

Common bottlenose dolphin, *Tursiops truncatus*, behavioral response to a record-breaking flood event in Pensacola Bay, Florida – Supplemental Material 2

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1. R Code for Species Distribution Models and Graphs.

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#Pensacola Bay Species Distribution Models

#Libraries

#install.packages("lattice")

library(lattice)

#install.packages("ggplot2")

library(ggplot2)

#install.packages("MASS")

library(MASS)

#install.packages("mgcv")

library(mgcv)

#install.packages("modEvA")

library(modEvA)

#install.packages("rpart")

library(rpart)

#install.packages("rsq")

library(rsq)

#install.packages("ResourceSelection")

library(ResourceSelection)

#install.packages("lmSupport")

library(lmSupport)

#install.packages("normtest")

library(normtest)

#install.packages("car")

library(car)

#install.packages("Metrics")

library(Metrics)

#install.packages("interactions")

library(interactions)

#Set working directory

```

setwd("C:/Users/shaun/Documents/Pensacola Flood Shift/Habitat Shapefiles")

#Importing dataset
flood_data_all <- read.csv('flood_data_all.csv', header=TRUE, sep=',', stringsAsFactors = FALSE)
summary(flood_data_all)
sapply(flood_data_all, class) #Checking class of variables

#Subset data into flood-impacted sessions and respective control sessions for species distribution modeling
flood_data <- flood_data_all[0:1848,,] #Removed Pre-Flood Spring session from dataset
summary(flood_data)
sapply(flood_data, class) #Checking class of variables

#Converting class of variables
flood_data$Season <- ordered(flood_data$Season, levels = c("Spring", "Summer"))
flood_data$FloodPeriod <- ordered(flood_data$FloodPeriod, levels = c("Control", "Flood"))
flood_data$Mark <- ordered(flood_data$Mark, levels = c("Control Spring", "Flood Spring", "Control Summer", "Flood Summer"), labels = c("Control Spring", "Flood Spring", "Control Summer", "Flood Summer"))
sapply(flood_data, class) #Checking class of variables
summary(flood_data)

names(flood_data)
#Dependent Variable <- Dolphin Group Density "Group_km"
#Predictor Variables <- Depth_m, Slope, Slope_SD (standard deviation), LandDist_m, SAVDist_m, DO (Surface DO), Salinity (Surface Salinity), Temp (Surface Temp), DO_Bot (Bottom DO), Sal_Bot (Bottom Salinity), Temp_Bot (Bottom Temp), Nitro (Nitrogen), Phos (Phosphorus), Point_X (Longitude), Point_Y (Latitude), Season, and Flood Period

#Checking variables are classed correctly
summary(flood_data)

#Missing values?
is.na(flood_data)
colSums(is.na(flood_data))

#Plotting variables
plot(flood_data$Mark, flood_data$Salinity)
plot(flood_data$Mark, flood_data$Sal_Bot)
plot(flood_data$Mark, flood_data$Temp)
plot(flood_data$Mark, flood_data$Temp_Bot)
plot(flood_data$Mark, flood_data$DO)
plot(flood_data$Mark, flood_data$DO_Bot)
plot(flood_data$Mark, flood_data$Nitro)
plot(flood_data$Mark, flood_data$Phos)
plot(flood_data$Mark, flood_data$Group_km)
plot(flood_data$Season, flood_data$Salinity)
plot(flood_data$Season, flood_data$Sal_Bot)
plot(flood_data$Season, flood_data$Temp)
plot(flood_data$Season, flood_data$Temp_Bot)
plot(flood_data$Season, flood_data$DO)
plot(flood_data$Season, flood_data$DO_Bot)

```

```

plot(flood_data$Season, flood_data$Nitro)
plot(flood_data$Season, flood_data$Phos)
plot(flood_data$Season, flood_data$Group_km)
plot(flood_data$FloodPeriod, flood_data$Salinity)
plot(flood_data$FloodPeriod, flood_data$Sal_Bot)
plot(flood_data$FloodPeriod, flood_data$Temp)
plot(flood_data$FloodPeriod, flood_data$Temp_Bot)
plot(flood_data$FloodPeriod, flood_data$DO)
plot(flood_data$FloodPeriod, flood_data$DO_Bot)
plot(flood_data$FloodPeriod, flood_data$Nitro)
plot(flood_data$FloodPeriod, flood_data$Phos)
plot(flood_data$FloodPeriod, flood_data$Group_km)

```

#Checking kurtosis, skewness, and normality of variables

```
kurtosis.norm.test(flood_data$Group_km, nrepl=2000)
```

#Significant kurtosis

```
skewness.norm.test(flood_data$Group_km, nrepl=2000)
```

#Significantly skewed

```
jb.norm.test(flood_data$Group_km, nrepl=2000)
```

#Not normally distributed

#Examine best fit for distribution type

```
Group_km_fitnorm <- fitdistr(flood_data$Group_km, "normal")
```

```
Group_km_fitnorm$loglik
```

#Set up plots to examine variable collinearity (see reference MacLeod 2013)

```
panel.cor <- function(x, y, digits = 2, prefix = "", cex.cor,...)
```

```
{
```

```
  usr <- par("usr");on.exit(par(usr))
```

```
  par(usr = c(0,1,0,1))
```

```
  r<-abs(cor(x,y))
```

```
  txt <- format(c(r, 0.123456789), digits=digits) [1]
```

```
  txt <- paste(prefix, txt, sep="")
```

```
  if(missing(cex.cor)) cex.cor <- 0.8/strwidth(txt)
```

```
  text(0.5, 0.5, txt, cex = cex.cor * r)
```

```
}
```

```

pairs(~Group_km+Depth_m+Slope+Slope_SD+Salinity+Temp+DO+LandDist_m+SAVDist_m+DO_Bot+Sal_Bot+Temp_Bot
+Point_X+Point_Y+Nitro+Phos, data=flood_data, lower.panel=panel.smooth, upper.panel=panel.cor,
      pch=20, main = "Habitat Characteristics Pair Plot Matrix")

```

#Slope and Slope_SD are highly correlated ($r = 0.92$) - use one or the other variable to test models

#Temp and Temp_Bot are highly correlated ($r = 0.81$) - leave them both in the model since they represent different parts of the habitat (surface vs. bottom)

#Determine homogeneity of variance of flood data

#Test for normally distributed data

```
leveneTest(Group_km ~ FloodPeriod, data=flood_data, center=mean)
```

#Nonsignificant variance in group distribution across flood periods

#Test for non-normally distributed data

```
fligner.test(Group_km ~ FloodPeriod, data=flood_data)
```

#Nonsignificant variance in group distribution across flood periods

```

#Determine normality of flood data
shapiro.test(flood_data$Group_km)
#W = 0.15518, p-value < 2.2e-16 - Group distribution is not normally distributed

#Mann-Whitney U Tests to determine differences between control seasons and flood seasons (see Table 2)

#Subset data into flood vs. control periods for comparisons
Flood <- subset(flood_data, flood_data$FloodPeriod == "Flood", select = c(Index:Expected_GD))
Control <- subset(flood_data, flood_data$FloodPeriod == "Control", select = c(Index:Expected_GD))

#Mann-Whitney U test on surface DO across flood periods
wilcox.test(Flood$DO, Control$DO, alternative = "two.sided")
#W = 369140, p-value = 4.778e-07

#Mann-Whitney U test on bottom DO across flood periods
wilcox.test(Flood$DO_Bot, Control$DO_Bot, alternative = "two.sided")
#W = 566560, p-value < 2.2e-16

#Mann-Whitney U test on surface salinity across flood periods
wilcox.test(Flood$Salinity, Control$Salinity, alternative = "two.sided")
#W = 154970, p-value < 2.2e-16

#Mann-Whitney U test on bottom salinity across flood periods
wilcox.test(Flood$Sal_Bot, Control$Sal_Bot, alternative = "two.sided")
#W = 377950, p-value = 1.981e-05

#Mann-Whitney U test on surface temperature across flood periods
wilcox.test(Flood$Temp, Control$Temp, alternative = "two.sided")
#W = 462230, p-value = 0.002061

#Mann-Whitney U test on bottom temperature across flood periods
wilcox.test(Flood$Temp_Bot, Control$Temp_Bot, alternative = "two.sided")
#W = 395000, p-value = 0.005435

#Mann-Whitney U test on nitrogen across flood periods
wilcox.test(Flood$Nitro, Control$Nitro, alternative = "two.sided")
#W = 603590, p-value < 2.2e-16

#Mann-Whitney U test on phosphorus across flood periods
wilcox.test(Flood$Phos, Control$Phos, alternative = "two.sided")
#W = 598760, p-value < 2.2e-16

#Test linear model to check for negative residuals
Flood_LM_slopemean <- lm(Group_km ~ (Depth_m + Slope + Salinity + Temp + DO + Sal_Bot + Temp_Bot +
    DO_Bot + LandDist_m + SAVDist_m + Season + Point_X +
    FloodPeriod + Point_Y + Nitro + Phos), data=flood_data)
summary(Flood_LM_slopemean)
#Adjusted R-squared: 0.008359

```

```
#Model validation with linear model (see reference Zuur & Ieno 2016)
```

```
E1 <- resid(Flood_LM_slopemean)
```

```
F1 <- fitted(Flood_LM_slopemean)
```

```
#Plot residuals vs fitted values
```

```
par(mar = c(5,5,2,2), cex.lab = 1.5)
```

```
plot(x = F1,
```

```
     y = E1,
```

```
     xlab = "Fitted values",
```

```
     ylab = "Residuals")
```

```
abline(h = 0, lty = 2)
```

```
abline(v = 0, lty = 2)
```

```
#Examine fitted values from Linear Model
```

```
fitted(Flood_LM_slopemean)
```

```
plot(x = fitted(Flood_LM_slopemean),
```

```
     y = flood_data$Group_km)
```

```
#Negative fitted residuals indicating very poor model fit
```

```
##### GLM Flood Models #####
```

```
#Slope mean and slope standard deviation are highly correlated
```

```
#Test these variables in separate models and compare AICs
```

```
#Select model with lowest AIC as best model
```

```
#Models with slope mean
```

```
GLM_flood_slopemean <- glm(Group_km~Depth_m+Slope+Salinity+Temp+DO+LandDist_m  
+SAVDist_m+Season+Point_X+Point_Y+Nitro+Phos + FloodPeriod + Sal_Bot + Temp_Bot + DO_Bot,  
data=flood_data, family=gaussian)
```

```
summary(GLM_flood_slopemean)
```

```
#AIC: -3273
```

```
#Backwards stepwise comparisons
```

```
stepAIC(GLM_flood_slopemean)
```

```
#Lowest AIC = -3291.28
```

```
#Model with lowest AIC from previous stepwise comparisons
```

```
GLM_flood_slopemean_step <- glm(Group_km ~ DO + LandDist_m + Point_Y,  
data=flood_data, family=gaussian)
```

```
summary(GLM_flood_slopemean_step)
```

```
#AIC: -3291.3
```

```
#Adding interactions between variables for models with slope mean
```

```
GLM_flood_slopemean_2interaction <- glm(Group_km~(Depth_m+Slope+Salinity+Temp+DO+LandDist_m  
+SAVDist_m+Season+Point_X+Point_Y+Nitro+Phos + FloodPeriod + Sal_Bot + Temp_Bot + DO_Bot)^2,  
data=flood_data, family=gaussian)
```

```
summary(GLM_flood_slopemean_2interaction)
```

```
#AIC: -3233.5
```

```
#Backwards stepwise comparisons
stepAIC(GLM_flood_slopemean_2interaction)
#Lowest AIC: -3338.7
```

```
#Model with lowest AIC from previous stepwise comparisons
GLM_flood_slopemean_2interaction_step <- glm(Group_km ~ Depth_m + Slope + Salinity + Temp +
  DO + LandDist_m + SAVDist_m + Season + Point_X + Point_Y +
  Nitro + Phos + FloodPeriod + Sal_Bot + Temp_Bot + DO_Bot +
  Depth_m:Slope + Depth_m:DO + Depth_m:Season + Depth_m:Nitro +
  Depth_m:Phos + Depth_m:FloodPeriod + Depth_m:Sal_Bot + Depth_m:Temp_Bot +
  Depth_m:DO_Bot + Slope:Temp + Slope:Season + Slope:FloodPeriod +
  Slope:Sal_Bot + Slope:Temp_Bot + Salinity:Phos + Temp:DO +
  Temp:Season + Temp:Point_Y + Temp:Nitro + Temp:Phos + Temp:FloodPeriod +
  Temp:Sal_Bot + Temp:DO_Bot + DO:SAVDist_m + DO:Point_X +
  DO:Nitro + DO:Phos + DO:FloodPeriod + DO:Sal_Bot + LandDist_m:Season +
  LandDist_m:Phos + LandDist_m:Sal_Bot + LandDist_m:Temp_Bot +
  Season:Point_X + Season:Sal_Bot + Point_X:FloodPeriod + Point_X:Sal_Bot +
  Point_X:DO_Bot + Point_Y:FloodPeriod + Point_Y:Sal_Bot +
  Point_Y:DO_Bot + Nitro:Temp_Bot + Phos:Temp_Bot + Phos:DO_Bot +
  FloodPeriod:Temp_Bot + Sal_Bot:Temp_Bot + Temp_Bot:DO_Bot,
  family = gaussian, data = flood_data)
summary(GLM_flood_slopemean_2interaction_step)
#AIC: -3338.7
```

```
#Models with slope standard deviation
GLM_flood_slopesd <- glm(Group_km~Depth_m+Slope_SD+Salinity+Temp+DO+LandDist_m
  +SAVDist_m+Season+Point_X+Point_Y+Nitro+Phos + FloodPeriod + Sal_Bot + Temp_Bot + DO_Bot,
  data=flood_data, family=gaussian)
summary(GLM_flood_slopesd)
#AIC: -3271.5
```

```
#Backwards stepwise comparisons
stepAIC(GLM_flood_slopesd)
#Lowest AIC=-3291.28
```

```
#Model with lowest AIC from previous stepwise comparisons
GLM_flood_slopesd_step <- glm(Group_km ~ DO + LandDist_m + Point_Y, family = gaussian,
  data = flood_data)
summary(GLM_flood_slopesd_step)
#AIC: -3291.3
```

```
#Adding interactions between variables for models with slope standard deviation
GLM_flood_slopesd_2interaction <- glm(Group_km~(Depth_m+Slope_SD+Salinity+Temp+DO+LandDist_m
  +SAVDist_m+Season+Point_X+Point_Y+Nitro+Phos + FloodPeriod + Sal_Bot + Temp_Bot + DO_Bot)^2,
  data=flood_data, family=gaussian)
summary(GLM_flood_slopesd_2interaction)
#AIC: -3225
```

```
#Backards stepwise comparisons
stepAIC(GLM_flood_slopesd_2interaction)
#Lowest AIC=-3346.19
```

```
#Model with lowest AIC from previous stepwise comparisons
GLM_flood_slopesd_2interaction_step <- glm(Group_km ~ Depth_m + Slope_SD + Salinity + Temp +
  DO + LandDist_m + SAVDist_m + Season + Point_X + Point_Y +
  Nitro + Phos + FloodPeriod + Sal_Bot + Temp_Bot + DO_Bot +
  Depth_m:DO + Depth_m:LandDist_m + Depth_m:Season + Depth_m:Phos +
  Depth_m:FloodPeriod + Depth_m:Sal_Bot + Depth_m:Temp_Bot +
  Depth_m:DO_Bot + Slope_SD:FloodPeriod + Slope_SD:DO_Bot +
  Salinity:Season + Temp:DO + Temp:Season + Temp:Point_Y +
  Temp:FloodPeriod + Temp:Sal_Bot + Temp:DO_Bot + DO:SAVDist_m +
  DO:Point_X + DO:Nitro + DO:Phos + DO:FloodPeriod + DO:Sal_Bot +
  LandDist_m:SAVDist_m + LandDist_m:Phos + Season:Point_X +
  Season:Sal_Bot + Point_X:FloodPeriod + Point_X:Sal_Bot +
  Point_X:DO_Bot + Point_Y:Phos + Point_Y:FloodPeriod + Point_Y:Sal_Bot +
  Point_Y:DO_Bot + Phos:Sal_Bot + Phos:DO_Bot + FloodPeriod:Temp_Bot +
  Sal_Bot:Temp_Bot + Temp_Bot:DO_Bot, family = gaussian, data = flood_data)
summary(GLM_flood_slopesd_2interaction_step)
#AIC: -3346.2
```

```
#Compare AICs of GLMs and select model with lowest AIC as best model
AIC(GLM_flood_slopemean)
AIC(GLM_flood_slopemean_step)
AIC(GLM_flood_slopemean_2interaction)
AIC(GLM_flood_slopemean_2interaction_step)
AIC(GLM_flood_slopesd)
AIC(GLM_flood_slopesd_step)
AIC(GLM_flood_slopesd_2interaction)
AIC(GLM_flood_slopesd_2interaction_step) #Lowest AIC = -3346.191; best model
```

```
#Assigning model with the lowest AIC as the best GLM
GLM_flood_best <- GLM_flood_slopesd_2interaction_step
```

```
#Determine adjusted r2 (explained variance) of best GLM
GLM_flood_rsqr <- rsqr(GLM_flood_best, adj=TRUE)
#Adjusted r2 = 0.066359
```

```
#Calculate expected group density values from best GLM
GLM_expected <- fitted(GLM_flood_best)
```

```
#Compare best GLM expected group density with observed group density
plot(GLM_expected, flood_data$Group_km)
summary(GLM_expected)
summary(flood_data$Group_km)
#Negative group density values indicates poor fit
```

```
#Mann-Whitney U test between GLM expected group density and observed group density
```

```
wilcox.test(GLM_expected, flood_data$Group_km)
#W = 2260500, p-value < 2.2e-16 - different from each other
```

```
#Calculate RMSE between observed and GLM expected group density
rmse(flood_data$Group_km, GLM_expected)
#RMSE = 0.09488047
```

```
##### GAM Flood Models #####
```

```
#Slope mean and slope standard deviation are highly correlated
#Test these variables in separate models and compare AICs
#Select model with lowest AIC as best model
```

```
#Models with slope mean
```

```
GAM_flood_slopemean = gam(Group_km ~ s(Depth_m, fx=F, k=10) + s(Slope, fx=F, k=10)
+ s(LandDist_m, fx=F, k=10) + s(SAVDist_m, fx=F, k=10)
+ s(Salinity, fx=F, k=10) + s(DO, fx=F, k=10) + s(Temp, fx=F, k=10)
+ s(Point_X, fx=F, k=10) + s(Point_Y, fx=F, k=10)
+ s(Nitro, fx=F, k=10) + s(Phos, fx=F, k=10) + Season + FloodPeriod
+ s(DO_Bot, fx=F, k=10) + s(Sal_Bot, fx=F, k=10)
+ s(Temp_Bot, fx=F, k=10),
family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopemean)
#R-sq.(adj) = 0.0115
```

```
#Checking GAM performance
```

```
gam.check(GAM_flood_slopemean)
```

```
#Backwards stepwise selection by manually removing least significant variable
```

```
#Step 1 - Remove DO_Bot
```

```
GAM_flood_slopemean_step1 = gam(Group_km ~ s(Depth_m, fx=F, k=10) + s(Slope, fx=F, k=10)
+ s(LandDist_m, fx=F, k=10) + s(SAVDist_m, fx=F, k=10)
+ s(Salinity, fx=F, k=10) + s(DO, fx=F, k=10) + s(Temp, fx=F, k=10)
+ s(Point_X, fx=F, k=10) + s(Point_Y, fx=F, k=10)
+ s(Nitro, fx=F, k=10) + s(Phos, fx=F, k=10) + Season + FloodPeriod
+ s(Sal_Bot, fx=F, k=10)
+ s(Temp_Bot, fx=F, k=10),
family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopemean_step1)
```

```
#Step 2 - Remove Depth
```

```
GAM_flood_slopemean_step2 = gam(Group_km ~ s(Slope, fx=F, k=10)
+ s(LandDist_m, fx=F, k=10) + s(SAVDist_m, fx=F, k=10)
+ s(Salinity, fx=F, k=10) + s(DO, fx=F, k=10) + s(Temp, fx=F, k=10)
+ s(Point_X, fx=F, k=10) + s(Point_Y, fx=F, k=10)
+ s(Nitro, fx=F, k=10) + s(Phos, fx=F, k=10) + Season + FloodPeriod
+ s(Sal_Bot, fx=F, k=10)
+ s(Temp_Bot, fx=F, k=10),
family=gaussian, data=flood_data, method="ML", select = TRUE)
```



```
summary(GAM_flood_slopemean_step2)
```

#Step 3 - Remove Nitro

```
GAM_flood_slopemean_step3 = gam(Group_km ~ s(Slope, fx=F, k=10)
+ s(LandDist_m, fx=F, k=10) + s(SAVDist_m, fx=F, k=10)
+ s(Salinity, fx=F, k=10) + s(DO, fx=F, k=10) + s(Temp, fx=F, k=10)
+ s(Point_X, fx=F, k=10) + s(Point_Y, fx=F, k=10)
+ s(Phos, fx=F, k=10) + Season + FloodPeriod
+ s(Sal_Bot, fx=F, k=10)
+ s(Temp_Bot, fx=F, k=10),
family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopemean_step3)
```

#Step 4 - Remove SAV distance

```
GAM_flood_slopemean_step4 = gam(Group_km ~ s(Slope, fx=F, k=10)
+ s(LandDist_m, fx=F, k=10) + s(Salinity,fx=F, k=10)
+ s(DO, fx=F, k=10) + s(Temp, fx=F, k=10)
+ s(Point_X, fx=F, k=10) + s(Point_Y, fx=F, k=10)
+ s(Phos, fx=F, k=10) + Season + FloodPeriod
+ s(Sal_Bot, fx=F, k=10)
+ s(Temp_Bot, fx=F, k=10),
family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopemean_step4)
```

#Step 5 - Remove phos

```
GAM_flood_slopemean_step5 = gam(Group_km ~ s(Slope, fx=F, k=10)
+ s(LandDist_m, fx=F, k=10) + s(Salinity,fx=F, k=10)
+ s(DO, fx=F, k=10) + s(Temp, fx=F, k=10)
+ s(Point_X, fx=F,k=10) + s(Point_Y, fx=F, k=10)
+ Season + FloodPeriod
+ s(Sal_Bot, fx=F, k=10)
+ s(Temp_Bot, fx=F, k=10),
family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopemean_step5)
```

#Step 6 - Remove surface salinity

```
GAM_flood_slopemean_step6 = gam(Group_km ~ s(Slope, fx=F, k=10)
+ s(LandDist_m, fx=F, k=10)
+ s(DO, fx=F, k=10)+s(Temp, fx=F, k=10) + s(Point_X, fx=F, k=10)
+ s(Point_Y, fx=F, k=10)
+ Season + FloodPeriod
+ s(Sal_Bot, fx=F, k=10)
+ s(Temp_Bot, fx=F, k=10),
family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopemean_step6)
```

#Step 7 - Remove bottom salinity

```
GAM_flood_slopemean_step7 = gam(Group_km ~ s(Slope, fx=F, k=10)
+ s(LandDist_m, fx=F, k=10)
```

```

+ s(DO, fx=F, k=10)+s(Temp, fx=F, k=10) + s(Point_X, fx=F, k=10)
+ s(Point_Y, fx=F, k=10)
+ Season + FloodPeriod
+ s(Temp_Bot, fx=F, k=10),
family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopemean_step7)

```

#Step 8 - Remove flood period

```

GAM_flood_slopemean_step8 = gam(Group_km ~ s(Slope, fx=F, k=10)
+ s(LandDist_m, fx=F, k=10)
+ s(DO, fx=F, k=10) + s(Temp, fx=F, k=10) + s(Point_X, fx=F, k=10)
+ s(Point_Y, fx=F, k=10)
+ Season
+ s(Temp_Bot, fx=F, k=10),
family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopemean_step8)

```

#Step 9 - Remove season

```

GAM_flood_slopemean_step9 = gam(Group_km ~ s(Slope, fx=F, k=10)
+ s(LandDist_m, fx=F, k=10)
+ s(DO, fx=F, k=10) + s(Temp, fx=F, k=10) + s(Point_X, fx=F, k=10)
+ s(Point_Y, fx=F, k=10)
+ s(Temp_Bot, fx=F, k=10),
family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopemean_step9)

```

#Step 10 - Remove surface temp

```

GAM_flood_slopemean_step10 = gam(Group_km ~ s(Slope, fx=F, k=10)
+ s(LandDist_m, fx=F, k=10)
+ s(DO, fx=F, k=10) + s(Point_X, fx=F, k=10)
+ s(Point_Y, fx=F, k=10)
+ s(Temp_Bot, fx=F, k=10),
family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopemean_step10)

```

#Step 11 - Remove bottom temp

```

GAM_flood_slopemean_step11 = gam(Group_km ~ s(Slope, fx=F, k=10)
+ s(LandDist_m, fx=F, k=10)
+ s(DO, fx=F, k=10) + s(Point_X, fx=F, k=10)
+ s(Point_Y, fx=F, k=10),
family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopemean_step11)

```

#Step 12 - Remove land distance

```

GAM_flood_slopemean_step12 = gam(Group_km ~ s(Slope, fx=F, k=10)
+ s(DO, fx=F, k=10) + s(Point_X, fx=F, k=10)
+ s(Point_Y, fx=F, k=10),
family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopemean_step12)

```

#Step 13 - Remove point_Y

```
GAM_flood_slopemean_step13 = gam(Group_km ~ s(Slope, fx=F, k=10)
+ s(DO, fx=F, k=10) + s(Point_X, fx=F, k=10),
family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopemean_step13)
```

#Step 14 - Remove surface DO

```
GAM_flood_slopemean_step14 = gam(Group_km ~ s(Slope, fx=F, k=10)
+ s(Point_X, fx=F, k=10),
family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopemean_step14)
```

#Compare AICs of GAMs with slope mean and select model with lowest AIC as best model

```
AIC(GAM_flood_slopemean)
AIC(GAM_flood_slopemean_step1)
AIC(GAM_flood_slopemean_step2)
AIC(GAM_flood_slopemean_step3)
AIC(GAM_flood_slopemean_step4)
AIC(GAM_flood_slopemean_step5)
AIC(GAM_flood_slopemean_step6)
AIC(GAM_flood_slopemean_step7)
AIC(GAM_flood_slopemean_step8)
AIC(GAM_flood_slopemean_step9)
AIC(GAM_flood_slopemean_step10)
AIC(GAM_flood_slopemean_step11)
AIC(GAM_flood_slopemean_step12)
AIC(GAM_flood_slopemean_step13)
AIC(GAM_flood_slopemean_step14)
```

#Lowest AIC = -3290.913; best model

#Assigning model with the lowest AIC as the best GAM with slope mean

```
GAM_flood_slopemean_best <- GAM_flood_slopemean_step13
summary(GAM_flood_slopemean_best)
```

#Adding interactions between variables for models with slope mean

```
GAM_flood_slopemean_interaction = gam(Group_km ~ s(Depth_m, fx=F, k=10) + s(Slope, fx=F, k=10)
+ s(LandDist_m, fx=F, k=10) + s(SAVDist_m, fx=F, k=10)
+ s(DO, fx=F, k=10) + s(Salinity, fx=F, k=10)
+ s(Temp, fx=F, k=10)
+ s(Point_X, fx=F, k=10) + s(Point_Y, fx=F, k=10)
+ s(Nitro, fx=F, k=10) + s(Phos, fx=F, k=10) + Season
+ FloodPeriod
+ s(DO_Bot, fx=F, k=10) + s(Sal_Bot, fx=F, k=10)
+ s(Temp_Bot, fx=F, k=10)
+ s(Depth_m, by=DO, fx=F, k=10)
+ s(Depth_m, by=Salinity, fx=F, k=10)
+ s(Depth_m, by=Temp, fx=F, k=10)
+ s(Depth_m, by=DO_Bot, fx=F, k=10)
+ s(Depth_m, by=Sal_Bot, fx=F, k=10))
```

- + s(Depth_m, by=Temp_Bot, fx=F, k=10)
- + s(Depth_m, by=Nitro, fx=F, k=10)
- + s(Depth_m, by=Phos, fx=F, k=10)
- + s(Depth_m, by=Season, fx=F, k=10)
- + s(Depth_m, by=FloodPeriod, fx=F, k=10)
- + s(Slope, by=DO, fx=F, k=10)
- + s(Slope, by=Salinity, fx=F, k=10)
- + s(Slope, by=Temp, fx=F, k=10)
- + s(Slope, by=DO_Bot, fx=F, k=10)
- + s(Slope, by=Sal_Bot, fx=F, k=10)
- + s(Slope, by=Temp_Bot, fx=F, k=10)
- + s(Slope, by=Nitro, fx=F, k=10)
- + s(Slope, by=Phos, fx=F, k=10)
- + s(Slope, by=Season, fx=F, k=10)
- + s(Slope, by=FloodPeriod, fx=F, k=10)
- + s(LandDist_m, by=DO, fx=F, k=10)
- + s(LandDist_m, by=Salinity, fx=F, k=10)
- + s(LandDist_m, by=Temp, fx=F, k=10)
- + s(LandDist_m, by=DO_Bot, fx=F, k=10)
- + s(LandDist_m, by=Sal_Bot, fx=F, k=10)
- + s(LandDist_m, by=Temp_Bot, fx=F, k=10)
- + s(LandDist_m, by=Nitro, fx=F, k=10)
- + s(LandDist_m, by=Phos, fx=F, k=10)
- + s(LandDist_m, by=Season, fx=F, k=10)
- + s(LandDist_m, by=FloodPeriod, fx=F, k=10)
- + s(SAVDist_m, by=DO, fx=F, k=10)
- + s(SAVDist_m, by=Salinity, fx=F, k=10)
- + s(SAVDist_m, by=Temp, fx=F, k=10)
- + s(SAVDist_m, by=DO_Bot, fx=F, k=10)
- + s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
- + s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
- + s(SAVDist_m, by=Nitro, fx=F, k=10)
- + s(SAVDist_m, by=Phos, fx=F, k=10)
- + s(SAVDist_m, by=Season, fx=F, k=10)
- + s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
- + s(Point_X, by=DO, fx=F, k=10)
- + s(Point_X, by=Salinity, fx=F, k=10)
- + s(Point_X, by=Temp, fx=F, k=10)
- + s(Point_X, by=DO_Bot, fx=F, k=10)
- + s(Point_X, by=Sal_Bot, fx=F, k=10)
- + s(Point_X, by=Temp_Bot, fx=F, k=10)
- + s(Point_X, by=Nitro, fx=F, k=10)
- + s(Point_X, by=Phos, fx=F, k=10)
- + s(Point_X, by=Season, fx=F, k=10)
- + s(Point_X, by=FloodPeriod, fx=F, k=10)
- + s(Point_Y, by=DO, fx=F, k=10)
- + s(Point_Y, by=Salinity, fx=F, k=10)
- + s(Point_Y, by=Temp, fx=F, k=10)
- + s(Point_Y, by=DO_Bot, fx=F, k=10)

+ s(Point_Y, by=Sal_Bot, fx=F, k=10)
+ s(Point_Y, by=Temp_Bot, fx=F, k=10)
+ s(Point_Y, by=Nitro, fx=F, k=10)
+ s(Point_Y, by=Phos, fx=F, k=10)
+ s(Point_Y, by=Season, fx=F, k=10)
+ s(Point_Y, by=FloodPeriod, fx=F, k=10)
+ s(DO, by=DO_Bot, fx=F, k=10)
+ s(DO, by=Salinity, fx=F, k=10)
+ s(DO, by=Temp, fx=F, k=10)
+ s(DO, by=Sal_Bot, fx=F, k=10)
+ s(DO, by=Temp_Bot, fx=F, k=10)
+ s(DO, by=Nitro, fx=F, k=10)
+ s(DO, by=Phos, fx=F, k=10)
+ s(DO, by=Season, fx=F, k=10)
+ s(DO, by=FloodPeriod, fx=F, k=10)
+ s(Salinity, by=Temp, fx=F, k=10)
+ s(Salinity, by=DO_Bot, fx=F, k=10)
+ s(Salinity, by=Sal_Bot, fx=F, k=10)
+ s(Salinity, by=Temp_Bot, fx=F, k=10)
+ s(Salinity, by=Nitro, fx=F, k=10)
+ s(Salinity, by=Phos, fx=F, k=10)
+ s(Salinity, by=Season, fx=F, k=10)
+ s(Salinity, by=FloodPeriod, fx=F, k=10)
+ s(Temp, by=DO_Bot, fx=F, k=10)
+ s(Temp, by=Sal_Bot, fx=F, k=10)
+ s(Temp, by=Temp_Bot, fx=F, k=10)
+ s(Temp, by=Nitro, fx=F, k=10)
+ s(Temp, by=Phos, fx=F, k=10)
+ s(Temp, by=Season, fx=F, k=10)
+ s(Temp, by=FloodPeriod, fx=F, k=10)
+ s(Nitro, by=DO_Bot, fx=F, k=10)
+ s(Nitro, by=Sal_Bot, fx=F, k=10)
+ s(Nitro, by=Temp_Bot, fx=F, k=10)
+ s(Nitro, by=Phos, fx=F, k=10)
+ s(Nitro, by=Season, fx=F, k=10)
+ s(Nitro, by=FloodPeriod, fx=F, k=10)
+ s(Phos, by=DO_Bot, fx=F, k=10)
+ s(Phos, by=Sal_Bot, fx=F, k=10)
+ s(Phos, by=Temp_Bot, fx=F, k=10)
+ s(Phos, by=Season, fx=F, k=10)
+ s(Phos, by=FloodPeriod, fx=F, k=10)
+ s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+ s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+ s(DO_Bot, by=Season, fx=F, k=10)
+ s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+ s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+ s(Sal_Bot, by=Season, fx=F, k=10)
+ s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+ s(Temp_Bot, by=Season, fx=F, k=10)

```

+ s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction)
#R-sq.(adj) = 0.0241

#Checking GAM performance
gam.check(GAM_flood_slopemean_interaction)

#Backwards stepwise selection by manually removing least significant variable
#Step 1 - Remove bottom salinity main effect
GAM_flood_slopemean_interaction_step1 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)+s(SAVDist_m, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Salinity, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_X, fx=F, k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(DO_Bot, fx=F, k=10)
+s(Temp_Bot, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=Temp, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)

```

+s(SAVDist_m, by=Temp, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Temp_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)

```

+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=Season, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step1)
```

#Step 2 - Remove bottom DO main effect

```

GAM_flood_slopemean_interaction_step2 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)+s(SAVDist_m, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Salinity, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_X, fx=F, k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Temp_Bot, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=Temp, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)

```


+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)
+s(SAVDist_m, by=Temp, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)

```

+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Temp_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=Season, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step2)
```

#Step 3 - Remove bottom temp main effect

```

GAM_flood_slopemean_interaction_step3 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)+s(SAVDist_m, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Salinity, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_X, fx=F, k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)

```

+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=Temp, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)
+s(SAVDist_m, by=Temp, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)

+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Temp_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=Season, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)

```

+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step3)

```

#Step 4 - Remove surface salinity main effect

```

GAM_flood_slopemean_interaction_step4 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)+s(SAVDist_m, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_X, fx=F, k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=Temp, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)
+s(SAVDist_m, by=Temp, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)

```

+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Temp_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)

```

+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=Season, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step4)
```

#Step 5 - Remove land distance and nitro interaction

```

GAM_flood_slopemean_interaction_step5 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)+s(SAVDist_m, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_X, fx=F, k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=Temp, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)

```

+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)
+s(SAVDist_m, by=Temp, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)


```

+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Temp_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=Season, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step5)

```

#Step 6 - Remove phos and season interaction

```

GAM_flood_slopemean_interaction_step6 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)+s(SAVDist_m, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_X, fx=F, k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)

```

+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=Temp, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)
+s(SAVDist_m, by=Temp, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)

```

+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Temp_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step6)
```

#Step 7 - Remove point_X main effect

```
GAM_flood_slopemean_interaction_step7 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)+s(SAVDist_m, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=Temp, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)
+s(SAVDist_m, by=Temp, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
```

+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Temp_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)

```

+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step7)

#Step 8 - Remove SAV distance and surface salinity interaction
GAM_flood_slopemean_interaction_step8 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)+s(SAVDist_m, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=Temp, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)

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+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Temp_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)

```

+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step8)
```

#Step 9 - Remove salinity and nitro interaction

```

GAM_flood_slopemean_interaction_step9 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)+s(SAVDist_m, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=Temp, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)

```


+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)

```

+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Temp_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step9)

#Step 10 - Remove SAV distance main effect
GAM_flood_slopemean_interaction_step10 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)

```

+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=Temp, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)

```

+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Temp_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step10)
```

#Step 11 - Remove surface DO and bottom DO interaction

```

GAM_flood_slopemean_interaction_step11 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=Temp, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)

```

+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Temp_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)

```

+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step11)

#Step 12 - Remove salinity and bottom temp interaction
GAM_flood_slopemean_interaction_step12 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=Temp, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)

```

+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)


```

+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step12)

```

#Step 13 - Remove depth and temp interaction

```

GAM_flood_slopemean_interaction_step13 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=Temp, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)

```

+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)

```

+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step13)

#Step 14 - Remove slope and surface temp interaction
GAM_flood_slopemean_interaction_step14 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)

```

+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)

```

+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step14)
```

#Step 15 - Remove surface DO main effect

```

GAM_flood_slopemean_interaction_step15 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)

```

+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)

```

+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step15)
```

#Step 16 - Remove surface salinity and bottom salinity interaction

```

GAM_flood_slopemean_interaction_step16 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)

```

+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)


```

+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step16)
```

#Step 17 - Remove surface temp and bottom salinity interaction

```

GAM_flood_slopemean_interaction_step17 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)

```

+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)

```

+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step17)
```

```
#Step 18 - Remove SAV distance and season interaction
```

```
GAM_flood_slopemean_interaction_step18 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
```

+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)

```

+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step18)

```

#Step 19 - Remove SAV distance and surface temp interaction

```

GAM_flood_slopemean_interaction_step19 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)

```

+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)

```

+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step19)

#Step 20 - Remove land distance and flood period interaction
GAM_flood_slopemean_interaction_step20 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)

```


+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)

```

+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step20)

```

#Step 21 - Remove land distance and surface salinity interaction

```

GAM_flood_slopemean_interaction_step21 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)

```

+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)

```

+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step21)

#Step 22 - Remove depth and surface salinity interaction
GAM_flood_slopemean_interaction_step22 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)

```

+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)

```

+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step22)

#Step 23 - Remove surface temp and season interaction
GAM_flood_slopemean_interaction_step23 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)

```

+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)

```

+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step23)

```

#Step 24 - Remove nitro and season interaction

```

GAM_flood_slopemean_interaction_step24 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)

```


+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)

```

+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step24)

#Step 25 - Remove bottom salinity and flood period
GAM_flood_slopemean_interaction_step25 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)

```

+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)

```

+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step25)

```

#Step 26 - Remove surface DO and bottom temp interaction

```

GAM_flood_slopemean_interaction_step26 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)

```

```

+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step26)
```

```
#Step 27 - Remove bottom temp and season interaction
```

```
GAM_flood_slopemean_interaction_step27 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
```

```

+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step27)
```

#Step 28 - Remove surface temp and bottom temp interaction

```

GAM_flood_slopemean_interaction_step28 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)

```

+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)


```

+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step28)
```

#Step 29 - Remove surface temp main effect

```

GAM_flood_slopemean_interaction_step29 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)

```

+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)

```

+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step29)

#Step 30 - Remove land distance and surface DO
GAM_flood_slopemean_interaction_step30 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)

```

+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)

```

+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step30)
```

#Step 31 - Remove SAV distance and flood period interactions

```

GAM_flood_slopemean_interaction_step31 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)

```

+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)

```

+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step31)

#Step 32 - Remove bottom DO and season interaction
GAM_flood_slopemean_interaction_step32 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)

```

+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)


```

+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step32)

```

#Step 33 - Remove surface temp and surface salinity interaction

```

GAM_flood_slopemean_interaction_step33 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)

```

```

+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step33)
```

#Step 34 - Remove point_Y and surface salinity interaction

```

GAM_flood_slopemean_interaction_step34 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod

```

+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)

```

+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step34)
```

#Step 35 - Remove point_X and surface salinity interaction

```

GAM_flood_slopemean_interaction_step35 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)

```

+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)

```

+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step35)

#Step 36 - Remove surface DO and surface salinity interaction
GAM_flood_slopemean_interaction_step36 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)

```

+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)

```

+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step36)

```

#Step 37 - Remove SAV distance and bottom salinity interaction

```

GAM_flood_slopemean_interaction_step37 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)

```



```

+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step37)
```

#Step 38 - Remove SAV distance and bottom DO interaction

```

GAM_flood_slopemean_interaction_step38 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)

```

+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)

```

+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step38)

#Step 39 - Remove nitro and phos interaction
GAM_flood_slopemean_interaction_step39 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)

```

+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)

```

+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step39)

```

#Step 40 - Remove point_Y and nitro interaction

```

GAM_flood_slopemean_interaction_step40 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=Salinity, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)

```

```

+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step40)

#Step 41 - Remove slope and surface salinity interaction
GAM_flood_slopemean_interaction_step41 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)

```

+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)

```

+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step41)

```

#Step 42 - Remove surface salinity and bottom DO interaction

```

GAM_flood_slopemean_interaction_step42 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)

```



```

+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopeinteraction_step42)
```

#Step 43 - Remove phos and flood period interaction

```
GAM_flood_slopeinteraction_step43 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10))
```

+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)

```

+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step43)

#Step 44 - Remove surface DO and season interaction
GAM_flood_slopemean_interaction_step44 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)

```

+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)

```

+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step44)

```

#Step 45 - Remove bottom DO and flood period interaction

```

GAM_flood_slopemean_interaction_step45 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)

```

```

+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step45)

#Step 46 - Remove point_Y and bottom DO interaction
GAM_flood_slopemean_interaction_step46 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)

```

+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)

```

+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step46)

```

#Step 47 - Remove SAV distance and phos interaction

```

GAM_flood_slopemean_interaction_step47 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)

```



```

+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step47)

#Step 48 - Remove SAV distance and nitro interaction
GAM_flood_slopemean_interaction_step48 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Phos, fx=F, k=10)

```

+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)

```

+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step48)

```

#Step 49 - Remove slope and phos interaction

```

GAM_flood_slopemean_interaction_step49 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)

```

```

+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step49)
```

#Step 50 - Remove bottom DO and bottom salinity interaction

```

GAM_flood_slopemean_interaction_step50 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)

```

```

+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slope_mean_interaction_step50)

#Step 51 - Remove nitro and flood period interaction
GAM_flood_slope_mean_interaction_step51 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10))

```

+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)

```

+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step51)

#Step 52 - Remove flood period main effect
GAM_flood_slopemean_interaction_step52 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Nitro, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)

```

```

+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step52)

#Step 53 - Remove slope and nitro interaction
GAM_flood_slopemean_interaction_step53 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)

```


+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)

```

+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step53)

#Step 54 - Remove point_X and phos interaction
GAM_flood_slopemean_interaction_step54 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)

```

```

+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step54)

#Step 55 - Remove phos and bottom temp interaction
GAM_flood_slopemean_interaction_step55 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)

```

```

+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step55)
```

#Step 56 - Remove point_Y and bottom temp interaction

```

GAM_flood_slopemean_interaction_step56 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season
+s(Depth_m, by=DO, fx=F, k=10)

```

+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)

```

+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step56)

#Step 57 - Remove land distance and surface temp interaction
GAM_flood_slopemean_interaction_step57 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)

```

```

+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step57)
```

#Step 58 - Remove depth and nitro interaction

```

GAM_flood_slopemean_interaction_step58 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)

```

```

+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step58)
```

#Step 59 - Remove land distance and bottom DO interaction

```

GAM_flood_slopemean_interaction_step59 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)

```



```

+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step59)
```

#Step 60 - Remove season main effect

```

GAM_flood_slopemean_interaction_step60 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)

```

```

+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step60)

```

#Step 61 - Remove land distance and season interaction

```

GAM_flood_slopemean_interaction_step61 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)

```

```

+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step61)

#Step 62 - Remove land distance and bottom temp interaction
GAM_flood_slopemean_interaction_step62 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)

```

```

+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step62)
```

#Step 63 - Remove land distance and bottom salinity interaction

```

GAM_flood_slopemean_interaction_step63 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)

```

```

+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step63)
```

#Step 64 - Remove slope and surface DO interaction

```

GAM_flood_slopemean_interaction_step64 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)

```

```

+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=DO_Bot, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step64)
```

#Step 65 - Remove slope and bottom DO interaction

```
GAM_flood_slopemean_interaction_step65 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=Sal_Bot, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
```



```

+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step65)

```

#Step 66 - Remove slope and bottom salinity interaction

```

GAM_flood_slopemean_interaction_step66 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)

```

```

+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step66)

```

#Step 67 - Remove point_Y and surface DO interaction

```

GAM_flood_slopemean_interaction_step67 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)

```

```

+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step67)

#Step 68 - Remove point_Y and season interaction
GAM_flood_slopemean_interaction_step68 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)

```

```

+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step68)

```

#Step 69 - Remove depth and flood period interaction

```

GAM_flood_slopemean_interaction_step69 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)

```

```

+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step69)
```

#Step 70 - Remove point_Y and phos interaction

```

GAM_flood_slopemean_interaction_step70 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)

```

```

+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step70)
```

#Step 71 - Remove phos main effect

```

GAM_flood_slopemean_interaction_step71 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)

```

```

+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step71)

#Step 72 - Remove bottom DO and bottom temp interaction
GAM_flood_slopemean_interaction_step72 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)

```

```

+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step72)

```

#Step 73 - Remove depth and bottom temp interaction

```

GAM_flood_slopemean_interaction_step73 <- gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)

```



```

+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step73)

```

#Step 74 - Remove depth main effect

```

GAM_flood_slopemean_interaction_step74 <- gam(Group_km ~ s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)

```

```

+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step74)

```

#Step 75 - Remove bottom temp and flood period interaction

```

GAM_flood_slopemean_interaction_step75 <- gam(Group_km ~ s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)

```

```

+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step75)

```

#Step 76 - Remove point_X and nitro interaction

```

GAM_flood_slopemean_interaction_step76 <- gam(Group_km ~ s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope, by=Temp_Bot, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)

```

```

+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step76)
```

#Step 77 - Remove slope and bottom temp interaction

```

GAM_flood_slopemean_interaction_step77 <- gam(Group_km ~ s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)

```

```

+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step77)

#Step 78 - Remove slope and season interaction
GAM_flood_slopemean_interaction_step78 <- gam(Group_km ~ s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)

```

```

+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step78)

```

#Step 79 - Remove surface salinity and phos interaction

```

GAM_flood_slopemean_interaction_step79 <- gam(Group_km ~ s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)

```

```

+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step79)

```

#Step 80 - Remove nitro

```

GAM_flood_slopemean_interaction_step80 <- gam(Group_km ~ s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)

```

```

+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopemean_interaction_step80)

```

#Step 81 - Remove SAV dist and bottom temp interaction

```

GAM_flood_slopemean_interaction_step81 <- gam(Group_km ~ s(Slope, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```



```
summary(GAM_flood_slopemean_interaction_step81)
```

```
#Step 82 - Remove SAV dist and surface DO interaction
```

```
GAM_flood_slopemean_interaction_step82 <- gam(Group_km ~ s(Slope, fx=F, k=10)
```

```
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
```

```
summary(GAM_flood_slopemean_interaction_step82)
```

```
#Step 83 - Remove surface DO and surface temp interaction
```

```
GAM_flood_slopemean_interaction_step83 <- gam(Group_km ~ s(Slope, fx=F, k=10)
```

```
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
```

```

+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopemean_interaction_step83)
```

```
#AIC steadily increasing as more variables are removed even though some variables remain nonsignificant
```

```
#Stopped backwards stepwise comparisons and chose model with lowest AIC
```

```
#Compare AICs of GAM interaction models with slope mean
```

```
#Select model with lowest AIC as best GAM interaction model with slope mean
```

```
AIC(GAM_flood_slopemean_interaction)
```

```
AIC(GAM_flood_slopemean_interaction_step1)
```

```
AIC(GAM_flood_slopemean_interaction_step2)
```

```
AIC(GAM_flood_slopemean_interaction_step3)
```

```
AIC(GAM_flood_slopemean_interaction_step4)
```

```
AIC(GAM_flood_slopemean_interaction_step5)
```

```
AIC(GAM_flood_slopemean_interaction_step6)
```

```
AIC(GAM_flood_slopemean_interaction_step7)
```

```
AIC(GAM_flood_slopemean_interaction_step8)
```

```
AIC(GAM_flood_slopemean_interaction_step9)
```

```
AIC(GAM_flood_slopemean_interaction_step10)
```

AIC(GAM_flood_slopemean_interaction_step11)
AIC(GAM_flood_slopemean_interaction_step12) #AIC = -3281.197
AIC(GAM_flood_slopemean_interaction_step13)
AIC(GAM_flood_slopemean_interaction_step14)
AIC(GAM_flood_slopemean_interaction_step15)
AIC(GAM_flood_slopemean_interaction_step16)
AIC(GAM_flood_slopemean_interaction_step17)
AIC(GAM_flood_slopemean_interaction_step18)
AIC(GAM_flood_slopemean_interaction_step19)
AIC(GAM_flood_slopemean_interaction_step20) #AIC = -3287.287
AIC(GAM_flood_slopemean_interaction_step21)
AIC(GAM_flood_slopemean_interaction_step22)
AIC(GAM_flood_slopemean_interaction_step23)
AIC(GAM_flood_slopemean_interaction_step24)
AIC(GAM_flood_slopemean_interaction_step25) #AIC = -3296.068
AIC(GAM_flood_slopemean_interaction_step26)
AIC(GAM_flood_slopemean_interaction_step27)
AIC(GAM_flood_slopemean_interaction_step28)
AIC(GAM_flood_slopemean_interaction_step29)
AIC(GAM_flood_slopemean_interaction_step30) #AIC = -3302.986
AIC(GAM_flood_slopemean_interaction_step31)
AIC(GAM_flood_slopemean_interaction_step32)
AIC(GAM_flood_slopemean_interaction_step33)
AIC(GAM_flood_slopemean_interaction_step34)
AIC(GAM_flood_slopemean_interaction_step35) #AIC = -3309.735
AIC(GAM_flood_slopemean_interaction_step36)
AIC(GAM_flood_slopemean_interaction_step37)
AIC(GAM_flood_slopemean_interaction_step38)
AIC(GAM_flood_slopemean_interaction_step39)
AIC(GAM_flood_slopemean_interaction_step40) #AIC = -3316.785
AIC(GAM_flood_slopemean_interaction_step41)
AIC(GAM_flood_slopemean_interaction_step42)
AIC(GAM_flood_slopemean_interaction_step43)
AIC(GAM_flood_slopemean_interaction_step44)
AIC(GAM_flood_slopemean_interaction_step45) #AIC = -3323.797
AIC(GAM_flood_slopemean_interaction_step46)
AIC(GAM_flood_slopemean_interaction_step47)
AIC(GAM_flood_slopemean_interaction_step48)
AIC(GAM_flood_slopemean_interaction_step49)
AIC(GAM_flood_slopemean_interaction_step50) #AIC = -3331.101
AIC(GAM_flood_slopemean_interaction_step51)
AIC(GAM_flood_slopemean_interaction_step52)
AIC(GAM_flood_slopemean_interaction_step53)
AIC(GAM_flood_slopemean_interaction_step54)
AIC(GAM_flood_slopemean_interaction_step55) #AIC = -3337.378
AIC(GAM_flood_slopemean_interaction_step56)
AIC(GAM_flood_slopemean_interaction_step57)
AIC(GAM_flood_slopemean_interaction_step58)
AIC(GAM_flood_slopemean_interaction_step59)

```

AIC(GAM_flood_slopemean_interaction_step60) #AIC = -3343.946
AIC(GAM_flood_slopemean_interaction_step61)
AIC(GAM_flood_slopemean_interaction_step62)
AIC(GAM_flood_slopemean_interaction_step63)
AIC(GAM_flood_slopemean_interaction_step64)
AIC(GAM_flood_slopemean_interaction_step65) #AIC = -3348.493
AIC(GAM_flood_slopemean_interaction_step66)
AIC(GAM_flood_slopemean_interaction_step67)
AIC(GAM_flood_slopemean_interaction_step68)
AIC(GAM_flood_slopemean_interaction_step69)
AIC(GAM_flood_slopemean_interaction_step70) #AIC = -3352.896
AIC(GAM_flood_slopemean_interaction_step71)
AIC(GAM_flood_slopemean_interaction_step72)
AIC(GAM_flood_slopemean_interaction_step73)
AIC(GAM_flood_slopemean_interaction_step74)
AIC(GAM_flood_slopemean_interaction_step75) #AIC = -3356.764 - Lowest AIC; best model
AIC(GAM_flood_slopemean_interaction_step76)
AIC(GAM_flood_slopemean_interaction_step77)
AIC(GAM_flood_slopemean_interaction_step78)
AIC(GAM_flood_slopemean_interaction_step79)
AIC(GAM_flood_slopemean_interaction_step80) #AIC = -3355.746
AIC(GAM_flood_slopemean_interaction_step81) #AIC = -3354.295
AIC(GAM_flood_slopemean_interaction_step82) #AIC = -3352.811
AIC(GAM_flood_slopemean_interaction_step83) #AIC = -3350.192

```

```

#Assigning model with lowest AIC as best GAM interaction model with slope mean
GAM_flood_slopemean_interaction_best <- GAM_flood_slopemean_interaction_step75
#R-sq.(adj) =0.0722

```

```

#GAMs with slope standard deviation

```

```

GAM_flood_slopesd = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
  +s(LandDist_m, fx=F, k=10)+s(SAVDist_m, fx=F, k=10)+s(Salinity,
    fx=F, k=10)+s(DO, fx=F, k=10)+s(Temp, fx=F, k=10)+s(Point_X, fx=F, k=10)
  +s(Point_Y, fx=F, k=10)+s(Nitro, fx=F,
    k=10)+s(Phos, fx=F, k=10)+Season + FloodPeriod
  + s(DO_Bot, fx=F, k=10) + s(Sal_Bot, fx=F, k=10)
  + s(Temp_Bot, fx=F, k=10),
  family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopesd)
#R-sq.(adj) = 0.0114

```

```

#Checking GAM performance

```

```

gam.check(GAM_flood_slopesd)

```

```

#Backwards stepwise comparisons by manually removing the least significant variable

```

```

#Step 1 - Remove bottom DO

```

```

GAM_flood_slopesd_step1 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
  +s(LandDist_m, fx=F, k=10)+s(SAVDist_m, fx=F, k=10)+s(Salinity,
    fx=F, k=10)+s(DO, fx=F, k=10)+s(Temp, fx=F, k=10)

```

```

+s(Point_X, fx=F,k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F,k=10)+s(Phos, fx=F, k=10)+Season + FloodPeriod
+s(Sal_Bot, fx=F, k=10)
+ s(Temp_Bot, fx=F, k=10),
family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopesd_step1)

```

#Step 2 - Remove nitro

```

GAM_flood_slopesd_step2 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)+s(SAVDist_m, fx=F, k=10)+s(Salinity,
fx=F, k=10)+s(DO, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_X, fx=F,k=10)+s(Point_Y, fx=F, k=10)
+s(Phos, fx=F, k=10)+Season + FloodPeriod
+s(Sal_Bot, fx=F, k=10)
+ s(Temp_Bot, fx=F, k=10),
family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopesd_step2)

```

#Step 3 - Remove SAV dist

```

GAM_flood_slopesd_step3 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)+s(Salinity, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_X, fx=F,k=10)+s(Point_Y, fx=F, k=10)
+s(Phos, fx=F, k=10)+Season + FloodPeriod
+s(Sal_Bot, fx=F, k=10)
+ s(Temp_Bot, fx=F, k=10),
family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopesd_step3)

```

#Step 4 - Remove bottom salinity

```

GAM_flood_slopesd_step4 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)+s(Salinity, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_X, fx=F,k=10)+s(Point_Y, fx=F, k=10)
+s(Phos, fx=F, k=10)+Season + FloodPeriod
+ s(Temp_Bot, fx=F, k=10),
family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopesd_step4)

```

#Step 5 - Remove surface salinity

```

GAM_flood_slopesd_step5 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_X, fx=F,k=10)+s(Point_Y, fx=F, k=10)
+s(Phos, fx=F, k=10)+Season + FloodPeriod
+ s(Temp_Bot, fx=F, k=10),
family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopesd_step5)

```

#Step 6 - Remove depth

```
GAM_flood_slopesd_step6 = gam(Group_km ~ s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_X, fx=F,k=10)+s(Point_Y, fx=F, k=10)
+s(Phos, fx=F, k=10)+Season + FloodPeriod
+ s(Temp_Bot, fx=F, k=10),
family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopesd_step6)
```

#Step 7 - Remove phos

```
GAM_flood_slopesd_step7 = gam(Group_km ~ s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_X, fx=F,k=10)+s(Point_Y, fx=F, k=10)
+Season + FloodPeriod
+ s(Temp_Bot, fx=F, k=10),
family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopesd_step7)
```

#Step 8 - Remove season

```
GAM_flood_slopesd_step8 = gam(Group_km ~ s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_X, fx=F,k=10)+s(Point_Y, fx=F, k=10)
+ FloodPeriod
+ s(Temp_Bot, fx=F, k=10),
family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopesd_step8)
```

#Step 9 - Remove flood period

```
GAM_flood_slopesd_step9 = gam(Group_km ~ s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_X, fx=F,k=10)+s(Point_Y, fx=F, k=10)
+ s(Temp_Bot, fx=F, k=10),
family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopesd_step9)
```

#Step 10 - Remove surface temp

```
GAM_flood_slopesd_step10 = gam(Group_km ~ s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(DO, fx=F, k=10)
+s(Point_X, fx=F,k=10)+s(Point_Y, fx=F, k=10)
+ s(Temp_Bot, fx=F, k=10),
family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopesd_step10)
```

#Step 11 - Remove bottom temp

```
GAM_flood_slopesd_step11 = gam(Group_km ~ s(Slope_SD, fx=F, k=10)
  +s(LandDist_m, fx=F, k=10)
  +s(DO, fx=F, k=10)
  +s(Point_X, fx=F,k=10)+s(Point_Y, fx=F, k=10),
  family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopesd_step11)
```

#Step 12 - Remove land distance

```
GAM_flood_slopesd_step12 = gam(Group_km ~ s(Slope_SD, fx=F, k=10)
  +s(DO, fx=F, k=10)
  +s(Point_X, fx=F,k=10)+s(Point_Y, fx=F, k=10),
  family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopesd_step12)
```

#Step 13 - Remove point_Y

```
GAM_flood_slopesd_step13 = gam(Group_km ~ s(Slope_SD, fx=F, k=10)
  +s(DO, fx=F, k=10)
  +s(Point_X, fx=F,k=10),
  family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopesd_step13)
```

#Step 14 - Remove surface DO

```
GAM_flood_slopesd_step14 = gam(Group_km ~ s(Slope_SD, fx=F, k=10)
  +s(Point_X, fx=F,k=10),
  family=gaussian, data=flood_data, method="ML", select = TRUE)
summary(GAM_flood_slopesd_step14)
```

#Compare AICs of GAMs with slope standard deviation

#Select model with lowest AIC as best GAM with slope standard deviation

```
AIC(GAM_flood_slopesd)      #AIC = -3286.201
AIC(GAM_flood_slopesd_step1)
AIC(GAM_flood_slopesd_step2)
AIC(GAM_flood_slopesd_step3)  #AIC = -3286.199
AIC(GAM_flood_slopesd_step4)
AIC(GAM_flood_slopesd_step5)  #AIC = -3285.748
AIC(GAM_flood_slopesd_step6)
AIC(GAM_flood_slopesd_step7)  #AIC = -3286.203
AIC(GAM_flood_slopesd_step8)
AIC(GAM_flood_slopesd_step9)  #AIC = -3290.895
AIC(GAM_flood_slopesd_step10) #AIC = -3289.897
AIC(GAM_flood_slopesd_step11) #AIC = -3290.953
AIC(GAM_flood_slopesd_step12) #AIC = -3290.969
AIC(GAM_flood_slopesd_step13) #AIC = -3291.294 - Lowest AIC; best model
AIC(GAM_flood_slopesd_step14) #AIC = -3289.964
```

#Assigning GAM with lowest AIC as best GAM with slope standard deviation

```
GAM_flood_slopesd_best <- GAM_flood_slopesd_step13
```

```
#R-sq.(adj) = 0.0123
```

#Adding interactions between variables for GAMs with slope standard deviation

```
GAM_flood_slopesd_interaction = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)+s(SAVDist_m, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Salinity, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_X, fx=F, k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(DO_Bot, fx=F, k=10)+s(Sal_Bot, fx=F, k=10)
+s(Temp_Bot, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Sal_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)
+s(SAVDist_m, by=Temp, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
```


+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Temp_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)

```

+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=Season, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction)
#R-sq.(adj) = 0.0545

#Checking GAM performance
gam.check(GAM_flood_slopesd_interaction)

#Backwards stepwise selection by manually removing least significant variable
#Step 1 - Remove bottom DO main effect
GAM_flood_slopesd_interaction_step1 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)+s(SAVDist_m, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Salinity, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_X, fx=F, k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Sal_Bot, fx=F, k=10)
+s(Temp_Bot, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Sal_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)

```

+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)
+s(SAVDist_m, by=Temp, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)

```

+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Temp_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=Season, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopesd_interaction_step1)
```

#Step 2 - Remove bottom temp main effect

```

GAM_flood_slopesd_interaction_step2 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)+s(SAVDist_m, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Salinity, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_X, fx=F, k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Sal_Bot, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)

```

+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Sal_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)
+s(SAVDist_m, by=Temp, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)

+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Temp_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=Season, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)

```

+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step2)

```

#Step 3 - Remove bottom salinity main effect

```

GAM_flood_slopesd_interaction_step3 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)+s(SAVDist_m, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Salinity, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_X, fx=F, k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Sal_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)
+s(SAVDist_m, by=Temp, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)

```

+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Temp_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)


```

+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=Season, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step3)

```

#Step 4 - Remove surface salinity main effect

```

GAM_flood_slopesd_interaction_step4 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)+s(SAVDist_m, fx=F, k=10)
+s(DO, fx=F, k=10)+s(Temp, fx=F, k=10)
+s(Point_X, fx=F, k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Sal_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)

```

+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)
+s(SAVDist_m, by=Temp, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)

```

+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Temp_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=Season, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopesd_interaction_step4)
```

#Step 5 - Remove surface DO main effect

```

GAM_flood_slopesd_interaction_step5 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)+s(SAVDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_X, fx=F, k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)

```

+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Sal_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)
+s(SAVDist_m, by=Temp, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)

```

+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Temp_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=Season, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

summary(GAM_flood_slopesd_interaction_step5)

#Step 6 - Remove SAV dist and surface temp interaction

```
GAM_flood_slopesd_interaction_step6 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)+s(SAVDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_X, fx=F, k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Sal_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
```

+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Temp_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)

```

+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=Season, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopesd_interaction_step6)
```

#Step 7 - Remove SAV dist and season interaction

```

GAM_flood_slopesd_interaction_step7 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)+s(SAVDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_X, fx=F, k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Sal_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)

```


+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Temp_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)

```

+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=Season, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step7)

```

#Step 8 - Remove surface salinity and bottom temp interaction

```

GAM_flood_slopesd_interaction_step8 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)+s(SAVDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_X, fx=F, k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)

```

+s(Slope_SD, by=Sal_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)

```

+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=Season, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopesd_interaction_step8)
```

#Step 9 - Remove land dist and surface DO interaction

```

GAM_flood_slopesd_interaction_step9 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)+s(SAVDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_X, fx=F, k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)

```

+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Sal_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)

+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=Season, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),

```
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step9)
```

#Step 10 - Remove slope_SD and surface DO interaction

```
GAM_flood_slopesd_interaction_step10 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)+s(SAVDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_X, fx=F, k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Sal_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
```

+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=Season, fx=F, k=10)


```

+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step10)

```

#Step 11 - Remove phos and season interaction

```

GAM_flood_slopesd_interaction_step11 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)+s(SAVDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_X, fx=F, k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Sal_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)

```

+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Sal_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)

```

+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step11)

#Step 12 - Remove surface temp and bottom salinity interaction
GAM_flood_slopesd_interaction_step12 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)+s(SAVDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_X, fx=F, k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Sal_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)

```

+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)

```

+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step12)

#Step 13 - Remove SAV dist main effect
GAM_flood_slopesd_interaction_step13 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_X, fx=F, k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)

```

+s(Slope_SD, by=Sal_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)

```

+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Sal_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step13)

#Step 14 - Remove surface salinity and bottom salinity interaction
GAM_flood_slopesd_interaction_step14 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_X, fx=F, k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)

```

+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Sal_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(LandDist_m, by=FloodPeriod, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)


```

+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step14)

#Step 15 - Remove land dist and flood period interaction
GAM_flood_slopesd_interaction_step15 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)

```

+s(Point_X, fx=F, k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Sal_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)

```

+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

summary(GAM_flood_slopesd_interaction_step15)

#Step 16 - Remove slope_SD and bottom salinity interaction

GAM_flood_slopesd_interaction_step16 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)

+s(LandDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_X, fx=F, k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)

+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=DO_Bot, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)

```

+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step16)

```

#Step 17 - Remove surface DO and bottom DO interaction

```

GAM_flood_slopesd_interaction_step17 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_X, fx=F, k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=Temp, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)

```

+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)

```

+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step17)

```

#Step 18 - Remove depth and surface temp interaction

```

GAM_flood_slopesd_interaction_step18 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_X, fx=F, k=10)+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)

```


+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)

```

+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step18)

```

#Step 19 - Remove point_X main effect

```

GAM_flood_slopesd_interaction_step19 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Salinity, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)

```

+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)

```

+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step19)

#Step 20 - Remove SAV distance and surface salinity interaction
GAM_flood_slopesd_interaction_step20 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Sal_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)

```

+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)

```

+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step20)

#Step 21 - Remove land dist and bottom salinity interaction
GAM_flood_slopesd_interaction_step21 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)

```

+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)

```

+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Sal_Bot, by=FloodPeriod, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step21)

#Step 22 - Remove bottom salinity and flood period interaction
GAM_flood_slopesd_interaction_step22 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)

```


+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=Season, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)

```

+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step22)

```

#Step 23 - Remove surface temp and season interaction

```

GAM_flood_slopesd_interaction_step23 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)

```

+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)

```

+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=Season, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step23)

#Step 24 - Remove nitro and season interaction
GAM_flood_slopesd_interaction_step24 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)

```

+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=DO, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)

```

+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step24)

#Step 25 - Remove Point_Y and surface DO interaction
GAM_flood_slopesd_interaction_step25 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Temp, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)

```

+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)

```

+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step25)

```

#Step 26 - Remove surface temp main effect

```

GAM_flood_slopesd_interaction_step26 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)

```


+s(SAVDist_m, by=FloodPeriod, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)

```

+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step26)

```

#Step 27 - Remove SAV dist and flood period interaction

```

GAM_flood_slopesd_interaction_step27 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)

```

+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Temp, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)

```

+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step27)

```

#Step 28 - Remove surface salinity and surface temp interaction

```

GAM_flood_slopesd_interaction_step28 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)

```

```

+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Temp_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopesd_interaction_step28)
```

#Step 29 - Remove surface temp and bottom temp interaction

GAM_flood_slopesd_interaction_step29 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)

+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Salinity, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)

```

+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step29)

#Step 30 - Remove slope_SD and surface salinity interaction
GAM_flood_slopesd_interaction_step30 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod

```

+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=DO_Bot, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)


```

+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopesd_interaction_step30)
```

#Step 31 - Remove SAV dist and bottom DO interaction

```

GAM_flood_slopesd_interaction_step31 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)

```

+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Sal_Bot, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)

```

+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopesd_interaction_step31)
```

#Step 32 - Remove SAV dist and bottom salinity interaction

```

GAM_flood_slopesd_interaction_step32 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Temp, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)

```

+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)

```

+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step32)

#Step 33 - Remove slope_SD and surface temp interaction
GAM_flood_slopesd_interaction_step33 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=Temp, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)

```

+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)

```

+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step33)

```

#Step 34 - Remove land distance and surface temp interaction

```

GAM_flood_slopesd_interaction_step34 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)

```

```

+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=Phos, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopesd_interaction_step34)
```

#Step 35 - Remove nitro and phos interaction

```

GAM_flood_slopesd_interaction_step35 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)

```


+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Nitro, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)

```

+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step35)

```

#Step 36 - Remove point_Y and nitro interaction

```

GAM_flood_slopesd_interaction_step36 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)

```

+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Nitro, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)

```

+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step36)

#Step 37 - Remove surface salinity and nitro interaction
GAM_flood_slopesd_interaction_step37 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)

```

```

+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(Phos, by=FloodPeriod, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopesd_interaction_step37)
```

#Step 38 - Remove phos and flood period interaction

GAM_flood_slopesd_interaction_step38 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)

+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)

```

+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Phos, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopesd_interaction_step38)
```

#Step 39 - Remove surface salinity and phos interaction

```

GAM_flood_slopesd_interaction_step39 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)

```

+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Phos, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)


```

+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step39)

#Step 40 - Remove point_X and phos interaction
GAM_flood_slopesd_interaction_step40 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)

```

```

+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopesd_interaction_step40)
```

#Step 41 - Remove bottom DO and bottom salinity interaction

```

GAM_flood_slopesd_interaction_step41 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)

```

```

+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step41)

```

#Step 42 - Remove phos and bottom temp interaction

```

GAM_flood_slopesd_interaction_step42 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)

```

+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Temp_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)

```

+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step42)

#Step 43 - Remove surface DO and bottom temp interaction
GAM_flood_slopesd_interaction_step43 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)

```

```

+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step43)

#Step 44 - Remove point_Y and bottom temp interaction
GAM_flood_slopesd_interaction_step44 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Nitro, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)

```

+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)


```

+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step44)

```

#Step 45 - Remove depth and nitro interaction

```

GAM_flood_slopesd_interaction_step45 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)

```

```

+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Salinity, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopesd_interaction_step45)
```

#Step 46 - Remove surface DO and surface salinity interaction

```

GAM_flood_slopesd_interaction_step46 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)

```

+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)

```

+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=Season, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step46)

#Step 47 - Remove bottom DO and season interaction
GAM_flood_slopesd_interaction_step47 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+Season+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)

```

```

+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopesd_interaction_step47)
```

#Step 48 - Remove season main effect

```

GAM_flood_slopesd_interaction_step48 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)

```

+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Salinity, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)

```

+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step48)

#Step 49 - Remove land distance and surface salinity interaction
GAM_flood_slopesd_interaction_step49 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Temp_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)

```

```

+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopesd_interaction_step49)
```

#Step 50 - Remove land distance and bottom temp interaction

```

GAM_flood_slopesd_interaction_step50 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)

```


+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(LandDist_m, by=Season, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)

```

+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step50)

```

#Step 51 - Remove land distance and season interaction

```

GAM_flood_slopesd_interaction_step51 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)

```

```

+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=DO_Bot, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step51)

#Step 52 - Remove surface salinity and bottom DO interaction
GAM_flood_slopesd_interaction_step52 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)

```

+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=Temp_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)

```

+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step52)

```

#Step 53 - Remove nitro and bottom temp interaction

```

GAM_flood_slopesd_interaction_step53 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)

```

```

+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(DO_Bot, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopesd_interaction_step53)
```

#Step 54 - Remove bottom DO and flood period interaction

```

GAM_flood_slopesd_interaction_step54 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)+FloodPeriod
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)

```

```

+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopesd_interaction_step54)
```

#Step 55 - Remove flood period main effect

```

GAM_flood_slopesd_interaction_step55 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)

```

+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)


```

+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step55)

```

#Step 56 - Remove botom temp and season interaction

```

GAM_flood_slopesd_interaction_step56 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)

```

```

+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Nitro, by=FloodPeriod, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopesd_interaction_step56)
```

#Step 57 - Remove nitro and flood period interaction

```

GAM_flood_slopesd_interaction_step57 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)

```

```

+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Salinity, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopesd_interaction_step57)
```

#Step 58 - Remove point_X and surface salinity interaction

```

GAM_flood_slopesd_interaction_step58 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)

```

+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=Season, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)

```

+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step58)

#Step 59 - Remove surface DO and season interaction
GAM_flood_slopesd_interaction_step59 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Salinity, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)

```

```

+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step59)

#Step 60 - Remove point_y and surface salinity interaction
GAM_flood_slopesd_interaction_step60 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)

```

```

+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=Season, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopesd_interaction_step60)
```

#Step 61 - Remove point_Y and season interaction

```

GAM_flood_slopesd_interaction_step61 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(LandDist_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)

```

```

+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopesd_interaction_step61)
```

#Step 62 - Remove land dist main effect


```

GAM_flood_slopesd_interaction_step62 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=DO_Bot, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)

```

```

+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step62)

```

#Step 63 - Remove land distance and bottom DO interaction

```

GAM_flood_slopesd_interaction_step63 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Nitro, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)

```

```

+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step63)

```

#Step 64 - Remove SAV dist and nitro interaction

```

GAM_flood_slopesd_interaction_step64 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(SAVDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)

```

```

+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step64)

```

#Step 65 - Remove SAV dist and phos interaction

```

GAM_flood_slopesd_interaction_step65 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Phos, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)

```

```

+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step65)

#Step 66 - Remove slope_SD and phos interaction
GAM_flood_slopesd_interaction_step66 = gam(Group_km ~ s(Depth_m, fx=F, k=10)+s(Slope_SD, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)

```

```

+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopesd_interaction_step66)
```

#Step 67 - Remove Slope_SD main effect

```

GAM_flood_slopesd_interaction_step67 = gam(Group_km ~ s(Depth_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)

```

```

+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=Temp, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

summary(GAM_flood_slopesd_interaction_step67)

#Step 68 - Remove point_X and surface temp interaction

GAM_flood_slopesd_interaction_step68 = gam(Group_km ~ s(Depth_m, fx=F, k=10)

+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Temp_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)


```

+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step68)

```

#Step 69 - Remove slope_SD and bottom temp interaction

```

GAM_flood_slopesd_interaction_step69 = gam(Group_km ~ s(Depth_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Nitro, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)

```

```

+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step69)

```

#Step 70 - Remove point_X and nitro interaction

```

GAM_flood_slopesd_interaction_step70 = gam(Group_km ~ s(Depth_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)

```

```

+s(Salinity, by=Season, fx=F, k=10)
+s(Salinity, by=FloodPeriod, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step70)

#Step 71 - Remove surface salinity and flood period interaction
GAM_flood_slopesd_interaction_step71 = gam(Group_km ~ s(Depth_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=Season, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)

```

```

+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step71)

```

#Step 72 - Remove slope_SD and season interaction

```

GAM_flood_slopesd_interaction_step72 = gam(Group_km ~ s(Depth_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)

```

```

+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10)
+s(Temp_Bot, by=FloodPeriod, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step72)

```

#Step 73 - Remove bottom temp and flood period interaction

```

GAM_flood_slopesd_interaction_step73 = gam(Group_km ~ s(Depth_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)

```

```

+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=DO_Bot, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step73)

```

#Step 74 - Remove nitro and bottom DO interaction

```

GAM_flood_slopesd_interaction_step74 = gam(Group_km ~ s(Depth_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=DO_Bot, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)

```

```

+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step74)

```

#Step 75 - Remove slope_SD and bottom DO interaction

```

GAM_flood_slopesd_interaction_step75 = gam(Group_km ~ s(Depth_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)

```

```

+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=Phos, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step75)

```

#Step 76 - Remove point_Y and phos interaction

```

GAM_flood_slopesd_interaction_step76 = gam(Group_km ~ s(Depth_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)+ s(Phos, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)

```



```

+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step76)

```

#Step 77 - Remove phos main effect

```

GAM_flood_slopesd_interaction_step77 = gam(Group_km ~ s(Depth_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)

```

```

+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(DO_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step77)

```

#Step 78 - Remove bottom DO and bottom temp interaction

```

GAM_flood_slopesd_interaction_step78 = gam(Group_km ~ s(Depth_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)

```

```

+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=Phos, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step78)

```

#Step 79 - Remove surface temp and phos interaction

```

GAM_flood_slopesd_interaction_step79 = gam(Group_km ~ s(Depth_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Depth_m, by=FloodPeriod, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)

```

```

+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step79)

```

#Step 80 - Remove depth and flood period interaction

```

GAM_flood_slopesd_interaction_step80 = gam(Group_km ~ s(Depth_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(SAVDist_m, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)

```

```

+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step80)

```

#Step 81 - Remove SAV dist and bottom temp interaction

```

GAM_flood_slopesd_interaction_step81 = gam(Group_km ~ s(Depth_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(SAVDist_m, by=DO, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step81)

```

#Step 82 - Remove SAV dist and surface DO interaction

```
GAM_flood_slopesd_interaction_step82 = gam(Group_km ~ s(Depth_m, fx=F, k=10)
```

```
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=DO_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
```

```
summary(GAM_flood_slopesd_interaction_step82)
```

#Step 83 - Remove phos and bottom DO interaction

```
GAM_flood_slopesd_interaction_step83 = gam(Group_km ~ s(Depth_m, fx=F, k=10)
```

```
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
```

```

+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Phos, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopesd_interaction_step83)
```

#Step 84 - Remove depth and phos interaction

```

GAM_flood_slopesd_interaction_step84 = gam(Group_km ~ s(Depth_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)

```

```

+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Sal_Bot, by=Temp_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopesd_interaction_step84)
```

#Step 85 - Remove bottom salinity and bottom temp interaction

```

GAM_flood_slopesd_interaction_step85 = gam(Group_km ~ s(Depth_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Temp_Bot, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)

```



```

+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step85)

```

#Step 86 - Remove depth and bottom temp interaction

```

GAM_flood_slopesd_interaction_step86 = gam(Group_km ~ s(Depth_m, fx=F, k=10)
+s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Phos, by=Sal_Bot, fx=F, k=10)

```

```

      +s(Sal_Bot, by=Season, fx=F, k=10),
      family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step86)

```

#Step 87 - Remove depth main effect

```

GAM_flood_slopesd_interaction_step87 = gam(Group_km ~ s(Point_Y, fx=F, k=10)
      +s(Nitro, fx=F, k=10)
      +s(Depth_m, by=DO, fx=F, k=10)
      +s(Depth_m, by=Salinity, fx=F, k=10)
      +s(Depth_m, by=DO_Bot, fx=F, k=10)
      +s(Depth_m, by=Sal_Bot, fx=F, k=10)
      +s(Depth_m, by=Season, fx=F, k=10)
      +s(Slope_SD, by=Nitro, fx=F, k=10)
      +s(Slope_SD, by=FloodPeriod, fx=F, k=10)
      +s(LandDist_m, by=Nitro, fx=F, k=10)
      +s(LandDist_m, by=Phos, fx=F, k=10)
      +s(Point_X, by=DO, fx=F, k=10)
      +s(Point_X, by=DO_Bot, fx=F, k=10)
      +s(Point_X, by=Sal_Bot, fx=F, k=10)
      +s(Point_X, by=Temp_Bot, fx=F, k=10)
      +s(Point_X, by=Season, fx=F, k=10)
      +s(Point_X, by=FloodPeriod, fx=F, k=10)
      +s(Point_Y, by=Temp, fx=F, k=10)
      +s(Point_Y, by=DO_Bot, fx=F, k=10)
      +s(Point_Y, by=Sal_Bot, fx=F, k=10)
      +s(Point_Y, by=FloodPeriod, fx=F, k=10)
      +s(DO, by=Temp, fx=F, k=10)
      +s(DO, by=Sal_Bot, fx=F, k=10)
      +s(DO, by=Nitro, fx=F, k=10)
      +s(DO, by=Phos, fx=F, k=10)
      +s(DO, by=FloodPeriod, fx=F, k=10)
      +s(Salinity, by=Season, fx=F, k=10)
      +s(Temp, by=DO_Bot, fx=F, k=10)
      +s(Temp, by=Nitro, fx=F, k=10)
      +s(Temp, by=FloodPeriod, fx=F, k=10)
      +s(Nitro, by=Sal_Bot, fx=F, k=10)
      +s(Phos, by=Sal_Bot, fx=F, k=10)
      +s(Sal_Bot, by=Season, fx=F, k=10),
      family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step87)

```

#Step 88 - Remove phos and bottom salinity interaction

```

GAM_flood_slopesd_interaction_step88 = gam(Group_km ~ s(Point_Y, fx=F, k=10)
      +s(Nitro, fx=F, k=10)
      +s(Depth_m, by=DO, fx=F, k=10)
      +s(Depth_m, by=Salinity, fx=F, k=10)
      +s(Depth_m, by=DO_Bot, fx=F, k=10)
      +s(Depth_m, by=Sal_Bot, fx=F, k=10)
      +s(Depth_m, by=Season, fx=F, k=10)

```

```

+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Nitro, by=Sal_Bot, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step88)

```

#Step 89 - Remove nitro and bottom salinity interaction

```

GAM_flood_slopesd_interaction_step89 = gam(Group_km ~ s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)

```

```

+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Nitro, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step89)

```

#Step 90 - Remove surface DO and nitro interaction

```

GAM_flood_slopesd_interaction_step90 = gam(Group_km ~ s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(LandDist_m, by=Phos, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step90)

```

#Step 91 - Remove land dist and phos interaction

```

GAM_flood_slopesd_interaction_step91 = gam(Group_km ~ s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=Nitro, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step91)

```

#Step 92 - Remove surface temp and nitro interaction

```

GAM_flood_slopesd_interaction_step92 = gam(Group_km ~ s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=Season, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)

```

```

+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step92)

```

#Step 93- Remove point_X and season interaction

```

GAM_flood_slopesd_interaction_step93 = gam(Group_km ~ s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Sal_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step93)

```

#Step 94- Remove point_X and bottom salinity interaction

```

GAM_flood_slopesd_interaction_step94 = gam(Group_km ~ s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)

```

```

+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_X, by=FloodPeriod, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)
+s(Salinity, by=Season, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")

```

```
summary(GAM_flood_slopesd_interaction_step94)
```

#Step 95- Remove point_X and flood period interaction

```

GAM_flood_slopesd_interaction_step95 = gam(Group_km ~ s(Point_Y, fx=F, k=10)
+s(Nitro, fx=F, k=10)
+s(Depth_m, by=DO, fx=F, k=10)
+s(Depth_m, by=Salinity, fx=F, k=10)
+s(Depth_m, by=DO_Bot, fx=F, k=10)
+s(Depth_m, by=Sal_Bot, fx=F, k=10)
+s(Depth_m, by=Season, fx=F, k=10)
+s(Slope_SD, by=Nitro, fx=F, k=10)
+s(Slope_SD, by=FloodPeriod, fx=F, k=10)
+s(LandDist_m, by=Nitro, fx=F, k=10)
+s(Point_X, by=DO, fx=F, k=10)
+s(Point_X, by=DO_Bot, fx=F, k=10)
+s(Point_X, by=Temp_Bot, fx=F, k=10)
+s(Point_Y, by=Temp, fx=F, k=10)
+s(Point_Y, by=DO_Bot, fx=F, k=10)
+s(Point_Y, by=Sal_Bot, fx=F, k=10)
+s(Point_Y, by=FloodPeriod, fx=F, k=10)
+s(DO, by=Temp, fx=F, k=10)
+s(DO, by=Sal_Bot, fx=F, k=10)
+s(DO, by=Phos, fx=F, k=10)
+s(DO, by=FloodPeriod, fx=F, k=10)

```

```

+s(Salinity, by=Season, fx=F, k=10)
+s(Temp, by=DO_Bot, fx=F, k=10)
+s(Temp, by=FloodPeriod, fx=F, k=10)
+s(Sal_Bot, by=Season, fx=F, k=10),
family=gaussian, data=flood_data, method="ML")
summary(GAM_flood_slopesd_interaction_step95)

#Compare AICs of GAM interaction models with slope standard deviation
#Select model with lowest AIC as best GAM interaction model with slope standard deviation
AIC(GAM_flood_slopesd_interaction)      #AIC = -3255.86
AIC(GAM_flood_slopesd_interaction_step1)
AIC(GAM_flood_slopesd_interaction_step2)
AIC(GAM_flood_slopesd_interaction_step3)
AIC(GAM_flood_slopesd_interaction_step4)
AIC(GAM_flood_slopesd_interaction_step5)  #AIC = -3255.86
AIC(GAM_flood_slopesd_interaction_step6)
AIC(GAM_flood_slopesd_interaction_step7)
AIC(GAM_flood_slopesd_interaction_step8)
AIC(GAM_flood_slopesd_interaction_step9)
AIC(GAM_flood_slopesd_interaction_step10) #AIC = -3265.836
AIC(GAM_flood_slopesd_interaction_step11) #AIC = -3267.802
AIC(GAM_flood_slopesd_interaction_step12)
AIC(GAM_flood_slopesd_interaction_step13)
AIC(GAM_flood_slopesd_interaction_step14)
AIC(GAM_flood_slopesd_interaction_step15) #AIC = -3275.547
AIC(GAM_flood_slopesd_interaction_step16)
AIC(GAM_flood_slopesd_interaction_step17)
AIC(GAM_flood_slopesd_interaction_step18)
AIC(GAM_flood_slopesd_interaction_step19)
AIC(GAM_flood_slopesd_interaction_step20) #AIC = -3284.627
AIC(GAM_flood_slopesd_interaction_step21)
AIC(GAM_flood_slopesd_interaction_step22)
AIC(GAM_flood_slopesd_interaction_step23)
AIC(GAM_flood_slopesd_interaction_step24) #AIC = -3291.158
AIC(GAM_flood_slopesd_interaction_step25)
AIC(GAM_flood_slopesd_interaction_step26)
AIC(GAM_flood_slopesd_interaction_step27) #AIC = -3294.046
AIC(GAM_flood_slopesd_interaction_step28)
AIC(GAM_flood_slopesd_interaction_step29)
AIC(GAM_flood_slopesd_interaction_step30) #AIC = -3299.181
AIC(GAM_flood_slopesd_interaction_step31)
AIC(GAM_flood_slopesd_interaction_step32)
AIC(GAM_flood_slopesd_interaction_step33)
AIC(GAM_flood_slopesd_interaction_step34)
AIC(GAM_flood_slopesd_interaction_step35) #AIC = -3308.083
AIC(GAM_flood_slopesd_interaction_step36)
AIC(GAM_flood_slopesd_interaction_step37)
AIC(GAM_flood_slopesd_interaction_step38)
AIC(GAM_flood_slopesd_interaction_step39) #AIC = -3315.006

```


AIC(GAM_flood_slopesd_interaction_step40)
AIC(GAM_flood_slopesd_interaction_step41)
AIC(GAM_flood_slopesd_interaction_step42)
AIC(GAM_flood_slopesd_interaction_step43)
AIC(GAM_flood_slopesd_interaction_step44)
AIC(GAM_flood_slopesd_interaction_step45) #AIC = -3323.977
AIC(GAM_flood_slopesd_interaction_step46)
AIC(GAM_flood_slopesd_interaction_step47)
AIC(GAM_flood_slopesd_interaction_step48)
AIC(GAM_flood_slopesd_interaction_step49)
AIC(GAM_flood_slopesd_interaction_step50) #AIC = -3330.998
AIC(GAM_flood_slopesd_interaction_step51)
AIC(GAM_flood_slopesd_interaction_step52)
AIC(GAM_flood_slopesd_interaction_step53)
AIC(GAM_flood_slopesd_interaction_step54)
AIC(GAM_flood_slopesd_interaction_step55) #AIC = -3338.51
AIC(GAM_flood_slopesd_interaction_step56)
AIC(GAM_flood_slopesd_interaction_step57)
AIC(GAM_flood_slopesd_interaction_step58)
AIC(GAM_flood_slopesd_interaction_step59)
AIC(GAM_flood_slopesd_interaction_step60) #AIC = -3345.482
AIC(GAM_flood_slopesd_interaction_step61)
AIC(GAM_flood_slopesd_interaction_step62)
AIC(GAM_flood_slopesd_interaction_step63)
AIC(GAM_flood_slopesd_interaction_step64) #AIC = -3348.993
AIC(GAM_flood_slopesd_interaction_step65) #AIC = -3350.647
AIC(GAM_flood_slopesd_interaction_step66)
AIC(GAM_flood_slopesd_interaction_step67)
AIC(GAM_flood_slopesd_interaction_step68)
AIC(GAM_flood_slopesd_interaction_step69)
AIC(GAM_flood_slopesd_interaction_step70) #AIC = -3353.82
AIC(GAM_flood_slopesd_interaction_step71)
AIC(GAM_flood_slopesd_interaction_step72)
AIC(GAM_flood_slopesd_interaction_step73)
AIC(GAM_flood_slopesd_interaction_step74) #AIC = -3357.042
AIC(GAM_flood_slopesd_interaction_step75) #AIC = -3356.771
AIC(GAM_flood_slopesd_interaction_step76) #AIC = -3356.38
AIC(GAM_flood_slopesd_interaction_step77) #AIC = -3356.381
AIC(GAM_flood_slopesd_interaction_step78) #AIC = -3356.747
AIC(GAM_flood_slopesd_interaction_step79) #AIC = -3357.297
AIC(GAM_flood_slopesd_interaction_step80) #AIC = -3357.959
AIC(GAM_flood_slopesd_interaction_step81) #AIC = -3356.646
AIC(GAM_flood_slopesd_interaction_step82) #AIC = -3357.599
AIC(GAM_flood_slopesd_interaction_step83) #AIC = -3357.556
AIC(GAM_flood_slopesd_interaction_step84) #AIC = -3359.121
AIC(GAM_flood_slopesd_interaction_step85) #AIC = -3360.06 - Lowest AIC; best model
AIC(GAM_flood_slopesd_interaction_step86) #AIC = -3359.675
AIC(GAM_flood_slopesd_interaction_step87) #AIC = -3355.56
AIC(GAM_flood_slopesd_interaction_step88) #AIC = -3354.408

```

AIC(GAM_flood_slopesd_interaction_step89) #AIC = -3356.202
AIC(GAM_flood_slopesd_interaction_step90) #AIC = -3355.952
AIC(GAM_flood_slopesd_interaction_step91) #AIC = -3355.788
AIC(GAM_flood_slopesd_interaction_step92) #AIC = -3355.666
AIC(GAM_flood_slopesd_interaction_step93) #AIC = -3353.809
AIC(GAM_flood_slopesd_interaction_step94) #AIC = -3352.179
AIC(GAM_flood_slopesd_interaction_step95) #AIC = -3352.401

#Assigning model with lowest AIC as best GAM interaction model with slope standard deviation
GAM_flood_slopesd_interaction_best <- GAM_flood_slopesd_interaction_step85
#R-sq.(adj) = 0.0716

#Compare all of the best GAMs together to determine best overall GAM
AIC(GAM_flood_slopemean_best) #AIC = -3290.913
AIC(GAM_flood_slopemean_interaction_best) #AIC = -3356.764
AIC(GAM_flood_slopesd_best) #AIC = -3291.294
AIC(GAM_flood_slopesd_interaction_best) #AIC = -3360.06 - Lowest AIC; best overall GAM

#Assigning GAM with the lowest AIC as the best overall GAM
GAM_flood_best <- GAM_flood_slopesd_interaction_best

#Calculate expected group density values from best GAM
GAM_expected <- fitted(GAM_flood_best)

#Compare best GAM expected group density with observed group density
plot(GAM_expected, flood_data$Group_km)
summary(GAM_expected)
summary(flood_data$Group_km)
#Negative group density values indicate poor fit

#Mann-Whitney U test between GAM expected group density and observed group density
wilcox.test(GAM_expected, flood_data$Group_km)
#W = 2400600, p-value < 2.2e-16 - different from each other

#Calculate RMSE between observed and GLM expected group density
rmse(flood_data$Group_km, GAM_expected)
#RMSE = 0.09479454

##### ZAG Flood Models #####

#Setting up the ZAG Model (see reference Zuur & Ieno 2016)
#First separating the nonzero group density values to create Zag1 gamma model
Group_km.pos_flood <- subset(flood_data, Group_km > 0) #Values (96) should match
sum(flood_data$Group_km == 0) / nrow(flood_data) #94.8% of values are zero
sum(flood_data$Group_km > 0) #Values (96) should match

#Slope mean and slope standard deviation are highly correlated
#Test these variables in separate models and compare AICs
#Select model with the lowest AIC as the best model

```

```
#Create Zag1 model with slope mean
Zag1_flood_slopemean <- glm(Group_km ~ Depth_m + Slope + LandDist_m + SAVDist_m + Salinity + DO +
  Temp + Season + Nitro + Phos + Point_X + Point_Y + FloodPeriod + DO_Bot
  + Sal_Bot + Temp_Bot, data = Group_km.pos_flood,
  family = Gamma(link = "log"))
summary(Zag1_flood_slopemean)
#AIC: -67.169
```

```
#Backwards stepwise comparisons
stepAIC(Zag1_flood_slopemean)
#Lowest AIC = -84.06
```

```
#Zag1 model with lowest AIC from previous stepwise comparisons
Zag1_flood_slopemean_step <- glm(Group_km ~ Depth_m + LandDist_m + Temp + FloodPeriod,
  family = Gamma(link = "log"), data = Group_km.pos_flood)
summary(Zag1_flood_slopemean_step)
#AIC: -84.063
```

```
#Adding interactions between variables for Zag1 models with slope mean
Zag1_flood_slopemean_2interaction <- glm(Group_km ~ (Depth_m + Slope + LandDist_m + SAVDist_m +
  Salinity + DO + Temp + Season + Nitro + Phos + Point_X + Point_Y + FloodPeriod
  + DO_Bot + Sal_Bot + Temp_Bot)^2, data = Group_km.pos_flood,
  family = Gamma(link = "log"))
summary(Zag1_flood_slopemean_2interaction)
#Model did not converge
```

```
#Compare flood period and season interactions for Zag1 models with slope mean
Zag1_flood_slopemean_floodinteraction <- glm(Group_km ~ (Depth_m + Slope + LandDist_m + SAVDist_m
  + Salinity + DO + Temp + Season + Nitro + Phos + Point_X + Point_Y + FloodPeriod
  + DO_Bot + Sal_Bot + Temp_Bot + Depth_m:FloodPeriod + Slope:FloodPeriod
  + LandDist_m:FloodPeriod + SAVDist_m:FloodPeriod + Salinity:FloodPeriod
  + DO:FloodPeriod + Temp:FloodPeriod + Nitro:FloodPeriod
  + Phos:FloodPeriod + Point_X:FloodPeriod + Point_Y:FloodPeriod
  + DO_Bot:FloodPeriod + Sal_Bot:FloodPeriod + Temp_Bot:FloodPeriod
  + Depth_m:Season + Slope:Season
  + LandDist_m:Season + SAVDist_m:Season + Salinity:Season
  + DO:Season + Temp:Season + Nitro:Season
  + Phos:Season + Point_X:Season + Point_Y:Season
  + DO_Bot:Season + Sal_Bot:Season + Temp_Bot:Season),
  data = Group_km.pos_flood, family = Gamma(link = "log"))
summary(Zag1_flood_slopemean_floodinteraction)
#AIC: -63.37
```

```
#Backwards stepwise comparisons
stepAIC(Zag1_flood_slopemean_floodinteraction)
#Lowest AIC = -93.42
```

```
#Zag1 model with lowest AIC from previous stepwise comparisons
```

```
Zag1_flood_slopemean_floodinteraction_step <- glm(Group_km ~ Depth_m + LandDist_m + SAVDist_m + DO +
  Season + Nitro + Phos + Point_Y + FloodPeriod + DO_Bot +
  Sal_Bot + Temp_Bot + Depth_m:FloodPeriod + SAVDist_m:FloodPeriod +
  DO:FloodPeriod + Nitro:FloodPeriod + FloodPeriod:DO_Bot +
  FloodPeriod:Sal_Bot + FloodPeriod:Temp_Bot + LandDist_m:Season +
  SAVDist_m:Season + DO:Season + Season:Nitro + Season:Phos +
  Season:Point_Y + Season:Sal_Bot, family = Gamma(link = "log"),
  data = Group_km.pos_flood)
summary(Zag1_flood_slopemean_floodinteraction_step)
#AIC: -93.422
```

```
#Zag1 models with slope standard deviation
Zag1_flood_slopesd <- glm(Group_km ~ Depth_m + Slope_SD + LandDist_m + SAVDist_m + Salinity + DO +
  Temp + Season + Nitro + Phos + Point_X + Point_Y + FloodPeriod + DO_Bot
  + Sal_Bot + Temp_Bot, data = Group_km.pos_flood,
  family = Gamma(link = "log"))
summary(Zag1_flood_slopesd)
#AIC: -71.492
```

```
#Backwards stepwise comparisons
stepAIC(Zag1_flood_slopesd)
#Lowest AIC=-87.53
```

```
#Zag1 model with lowest AIC from previous stepwise comparisons
Zag1_flood_slopesd_step <- glm(Group_km ~ Depth_m + Slope_SD + LandDist_m + Temp + Season +
  Temp_Bot, data=Group_km.pos_flood, family = Gamma(link = "log"))
summary(Zag1_flood_slopesd_step)
#AIC: -87.526
```

```
#Adding interactions between variables for Zag1 models with slope standard deviation
Zag1_flood_slopesd_2interaction <- glm(Group_km ~ (Depth_m + Slope_SD + LandDist_m + SAVDist_m
  + Salinity + DO + Temp + Season + Nitro + Phos + Point_X + Point_Y
  + FloodPeriod + DO_Bot + Sal_Bot + Temp_Bot)^2, data = Group_km.pos_flood,
  family = Gamma(link = "log"))
summary(Zag1_flood_slopesd_2interaction)
#Model did not converge
```

```
#Compare flood period and season interactions for Zag1 models with slope standard deviation
Zag1_flood_slopesd_floodinteraction <- glm(Group_km ~ Depth_m + Slope_SD + LandDist_m + SAVDist_m
  + Salinity + DO + Temp + Season + Nitro + Phos + Point_X + Point_Y
  + FloodPeriod + DO_Bot + Sal_Bot + Temp_Bot + Depth_m:FloodPeriod
  + Slope_SD:FloodPeriod + LandDist_m:FloodPeriod + SAVDist_m:FloodPeriod
  + Salinity:FloodPeriod + DO:FloodPeriod + Temp:FloodPeriod + Nitro:FloodPeriod
  + Phos:FloodPeriod + Point_X:FloodPeriod + Point_Y:FloodPeriod
  + DO_Bot:FloodPeriod + Sal_Bot:FloodPeriod + Temp_Bot:FloodPeriod
  + Depth_m:Season
  + Slope_SD:Season + LandDist_m:Season + SAVDist_m:Season
  + Salinity:Season + DO:Season + Temp:Season + Nitro:Season
  + Phos:Season + Point_X:Season + Point_Y:Season
```

```

+ DO_Bot:Season + Sal_Bot:Season + Temp_Bot:Season,
data = Group_km.pos_flood, family = Gamma(link = "log"))
summary(Zag1_flood_slopesd_floodinteraction)
#AIC: -65.84

```

```

#Backwards stepwise comparisons
stepAIC(Zag1_flood_slopesd_floodinteraction)
#Lowest AIC = -95.02

```

```

#Zag1 model with lowest AIC from previous stepwise comparisons
Zag1_flood_slopesd_floodinteraction_step <- glm(Group_km ~ Depth_m + Slope_SD + LandDist_m + SAVDist_m
+ DO + Temp + Season + Nitro + Phos + Point_Y + FloodPeriod + Sal_Bot +
Temp_Bot + SAVDist_m:FloodPeriod + DO:FloodPeriod + Temp:FloodPeriod +
Nitro:FloodPeriod + FloodPeriod:Sal_Bot + LandDist_m:Season +
SAVDist_m:Season + DO:Season + Season:Nitro + Season:Phos +
Season:Point_Y + Season:Sal_Bot, family = Gamma(link = "log"), data = Group_km.pos_flood)
summary(Zag1_flood_slopesd_floodinteraction_step)
#AIC: -95.019

```

```

#Compare AICs of Zag1 models and select model with lowest AIC as best model
AIC(Zag1_flood_slopemean)
AIC(Zag1_flood_slopemean_step)
AIC(Zag1_flood_slopemean_floodinteraction)
AIC(Zag1_flood_slopemean_floodinteraction_step)
AIC(Zag1_flood_slopesd)
AIC(Zag1_flood_slopesd_step)
AIC(Zag1_flood_slopesd_floodinteraction)
AIC(Zag1_flood_slopesd_floodinteraction_step) #Lowest AIC = -95.01947; best model

```

```

#Assigning Zag1 model with lowest AIC as best Zag1 model
Zag1_flood_best <- Zag1_flood_slopesd_floodinteraction_step
summary(Zag1_flood_best)

```

```

#Determine adjusted r2 (explained variance) of best Zag1 model
Zag1_flood_rsqr <- rsqr(Zag1_flood_best, adj=TRUE)
#Adjusted r2 = 0.1536932

```

```

##### ZAG 2 Flood Model #####

```

```

#Convert group density into a binomial presence-absence variable for binomial model
flood_data$Group_km.binomial <- as.numeric(flood_data$Group_km > 0)
summary(flood_data$Group_km.binomial) #Check that group density values are binomial
head(flood_data$Group_km.binomial)
sum(flood_data$Group_km.binomial == 0) / nrow(flood_data)
sum(flood_data$Group_km.binomial > 0)
sum(flood_data$Group_km.binomial == 0)

```

```

#Slope mean and slope standard deviation are highly correlated
#Test these variables in separate models and compare AICs

```

```
#Select model with the lowest AIC as the best model
```

```
#Zag2 model with slope mean
```

```
Zag2_flood_slopemean <- glm(Group_km.binomial ~ Depth_m + Slope + LandDist_m + SAVDist_m + Season  
+ Salinity + DO + Temp + Nitro + Phos + Point_X + Point_Y + FloodPeriod  
+ DO_Bot + Sal_Bot + Temp_Bot, data = flood_data, family = binomial)
```

```
summary(Zag2_flood_slopemean)
```

```
#AIC: 712.53
```

```
#Backwards stepwise comparisons
```

```
stepAIC(Zag2_flood_slopemean)
```

```
#Lowest AIC = 700.52
```

```
#Zag2 model with the lowest AIC from previous stepwise comparisons
```

```
Zag2_flood_slopemean_step <- glm(Group_km.binomial ~ Depth_m + LandDist_m + DO +  
Temp + Point_X, family = binomial, data = flood_data)
```

```
summary(Zag2_flood_slopemean_step)
```

```
#AIC: 700.52
```

```
#Adding interactions between variables for Zag2 models with slope mean
```

```
Zag2_flood_slopemean_2interaction <- glm(Group_km.binomial ~ (Depth_m + Slope + LandDist_m  
+ SAVDist_m + Season + Salinity + DO + Temp + Nitro + Phos + Point_X  
+ Point_Y + FloodPeriod + DO_Bot + Sal_Bot + Temp_Bot)^2,  
data = flood_data, family = binomial)
```

```
summary(Zag2_flood_slopemean_2interaction)
```

```
#AIC: 780.6
```

```
#Backwards stepwise comparisons
```

```
stepAIC(Zag2_flood_slopemean_2interaction)
```

```
#Lowest AIC = 661.72
```

```
#Zag2 model with lowest AIC from previous stepwise comparisons
```

```
Zag2_flood_slopemean_2interaction_step <- glm(Group_km.binomial ~ Depth_m + Slope + LandDist_m +  
SAVDist_m + Season + Salinity + DO + Temp + Nitro + Phos +  
Point_X + Point_Y + FloodPeriod + DO_Bot + Sal_Bot + Temp_Bot +  
Depth_m:Slope + Depth_m:DO + Depth_m:FloodPeriod + Depth_m:DO_Bot +  
Depth_m:Sal_Bot + Depth_m:Temp_Bot + Slope:Salinity + Slope:Temp +  
Slope:Nitro + Slope:Point_Y + SAVDist_m:Temp + SAVDist_m:FloodPeriod +  
SAVDist_m:Temp_Bot + Season:Temp + Season:Phos + Season:Point_X +  
Season:Sal_Bot + Salinity:Temp + Salinity:Nitro + Salinity:Phos +  
Salinity:Point_X + DO:Nitro + DO:Phos + DO:Point_X + DO:FloodPeriod +  
Temp:FloodPeriod + Temp:DO_Bot + Nitro:Point_X + Nitro:DO_Bot +  
Nitro:Sal_Bot + Phos:Point_X + Phos:Point_Y + Phos:FloodPeriod +  
Phos:DO_Bot + Phos:Sal_Bot + Phos:Temp_Bot + Point_X:Point_Y +  
Point_X:Temp_Bot + FloodPeriod:Temp_Bot + DO_Bot:Temp_Bot +  
Sal_Bot:Temp_Bot, family = binomial, data = flood_data)
```

```
summary(Zag2_flood_slopemean_2interaction_step)
```

```
#AIC: 661.72
```

```

#Adding flood period interactions to Zag2 models with slope mean
Zag2_flood_slopemean_floodinteraction <- glm(Group_km.binomial ~ Depth_m + Slope + LandDist_m
      + SAVDist_m + Season + Salinity + DO + Temp + Nitro + Phos + Point_X
      + Point_Y + FloodPeriod + DO_Bot + Sal_Bot + Temp_Bot
      + Depth_m:FloodPeriod + Slope:FloodPeriod + LandDist_m:FloodPeriod
      + SAVDist_m:FloodPeriod + Salinity:FloodPeriod + DO:FloodPeriod
      + Temp:FloodPeriod + Nitro:FloodPeriod + Phos:FloodPeriod
      + Point_X:FloodPeriod + Point_Y:FloodPeriod + DO_Bot:FloodPeriod
      + Sal_Bot:FloodPeriod + Temp_Bot:FloodPeriod,
      data = flood_data, family = binomial)
summary(Zag2_flood_slopemean_floodinteraction)
#AIC: 714.62

#Backwards stepwise comparisons
stepAIC(Zag2_flood_slopemean_floodinteraction)
#Lowest AIC = 691.44

#Zag2 model with lowest AIC from previous stepwise comparisons
Zag2_flood_slopemean_floodinteraction_step <- glm(Group_km.binomial ~ Depth_m + LandDist_m + Salinity +
      DO + Temp + Phos + Point_X + Point_Y + FloodPeriod + DO_Bot +
      Sal_Bot + Depth_m:FloodPeriod + Phos:FloodPeriod + FloodPeriod:DO_Bot +
      FloodPeriod:Sal_Bot, family = binomial, data = flood_data)
summary(Zag2_flood_slopemean_floodinteraction_step)
#AIC: 691.44

#Zag2 models with slope standard deviation
Zag2_flood_slopesd <- glm(Group_km.binomial ~ Depth_m + Slope_SD + LandDist_m + SAVDist_m + Season
      + Salinity + DO + Temp + Nitro + Phos + Point_X + Point_Y + FloodPeriod
      + DO_Bot + Sal_Bot + Temp_Bot, data = flood_data, family = binomial)
summary(Zag2_flood_slopesd)
#AIC: 712.56

#Backwards stepwise comparisons
stepAIC(Zag2_flood_slopesd)
#Lowest AIC = 700.52

#Zag2 model with lowest AIC from previous stepwise comparisons
Zag2_flood_slopesd_step <- glm(Group_km.binomial ~ Depth_m + LandDist_m + DO +
      Temp + Point_X, family = binomial, data = flood_data)
summary(Zag2_flood_slopesd_step)
#AIC: 700.52

#Adding interactions between variables to Zag2 models with slope standard deviation
Zag2_flood_slopesd_2interaction <- glm(Group_km.binomial ~ (Depth_m + Slope_SD + LandDist_m
      + SAVDist_m + Season + Salinity + DO + Temp + Nitro + Phos + Point_X
      + Point_Y + FloodPeriod + DO_Bot + Sal_Bot + Temp_Bot)^2,
      data = flood_data, family = binomial)
summary(Zag2_flood_slopesd_2interaction)
#AIC: 769.01

```

```
#Backwards stepwise comparisons
stepAIC(Zag2_flood_slopesd_2interaction)
#Lowest AIC = 647.86
```

```
#Zag2 model with lowest AIC from previous stepwise comparisons
Zag2_flood_slopesd_2interaction_step <- glm(Group_km.binomial ~ Depth_m + Slope_SD + LandDist_m +
  SAVDist_m + Season + Salinity + DO + Temp + Nitro + Phos +
  Point_X + Point_Y + FloodPeriod + DO_Bot + Sal_Bot + Temp_Bot +
  Depth_m:Salinity + Depth_m:DO + Depth_m:DO_Bot + Depth_m:Sal_Bot +
  Depth_m:Temp_Bot + Slope_SD:SAVDist_m + Slope_SD:DO_Bot +
  LandDist_m:Temp + SAVDist_m:DO + SAVDist_m:Temp + SAVDist_m:Point_Y +
  SAVDist_m:Temp_Bot + Season:DO + Season:Phos + Season:Point_X +
  Season:DO_Bot + Season:Sal_Bot + Salinity:Phos + Salinity:Point_Y +
  Salinity:DO_Bot + Salinity:Sal_Bot + DO:Nitro + DO:Phos +
  DO:Point_X + DO:DO_Bot + DO:Temp_Bot + Temp:DO_Bot + Nitro:FloodPeriod +
  Nitro:DO_Bot + Nitro:Sal_Bot + Phos:Point_X + Phos:Point_Y +
  Phos:DO_Bot + Phos:Sal_Bot + Phos:Temp_Bot + Point_X:Sal_Bot +
  Point_X:Temp_Bot + FloodPeriod:DO_Bot + FloodPeriod:Sal_Bot +
  FloodPeriod:Temp_Bot + DO_Bot:Temp_Bot + Sal_Bot:Temp_Bot,
  family = binomial, data = flood_data)
summary(Zag2_flood_slopesd_2interaction_step)
#AIC: 647.86
```

```
#Adding flood period interactions to Zag2 model with slope standard deviation
Zag2_flood_slopesd_floodinteraction <- glm(Group_km.binomial ~ Depth_m + Slope_SD + LandDist_m
  + SAVDist_m + Season + Salinity + DO + Temp + Nitro + Phos + Point_X
  + Point_Y + FloodPeriod+ DO_Bot + Sal_Bot + Temp_Bot
  + Depth_m:FloodPeriod + Slope_SD:FloodPeriod + LandDist_m:FloodPeriod
  + SAVDist_m:FloodPeriod + Salinity:FloodPeriod + DO:FloodPeriod
  + Temp:FloodPeriod + Nitro:FloodPeriod + Phos:FloodPeriod
  + Point_X:FloodPeriod + Point_Y:FloodPeriod + DO_Bot:FloodPeriod
  + Sal_Bot:FloodPeriod + Temp_Bot:FloodPeriod,
  data = flood_data, family = binomial)
summary(Zag2_flood_slopesd_floodinteraction)
#AIC: 711.18
```

```
#Backwards stepwise comparisons
stepAIC(Zag2_flood_slopesd_floodinteraction)
#Lowest AIC: 690.29
```

```
#Zag2 model with lowest AIC from previous stepwise comparisons
Zag2_flood_slopesd_floodinteraction_step <- glm(Group_km.binomial ~ Depth_m + Slope_SD + LandDist_m +
  Salinity + DO + Temp + Phos + Point_X + Point_Y + FloodPeriod +
  DO_Bot + Sal_Bot + Depth_m:FloodPeriod + Slope_SD:FloodPeriod +
  Phos:FloodPeriod + FloodPeriod:DO_Bot + FloodPeriod:Sal_Bot,
  family = binomial, data = flood_data)
summary(Zag2_flood_slopesd_floodinteraction_step)
#AIC: 690.29
```



```

#Compare AICs of Zag2 models and select model with the lowest AIC as the best Zag2 model
AIC(Zag2_flood_slopemean)
AIC(Zag2_flood_slopemean_step)
AIC(Zag2_flood_slopemean_2interaction)
AIC(Zag2_flood_slopemean_2interaction_step)
AIC(Zag2_flood_slopemean_floodinteraction)
AIC(Zag2_flood_slopemean_floodinteraction_step)
AIC(Zag2_flood_slopesd)
AIC(Zag2_flood_slopesd_step)
AIC(Zag2_flood_slopesd_2interaction)
AIC(Zag2_flood_slopesd_2interaction_step)
AIC(Zag2_flood_slopesd_floodinteraction)
AIC(Zag2_flood_slopesd_floodinteraction_step)

#Lowest AIC = 647.8573; best model

#Assigning Zag2 model with lowest AIC as best Zag2 model
Zag2_flood_best <- Zag2_flood_slopesd_2interaction_step
summary(Zag2_flood_best)

#Determine adjusted r2 (explained variance) of best Zag models
Zag1_flood_rsqr <- rsqr(Zag1_flood_best, adj=TRUE)
Zag2_flood_rsqr <- rsqr(Zag2_flood_best, adj=TRUE)
Zag1_flood_rsqr
#Adjusted r2 = 0.1536932
Zag2_flood_rsqr
#Adjusted r2 = 0.155203

Zag1_flood_rsqr + Zag2_flood_rsqr
#Combined adjusted r2 = 0.3088962

#Examine whether Zag2 flood model fits binomial data well
hoslem.test(flood_data$Group_km.binomial, fitted(Zag2_flood_best))
#X-squared = 5.9698, df = 8, p-value = 0.6506 - model fits binomial data well (p>0.05)

#Combining the ZAG models together (see reference Zuur & Ieno 2016)
#Calculate the ZAG expected values
#Bernoulli components
gamma <- coef(Zag2_flood_best)
Xb <- model.matrix(~ Depth_m + Slope_SD + LandDist_m +
  SAVDist_m + Season + Salinity + DO + Temp + Nitro + Phos +
  Point_X + Point_Y + FloodPeriod + DO_Bot + Sal_Bot + Temp_Bot +
  Depth_m:Salinity + Depth_m:DO + Depth_m:DO_Bot + Depth_m:Sal_Bot +
  Depth_m:Temp_Bot + Slope_SD:SAVDist_m + Slope_SD:DO_Bot +
  LandDist_m:Temp + SAVDist_m:DO + SAVDist_m:Temp + SAVDist_m:Point_Y +
  SAVDist_m:Temp_Bot + Season:DO + Season:Phos + Season:Point_X +
  Season:DO_Bot + Season:Sal_Bot + Salinity:Phos + Salinity:Point_Y +
  Salinity:DO_Bot + Salinity:Sal_Bot + DO:Nitro + DO:Phos +
  DO:Point_X + DO:DO_Bot + DO:Temp_Bot + Temp:DO_Bot + Nitro:FloodPeriod +
  Nitro:DO_Bot + Nitro:Sal_Bot + Phos:Point_X + Phos:Point_Y +

```

```

Phos:DO_Bot + Phos:Sal_Bot + Phos:Temp_Bot + Point_X:Sal_Bot +
Point_X:Temp_Bot + FloodPeriod:DO_Bot + FloodPeriod:Sal_Bot +
FloodPeriod:Temp_Bot + DO_Bot:Temp_Bot + Sal_Bot:Temp_Bot,
family = binomial, data = flood_data)
eta.binary <- Xb %*% gamma
Pi <- exp(eta.binary) / (1 + exp(eta.binary))

#The gamma GLM component
beta <- coef(Zag1_flood_best)
Xc <- model.matrix(~ Depth_m + Slope_SD + LandDist_m + SAVDist_m +
DO + Temp + Season + Nitro + Phos + Point_Y + FloodPeriod +
Sal_Bot + Temp_Bot + SAVDist_m:FloodPeriod + DO:FloodPeriod +
Temp:FloodPeriod + Nitro:FloodPeriod + FloodPeriod:Sal_Bot +
LandDist_m:Season + SAVDist_m:Season + DO:Season + Season:Nitro +
Season:Phos + Season:Point_Y + Season:Sal_Bot, family = Gamma(link = "log"),
data = Group_km.pos_flood)
eta.gamma <- Xc %*% beta
mu.gamma <- exp(eta.gamma)

W <- flood_data$Group_km > 0
mu <- rep(1, nrow(flood_data))
mu[W] <- mu.gamma
mu

#Calculate the ZAG expected values and variance:
r <- 1 / summary(Zag1_flood_best)$dispersion
ExpY <- Pi * mu
VarY <- (Pi * r + Pi - Pi^2 * r) * mu^2 * (1 / r)

#Calculate the Pearson residuals:
E.zag <- (flood_data$Group_km - ExpY) / sqrt(VarY)

#Plot fitted values versus residuals
plot(x = ExpY,
y = E.zag,
xlab = "Fitted values",
ylab = "Pearson residuals ZAG")
abline(h = 0, lty = 2)

#Combined AIC of the ZAG Models
AIC(Zag1_flood_best) + AIC(Zag2_flood_best)
#552.8378

par(mfrow = c(2,2), mar = c(5,5,2,2), cex.lab = 1.5)
plot(x = ExpY,
y = E.zag,
xlab = "Expected values",
ylab = "Pearson residuals")
abline(h = 0, lty = 2)

```

```
text(0.01, 7.5, "A", cex = 2)
```

```
plot(x = jitter(flood_data$Sal_Bot),  
     y = E.zag,  
     xlab = "Bottom Salinity",  
     ylab = "Pearson residuals")  
abline(h = 0, lty = 2)  
text(3.8, 7.5, "B", cex = 2)
```

```
plot(x = ExpY,  
     y = flood_data$Group_km,  
     xlab = "Expected values",  
     ylab = "Observed Group Density",  
     xlim = c(0, 2.5),  
     ylim = c(0, 2.5)  
)  
text(0.01, 2.3, "C", cex = 2)
```

```
#Mann-Whitney U test between ZAG expected group density and observed group density  
wilcox.test(ExpY, flood_data$Group_km)  
#W = 3244400, p-value < 2.2e-16 - different from each other
```

```
#Compare ZAG expected group density with observed group density  
summary(ExpY)  
summary(flood_data$Group_km)
```

```
flood_data$Expected_GD <- as.numeric(ExpY)
```

```
#Set up plots to examine variable collinearity (see reference MacLeod 2013)  
panel.cor <- function(x, y, digits = 2, prefix = "", cex.cor,...)  
{  
  usr <- par("usr");on.exit(par(usr))  
  par(usr = c(0,1,0,1))  
  r<-abs(cor(x,y))  
  txt <- format(c(r, 0.123456789), digits=digits) [1]  
  txt <- paste(prefix, txt, sep="")  
  if(missing(cex.cor)) cex.cor <- 0.8/strwidth(txt)  
  text(0.5, 0.5, txt, cex = cex.cor * r)  
}
```

```
pairs(~Group_km+Expected_GD+Depth_m+Slope+Slope_SD+Salinity+Temp+DO+LandDist_m+SAVDist_m+DO_Bot+Sal_  
Bot+Temp_Bot+Point_X+Point_Y+Nitro+Phos, data=flood_data, lower.panel=panel.smooth, upper.panel=panel.cor,  
     pch=20, main = "Habitat Characteristics Pair Plot Matrix")
```

```
#Compare if ZAG model predicts dolphin group density better than chance  
comp_model <- glm(Group_km ~ Expected_GD, family=gaussian, data=flood_data)  
summary(comp_model)  
Zag_base_model <- glm(Group_km ~ 1, family=gaussian, data=flood_data)  
anova(Zag_base_model, comp_model, test="Chisq")
```

```
#Expected values from Zag model better explain observed group density than base model
```

```
#Calculate RMSE between observed and expected group density
```

```
rmse(flood_data$Group_km, flood_data$Expected_GD)
```

```
#RMSE = 0.1231145
```

```
##### Compare Adjusted r2 values of best fit models #####
```

```
GLM_flood_best_rsqr <- rsqr(GLM_flood_best, adj = TRUE) #Adj-r2 = 0.066359
```

```
GAM_flood_best_rsqr <- rsqr(GAM_flood_best, adj = TRUE) #Adj-r2 = 0.07163563
```

```
Zag1_flood_rsqr #Adj-r2 = 0.1536932
```

```
Zag2_flood_rsqr #Adj-r2 = 0.155203
```

```
#ZAG models have highest explained variance (adjusted r2) - selected as best model over GAM and GLM
```

```
##### Exporting flood_data #####
```

```
write.csv(flood_data, "C:/Users/shaun/Documents/Pensacola Flood Shift/Habitat Shapefiles/flood_data_export.csv",  
col.names=TRUE)
```

```
##### Graphing ZAG model results #####
```

```
#Graphs of ZAG 1 significant main effect results
```

```
#Separating the nonzero group density values to create gamma model
```

```
Group_km.pos_flood <- subset(flood_data, Group_km > 0) #Values should match
```

```
sum(flood_data$Group_km == 0) / nrow(flood_data)
```

```
sum(flood_data$Group_km > 0) #Values should match
```

```
#Graphs of ZAG 1 significant main effect results
```

```
dev.off() #Resets default plot settings
```

```
plot(Group_km.pos_flood$Depth_m, Group_km.pos_flood$Group_km, xlab = "Depth (m)", ylab = "Group Density  
(Group/km)", main = "Group Density and Depth")
```

```
plot(Group_km.pos_flood$Slope_SD, Group_km.pos_flood$Group_km, xlab = "Slope Standard Deviation (degrees)", ylab =  
"Group Density (Group/km)", main = "Group Density and Slope Standard Deviation")
```

```
plot(Group_km.pos_flood$LandDist_m, Group_km.pos_flood$Group_km, xlab = "Land Distance (m)", ylab = "Group  
Density (Group/km)", main = "Group Density and Land Distance")
```

```
plot(Group_km.pos_flood$Season, Group_km.pos_flood$Group_km, ylab = "Group Density (Group/km)", main = "Group  
Density and Season")
```

```
plot(Group_km.pos_flood$FloodPeriod, Group_km.pos_flood$Group_km, ylab = "Group Density (Group/km)", main =  
"Group Density and Flood Period")
```

```
plot(Group_km.pos_flood$Temp_Bot, Group_km.pos_flood$Group_km, xlab = "Bottom Temperature (C)", ylab = "Group  
Density (Group/km)", main = "Group Density and Bottom Temperature")
```

```
#Prepare data to graph ZAG 2 significant main effect results
```

```
#Convert group density into a binomial presence-absence variable for binomial model
```

```
flood_data$Group_km.binomial <- as.numeric(flood_data$Group_km > 0)
summary(flood_data$Group_km.binomial) #Check that group density values are binomial
head(flood_data$Group_km.binomial)
sum(flood_data$Group_km.binomial == 0) / nrow(flood_data)
sum(flood_data$Group_km.binomial > 0)
sum(flood_data$Group_km.binomial == 0)
```

```
#Setting up presence-absence counts
```

```
flood_data$Group_Presence <- as.numeric(flood_data$Group_km > 0)
summary(flood_data$Group_km.binomial) #Check that group density values are binomial
summary(flood_data$Group_Presence)
head(flood_data$Group_Presence)
sum(flood_data$Group_Presence == 0) / nrow(flood_data)
sum(flood_data$Group_Presence > 0)
sum(flood_data$Group_Presence == 0)
```

```
flood_data$Group_Presence <- ordered(flood_data$Group_Presence, levels = c("1","0"), labels = c("Presence", "Absence"))
```

```
#Subset Presence-Absence Data
```

```
Presence <- subset(flood_data, flood_data$Group_km > 0, select = c(Index:Group_Presence))
Absence <- subset(flood_data, flood_data$Group_km == 0, select = c(Index:Group_Presence))
```

```
#Graphs of ZAG 2 significant main effect results
```

```
plot(flood_data$Group_Presence, flood_data$Slope_SD, main="Group Presence-Absence and Slope Standard Deviation",
ylab="Slope Standard Deviation (degrees)")
```

```
plot(flood_data$Group_Presence, flood_data$LandDist_m, main="Group Presence-Absence and Land Distance",
ylab="Land Distance (m)")
```

```
plot(flood_data$Group_Presence, flood_data$SAVDist_m, main="Group Presence-Absence and SAV Distance",
ylab="SAV Distance (m)")
```

```
plot(flood_data$Group_Presence, flood_data$DO, main="Group Presence-Absence and Surface DO", ylab="Surface DO
(mg/L)")
```

```
plot(flood_data$Group_Presence, flood_data$Temp, main="Group Presence-Absence and Surface Temperature",
ylab="Surface Temperature (C)")
```

```
plot(flood_data$Group_Presence, flood_data$Season,
main="Group Presence-Absence and Season", xlab = " ", ylab = "Season")
```

```
plot(flood_data$Group_Presence, flood_data$Phos, main="Group Presence-Absence and Phosphorus", ylab="Phosphorus
(mg/L)")
```

```
plot(flood_data$Group_Presence, flood_data$Point_X, main="Group Presence-Absence and Longitude", ylab="Longitude (decimal degrees)")
```

```
plot(flood_data$Group_Presence, flood_data$FloodPeriod, main="Group Presence-Absence and Flood Period", xlab = " ", ylab = "Flood Period")
```

```
plot(flood_data$Group_Presence, flood_data$DO_Bot, main="Group Presence-Absence and Bottom DO", ylab="Bottom DO (mg/L)")
```

```
plot(flood_data$Group_Presence, flood_data$Temp_Bot, main="Group Presence-Absence and Bottom Temperature", ylab="Bottom Temperature (C)")
```

```
#Graphs of ZAG 1 significant interactions between variables with 'interactions' package
```

```
interact_plot(Zag1_flood_best, pred = Sal_Bot, modx = FloodPeriod, main.title = "Interaction between Group Density, Bottom Salinity and Flood Period", x.label = "Bottom Salinity (ppt)", y.label = "Group Density (Group/km)") + scale_color_manual(values = c("black", "gray47")) + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag1_flood_best, pred = Temp, modx = FloodPeriod, main.title = "Interaction between Group Density, Surface Temperature and Flood Period", x.label = "Surface Temperature (C)", y.label = "Group Density (Group/km)") + scale_color_manual(values = c("black", "gray47")) + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag1_flood_best, pred = Nitro, modx = FloodPeriod, main.title = "Interaction between Group Density, Nitrogen and Flood Period", x.label = "Nitrogen (mg/L)", y.label = "Group Density (Group/km)") + scale_color_manual(values = c("black", "gray47")) + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag1_flood_best, pred = LandDist_m, modx = Season, main.title = "Interaction between Group Density, Land Distance and Season", x.label = "Land Distance (m)", y.label = "Group Density (Group/km)") + scale_color_manual(values = c("black", "gray47")) + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag1_flood_best, pred = SAVDist_m, modx = Season, main.title = "Interaction between Group Density, SAV Distance and Season", x.label = "SAV Distance (m)", y.label = "Group Density (Group/km)") + scale_color_manual(values = c("black", "gray47")) + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag1_flood_best, pred = Nitro, modx = Season, main.title = "Interaction between Group Density, Nitrogen and Season", x.label = "Nitrogen (mg/L)", y.label = "Group Density (Group/km)") + scale_color_manual(values = c("black", "gray47")) + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag1_flood_best, pred = Phos, modx = Season, main.title = "Interaction between Group Density, Phosphorus and Season", x.label = "Phosphorus (mg/L)", y.label = "Group Density (Group/km)") + scale_color_manual(values = c("black", "gray47")) + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag1_flood_best, pred = Point_Y, modx = Season, main.title = "Interaction between Group Density, Latitude and Season", x.label = "Latitude (decimal degrees)", y.label = "Group Density (Group/km)") + scale_color_manual(values = c("black", "gray47")) + theme(plot.title = element_text(hjust = 0.5))
```

```
#Graphs of ZAG 2 significant interactions between variables with 'interactions' package
```

```
interact_plot(Zag2_flood_best, pred = Sal_Bot, modx = FloodPeriod, main.title = "Interaction between Group Presence-Absence, Bottom Salinity and Flood Period", x.label = "Bottom Salinity (ppt)", y.label = "Group Presence Likelihood") +  
scale_color_manual(values = c("black", "gray47")) + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag2_flood_best, pred = Nitro, modx = FloodPeriod, main.title = "Interaction between Group Presence-Absence, Nitrogen and Flood Period", x.label = "Nitrogen (mg/L)", y.label = "Group Presence Likelihood") +  
scale_color_manual(values = c("black", "gray47")) + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag2_flood_best, pred = DO_Bot, modx = FloodPeriod, main.title = "Interaction between Group Presence-Absence, Bottom DO and Flood Period", x.label = "Bottom DO (mg/L)", y.label = "Group Presence Likelihood") +  
scale_color_manual(values = c("black", "gray47")) + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag2_flood_best, pred = Temp_Bot, modx = FloodPeriod, main.title = "Interaction between Group Presence-Absence, Bottom Temperature and Flood Period", x.label = "Bottom Temperature (C)", y.label = "Group Presence Likelihood") +  
scale_color_manual(values = c("black", "gray47")) + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag2_flood_best, pred = DO, modx = Season, main.title = "Interaction between Group Presence-Absence, Surface DO and Season", x.label = "Surface DO (mg/L)", y.label = "Group Presence Likelihood") +  
scale_color_manual(values = c("black", "gray47")) + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag2_flood_best, pred = Point_X, modx = Season, main.title = "Interaction between Group Presence-Absence, Longitude and Season", x.label = "Longitude (decimal degrees)", y.label = "Group Presence Likelihood") +  
scale_color_manual(values = c("black", "gray47")) + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag2_flood_best, pred = DO_Bot, modx = Season, main.title = "Interaction between Group Presence-Absence, Bottom DO and Season", x.label = "Bottom DO (mg/L)", y.label = "Group Presence Likelihood") +  
scale_color_manual(values = c("black", "gray47")) + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag2_flood_best, pred = Sal_Bot, modx = Season, main.title = "Interaction between Group Presence-Absence, Bottom Salinity and Season", x.label = "Bottom Salinity (ppt)", y.label = "Group Presence Likelihood") +  
scale_color_manual(values = c("black", "gray47")) + theme(plot.title = element_text(hjust = 0.5))
```

#Graphs of ZAG 2 significant interactions between continuous variables

```
interact_plot(Zag2_flood_best, pred = Depth_m, modx = Salinity, modx.values = c(0,5, 10, 15, 20, 25, 30, 35), main.title =  
"Interaction between Group Presence-Absence, Depth and Surface Salinity", x.label = "Depth (m)", y.label = "Group  
Presence Likelihood", legend.main = "Surface  
Salinity (ppt)") + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag2_flood_best, pred = Depth_m, modx = DO, modx.values = c(0,2,4,6,8,10), main.title = "Interaction  
between Group Presence-Absence, Depth and Surface DO", x.label = "Depth (m)", y.label = "Group Presence Likelihood",  
legend.main = "Surface  
DO (mg/L)") + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag2_flood_best, pred = Depth_m, modx = DO_Bot, modx.values = c(0,5,10,15,20,25), main.title =  
"Interaction between Group Presence-Absence, Depth and Bottom DO", x.label = "Depth (m)", y.label = "Group Presence  
Likelihood", legend.main = "Bottom  
DO (mg/L)") + theme(plot.title = element_text(hjust = 0.5))
```

```

interact_plot(Zag2_flood_best, pred = Depth_m, modx = Sal_Bot, modx.values = c(0,5, 10, 15, 20, 25, 30, 35), main.title =
"Interaction between Group Presence-Absence, Depth and Bottom Salinity", x.label = "Depth (m)", y.label = "Group
Presence Likelihood", legend.main = "Bottom
Salinity (ppt)") + theme(plot.title = element_text(hjust = 0.5))

interact_plot(Zag2_flood_best, pred = Depth_m, modx = Temp_Bot, modx.values = c(22, 24, 26, 28, 30), main.title =
"Interaction between Group Presence-Absence, Depth and Bottom Temperature", x.label = "Depth (m)", y.label = "Group
Presence Likelihood", legend.main = "Bottom
Temperature
(C)") + theme(plot.title = element_text(hjust = 0.5))

interact_plot(Zag2_flood_best, pred = Slope_SD, modx = DO_Bot, modx.values = c(0,5,10,15,20,25), main.title =
"Interaction between Group Presence-Absence, Slope SD and Bottom DO", x.label = "Slope SD (degrees)", y.label = "Group
Presence Likelihood", legend.main = "Bottom
DO (mg/L)") + theme(plot.title = element_text(hjust = 0.5))

interact_plot(Zag2_flood_best, pred = SAVDist_m, modx = Temp, modx.values = c(20, 22, 24, 26, 28, 30, 32), main.title =
"Interaction between Group Presence-Absence, SAV Distance and Surface Temperature", x.label = "SAV Distance (m)",
y.label = "Group Presence Likelihood", legend.main = "Surface
Temperature
(C)") + theme(plot.title = element_text(hjust = 0.5))

interact_plot(Zag2_flood_best, pred = SAVDist_m, modx = Point_Y, modx.values = c(30.35, 30.45, 30.55), main.title =
"Interaction between Group Presence-Absence, SAV Distance and Latitude", x.label = "SAV Distance (m)", y.label =
"Group Presence Likelihood", legend.main = "Latitude
(decimal
degrees)") + theme(plot.title = element_text(hjust = 0.5))

interact_plot(Zag2_flood_best, pred = SAVDist_m, modx = Temp_Bot, modx.values = c(22, 24, 26, 28, 30), main.title =
"Interaction between Group Presence-Absence, SAV Distance and Bottom Temperature", x.label = "SAV Distance (m)",
y.label = "Group Presence Likelihood", legend.main = "Bottom
Temperature
(C)") + theme(plot.title = element_text(hjust = 0.5))

interact_plot(Zag2_flood_best, pred = Phos, modx = Salinity, modx.values = c(0,5,10,15,20,25,30,35), main.title =
"Interaction between Group Presence-Absence, Phosphorus and Surface Salinity", x.label = "Phosphorus (mg/L)", y.label =
"Group Presence Likelihood", legend.main = "Surface
Salinity (ppt)") + theme(plot.title = element_text(hjust = 0.5))

interact_plot(Zag2_flood_best, pred = Nitro, modx = DO, modx.values = c(0,2,4,6,8,10), main.title = "Interaction between
Group Presence-Absence, Nitrogen and Surface DO", x.label = "Nitrogen (mg/L)", y.label = "Group Presence Likelihood",
legend.main = "Surface
DO (mg/L)") + theme(plot.title = element_text(hjust = 0.5))

interact_plot(Zag2_flood_best, pred = Phos, modx = DO, modx.values = c(0,2,4,6,8,10), main.title = "Interaction between
Group Presence-Absence, Phosphorus and Surface DO", x.label = "Phosphorus (mg/L)", y.label = "Group Presence
Likelihood", legend.main = "Surface
DO (mg/L)") + theme(plot.title = element_text(hjust = 0.5))

```



```
interact_plot(Zag2_flood_best, pred = Point_X, modx = DO, modx.values = c(0,2,4,6,8,10), main.title = "Interaction between Group Presence-Absence, Longitude and Surface DO", x.label = "Longitude (decimal degrees)", y.label = "Group Presence Likelihood", legend.main = "Surface DO (mg/L)") + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag2_flood_best, pred = DO, modx = DO_Bot, modx.values = c(0,5,10,15,20,25), main.title = "Interaction between Group Presence-Absence, Surface DO and Bottom DO", x.label = "Surface DO (mg/L)", y.label = "Group Presence Likelihood", legend.main = "Bottom DO (mg/L)") + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag2_flood_best, pred = Temp_Bot, modx = DO, modx.values = c(0,2,4,6,8,10), main.title = "Interaction between Group Presence-Absence, Bottom Temperature and Surface DO", x.label = "Bottom Temperature (C)", y.label = "Group Presence Likelihood", legend.main = "Surface DO (mg/L)") + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag2_flood_best, pred = Temp, modx = DO_Bot, modx.values = c(0,5,10,15,20,25), main.title = "Interaction between Group Presence-Absence, Surface Temperature and Bottom DO", x.label = "Surface Temperature (C)", y.label = "Group Presence Likelihood", legend.main = "Bottom DO (mg/L)") + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag2_flood_best, pred = Nitro, modx = DO_Bot, modx.values = c(0,5,10,15,20,25), main.title = "Interaction between Group Presence-Absence, Nitrogen and Bottom DO", x.label = "Nitrogen (mg/L)", y.label = "Group Presence Likelihood", legend.main = "Bottom DO (mg/L)") + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag2_flood_best, pred = Nitro, modx = Sal_Bot, modx.values = c(0,5,10,15,20,25,30,35), main.title = "Interaction between Group Presence-Absence, Nitrogen and Bottom Salinity", x.label = "Nitrogen (mg/L)", y.label = "Group Presence Likelihood", legend.main = "Bottom Salinity (ppt)") + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag2_flood_best, pred = Phos, modx = Point_Y, modx.values = c(30.35,30.45,30.55), main.title = "Interaction between Group Presence-Absence, Phosphorus and Latitude", x.label = "Phosphorus (mg/L)", y.label = "Group Presence Likelihood", legend.main = "Latitude (decimal degrees)") + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag2_flood_best, pred = Point_X, modx = Phos, modx.values = c(0.01,0.03,0.05,0.07), main.title = "Interaction between Group Presence-Absence, Longitude and Phosphorus", x.label = "Longitude (decimal degrees)", y.label = "Group Presence Likelihood", legend.main = "Phosphorus (mg/L)") + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag2_flood_best, pred = Phos, modx = DO_Bot, modx.values = c(0,5,10,15,20,25), main.title = "Interaction between Group Presence-Absence, Phosphorus and Bottom DO", x.label = "Phosphorus (mg/L)", y.label = "Group Presence Likelihood", legend.main = "Bottom DO (mg/L)") + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag2_flood_best, pred = Phos, modx = Sal_Bot, modx.values = c(0,5,10,15,20,25,30,35), main.title = "Interaction between Group Presence-Absence, Phosphorus and Bottom Salinity", x.label = "Phosphorus (mg/L)", y.label = "Group Presence Likelihood", legend.main = "Bottom
```

```
Salinity (ppt)") + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag2_flood_best, pred = Phos, modx = Temp_Bot, modx.values = c(22,24,26,28,30), main.title = "Interaction  
between Group Presence-Absence, Phosphorus and Bottom Temperature", x.label = "Phosphorus (mg/L)", y.label =  
"Group Presence Likelihood", legend.main = "Bottom  
Temperature  
(C)") + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag2_flood_best, pred = Point_X, modx = Sal_Bot, modx.values = c(0,5,10,15,20,25,30,35), main.title =  
"Interaction between Group Presence-Absence, Longitude and Bottom Salinity", x.label = "Longitude (decimal degrees)",  
y.label = "Group Presence Likelihood", legend.main = "Bottom  
Salinity (ppt)") + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag2_flood_best, pred = Point_X, modx = Temp_Bot, modx.values = c(22,24,26,28,30), main.title =  
"Interaction between Group Presence-Absence, Longitude and Bottom Temperature", x.label = "Longitude (decimal  
degrees)", y.label = "Group Presence Likelihood", legend.main = "Bottom  
Temperature  
(C)") + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag2_flood_best, pred = Temp_Bot, modx = DO_Bot, modx.values = c(0,5,10,15,20,25), main.title =  
"Interaction between Group Presence-Absence, Bottom Temperature and Bottom DO", x.label = "Bottom Temperature  
(C)", y.label = "Group Presence Likelihood", legend.main = "Bottom  
DO (mg/L)") + theme(plot.title = element_text(hjust = 0.5))
```

```
interact_plot(Zag2_flood_best, pred = Temp_Bot, modx = Sal_Bot, modx.values = c(0,5,10,15,20,25,30,35), main.title =  
"Interaction between Group Presence-Absence, Bottom Temperature and Bottom Salinity", x.label = "Bottom Temperature  
(C)", y.label = "Group Presence Likelihood", legend.main = "Bottom  
Salinity (ppt)") + theme(plot.title = element_text(hjust = 0.5))
```