Muusoctopus leioderma respiration

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# Reading in libraries

library(OTools)  
library(xlsx)  
library(nlme)  
library(car)

## Loading required package: carData

library(emmeans)  
library(respirometry)

## Loading required package: PKNCA

library(knitr)

# Find the relevant files

files=list.files(recursive=T)  
resp.files=grep(".txt",files,value=T)  
pcrit.files=grep("pcrit|pcrti",resp.files,value=T,ignore.case=T)  
metab.files=setdiff(resp.files,pcrit.files)  
blank.files=grep("blank\_only",resp.files,value=T,ignore.case=T)  
rmr.files=setdiff(metab.files,blank.files)  
rmr.files=rmr.files[!grepl("-ch2.txt|-ch3.txt|-ch4.txt|\\(1\\).txt",rmr.files)]  
rmr.files=rmr.files[!duplicated(basename(rmr.files))]

# Reading in the data log xlsx file

data.log=read.csv("Muus\_Data\_Log.csv")

# Running the RMR data analysis

First I am going to make a object to put the RMR data into

routine=data.frame(filename=as.character(),spreadsheet\_guess=as.character(),octo=as.character(),mass=as.numeric(),pco2=as.numeric(),day=as.numeric(),rmr=as.numeric())

filename match check

file\_check=as.character()  
score=as.numeric()  
for (i in 1:length(rmr.files)){  
 filename=rmr.files[i]  
 guess=which.min(adist(basename(filename),data.log$File.name))  
 file\_check[i]=data.log$File.name[guess]  
 score[i]=min(adist(basename(filename),data.log$File.name))  
}  
  
write.csv(cbind(basename(rmr.files),file\_check,score),file = "filecheck.csv")  
  
#i=27  
#cbind(t(adist(basename(rmr.files[i]),data.log$File.name)),basename(rmr.files),basename(rmr.files)[i])  
  
#sum(is.na(resp$O23))<10&!grepl("blank",filename)

column.count=1  
for (i in 1:length(rmr.files)){  
 filename=rmr.files[i]  
 print(paste("starting file ", basename(filename)," (loop",i,")",sep=""))  
 if(length(grep("Group 4|presens|ch\\d\\.txt",basename(filename)))>0){  
 resp=read.presens(filename)  
 }else{  
 resp=read.pyro(filename)  
 }  
 print("finding closest match in log")  
  
guess=which.min(adist(basename(filename),data.log$File.name))  
   
 flow=as.numeric(data.log$flow.rate..L.min.[guess])  
 mass=as.numeric(data.log$Mass..g.[guess])  
 if(is.na(flow)){  
 flow=0.1  
 }  
 if(is.na(mass)){  
 mass=10  
 }  
 print("calculating rmr")  
 resp.mean=mean(resp.open(resp[resp$times>3600\*3,],flow.rate=flow\*1000,weight=mass)$resp,na.rm=T)  
 print("writing data to object")  
 routine[column.count,1]=basename(filename)  
 routine[column.count,2]=data.log$File.name[guess]  
 routine[column.count,3]=data.log$octo1[guess]  
 routine[column.count,4]=mass  
  
 if(length(grep("1800",filename))>0){  
 routine[column.count,5]=1800  
 }  
 if(length(grep("1000",filename))>0){  
 routine[column.count,5]=1000  
 }  
 routine[column.count,6]=data.log$day[guess]  
 routine[column.count,7]=resp.mean  
 column.count=column.count+1  
 if(sum(is.na(resp$O23))<10&!grepl("blank",filename)){  
 print("found second respirometer")  
 flow=as.numeric(data.log$Flow.rate.2[guess])  
 mass=as.numeric(data.log$Mass.2[guess])  
 resp.mean=mean(resp.open(resp[resp$times>3600,],inflow=3,outflow=4,flow.rate=flow\*1000,weight=mass)$resp,na.rm=T)  
 print("writing data to object")  
 routine[column.count,1]=basename(filename)  
 routine[column.count,2]=data.log$File.name[guess]  
 routine[column.count,3]=data.log$octo2[guess]  
 routine[column.count,4]=mass  
   
 if(length(grep("1800",filename))>0){  
 routine[column.count,5]=1800  
 }  
 if(length(grep("1000",filename))>0){  
 routine[column.count,5]=1000  
 }  
 routine[column.count,6]=data.log$day[guess]  
 routine[column.count,7]=resp.mean  
 column.count=column.count+1  
 }  
 print(paste("end of file ", basename(filename)," (loop",i,")",sep=""))  
}

write.csv(routine,"RMR\_Results.csv")

routine=read.csv("RMR\_Results.csv")

# Running linear effects model

# log-log transformation

routine$mass.log=log(routine$mass)  
routine$rmr.log=log(routine$rmr)

## setting pCO2 to factor class:

routine$pco2=as.factor(routine$pco2)

## Next I set orthogonal contrasts:

contrasts(routine$pco2)=contr.poly(2)

## Running the linear mixed effects model and ANOVA using type III sum of squares:

routine.lme=lme(rmr.log~mass.log+pco2+day,random=~1|octo,  
 correlation=corAR1(form=~day|octo),  
 data=routine[routine$octo!="2-1",])  
routine.anova=Anova(routine.lme,type="III")  
routine.anova

## Analysis of Deviance Table (Type III tests)  
##   
## Response: rmr.log  
## Chisq Df Pr(>Chisq)   
## (Intercept) 35.6056 1 2.416e-09 \*\*\*  
## mass.log 13.0722 1 0.0002997 \*\*\*  
## pco2 0.1150 1 0.7344687   
## day 0.0572 1 0.8110012   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

rmr.lme.table=cbind(  
 c("mass","pCO2","day"),  
 round(routine.anova$Chisq[2:4],2),  
 routine.anova$Df[2:4],  
 round(routine.anova$`Pr(>Chisq)`[2:4],5)  
)  
colnames(rmr.lme.table)=c("factor","Chi-square", "DF", "p-value")  
  
kable(rmr.lme.table)

| factor | Chi-square | DF | p-value |
| --- | --- | --- | --- |
| mass | 13.07 | 1 | 3e-04 |
| pCO2 | 0.12 | 1 | 0.73447 |
| day | 0.06 | 1 | 0.811 |

predictions=data.frame(  
 day=c(1,7,1,7),  
 mass.log=log(rep(log(25.6),4)),  
 pco2=as.factor(c(1000,1000,1800,1800))  
)  
  
exp(predict(routine.lme,newdata=predictions,level=0))

## [1] 5.630975 5.721444 6.108368 6.206507  
## attr(,"label")  
## [1] "Predicted values"

# Regressions

#reg1.1800=nls(rmr~a\*mass^b,data=routine[routine$pco2==1800&routine$day==1,],start=list(a=10,b=-0.7))  
seq1.1800=seq(from=min(routine$mass.log[routine$pco2==1800]),  
 to=max(routine$mass.log[routine$pco2==1800]),  
 length.out=100)  
  
df1.1800=data.frame(  
 day=rep(1,100),  
 mass.log=seq1.1800,  
 pco2=as.factor(rep(1800,100))  
)  
pred1.1800= predict(routine.lme,newdata = df1.1800,level=0)  
  
#reg1.1000=nls(rmr~a\*mass^b,data=routine[routine$pco2==1000&routine$day==1,],start=list(a=10,b=-0.7))  
seq1.1000=seq(from=min(routine$mass.log[routine$pco2==1000]),  
 to=max(routine$mass.log[routine$pco2==1000]),  
 length.out=100)  
  
df1.1000=data.frame(  
 day=rep(1,100),  
 mass.log=seq1.1000,  
 pco2=as.factor(rep(1000,100))  
)  
  
pred1.1000=predict(routine.lme,newdata = df1.1000,level=0)  
  
#reg7.1800=nls(rmr~a\*mass^b,data=routine[routine$pco2==1800&routine$day==7,],start=list(a=10,b=-0.7))  
seq7.1800=seq(from=min(routine$mass.log[routine$pco2==1800]),  
 to=max(routine$mass.log[routine$pco2==1800]),  
 length.out=100)  
  
df7.1800=data.frame(  
 day=rep(7,100),  
 mass.log=seq7.1800,  
 pco2=as.factor(rep(1800,100))  
)  
  
pred7.1800=predict(routine.lme,newdata = df7.1800,level=0)  
  
#reg7.1000=nls(rmr~a\*mass^b,data=routine[routine$pco2==1000&routine$day==7,],start=list(a=10,b=-0.7))  
seq7.1000=seq(from=min(routine$mass.log[routine$pco2==1000]),  
 to=max(routine$mass.log[routine$pco2==1000]),  
 length.out=100)  
  
df7.1000=data.frame(  
 day=rep(77,100),  
 mass.log=seq7.1000,  
 pco2=as.factor(rep(1000,100))  
)  
  
pred7.1000=predict(routine.lme,newdata = df7.1000,level=0)

plot(rmr~mass,data=routine[routine$octo!="2-1",],log="xy")  
points(rmr~mass,data=routine[routine$pco2==1000&routine$day==1&routine$octo!="2-1",],pch=21,bg="white",col="blue")  
points(rmr~mass,data=routine[routine$pco2==1000&routine$day==7&routine$octo!="2-1",],pch=21,bg="blue")  
points(rmr~mass,data=routine[routine$pco2==1800&routine$day==7&routine$octo!="2-1",],pch=21,bg="red")  
points(rmr~mass,data=routine[routine$pco2==1800&routine$day==1&routine$octo!="2-1",],pch=21,bg="white",col="red")  
lines(exp(seq1.1800),exp(pred1.1800),col="red",lwd=2,lty=2)  
lines(exp(seq1.1000),exp(pred1.1000),col="blue",lwd=2,lty=2)  
lines(exp(seq7.1800),exp(pred7.1800),col="red",lwd=2,lty=1)  
lines(exp(seq7.1000),exp(pred7.1000),col="blue",lwd=2,lty=1)

