JR_Data_Comparisons

2024-10-15

This code examines the differences between environmental data for the JR site, located at Deep Water Shoal, James River, Virginia, as part of the CViMVP project. The two data sources are:

1. VIMS Water Quality Data, which were downloaded by Madeline Eppley on 15 September 2023
2. NOAA National Buoy Data Center (NBDC), Chesapeake Bay Interpretive Buoy System downloaded by myself (Nicole Mongillo) on 1 October 2024.

I will plot the salinity and temperature data from each data set against each other to see how similar the data are. I will then apply a correction factor to the NBDC data based on the difference between NBDC and VIMS data.

All labels for objects with data from NOAA will begin with NBDC, and all labels for objects with data from VIMS will be labeled VIMS.

```
setwd("/Users/nicolemongillo/Desktop/GitHub/MVP_Chesapeake_VIMS_hatchery/src/NM")
```

```
library("dplyr") #Used for working with data frames
```

```
##
## 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("lubridate") #Used for time-date conversions
```

```
##
## Attaching package: 'lubridate'

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

```
library("readr") #Used to read the CSV file
library("ggplot2")
library("stringr")
```

#VIMS Data Upload and Cleaning

```r
#Environmental data from the NBDC could only be downloaded by year, so first we need to merge the yearly

VIMS_raw <- read_csv("/Users/nicolemongillo/Desktop/GitHub/MVP_Chesapeake_VIMS_hatchery/data/envr_raw_da
```

```
## Rows: 220 Columns: 7
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr (2): DateDeployed, DateRetrieved
## dbl (5): StationID, Year, AverageSpat, WaterTemperature, Salinity
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```r
# View how the data are stored. Note the variable names and the format and units that the data are stor
summary(VIMS_raw)
```

```
##    StationID        Year      DateDeployed       DateRetrieved
##  Min.   :435   Min.   :2010   Length:220         Length:220
##  1st Qu.:435   1st Qu.:2013   Class :character   Class :character
##  Median :435   Median :2016   Mode  :character   Mode  :character
##  Mean   :435   Mean   :2016
##  3rd Qu.:435   3rd Qu.:2020
##  Max.   :435   Max.   :2023
##
##   AverageSpat     WaterTemperature    Salinity
##  Min.   : 0.000   Min.   :17.40    Min.   : 3.80
##  1st Qu.: 0.325   1st Qu.:25.15    1st Qu.:12.70
##  Median : 1.450   Median :26.55    Median :15.70
##  Mean   : 6.179   Mean   :26.21    Mean   :15.05
##  3rd Qu.: 5.400   3rd Qu.:27.80    3rd Qu.:18.00
##  Max.   :81.700   Max.   :29.90    Max.   :21.60
##  NA's   :22
```

```r
#Convert to POSIXct format. Store it into a column named datetime in the data frame.
VIMS_raw$datetime <- as.POSIXct(VIMS_raw$DateRetrieved, "%d-%b-%y", tz = "")

#Print the new data frame and examine to make sure the new datetime column is in the correct format.
head(VIMS_raw)
```

```
## # A tibble: 6 x 8
##   StationID  Year DateDeployed DateRetrieved AverageSpat WaterTemperature
##       <dbl> <dbl> <chr>        <chr>               <dbl>            <dbl>
## 1       435  2023 01-Jun-23    01-Jun-23            NA               19.6
## 2       435  2023 01-Jun-23    15-Jun-23             0               23
## 3       435  2023 15-Jun-23    22-Jun-23             1               23.1
## 4       435  2023 22-Jun-23    29-Jun-23             7.7             24.4
## 5       435  2023 29-Jun-23    06-Jul-23            14.2             28.1
## 6       435  2023 06-Jul-23    13-Jul-23            35.5             28.7
## # i 2 more variables: Salinity <dbl>, datetime <dttm>
```

```
#rename columns
VIMS_raw <- VIMS_raw %>% rename("salinity_VIMS" = "Salinity")
VIMS_raw <- VIMS_raw  %>% rename("temp_VIMS" = "WaterTemperature")

#Filter the data between the values of 0 and 40 for both salinity and temperature.
VIMS_filtered <- VIMS_raw %>%
    filter(between(salinity_VIMS, 0, 40))

VIMS_filtered <- VIMS_raw %>%
    filter(between(temp_VIMS, 0, 40))

# Sanity check - print the ranges to ensure values are filtered properly. We can see that the ranges fo
print(summary(VIMS_filtered$salinity_VIMS))
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    3.80   12.70   15.70   15.05   18.00   21.60
```

```
print(summary(VIMS_filtered$temp_VIMS))
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   17.40   25.15   26.55   26.21   27.80   29.90
```

```
VIMS_filtered$date <- as.POSIXct(VIMS_filtered$datetime, "%Y-%m-%d", tz = "")
```

#NDBC Data Upload and Cleaning

```
#Environmental data from the NBDC could only be downloaded by year, so first we need to merge the yearl

#set working directory to files location
setwd("/Users/nicolemongillo/Desktop/GitHub/MVP_Chesapeake_VIMS_hatchery/data/envr_raw_data/JR_NBDC_Data

#merge files into one
NBDC_raw <- list.files(path="/Users/nicolemongillo/Desktop/GitHub/MVP_Chesapeake_VIMS_hatchery/data/envi
  lapply(read.csv) %>%
  bind_rows

NBDC_raw <- subset(NBDC_raw, select = c(X.YY, MM, DD, hh, mm, OTMP, SAL)) #keep year, month, day, hour,

# View how the data are stored. Note the variable names and the format and units that the data are stor
summary(NBDC_raw)
```

```
##       X.YY            MM              DD              hh
##  Min.   :2008   Min.   : 1.000   Min.   : 1.00   Min.   : 0.00
##  1st Qu.:2012   1st Qu.: 5.000   1st Qu.: 8.00   1st Qu.: 5.00
##  Median :2016   Median : 8.000   Median :16.00   Median :11.00
##  Mean   :2015   Mean   : 7.222   Mean   :16.01   Mean   :11.49
##  3rd Qu.:2019   3rd Qu.:10.000   3rd Qu.:24.00   3rd Qu.:18.00
##  Max.   :2019   Max.   :12.000   Max.   :31.00   Max.   :23.00
##  NA's   :349    NA's   :349      NA's   :349     NA's   :349
##        mm              OTMP            SAL
##  Min.   : 0.000   Min.   : 0.00   Min.   : 0.000
```

```
##  1st Qu.: 0.000   1st Qu.:11.80   1st Qu.: 0.400
##  Median : 0.000   Median :21.50   Median : 2.600
##  Mean   : 9.928   Mean   :19.97   Mean   : 3.268
##  3rd Qu.:18.000   3rd Qu.:27.60   3rd Qu.: 5.300
##  Max.   :54.000   Max.   :99.00   Max.   :99.000
##  NA's   :349      NA's   :349     NA's   :349
```

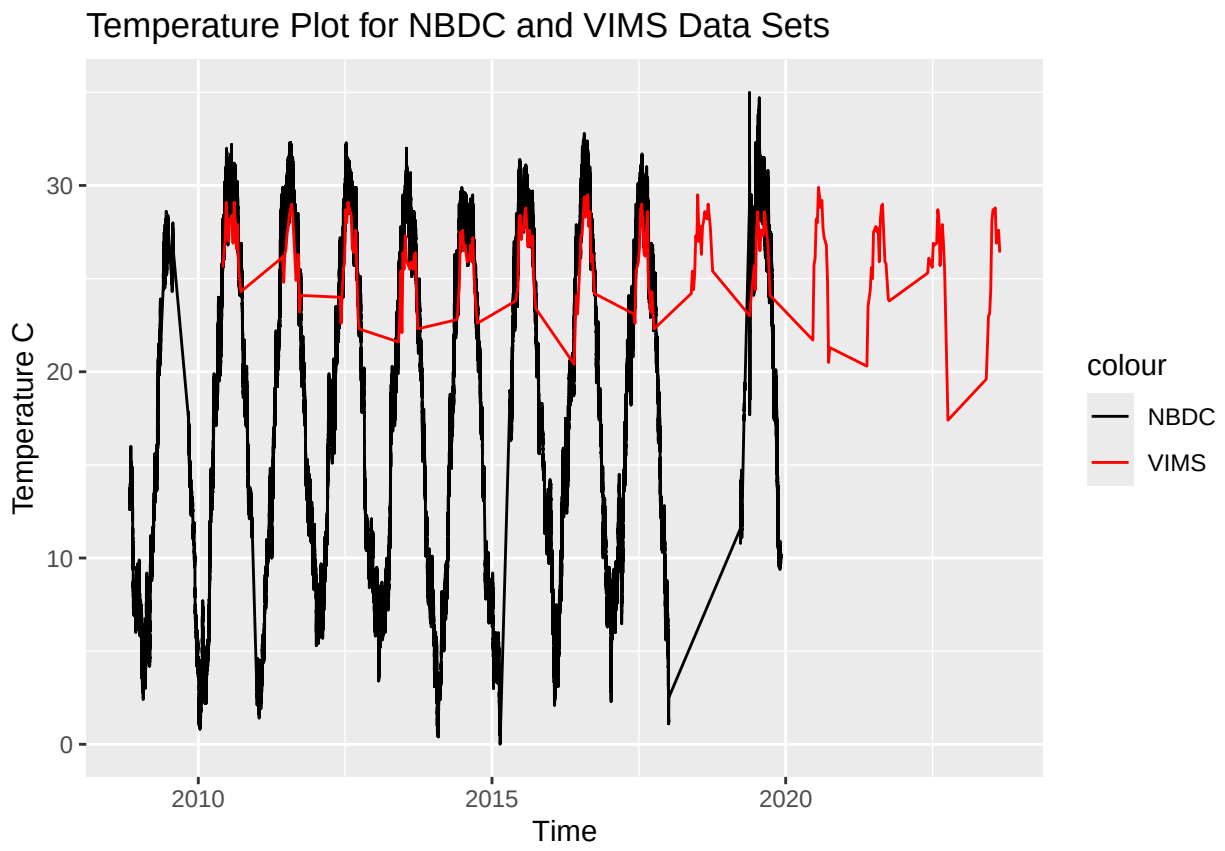
```
#make one single datetime column in POSIXct format
NBDC_raw$datetime <- as.POSIXct(paste(NBDC_raw$X.YY, NBDC_raw$MM, NBDC_raw$DD, NBDC_raw$hh, NBDC_raw$mm

#remove unmerged date-time columns
NBDC_raw<- subset(NBDC_raw, select = c(OTMP, SAL, datetime))

#reorder and rename columns
NBDC_raw <- NBDC_raw[ , c(3,1,2)]

colnames(NBDC_raw) <- c("datetime", "temp_NBDC", "salinity_NBDC")

#Filter the data between the values of 0 and 40 for both salinity and temperature.
NBDC_filtered <- NBDC_raw %>%
    filter(between(salinity_NBDC, 0, 40))

NBDC_filtered <- NBDC_raw %>%
    filter(between(temp_NBDC, 0, 40))

# Sanity check - print the ranges to ensure values are filtered properly. We can see that the ranges fo
print(summary(NBDC_filtered$salinity_NBDC))
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   0.000   0.400   2.600   3.178   5.300  99.000
```

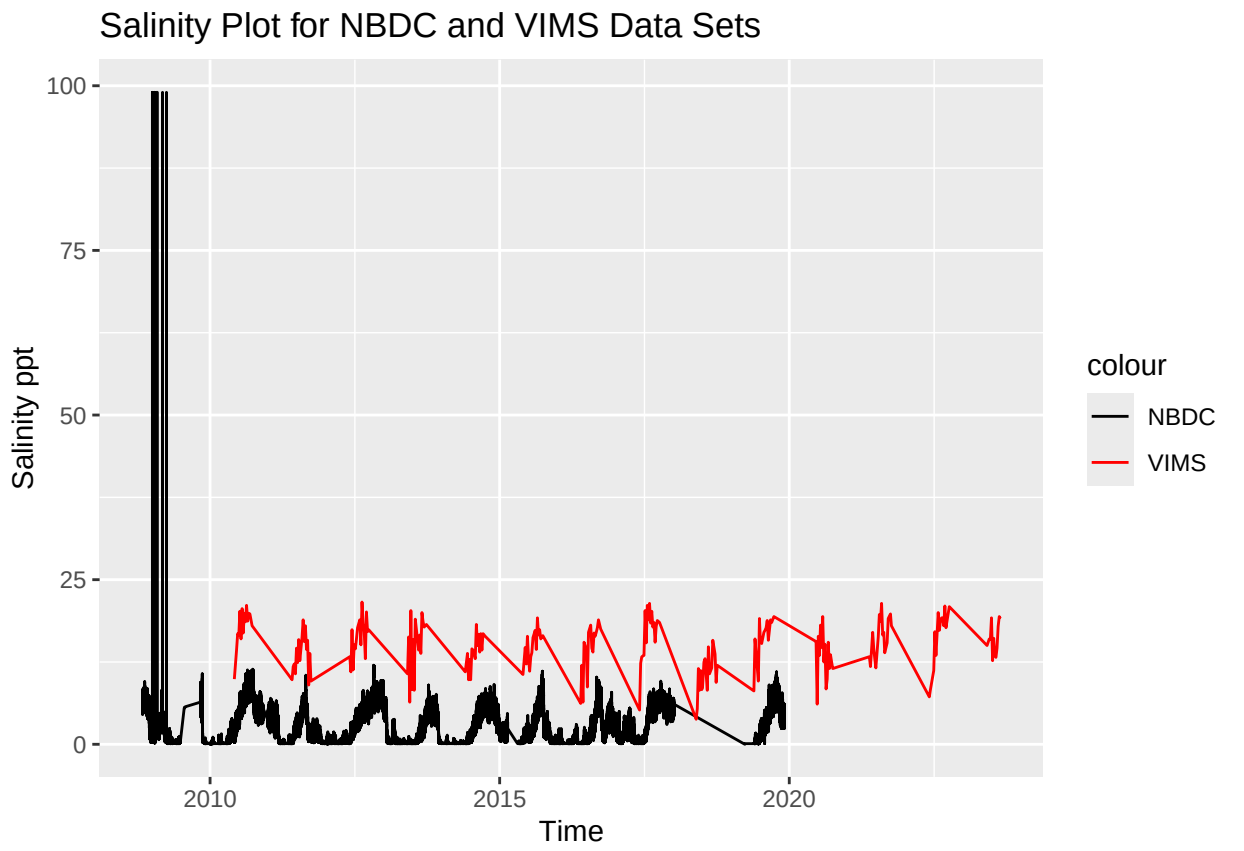
```
print(summary(NBDC_filtered$temp_NBDC))
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    0.00   11.80   21.50   19.82   27.60   35.00
```

```
tempplot <- ggplot(NBDC_filtered, aes(x=datetime, y = temp_NBDC, color = "NBDC")) +
    geom_line()+
    geom_line(data = VIMS_filtered, aes(x=datetime, y = temp_VIMS, color = "VIMS"))+
  scale_color_manual(values=c("black", "red"))+
  labs(x = "Time", y = "Temperature C", title = "Temperature Plot for NBDC and VIMS Data Sets")

tempplot
```




```
salplot <- ggplot(NBDC_filtered, aes(x=datetime, y = salinity_NBDC, color = "NBDC")) +
    geom_line()+
    geom_line(data = VIMS_filtered, aes(x=datetime, y = salinity_VIMS, color = "VIMS"))+
  scale_color_manual(values=c("black", "red"))+
  labs(x = "Time", y = "Salinity ppt", title = "Salinity Plot for NBDC and VIMS Data Sets")

salplot
```



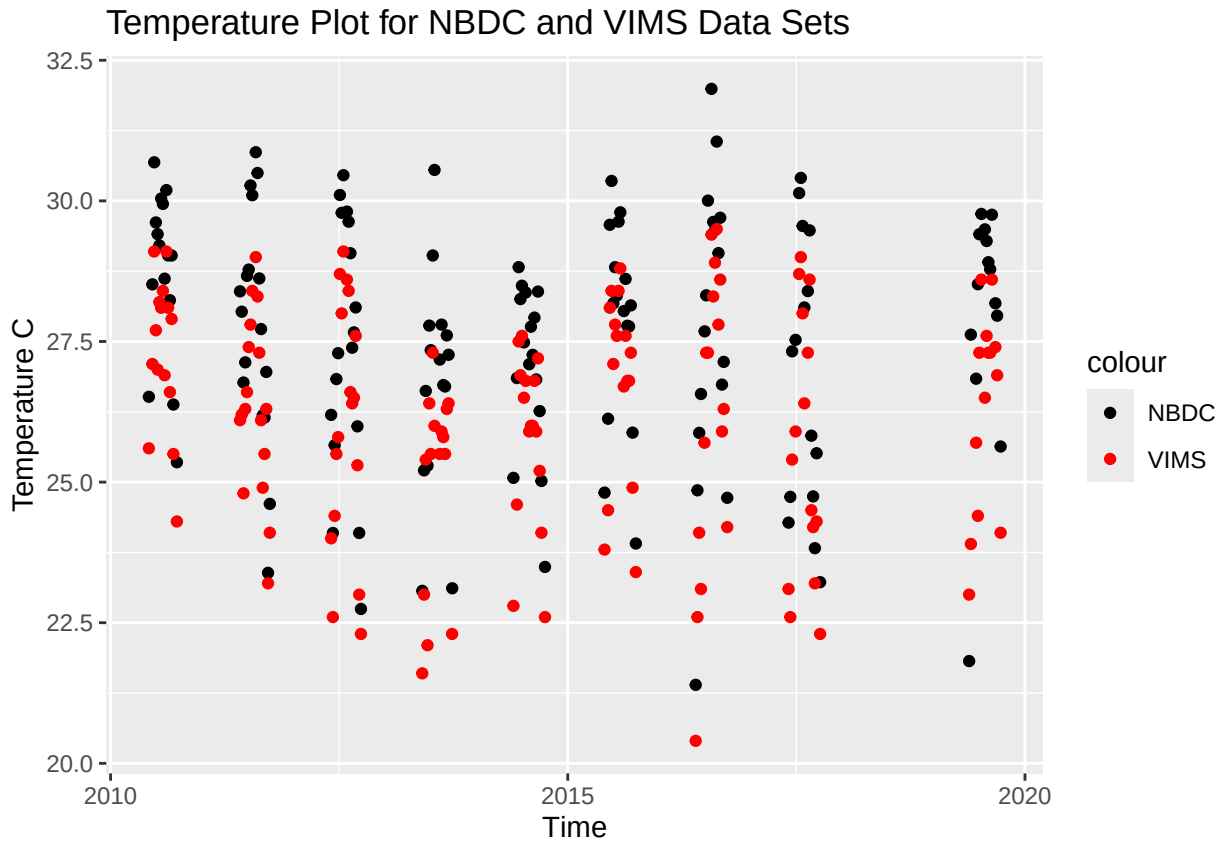
VIMS data are recorded daily, while NBDC are recorded once an hour. I will average NBDC temperature and salinity by day. Then I will select days that appear in both data sets in order to do a correction.

```
#extract date from datetime and make it POSIXct format
NBDC_filtered$date <- format(NBDC_filtered$datetime, "%Y-%m-%d")
NBDC_filtered$date <- as.POSIXct(NBDC_filtered$date, "%Y-%m-%d", tz = "")

#average temperature and salinity by day for NBDC
NBDC_filtered <- NBDC_filtered %>%
  group_by(date) %>%
  mutate(mean_daily_temp_NBDC = mean(temp_NBDC), mean_daily_sal_NBDC = mean(salinity_NBDC))

#filter so each day is represented once

NBDC_day <- NBDC_filtered[match(unique(NBDC_filtered$date), NBDC_filtered$date), ]

NBDC_day_filtered <- NBDC_day[NBDC_day$date %in% VIMS_filtered$datetime, ]

VIMS_day_filtered <- VIMS_filtered[VIMS_filtered$datetime %in% NBDC_day_filtered$date, ]
```

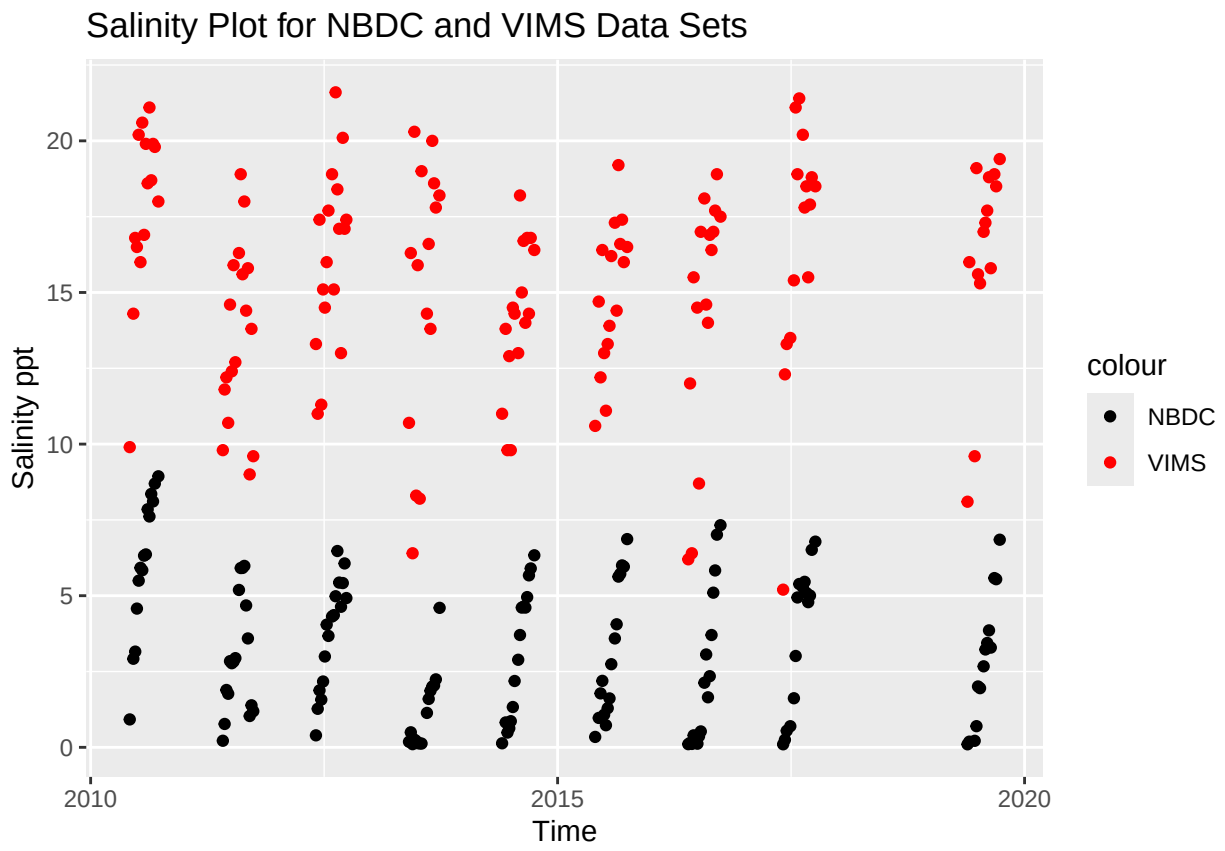
Re-plot temperature and salinity from the two data sets to make sure dates look like they align

```
filter_tempplot <- ggplot(NBDC_day_filtered, aes(x=datetime, y = mean_daily_temp_NBDC, color = "NBDC"))
    geom_point()+
    geom_point(data = VIMS_day_filtered, aes(x=date, y = temp_VIMS, color = "VIMS"))+
  scale_color_manual(values=c("black", "red"))+
```

```
  labs(x = "Time", y = "Temperature C", title = "Temperature Plot for NBDC and VIMS Data Sets")

filter_tempplot
```




```
filtered_salplot <- ggplot(NBDC_day_filtered, aes(x=datetime, y = mean_daily_sal_NBDC, color = "NBDC"))
    geom_point()+
    geom_point(data = VIMS_day_filtered, aes(x=date, y = salinity_VIMS, color = "VIMS"))+
  scale_color_manual(values=c("black", "red"))+
  labs(x = "Time", y = "Salinity ppt", title = "Salinity Plot for NBDC and VIMS Data Sets")

filtered_salplot
```




```
NBDC_VIMS_df <- left_join(VIMS_day_filtered,
          NBDC_day_filtered, by = "date")

#select relevant columns
NBDC_VIMS_df <- NBDC_VIMS_df[ , c("date", "mean_daily_temp_NBDC", "temp_VIMS", "mean_daily_sal_NBDC", "

NBDC_VIMS_df <- NBDC_VIMS_df %>%
  mutate(temp_diff = temp_VIMS-mean_daily_temp_NBDC, sal_diff = salinity_VIMS -mean_daily_sal_NBDC)

temp_correction <- mean(NBDC_VIMS_df$temp_diff)
#On average, VIMS temperature readings are 1.4 °C lower than readings from NBDC. Correct NBDC temperatu

sal_correction <- mean(NBDC_VIMS_df$sal_diff)
#On average, VIMS salinity readings are 12.1 ppt higher than readings from NBDC. Correct NBDC salinity

NBDC_raw$temp_corrected <- NBDC_raw$temp_NBDC-1.4

NBDC_raw$salinity_corrected <- NBDC_raw$salinity_NBDC+12.1

write.csv(NBDC_raw, "/Users/nicolemongillo/Desktop/GitHub/MVP_Chesapeake_VIMS_hatchery/data/envr_raw_da
```