WalshGravityCurrentFigure

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# Initial stuff, including loading packages and importing data

##loading packages

library(here)  
library(rstatix)  
library(ggplot2)  
library(tidyverse)  
library(dplyr)  
library(lubridate)  
library(scales)  
library(ggpubr)  
library(reshape2)  
library(RColorBrewer)

## loading files

# Tell R where files are stored  
here::i\_am("scripts/WalshTemperatureProfileAndMixing.Rmd")  
  
# Load Files  
a <- readr::read\_csv(here("data/SporeConcentrationsByDepthLocations.csv"))  
b <- readr::read\_csv(here("data/Walsh\_Basin\_Nearshore.csv"))

col <- c("0"= "#C6DBEF", "1"= "#9ECAE1", "2"="#6BAED6", "3"="#4292C6","4"= "#2171B5","5"= "#08519C","6"= "#08306B")  
col2 <- c("Basin"="#0072B2", "Nearshore"="#009E73")  
######### Walsh  
  
wb = a %>%  
 filter(Parasite== "Blastulidium",  
 Lake=="Walsh",  
 Location=="Basin"| Location=="Nearshore",  
 Depth=="3")  
locw<- wb$Location  
  
concwb <- wb$ConcentrationLog10Plus1  
pwb <- wb$Parasite  
dwb <- wb$Depth  
dwb <- as.factor(dwb)  
yywb <- wb$Date  
strptime(yywb, format = "%m/%d/%y")

## [1] "2021-06-14 EDT" "2021-06-28 EDT" "2021-07-12 EDT" "2021-07-26 EDT"  
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lwb <- as.POSIXct(yywb,format="%m/%d/%y",tz=Sys.timezone())  
  
  
walsh.brood <- ggplot(wb) +  
 geom\_point(aes(x=lwb,y=concwb, group=locw,color=locw), size=2) +  
 geom\_line(aes(x=lwb,y=concwb, group=locw, color=locw), size=1.5)+  
 ##geom\_smooth(aes(x=lwb,y=concwb, group=locw, color=locw),method = "loess", size = 1.5, span=.5, se=FALSE)+  
 scale\_colour\_manual(values = col2)+  
 scale\_y\_continuous(limits=c(0,6.5), breaks = seq(0,6.5,1))+  
 scale\_x\_datetime(limits = c(as.POSIXct(as.Date("2021-06-07")), as.POSIXct(as.Date("2021-11-13"))))+  
 theme\_bw() +  
 theme(panel.border = element\_blank(),   
 panel.grid.major = element\_blank(),  
 panel.grid.minor = element\_blank(),   
 axis.line = element\_line(colour = "black"))+  
 ggtitle("B. paedophthorum") +  
 theme(plot.title = element\_text(face = "bold.italic",size = 14)) +  
 theme(axis.text=element\_text(size=10, face = "bold"),   
 axis.title=element\_text(size=12,face="bold")) +  
 theme(legend.title = element\_text(face = "bold",size = 12),  
 legend.text=element\_text(size=10,face="bold"),  
 legend.position = "bottom") +   
 labs(colour = "Location", x = ("Date"), y = ("Log(Spore Concentration + 1)"))+  
 geom\_rect(aes(xmin=as.POSIXct(as.Date("2021-09-22")), xmax=as.POSIXct(as.Date("2021-09-26")), ymin=0, ymax=Inf), alpha=.015, fill="grey90")+  
 geom\_rect(aes(xmin=as.POSIXct(as.Date("2021-10-22")), xmax=as.POSIXct(as.Date("2021-10-28")), ymin=0, ymax=Inf), alpha = .015, fill="grey90")  
  
######## Walsh MicG  
wo = a %>%  
 filter(Parasite== "Ordospora",  
 Lake=="Walsh",  
 Location=="Basin"| Location=="Nearshore",  
 Depth=="3")  
locwo<- wo$Location  
  
concwo <- wo$ConcentrationLog10Plus1  
pwo <- wo$Parasite  
dwo <- wo$Depth  
dwo <- as.factor(dwo)  
yywo <- wo$Date  
strptime(yywo, format = "%m/%d/%y")

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lwo <- as.POSIXct(yywo,format="%m/%d/%y",tz=Sys.timezone())  
  
  
walsh.micg <- ggplot(wo) +  
 geom\_point(aes(x=lwo,y=concwo, group=locwo,color=locwo), size=2) +  
 geom\_line(aes(x=lwo,y=concwo, group=locwo, color=locwo), size=1.5)+  
 ##geom\_smooth(aes(x=lwb,y=concwb, group=locw, color=locw),method = "loess", size = 1.5, span=.5, se=FALSE)+  
 scale\_colour\_manual(values = col2)+  
 scale\_y\_continuous(limits=c(0,6.5), breaks = seq(0,6.5,1))+  
 scale\_x\_datetime(limits = c(as.POSIXct(as.Date("2021-06-07")), as.POSIXct(as.Date("2021-11-13"))))+  
 theme\_bw() +  
 theme(panel.border = element\_blank(),   
 panel.grid.major = element\_blank(),  
 panel.grid.minor = element\_blank(),   
 axis.line = element\_line(colour = "black"))+  
 ggtitle("O. pajunii") +  
 theme(plot.title = element\_text(face = "bold.italic",size = 14)) +  
 theme(axis.text=element\_text(size=10, face = "bold"),   
 axis.title=element\_text(size=12,face="bold")) +  
 theme(legend.title = element\_text(face = "bold",size = 12),  
 legend.text=element\_text(size=10,face="bold"),  
 legend.position = "bottom") +   
 labs(colour = "Location", x = ("Date"), y = ("Log(Spore Concentration + 1)"))+  
 geom\_rect(aes(xmin=as.POSIXct(as.Date("2021-09-22")), xmax=as.POSIXct(as.Date("2021-09-26")), ymin=0, ymax=Inf), alpha=.015, fill="grey90")+  
 geom\_rect(aes(xmin=as.POSIXct(as.Date("2021-10-22")), xmax=as.POSIXct(as.Date("2021-10-28")), ymin=0, ymax=Inf), alpha = .015, fill="grey90")  
  
######### Walsh Metsch  
wm = a %>%  
 filter(Parasite== "Metschnikowia",  
 Lake=="Walsh",  
 Location=="Basin"| Location=="Nearshore",  
 Depth=="3")  
  
locwm<-wm$Location  
  
concwm <- wm$ConcentrationLog10Plus1  
pwm <- wm$Parasite  
dwm <- wm$Depth  
dwm <- as.factor(dwm)  
yywm <- wm$Date  
strptime(yywm, format = "%m/%d/%y")

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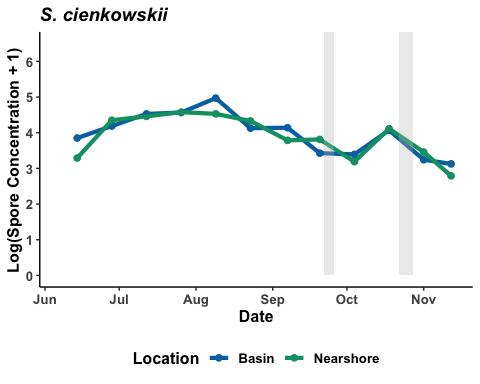
lwm <- as.POSIXct(yywm,format="%m/%d/%y",tz=Sys.timezone())  
  
walsh.metsch <- ggplot(wm) +  
 geom\_point(aes(x=lwm,y=concwm, group=locwm,color=locwm), size=2) +  
 geom\_line(aes(x=lwm,y=concwm, group=locwm, color=locwm), size=1.5)+  
 ##geom\_smooth(aes(x=lwb,y=concwb, group=locw, color=locw),method = "loess", size = 1.5, span=.5, se=FALSE)+  
 scale\_colour\_manual(values = col2)+  
 scale\_y\_continuous(limits=c(0,6.5), breaks = seq(0,6.5,1))+  
 scale\_x\_datetime(limits = c(as.POSIXct(as.Date("2021-06-07")), as.POSIXct(as.Date("2021-11-13"))))+  
 theme\_bw() +  
 theme(panel.border = element\_blank(),   
 panel.grid.major = element\_blank(),  
 panel.grid.minor = element\_blank(),   
 axis.line = element\_line(colour = "black"))+  
 ggtitle("M. bicuspidata") +  
 theme(plot.title = element\_text(face = "bold.italic",size = 14)) +  
 theme(axis.text=element\_text(size=10, face = "bold"),   
 axis.title=element\_text(size=12,face="bold")) +  
 theme(legend.title = element\_text(face = "bold",size = 12),  
 legend.text=element\_text(size=10,face="bold"),  
 legend.position = "bottom") +   
 labs(colour = "Location", x = ("Date"), y = ("Log(Spore Concentration + 1)"))+  
 geom\_rect(aes(xmin=as.POSIXct(as.Date("2021-09-22")), xmax=as.POSIXct(as.Date("2021-09-26")), ymin=0, ymax=Inf), alpha=.015, fill="grey90")+  
 geom\_rect(aes(xmin=as.POSIXct(as.Date("2021-10-22")), xmax=as.POSIXct(as.Date("2021-10-28")), ymin=0, ymax=Inf), alpha = .015, fill="grey90")  
  
####### Walsh Past  
  
wp = a %>%  
 filter(Parasite== "Pasteuria",  
 Lake=="Walsh",  
 Location=="Basin"| Location=="Nearshore",  
 Depth=="3")  
  
locwp<-wp$Location  
  
concwp <- wp$ConcentrationLog10Plus1  
pwp <- wp$Parasite  
dwp <- wp$Depth  
dwp <- as.factor(dwp)  
yywp <- wp$Date  
strptime(yywp, format = "%m/%d/%y")

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lwp <- as.POSIXct(yywp,format="%m/%d/%y",tz=Sys.timezone())  
  
  
walsh.past <- ggplot(wp) +  
 geom\_point(aes(x=lwp,y=concwp, group=locwp,color=locwp), size=2) +  
 geom\_line(aes(x=lwp,y=concwp, group=locwp, color=locwp), size=1.5)+  
 ##geom\_smooth(aes(x=lwb,y=concwb, group=locw, color=locw),method = "loess", size = 1.5, span=.5, se=FALSE)+  
 scale\_colour\_manual(values = col2)+  
 scale\_y\_continuous(limits=c(0,6.5), breaks = seq(0,6.5,1))+  
 scale\_x\_datetime(limits = c(as.POSIXct(as.Date("2021-06-07")), as.POSIXct(as.Date("2021-11-13"))))+  
 theme\_bw() +  
 theme(panel.border = element\_blank(),   
 panel.grid.major = element\_blank(),  
 panel.grid.minor = element\_blank(),   
 axis.line = element\_line(colour = "black"))+  
 ggtitle("P. ramosa") +  
 theme(plot.title = element\_text(face = "bold.italic",size = 14)) +  
 theme(axis.text=element\_text(size=10, face = "bold"),   
 axis.title=element\_text(size=12,face="bold")) +  
 theme(legend.title = element\_text(face = "bold",size = 12),  
 legend.text=element\_text(size=10,face="bold"),  
 legend.position = "bottom") +   
 labs(colour = "Location", x = ("Date"), y = ("Log(Spore Concentration + 1)"))+  
 geom\_rect(aes(xmin=as.POSIXct(as.Date("2021-09-22")), xmax=as.POSIXct(as.Date("2021-09-26")), ymin=0, ymax=Inf), alpha=.015, fill="grey90")+  
 geom\_rect(aes(xmin=as.POSIXct(as.Date("2021-10-22")), xmax=as.POSIXct(as.Date("2021-10-28")), ymin=0, ymax=Inf), alpha = .015, fill="grey90")  
  
######## Walsh Spiro  
  
ws = a %>%  
 filter(Parasite== "Spirobacillus",  
 Lake=="Walsh",  
 Location=="Basin"| Location=="Nearshore",  
 Depth=="3")  
  
locws<-ws$Location  
  
concws <- ws$ConcentrationLog10Plus1  
pws <- ws$Parasite  
dws <- ws$Depth  
dws <- as.factor(dws)  
yyws <- ws$Date  
strptime(yyws, format = "%m/%d/%y")

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lws <- as.POSIXct(yyws,format="%m/%d/%y",tz=Sys.timezone())  
  
  
walsh.spiro <- ggplot(ws) +  
 geom\_point(aes(x=lws,y=concws, group=locws,color=locws), size=2) +  
 geom\_line(aes(x=lws,y=concws, group=locws, color=locws), size=1.5)+  
 ##geom\_smooth(aes(x=lwb,y=concwb, group=locw, color=locw),method = "loess", size = 1.5, span=.5, se=FALSE)+  
 scale\_colour\_manual(values = col2)+  
 scale\_y\_continuous(limits=c(0,6.5), breaks = seq(0,6.5,1))+  
 scale\_x\_datetime(limits = c(as.POSIXct(as.Date("2021-06-07")), as.POSIXct(as.Date("2021-11-13"))))+  
 theme\_bw() +  
 theme(panel.border = element\_blank(),   
 panel.grid.major = element\_blank(),  
 panel.grid.minor = element\_blank(),   
 axis.line = element\_line(colour = "black"))+  
 ggtitle("S. cienkowskii") +  
 theme(plot.title = element\_text(face = "bold.italic",size = 14)) +  
 theme(axis.text=element\_text(size=10, face = "bold"),   
 axis.title=element\_text(size=12,face="bold")) +  
 theme(legend.title = element\_text(face = "bold",size = 12),  
 legend.text=element\_text(size=10,face="bold"),  
 legend.position = "bottom") +   
 labs(colour = "Location", x = ("Date"), y = ("Log(Spore Concentration + 1)"))+  
 geom\_rect(aes(xmin=as.POSIXct(as.Date("2021-09-22")), xmax=as.POSIXct(as.Date("2021-09-26")), ymin=0, ymax=Inf), alpha=.015, fill="grey90")+  
 geom\_rect(aes(xmin=as.POSIXct(as.Date("2021-10-22")), xmax=as.POSIXct(as.Date("2021-10-28")), ymin=0, ymax=Inf), alpha = .015, fill="grey90")  
  
walsh.spiro



##########  
  
  
z <- strptime(b$Date,format = "%m/%d/%y %H:%M")  
l <- as.POSIXct(z,format="%m/%d/%y %H:%M",tz=Sys.timezone())  
  
W.TDiff.3 <- b$Diff.3  
  
df.WTDiff3 <- data.frame(check.names = FALSE, time = l,  
 "3m" = W.TDiff.3)  
  
df.WTDiff3 <- melt(df.WTDiff3, id.vars = 'time', variable.name = 'series')  
  
WTdiff3 = ggplot(df.WTDiff3, aes(time,value)) +   
 geom\_rect(aes(xmin=as.POSIXct(as.Date("2021-10-22")), xmax=as.POSIXct(as.Date("2021-10-28")), ymin=-Inf, ymax=Inf), alpha = .015, fill="grey90")+  
 geom\_rect(aes(xmin=as.POSIXct(as.Date("2021-09-22")), xmax=as.POSIXct(as.Date("2021-09-26")), ymin=-Inf, ymax=Inf), alpha=.015, fill="grey90")+  
 geom\_line(aes(colour = series)) +  
 scale\_color\_manual(values = "black") +  
 theme\_bw() +  
 theme(panel.border = element\_blank(),   
 panel.grid.major = element\_blank(),  
 panel.grid.minor = element\_blank(),   
 axis.line = element\_line(colour = "black")) +  
 scale\_y\_continuous(limits = c(-1.5, 1.5), breaks = seq(-1.5, 1.5, 0.5))+  
 labs(x = "",  
 y = (expression(bold("Temperature Difference " ( degree\*C))))) +  
 ggtitle("Thermal Difference: Basin - Nearshore") +  
 theme(plot.title = element\_text(face = "bold",size = 14)) +  
 theme(axis.text=element\_text(size=11, face = "bold"),   
 axis.title=element\_text(size=14,face="bold")) +  
 theme(legend.title = element\_text(face = "bold",size = 14),  
 legend.text=element\_text(size=11,face="bold")) +   
 scale\_x\_datetime(limits = c(as.POSIXct(as.Date("2021-06-07")),   
 as.POSIXct(as.Date("2021-11-13")))) +  
 theme(legend.position = "none") +  
 geom\_hline(yintercept=0)  
  
  
legw <- get\_legend(walsh.brood)  
walsh.combined = ggarrange(WTdiff3, walsh.brood, walsh.micg, walsh.metsch,   
 walsh.past,walsh.spiro,  
 nrow = 3, ncol = 2, common.legend = TRUE,legend.grob = legw, legend="bottom")  
  
walsh.combined=annotate\_figure(walsh.combined,top = text\_grob("Gravity Currents: Walsh 3m", color = "black", face = "bold", size = 16))  
  
#### saving combined plot  
ggsave(here("figures", "WalshCombinedSporesGravityCurrents3m\_reordered.jpg"), walsh.combined, width = 10, height = 10, dpi = 300)