

“Hypoxia Time Series Creation”

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Contents

Setup	1
Time Series (all years)	2
Time Series (2021-2023)	4

Goal: Combine CTD and mooring data to assemble a hypoxia time series

Questions:

- Which depths can I use? Can I average them?
- What units is this dissolved oxygen data in?
- What is the hypoxic threshold?

Setup

```
# Warnings and startup messages suppressed
library(tidyverse)
library(patchwork)
library(scales)
library(ggrepel)
library(readxl)
library(here)

wd <- "OCNMS_Hypoxia/Outputs"
exp <- "OCNMS_Hypoxia/Outputs"
pltPath <- "OCNMS_Hypoxia/Plots"

CTD_short <- read.csv(here(wd, "OCNMS_CTD_TH042_CleanData.csv")) %>%
  mutate(date = as.POSIXct(date), year = as.factor(year), source = as.factor(source))
CTD <- read.csv(here(wd, "OCNMS_CTD_TH042ext_CleanData.csv")) %>%
  mutate(date = as.POSIXct(date), year = as.factor(year), source = as.factor(source))
Mooring <- read.csv(here(wd, "OCNMS_Mooring_CleanData.csv")) %>%
  mutate(date = as.POSIXct(date), year = as.factor(year), source = as.factor(source))

EnvData1short <- rbind(CTD_short, Mooring) %>%      # 39.9 - 44.9 meters deep
  select(-X) %>%
  mutate(date = as.POSIXct(date), year = as.factor(year), source = as.factor(source))

EnvData1 <- rbind(CTD, Mooring) %>%      # 30-45 meters deep
  select(-X) %>%
  mutate(date = as.POSIXct(date), year = as.factor(year), source = as.factor(source))
```

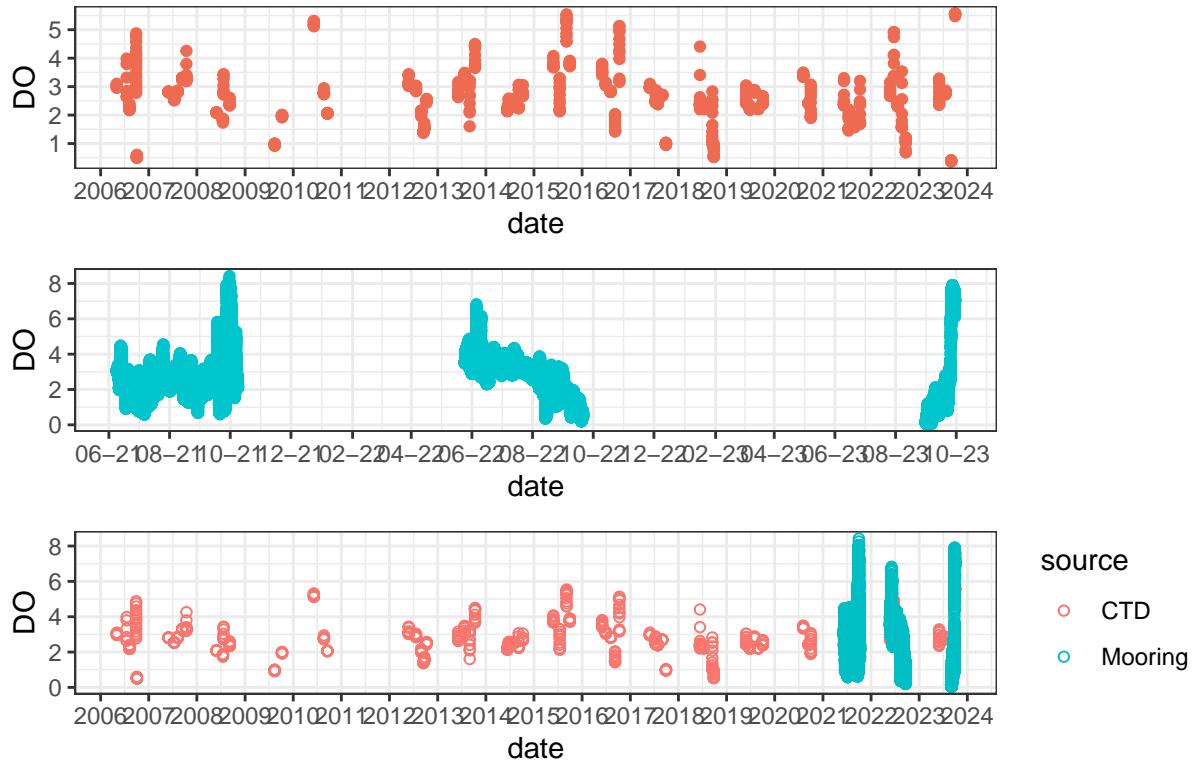
Time Series (all years)

```
ctdplt <- ggplot(CTD, aes(x = date, y = DO)) +
  geom_point(color = "coral2") +
  scale_x_datetime(date_breaks = "1 year", date_labels = "%Y") +
  theme_bw()
morplt <- ggplot(Mooring, aes(x = date, y = DO)) +
  geom_point(color = "turquoise3") +
  scale_x_datetime(date_breaks = "2 months", date_labels = "%m-%y") +
  theme_bw()
plt1 <- ggplot(EnvData1, aes(x = date, y = DO, color = source)) +
  geom_point(shape = 1) +
  scale_x_datetime(date_breaks = "1 year", date_labels = "%Y") +
  theme_bw()

(ctdplt / morplt / plt1) +
  plot_annotation(title = "CTD and Mooring Oxygen Data In OCNMS")

## Warning: Removed 238 rows containing missing values or values outside the scale range
## (`geom_point()`).
## Removed 238 rows containing missing values or values outside the scale range
## (`geom_point()`).
```

CTD and Mooring Oxygen Data In OCNMS



```
ggsave(here(pltpath, "CombinedOxygenSeries.png"), height = 2000, width = 3000, units =
  "px")
```

```
## Warning: Removed 238 rows containing missing values or values outside the scale range
## (`geom_point()`).
```

```

## Removed 238 rows containing missing values or values outside the scale range
## (`geom_point()`).

ctdplt2 <- ggplot(CTD, aes(x = date, y = temperature)) +
  geom_point(color = "coral2") +
  scale_x_datetime(date_breaks = "1 year", date_labels = "%Y") +
  theme_bw()
morplt2 <- ggplot(Mooring, aes(x = date, y = temperature)) +
  geom_point(color = "turquoise3") +
  scale_x_datetime(date_breaks = "2 months", date_labels = "%m-%y") +
  theme_bw()
plt12 <- ggplot(EnvData1, aes(x = date, y = temperature, color = source)) +
  geom_point(shape = 1) +
  scale_x_datetime(date_breaks = "1 year", date_labels = "%Y") +
  theme_bw()

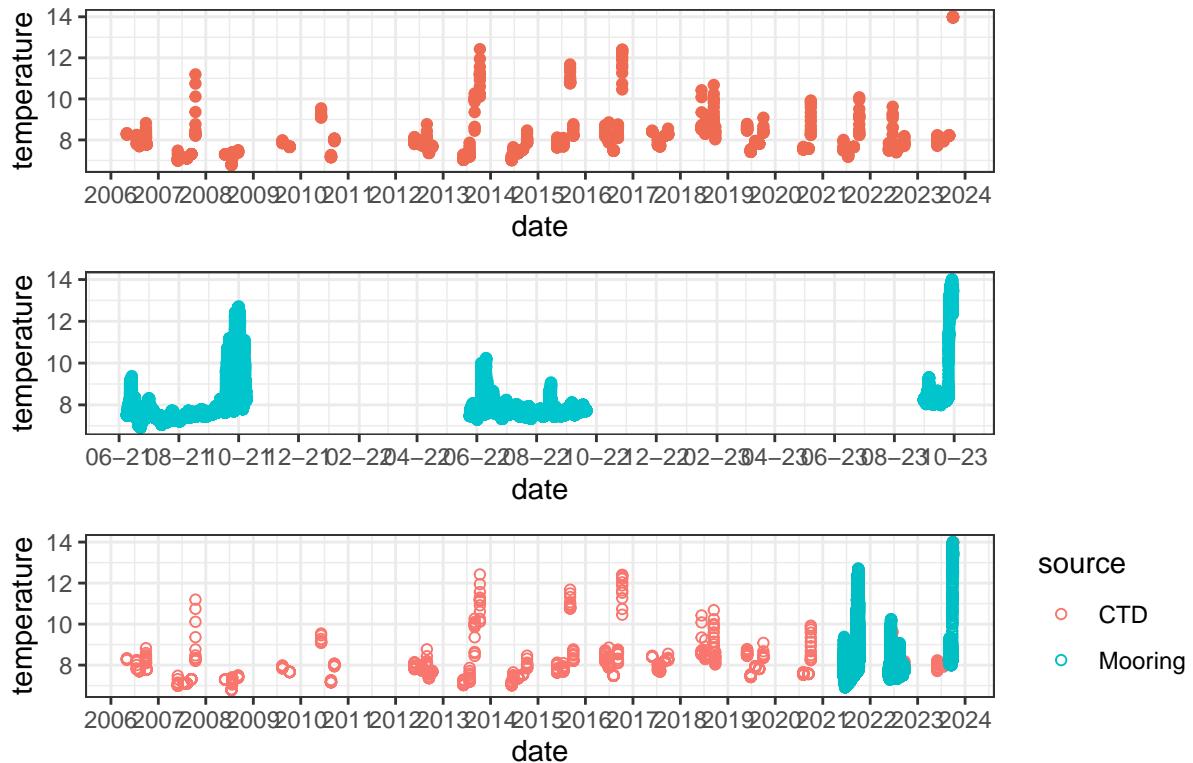
(ctdplt2 / morplt2 / plt12) +
  plot_annotation(title = "CTD and Mooring Temperature Data In OCNMS")

```

Warning: Removed 4 rows containing missing values or values outside the scale range
(`geom_point()`).

Warning: Removed 4 rows containing missing values or values outside the scale range
(`geom_point()`).

CTD and Mooring Temperature Data In OCNMS



```

ggsave(here(pltpath, "CombinedTemperatureSeries.png"), height = 2000, width = 3000, units
       = "px")

```

Warning: Removed 4 rows containing missing values or values outside the scale range

```
## (`geom_point()`).
## Removed 4 rows containing missing values or values outside the scale range
## (`geom_point()`).
```

Time Series (2021-2023)

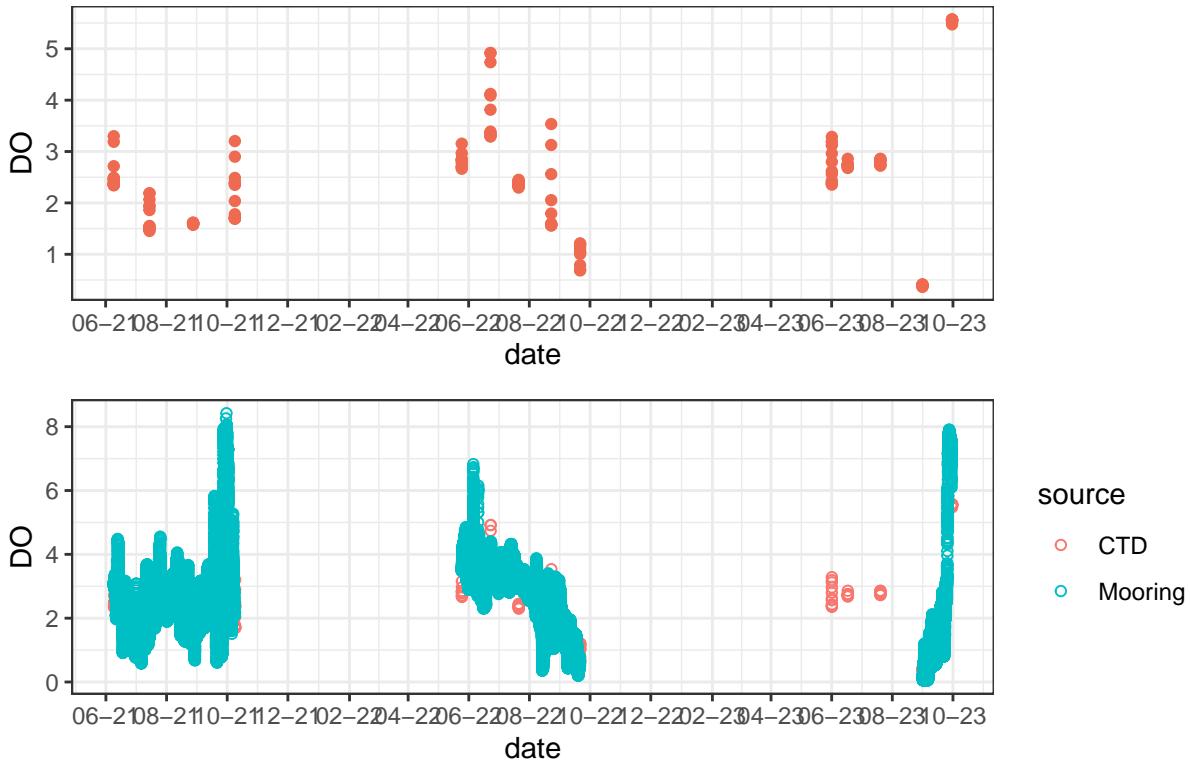
```
CTD2 <- CTD %>%
  filter(year %in% c(2021, 2022, 2023))
Mooring2 <- Mooring %>%
  filter(year %in% c(2021, 2022, 2023))
EnvData1_yr <- EnvData1 %>%
  filter(year %in% c(2021, 2022, 2023))

ctdplt <- ggplot(CTD2, aes(x = date, y = DO)) +
  geom_point(color = "coral2") +
  scale_x_datetime(date_breaks = "2 months", date_labels = "%m-%y") +
  theme_bw()
morplt <- ggplot(Mooring2, aes(x = date, y = DO)) +
  geom_point(color = "turquoise3") +
  scale_x_datetime(date_breaks = "2 months", date_labels = "%m-%y") +
  theme_bw()
plt1 <- ggplot(EnvData1_yr, aes(x = date, y = DO, color = source)) +
  geom_point(shape = 1) +
  scale_x_datetime(date_breaks = "2 months", date_labels = "%m-%y") +
  theme_bw()

(ctdplt / plt1) +
  plot_annotation(title = "CTD and Mooring Oxygen Data In OCNMS")

## Warning: Removed 238 rows containing missing values or values outside the scale range
## (`geom_point()`).
```

CTD and Mooring Oxygen Data In OCNMS



```
ggsave(here(pltpath, "CombinedOxygenSeries_crop.png"), height = 1000, width = 3000, units
       = "px")
```

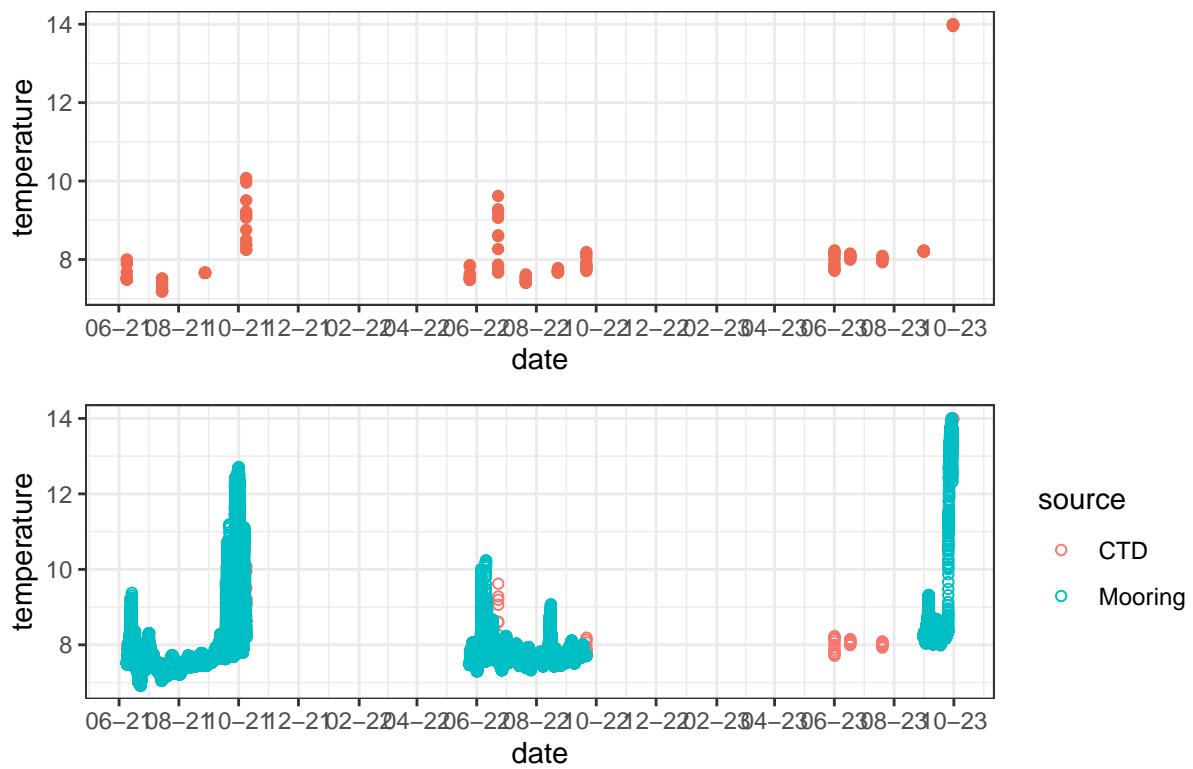
```
## Warning: Removed 238 rows containing missing values or values outside the scale range
## (`geom_point()`).
```

```
ctdplt2 <- ggplot(CTD2, aes(x = date, y = temperature)) +
  geom_point(color = "coral2") +
  scale_x_datetime(date_breaks = "2 months", date_labels = "%m-%y") +
  theme_bw()
morplt2 <- ggplot(Mooring2, aes(x = date, y = temperature)) +
  geom_point(color = "turquoise3") +
  scale_x_datetime(date_breaks = "2 months", date_labels = "%m-%y") +
  theme_bw()
plt12 <- ggplot(EnvData1_yr, aes(x = date, y = temperature, color = source)) +
  geom_point(shape = 1) +
  scale_x_datetime(date_breaks = "2 months", date_labels = "%m-%y") +
  theme_bw()

(ctdplt2 / plt12) +
  plot_annotation(title = "CTD and Mooring Temperature Data In OCNMS")
```

```
## Warning: Removed 4 rows containing missing values or values outside the scale range
## (`geom_point()`).
```

CTD and Mooring Temperature Data In OCNMS



```
ggsave(here(pltpath, "CombinedTemperatureSeries_crop.png"), height = 1000, width = 3000,  
       units = "px")
```

```
## Warning: Removed 4 rows containing missing values or values outside the scale range  
## (`geom_point()`).
```

```
# Export EnvData1short (narrower depth range, full year range), EnvData1 (wider depth,  
# full year), and EnvData1_yr (wider depth, 2021-2023)
```

```
write.csv(EnvData1short, file = here("OCNMS_Hypoxia", "Outputs",  
                                   "EnvironmentalDataset1_Short_AllYears.csv"))  
write.csv(EnvData1, file = here("OCNMS_Hypoxia", "Outputs",  
                               "EnvironmentalDataset1_AllYears.csv"))  
write.csv(EnvData1_yr, file = here("OCNMS_Hypoxia", "Outputs",  
                                 "EnvironmentalDataset1.csv"))
```