheca     41
## 9  9/11/2019 Kotzebue Lagoon       crucigenia    245
## 10 9/11/2019 Kotzebue Lagoon    gomphospharia    114
## 11 9/11/2019 Kotzebue Lagoon       pediastrum     10
## 12 9/11/2019 Kotzebue Lagoon      cryptomonid    186
## 13 9/11/2019 Kotzebue Lagoon         centrics     14
## 14 9/11/2019 Kotzebue Lagoon         navicula     43
## 15 9/11/2019 Kotzebue Lagoon    coscinodiscus     21
## 16 9/11/2019 Kotzebue Lagoon     pleurosignma     10
## 17 9/11/2019 Kotzebue Lagoon      chroococous     24
## 18 9/11/2019 Kotzebue Lagoon       fragilaria    126
## 19 9/11/2019 Kotzebue Lagoon          synedra    114
## 20 9/11/2019 Kotzebue Lagoon         melosira     44
## 21 9/17/2019 Kotzebue Lagoon     asterionella    176
## 22 9/17/2019 Kotzebue Lagoon       crucigenia    455
## 23 9/17/2019 Kotzebue Lagoon   leptocylindrus   1186
## 24 9/17/2019 Kotzebue Lagoon       lpp group     312
## 25 9/17/2019 Kotzebue Lagoon    coscinodiscus     35
## 26 9/17/2019 Kotzebue Lagoon    cylindratheca     18
## 27 9/17/2019 Kotzebue Lagoon      skeletonima    455
## 28 9/17/2019 Kotzebue Lagoon         centrics     22
## 29 9/17/2019 Kotzebue Lagoon         pennates     27
## 30 9/17/2019 Kotzebue Lagoon      cryptomonid    236
## 31 9/17/2019 Kotzebue Lagoon      scenedesmus    142
## 32 9/17/2019 Kotzebue Lagoon   ankistrodesmus     49
## 33 9/17/2019 Kotzebue Lagoon    gomphospharia     32
## 34 9/17/2019 Kotzebue Lagoon      chroococous     40
## 35 9/17/2019 Kotzebue Lagoon      merismopedia     29
## 36 9/17/2019 Kotzebue Lagoon        nitzschia     21
## 37 9/17/2019 Kotzebue Lagoon       pediastrum     17
## 38 9/17/2019 Kotzebue Lagoon         navicula     25
## 39 9/17/2019 Kotzebue Lagoon          amphora     12
## 40 9/17/2019 Kotzebue Lagoon        tabellaria     11
## 41 10/7/2019  Kotzebue Shore     asterionella   1197
## 42 10/7/2019  Kotzebue Shore      scenedesmus    116
## 43 10/7/2019  Kotzebue Shore      cryptomonid     23
## 44 10/7/2019  Kotzebue Shore      merismopedia     35
## 45 10/7/2019  Kotzebue Shore      skeletonima    156
## 46 10/7/2019  Kotzebue Shore       crucigenia    274
## 47 10/7/2019  Kotzebue Shore    gomphospharia     45
## 48 10/7/2019  Kotzebue Shore   ankistrodesmus     12
```

```
## 49 10/7/2019   Kotzebue Shore    coscinodiscus       51
## 50 10/7/2019   Kotzebue Shore         melosira       17
## 51 10/7/2019   Kotzebue Shore          synedra       12
## 52 10/7/2019   Kotzebue Shore         anabeana        9
## 53 10/7/2019   Kotzebue Shore        gryosigma        1
## 54 10/7/2019   Kotzebue Shore     pleurosignma        2
## 55 10/7/2019   Kotzebue Shore       tabellaria       24
## 56 10/7/2019   Kotzebue Shore         centrics       57
## 57 10/7/2019   Kotzebue Shore    cylindratheca       30
## 58 10/7/2019   Kotzebue Shore        pediastrum       12
## 59 10/7/2019   Kotzebue Shore        lpp group      131
## 60 10/7/2019   Kotzebue Shore         pennates      153
## 61 10/7/2019   Kotzebue Shore         melosira       21
## 62 10/7/2019   Kotzebue Shore   leptocylindrus      883
## 63 10/7/2019   Kotzebue Shore         navicula       34
## 64 10/7/2019   Kotzebue Shore     coelospharium        4
## 65 10/7/2019   Kotzebue Shore       chroococous        3
## 66 10/7/2019   Kotzebue Shore        gleocapsa       12
## 67 10/7/2019   Kotzebue Shore     achnanthidium        2
## 68 10/7/2019   Kotzebue Shore          amphora        2
## 69 10/7/2019   Kotzebue Shore        encyonopsis        1
## 70 10/7/2019   Kotzebue Shore      closteriopsis       81
## 71 9/17/2019   Kotzebue Shore      asterionella      165
## 72 9/17/2019   Kotzebue Shore         crucigenia      612
## 73 9/17/2019   Kotzebue Shore   leptocylindrus     1368
## 74 9/17/2019   Kotzebue Shore        lpp group      173
## 75 9/17/2019   Kotzebue Shore     coscinodiscus      139
## 76 9/17/2019   Kotzebue Shore     cylindratheca       27
## 77 9/17/2019   Kotzebue Shore        skeletonima      806
## 78 9/17/2019   Kotzebue Shore        scenedesmus      163
## 79 9/17/2019   Kotzebue Shore        cryptomonid       34
## 80 9/17/2019   Kotzebue Shore      gomphospharia       80
## 81 9/17/2019   Kotzebue Shore         melosira        5
## 82 9/17/2019   Kotzebue Shore         pennates       77
## 83 9/17/2019   Kotzebue Shore     ankistrodesmus        9
## 84 9/17/2019   Kotzebue Shore        pediastrum       22
## 85 9/17/2019   Kotzebue Shore         centrics        5
## 86 9/17/2019   Kotzebue Shore          amphora        2
## 87 9/17/2019   Kotzebue Shore       merismopedia       20
## 88 9/17/2019   Kotzebue Shore         centrics        7
## 89 9/17/2019   Kotzebue Shore          caticula       10
## 90 9/17/2019   Kotzebue Shore         navicula        8
## 91 9/17/2019   Kotzebue Shore     pleurosignma        2
## 92 9/17/2019   Kotzebue Shore       chroococous        8
```

```r
# stacked barplot of lagoon and shore counts
kotz_community <- ggplot(kotz_samples, aes(fill=phytoplankton,y=counts, x=site))+
  geom_bar(position="stack", stat="identity", colour="black")+
  ggtitle("Phytoplankton Counts at Kotzebue Lagoon & Shore")

kotz_community
```

Phytoplankton Counts at Kotzebue Lagoon & Shore


```r
# filter data by location
lagoon <- data.frame(filter(kotz_samples, site=="Kotzebue Lagoon"))
lagoon1 <- aggregate(counts~phytoplankton, data=lagoon,sum)
lagoon1
```

```
##       phytoplankton counts
## 1           amphora     12
## 2     ankistrodesmus    445
## 3       asterionella    772
## 4           centrics     36
## 5        chroococous     64
## 6       coscinodiscus     56
## 7          crucigenia    700
## 8         cryptomonid    422
## 9       cylindratheca     59
## 10         fragilaria    126
## 11      gomphospharia    146
## 12     leptocylindrus   3664
## 13          lpp group    678
## 14           melosira     44
## 15        merismopedia     29
## 16           navicula     68
## 17          nitzschia    115
## 18         pediastrum     27
## 19           pennates     27
## 20       pleurosignma     10
```

```
## 21      scenedesmus     218
## 22      skeletonima     763
## 23          synedra     114
## 24        tabellaria      11
```

```r
# finding max of phytoplankton populations
summary(lagoon1)
```

```
##  phytoplankton         counts
##  Length:24         Min.   :  10.00
##  Class :character  1st Qu.:  34.25
##  Mode  :character  Median :  91.00
##                    Mean   : 358.58
##                    3rd Qu.: 427.75
##                    Max.   :3664.00
```

```r
shore <- data.frame(filter(kotz_samples, site=="Kotzebue Shore"))
shore1 <- aggregate(counts~phytoplankton, data=shore,sum)
shore1
```

```
##       phytoplankton counts
## 1     achnanthidium      2
## 2           amphora      4
## 3          anabeana      9
## 4     ankistrodesmus     21
## 5      asterionella   1362
## 6          caticula     10
## 7           centrics     69
## 8        chroococous     11
## 9      closteriopsis     81
## 10    coelospharium      4
## 11    coscinodiscus    190
## 12        crucigenia    886
## 13       cryptomonid     57
## 14    cylindratheca     57
## 15       encyonopsis      1
## 16         gleocapsa     12
## 17    gomphospharia    125
## 18         gryosigma      1
## 19    leptocylindrus   2251
## 20        lpp group    304
## 21          melosira     43
## 22      merismopedia     55
## 23          navicula     42
## 24        pediastrum     34
## 25          pennates    230
## 26      pleurosignma      4
## 27      scenedesmus    279
## 28      skeletonima    962
## 29          synedra     12
## 30        tabellaria     24
```

```
summary(shore1)
```

```
##   phytoplankton         counts
##   Length:30        Min.   :   1.00
##   Class :character 1st Qu.:  10.25
##   Mode  :character Median :  42.50
##                    Mean   : 238.07
##                    3rd Qu.: 173.75
##                    Max.   :2251.00
```

ANOVA analysis

```
two.way <- aov(counts~phytoplankton+site, data=kotz_samples)

summary(two.way)
```

```
##                Df  Sum Sq Mean Sq F value   Pr(>F)
## phytoplankton 31 9085664  293086   6.492 4.44e-10 ***
## site           1   29879   29879   0.662    0.419
## Residuals     59 2663546   45145
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

I reject my null hypothesis b/c of a very small (insignificant) p-value, and both sites have the same dominant phytoplankton species.