# BIO311: Population Ecology
## *Prac 8: Life tables & Population Matrices*

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## Contents

```
library('popbio')

## Loading required package:  quadprog

rot23<-read.csv("BIO311_with_rates.csv",sep=",",header=T)
rot23<-rot23[,c(-1,-3,-6,-7,-8,-9,-10)]

temp<-aggregate(rot23$F,by=list(rot23$Population,rot23$Copper),function(x) mean(x,na.rm=TRUE
temp<-temp[order(temp$Group.1,temp$Group.2),]
colnames(temp)[3]<-"R"
temp2<-aggregate(rot23$Pa,by=list(rot23$Population,rot23$Copper),function(x) mean(x,na.rm=TR
colnames(temp2)[3]<-"Sa"
temp3<-aggregate(rot23$Pj,by=list(rot23$Population,rot23$Copper),function(x) mean(x,na.rm=TR
colnames(temp3)[3]<-"Sj"
roti<-merge(temp,temp2,by=c(1,2))
roti<-merge(roti,temp3,by=c(1,2))
roti$lambda<-NA

for(i in 1:length(roti$Sj)){
A<-matrix(c(0,roti$Sj[i],roti$R[i],roti$Sa[i]),nrow=2)

  roti$lambda[i]<-lambda(A)
}

rotiR<-subset(roti,roti$Group.1=="Recovery")
rotiP<-subset(roti,roti$Group.1=="Pollution")
###### ALPHA : LAYER EFFECT #######
Rav<-mean(c(mean(rotiR$R),mean(rotiP$R)))
Sjav<-mean(c(mean(rotiR$Sj),mean(rotiP$Sj)))
Saav<-mean(c(mean(rotiR$Sa),mean(rotiP$Sa)))
Aav<-matrix(c(0,Sjav,Rav,Saav),nrow=2)

### 1) Pollution
Rav<-mean(rotiP$R)
Sjav<-mean(rotiP$Sj)
Saav<-mean(rotiP$Sa)
AavP<-matrix(c(0,Sjav,Rav,Saav),nrow=2)

Midw<-0.5*(Aav+AavP)

EffP<-sensitivity(Midw)*(AavP-Aav)

### 2) Recovery
Rav<-mean(rotiR$R)
Sjav<-mean(rotiR$Sj)
Saav<-mean(rotiR$Sa)
```

```r
AavR<-matrix(c(0,Sjav,Rav,Saav),nrow=2)

Midw<-0.5*(Aav+AavR)

EffR<-sensitivity(Midw)*(AavR-Aav)


##### BETA: COPPER EFFECT #########
roti<-rbind(rotiR,rotiP)
rotiL<-subset(roti,roti$Group.2=="low")
rotiH<-subset(roti,roti$Group.2=="high")
rotiM<-subset(roti,roti$Group.2=="medium")

## High
Rav<-mean(rotiH$R)
Sjav<-mean(rotiH$Sj)
Saav<-mean(rotiH$Sa)
AavH<-matrix(c(0,Sjav,Rav,Saav),nrow=2)

Midw<-0.5*(Aav+AavH)

EffH<-sensitivity(Midw)*(AavH-Aav)

## Medium
Rav<-mean(rotiM$R)
Sjav<-mean(rotiM$Sj)
Saav<-mean(rotiM$Sa)
AavM<-matrix(c(0,Sjav,Rav,Saav),nrow=2)

Midw<-0.5*(Aav+AavM)

EffM<-sensitivity(Midw)*(AavM-Aav)

## Low
Rav<-mean(rotiL$R)
Sjav<-mean(rotiL$Sj)
Saav<-mean(rotiL$Sa)
AavL<-matrix(c(0,Sjav,Rav,Saav),nrow=2)

Midw<-0.5*(Aav+AavL)

EffL<-sensitivity(Midw)*(AavL-Aav)

###### INTERACTIONS.... YAY
```

```r
# Poll/Low
rotii<-subset(roti,(roti$Group.1=="Pollution" & roti$Group.2=="low"))
Rav<-mean(rotii$R)
Sjav<-mean(rotii$Sj)
Saav<-mean(rotii$Sa)
AavPL<-matrix(c(0,Sjav,Rav,Saav),nrow=2)

Midw<-0.5*(Aav+AavPL)

EffPL<-sensitivity(Midw)*(AavPL-Aav)-EffL-EffP
EffPL

##             [,1]      [,2]
## [1,] 0.000000 -0.03350
## [2,] 0.002176 -0.05865

# Poll/Med
rotii<-subset(roti,(roti$Group.1=="Pollution" & roti$Group.2=="medium"))
Rav<-mean(rotii$R)
Sjav<-mean(rotii$Sj)
Saav<-mean(rotii$Sa)
AavPM<-matrix(c(0,Sjav,Rav,Saav),nrow=2)

Midw<-0.5*(Aav+AavPM)

EffPM<-sensitivity(Midw)*(AavPM-Aav)-EffM-EffP
EffPM

##       [,1]    [,2]
## [1,] 0.00 0.05434
## [2,] 0.03 0.08829

# Poll/High
rotii<-subset(roti,(roti$Group.1=="Pollution" & roti$Group.2=="high"))
Rav<-mean(rotii$R)
Sjav<-mean(rotii$Sj)
Saav<-mean(rotii$Sa)
AavPH<-matrix(c(0,Sjav,Rav,Saav),nrow=2)

Midw<-0.5*(Aav+AavPH)

EffPH<-sensitivity(Midw)*(AavPH-Aav)-EffH-EffP
EffPH

##             [,1]      [,2]
## [1,]  0.00000 -0.04088
## [2,] -0.02844 -0.02645
```

```r
# R/L
rotii<-subset(roti,(roti$Group.1=="Recovery" & roti$Group.2=="low"))
Rav<-mean(rotii$R)
Sjav<-mean(rotii$Sj)
Saav<-mean(rotii$Sa)
AavRL<-matrix(c(0,Sjav,Rav,Saav),nrow=2)

Midw<-0.5*(Aav+AavRL)

EffRL<-sensitivity(Midw)*(AavRL-Aav)-EffL-EffR
EffRL

##            [,1]    [,2]
## [1,]   0.000000 0.03395
## [2,]  -0.002051 0.06077

# R/M
rotii<-subset(roti,(roti$Group.1=="Recovery" & roti$Group.2=="medium"))
Rav<-mean(rotii$R)
Sjav<-mean(rotii$Sj)
Saav<-mean(rotii$Sa)
AavRM<-matrix(c(0,Sjav,Rav,Saav),nrow=2)

Midw<-0.5*(Aav+AavRM)

EffRM<-sensitivity(Midw)*(AavRM-Aav)-EffM-EffR
EffRM

##           [,1]     [,2]
## [1,]   0.00000 -0.05760
## [2,]  -0.02179 -0.09144

# R/H
rotii<-subset(roti,(roti$Group.1=="Recovery" & roti$Group.2=="high"))
Rav<-mean(rotii$R)
Sjav<-mean(rotii$Sj)
Saav<-mean(rotii$Sa)
AavRH<-matrix(c(0,Sjav,Rav,Saav),nrow=2)

Midw<-0.5*(Aav+AavRH)

EffRH<-sensitivity(Midw)*(AavRH-Aav)-EffH-EffR
EffRH

##           [,1]    [,2]
## [1,] 0.00000 0.04235
## [2,] 0.02797 0.02575
```