Kotzebue Phytoplankton Community Composition in September-October 2019

Mariam Moreno

13 May 2024

```
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
```

```
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
```

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

Data, Dataset card, and this report are available at: https://github.com/morenomg02/Alaska-HABs

Introduction

For my independent project, I compared phytoplankton community compositions between two of five sites in KOtzebue, Alaska that I will be assessing for my thesis. The goal of this project is to determine what environmental factors influence phytoplankton composition in the Kotzebue Sound, an aquatic region that can reflect anthropogenic activity in addition to natural systems (i.e. freshwater and nutrient input from rivers and streams). The motivation for this project came from a concern of "green slime" on the surface of the water near coastal Kotzebue- an indicator of possible harmful algae blooms which has never observed before around Kotzebue. By recording the phytoplankton community composition of Kotzebue, we can finally get a picture of what phytoplankton species reside in this region and how prominant harmful algae species may be, if any.

Aim 2: Enumerate and Identify Phytoplankton

Starting with samples taken in 2019, we will build a "portfolio" of phytoplankton species of the Kotzebue Sound. The small dataset used for this independent project has phytoplankton counts from Kotzebue Lagoon and Kotzebue Shore from September to October of 2019. More details are in the dataset card here: https://github.com/morenomg02/Alaska-HABs/blob/main/DATA/dataset-card.pdf

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.

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

kotz_samples
```

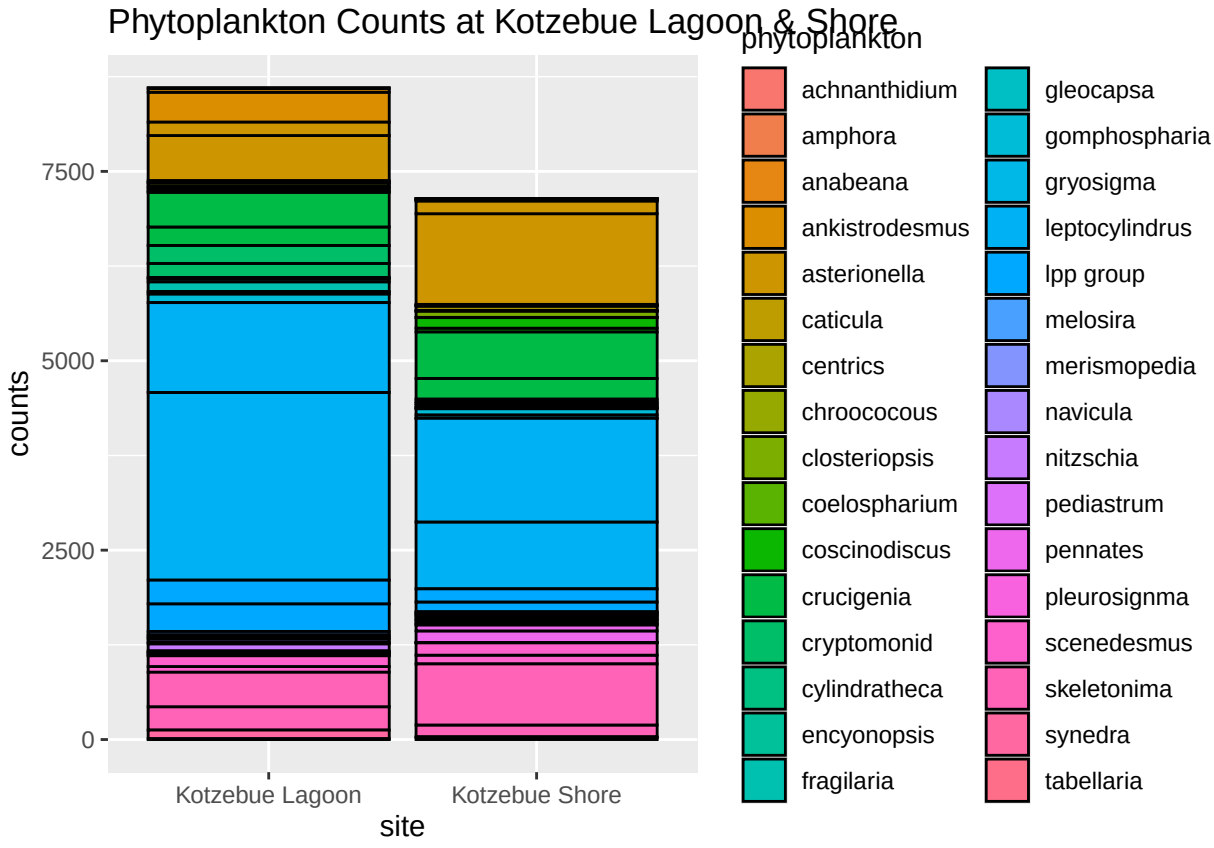
```
##         date            site  phytoplankton counts
## 1  9/11/2019 Kotzebue Lagoon   asterionella    596
## 2  9/11/2019 Kotzebue Lagoon leptocylindrus   2478
## 3  9/11/2019 Kotzebue Lagoon    skeletonima    308
## 4  9/11/2019 Kotzebue Lagoon      lpp group    366
## 5  9/11/2019 Kotzebue Lagoon      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
```

```
# 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
```



Both sites have almost the same relative proportion of phytoplankton species abundance. The most abundant group for each site is "Leptocylindrus" followed by "Asterionella."

```
# 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
```

```
# 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
```

```
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.