FigyTab_ANEXO_II_Sensibilidad

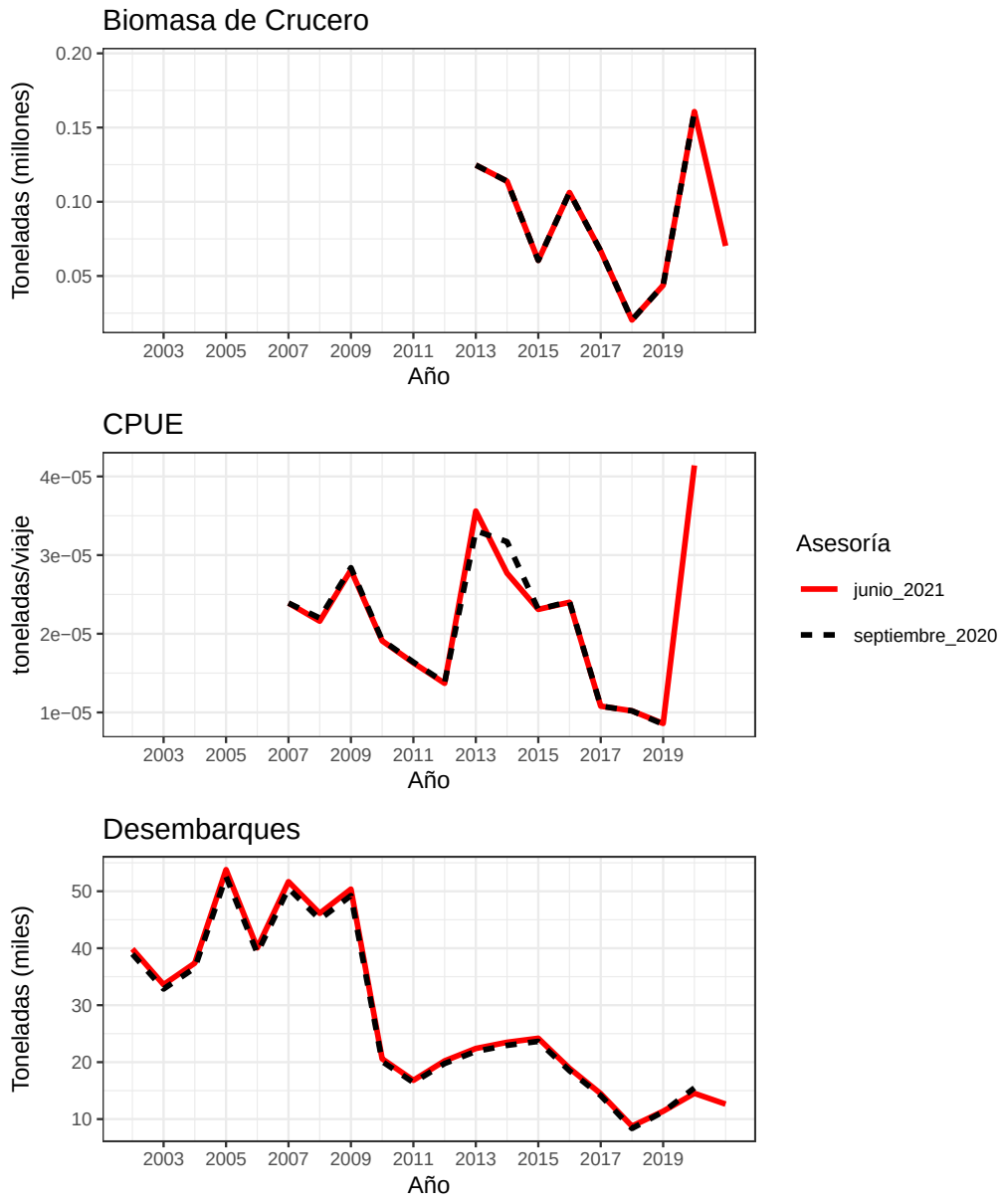
```
library(knitr) # para generar reporte Rmarkdown
library(stringr)
library(reshape)
library(dplyr)
library(ggplot2)
library(ggthemes) # para ggplot
library(patchwork) # para unir gráficos de ggplot
library(strucchange) # libreria utilizada para análisis de quiebres

dir.Fig     <-"Figuras/" # carpeta de las figuras utilizadas y generadas en este estudio
fig         <-c("pdf") # formato de figuras generadas por este código
dir.0       <-getwd() # directorio de trabajo
dir.1       <-paste(dir.0,"/codigos_admb",sep="") # carpeta de códigos ADMB
dir.2       <-paste(dir.0,"/Retrospectivobase",sep="") # carpeta de códigos ADMB
dir.3       <-paste(dir.0,"/Retrospectivoalternativo",sep="") # carpeta de códigos ADMB
dir.4       <-paste(dir.0,"/Verosimilitudalternativo",sep="") # carpeta de códigos ADMB
dir.5       <-paste(dir.0,"/Verosimilitudbase",sep="") # carpeta de códigos ADMB

dir.fun     <-paste(dir.0,"/funciones/",sep="") # carpeta de funciones utilizadas en este informe
source(paste(dir.fun,"functions.R",sep="")) # funciones para leer .dat y .rep
source(paste(dir.fun,"Fn_PBRs.R",sep="")) # funciones para leer .dat y .rep
```

```
setwd(dir.1)
#Asesoría septiembre 2020 MODELO BASE
data.0   <- lisread(paste(dir.1,"MTT0920.dat", sep='/'));
names(data.0)<-str_trim(names(data.0), side="right")
rep0     <- reptoRlist("MTT0920.rep")
std0     <- read.table("MTT0920.std",header=T,sep="",na="NA",fill=T)

#Asesoría junio 2021 MODELO BASE
data.1   <- lisread(paste(dir.1,"MTT0621.dat", sep='/'));
names(data.1)<-str_trim(names(data.1), side="right")
rep1     <- reptoRlist("MTT0621.rep")
std1     <- read.table("MTT0621.std",header=T,sep="",na="NA",fill=T)
```

```
##############################################################################################
# AREGLOS DE DATOS
##############################################################################################

library(patchwork)

yrs   <- rep1$Years
nyrs  <- length(yrs)
lasty <- yrs[nyrs]
cvCB   <-data.1$Ind[,7]
cvcpue <-data.1$Ind[,5]
cvdes  <-data.1$Ind[,3]
```

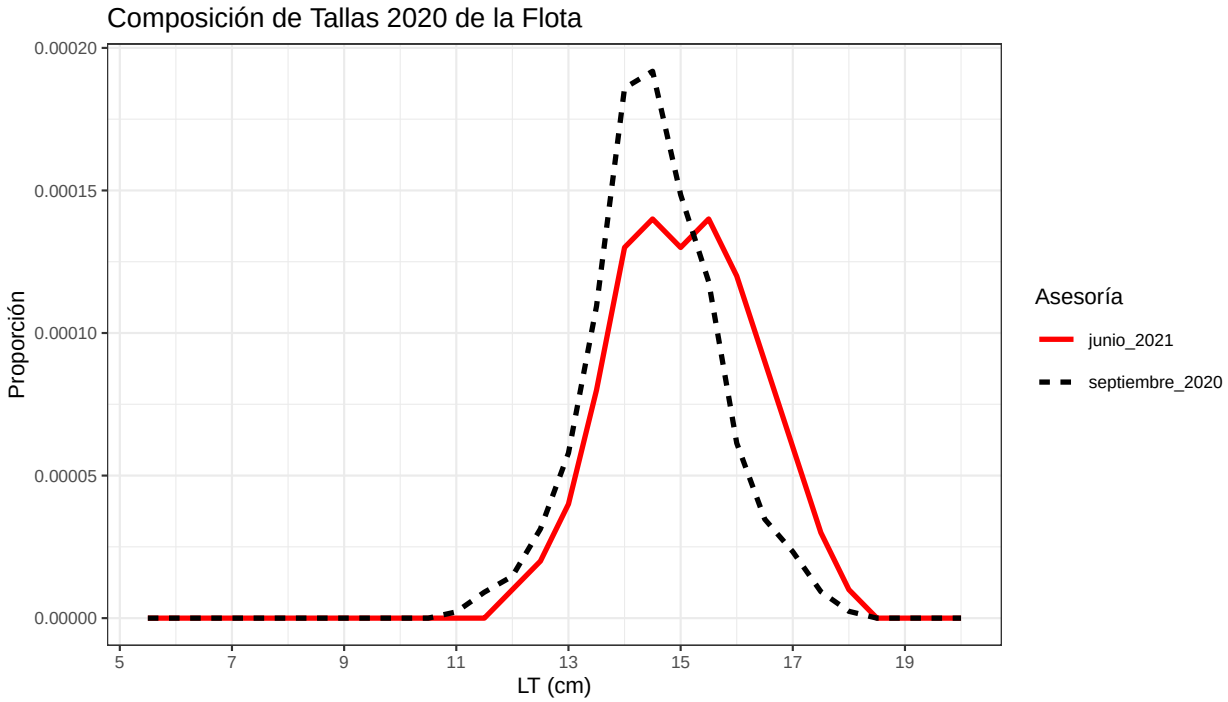
```
Bcru_obs_jun<-rep1$Bcru_obs     ;Bcru_obs_jun[Bcru_obs_jun==0] <- NA
CPUE_obs_jun<-rep1$CPUE_obs     ;CPUE_obs_jun[CPUE_obs_jun==0] <- NA
Desemb_obs_jun<-rep1$Desemb_obs ;Desemb_obs_jun[Desemb_obs_jun==0] <- NA


Bcru_obs_sept<-rep0$Bcru_obs    ;Bcru_obs_sept[Bcru_obs_sept==0] <- NA
CPUE_obs_sept<-rep0$CPUE_obs    ;CPUE_obs_sept[CPUE_obs_sept==0] <- NA
Desemb_obs_sept<-rep0$Desemb_obs ;Desemb_obs_sept[Desemb_obs_sept==0] <- NA



ind_jun   <- cbind(c(Bcru_obs_jun), c(CPUE_obs_jun), c(Desemb_obs_jun))
colnames(ind_jun) <- c('Biomasa_Crucero', 'CPUE', 'Desembarques')

ind_sept <- cbind(c(Bcru_obs_sept,NA), c(CPUE_obs_sept,NA), c(Desemb_obs_sept,NA))
colnames(ind_sept) <- c('Biomasa_Crucero', 'CPUE', 'Desembarques')


junio   <- data.frame(ind_jun) %>% mutate (Asesoría='junio_2021') %>%
           mutate (yrs= yrs)  %>% melt(id.var=c('yrs', 'Asesoría'))
sept    <- data.frame(ind_sept) %>% mutate (Asesoría='septiembre_2020') %>%
           mutate (yrs= yrs)  %>% melt(id.var=c('yrs', 'Asesoría'))

base1 <- data.frame(rbind(junio, sept))

##############################################################################################
# GRAFICAS
##############################################################################################

f1 <- ggplot(base1 %>% filter(Asesoría!='observado', variable=='Biomasa_Crucero'),
        aes(yrs,value/1000000)) +
        geom_line(aes(colour=Asesoría,linetype = Asesoría), size=1) +
        scale_colour_manual(values=c('red','black')) +
        geom_point(data = base1 %>% filter(Asesoría=='observado',
                                           variable=='Biomasa_Crucero'),
        aes(yrs,value/1000000), shape = 19, colour = 'gray30') +
        scale_x_continuous(breaks = seq(from = 1985, to = 2020, by = 2)) +
        labs(title='Biomasa de Crucero', x = 'Año', y = 'Toneladas (millones)') +
        theme_bw(base_size=9)

f2 <- ggplot(base1 %>% filter(Asesoría!='observado', variable=='CPUE'),
            aes(yrs,value/1000000)) +
        geom_line(aes(colour=Asesoría,linetype = Asesoría), size=1) +
        scale_colour_manual(values=c('red','black')) +
        geom_point(data = base1 %>% filter(Asesoría=='observado',
                                           variable=='CPUE'),
        aes(yrs,value/1000000), shape = 19, colour = 'gray30') +
        scale_x_continuous(breaks = seq(from = 1985, to = 2020, by = 2)) +
        labs(title='CPUE', x = 'Año', y = 'toneladas/viaje') +
        theme_bw(base_size=9)

f3 <- ggplot(base1 %>% filter(Asesoría!='observado', variable=='Desembarques'),
        aes(yrs,value/1000)) +
```

```
        geom_line(aes(colour=Asesoría,linetype = Asesoría), size=1) +
        scale_colour_manual(values=c('red','black')) +
        geom_point(data = base1 %>% filter(Asesoría=='observado',
                                           variable=='Desembarques'),
        aes(yrs,value/1000), shape = 19, colour = 'gray30') +
        scale_x_continuous(breaks = seq(from = 1985, to = 2020, by = 2)) +
        labs(title='Desembarques', x = 'Año', y = 'Toneladas (miles)') +
        theme_bw(base_size=9)

f1/f2/f3 + plot_layout(guides="collect")
```



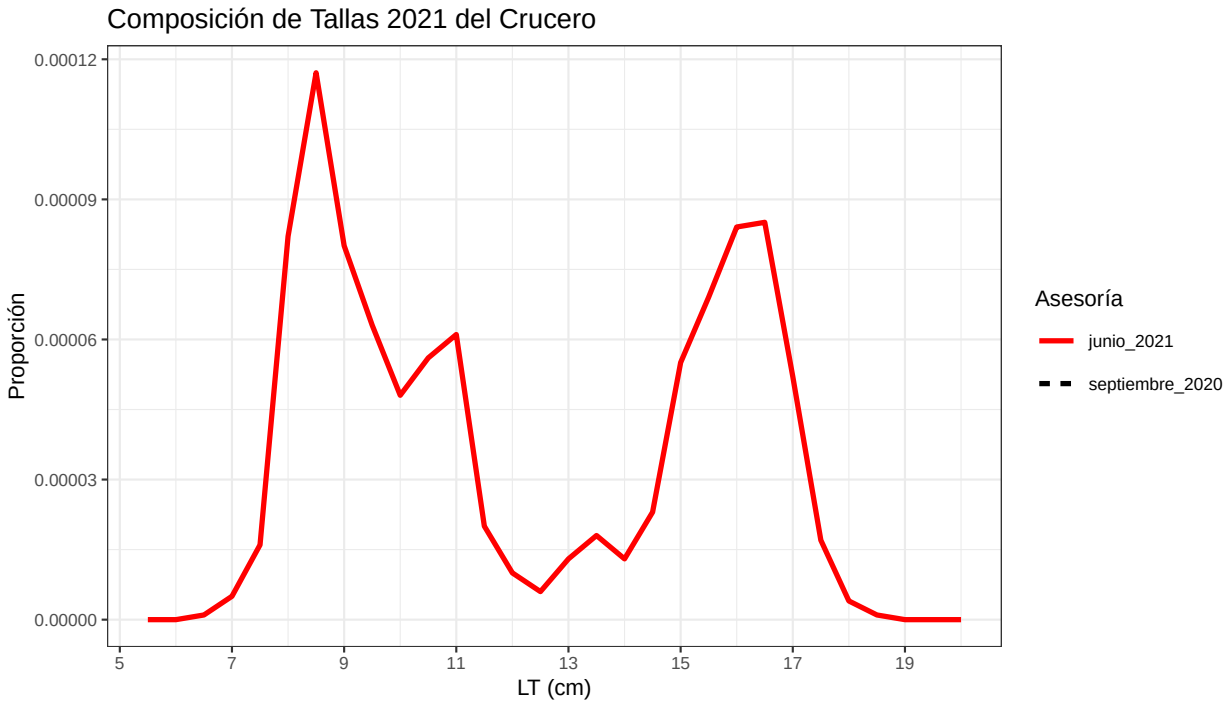

```
Tallas<-rep1$Tallas
Tallasflota_jun<-rep1$Propfl_obs[nyrs-1,]
Tallasflota_sept<-rep0$Propfl_obs[nyrs-1,]
```

```
Tjunio   <- data.frame(Tallasflota_jun) %>% mutate (Asesoría='junio_2021') %>%
          mutate (Tallas= Tallas)  %>% melt(id.var=c('Tallas', 'Asesoría'))
Tsept    <- data.frame(Tallasflota_sept) %>% mutate (Asesoría='septiembre_2020') %>%
          mutate (Tallas= Tallas)  %>% melt(id.var=c('Tallas', 'Asesoría'))

Tbase1 <- data.frame(rbind(Tjunio, Tsept))

f1<-ggplot(Tbase1 %>% filter(Asesoría!='observado'),
        aes(Tallas,value/1000)) +
        geom_line(aes(colour=Asesoría,linetype = Asesoría), size=1) +
        scale_colour_manual(values=c('red','black')) +
        scale_x_continuous(breaks = seq(from = 5, to = 20, by = 2)) +
        labs(title='Composición de Tallas 2020 de la Flota', x = 'LT (cm)', y = 'Proporción') +
        theme_bw(base_size=9)

f1
```




```
Tallas<-rep1$Tallas
Tallascru_jun<-rep1$Propcru_obs[nyrs,]
Tallascru_sept<-rep(NA,length(Tallas))

Tjunio   <- data.frame(Tallascru_jun) %>% mutate (Asesoría='junio_2021') %>%
          mutate (Tallas= Tallas)  %>% melt(id.var=c('Tallas', 'Asesoría'))
Tsept    <- data.frame(Tallascru_sept) %>% mutate (Asesoría='septiembre_2020') %>%
          mutate (Tallas= Tallas)  %>% melt(id.var=c('Tallas', 'Asesoría'))

Tbase1 <- data.frame(rbind(Tjunio, Tsept))

f1<-ggplot(Tbase1 %>% filter(Asesoría!='observado'),
```

```
        aes(Tallas,value/1000)) +
        geom_line(aes(colour=Asesoría,linetype = Asesoría), size=1) +
        scale_colour_manual(values=c('red','black')) +
        scale_x_continuous(breaks = seq(from = 5, to = 20, by = 2)) +
        labs(title='Composición de Tallas 2021 del Crucero', x = 'LT (cm)', y = 'Proporción') +
        theme_bw(base_size=9)

f1
```




```
Carpeta<-"/Sensibilidad_al_update_junio21"
dir<-paste(dir.0,Carpeta,sep="")

admb<-"MTT0920"
dat_admb<-paste(admb,".dat",sep="")
tpl_admb<-paste(admb,".tpl",sep="")

admb_jun<-"MTT0621"
dat_admb_jun<-paste(admb_jun,".dat",sep="")
tpl_admb_jun<-paste(admb_jun,".tpl",sep="")

setwd(dir.1)
unlink(dir,recursive=T) #borra la carpeta creada
dir.create(file.path(dir.0,Carpeta))#crea la carpeta nuevamente
setwd(dir.1);file.copy(c(dat_admb,tpl_admb),dir) #copia los archivos de la carpeta creada
setwd(dir.1);file.copy(c(dat_admb_jun,tpl_admb_jun),dir)

setwd(dir)
data        <- lisread(paste(admb,".dat",sep=""))
names(data) <- str_trim(names(data), side="right")
dat         <- data
```

```
  data_jun        <- lisread(paste(admb_jun,".dat",sep=""))
  names(data_jun) <- str_trim(names(data_jun), side="right")
  dat_jun         <- data_jun
#=============================================================================
  ########################     CREA Y CORRE ESCENARIOS ######################
  #=============================================================================
  setwd(dir)
  #--------------
  # escenario 1: Caso 1 Igual al caso base de septiembre 2020 (MTT2020)
  #--------------
  # caso base
  dat<- data
  writeData(paste(admb,"s",1,".dat",sep=""), dat, append=FALSE)
  ##############################################################################
  # **Actualización 2020**
  ##############################################################################
  #--------------
  # escenario 2: S1 +   Desembarque 2020
  #--------------
  dat<- data
  dat$Ind[19,2] <- 14194
  writeData(paste(admb,"s",2,".dat",sep=""), dat, append=FALSE)
  dat<- data
  #--------------
  # escenario 3: S2 +   incorporación del descarte a la serie de desembarques
  #--------------
  dat<- data
  dat$Ind[,2] <- c(39878,33605,37393,53789,40054,51678,46124,50367,20590,
                   16810,20222,22396,23483,24192,18924,14462,8761,11383,14523)
  writeData(paste(admb,"s",3,".dat",sep=""), dat, append=FALSE)
  #--------------
  # escenario 4: S3 +   estructura de tallas de la flota 2020
  #--------------
  dat<- data
  dat$Frecuencia_flota[19,] <-c(0,  0,  0,  0,  0,  0,  0.00,   0,  0,  0,  0.00,
                                0.00,   0.00,   0.01,   0.02,   0.04,   0.08,   0.13,   0.14,
                                0.13,   0.14,   0.12,   0.09,   0.06,   0.03,   0.01,   0.00,
                                0.00,   0,  0)
  writeData(paste(admb,"s",4,".dat",sep=""), dat, append=FALSE)
  #--------------
  # escenario 5: S4 +   CPUE 2020
  #--------------
  dat<- data
  dat$Ind[19,4]<- 41.4
  writeData(paste(admb,"s",5,".dat",sep=""), dat, append=FALSE)
  ##############################################################################
  # **Actualización 2021**
  ##############################################################################

  #--------------
  # escenario 6: S5 +   Desembarque + descarte 2021
  #--------------
  dat_jun<- data_jun
```

```
dat_jun$Ind[20,2]  <- 12633
dat_jun$Ind[20,6]  <- 0
dat_jun$Fase_F     <- 2
dat_jun$Fase_desRt <- 1
dat_jun$Fase_devNo <- 1
dat_jun$Frecuencia_cruceros[20,]<-c(0,    0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,
                           0, 0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,
                           0, 0)
writeData(paste(admb,"s",6,".dat",sep=""), dat_jun, append=FALSE)

#--------------
# escenario 7: S6 +   Biomasa acústica 2021
#--------------
dat_jun<- data_jun
dat_jun$Ind[20,2]  <- 12633
dat_jun$Ind[20,6]  <- 66626
dat_jun$Fase_F     <- 1
dat_jun$Fase_desRt <- 2
dat_jun$Fase_devNo <- 2
dat_jun$Frecuencia_cruceros[20,]<-c(0,    0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,
                           0, 0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,
                           0, 0)
writeData(paste(admb,"s",7,".dat",sep=""), dat_jun, append=FALSE)

#--------------
# escenario 8: S7 +   Estructura de tallas del crucero 2021
#--------------
dat_jun<- data_jun
dat_jun$Ind[20,2] <- 12633
dat_jun$Ind[20,6] <- 66626
dat_jun$Frecuencia_cruceros[20,]<-c(0,    0,  0.000,  0.001,  0.005,  0.059,  0.097,  0.070,  0.046,
writeData(paste(admb,"s",8,".dat",sep=""), dat_jun, append=FALSE)



for(i in 1:8){
setwd(dir.1);  file.copy(c(paste(admb,".tpl",sep="")),dir)
setwd(dir);  file.rename(paste(admb,".tpl",sep=""),paste(admb,"s",i,".tpl",sep=""))

if(system=="mac"){
  system(paste("~/admb-12.2/admb ",admb,"s",i,sep=""))
  system(paste("./",admb,"s",i,sep="")) }

if(system=="windows"){
  system(paste("admb ",admb,"s",i,sep=""))
  system(paste(admb,"s",i,sep="")) }

file.remove(paste(admb,"s",i,".htp", sep=""),
            paste(admb,"s",i,".cpp", sep=""),
            paste(admb,"s",i,".obj", sep=""),
            paste(admb,"s",i,".p01", sep=""),
            paste(admb,"s",i,".b01", sep=""),
            paste(admb,"s",i,".r01", sep=""),
```

```
              paste(admb,"s",i,".p02", sep=""),
              paste(admb,"s",i,".b02", sep=""),
              paste(admb,"s",i,".r02", sep=""),
              paste(admb,"s",i,".p03", sep=""),
              paste(admb,"s",i,".b03", sep=""),
              paste(admb,"s",i,".r03", sep=""),
              paste(admb,"s",i,".p04", sep=""),
              paste(admb,"s",i,".b04", sep=""),
              paste(admb,"s",i,".r04", sep=""),
              paste(admb,"s",i,".p05", sep=""),
              paste(admb,"s",i,".b05", sep=""),
              paste(admb,"s",i,".r05", sep=""),
              paste(admb,"s",i,".p06", sep=""),
              paste(admb,"s",i,".b06", sep=""),
              paste(admb,"s",i,".r06", sep=""),
              paste(admb,"s",i,".par", sep=""),
              paste(admb,"s",i,".bar", sep=""),
              paste(admb,"s",i,".eva", sep=""),
              paste(admb,"s",i,".cor", sep=""),
              paste(admb,"s",i,".log", sep=""),
              paste(admb,"s",i,".tpl", sep=""),
              paste(admb,"s",i,".exe", sep=""))

  }
```

```
Carpeta<-"/Sensibilidad_al_update_junio21"
  dir<-paste(dir.0,Carpeta,sep="")

setwd(dir)
admb<-"MTT0920"
#############################################################################################

years       <- rep1$Years
nyears      <- length(years)
retros      <- seq(1,8)
nretros     <- length(retros)


retroR      <- matrix(0,nrow=nyears,ncol=nretros)
retroBD     <- matrix(0,nrow=nyears,ncol=nretros)
retroBT     <- matrix(0,nrow=nyears,ncol=nretros)
retroF      <- matrix(0,nrow=nyears,ncol=nretros)

for(i in 1:(nretros-3)){
  rep <- reptoRlist(paste(admb,"s",i,".rep",sep=""))
  retroR[,i]  <- c(rep$Reclutamiento,NA)
  retroBD[,i] <- c(rep$Biomasa_desovante,NA)
  retroBT[,i] <- c(rep$Biomasa_total,NA)
  retroF[,i]  <- c(rep$F,NA)
}
```

```
## Warning in lapply(X = X, FUN = FUN, ...): NAs introduced by coercion

## Warning in lapply(X = X, FUN = FUN, ...): NAs introduced by coercion
```

```
## Warning in lapply(X = X, FUN = FUN, ...): NAs introduced by coercion

## Warning in lapply(X = X, FUN = FUN, ...): NAs introduced by coercion

## Warning in lapply(X = X, FUN = FUN, ...): NAs introduced by coercion
```

```
 for(i in 6:(nretros)){
  rep <- reptoRlist(paste(admb,"s",i,".rep",sep=""))
  retroR[,i]  <- c(rep$Reclutamiento)
  retroBD[,i] <- c(rep$Biomasa_desovante)
  retroBT[,i] <- c(rep$Biomasa_total)
  retroF[,i]  <- c(rep$F)
 }
```

```
## Warning in lapply(X = X, FUN = FUN, ...): NAs introduced by coercion

## Warning in lapply(X = X, FUN = FUN, ...): NAs introduced by coercion

## Warning in lapply(X = X, FUN = FUN, ...): NAs introduced by coercion
```

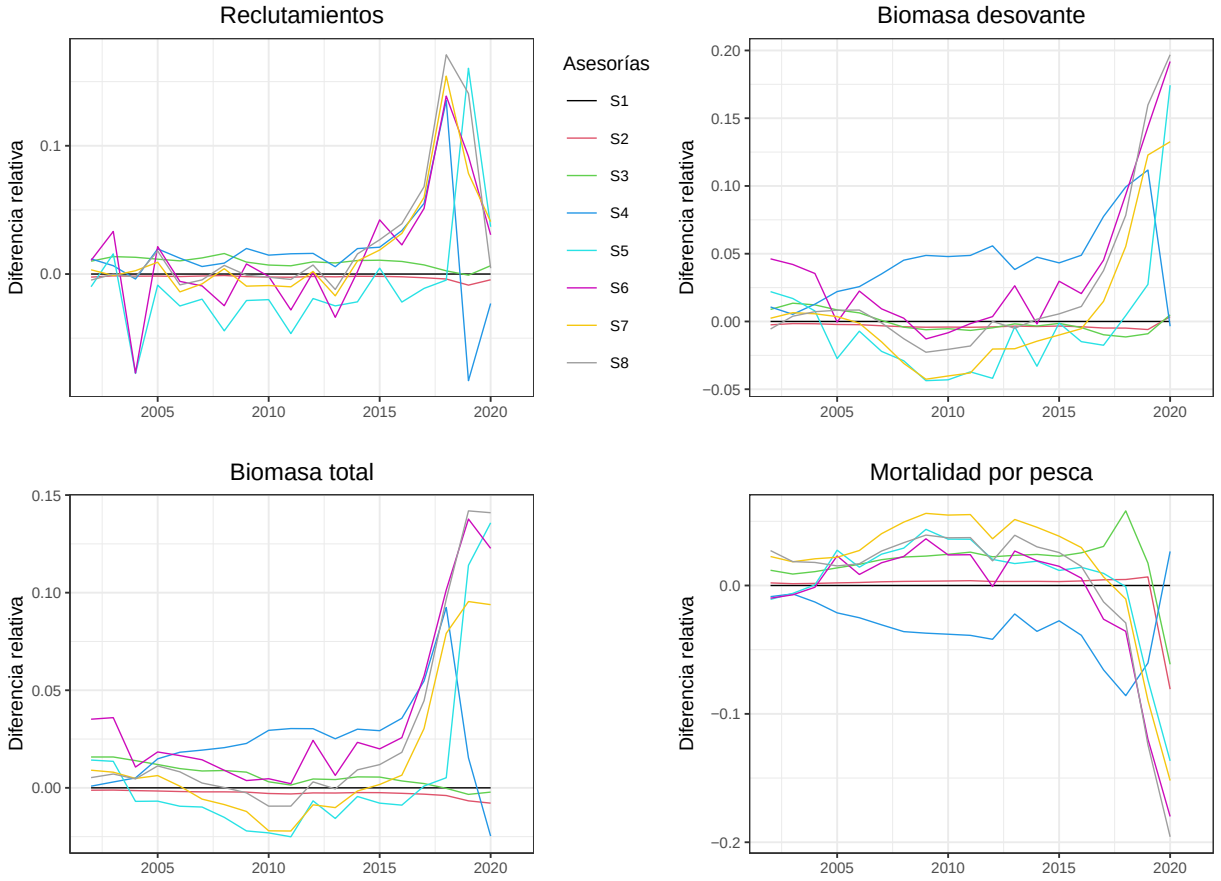
```
# Diferencia relativa con caso base actual
    rel.diff.r   <- matrix(NA, nrow=nyears, ncol=(nretros))
    rel.diff.ssb <- matrix(NA, nrow=nyears, ncol=(nretros))
    rel.diff.bt  <- matrix(NA, nrow=nyears, ncol=(nretros))
    rel.diff.f   <- matrix(NA, nrow=nyears, ncol=(nretros))

    for(j in 1:nretros){
      rel.diff.r[,j]   <- (retroR[,(j)]-retroR[,1])/retroR[,1]
      rel.diff.ssb[,j] <- (retroBD[,(j)]-retroBD[,1])/retroBD[,1]
      rel.diff.bt[,j] <- (retroBT[,(j)]-retroBT[,1])/retroBT[,1]
      rel.diff.f[,j]   <- (retroF[,(j)]-retroF[,1])/retroF[,1]
    }
```

```
datR <- data.frame(years=years,
                   S1=rel.diff.r[,1],
                   S2=rel.diff.r[,2],
                   S3=rel.diff.r[,3],
                   S4=rel.diff.r[,4],
                   S5=rel.diff.r[,5],
                   S6=rel.diff.r[,6],
                   S7=rel.diff.r[,7],
                   S8=rel.diff.r[,8])%>%
         mutate(Series=rep("Reclutamientos",nyears))%>%
         melt(id.var=c('years', 'Series'))

datBT <- data.frame(years=years,
                   S1=rel.diff.bt[,1],
                   S2=rel.diff.bt[,2],
                   S3=rel.diff.bt[,3],
                   S4=rel.diff.bt[,4],
                   S5=rel.diff.bt[,5],
                   S6=rel.diff.bt[,6],
                   S7=rel.diff.bt[,7],
                   S8=rel.diff.bt[,8])%>%
         mutate(Series=rep("Biomasa_total",nyears))%>%
```

```
        melt(id.var=c('years', 'Series'))

datBD <- data.frame(years=years,
                    S1=rel.diff.ssb[,1],
                    S2=rel.diff.ssb[,2],
                    S3=rel.diff.ssb[,3],
                    S4=rel.diff.ssb[,4],
                    S5=rel.diff.ssb[,5],
                    S6=rel.diff.ssb[,6],
                    S7=rel.diff.ssb[,7],
                    S8=rel.diff.ssb[,8])%>%
        mutate(Series=rep("Biomasa_desovante",nyears))%>%
        melt(id.var=c('years', 'Series'))

datF <- data.frame(years=years,
                    S1=rel.diff.f[,1],
                    S2=rel.diff.f[,2],
                    S3=rel.diff.f[,3],
                    S4=rel.diff.f[,4],
                    S5=rel.diff.f[,5],
                    S6=rel.diff.f[,6],
                    S7=rel.diff.f[,7],
                    S8=rel.diff.f[,8])%>%
        mutate(Series=rep("Mortalidad_por_pesca",nyears))%>%
        melt(id.var=c('years', 'Series'))

data <- data.frame(rbind(datR,datBT,datBD,datF))
```

```
################################################################################################
# GRAFICAS
################################################################################################
f1<- ggplot(data %>% filter(Series=="Reclutamientos"),
            aes(years,value)) +
     geom_line(aes(colour=variable), size=0.3)+
     labs(x = '', y = 'Diferencia relativa',colour='Asesorías')  +
     scale_x_continuous(breaks = seq(from = 1990, to = 2021, by = 5)) +
     scale_colour_manual(values=seq(1,8,1))+
     theme_bw(base_size=9) +
     ggtitle('Reclutamientos')+
     theme(plot.title = element_text(hjust = 0.5),legend.position="none")

f2<- ggplot(data %>% filter(Series=="Biomasa_total"),
            aes(years,value)) +
     geom_line(aes(colour=variable), size=0.3)+
     labs(x = '', y = 'Diferencia relativa',colour='Asesorías')  +
     scale_x_continuous(breaks = seq(from = 1990, to = 2021, by = 5)) +
     scale_colour_manual(values=seq(1,8,1))+
     theme_bw(base_size=9) +
     ggtitle('Biomasa total')+
     theme(plot.title = element_text(hjust = 0.5),legend.position="none")

f3<- ggplot(data %>% filter(Series=="Biomasa_desovante"),
            aes(years,value)) +
     geom_line(aes(colour=variable), size=0.3)+
```

```
     labs(x = '', y = 'Diferencia relativa',colour='Asesorías')  +
     scale_x_continuous(breaks = seq(from = 1990, to = 2021, by = 5)) +
     scale_colour_manual(values=seq(1,8,1))+
     theme_bw(base_size=9) +
     ggtitle('Biomasa desovante')+
     theme(plot.title = element_text(hjust = 0.5),legend.position="left")

f4<- ggplot(data %>% filter(Series=="Mortalidad_por_pesca"),
            aes(years,value)) +
     geom_line(aes(colour=variable), size=0.3)+
     labs(x = '', y = 'Diferencia relativa',colour='Asesorías')  +
     scale_x_continuous(breaks = seq(from = 1990, to = 2021, by = 5)) +
     scale_colour_manual(values=seq(1,8,1))+
     theme_bw(base_size=9) +
     ggtitle('Mortalidad por pesca')+
     theme(plot.title = element_text(hjust = 0.5),legend.position="none")

(f1/f2) | (f3/f4)
```




```
kable(data.frame(indicador=rep("Rt",nyears),years=years,retroR))
```

indicador	years	X1	X2	X3	X4	X5	X6	X7	X8
Rt	2002	6279.72	6264.81	6342.66	6353.85	6217.58	6346.51	6300.42	6250.16

indicador	years	X1	X2	X3	X4	X5	X6	X7	X8
Rt	2003	9191.00	9177.90	9315.86	9250.84	9335.69	9496.27	9180.40	9190.08
Rt	2004	13264.30	13242.20	13437.60	13212.50	12235.90	12240.80	13298.70	13233.20
Rt	2005	20281.70	20250.00	20516.60	20679.00	20105.80	20714.70	20468.40	20646.00
Rt	2006	8369.45	8353.22	8455.40	8472.92	8160.89	8321.51	8253.05	8298.74
Rt	2007	8651.36	8638.11	8760.06	8702.08	8482.06	8571.46	8584.86	8611.93
Rt	2008	10848.00	10835.60	11021.60	10940.40	10367.60	10579.90	10893.50	10921.10
Rt	2009	6789.41	6775.65	6852.76	6924.71	6649.26	6842.88	6725.30	6783.15
Rt	2010	5311.60	5299.34	5348.83	5389.88	5205.54	5302.01	5263.99	5298.52
Rt	2011	5564.11	5550.28	5599.93	5652.04	5305.97	5408.33	5508.72	5540.69
Rt	2012	14058.00	14031.50	14191.70	14284.20	13789.60	14076.70	14086.60	14157.00
Rt	2013	2520.90	2515.41	2542.71	2535.27	2458.32	2435.82	2478.08	2490.61
Rt	2014	12318.90	12297.20	12448.70	12563.40	12052.00	12341.70	12444.30	12512.00
Rt	2015	3317.14	3311.18	3352.91	3386.49	3332.40	3457.17	3379.23	3405.77
Rt	2016	2550.45	2544.99	2575.49	2636.83	2494.72	2608.39	2631.26	2650.48
Rt	2017	4984.22	4969.83	5019.65	5258.58	4928.44	5239.23	5282.17	5323.63
Rt	2018	3550.68	3536.96	3559.57	4030.55	3533.92	4043.32	4098.53	4157.70
Rt	2019	10586.10	10494.50	10576.60	9706.21	12284.30	11557.00	11416.40	12076.00
Rt	2020	2377.60	2366.95	2393.05	2323.00	2465.25	2450.37	2474.83	2388.41
Rt	2021	NA	NA	NA	NA	NA	7492.06	5744.90	4421.96

```
kable(data.frame(indicador=rep("BT",nyears),years=years,retroBT))
```

indicador	years	X1	X2	X3	X4	X5	X6	X7	X8
BT	2002	194918.0	194680.0	197999.0	195086.0	197693.0	201774.0	196679.0	195940.0
BT	2003	200800.0	200571.0	203975.0	201402.0	203526.0	208023.0	202410.0	202223.0
BT	2004	210788.0	210489.0	213728.0	211859.0	209329.0	213035.0	211805.0	211753.0
BT	2005	266799.0	266369.0	269989.0	270768.0	264982.0	271705.0	268476.0	269798.0
BT	2006	252551.0	252076.0	255042.0	257157.0	250172.0	256724.0	252767.0	254624.0
BT	2007	207379.0	206952.0	209171.0	211387.0	205340.0	210361.0	206182.0	207890.0
BT	2008	176058.0	175698.0	177623.0	179683.0	173397.0	177641.0	174549.0	176087.0
BT	2009	150359.0	150030.0	151570.0	153779.0	147041.0	150920.0	148540.0	149976.0
BT	2010	107454.0	107143.0	107787.0	110620.0	104974.0	107957.0	105089.0	106446.0
BT	2011	99342.1	99031.5	99484.5	102359.0	96851.2	99553.2	97145.1	98412.3
BT	2012	146178.0	145798.0	146841.0	150608.0	145203.0	149736.0	144908.0	146625.0
BT	2013	140569.0	140197.0	141165.0	144103.0	138363.0	141467.0	139147.0	140490.0
BT	2014	149189.0	148828.0	150027.0	153672.0	148529.0	152667.0	148948.0	150565.0
BT	2015	135135.0	134802.0	135881.0	139092.0	134076.0	137832.0	135368.0	136744.0
BT	2016	90698.1	90444.1	91018.9	93931.6	89895.5	93030.9	91286.3	92348.1
BT	2017	74463.8	74223.0	74627.1	78543.0	74533.1	78734.3	76728.1	77789.0
BT	2018	70331.4	70054.6	70313.6	76830.5	70694.6	77462.9	75898.8	77126.8
BT	2019	110237.0	109503.0	109868.0	111935.0	122805.0	125418.0	120759.0	125880.0
BT	2020	113795.0	112904.0	113546.0	110981.0	129245.0	127757.0	124476.0	129835.0
BT	2021	NA	NA	NA	NA	NA	121993.0	108406.0	104121.0

```
kable(data.frame(indicador=rep("BD",nyears),years=years,retroBD))
```

indicador	years	X1	X2	X3	X4	X5	X6	X7	X8
BD	2002	40951.4	40849.6	41315.8	41388.5	41852.3	42843.5	41049.0	40723.3
BD	2003	57096.5	57007.1	57865.9	57397.8	58063.9	59498.4	57465.8	57318.6

indicador	years	X1	X2	X3	X4	X5	X6	X7	X8
BD	2004	57102.0	57006.0	57800.3	57832.1	57543.2	59123.5	57426.2	57513.7
BD	2005	58821.2	58690.3	59321.3	60119.4	57212.6	58794.0	59032.0	59307.9
BD	2006	77956.9	77772.3	78451.4	79959.8	77397.5	79705.8	77859.0	78614.5
BD	2007	61494.2	61298.9	61541.2	63651.1	60136.9	62066.8	60570.0	61431.3
BD	2008	40283.3	40126.0	40114.8	42104.7	39114.1	40380.5	39037.5	39770.5
BD	2009	31676.5	31542.4	31483.1	33220.1	30292.7	31268.3	30326.7	30957.2
BD	2010	30535.2	30409.0	30372.6	31998.2	29220.4	30280.7	29307.4	29906.9
BD	2011	29096.8	28972.0	28904.7	30515.1	28014.6	29049.6	27991.0	28570.0
BD	2012	31431.6	31305.5	31284.3	33185.5	30112.9	31544.8	30791.8	31431.9
BD	2013	46501.3	46341.4	46418.3	48283.9	46320.2	47726.9	45565.4	46266.8
BD	2014	39131.0	38986.0	38999.6	40988.5	37837.7	39059.5	38561.3	39196.7
BD	2015	42500.6	42357.1	42440.1	44338.4	42452.0	43762.1	42075.8	42738.4
BD	2016	32793.0	32665.6	32645.3	34395.5	32304.8	33467.9	32618.2	33155.7
BD	2017	19677.1	19582.0	19484.0	21201.4	19331.6	20567.3	19969.5	20416.0
BD	2018	20680.2	20579.1	20444.0	22733.4	20769.5	22616.7	21824.0	22300.3
BD	2019	24775.7	24628.0	24550.9	27544.2	25453.1	28333.5	27819.0	28733.5
BD	2020	38349.2	38484.0	38536.4	38214.1	45035.0	45706.0	43435.8	45897.9
BD	2021	NA	NA	NA	NA	NA	40406.7	38526.8	39891.2

```
kable(data.frame(indicador=rep("F",nyears),years=years,retroF))
```

indicador	years	X1	X2	X3	X4	X5	X6	X7	X8
F	2002	0.493403	0.494405	0.499264	0.489127	0.488065	0.488530	0.504542	0.506812
F	2003	0.342980	0.343465	0.346041	0.340731	0.340867	0.340492	0.349320	0.349359
F	2004	0.394266	0.394916	0.398526	0.389189	0.394459	0.393726	0.402465	0.401348
F	2005	0.479449	0.480427	0.486027	0.469233	0.492627	0.490503	0.490001	0.486767
F	2006	0.316877	0.317621	0.322106	0.308918	0.321398	0.319598	0.325517	0.322241
F	2007	0.564667	0.566296	0.576029	0.547374	0.578449	0.574664	0.587462	0.579838
F	2008	0.674416	0.676569	0.689382	0.650183	0.694054	0.689672	0.707720	0.696902
F	2009	0.883464	0.886423	0.903705	0.850667	0.922105	0.915618	0.933104	0.918167
F	2010	0.355950	0.357200	0.364600	0.342440	0.368810	0.364425	0.375480	0.369178
F	2011	0.310689	0.311853	0.318763	0.298624	0.321888	0.318143	0.327852	0.322281
F	2012	0.264742	0.265577	0.270668	0.253649	0.270134	0.264540	0.274376	0.269827
F	2013	0.302481	0.303438	0.309587	0.295775	0.307648	0.310605	0.318039	0.314327
F	2014	0.375407	0.376619	0.384493	0.361993	0.382519	0.382652	0.392437	0.386719
F	2015	0.361497	0.362605	0.369743	0.351559	0.365744	0.366900	0.375388	0.370786
F	2016	0.424240	0.425743	0.435037	0.407787	0.430258	0.426673	0.436778	0.430541
F	2017	0.484830	0.486986	0.499590	0.452973	0.489415	0.472097	0.488092	0.478649
F	2018	0.254721	0.255914	0.269531	0.232859	0.254491	0.245631	0.252040	0.247303
F	2019	0.246693	0.248342	0.251000	0.231791	0.228566	0.217162	0.224612	0.216113
F	2020	0.257286	0.236508	0.241493	0.264116	0.222140	0.210994	0.218190	0.206921
F	2021	NA	NA	NA	NA	NA	0.216723	0.235736	0.235211