sim <- 10000

# Matrix for sensitivity

WL <- ILI <- Socoy <- Sof1 <- Sof2\_4 <- Sof5\_19 <- Sof20 <- Som1 <- Som2\_4 <- Som5\_19 <- Som20 <- LS <- hr <- n <- FR<- fmr <-numeric()

for(i in 1:sim){

WL[i] <- runif(1, 0.5, 1) # Loss of whole litters; from Ofelia,Švigelj, Hristianenko

ILI[i] <- runif(1, 1.2, 2.2) # Zedrosser

Socoy[i] <- runif(1, 0.5 ,1)

#Bischof

Sof1[i] <- runif(1, 0.7, 1)

Sof2\_4[i]<- runif(1, 0.7, 1)

Sof5\_19[i] <- runif(1, 0.7, 1)

Sof20[i] <- runif(1, 0, 0.5)

#Bischof

Som1[i] <- runif(1, 0.7, 1)

Som2\_4[i] <- runif(1, 0.7, 1)

Som5\_19[i] <- runif(1, 0.7, 1)

Som20[i] <- runif(1, 0, 0.5)

LS[i] <- runif(1, 1, 3)

hr[i] <- runif(1, 0.75, 1.25)

n[i] <- runif(1, 500, 1500)

FR[i]<- runif(1,0.00,0.5)

fmr[i] <- runif(1, 0.45, 0.75)

}

## Control variables for step 2;

n.years=5

N10 <- matrix(ncol=n.years, nrow=42)

table3<-matrix(ncol=1,nrow=42)

B <- matrix(ncol=42, nrow=42, 0)

res <- matrix(ncol=1, nrow=sim)

lam <- matrix(ncol=1, nrow=sim)

for(i in 1:sim){

table3[1:21]<-table2[1:21,1]/(sum(table2[1:21,1]))\* fmr[i]

table3[22:42]<-table2[22:42,1]/(sum(table2[22:42,1]))\*(1- fmr[i])

N10[,1] <- table3\*n[i]

H <- c(0,55,74,52,28,14,12,17,16,2,5,6,4,2,2,1,2,0,0,0,0,0,87,117,105,72,36,27,30,20,8,19,9,3,3,1,4,2,1,1,1,0)\*hr[i] # Harvest

Ht<- H/6

F1 <- LS[i]

F = F1/2/ILI[i]

#female survival

B[2,1] <- Socoy[i]\*WL[i]

B[3,2] <- Sof1[i]

B[4,3] <- Sof2\_4[i]

B[5,4] <- Sof2\_4[i]

B[6,5] <- Sof2\_4[i]

B[7,6] <- Sof5\_19[i]

B[8,7] <- Sof5\_19[i]

B[9,8] <- Sof5\_19[i]

B[10,9] <- Sof5\_19[i]

B[11,10] <- Sof5\_19[i]

B[12,11] <- Sof5\_19[i]

B[13,12] <- Sof5\_19[i]

B[14,13] <- Sof5\_19[i]

B[15,14] <- Sof5\_19[i]

B[16,15] <- Sof5\_19[i]

B[17,16] <- Sof5\_19[i]

B[18,17] <- Sof5\_19[i]

B[19,18] <- Sof5\_19[i]

B[20,19] <- Sof5\_19[i]

B[21,20] <- Sof5\_19[i]

B[21,21] <- Sof20[i]

#male survival

B[23,22] <- Socoy[i]\*WL[i]

B[24,23] <- Som1[i]

B[25,24] <- Som2\_4[i]

B[26,25] <- Som2\_4[i]

B[27,26] <- Som2\_4[i]

B[28,27] <- Som5\_19[i]

B[29,28] <- Som5\_19[i]

B[30,29] <- Som5\_19[i]

B[31,30] <- Som5\_19[i]

B[32,31] <- Som5\_19[i]

B[33,32] <- Som5\_19[i]

B[34,33] <- Som5\_19[i]

B[35,34] <- Som5\_19[i]

B[36,35] <- Som5\_19[i]

B[37,36] <- Som5\_19[i]

B[38,37] <- Som5\_19[i]

B[39,38] <- Som5\_19[i]

B[40,39] <- Som5\_19[i]

B[41,40] <- Som5\_19[i]

B[42,41] <- Som5\_19[i]

B[42,42] <- Som20[i]

B[c(1,22),c(3,4)] <- Sof2\_4[i]\*F\*FR[i]

B[c(1,22),c(4,5)] <- Sof2\_4[i]\*F

B[c(1,22),c(6:16)] <- Sof5\_19[i]\*F

B[c(1,22),c(17:20)]<- Sof5\_19[i]\*F\*0.925 #Schwartz

B[c(1,22),c(21)]<- Sof5\_19[i]\*F\*0.848 #Schwartz

for(j in 1: (n.years-1)){

temp <- N10[,j]-Ht

temp <- transform(temp, temp=ifelse(temp<0, 0, temp))

N10[,j+1] <- (B%\*%temp[,2])

}

res[i,] <- sum(N10[,n.years])

lam[i,] <- pracma::nthroot(sum(N10[,n.years])/sum(N10[,1]), n.years)

}

##############################

## ESTIMATING SENSITIVITY

###########################

lam\_st <- (lam-mean(lam))/sd(lam)

res\_st <- (res-mean(res))/sd(res)

WL\_st <- (WL-mean(WL))/sd(WL)

ILI\_st <- (ILI-mean(ILI))/sd(ILI)

Socoy\_st <- (Socoy-mean(Socoy))/sd(Socoy)

Sof1\_st <- (Sof1-mean(Sof1))/sd(Sof1)

Sof2\_4\_st <- (Sof2\_4-mean(Sof2\_4))/sd(Sof2\_4)

Sof5\_19\_st <- (Sof5\_19-mean(Sof5\_19))/sd(Sof5\_19)

Sof20\_st <- (Sof20-mean(Sof20))/sd(Sof20)

Som1\_st <- (Som1-mean(Som1))/sd(Som1)

Som2\_4\_st <- (Som2\_4-mean(Som2\_4))/sd(Som2\_4)

Som5\_19\_st <- (Som5\_19-mean(Som5\_19))/sd(Som5\_19)

Som20\_st <- (Som20-mean(Som20))/sd(Som20)

LS\_st <- (LS-mean(LS))/sd(LS)

hr\_st <- (hr-mean(hr))/sd(hr)

n\_st <- (n-mean(n))/sd(n)

FR\_st <- (FR-mean(FR))/sd(FR)

fmr\_st <- (fmr-mean(fmr))/sd(fmr)

M1 <- glm(lam\_st~WL\_st + ILI\_st + Socoy\_st + Sof1\_st + Sof2\_4\_st + Sof5\_19\_st + Sof20\_st + Som1\_st + Som2\_4\_st + Som5\_19\_st + Som20\_st + LS\_st + hr\_st + n\_st + FR\_st + fmr\_st)

summary(M1)