Temperature data at Mahana

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Set Up

```
# load packages
library(tidyverse)
library(ggplot2)
library(RColorBrewer)
library(lme4)
library(lmerTest)
library(car)
library(effects)
library(ggfortify)
library(cowplot)
library(vegan)
library(corrr)
library(ggcorrplot)
library(GGally)
library(lubridate)
library(broom)
library(cowplot)
library(scales)
#library(ggradar)
#library(ggiraphExtra)
```

Read data files

Load all data frames.

```
#read in clean environmental data from E5 timeseries
master_qc <- read.csv("RAnalysis/data/temperature/environmental_timeseries.csv")

#filter for just site 2 data for Mahana site
master_qc_site2 <- filter(master_qc, site == "site2")
```

#Visualize E5 Mahana temperature data for warmest months

#Format dataframes for date time.

```
#split date and time column to be able to group by day

master_qc_site2 <- separate(data = master_qc_site2, col = Date.Time, into = c('Date', 'Time'), sep = 'T
```

```
#format date using lubridate package
master_qc_site2$Date <- ymd(master_qc_site2$Date)
```

QC and plotting clean data

```
#filter dates from February 15th until May 15th

master_qc_filter <- master_qc_site2[master_qc_site2$Date >= "2020-02-10" & master_qc_site2$Date <= "202
```

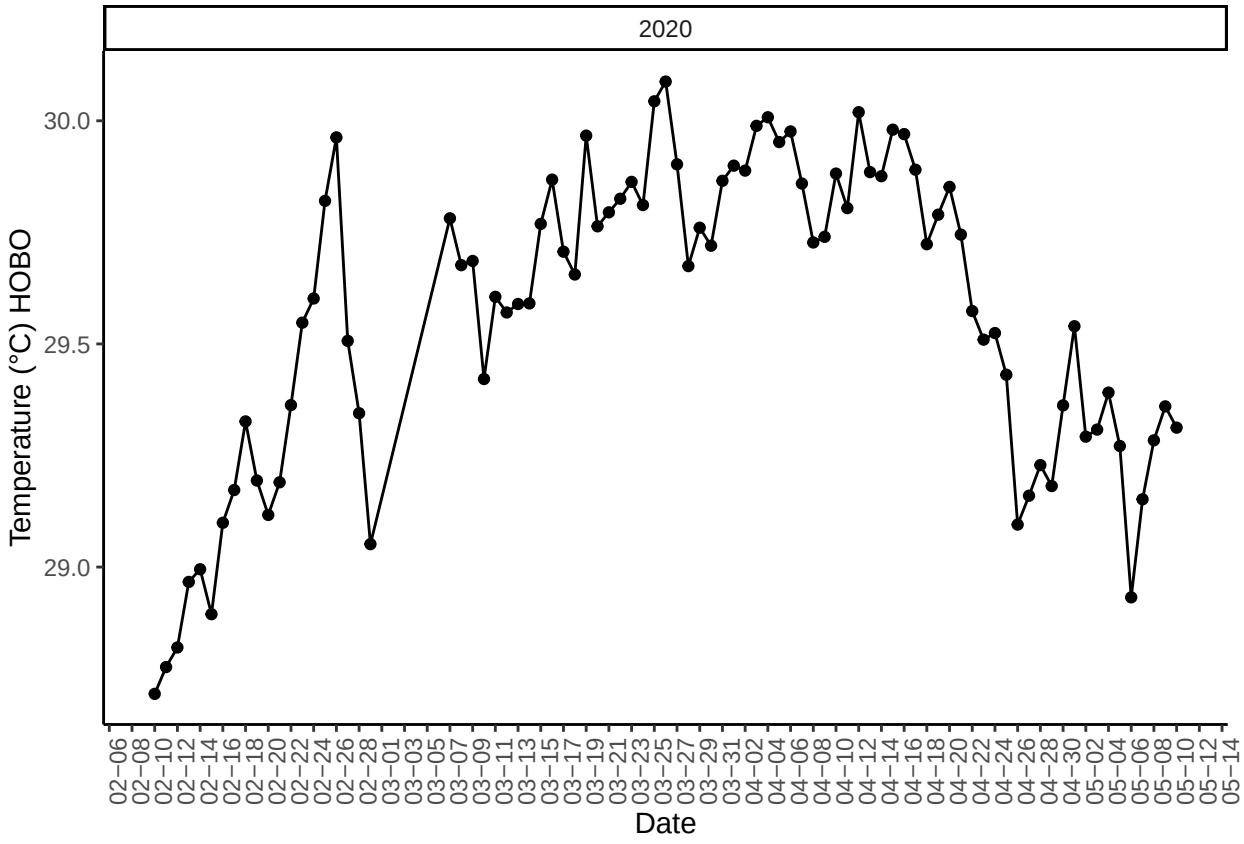
#plot temperature data from HOBO loggers

```
#temp data across date summarized, remove NAs from temp

#rename site2

master_qc_filter$site[master_qc_filter$site == 'site2'] <- 'E5_site2'


#add a year column to output

master_qc_filter$year <- format(as.Date(master_qc_filter$Date), "%Y")


#temp data across date summarized, remove NAs from temp
data.E5.HOBO <-master_qc_filter %>%
  group_by(Date, site,year) %>% #tells to group by treatment
  summarise(mean=mean(Hobo, na.rm=TRUE), se=sd(Hobo, na.rm=TRUE)/sqrt(n())) #calculates mean and se
data.E5.HOBO
```

```
## # A tibble: 91 x 5
## # Groups:   Date, site [91]
##    Date       site     year   mean      se
##    <date>     <chr>    <chr> <dbl>   <dbl>
##  1 2020-02-10 E5_site2 2020   28.7 0.00950
##  2 2020-02-11 E5_site2 2020   28.8 0.00826
##  3 2020-02-12 E5_site2 2020   28.8 0.00943
##  4 2020-02-13 E5_site2 2020   29.0 0.00982
##  5 2020-02-14 E5_site2 2020   29.0 0.00667
##  6 2020-02-15 E5_site2 2020   28.9 0.00668
##  7 2020-02-16 E5_site2 2020   29.1 0.00951
##  8 2020-02-17 E5_site2 2020   29.2 0.0122
##  9 2020-02-18 E5_site2 2020   29.3 0.0138
## 10 2020-02-19 E5_site2 2020   29.2 0.00788
## # ... with 81 more rows
```

```
#remove mean data from March 01 to March 06 due to logger read out and no data

data.E5.HOBO <- data.E5.HOBO[!is.na(data.E5.HOBO$mean), ]

#plot mean temp per day by date
hobo_plotQC<-data.E5.HOBO%>%
  ggplot(aes(x=Date, y=mean))+
  geom_line()+
```

```
  geom_point() +
  facet_wrap(.~year, scales = "free_x") +
  scale_x_date(date_breaks = "2 days", date_labels = "%m-%d") +
  theme_classic()+
  theme(axis.text.x = element_text(angle = 90)) +
  ylab("Temperature (°C) HOBO")+
  xlab("Date");hobo_plotQC
```




```
ggsave(filename="RAnalysis/data/temperature/e5_Mahana_temp_data.pdf", plot=hobo_plotQC, dpi=300, width=
```

#load and edit data from Mahana 2015 and 2016

```
#read in data from Mahana 2015 and 2016 CRIOBE Cami
CRIOBE_mahana <- read.csv("RAnalysis/data/temperature/Temperature_mahana_Cami.csv")

#format date and time, lubridate package format
CRIOBE_mahana$Date <- mdy(CRIOBE_mahana$Date)
```

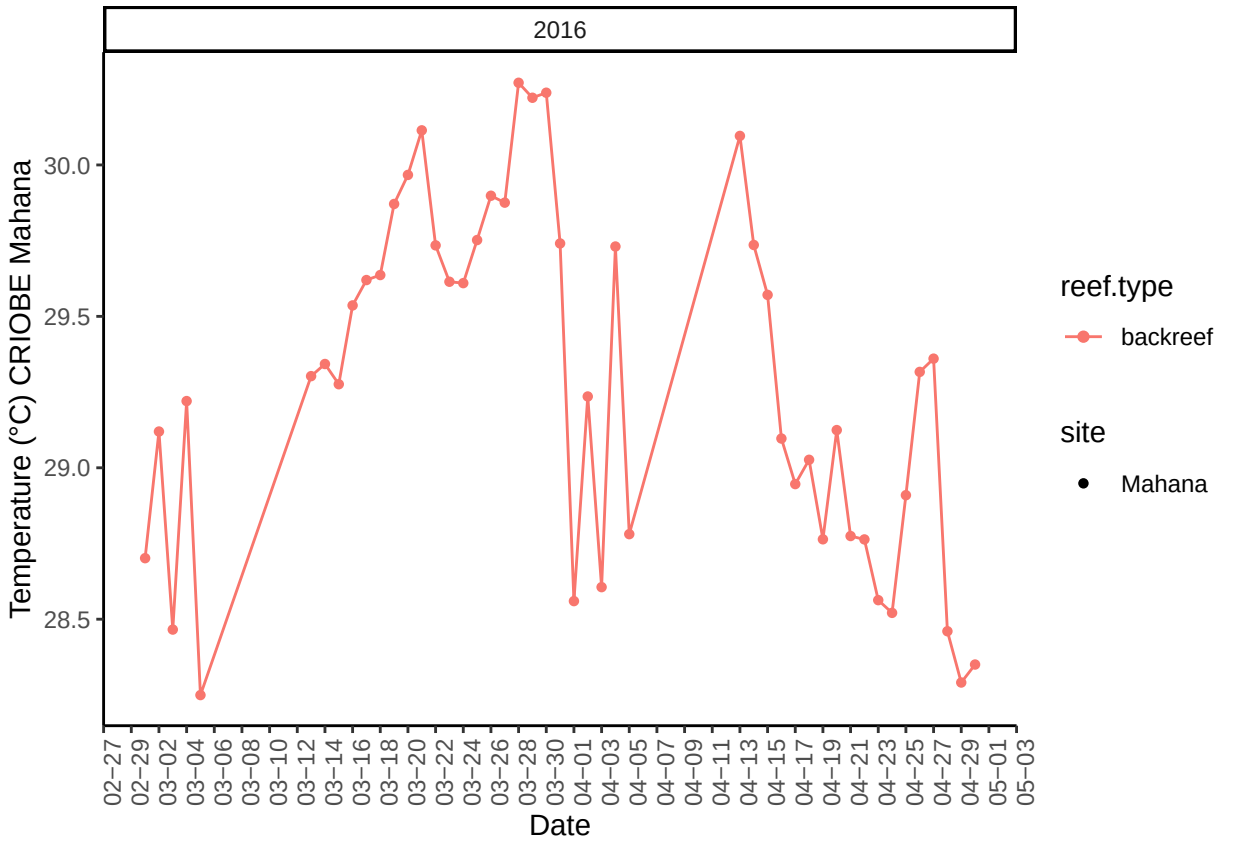
#plot temperature data from HOBO loggers

```
#temp data across date summarized, remove NAs from temp
CRIOBE_mahana <-CRIOBE_mahana %>%
  group_by(Date) %>% #tells to group by treatment
  summarise(mean=mean(temp, na.rm=TRUE), se=sd(temp, na.rm=TRUE)/sqrt(n())) #calculates mean and se
CRIOBE_mahana
```

```
## # A tibble: 154 x 3
##    Date        mean     se
##    <date>     <dbl>  <dbl>
```

```
##  1 2015-09-12  28.3 0.0826
##  2 2015-10-12  28.0 0.0418
##  3 2015-11-12  28.3 0.0630
##  4 2015-12-12  28.2 0.0482
##  5 2015-12-13  28.4 0.0732
##  6 2015-12-14  28.2 0.0577
##  7 2015-12-15  28.3 0.0806
##  8 2015-12-16  28.3 0.0674
##  9 2015-12-17  28.6 0.0858
## 10 2015-12-18  28.5 0.0931
## # ... with 144 more rows
```

```
#subset temp data for March through April for 2015 and 2016

CRIOBE_mahana_subset <- CRIOBE_mahana %>%
  filter(lubridate::month(Date) %in% c(3:4))


#add a year column to output

CRIOBE_mahana_subset$year <- format(as.Date(CRIOBE_mahana_subset$Date), "%Y")

#add in reef type and site column

CRIOBE_mahana_subset <- CRIOBE_mahana_subset %>%
  mutate(reef.type = "backreef")

CRIOBE_mahana_subset <- CRIOBE_mahana_subset %>%
  mutate(site = "Mahana")

#plot mean temp per day by date
CRIOBE_plotQC<-CRIOBE_mahana_subset %>%
  ggplot(aes(x=Date, y=mean, group = reef.type, color = reef.type, shape = site))+
  geom_line() +
  geom_point() +
  facet_wrap(.~year, scales = "free_x") +
  scale_x_date(date_breaks = "2 days", date_labels = "%m-%d") +
  theme_classic()+
  theme(axis.text.x = element_text(angle = 90)) +
  ylab("Temperature (°C) CRIOBE Mahana")+
  xlab("Date");CRIOBE_plotQC
```




```
ggsave(filename="RAnalysis/output/temperature/CRIOBE_MAHANA_TEMP_PLOT.pdf", plot=CRIOBE_plotQC, width=1
```

#Visualize MCR LTER temperature data site LTER01 manava from 2005 to 2018

Load all data frames.

```
#read in long term MCR LTER temperature data from 2005 to 20219 at LTER 01 and LTER 02
LTER1_temp <- read.csv("RAnalysis/data/temperature/MCR_LTER01_BottomMountThermistors_20200306.csv")
LTER2_temp <- read.csv("RAnalysis/data/temperature/MCR_LTER02_BottomMountThermistors_20200306.csv")
LTER1_temp_2018 <- read.csv("RAnalysis/data/temperature/LTER01_BottomMountThermistors_20210820.csv")
LTER1_temp_2021 <- read.csv("RAnalysis/data/temperature/LTER01_BottomMountThermistors_20211207.csv")
LTER2_temp_2018 <- read.csv("RAnalysis/data/temperature/LTER02_BottomMountThermistors_20210820.csv")
LTER2_temp_2021 <- read.csv("RAnalysis/data/temperature/LTER02_BottomMountThermistors_20211207.csv")


#split date and time column to be able to group by day

LTER1_temp <- separate(data = LTER1_temp, col = time_utc, into = c('Date', 'Time'), sep = ' ')
LTER2_temp <- separate(data = LTER2_temp, col = time_utc, into = c('Date', 'Time'), sep = ' ')
LTER1_temp_2018 <- separate(data = LTER1_temp_2018, col = time_utc, into = c('Date', 'Time'), sep = ' ')
LTER1_temp_2021 <- separate(data = LTER1_temp_2021, col = time_utc, into = c('Date', 'Time'), sep = ' ')
LTER2_temp_2018 <- separate(data = LTER2_temp_2018, col = time_utc, into = c('Date', 'Time'), sep = ' ')
LTER2_temp_2021 <- separate(data = LTER2_temp_2021, col = time_utc, into = c('Date', 'Time'), sep = ' ')
```

#Format dataframes for date time.

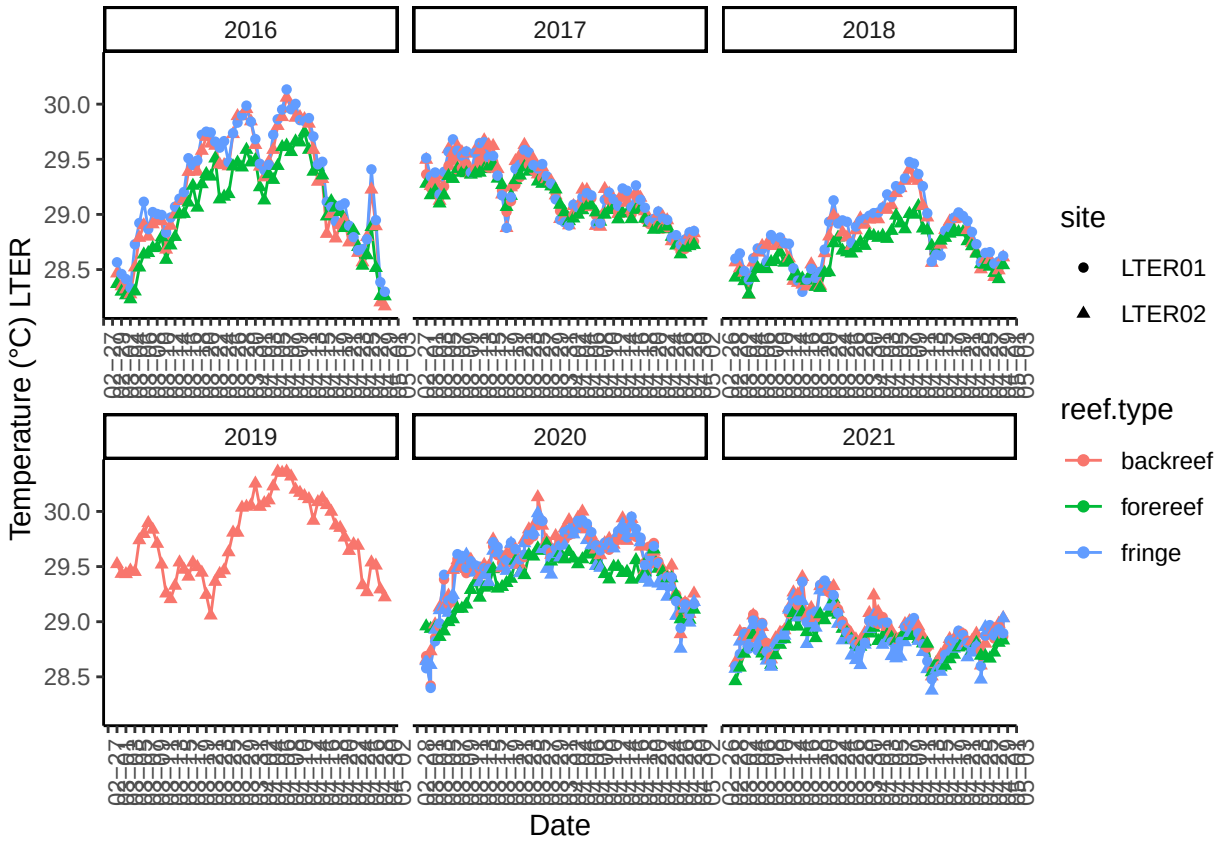
```
#combine data frames
LTER_1_2_temp <- rbind(LTER1_temp, LTER2_temp, LTER1_temp_2018, LTER1_temp_2021, LTER2_temp_2018, LTER2_

#format date and time, lubridate package format
LTER_1_2_temp$Date <- mdy(LTER_1_2_temp$Date)
```

#plot temperature data from HOBO loggers

```
#temp data across date summarized, remove NAs from temp
LTER_temp <-LTER_1_2_temp %>%
  group_by(Date, reef.type, site) %>% #tells to group by treatment
  summarise(mean=mean(temp, na.rm=TRUE), se=sd(temp, na.rm=TRUE)/sqrt(n())) #calculates mean and se
LTER_temp
```

```
## # A tibble: 21,057 x 5
## # Groups:   Date, reef.type [16,182]
##    Date       reef.type site    mean      se
##    <date>     <chr>     <chr>  <dbl>   <dbl>
##  1 2005-05-23 forereef  LTER02  27.9 0.0131
##  2 2005-05-24 forereef  LTER02  27.8 0.00516
##  3 2005-05-25 forereef  LTER02  27.6 0.00792
##  4 2005-05-26 forereef  LTER02  27.6 0.00690
##  5 2005-05-27 forereef  LTER02  27.5 0.0104
##  6 2005-05-28 forereef  LTER02  27.7 0.00412
##  7 2005-05-29 forereef  LTER02  27.4 0.00853
##  8 2005-05-30 forereef  LTER02  27.3 0.00497
##  9 2005-05-31 forereef  LTER02  27.5 0.00570
## 10 2005-06-01 backreef  LTER01  27.6 0.0309
## # ... with 21,047 more rows
```

```
#subset temp data for March through April for 2020

lter.dat.subset <- LTER_temp %>%
  filter(lubridate::month(Date) %in% c(3:4))

lter.dat.subset <- lter.dat.subset %>%
  filter(lubridate::year(Date) %in% c(2016:2021))


#add a year column to output

lter.dat.subset$year <- format(as.Date(lter.dat.subset$Date), "%Y")

#plot mean temp per day by date
lter_plotQC<-lter.dat.subset %>%
  ggplot(aes(x=Date, y=mean, group = reef.type, color = reef.type, shape = site))+
  geom_line() +
  geom_point() +
  facet_wrap(.~year, scales = "free_x") +
  scale_x_date(date_breaks = "2 days", date_labels = "%m-%d") +
  theme_classic()+
  theme(axis.text.x = element_text(angle = 90)) +
  ylab("Temperature (°C) LTER")+
  xlab("Date");lter_plotQC
```




```
ggsave(filename="RAnalysis/output/temperature/LTER_temp_data.pdf", plot=lter_plotQC, width=10, height=1
```

#Visualize MCR LTER temperature data site LTER01 manava from 2005 to 2018, E5 dta from 2020 and CRIOBE data from Mahana 2015 to 2016

```
#E5, CRIOBE, and LTER data

data.E5.HOBO
```

```
## # A tibble: 85 x 5
## # Groups:   Date, site [85]
##    Date       site      year   mean      se
##    <date>     <chr>     <chr> <dbl>   <dbl>
##  1 2020-02-10 E5_site2 2020   28.7 0.00950
##  2 2020-02-11 E5_site2 2020   28.8 0.00826
##  3 2020-02-12 E5_site2 2020   28.8 0.00943
##  4 2020-02-13 E5_site2 2020   29.0 0.00982
##  5 2020-02-14 E5_site2 2020   29.0 0.00667
##  6 2020-02-15 E5_site2 2020   28.9 0.00668
##  7 2020-02-16 E5_site2 2020   29.1 0.00951
##  8 2020-02-17 E5_site2 2020   29.2 0.0122
##  9 2020-02-18 E5_site2 2020   29.3 0.0138
## 10 2020-02-19 E5_site2 2020   29.2 0.00788
## # ... with 75 more rows
```

```
CRIOBE_mahana_subset
```

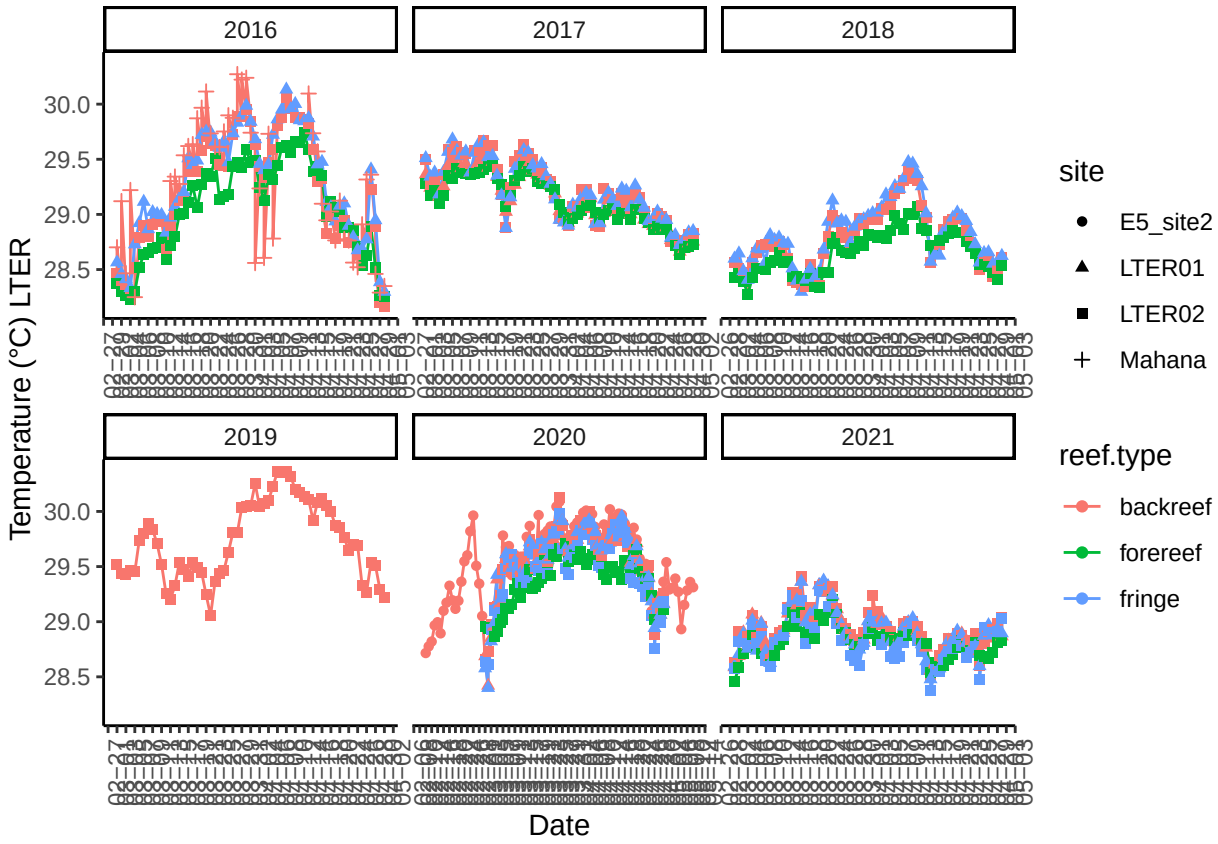
```
## # A tibble: 47 x 6
##    Date        mean     se year  reef.type site
```

```
##    <date>     <dbl>  <dbl> <chr> <chr>     <chr>
##  1 2016-03-01  28.7 0.0532 2016  backreef  Mahana
##  2 2016-03-02  29.1 0.0756 2016  backreef  Mahana
##  3 2016-03-03  28.5 0.0322 2016  backreef  Mahana
##  4 2016-03-04  29.2 0.0338 2016  backreef  Mahana
##  5 2016-03-05  28.2 0.0687 2016  backreef  Mahana
##  6 2016-03-13  29.3 0.0787 2016  backreef  Mahana
##  7 2016-03-14  29.3 0.0697 2016  backreef  Mahana
##  8 2016-03-15  29.3 0.0671 2016  backreef  Mahana
##  9 2016-03-16  29.5 0.0725 2016  backreef  Mahana
## 10 2016-03-17  29.6 0.0685 2016  backreef  Mahana
## # ... with 37 more rows
```

```
lter.dat.subset
```

```
## # A tibble: 1,281 x 6
## # Groups:   Date, reef.type [976]
##    Date       reef.type site    mean      se year
##    <date>     <chr>     <chr>  <dbl>   <dbl> <chr>
##  1 2016-03-01 backreef  LTER02  28.5 0.0133  2016
##  2 2016-03-01 forereef  LTER02  28.4 0.00891 2016
##  3 2016-03-01 fringe    LTER01  28.6 0.0104  2016
##  4 2016-03-02 backreef  LTER02  28.3 0.0166  2016
##  5 2016-03-02 forereef  LTER02  28.3 0.0115  2016
##  6 2016-03-02 fringe    LTER01  28.5 0.00793 2016
##  7 2016-03-03 backreef  LTER02  28.3 0.00628 2016
##  8 2016-03-03 forereef  LTER02  28.3 0.00696 2016
##  9 2016-03-03 fringe    LTER01  28.4 0.00888 2016
## 10 2016-03-04 backreef  LTER02  28.3 0.0176  2016
## # ... with 1,271 more rows
```

```
#add reef type column to E5 data

data.E5.HOBO_add <- data.E5.HOBO %>%
  mutate(reef.type = "backreef")

#combine E5 and lter data

lter_e5 <- full_join(data.E5.HOBO_add, lter.dat.subset)

#combine all data (E5, CRIOBE, and LTER)

lter_e5_CRIOBE <- full_join(lter_e5, CRIOBE_mahana_subset)

#plot mean temp per day by date
lter_e5_criobeQC<-lter_e5_CRIOBE %>%
  ggplot(aes(x=Date, y=mean, group = reef.type, color = reef.type, shape = site))+
  geom_line() +
  geom_point() +
  facet_wrap(.~year, scales = "free_x") +
  scale_x_date(date_breaks = "2 days", date_labels = "%m-%d") +
  theme_classic()+
  theme(axis.text.x = element_text(angle = 90)) +
  ylab("Temperature (°C) LTER")+
  xlab("Date");lter_e5_criobeQC
```

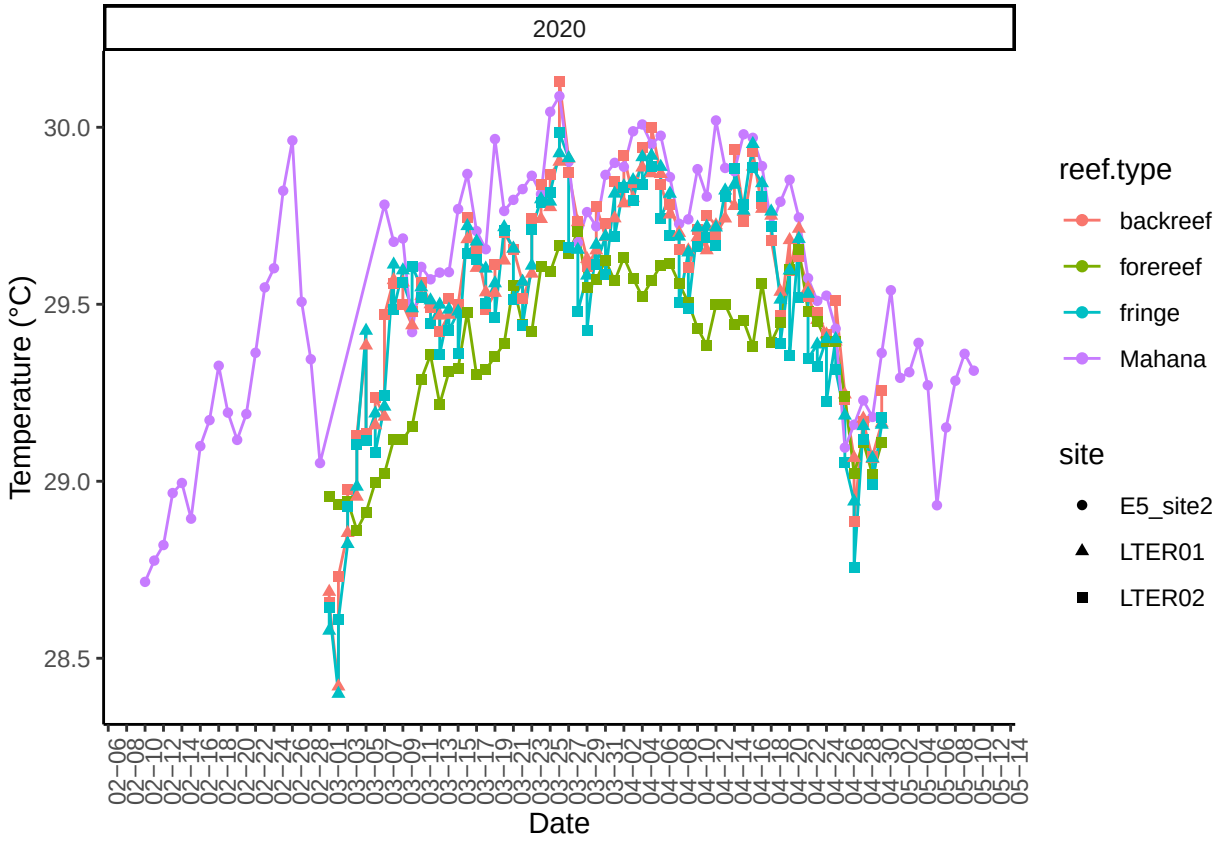



```
ggsave(filename="RAnalysis/output/temperature/E5_LTER_CRIOBE_temp_plot.pdf", plot=lter_e5_criobeQC, wid
```

#plot temperature data from LTER and E5 2020 March April data

```
#subset temp data for March through April for 2020

lter.dat.subset_2020 <- LTER_temp %>%
  filter(lubridate::month(Date) %in% c(3:4))

lter.dat.subset_2020 <- lter.dat.subset_2020 %>%
  filter(lubridate::year(Date) %in% c(2020))


#add a year column to output

lter.dat.subset_2020$year <- format(as.Date(lter.dat.subset_2020$Date), "%Y")

#make e5 mahana site clearer

data.E5.HOBO_mahana <- data.E5.HOBO %>%
  mutate(reef.type = "Mahana")

lter_e5_2020 <- full_join(data.E5.HOBO_mahana, lter.dat.subset_2020)


#plot mean temp per day by date
lter_E5_2020_plot <-lter_e5_2020 %>%
  ggplot(aes(x=Date, y=mean, group = reef.type, color = reef.type, shape = site))+
```

```
  geom_line() +
  geom_point() +
  facet_wrap(.~year, scales = "free_x") +
  scale_x_date(date_breaks = "2 days", date_labels = "%m-%d") +
  theme_classic()+
  theme(axis.text.x = element_text(angle = 90)) +
  ylab("Temperature (°C)")+
  xlab("Date");lter_E5_2020_plot
```

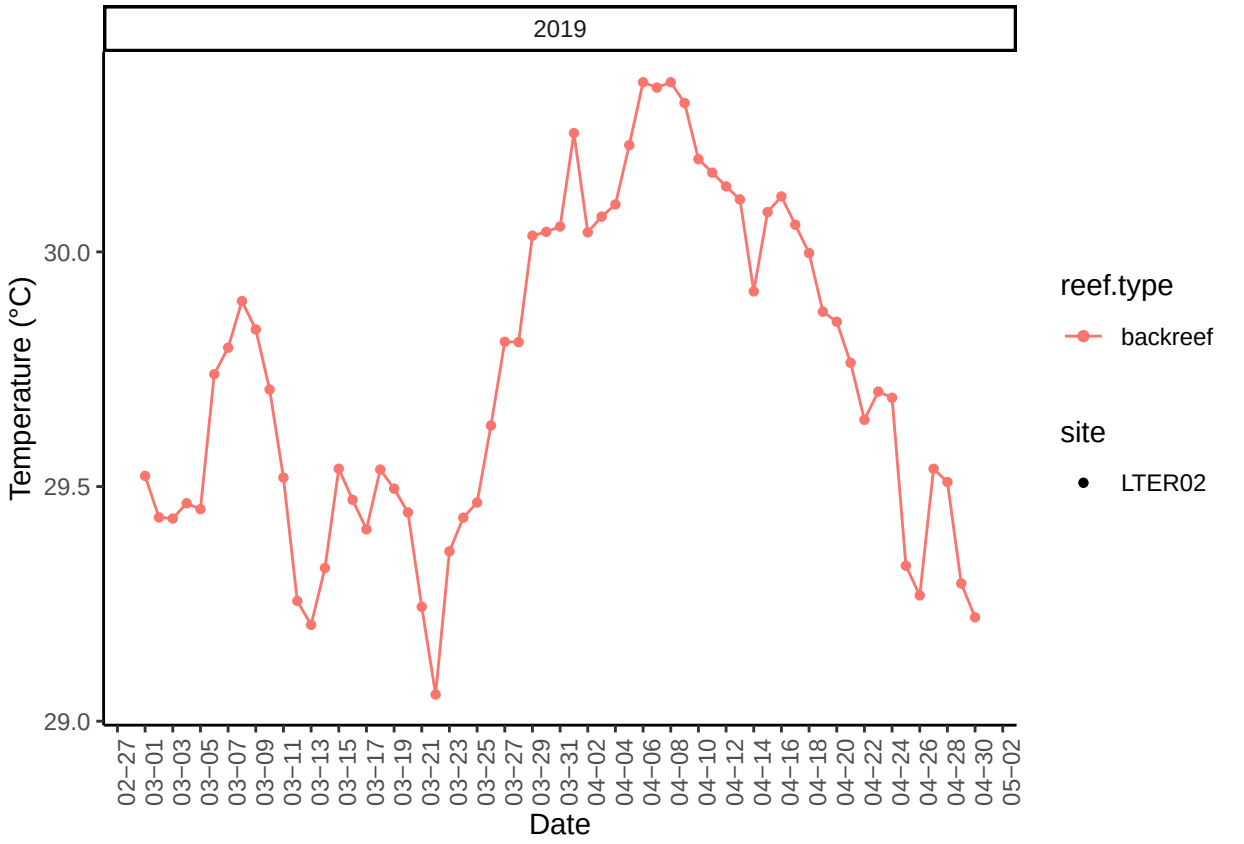



```
ggsave(filename="RAnalysis/output/temperature/LTER_E5_2020_temp_data.pdf", plot=lter_E5_2020_plot, width
```

#plot temperature data from LTER 2019 March April data

```
#subset temp data for March through April for 2020

lter_2019 <- LTER_temp %>%
  filter(lubridate::month(Date) %in% c(3:4))

lter_2019 <- lter_2019 %>%
  filter(lubridate::year(Date) %in% c(2019))


#add a year column to output

lter_2019$year <- format(as.Date(lter_2019$Date), "%Y")


#plot mean temp per day by date
```

```
lter_2019_plot <-lter_2019 %>%
  ggplot(aes(x=Date, y=mean, group = reef.type, color = reef.type, shape = site))+
  geom_line() +
  geom_point() +
  facet_wrap(.~year, scales = "free_x") +
  scale_x_date(date_breaks = "2 days", date_labels = "%m-%d") +
  theme_classic()+
  theme(axis.text.x = element_text(angle = 90)) +
  ylab("Temperature (°C)")+
  xlab("Date");lter_2019_plot
```




```
ggsave(filename="RAnalysis/output/temperature/LTER_2019_temp_data.pdf", plot=lter_2019_plot, width=10, h
```

#organize data for LTER 01 and 02 to have separate backreef and fringe dataframes

```
#COMBINE LTER 2 DATA FRAMES
LTER_2_temp <- rbind(LTER2_temp, LTER2_temp_2018, LTER2_temp_2021)

#format date and time, lubridate package format
LTER_2_temp$Date <- mdy(LTER_2_temp$Date)

#filter for just 2020 data in LTER2 for march and april

lter_2_2020 <- LTER_2_temp %>%
  filter(lubridate::year(Date) %in% c(2020)) %>% filter(lubridate::month(Date) %in% c(3:4))

#temp data across date summarized, remove NAs from temp
lter_2_2020.sum <- lter_2_2020 %>%
```

```
  group_by(Date, reef.type, site) %>% #tells to group by treatment
  summarise(mean=mean(temp, na.rm=TRUE), se=sd(temp, na.rm=TRUE)/sqrt(n())) #calculates mean and se
lter_2_2020.sum
```

```
## # A tibble: 183 x 5
## # Groups:   Date, reef.type [183]
##    Date       reef.type site    mean      se
##    <date>     <chr>     <chr>  <dbl>   <dbl>
##  1 2020-03-01 backreef  LTER02  28.7 0.0162
##  2 2020-03-01 forereef  LTER02  29.0 0.0113
##  3 2020-03-01 fringe    LTER02  28.6 0.0111
##  4 2020-03-02 backreef  LTER02  28.7 0.0146
##  5 2020-03-02 forereef  LTER02  28.9 0.00663
##  6 2020-03-02 fringe    LTER02  28.6 0.0196
##  7 2020-03-03 backreef  LTER02  29.0 0.0183
##  8 2020-03-03 forereef  LTER02  28.9 0.00470
##  9 2020-03-03 fringe    LTER02  28.9 0.0248
## 10 2020-03-04 backreef  LTER02  29.1 0.0292
## # ... with 173 more rows
```

```
#filter for just backreef data from LTER 2 2020
LTER_2_BACKREEF <-  lter_2_2020.sum %>%
    filter(reef.type %in% "backreef")

#filter for just fringe data from LTER 2 2020
LTER_2_FRINGE <-  lter_2_2020.sum %>%
    filter(reef.type %in% "fringe")


#COMBINE LTER 1 DATA FRAMES
LTER_1_temp <- rbind(LTER1_temp, LTER1_temp_2018, LTER1_temp_2021)

#format date and time, lubridate package format
LTER_1_temp$Date <- mdy(LTER_1_temp$Date)

#filter for just 2020 data in LTER2

lter_1_2020 <- LTER_1_temp %>%
   filter(lubridate::year(Date) %in% c(2020)) %>% filter(lubridate::month(Date) %in% c(3:4))

#temp data across date summarized, remove NAs from temp
lter_1_2020.sum <- lter_1_2020 %>%
  group_by(Date, reef.type, site) %>% #tells to group by treatment
  summarise(mean=mean(temp, na.rm=TRUE), se=sd(temp, na.rm=TRUE)/sqrt(n())) #calculates mean and se
lter_1_2020.sum
```

```
## # A tibble: 122 x 5
## # Groups:   Date, reef.type [122]
##    Date       reef.type site    mean     se
##    <date>     <chr>     <chr>  <dbl>  <dbl>
##  1 2020-03-01 backreef  LTER01  28.7 0.0401
##  2 2020-03-01 fringe    LTER01  28.6 0.0244
##  3 2020-03-02 backreef  LTER01  28.4 0.0200
##  4 2020-03-02 fringe    LTER01  28.4 0.0138
##  5 2020-03-03 backreef  LTER01  28.9 0.0125
```

```
##  6 2020-03-03 fringe    LTER01  28.8 0.0146
##  7 2020-03-04 backreef  LTER01  29.0 0.0197
##  8 2020-03-04 fringe    LTER01  29.0 0.0270
##  9 2020-03-05 backreef  LTER01  29.4 0.0309
## 10 2020-03-05 fringe    LTER01  29.4 0.0268
## # ... with 112 more rows
```

```
#filter for just backreef data from LTER 1 2020
LTER_1_BACKREEF <-  lter_1_2020.sum %>%
    filter(reef.type %in% "backreef")

#filter for just fringe data from LTER 1 2020
LTER_1_FRINGE <-  lter_1_2020.sum %>%
    filter(reef.type %in% "fringe")
```

#coorelation analysis between E5 2020 data and LTER 1 and LTER 2 backrreef and fringe data frames

```
#e5 temp 2020 data
data.E5.HOBO
```

```
## # A tibble: 85 x 5
## # Groups:   Date, site [85]
##    Date       site     year   mean      se
##    <date>     <chr>    <chr> <dbl>   <dbl>
##  1 2020-02-10 E5_site2 2020   28.7 0.00950
##  2 2020-02-11 E5_site2 2020   28.8 0.00826
##  3 2020-02-12 E5_site2 2020   28.8 0.00943
##  4 2020-02-13 E5_site2 2020   29.0 0.00982
##  5 2020-02-14 E5_site2 2020   29.0 0.00667
##  6 2020-02-15 E5_site2 2020   28.9 0.00668
##  7 2020-02-16 E5_site2 2020   29.1 0.00951
##  8 2020-02-17 E5_site2 2020   29.2 0.0122
##  9 2020-02-18 E5_site2 2020   29.3 0.0138
## 10 2020-02-19 E5_site2 2020   29.2 0.00788
## # ... with 75 more rows
```

```
#filter e5 data for march april
E5.compare <- data.E5.HOBO %>%
    filter(lubridate::month(Date) %in% c(3:4))

#for all comparisons you need to specify the number of the column it needs to compare between data fram

#remove data from March 1-7th for lter datasets to be able to use correlation analysis between e5 and l

LTER_1_FRINGE.FILTER <- LTER_1_FRINGE %>%
  filter(Date >= "2020-03-07")

LTER_1_BACKREEF.FILTER <- LTER_1_BACKREEF %>%
  filter(Date >= "2020-03-07")

LTER_2_FRINGE.FILTER <- LTER_2_FRINGE %>%
  filter(Date >= "2020-03-07")

LTER_2_BACKREEF.FILTER <- LTER_2_BACKREEF %>%
  filter(Date >= "2020-03-07")
```

```r
#correlation analysis between E5 and LTER 1 fringe

cor.test(E5.compare$mean, LTER_1_FRINGE.FILTER$mean, method = "pearson", use = "complete.obs")
```

```
##
##  Pearson's product-moment correlation
##
## data:  E5.compare$mean and LTER_1_FRINGE.FILTER$mean
## t = 12.888, df = 53, p-value < 2.2e-16
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.7872448 0.9228254
## sample estimates:
##       cor
## 0.8706942
```

```r
#0.8706942

#correlation analysis between E5 and LTER 1 backreef

cor.test(E5.compare$mean, LTER_1_BACKREEF.FILTER$mean, method = "pearson", use = "complete.obs")
```

```
##
##  Pearson's product-moment correlation
##
## data:  E5.compare$mean and LTER_1_BACKREEF.FILTER$mean
## t = 12.501, df = 53, p-value < 2.2e-16
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.7769656 0.9187991
## sample estimates:
##       cor
## 0.8641403
```

```r
#0.8641403

#correlation analysis between E5 and LTER 2 fringe

cor.test(E5.compare$mean, LTER_2_FRINGE.FILTER$mean, method = "pearson", use = "complete.obs")
```

```
##
##  Pearson's product-moment correlation
##
## data:  E5.compare$mean and LTER_2_FRINGE.FILTER$mean
## t = 11.353, df = 53, p-value = 8.284e-16
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.7422497 0.9049795
## sample estimates:
##       cor
## 0.8417853
```

```r
#0.8417853

#correlation analysis between E5 and LTER 2 backreef
```

```r
cor.test(E5.compare$mean, LTER_2_BACKREEF.FILTER$mean, method = "pearson", use = "complete.obs")
```

```
##
##  Pearson's product-moment correlation
##
## data:  E5.compare$mean and LTER_2_BACKREEF.FILTER$mean
## t = 13.496, df = 53, p-value < 2.2e-16
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.8021065 0.9285947
## sample estimates:
##       cor
## 0.8801176
```

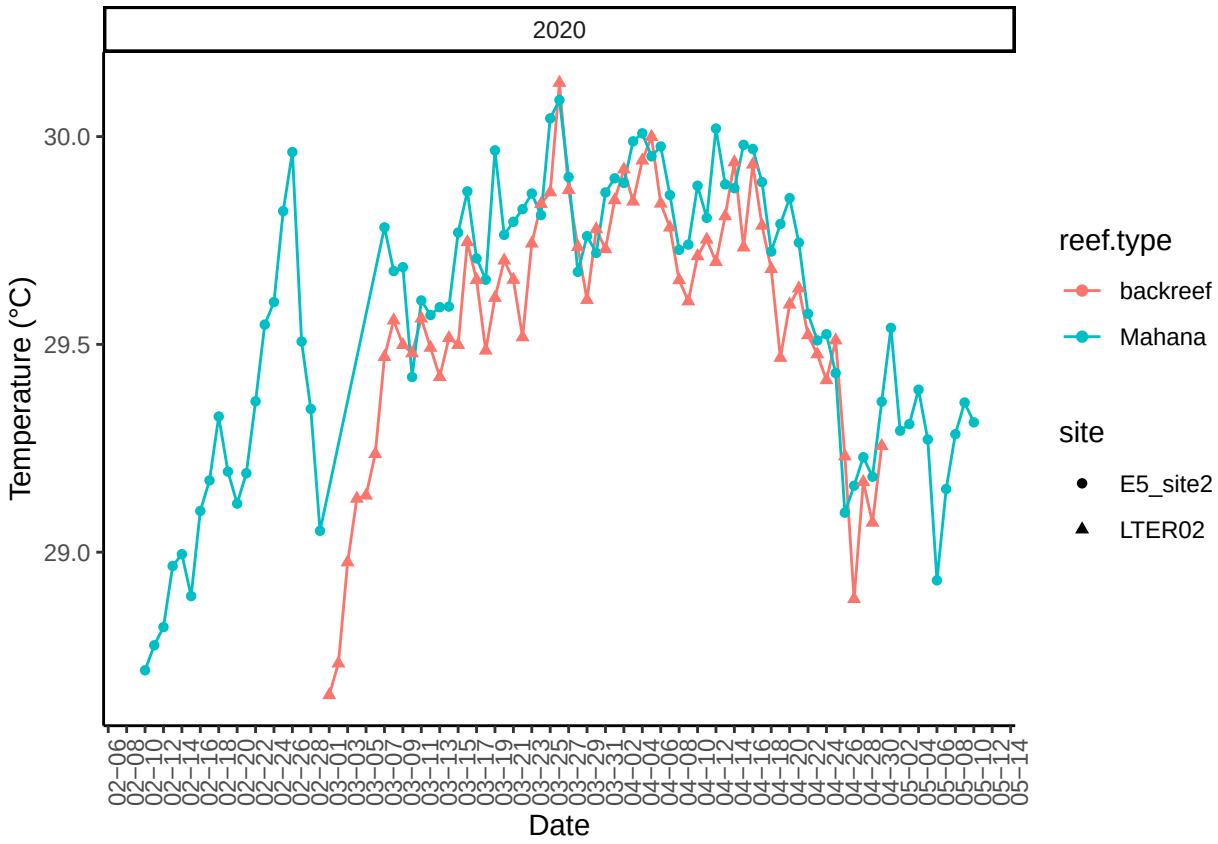
```r
#0.8801176
#2.2 e-16

##LTER02 IS highly correlated with mahana e5 2020 data
```

#make data frame from all LTER 02 backreef data from 2003 to be used for marine heatwave scenario

```r
#filter for just backreef data from full timeseries and save

LTER_2_temp_backreef <-  LTER_2_temp %>%
    filter(reef.type %in% "backreef")

write.csv(LTER_2_temp_backreef, "RAnalysis/output/temperature/LTER_2_temp_backreef.csv")
```

#plot temperature data from LTER backreef and E5 2020 March April data

```r
#add a year column to backreef lter2 data output

LTER_2_BACKREEF$year <- format(as.Date(LTER_2_BACKREEF$Date), "%Y")

#join E5 data set for 2020 and lter 2020 backreef

LTER_backreef_E5_2020 <- full_join(data.E5.HOBO_mahana, LTER_2_BACKREEF)


#plot mean temp per day by date
final_2020_compare_plot <-LTER_backreef_E5_2020 %>%
  ggplot(aes(x=Date, y=mean, group = reef.type, color = reef.type, shape = site))+
  geom_line() +
  geom_point() +
  facet_wrap(.~year, scales = "free_x") +
  scale_x_date(date_breaks = "2 days", date_labels = "%m-%d") +
  theme_classic()+
  theme(axis.text.x = element_text(angle = 90)) +
  ylab("Temperature (°C)")+
  xlab("Date");final_2020_compare_plot
```




```
ggsave(filename="RAnalysis/output/temperature/final_2020_compare_plot.pdf", plot=final_2020_compare_plo
```

#calculate mean temperature in March and April from LTER02 backreef data

```
#subset temp data for March through April for 2020

LTER_2_BACKREEF_meantemp <- LTER_2_temp_backreef %>%
  filter(lubridate::month(Date) %in% c(3:4))


#temp data across date summarized, remove NAs from temp
LTER_2_BACKREEF_meantemp.dat <- LTER_2_BACKREEF_meantemp %>%
  summarise(mean=mean(temp, na.rm=TRUE), se=sd(temp, na.rm=TRUE)/sqrt(n())) #calculates mean and se
LTER_2_BACKREEF_meantemp.dat
```

```
##       mean          se
## 1 28.96985 0.002176216
```

```
#28.96 degrees C in March April from 2006 - 2021
```