OA Treatment Summary

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Contents

1 Loading libraries

```
library(knitr)
```

2 Reading in data files

First we pull in the RMR results to get the treatment dates. This forms the basis of over what time periods to summarize tank conditions for each octopus.

```
RMR=read.csv(file="RMR_Results.csv")
```

Next, we extract dates from each file.

```
dates=strptime(gsub(".*([78]-\\d+-21).*","\\1",RMR$filename),format="%m-%d-%y")
```

Now, we read in the OA data sheet that contains the daily carbonate chemistry results in each tank.

```
OA=read.csv("OA_Data_Sheet.csv")
OA$Date=strptime(OA$Date,format="%Y/%m/%d")
OA$Date=as.Date(OA$Date)
```

3 Per octopus summary

We are going to summarize the pCO_2 environment that each octopus experienced during the experiment. To do this, First we get the ID's of each octopus in the study.

```
octos=unique(RMR$octo)
```

Next, we are building a dataframe in which to place the summarize results.

```
OA_Summary=data.frame(octo=as.character(rep(NA,17)),
                      start.date=rep(as.Date(OA$Date[1]),17),
                      end.date=rep(as.Date(OA$Date[1]),17),
                      treat=as.numeric(rep(NA,17)),
                      pco2=as.numeric(rep(NA,17)),
                      pco2.sd=as.numeric(rep(NA,17)),
                      ph=as.numeric(rep(NA,17)),
                      ph.sd=as.numeric(rep(NA,17)),
                      alk=as.numeric(rep(NA,17)),
                      alk.sd=as.numeric(rep(NA,17)),
                      salinity=as.numeric(rep(NA,17))
                      ,salinity.sd=as.numeric(rep(NA,17))
                      )
```

The following loops get the beginning and ending dates for each octopus from the filenames and gets summary statistics for each carbonate chemistry parameter measured during that time period for the tank each octopus was in.

```
for (i in 1:length(octos)){
  OA_Summary$octo[i]=octos[i]
  OA_Summary$start.date[i]=
    as.Date(min(dates[RMR$octo==octos[i]]))
  OA_Summary$end.date[i]=
    as.Date(max(dates[RMR$octo==octos[i]]))
  if(OA_Summary$end.date[i]==OA_Summary$start.date[i]){
    OA_Summary$start.date[i]=OA_Summary$end.date[i]-6
  }
  OA_Summary$treat[i]=
    RMR$pco2[RMR$octo==octos[i]][1]
  group=
    as.numeric(gsub("(\\d+)\\-\\d+","\\1",octos[i]))
  if (OA_Summary$treat[i]==1000){
    tank=group
  }
  if (OA_Summary$treat[i]==1800){
    tank=group+4
  }
  if (grepl("5",octos[i])){
    tank=
      as.numeric(gsub("5-(\\d)","\\1",octos[i]))
  }
  if (octos[i]=="5-5"){
    tank=5
  }
```

```
  OA_Summary$pco2[i]=
    round(mean(OA[,tank+2][OA$Variable=="pCO2"&
          OA$Date>=OA_Summary$start.date[i]&
          OA$Date<=OA_Summary$end.date[i]],
          na.rm=T))
  OA_Summary$pco2.sd[i]=
    round(sd(OA[,tank+2][OA$Variable=="pCO2"&
          OA$Date>=OA_Summary$start.date[i]&
          OA$Date<=OA_Summary$end.date[i]],
          na.rm=T))
  OA_Summary$ph[i]=
    round(mean(OA[,tank+2][OA$Variable=="pH"&
          OA$Date>=OA_Summary$start.date[i]&
          OA$Date<=OA_Summary$end.date[i]],
          na.rm=T),3)
  OA_Summary$ph.sd[i]=
    round(sd(OA[,tank+2][OA$Variable=="pH"&
          OA$Date>=OA_Summary$start.date[i]&
          OA$Date<=OA_Summary$end.date[i]],
          na.rm=T),3)
  OA_Summary$alk[i]=
   round(mean(OA[,tank+2][OA$Variable=="Alkalinity"&
          OA$Date>=OA_Summary$start.date[i]&
          OA$Date<=OA_Summary$end.date[i]],
          na.rm=T)*1000000)
  OA_Summary$alk.sd[i]=
    round(sd(OA[,tank+2][OA$Variable=="Alkalinity"&
          OA$Date>=OA_Summary$start.date[i]&
          OA$Date<=OA_Summary$end.date[i]],
          na.rm=T)*1000000)
  OA_Summary$salinity[i]=
    round(mean(OA[,tank+2][OA$Variable=="Salinity"&
          OA$Date>=OA_Summary$start.date[i]&
          OA$Date<=OA_Summary$end.date[i]],
          na.rm=T),1)
  OA_Summary$salinity.sd[i]=
    round(sd(OA[,tank+2][OA$Variable=="Salinity"&
          OA$Date>=OA_Summary$start.date[i]&
          OA$Date<=OA_Summary$end.date[i]],
          na.rm=T),1)

  }
```

This table give a summary of the carbonate conditions experienced by each octopus during the experiment.

```
kable(OA_Summary,align="c")
```

octo	start.date	end.date	treat	pco2	pco2.sd	ph	ph.sd	alk	alk.sd	salinity	salinity.sd
1-3	2021-07-26	2021-08-02	1800	1692	176	7.430	0.042	2049	0	30.6	0.3
1-2	2021-07-20	2021-07-26	1000	1135	121	7.600	0.045	2063	4	30.5	1.0

octo	start.date	end.date	treat	pco2	pco2.sd	ph	ph.sd	alk	alk.sd	salinity	salinity.sd
1-1	2021-07-12	2021-07-19	1800	1716	102	7.430	0.023	2070	23	29.7	0.9
2-2	2021-07-20	2021-07-26	1000	1117	166	7.618	0.069	2062	2	29.6	3.0
2-1	2021-07-13	2021-07-19	1800	1942	386	7.387	0.072	2065	11	30.1	0.5
2-3	2021-07-27	2021-08-02	1800	1738	254	7.431	0.063	2093	6	30.6	0.9
3-2	2021-07-20	2021-07-26	1000	1048	97	7.626	0.031	2092	0	30.2	0.8
3-3	2021-07-27	2021-08-02	1800	1976	339	7.375	0.069	2074	0	30.2	0.5
3-1	2021-07-12	2021-07-19	1800	1580	313	7.474	0.086	2040	15	29.3	0.7
4-2	2021-07-21	2021-07-26	1000	1011	64	7.638	0.026	2016	58	30.0	0.5
4-3	2021-07-26	2021-08-02	1800	1816	65	7.406	0.015	2080	22	30.7	0.7
4-1	2021-07-12	2021-07-19	1800	1678	403	7.445	0.099	2056	0	30.0	2.4
5-1	2021-08-10	2021-08-18	1000	1168	26	7.592	0.010	2081	0	29.8	0.2
5-2	2021-08-10	2021-08-18	1000	984	172	7.667	0.071	2095	0	30.0	0.3
5-3	2021-08-10	2021-08-18	1000	1128	242	7.607	0.091	2066	0	29.6	0.1
5-4	2021-08-10	2021-08-18	1000	1075	21	7.623	0.009	2070	0	30.1	0.1
5-5	2021-08-12	2021-08-19	1800	NaN	NA	NaN	NA	NaN	NA	NaN	NA

4 Per treatment summary

Next, I want to summarize the condition actually experienced by octopuses in each treatment.

```
treatment.sum=data.frame(
  Treatment=c("Control","Elevated CO~2~"),
  pCO2=paste0(round(aggregate(pco2~treat,data=OA_Summary,FUN="mean")$pco2),"±",
  c(round(sqrt(mean(OA_Summary$pco2.sd[OA_Summary$treat==1000]^2,na.rm=T))/
             sqrt(sum(OA_Summary$treat==1000))),
    round(sqrt(mean(OA_Summary$pco2.sd[OA_Summary$treat==1800]^2,na.rm=T))/
             sqrt(sum(OA_Summary$treat==1800))))
  ),
#  round(aggregate(pco2~treat,data=OA_Summary,FUN="sd")$pco2)),
  pH=paste0(round(aggregate(ph~treat,data=OA_Summary,FUN="mean")$ph,3),"±",
  c(round(sqrt(mean(OA_Summary$ph.sd[OA_Summary$treat==1000]^2,na.rm=T))/
             sqrt(sum(OA_Summary$treat==1000)),3),
    round(sqrt(mean(OA_Summary$ph.sd[OA_Summary$treat==1800]^2,na.rm=T))/
             sqrt(sum(OA_Summary$treat==1800)),3))
  ),
```

```
  Alkalinity=paste0(round(aggregate(alk~treat,data=OA_Summary,FUN="mean")$alk),"±",
  c(round(sqrt(mean(OA_Summary$alk.sd[OA_Summary$treat==1000]^2,na.rm=T))/
             sqrt(sum(OA_Summary$treat==1000)),0),
    round(sqrt(mean(OA_Summary$alk.sd[OA_Summary$treat==1800]^2,na.rm=T))/
             sqrt(sum(OA_Summary$treat==1800)),0))
  ),
  Salinity=paste0(round(aggregate(salinity~treat,data=OA_Summary,FUN="mean")$salinity,1),"±",
  c(round(sqrt(mean(OA_Summary$salinity.sd[OA_Summary$treat==1000]^2,na.rm=T))/
             sqrt(sum(OA_Summary$treat==1000)),1),
    round(sqrt(mean(OA_Summary$salinity.sd[OA_Summary$treat==1800]^2,na.rm=T))/
             sqrt(sum(OA_Summary$treat==1800)),1))
  )
)

colnames(treatment.sum)[2]="pCO~2~ ($\\mu$atm)"
colnames(treatment.sum)[4]="Alkalinity ($\\mu$mol kg^-1^)"
colnames(treatment.sum)[5]="Salinity (PSU)"
```

```
kable(treatment.sum,align="c")
```

Treatment	pCO_2 (μatm)	pH	Alkalinity (μmol kg^{-1})	Salinity (PSU)
Control	1083±48	7.621±0.019	2068±7	30±0.4
Elevated CO_2	1767±94	7.422±0.022	2066±4	30.1±0.4