COMPASS_Synoptic_SEAL_Data_Analysis_Sept2022

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Information

```
###############################################################################
####### COMPASS Synoptic
####### Chesapeake Bay Sites
####### Data Analysis Code: Porewater Nutrients
####### MONTH: August 2022
###############################################################################


############################# Information ###############################
#Author: Stephanie J. Wilson
#Edited: 20220727

#Samples taken from Lysimeters & Sippers at CB Synoptic Sites
#Samples were filtered with 0.45 uM, kept on ice, frozen until analysis
#Field Protocol:
#Samples Analyzed on a SEAL discrete auto analyzer
#Lab Protocol: https://docs.google.com/document/d/1VaJT7Wb9AcdmM1tgsR_9ZtQ6kwcaoNmp/edit?usp=sharing&ou
#NOx method = https://drive.google.com/file/d/1sicqBFnzVxmDd5I2_pu8s8pj7iNOAuhF/view?usp=sharing
#NH4 method = https://drive.google.com/file/d/1ENGemUEvm_rffZqv3lz9BjDOpAMX5nzu/view?usp=sharing
#PO4 method = https://drive.google.com/file/d/1m3gXDZnJoIo_QmyhvZG4HRgGShCzm9Wq/view?usp=sharing
#Units from SEAL = mg/L and converted to uMoles/L
```

QAQC on Slopes

```
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 4.3.3
```

```
library(data.table)

#read in datafile with all the slopes
qlog <- read.csv("Raw Data/SERC_SEAL_STDs_Log.csv")
head(qlog)
```

```
##         Date            User  Machine Analysis  Slope Intercept     R2
```

```
## 1 20220513 Stephanie Wilson SERC SEAL       NH3 1.9370      -0.030 0.9995
## 2 20220513 Stephanie Wilson SERC SEAL       PO4 2.8690       0.002 0.9994
## 3 20220525 Stephanie Wilson SERC SEAL     V-Nox 1.0000       0.000 0.9990
## 4 20220614 Stephanie Wilson SERC SEAL       NH3 1.1487      -0.011 0.9999
## 5 20220614 Stephanie Wilson SERC SEAL       PO4 2.3950      -0.001 0.9998
## 6 20220615 Stephanie Wilson SERC SEAL     V-Nox 1.0000       0.000 0.9998
##   Nox_Red_Eff X
## 1          NA
## 2          NA
## 3          NA
## 4          NA
## 5          NA
## 6          NA
```

```r
#pull out each method
qNH3 <- qlog[qlog$Analysis %like% "NH3", ]
head(qNH3)
```

```
##         Date          User  Machine Analysis  Slope Intercept     R2
## 1  20220513 Stephanie Wilson SERC SEAL      NH3 1.9370    -0.030 0.9995
## 4  20220614 Stephanie Wilson SERC SEAL      NH3 1.1487    -0.011 0.9999
## 7  20220615 Stephanie Wilson SERC SEAL      NH3 1.7070    -0.008 1.0000
## 10 20220718 Stephanie Wilson SERC SEAL      NH3 1.7080    -0.017 0.9995
## 12 20220718 Stephanie Wilson SERC SEAL      NH3 1.6590    -0.017 0.9997
## 14 20220719 Stephanie Wilson SERC SEAL      NH3 1.5560     0.000 0.9994
##    Nox_Red_Eff X
## 1           NA
## 4           NA
## 7           NA
## 10          NA
## 12          NA
## 14          NA
```

```r
qPO4 <- qlog[qlog$Analysis %like% "PO4", ]
head(qPO4)
```

```
##        Date          User  Machine Analysis Slope Intercept     R2
## 2  20220513 Stephanie Wilson SERC SEAL      PO4 2.869     0.002 0.9994
## 5  20220614 Stephanie Wilson SERC SEAL      PO4 2.395    -0.001 0.9998
## 8  20220615 Stephanie Wilson SERC SEAL      PO4 2.349     0.000 0.9999
## 11 20220718 Stephanie Wilson SERC SEAL      PO4 2.445    -0.003 0.9993
## 13 20220718 Stephanie Wilson SERC SEAL      PO4 2.349    -0.004 0.9992
## 15 20220719 Stephanie Wilson SERC SEAL      PO4 2.271    -0.003 0.9993
##    Nox_Red_Eff X
## 2           NA
## 5           NA
## 8           NA
## 11          NA
## 13          NA
## 15          NA
```
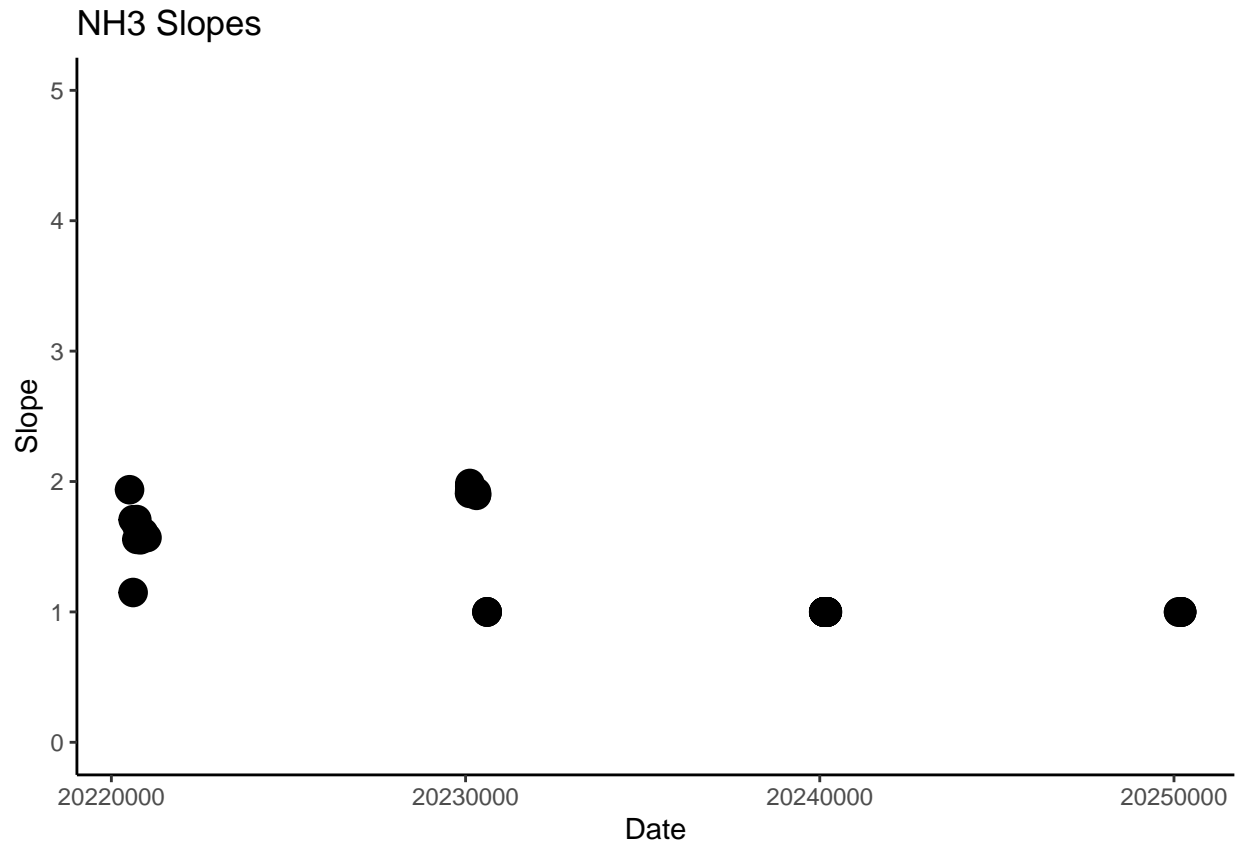
```r
qNOx <- qlog[qlog$Analysis %like% "V-Nox", ]
head(qNOx)
```

```
##        Date          User   Machine Analysis Slope Intercept    R2
## 3  20220525 Stephanie Wilson SERC SEAL   V-Nox     1         0 0.9990
## 6  20220615 Stephanie Wilson SERC SEAL   V-Nox     1         0 0.9998
## 9  20220718 Stephanie Wilson SERC SEAL   V-Nox     1         0 0.9999
## 16 20220730 Stephanie Wilson SERC SEAL   V-Nox     1         0 1.0000
## 17 20220731 Stephanie Wilson SERC SEAL   V-Nox     1         0 1.0000
## 22 20220824 Stephanie Wilson SERC SEAL   V-Nox     1         0 0.9988
##    Nox_Red_Eff X
## 3           NA
## 6           NA
## 9           NA
## 16          NA
## 17          NA
## 22          NA
```

```r
########### NH3
#plot the slopes to make sure there are no crazy outliers
slope1 <- ggplot(data=qNH3, aes(x=Date, y=Slope)) +
          #geom_line()+
           geom_point(aes(size=3)) +
           theme_classic() + ylim(0, 5) +
          theme(legend.position="none") +
          ggtitle("NH3 Slopes")

slope1
```
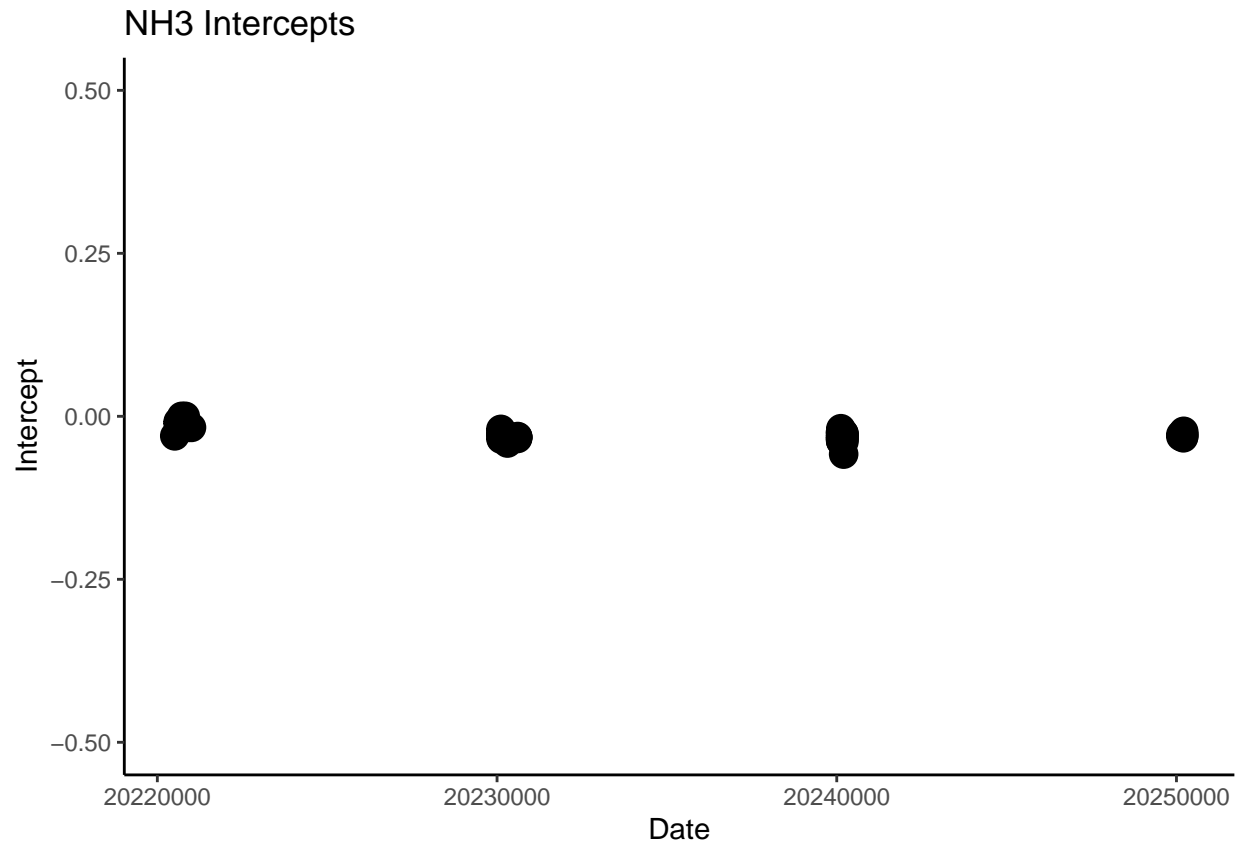
```
## Warning: Removed 1 row containing missing values or values outside the scale range
## ('geom_point()').
```

NH3 Slopes


```r
#plot the intercepts to make sure there are no crazy outliers
int1 <- ggplot(data=qNH3, aes(x=Date, y=Intercept)) +
  #geom_line()+
  geom_point(aes(size=3)) +
  theme_classic() + ylim(-0.5,0.5) +
  theme(legend.position="none")+
  ggtitle("NH3 Intercepts")

int1
```
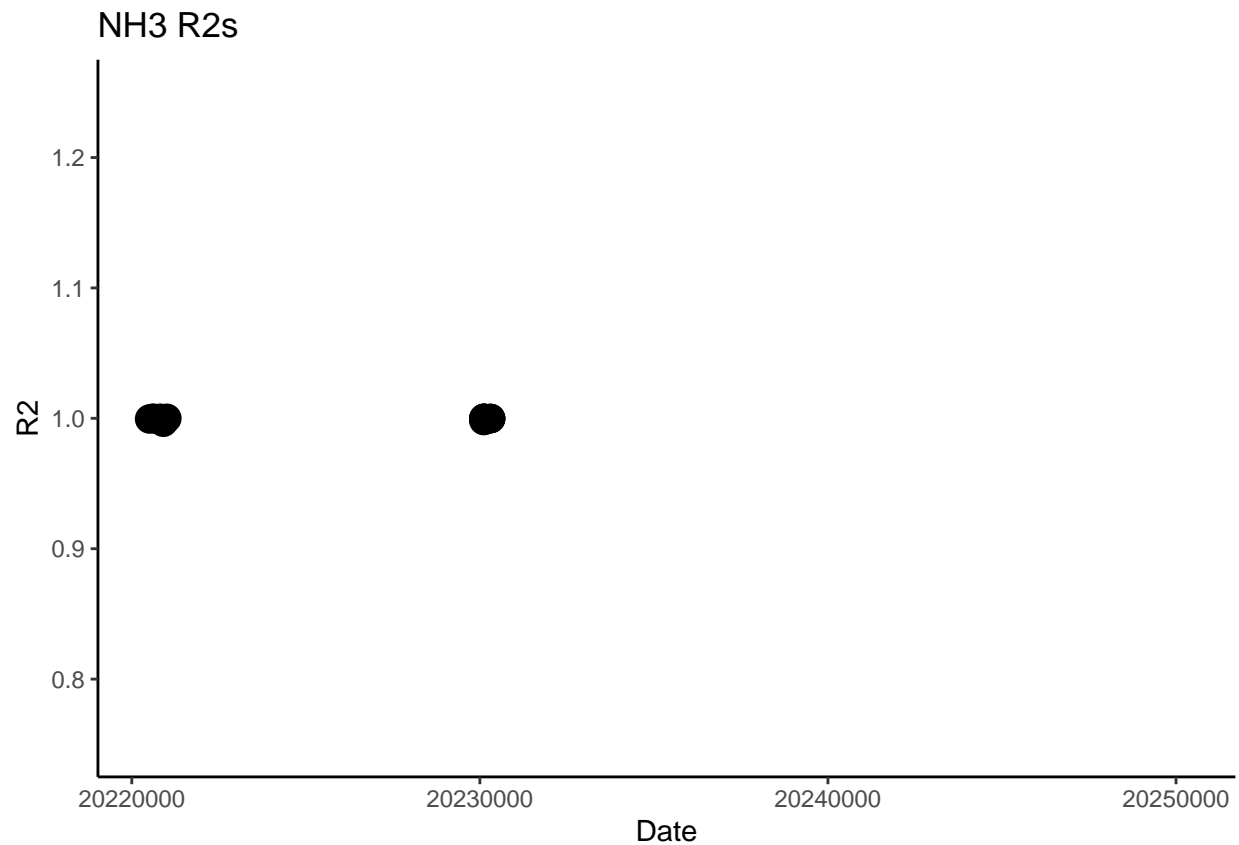
```
## Warning: Removed 1 row containing missing values or values outside the scale range
## ('geom_point()').
```

NH3 Intercepts

```r
#plot the R2s to make sure there are no crazy outliers
Rsq1 <- ggplot(data=qNH3, aes(x=Date, y=R2)) +
  #geom_line()+
  geom_point(aes(size=3)) +
  theme_classic() + ylim(0.75, 1.25) +
  theme(legend.position="none")+
  ggtitle("NH3 R2s")

Rsq1
```
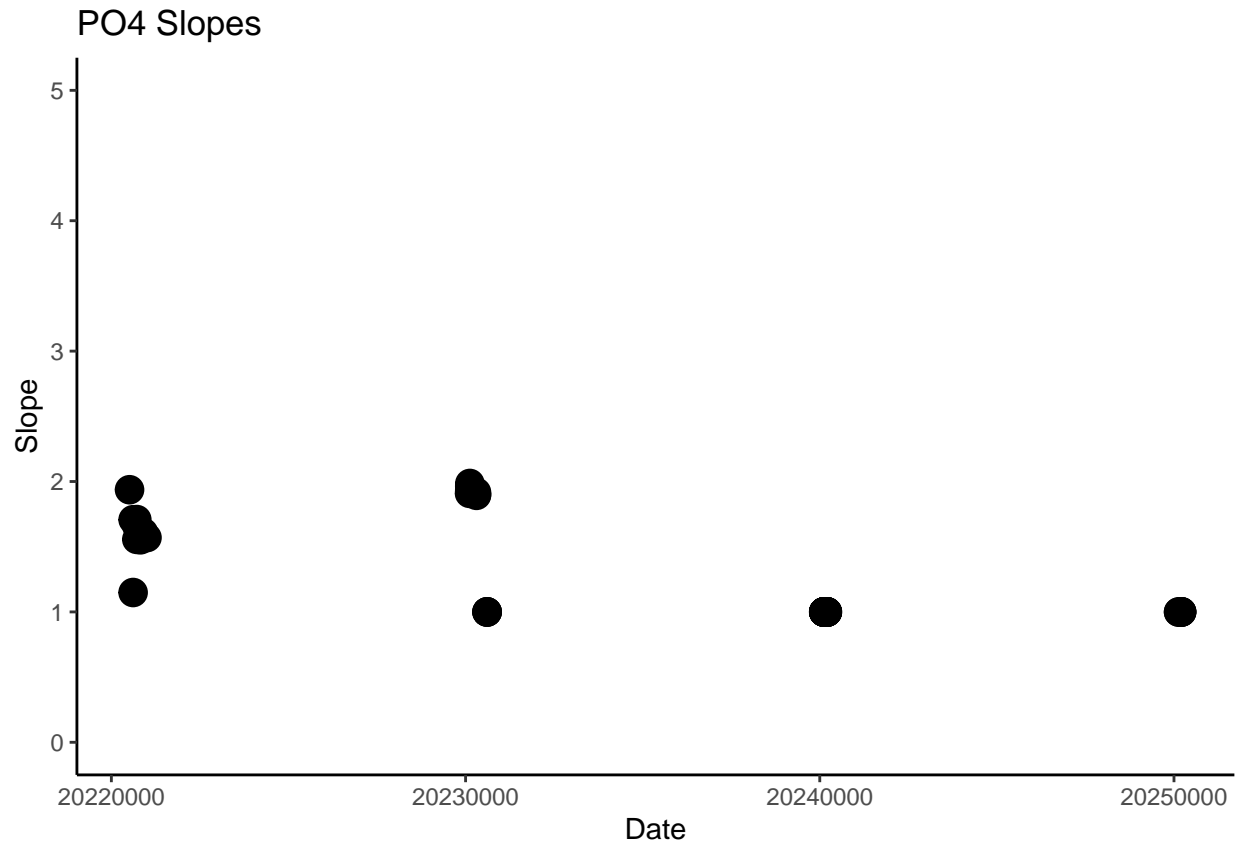
```
## Warning: Removed 39 rows containing missing values or values outside the scale range
## ('geom_point()').
```

NH3 R2s


```
########### PO4
slope2 <- ggplot(data=qNH3, aes(x=Date, y=Slope)) +
  #geom_line()+
  geom_point(aes(size=3)) +
  theme_classic() + ylim(0, 5) +
  theme(legend.position="none")+
  ggtitle("PO4 Slopes")

slope2
```
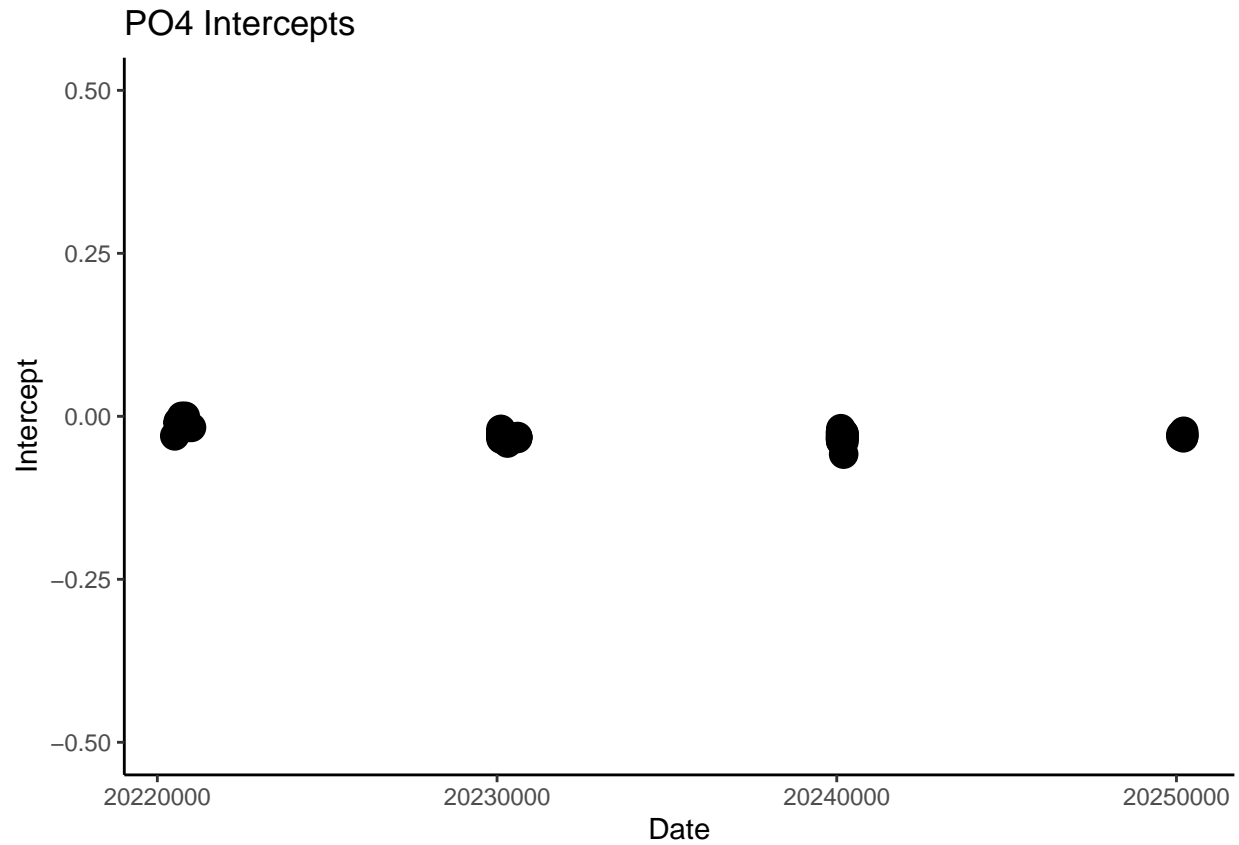
```
## Warning: Removed 1 row containing missing values or values outside the scale range
## ('geom_point()').
```

PO4 Slopes


```
#plot the intercepts to make sure there are no crazy outliers
int2 <- ggplot(data=qNH3, aes(x=Date, y=Intercept)) +
  #geom_line()+
  geom_point(aes(size=3)) +
  theme_classic() + ylim(-0.5,0.5) +
  theme(legend.position="none")+
  ggtitle("PO4 Intercepts")

int2
```

```
## Warning: Removed 1 row containing missing values or values outside the scale range
## ('geom_point()').
```

PO4 Intercepts


```
#plot the R2s to make sure there are no crazy outliers
Rsq2 <- ggplot(data=qNH3, aes(x=Date, y=R2)) +
  #geom_line()+
  geom_point(aes(size=3)) +
  theme_classic() + ylim(0.75, 1.25) +
  theme(legend.position="none")+
  ggtitle("PO4 R2s")

Rsq2
```

```
## Warning: Removed 39 rows containing missing values or values outside the scale range
## ('geom_point()').
```

PO4 R2s


```
########### NOx
slope3 <- ggplot(data=qNH3, aes(x=Date, y=Slope)) +
  #geom_line()+
  geom_point(aes(size=3)) +
  theme_classic() + ylim(0, 5) +
  theme(legend.position="none")+
  ggtitle("NOx Slopes")

slope3
```

```
## Warning: Removed 1 row containing missing values or values outside the scale range
## ('geom_point()').
```

NOx Slopes


```r
#plot the intercepts to make sure there are no crazy outliers
int3 <- ggplot(data=qNH3, aes(x=Date, y=Intercept)) +
  #geom_line()+
  geom_point(aes(size=3)) +
  theme_classic() + ylim(-0.5,0.5) +
  theme(legend.position="none")+
  ggtitle("NOx Intercepts")

int3
```
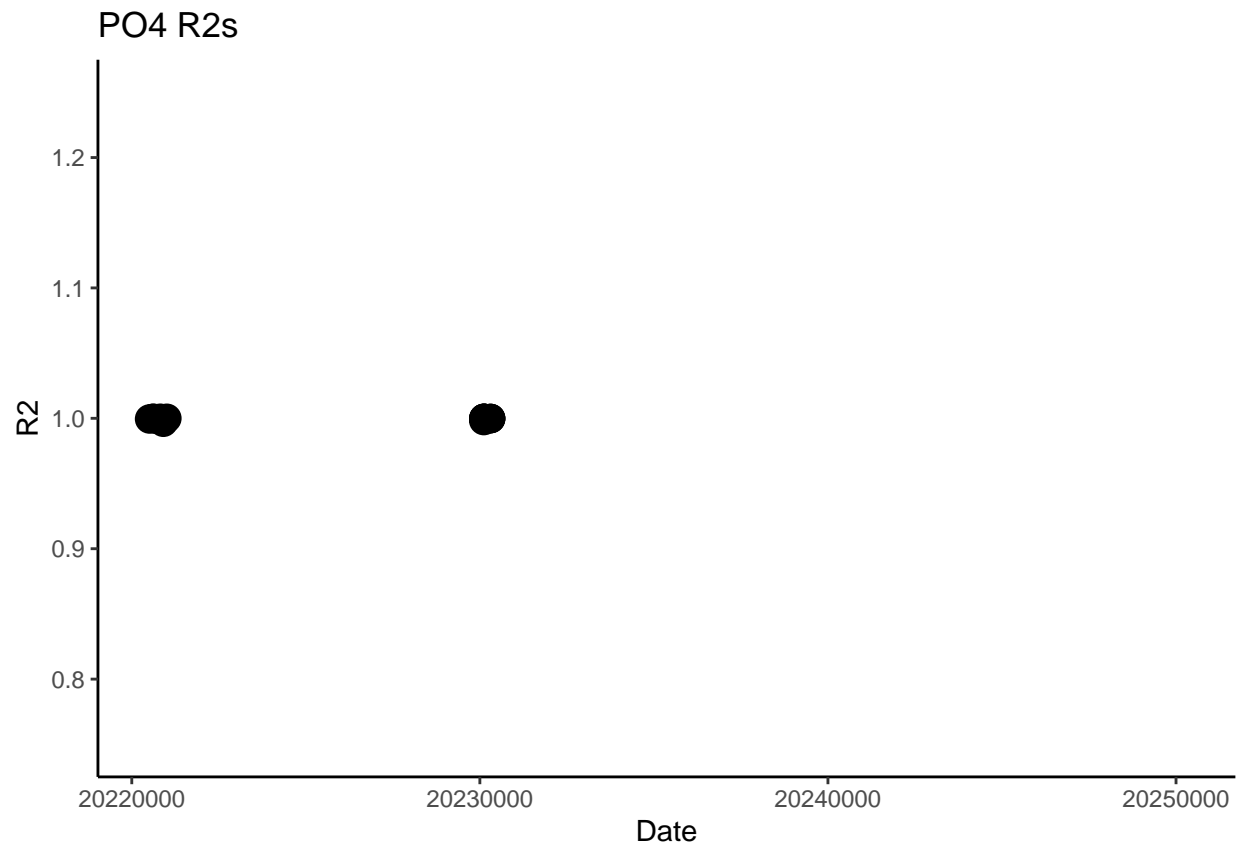
```
## Warning: Removed 1 row containing missing values or values outside the scale range
## ('geom_point()').
```

NOx Intercepts


```
#plot the R2s to make sure there are no crazy outliers
Rsq3 <- ggplot(data=qNH3, aes(x=Date, y=R2)) +
  #geom_line()+
  geom_point(aes(size=3)) +
  theme_classic() + ylim(0.75, 1.25) +
  theme(legend.position="none")+
  ggtitle("NOx R2s")

Rsq3
```
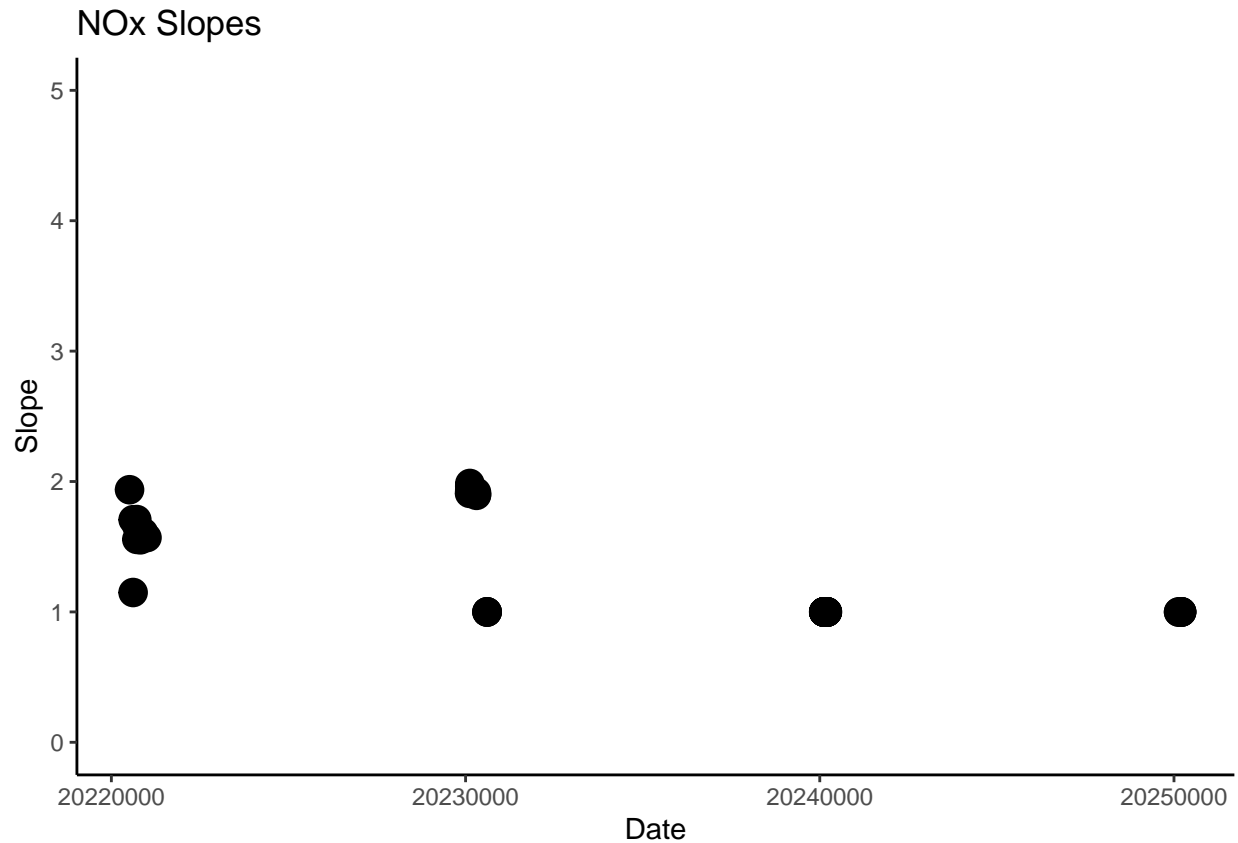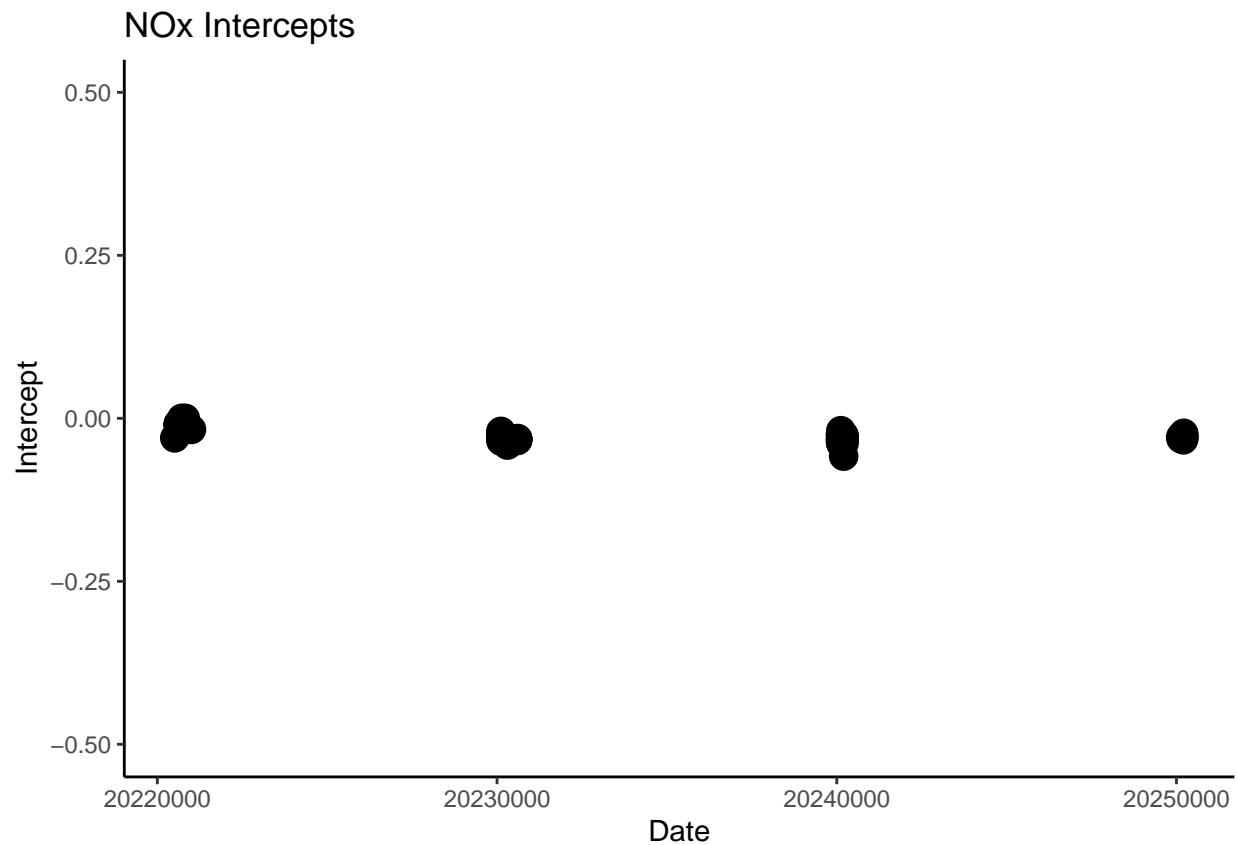
```
## Warning: Removed 39 rows containing missing values or values outside the scale range
## ('geom_point()').
```

NOx R2s

Code Set up

```r
#packages:
library(ggplot2)
library(dplyr)
```

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

## The following objects are masked from 'package:data.table':
##
##     between, first, last

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

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

```
library(data.table)
library(matrixStats)
```

```
##
## Attaching package: 'matrixStats'
```

```
## The following object is masked from 'package:dplyr':
##
##     count
```

```
library(gridExtra)
```

```
##
## Attaching package: 'gridExtra'
```

```
## The following object is masked from 'package:dplyr':
##
##     combine
```

```
library(ggpubr)
library(grid)
```

Ammonia & Phosphate

```
#read in data
file1 <- read.csv("Raw Data/SEAL_COMPASS_Synoptic_NH3_PO4_202209_1.csv")
#Quick look at dataframe
head(file1)
```

```
##   RUNSTARTED X1553789462 X3.28.2019.12.11        X X.1       X.2       X.3 X.4
## 1     RESULT          -1                  S1  Standard 1   0 0.000019 0.000019   0
## 2     RESULT          -2                 S90 Standard 90   1 0.008778 0.008778   0
## 3     RESULT          -2                 S91 Standard 91   2 0.023144 0.023144   0
## 4     RESULT          -2                 S92 Standard 92   3 0.045439 0.045439   0
## 5     RESULT          -2                 S93 Standard 93   4 0.117195 0.117195   0
## 6     RESULT          -2                 S94 Standard 94   5 0.237585 0.237585   0
##   X.5 X.6 X.7     X.8       X.9       X.10           X.11
## 1   0   0   0 mg N/L Nitrite 0.2 1553790057 3/28/2019 12:20
## 2   0   0   0 mg N/L Nitrite 0.2 1553790098 3/28/2019 12:21
## 3   0   0   0 mg N/L Nitrite 0.2 1553790139 3/28/2019 12:22
## 4   0   0   0 mg N/L Nitrite 0.2 1553790179 3/28/2019 12:22
## 5   0   0   0 mg N/L Nitrite 0.2 1553790220 3/28/2019 12:23
## 6   0   0   0 mg N/L Nitrite 0.2 1553790261 3/28/2019 12:24
```

```
#take out only the columns that we need
dat1 <- file1[ ,c(1,4,6,7, 12, 13)]
# assigning new names to the columns of the data frame
colnames(dat1) <- c('Run_Info','Sample_Name','Conc', "Abs", "Units", "Test")
head(dat1)
```

```
##   Run_Info Sample_Name     Conc     Abs Units      Test
## 1   RESULT  Standard 1 0.000019 0.000019 mg N/L Nitrite 0.2
## 2   RESULT Standard 90 0.008778 0.008778 mg N/L Nitrite 0.2
## 3   RESULT Standard 91 0.023144 0.023144 mg N/L Nitrite 0.2
## 4   RESULT Standard 92 0.045439 0.045439 mg N/L Nitrite 0.2
## 5   RESULT Standard 93 0.117195 0.117195 mg N/L Nitrite 0.2
## 6   RESULT Standard 94 0.237585 0.237585 mg N/L Nitrite 0.2
```

```r
#read in data
file2 <- read.csv("Raw Data/SEAL_COMPASS_Synoptic_NH3_PO4_202209_2.csv")
#Quick look at dataframe
head(file2)
```

```
##   RUNSTARTED X1568815852 X9.18.2019.10.10     X X.1      X.2      X.3 X.4
## 1     RESULT          -1               S1  Standard 1   0 0.584576 0.584576   0
## 2     RESULT          -2              S90 Standard 90   1 0.518989 0.518989   0
## 3     RESULT          -2              S91 Standard 91   2 0.605939 0.605939   0
## 4     RESULT          -2              S92 Standard 92   3 0.684434 0.684434   0
## 5     RESULT          -2              S93 Standard 93   4 0.787007 0.787007   0
## 6     RESULT          -2              S94 Standard 94   5 0.938437 0.938437   0
##   X.5 X.6 X.7   X.8      X.9       X.10            X.11
## 1   0   0   0 mg N/L NO3_NO2 2 1568817080 9/18/2019 10:31
## 2   0   0   0 mg N/L NO3_NO2 2 1568817209 9/18/2019 10:33
## 3   0   0   0 mg N/L NO3_NO2 2 1568817338 9/18/2019 10:35
## 4   0   0   0 mg N/L NO3_NO2 2 1568817466 9/18/2019 10:37
## 5   0   0   0 mg N/L NO3_NO2 2 1568817594 9/18/2019 10:39
## 6   0   0   0 mg N/L NO3_NO2 2 1568817722 9/18/2019 10:42
```

```r
#take out only the columns that we need
dat2 <- file2[ ,c(1,4,6,7, 12, 13)]
# assigning new names to the columns of the data frame
colnames(dat2) <- c('Run_Info','Sample_Name','Conc', "Abs", "Units", "Test")
head(dat2)
```

```
##   Run_Info Sample_Name     Conc      Abs Units        Test
## 1   RESULT  Standard 1 0.584576 0.584576 mg N/L NO3_NO2 2
## 2   RESULT Standard 90 0.518989 0.518989 mg N/L NO3_NO2 2
## 3   RESULT Standard 91 0.605939 0.605939 mg N/L NO3_NO2 2
## 4   RESULT Standard 92 0.684434 0.684434 mg N/L NO3_NO2 2
## 5   RESULT Standard 93 0.787007 0.787007 mg N/L NO3_NO2 2
## 6   RESULT Standard 94 0.938437 0.938437 mg N/L NO3_NO2 2
```

```r
#read in data
file3 <- read.csv("Raw Data/SEAL_COMPASS_Synoptic_NH3_PO4_202209_3.csv")
#Quick look at dataframe
head(file3)
```

```
##   RUNSTARTED X1673644940 X1.13.2023.16.22      X X.1      X.2      X.3
## 1     RESULT          -1               S1     Standard 1   0 0.009933 0.009933
## 2     RESULT          -2              S90  Standard .0389   1 0.029260 0.029260
## 3     RESULT          -2              S91  Standard .1000   2 0.063726 0.063726
## 4     RESULT          -2              S92  Standard .2000   3 0.094039 0.094039
```

```
## 5       RESULT          -2              S93  Standard .5000     4 0.271131 0.271131
## 6       RESULT          -2              S94 Standard 1.0000     5 0.558844 0.558844
##   X.4 X.5 X.6 X.7    X.8       X.9        X.10                X.11
## 1   0   0   0   0 mg N/L Ammonia 2 1673646166 1/13/2023 16:42
## 2   0   0   0   0 mg N/L Ammonia 2 1673646326 1/13/2023 16:45
## 3   0   0   0   0 mg N/L Ammonia 2 1673646486 1/13/2023 16:48
## 4   0   0   0   0 mg N/L Ammonia 2 1673646646 1/13/2023 16:50
## 5   0   0   0   0 mg N/L Ammonia 2 1673646806 1/13/2023 16:53
## 6   0   0   0   0 mg N/L Ammonia 2 1673646966 1/13/2023 16:56
```

```r
#take out only the columns that we need
dat3 <- file3[ ,c(1,4,6,7, 12, 13)]
# assigning new names to the columns of the data frame
colnames(dat3) <- c('Run_Info','Sample_Name','Conc', "Abs", "Units", "Test")
head(dat3)
```

```
##   Run_Info     Sample_Name     Conc      Abs  Units     Test
## 1   RESULT      Standard 1 0.009933 0.009933 mg N/L Ammonia 2
## 2   RESULT  Standard .0389 0.029260 0.029260 mg N/L Ammonia 2
## 3   RESULT  Standard .1000 0.063726 0.063726 mg N/L Ammonia 2
## 4   RESULT  Standard .2000 0.094039 0.094039 mg N/L Ammonia 2
## 5   RESULT  Standard .5000 0.271131 0.271131 mg N/L Ammonia 2
## 6   RESULT Standard 1.0000 0.558844 0.558844 mg N/L Ammonia 2
```

```r
alldat <- rbind(dat1, dat2, dat3)
```

```r
#Pull out standards
stds <- alldat[alldat$Sample_Name %like% "Standard", ]
head(stds)
```

```
##   Run_Info Sample_Name     Conc      Abs  Units      Test
## 1   RESULT  Standard 1 0.000019 0.000019 mg N/L Nitrite 0.2
## 2   RESULT Standard 90 0.008778 0.008778 mg N/L Nitrite 0.2
## 3   RESULT Standard 91 0.023144 0.023144 mg N/L Nitrite 0.2
## 4   RESULT Standard 92 0.045439 0.045439 mg N/L Nitrite 0.2
## 5   RESULT Standard 93 0.117195 0.117195 mg N/L Nitrite 0.2
## 6   RESULT Standard 94 0.237585 0.237585 mg N/L Nitrite 0.2
```

```r
#Pull out samples
alldat2 <- alldat[alldat$Sample_Name %like% "MSM_", ]
alldat2 <- rbind(alldat2, (alldat[alldat$Sample_Name %like% "GWI_", ]))
alldat2 <- rbind(alldat2, (alldat[alldat$Sample_Name %like% "GCrew_", ]))
head(alldat2)
```

```
##     Run_Info            Sample_Name     Conc      Abs  Units     Test
## 122   RESULT MSM_202209_UP_LysA_20cm 1.390346 0.896168 mg N/L Ammonia 2
## 123   RESULT MSM_202209_UP_LysA_45cm 0.681030 0.444370 mg N/L Ammonia 2
## 124   RESULT MSM_202209_UP_LysB_10cm 0.029888 0.029626 mg N/L Ammonia 2
## 125   RESULT MSM_202209_UP_LysB_20cm 0.194465 0.134453 mg N/L Ammonia 2
## 126   RESULT MSM_202209_UP_LysB_45cm 0.395437 0.262462 mg N/L Ammonia 2
## 127   RESULT MSM_202209_UP_LysC_10cm 0.375479 0.249749 mg N/L Ammonia 2
```

NOx

```r
#read in data
Nfile1 <- read.csv("Raw Data/SEAL_COMPASS_Synoptic_NOx_202209_1.csv")
#Quick look at dataframe
head(Nfile1)
```

```
##   RUNSTARTED X1674261103    X1.20.2023.19.31      X  X.1      X.2      X.3
## 1   RUNENDED  1674261139 INSUFFICIENT REAGENT         NA       NA       NA
## 2 RUNSTARTED  1674261195     1/20/2023 19:33         NA       NA       NA
## 3     RESULT          -1                    S1  Standard 1   0 0.184456 0.184456
## 4     RESULT          -2                   S90 Standard 90   1 0.203401 0.203401
## 5     RESULT          -2                   S91 Standard 91   2 0.227204 0.227204
## 6     RESULT          -2                   S92 Standard 92   3 0.266972 0.266972
##   X.4 X.5 X.6 X.7      X.8             X.9          X.10          X.11
## 1  NA  NA  NA  NA                                  NA
## 2  NA  NA  NA  NA                                  NA
## 3   0   0   0 512 mg N/L Vanadium NOx 1674263383 1/20/2023 20:09
## 4   0   0   0 512 mg N/L Vanadium NOx 1674263465 1/20/2023 20:11
## 5   0   0   0 512 mg N/L Vanadium NOx 1674263546 1/20/2023 20:12
## 6   0   0   0 512 mg N/L Vanadium NOx 1674263627 1/20/2023 20:13
```

```r
#take out only the columns that we need
Ndat1 <- Nfile1[ ,c(1,4,6,7, 12, 13)]
# assigning new names to the columns of the data frame
colnames(Ndat1) <- c('Run_Info','Sample_Name','Conc', "Abs", "Units", "Test")
head(Ndat1)
```

```
##     Run_Info Sample_Name     Conc      Abs Units            Test
## 1   RUNENDED                   NA       NA
## 2 RUNSTARTED                   NA       NA
## 3     RESULT  Standard 1 0.184456 0.184456 mg N/L Vanadium NOx
## 4     RESULT Standard 90 0.203401 0.203401 mg N/L Vanadium NOx
## 5     RESULT Standard 91 0.227204 0.227204 mg N/L Vanadium NOx
## 6     RESULT Standard 92 0.266972 0.266972 mg N/L Vanadium NOx
```

```r
#read in data
Nfile2 <- read.csv("Raw Data/SEAL_COMPASS_Synoptic_NOx_202209_2.csv")
#Quick look at dataframe
head(Nfile2)
```

```
##   RUNSTARTED X1673807323 X1.15.2023.13.28      X  X.1      X.2      X.3 X.4
## 1     RESULT          -1                  S1  Standard 1   0 0.140496 0.140496   0
## 2     RESULT          -2                 S90 Standard 90   1 0.158302 0.158302   0
## 3     RESULT          -2                 S91 Standard 91   2 0.182799 0.182799   0
## 4     RESULT          -2                 S92 Standard 92   3 0.223878 0.223878   0
## 5     RESULT          -2                 S93 Standard 93   4 0.344134 0.344134   0
## 6     RESULT          -2                 S94 Standard 94   5 0.553945 0.553945   0
##   X.5 X.6 X.7      X.8             X.9          X.10          X.11
## 1   0   0   0 mg N/L Vanadium NOx 1673809505 1/15/2023 14:05
## 2   0   0   0 mg N/L Vanadium NOx 1673809585 1/15/2023 14:06
```

```
## 3    0    0    0 mg N/L Vanadium NOx 1673809665 1/15/2023 14:07
## 4    0    0    0 mg N/L Vanadium NOx 1673809745 1/15/2023 14:09
## 5    0    0    0 mg N/L Vanadium NOx 1673809825 1/15/2023 14:10
## 6    0    0    0 mg N/L Vanadium NOx 1673809905 1/15/2023 14:11
```

```r
#take out only the columns that we need
Ndat2 <- Nfile2[ ,c(1,4,6,7, 12, 13)]
# assigning new names to the columns of the data frame
colnames(Ndat2) <- c('Run_Info','Sample_Name','Conc', "Abs", "Units", "Test")
head(Ndat2)
```

```
##   Run_Info Sample_Name     Conc      Abs Units         Test
## 1   RESULT  Standard 1 0.140496 0.140496 mg N/L Vanadium NOx
## 2   RESULT Standard 90 0.158302 0.158302 mg N/L Vanadium NOx
## 3   RESULT Standard 91 0.182799 0.182799 mg N/L Vanadium NOx
## 4   RESULT Standard 92 0.223878 0.223878 mg N/L Vanadium NOx
## 5   RESULT Standard 93 0.344134 0.344134 mg N/L Vanadium NOx
## 6   RESULT Standard 94 0.553945 0.553945 mg N/L Vanadium NOx
```

```r
#read in data
Nfile3 <- read.csv("Raw Data/SEAL_COMPASS_Synoptic_NOx_202209_3.csv")
#Quick look at dataframe
head(Nfile3)
```

```
##    RUNSTARTED X1673913818 X1.16.2023.19.03          X  X.1      X.2      X.3 X.4
## 1 RUNSTARTED    1673918924    1/16/2023 20:28              NA       NA       NA  NA
## 2     RESULT          -1              S1  Standard 1    0 0.139612 0.139612   0
## 3     RESULT          -2             S90 Standard 90    1 0.156868 0.156868   0
## 4     RESULT          -2             S91 Standard 91    2 0.177989 0.177989   0
## 5     RESULT          -2             S92 Standard 92    3 0.220473 0.220473   0
## 6     RESULT          -2             S93 Standard 93    4 0.339950 0.339950   0
##   X.5 X.6 X.7    X.8           X.9       X.10           X.11
## 1  NA  NA  NA                   NA
## 2   0   0   0 mg N/L Vanadium NOx 1673921121 1/16/2023 21:05
## 3   0   0   0 mg N/L Vanadium NOx 1673921200 1/16/2023 21:06
## 4   0   0   0 mg N/L Vanadium NOx 1673921281 1/16/2023 21:08
## 5   0   0   0 mg N/L Vanadium NOx 1673921360 1/16/2023 21:09
## 6   0   0   0 mg N/L Vanadium NOx 1673921441 1/16/2023 21:10
```

```r
#take out only the columns that we need
Ndat3 <- Nfile3[ ,c(1,4,6,7, 12, 13)]
# assigning new names to the columns of the data frame
colnames(Ndat3) <- c('Run_Info','Sample_Name','Conc', "Abs", "Units", "Test")
head(Ndat3)
```

```
##     Run_Info Sample_Name     Conc      Abs Units         Test
## 1 RUNSTARTED                   NA       NA
## 2     RESULT  Standard 1 0.139612 0.139612 mg N/L Vanadium NOx
## 3     RESULT Standard 90 0.156868 0.156868 mg N/L Vanadium NOx
## 4     RESULT Standard 91 0.177989 0.177989 mg N/L Vanadium NOx
## 5     RESULT Standard 92 0.220473 0.220473 mg N/L Vanadium NOx
## 6     RESULT Standard 93 0.339950 0.339950 mg N/L Vanadium NOx
```

```
Nalldat <- rbind(Ndat1, Ndat2, Ndat3)

#Pull out standards
Nstds <- Nalldat[Nalldat$Sample_Name %like% "Standard", ]
head(Nstds)
```

```
##   Run_Info Sample_Name     Conc      Abs   Units       Test
## 3   RESULT  Standard 1 0.184456 0.184456 mg N/L Vanadium NOx
## 4   RESULT Standard 90 0.203401 0.203401 mg N/L Vanadium NOx
## 5   RESULT Standard 91 0.227204 0.227204 mg N/L Vanadium NOx
## 6   RESULT Standard 92 0.266972 0.266972 mg N/L Vanadium NOx
## 7   RESULT Standard 93 0.382567 0.382567 mg N/L Vanadium NOx
## 8   RESULT Standard 94 0.583302 0.583302 mg N/L Vanadium NOx
```

```
#Pull out samples
Nalldat2 <- Nalldat[Nalldat$Sample_Name %like% "MSM_", ]
Nalldat2 <- rbind(Nalldat2, (Nalldat[Nalldat$Sample_Name %like% "GWI_", ]))
Nalldat2 <- rbind(Nalldat2, (Nalldat[Nalldat$Sample_Name %like% "GCrew_", ]))
head(Nalldat2)
```

```
##    Run_Info              Sample_Name      Conc      Abs   Units       Test
## 23   RESULT MSM_202209_UP_LysA_20cm  0.005178 0.189194 mg N/L Vanadium NOx
## 24   RESULT MSM_202209_UP_LysA_45cm  0.004450 0.188606 mg N/L Vanadium NOx
## 25   RESULT MSM_202209_UP_LysB_10cm -0.000600 0.184527 mg N/L Vanadium NOx
## 26   RESULT MSM_202209_UP_LysB_20cm -0.000584 0.184540 mg N/L Vanadium NOx
## 27   RESULT MSM_202209_UP_LysB_45cm  0.020174 0.201302 mg N/L Vanadium NOx
## 28   RESULT MSM_202209_UP_LysC_10cm -0.002939 0.182637 mg N/L Vanadium NOx
```

Constants

```
N_mw <- 14.0067     # molecular weight of N

P_mw <- 30.973762   # molecular weight of P

Con1 <- 1000        # conversion factor value

Con2 <- 1000000     # conversion factor value
```

Convert Data from mg/L to uM

```
head(alldat2)
```

```
##     Run_Info              Sample_Name     Conc      Abs   Units      Test
## 122   RESULT MSM_202209_UP_LysA_20cm 1.390346 0.896168 mg N/L Ammonia 2
## 123   RESULT MSM_202209_UP_LysA_45cm 0.681030 0.444370 mg N/L Ammonia 2
## 124   RESULT MSM_202209_UP_LysB_10cm 0.029888 0.029626 mg N/L Ammonia 2
## 125   RESULT MSM_202209_UP_LysB_20cm 0.194465 0.134453 mg N/L Ammonia 2
## 126   RESULT MSM_202209_UP_LysB_45cm 0.395437 0.262462 mg N/L Ammonia 2
## 127   RESULT MSM_202209_UP_LysC_10cm 0.375479 0.249749 mg N/L Ammonia 2
```

```r
head(Nalldat2)
```

```
##     Run_Info           Sample_Name      Conc      Abs Units         Test
## 23   RESULT MSM_202209_UP_LysA_20cm  0.005178 0.189194 mg N/L Vanadium NOx
## 24   RESULT MSM_202209_UP_LysA_45cm  0.004450 0.188606 mg N/L Vanadium NOx
## 25   RESULT MSM_202209_UP_LysB_10cm -0.000600 0.184527 mg N/L Vanadium NOx
## 26   RESULT MSM_202209_UP_LysB_20cm -0.000584 0.184540 mg N/L Vanadium NOx
## 27   RESULT MSM_202209_UP_LysB_45cm  0.020174 0.201302 mg N/L Vanadium NOx
## 28   RESULT MSM_202209_UP_LysC_10cm -0.002939 0.182637 mg N/L Vanadium NOx
```

```r
#subset by test
NH4samples <- subset(alldat2, Test == "Ammonia 2")
head(NH4samples)
```

```
##      Run_Info           Sample_Name     Conc      Abs Units      Test
## 122   RESULT MSM_202209_UP_LysA_20cm 1.390346 0.896168 mg N/L Ammonia 2
## 123   RESULT MSM_202209_UP_LysA_45cm 0.681030 0.444370 mg N/L Ammonia 2
## 124   RESULT MSM_202209_UP_LysB_10cm 0.029888 0.029626 mg N/L Ammonia 2
## 125   RESULT MSM_202209_UP_LysB_20cm 0.194465 0.134453 mg N/L Ammonia 2
## 126   RESULT MSM_202209_UP_LysB_45cm 0.395437 0.262462 mg N/L Ammonia 2
## 127   RESULT MSM_202209_UP_LysC_10cm 0.375479 0.249749 mg N/L Ammonia 2
```

```r
PO4samples <- subset(alldat2, Test == "o-PHOS 0.3")
head(PO4samples)
```

```
##      Run_Info           Sample_Name     Conc      Abs Units      Test
## 274   RESULT MSM_202209_UP_LysA_20cm 0.015957 0.007203 mg P/L o-PHOS 0.3
## 275   RESULT MSM_202209_UP_LysA_45cm 0.042254 0.018219 mg P/L o-PHOS 0.3
## 276   RESULT MSM_202209_UP_LysB_10cm 0.011573 0.005367 mg P/L o-PHOS 0.3
## 277   RESULT MSM_202209_UP_LysB_20cm 0.009140 0.004347 mg P/L o-PHOS 0.3
## 278   RESULT MSM_202209_UP_LysB_45cm 0.039296 0.016980 mg P/L o-PHOS 0.3
## 279   RESULT MSM_202209_UP_LysC_10cm 0.013091 0.006002 mg P/L o-PHOS 0.3
```

```r
NOXsamples <- subset(Nalldat2, Test == "Vanadium NOx")
head(NOXsamples)
```

```
##     Run_Info           Sample_Name      Conc      Abs Units         Test
## 23   RESULT MSM_202209_UP_LysA_20cm  0.005178 0.189194 mg N/L Vanadium NOx
## 24   RESULT MSM_202209_UP_LysA_45cm  0.004450 0.188606 mg N/L Vanadium NOx
## 25   RESULT MSM_202209_UP_LysB_10cm -0.000600 0.184527 mg N/L Vanadium NOx
## 26   RESULT MSM_202209_UP_LysB_20cm -0.000584 0.184540 mg N/L Vanadium NOx
## 27   RESULT MSM_202209_UP_LysB_45cm  0.020174 0.201302 mg N/L Vanadium NOx
## 28   RESULT MSM_202209_UP_LysC_10cm -0.002939 0.182637 mg N/L Vanadium NOx
```

```r
NH4samples$Conc_uM <- (((as.numeric(NH4samples$Conc))/Con1)/N_mw)*Con2
head(NH4samples)
```

```
##      Run_Info           Sample_Name     Conc      Abs Units      Test
## 122   RESULT MSM_202209_UP_LysA_20cm 1.390346 0.896168 mg N/L Ammonia 2
## 123   RESULT MSM_202209_UP_LysA_45cm 0.681030 0.444370 mg N/L Ammonia 2
```

```
## 124    RESULT MSM_202209_UP_LysB_10cm 0.029888 0.029626 mg N/L Ammonia 2
## 125    RESULT MSM_202209_UP_LysB_20cm 0.194465 0.134453 mg N/L Ammonia 2
## 126    RESULT MSM_202209_UP_LysB_45cm 0.395437 0.262462 mg N/L Ammonia 2
## 127    RESULT MSM_202209_UP_LysC_10cm 0.375479 0.249749 mg N/L Ammonia 2
##       Conc_uM
## 122 99.262924
## 123 48.621731
## 124  2.133836
## 125 13.883713
## 126 28.231989
## 127 26.807099
```

```
PO4samples$Conc_uM <- (((as.numeric(PO4samples$Conc))/Con1)/N_mw)*Con2
head(PO4samples)
```

```
##       Run_Info            Sample_Name     Conc      Abs Units     Test
## 274    RESULT MSM_202209_UP_LysA_20cm 0.015957 0.007203 mg P/L o-PHOS 0.3
## 275    RESULT MSM_202209_UP_LysA_45cm 0.042254 0.018219 mg P/L o-PHOS 0.3
## 276    RESULT MSM_202209_UP_LysB_10cm 0.011573 0.005367 mg P/L o-PHOS 0.3
## 277    RESULT MSM_202209_UP_LysB_20cm 0.009140 0.004347 mg P/L o-PHOS 0.3
## 278    RESULT MSM_202209_UP_LysB_45cm 0.039296 0.016980 mg P/L o-PHOS 0.3
## 279    RESULT MSM_202209_UP_LysC_10cm 0.013091 0.006002 mg P/L o-PHOS 0.3
##       Conc_uM
## 274 1.1392405
## 275 3.0166992
## 276 0.8262474
## 277 0.6525449
## 278 2.8055145
## 279 0.9346241
```

```
NOXsamples$Conc_uM_raw <- (((as.numeric(NOXsamples$Conc))/Con1)/N_mw)*Con2
head(NOXsamples)
```

```
##     Run_Info            Sample_Name      Conc      Abs Units         Test
## 23   RESULT MSM_202209_UP_LysA_20cm  0.005178 0.189194 mg N/L Vanadium NOx
## 24   RESULT MSM_202209_UP_LysA_45cm  0.004450 0.188606 mg N/L Vanadium NOx
## 25   RESULT MSM_202209_UP_LysB_10cm -0.000600 0.184527 mg N/L Vanadium NOx
## 26   RESULT MSM_202209_UP_LysB_20cm -0.000584 0.184540 mg N/L Vanadium NOx
## 27   RESULT MSM_202209_UP_LysB_45cm  0.020174 0.201302 mg N/L Vanadium NOx
## 28   RESULT MSM_202209_UP_LysC_10cm -0.002939 0.182637 mg N/L Vanadium NOx
##     Conc_uM_raw
## 23   0.36968022
## 24   0.31770510
## 25  -0.04283664
## 26  -0.04169433
## 27   1.44031071
## 28  -0.20982815
```

```
#add step to make negative values equal to bd (below detection) and replace with zeros
NOXsamples$Conc_uM <- ifelse(NOXsamples$Conc_uM_raw<0, 0, (NOXsamples$Conc_uM_raw) )
head(NOXsamples)
```

```
##    Run_Info               Sample_Name     Conc      Abs Units       Test
## 23   RESULT MSM_202209_UP_LysA_20cm  0.005178 0.189194 mg N/L Vanadium NOx
## 24   RESULT MSM_202209_UP_LysA_45cm  0.004450 0.188606 mg N/L Vanadium NOx
## 25   RESULT MSM_202209_UP_LysB_10cm -0.000600 0.184527 mg N/L Vanadium NOx
## 26   RESULT MSM_202209_UP_LysB_20cm -0.000584 0.184540 mg N/L Vanadium NOx
## 27   RESULT MSM_202209_UP_LysB_45cm  0.020174 0.201302 mg N/L Vanadium NOx
## 28   RESULT MSM_202209_UP_LysC_10cm -0.002939 0.182637 mg N/L Vanadium NOx
##    Conc_uM_raw   Conc_uM
## 23  0.36968022 0.3696802
## 24  0.31770510 0.3177051
## 25 -0.04283664 0.0000000
## 26 -0.04169433 0.0000000
## 27  1.44031071 1.4403107
## 28 -0.20982815 0.0000000
```

Pull all data back together and add flags

```
#pull out the columns we want from each dataframe
NH4_pull <- NH4samples[ ,c(2,3,7) ]
head(NH4_pull)
```

```
##                  Sample_Name     Conc   Conc_uM
## 122 MSM_202209_UP_LysA_20cm 1.390346 99.262924
## 123 MSM_202209_UP_LysA_45cm 0.681030 48.621731
## 124 MSM_202209_UP_LysB_10cm 0.029888  2.133836
## 125 MSM_202209_UP_LysB_20cm 0.194465 13.883713
## 126 MSM_202209_UP_LysB_45cm 0.395437 28.231989
## 127 MSM_202209_UP_LysC_10cm 0.375479 26.807099
```

```
PO4_pull <- PO4samples[ ,c(2,3,7) ]
head(PO4_pull)
```

```
##                  Sample_Name     Conc   Conc_uM
## 274 MSM_202209_UP_LysA_20cm 0.015957 1.1392405
## 275 MSM_202209_UP_LysA_45cm 0.042254 3.0166992
## 276 MSM_202209_UP_LysB_10cm 0.011573 0.8262474
## 277 MSM_202209_UP_LysB_20cm 0.009140 0.6525449
## 278 MSM_202209_UP_LysB_45cm 0.039296 2.8055145
## 279 MSM_202209_UP_LysC_10cm 0.013091 0.9346241
```

```
NOX_pull <- NOXsamples[ ,c(2,3,8) ]
head(NOX_pull)
```

```
##                 Sample_Name      Conc   Conc_uM
## 23 MSM_202209_UP_LysA_20cm  0.005178 0.3696802
## 24 MSM_202209_UP_LysA_45cm  0.004450 0.3177051
## 25 MSM_202209_UP_LysB_10cm -0.000600 0.0000000
## 26 MSM_202209_UP_LysB_20cm -0.000584 0.0000000
## 27 MSM_202209_UP_LysB_45cm  0.020174 1.4403107
## 28 MSM_202209_UP_LysC_10cm -0.002939 0.0000000
```

```r
#Bring all this data back together:
all_data <- merge(NH4_pull, PO4_pull, by="Sample_Name", all.x=TRUE)
all_data <- merge(all_data, NOX_pull, by="Sample_Name", all.x=TRUE)
head(all_data)
```

```
##                    Sample_Name   Conc.x  Conc_uM.x    Conc.y Conc_uM.y      Conc
## 1         GCrew_202209_SW_A 0.267645 19.108355 0.065339 4.6648390 0.018448
## 2         GCrew_202209_SW_B 0.174531 12.460537 0.060568 4.3242163 0.004947
## 3         GCrew_202209_SW_C 0.095026  6.784325 0.038633 2.7581800 0.009035
## 4 GCrew_202209_TR_LysA_20cm 0.288862 20.623130 0.007691 0.5490944       NA
## 5 GCrew_202209_TR_LysA_45cm 0.110145  7.863737 0.008317 0.5937873       NA
## 6 GCrew_202209_TR_LysB_10cm 0.454608 32.456467 0.007700 0.5497369 0.006141
##      Conc_uM
## 1 1.3170840
## 2 0.3531881
## 3 0.6450484
## 4        NA
## 5        NA
## 6 0.4384330
```

```r
colnames(all_data) <- c("Sample_Name", "NH3_mgL", "NH3_uM", "PO4_mgL", "PO4_uM", "NOx_mgL", "NOx_uM")
head(all_data)
```

```
##                    Sample_Name  NH3_mgL    NH3_uM   PO4_mgL    PO4_uM   NOx_mgL
## 1         GCrew_202209_SW_A 0.267645 19.108355 0.065339 4.6648390 0.018448
## 2         GCrew_202209_SW_B 0.174531 12.460537 0.060568 4.3242163 0.004947
## 3         GCrew_202209_SW_C 0.095026  6.784325 0.038633 2.7581800 0.009035
## 4 GCrew_202209_TR_LysA_20cm 0.288862 20.623130 0.007691 0.5490944       NA
## 5 GCrew_202209_TR_LysA_45cm 0.110145  7.863737 0.008317 0.5937873       NA
## 6 GCrew_202209_TR_LysB_10cm 0.454608 32.456467 0.007700 0.5497369 0.006141
##      NOx_uM
## 1 1.3170840
## 2 0.3531881
## 3 0.6450484
## 4        NA
## 5        NA
## 6 0.4384330
```

```r
#add in an if then statement that tells us if they are within the range of the test - check this after
all_data$NH3_range <- ifelse(all_data$NH3_mgL<0.02, "bdl",  ifelse(all_data$NH3_mgL>2, "adl", "Within_Ra
all_data$PO4_range <- ifelse(all_data$PO4_mgL<0.003, "bdl",  ifelse(all_data$PO4_mgL>3, "adl", "Within_
all_data$NOx_range <- ifelse(all_data$NOx_mgL<0.025, "bdl",  ifelse(all_data$NOx_mgL>1, "adl", "Within_
head(all_data)
```
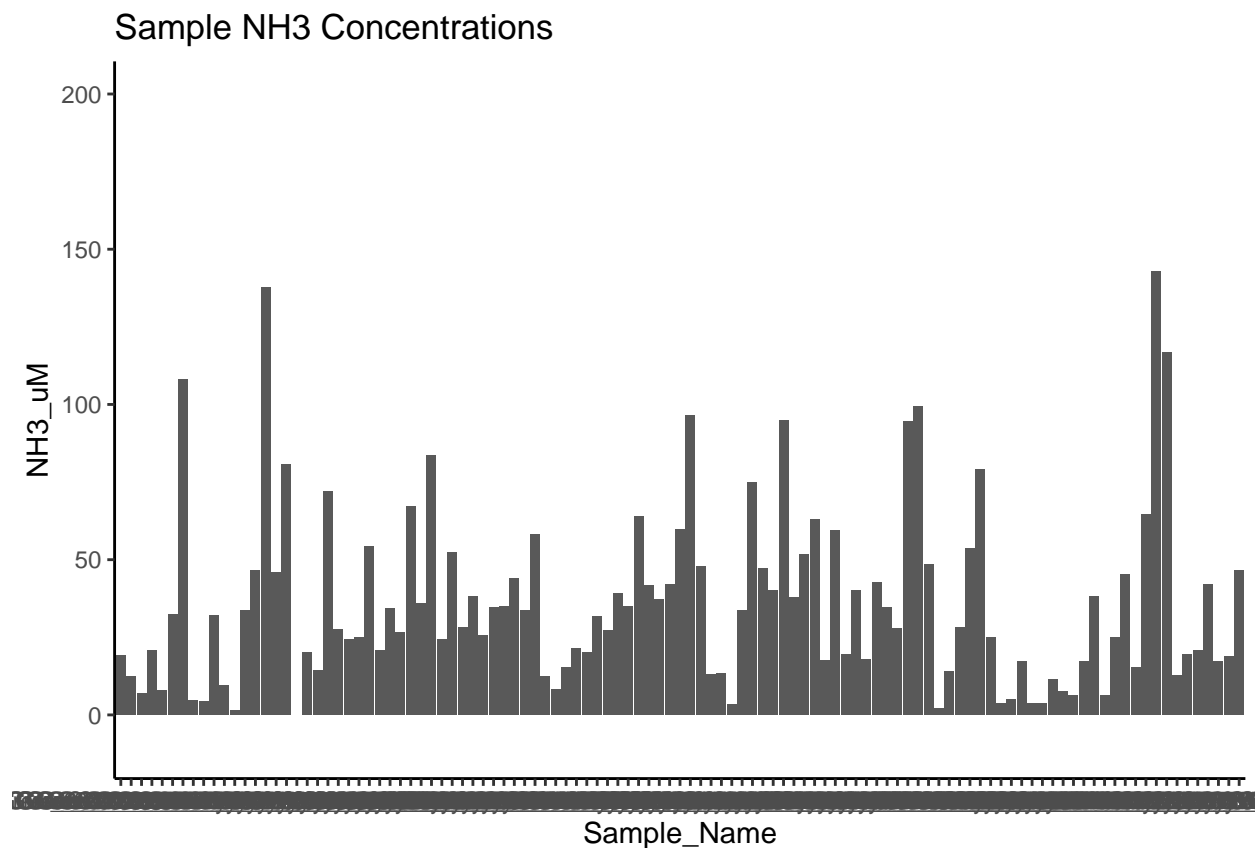
```
##                    Sample_Name  NH3_mgL    NH3_uM   PO4_mgL    PO4_uM   NOx_mgL
## 1         GCrew_202209_SW_A 0.267645 19.108355 0.065339 4.6648390 0.018448
## 2         GCrew_202209_SW_B 0.174531 12.460537 0.060568 4.3242163 0.004947
## 3         GCrew_202209_SW_C 0.095026  6.784325 0.038633 2.7581800 0.009035
## 4 GCrew_202209_TR_LysA_20cm 0.288862 20.623130 0.007691 0.5490944       NA
## 5 GCrew_202209_TR_LysA_45cm 0.110145  7.863737 0.008317 0.5937873       NA
## 6 GCrew_202209_TR_LysB_10cm 0.454608 32.456467 0.007700 0.5497369 0.006141
##      NOx_uM   NH3_range   PO4_range NOx_range
```

```
## 1 1.3170840 Within_Range Within_Range        bdl
## 2 0.3531881 Within_Range Within_Range        bdl
## 3 0.6450484 Within_Range Within_Range        bdl
## 4       NA Within_Range Within_Range       <NA>
## 5       NA Within_Range Within_Range       <NA>
## 6 0.4384330 Within_Range Within_Range        bdl
```

Take an initial look at concentrations

```r
#plot data to get a sense of any outliers
NH3look <- ggplot(data=all_data, aes(x=Sample_Name, y=NH3_uM)) +
  geom_bar(stat="identity") +
  theme_classic() + ylim(-10, 200) +
  theme(legend.position="none") +
  ggtitle("Sample NH3 Concentrations")
NH3look
```
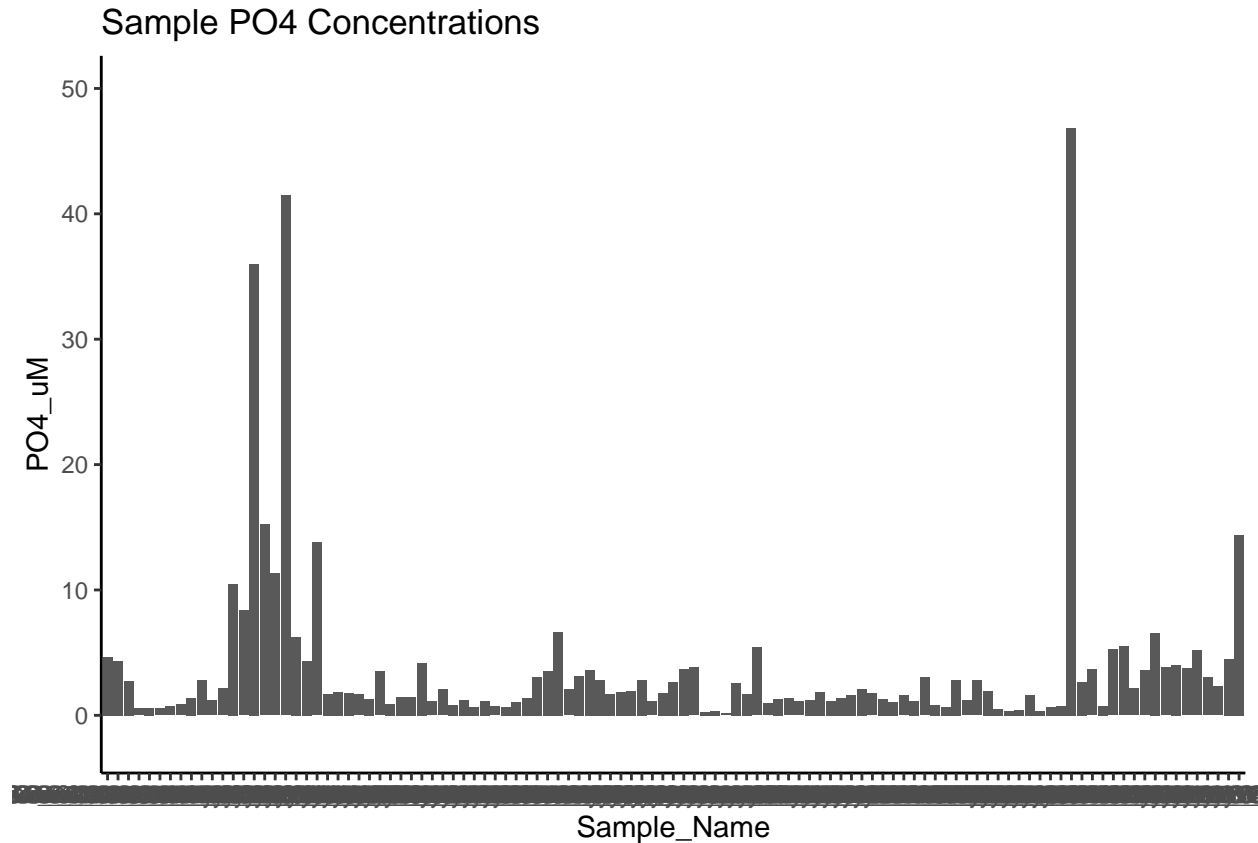
```
## Warning: Removed 7 rows containing missing values or values outside the scale range
## ('geom_bar()').
```



```r
PO4look <- ggplot(data=all_data, aes(x=Sample_Name, y=PO4_uM)) +
  geom_bar(stat="identity") +
  theme_classic() + ylim(-2, 50) +
```
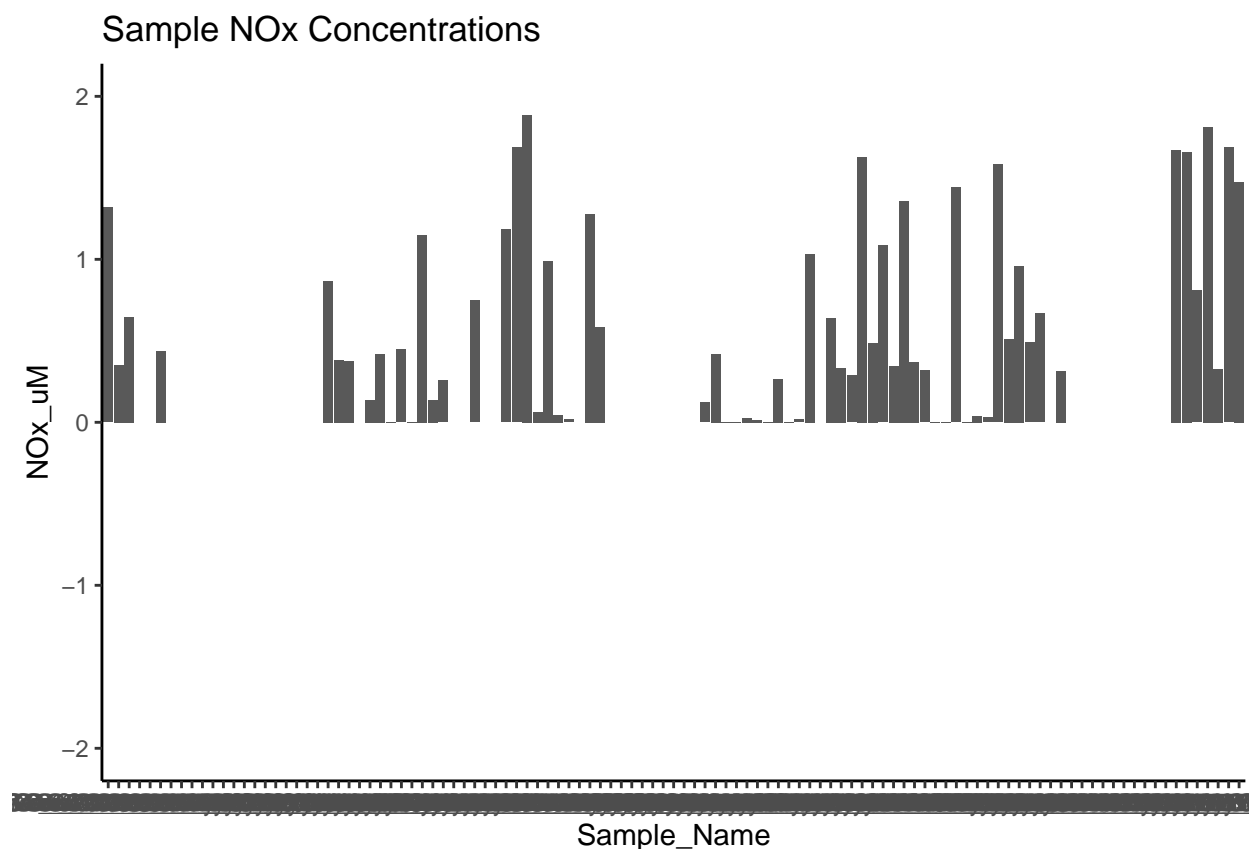
```
  theme(legend.position="none") +
  ggtitle("Sample PO4 Concentrations")
PO4look
```

Warning: Removed 5 rows containing missing values or values outside the scale range
(`geom_bar()`).

NOXlook <- ggplot(data=all_data, aes(x=Sample_Name, y=NOx_uM)) +
  geom_bar(stat="identity") +
  theme_classic() + ylim(-2, 2) +
  theme(legend.position="none") +
  ggtitle("Sample NOx Concentrations")
NOXlook

Warning: Removed 56 rows containing missing values or values outside the scale range
(`geom_bar()`).

Sample NOx Concentrations

Pull out data you need, make IDs

```
head(all_data)
```

```
##                    Sample_Name   NH3_mgL     NH3_uM   PO4_mgL     PO4_uM  NOx_mgL
## 1          GCrew_202209_SW_A  0.267645  19.108355  0.065339  4.6648390  0.018448
## 2          GCrew_202209_SW_B  0.174531  12.460537  0.060568  4.3242163  0.004947
## 3          GCrew_202209_SW_C  0.095026   6.784325  0.038633  2.7581800  0.009035
## 4  GCrew_202209_TR_LysA_20cm  0.288862  20.623130  0.007691  0.5490944       NA
## 5  GCrew_202209_TR_LysA_45cm  0.110145   7.863737  0.008317  0.5937873       NA
## 6  GCrew_202209_TR_LysB_10cm  0.454608  32.456467  0.007700  0.5497369  0.006141
##       NOx_uM    NH3_range     PO4_range  NOx_range
## 1  1.3170840  Within_Range  Within_Range        bdl
## 2  0.3531881  Within_Range  Within_Range        bdl
## 3  0.6450484  Within_Range  Within_Range        bdl
## 4         NA  Within_Range  Within_Range       <NA>
## 5         NA  Within_Range  Within_Range       <NA>
## 6  0.4384330  Within_Range  Within_Range        bdl
```

```
out <- all_data[ ,c(1,3,5,7,8,9,10)]
head(out)
```

```
##                    Sample_Name     NH3_uM     PO4_uM     NOx_uM    NH3_range
```

```
## 1         GCrew_202209_SW_A 19.108355 4.6648390 1.3170840 Within_Range
## 2         GCrew_202209_SW_B 12.460537 4.3242163 0.3531881 Within_Range
## 3         GCrew_202209_SW_C  6.784325 2.7581800 0.6450484 Within_Range
## 4 GCrew_202209_TR_LysA_20cm 20.623130 0.5490944        NA Within_Range
## 5 GCrew_202209_TR_LysA_45cm  7.863737 0.5937873        NA Within_Range
## 6 GCrew_202209_TR_LysB_10cm 32.456467 0.5497369 0.4384330 Within_Range
##      PO4_range NOx_range
## 1 Within_Range       bdl
## 2 Within_Range       bdl
## 3 Within_Range       bdl
## 4 Within_Range      <NA>
## 5 Within_Range      <NA>
## 6 Within_Range       bdl
```

```r
#for steph <- pull out identifiers of the sample names
#pull the sample ID and separate it by the underscores
IDs <- data.frame(do.call('rbind', strsplit(as.character(out$Sample_Name),'_',fixed=TRUE)))
```

```
## Warning in rbind(c("GCrew", "202209", "SW", "A"), c("GCrew", "202209", "SW", :
## number of columns of result is not a multiple of vector length (arg 1)
```

```r
colnames(IDs) <- c("Site" , "Date","Zone", "Replicate", "Depth", "Tree")
IDs$Month <- "September"
head(IDs)
```

```
##    Site   Date Zone Replicate Depth  Tree     Month
## 1 GCrew 202209   SW         A GCrew 202209 September
## 2 GCrew 202209   SW         B GCrew 202209 September
## 3 GCrew 202209   SW         C GCrew 202209 September
## 4 GCrew 202209   TR      LysA  20cm  GCrew September
## 5 GCrew 202209   TR      LysA  45cm  GCrew September
## 6 GCrew 202209   TR      LysB  10cm  GCrew September
```

```r
#rejoin them to the dataframe
alldat <- cbind(IDs, out)
head(alldat)
```

```
##    Site   Date Zone Replicate Depth  Tree     Month               Sample_Name
## 1 GCrew 202209   SW         A GCrew 202209 September         GCrew_202209_SW_A
## 2 GCrew 202209   SW         B GCrew 202209 September         GCrew_202209_SW_B
## 3 GCrew 202209   SW         C GCrew 202209 September         GCrew_202209_SW_C
## 4 GCrew 202209   TR      LysA  20cm  GCrew September GCrew_202209_TR_LysA_20cm
## 5 GCrew 202209   TR      LysA  45cm  GCrew September GCrew_202209_TR_LysA_45cm
## 6 GCrew 202209   TR      LysB  10cm  GCrew September GCrew_202209_TR_LysB_10cm
##      NH3_uM    PO4_uM    NOx_uM    NH3_range    PO4_range NOx_range
## 1 19.108355 4.6648390 1.3170840 Within_Range Within_Range       bdl
## 2 12.460537 4.3242163 0.3531881 Within_Range Within_Range       bdl
## 3  6.784325 2.7581800 0.6450484 Within_Range Within_Range       bdl
## 4 20.623130 0.5490944        NA Within_Range Within_Range      <NA>
## 5  7.863737 0.5937873        NA Within_Range Within_Range      <NA>
## 6 32.456467 0.5497369 0.4384330 Within_Range Within_Range       bdl
```

Export final data with flags

```r
#Export Data

write.csv(alldat, file="Processed Data/COMPASS_SynopticCB_Nutrients_202209.csv")
```