Appendix S1. R Script on statistical analyses of data from Experiment 1 and Experiment 2.

```
### Exp. no. 1 ###

## Copy the table stored in "Sheet1" in "Raw_data" excel file and import here as a data frame using "read.delim" function

raci2<-read.delim2("clipboard",as.is = FALSE)

summary(raci2)

## CLM(M)

library(ordinal)

library(car)

library(MASS)

# Change "Plot" to categorical variable

raci2$Plot<-as.factor(raci2$Plot)

# Create a new data frame with each row representing a single occasion of an individual ordinal response variable

raci2.long<-as.data.frame(apply(raci2,2,function(x)rep(x,raci2$Freq)),row.names=FALSE)

summary(raci2.long)

# Adjust all variables to their respective categorical/numerical character

raci2.long$Status<-as.factor(raci2.long$Status)

raci2.long$Species <-as.factor(raci2.long$Species)
```

```
raci2.long$Date_2 <-as.numeric(raci2.long$Date_2)

raci2.long$Freq <-as.numeric(raci2.long$Freq)

raci2.long$Plot <-as.factor(raci2.long$Plot)

raci2.long$Fish<-as.numeric(raci2.long$Fish)

raci2.long$Interval<-as.numeric(raci2.long$Interval)


# Center (Subtract mean) from the numerical explanatory variables


summary(raci2.long$Interval)

summary(raci2$Fish)

summary(raci2.long$Date_2)


raci2.long$Fish <-as.numeric(raci2.long$Fish-44.72)

raci2.long$Date_2 <-as.numeric(raci2.long$Date_2-12.93)

raci2.long$Interval <-as.numeric(raci2.long$Interval -3.305)


# Fit "clmm.1" with "Plot" identity as random effect (intercept) and "clm.1" to test its effect by
"anova" function


clmm.1<-clmm(Status ~ Species*Interval*Fish +(1|Plot), data = raci2.long, link = "logit", Hess = TRUE)


clm.1<-clm(Status ~ Species*Interval*Fish , data = raci2.long, link = "logit", Hess = TRUE)


anova(clm.1,clmm.1) # The random effect highly significant


# Fit "clmm.2" with "Date_2" as second random effect (intercept) and compare it with "clmm.1" by
"anova" function


clmm.2<-clmm(Status ~ Species*Interval*Fish +(1|Plot) + (1|Date_2), data = raci2.long, link = "logit",
Hess = TRUE)


anova(clmm.1,clmm.2) # The random effect not significant (marginal)
```

```
# Drop the partial effects of "clmm.1"

drop1(clmm.1,test = "Chisq") # The 2nd order interaction not significant

# Fit "clmm.3" with lower complexity and compare it with "clmm.1" by "anova" function

clmm.3<-clmm(Status ~ Species*Interval+Fish +(1|Plot), data = raci2.long, link = "logit", Hess = TRUE)

anova(clmm.3,clmm.1) # clmm.1 significantly worse than clmm.3

# Drop the partial effects of "clmm.3"

drop1(clmm.3,test = "Chisq") # The 1st order intercation not significant, "Fish" significant

# Fit "clmm.4" of lower complexity and compare it with "clmm.1" by "anova" function

clmm.4<-clmm(Status ~ Species*Fish+Interval +(1|Plot), data = raci2.long, link = "logit", Hess = TRUE)

anova(clmm.4,clmm.1) # clmm.1 significantly worse than clmm.4

# Drop the partial effects of "clmm.4"

drop1(clmm.4,test = "Chisq") # The 1st order intercation not significant, "Interval" significant

# Fit "clmm.5" of lower complexity and compare it with "clmm.1" by "anova" function

clmm.5<-clmm(Status ~ Species+Fish*Interval +(1|Plot), data = raci2.long, link = "logit", Hess = TRUE)

anova(clmm.5,clmm.1) # clmm.1 significantly worse than clmm.5
```

```
drop1(clmm.5,test = "Chisq") # The 1st order intercation not significant, "Species" significant

# Fit "clmm.6" without intercations of predictors

clmm.6<-clmm(Status ~ Species+Fish+Interval +(1|Plot), data = raci2.long, link = "logit", Hess = TRUE)

# Drop the partial effects of "clmm.6"

drop1(clmm.6,test = "Chisq") # Warning message: Non finite negative log-likelihood

# De-center the numerical predictors

raci2.long$Fish <-as.numeric(raci2.long$Fish+44.72)
raci2.long$Interval <-as.numeric(raci2.long$Interval +3.305)

# Re-Fit "clmm.6"

clmm.6<-clmm(Status ~ Species+Fish+Interval +(1|Plot), data = raci2.long, link = "logit", Hess = TRUE)

# Drop the partial effects of "clmm.6" again

drop1(clmm.6,test = "Chisq")

# Fit "clmm.6b" with "Date_2" as second random effect (intercept) and compare it with "clmm.6" by
"anova" function

clmm.6b<-clmm(Status ~ Species+Fish+Interval +(1|Plot)+(1|Date_2), data = raci2.long, link = "logit",
Hess = TRUE)

anova(clmm.6,clmm.6b) # The random effect not significant (marginal)

# clmm.6 chosen as the final model
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```
summary(clmm.6)

## R^2

# Fit the null clmm

clmm.null<-clmm(Status ~ (1|Plot), data =  raci2.long, link = "logit", Hess = TRUE)

# Calculate  McFadden's pseudo R^2

McF.pR2 <- 1 - clmm.1$logLik/clmm.null$logLik

McF.pR2 # McFadden's pseudo R^2 = 0.15

## Prepare a data frame prior to graphic work (e.g. using library(ggplot2)) with model estimates of fixed effects within the given intervals of chosen predictors ("Interval" 1 h, 3 h, and 6h and "Fish" between 37 and 51 mm)

library(effects)

ef<-effect("Species*Fish*Interval",clmm.6, confint = TRUE ,confint.level = 0.95,
xlevels=list(Interval=c(1,3,6),Fish = seq(37,51, by = 0.5)))

x <- as.data.frame(ef)

summary(x)

# Change "Interval" to a factor

x$Interval<-as.factor(x$Interval)
```

```
# Store the data frame for future plot making

library(openxlsx)

file_path <- "Exp_1.xlsx"

write.xlsx(x, file_path, rowNames = FALSE)



### Exp. no. 2 ###

## Copy the table stored in "Sheet2" in "Raw_data" excel file and import here as a data frame using "read.delim" function

mramor<-read.delim("clipboard",as.is = FALSE)

### CLM(M)

library(ordinal)

library(car)

library(MASS)

# Change "Plot" to categorical variable

mramor$Plot<-as.factor(mramor$Plot)

# Create a new data frame with each row representing a single occasion of an individual ordinal response variable

mramor.long<-as.data.frame(apply(mramor,2,function(x)rep(x,mramor$Freq)),row.names=FALSE)

summary(mramor.long)
```

```
# Adjust all variables to their respective categorical/numerical character

mramor.long$Status<-as.factor(mramor.long$Status)
mramor.long$Group <-as.factor(mramor.long$Group)
mramor.long$Freq <-as.numeric(mramor.long$Freq)
mramor.long$Trial <-as.numeric(mramor.long$Trial)
mramor.long$Fish.SL<-as.numeric(mramor.long$Fish.SL)
mramor.long$Plot<-as.factor(mramor.long$Plot)
mramor.long$Group2 <-as.factor(mramor.long$Group2)

summary(mramor.long$Fish.SL)

# Center (Subtract mean) from the numerical "Fish SL"

mramor.long$Fish.SL <-as.numeric(mramor.long$Fish.SL-48.03)

summary(mramor.long)

# Fit "clmm.1" with "Plot" identity as random effect (intercept) and "clm.1" to test its effect by "anova" function

clmm.1<-clmm(Status ~ Fish.SL*Group2 +(1|Plot), data = mramor.long, link = "logit", Hess = TRUE)

clm.1<-clm(Status ~ Fish.SL*Group, data = mramor.long, link = "logit", Hess = TRUE)

anova(clm.1,clmm.1) # The random effect of plot not significant

# Fit "clmm.2" with "Trial" identity as random effect (intercept) and "clm.1" to test its effect by "anova" function

clmm.2<-clmm(Status ~ Fish.SL*Group +(1|Trial), data = mramor.long, link = "logit", Hess = TRUE)
```

```
anova(clm.1,clmm.2) # The random effect of trial not significant

# Drop the partial effects of "clm.1"

drop1(clm.1,test ="Chisq") # the 1st order interaction not significant

# Fit "clm.2" without the 1st order interaction

clm.2<-update(clm.1,.~.-Fish.SL:Group)

# Drop the partial effects of "clm.2"

drop1(clm.2,test = "Chisq") # "Fish.SL" not significant

# Fit "clm.3" without "Fish.SL"

clm.3<-update(clm.2,.~.-Fish.SL)

# Drop the partial effect of "clm.3"

drop1(clm.3,test = "Chisq") # "Group" highly significant

summary(clm.3)

# clm.3 chosen as the final model

## R^2

# Fit the null clmm
```

```
clm.null<-clm(Status ~ 1, data =  mramor.long, link = "logit", Hess = TRUE)

# Calculate  McFadden's pseudo R^2

McF.pR2 <- 1 - clm.3$logLik/clm.null$logLik

McF.pR2 # McFadden's pseudo R^2 = 0.13

## Tukey's post-hoc test

library(emmeans)

pairs(emmeans(clm.3,~ Group)) # All groups significantly different

## Prepare a data frame prior to graphic work (e.g. using library(ggplot2)) with model estimates of the fixed effect

library(effects)

ef<-effect("Group",clm.3, confint = TRUE ,confint.level = 0.95)

x <- as.data.frame(ef)

summary(x)

# Store the data frame for future plot making

library(openxlsx)

file_path <- "Exp_2.xlsx"
```

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write.xlsx(x, file_path, rowNames = FALSE)
```