SalidasInformeFinal-junio 2021

PRIMER PARTE: CORRE CÓDIGOS Y FUNCIONES

```
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)
```

FUNCIÓN DE RETROSPECTIVO

FUNCIÓN DE VEROSIMILITUD

FUNCIÓN DE CBA

CORRE CODIGOS DE ASESORÍAS PREVIAS MODELO BASE Y ALTERNATIVO

```
#Primer paso correr códigos
setwd(dir.1)
###############################################################################################
# MODELO BASE
###############################################################################################
#modelo base junio 2020 - Hito 2
#system("~/admb-12.2/admb MTT0520")
#system("./MTT0520")

#modelo base septiembre 2019 - Hito 1
#system("./MTT0819")
##system("~/admb-12.2/admb MTT0819")

###############################################################################################
# MODELO ALTERNATIVO
###############################################################################################

#modelo alternativo septiembre 2020 - Hito 1
#system("~/admb-12.2/admb MAT0920")
#system("./MAT0920")

#modelo alternativo junio 2020 - Hito 2
#system("~/admb-12.2/admb MAT0420")
#system("./MAT0420")

#modelo alternativo septiembre 2019 - Hito 1
#system("~/admb-12.2/admb MAT0919")
#system("./MAT0919")

#modelo alternativo junio 2019 - Hito 2
#system("~/admb-12.2/admb MAT0619")
#system("./MAT0619")
```

LEE SALIDAS DE ASESORÍAS PREVIAS MODELO BASE Y ALTERNATIVO

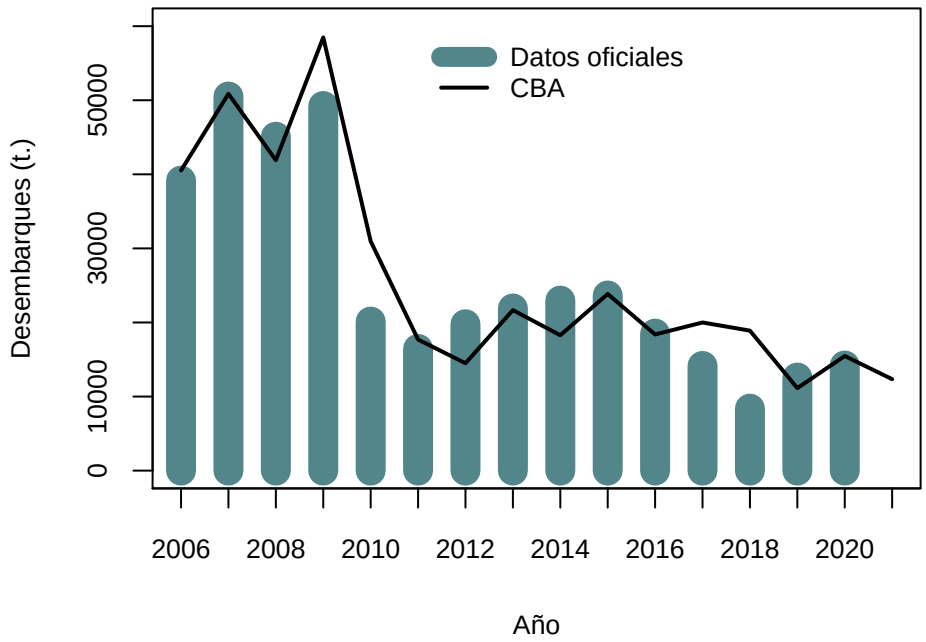
```
setwd(dir.1)
###############################################################################################
# MODELO BASE
###############################################################################################
#modelo base junio 2020 - Hito 2
data0b        <- lisread(paste(dir.1,"MTT0520.dat", sep='/'));
names(data0b) <- str_trim(names(data0b), side="right")
rep.0b        <- reptoRlist("MTT0520.rep")
std.0b        <- read.table("MTT0520.std",header=T,sep="",na="NA",fill=T)

#modelo base septiembre 2019 - Hito 1
data0a        <- lisread(paste(dir.1,"MTT0819.dat", sep='/'));
names(data0a) <- str_trim(names(data0a), side="right")
rep.0a        <- reptoRlist("MTT0819.rep")
```

```r
std.0a        <- read.table("MTT0819.std",header=T,sep="",na="NA",fill=T)

#########################################################################################
# MODELO ALTERNATIVO
#########################################################################################
#modelo alternativo septiembre 2020 - Hito 1
data0        <- lisread(paste(dir.1,"MAT0920.dat", sep='/'));
names(data0) <- str_trim(names(data0), side="right")
rep.0        <- reptoRlist("MAT0920.rep")
std.0        <- read.table("MAT0920.std",header=T,sep="",na="NA",fill=T)

#modelo alternativo junio 2020 - Hito 2
data1        <- lisread(paste(dir.1,"MAT0420.dat", sep='/'));
names(data1) <- str_trim(names(data1), side="right")
rep.1        <- reptoRlist("MAT0420.rep")
std.1        <- read.table("MAT0420.std",header=T,sep="",na="NA",fill=T)

#modelo alternativo septiembre 2019 - Hito 1
data2        <- lisread(paste(dir.1,"MAT0919.dat", sep='/'));
names(data2) <- str_trim(names(data2), side="right")
rep.2        <- reptoRlist("MAT0919.rep")
std.2        <- read.table("MAT0919.std",header=T,sep="",na="NA",fill=T)

#modelo alternativo junio 2019 - Hito 2
data3        <- lisread(paste(dir.1,"MAT0619.dat", sep='/'));
names(data3) <- str_trim(names(data3), side="right")
rep.3        <- reptoRlist("MAT0619.rep")
std.3        <- read.table("MAT0619.std",header=T,sep="",na="NA",fill=T)
```

SEGUNDA PARTE: GENERA GRÁFICAS Y TABLAS

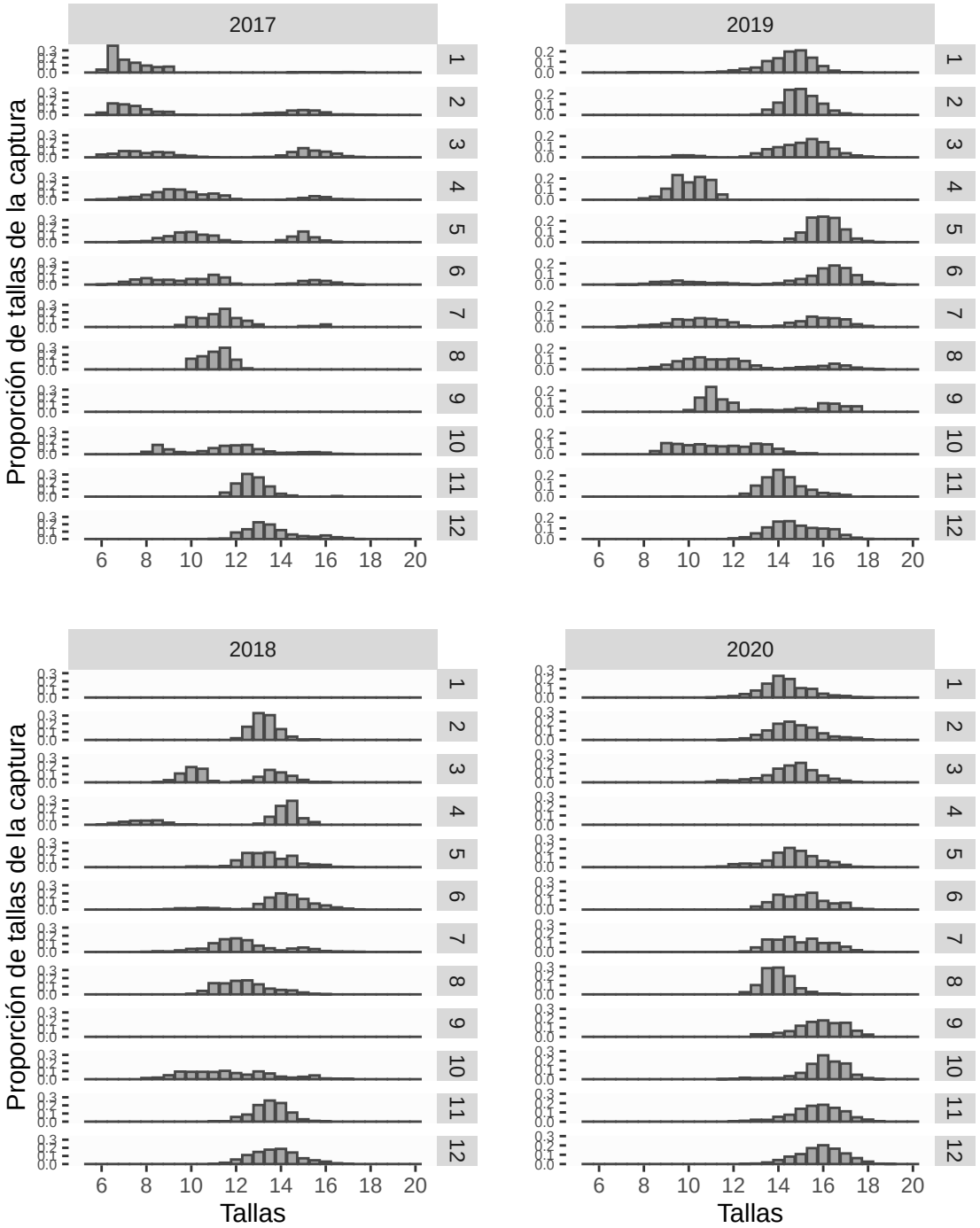
1. Antecedentes

```
year<-seq(2006,2021,1)
desemb<-c(39146,50506,45078,49225,20123,16429,19763,21888,22951,23643,18495,14134,8366,12565,14194,NA)
cuota<-c(40522,50872,41904,58481,30966,17693,14500,21670,18276,23848,18380,20000,18897,11137,15471,1234


par(mfcol=c(1,1),mar=c(4,4,1,1))
plot(year,desemb,type="h",lwd=15,ylab="Desembarques (t.)",xlab="Año",ylim=c(0,60000),xaxp=c(2000,2022,2
lines(year,cuota,type="l",lwd=2,col=1)
legend(2011,60000,c("Datos oficiales","CBA"),lwd=c(10,2),col=c("cadetblue4",1),bty="n",cex=0.8)
```



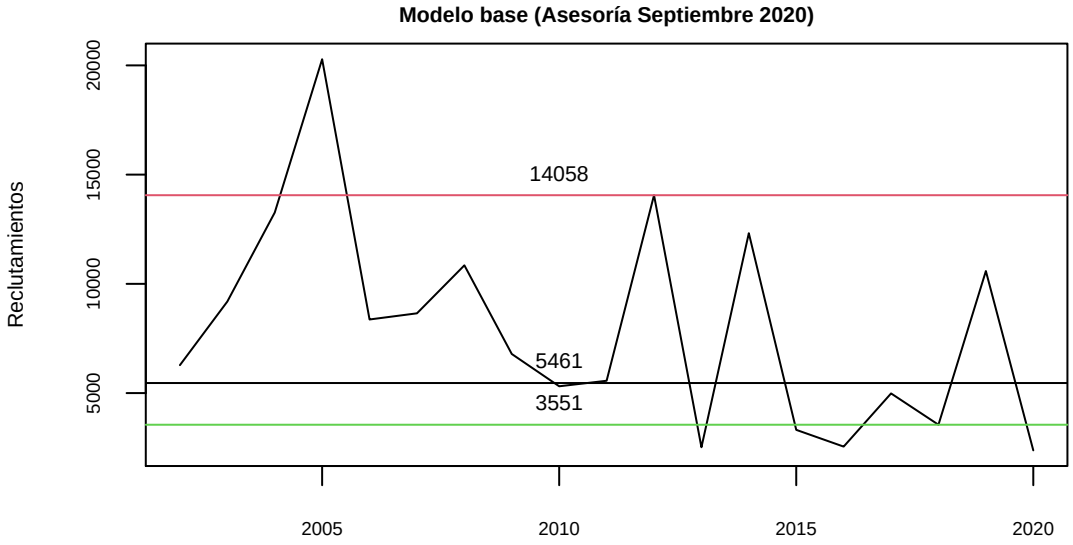

```
datafrec<-read.table(paste(getwd(),"/Tallasmensuales.txt",sep=""),header = FALSE, sep = "")

tallas     <-seq(5.5,20,0.5)
ntallas    <-length(tallas)
etf_obs <- data.frame(datafrec[,3:32])
yearf   <- datafrec[,1]
nyearf  <-length(yearf)
month <- datafrec[,2]
nmonth <-length(month)

obs  <- as.data.frame(etf_obs) %>% mutate(year=yearf) %>% mutate(mes=month) %>% melt(id.vars=c('year','m
          mutate(talla = rep(tallas, each=nyearf))


fig0 <-   ggplot(filter(obs,year==2017)) +
          geom_bar(aes(x = talla, y = value), stat="identity", fill='gray66', color = 'gray28') +
          facet_grid(mes~year) +
          labs(x = '', y = 'Proporción de tallas de la captura')  +
```

```
          theme(panel.background = element_rect(fill ="gray99"),axis.text.y = element_text(hjust = 1, si
          theme(panel.grid=element_line(color=NA)) +
          scale_x_continuous(breaks = seq(from = 2, to = 20, by = 2))+
          scale_y_continuous(breaks = seq(from = 0, to = 0.3, by = 0.1))

fig1 <-   ggplot(filter(obs,year==2018)) +
          geom_bar(aes(x = talla, y = value), stat="identity", fill='gray66', color = 'gray28') +
          facet_grid(mes~year) +
          labs(x = 'Tallas', y = 'Proporción de tallas de la captura')  +
          theme(panel.background = element_rect(fill ="gray99"),axis.text.y = element_text(hjust = 1, si
          theme(panel.grid=element_line(color=NA)) +
          scale_x_continuous(breaks = seq(from = 2, to = 20, by = 2)) +
          scale_y_continuous(breaks = seq(from = 0, to = 0.3, by = 0.1))

fig2 <-   ggplot(filter(obs,year==2019)) +
          geom_bar(aes(x = talla, y = value), stat="identity", fill='gray66', color = 'gray28') +
          facet_grid(mes~year) +
          labs(x = '', y = '')  +
          theme(panel.background = element_rect(fill ="gray99"),axis.text.y = element_text(hjust = 1, si
          theme(panel.grid=element_line(color=NA)) +
          scale_x_continuous(breaks = seq(from = 2, to = 20, by = 2))+
          scale_y_continuous(breaks = seq(from = 0, to = 0.3, by = 0.1))

fig3 <-   ggplot(filter(obs,year==2020)) +
          geom_bar(aes(x = talla, y = value), stat="identity", fill='gray66', color = 'gray28') +
          facet_grid(mes~year) +
          labs(x = 'Tallas', y = '')  +
          theme(panel.background = element_rect(fill ="gray99"),axis.text.y = element_text(hjust = 1, si
          theme(panel.grid=element_line(color=NA)) +
          scale_x_continuous(breaks = seq(from = 2, to = 20, by = 2))+
          scale_y_continuous(breaks = seq(from = 0, to = 0.3, by = 0.1))



fig0+fig2+fig1+fig3
```


2017
2019
2018
2020
Proporción de tallas de la captura
Tallas
1
2
3
4
5
6
7
8
9
10
11
12
6
8
10
12
14
16
18
20

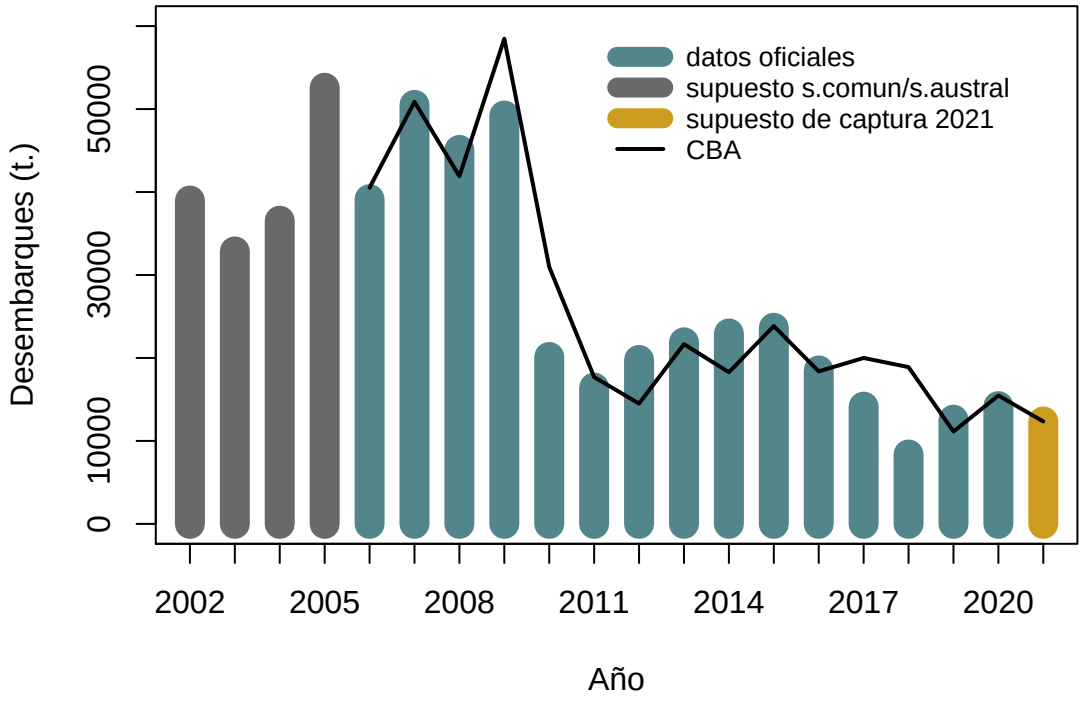
2. Metodología

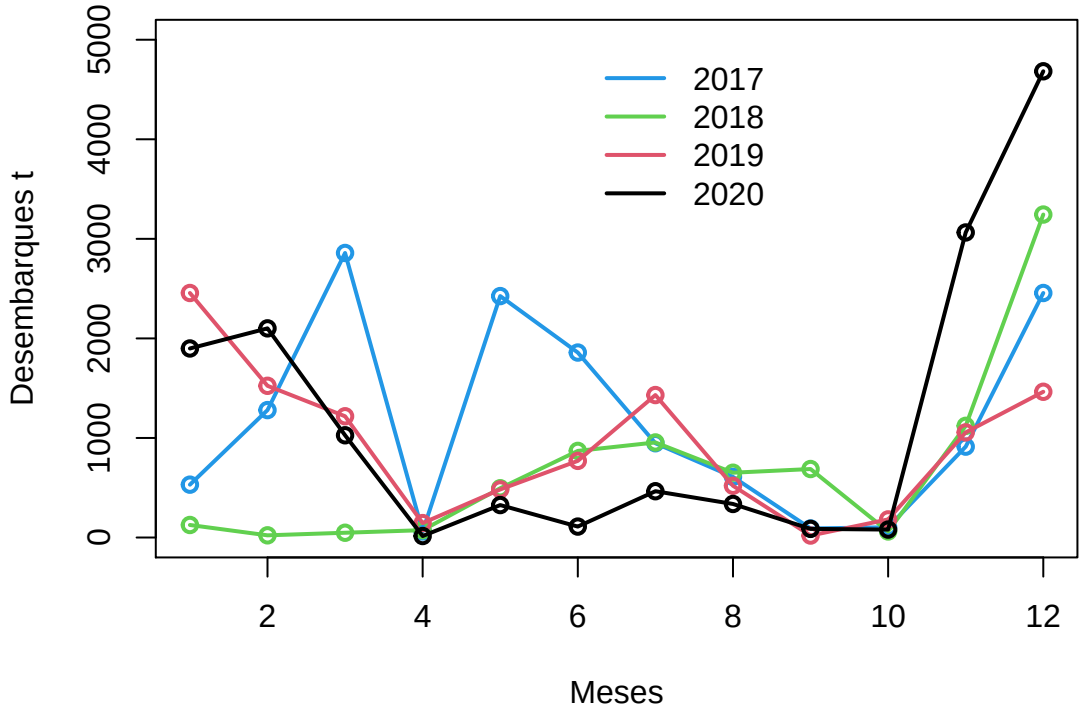
```
dirb<-paste(dir.0,"/cba_septiembre2020_base",sep="")
setwd(dirb)
reps1b     <- reptoRlist("MTT0920s1.rep")
reps2b     <- reptoRlist("MTT0920s2.rep")
reps3b     <- reptoRlist("MTT0920s3.rep")



par(mfcol=c(1,1),mar=c(2,4,1,1)+0.5)

# modelo base
plot(reps1b$Years,reps1b$Reclutamiento,type="l",ylab="Reclutamientos",xlab="",main="Modelo base (Asesori
abline(h=c(exp(8.6053e+000),reps2b$Reclutamiento[11],reps3b$Reclutamiento[17]),col=c(1,2,3))
text(2010,c(exp(8.6053e+000),reps2b$Reclutamiento[11],reps3b$Reclutamiento[17])+1000,round(c(exp(8.6053
```

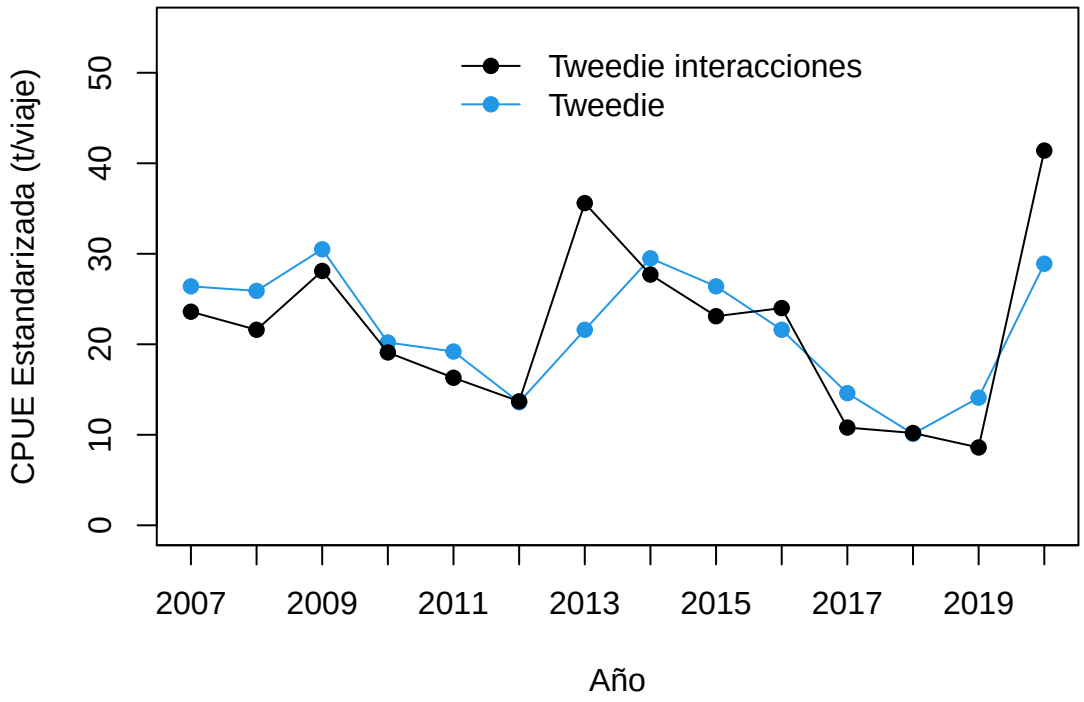


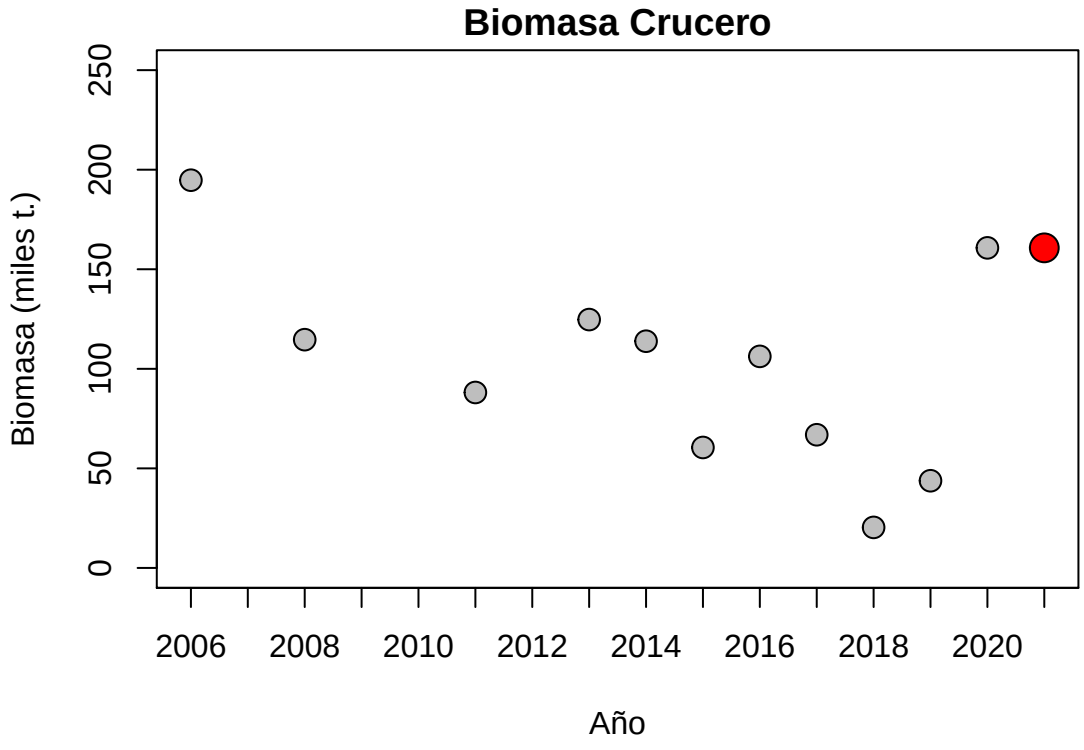
3. RESULTADOS OBJETIVO 1

3.1. Descripción de los datos de entrada al modelo de evaluación de stock





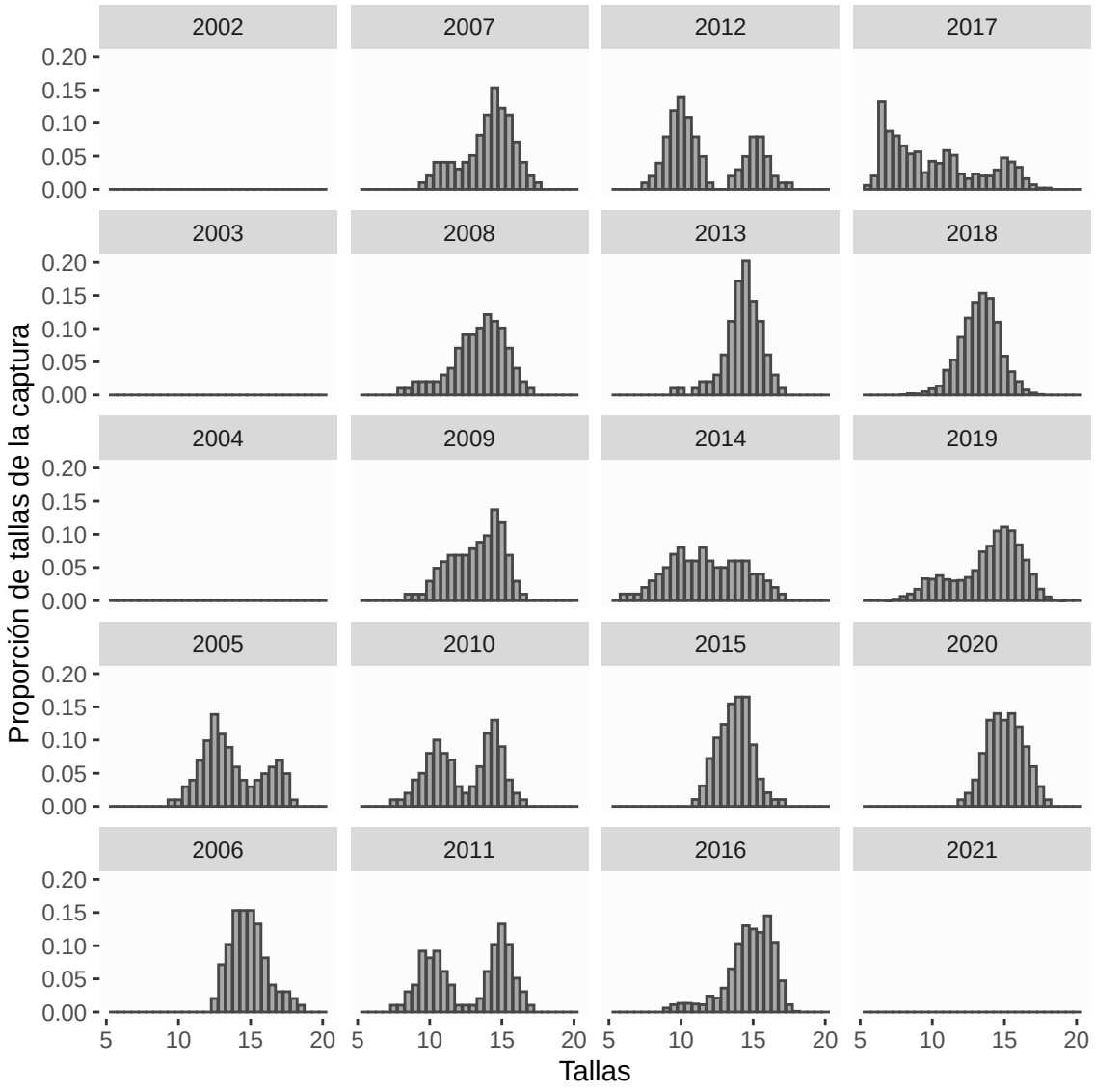




ESTRUCTURA DE TALLAS DE LA FLOTA

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

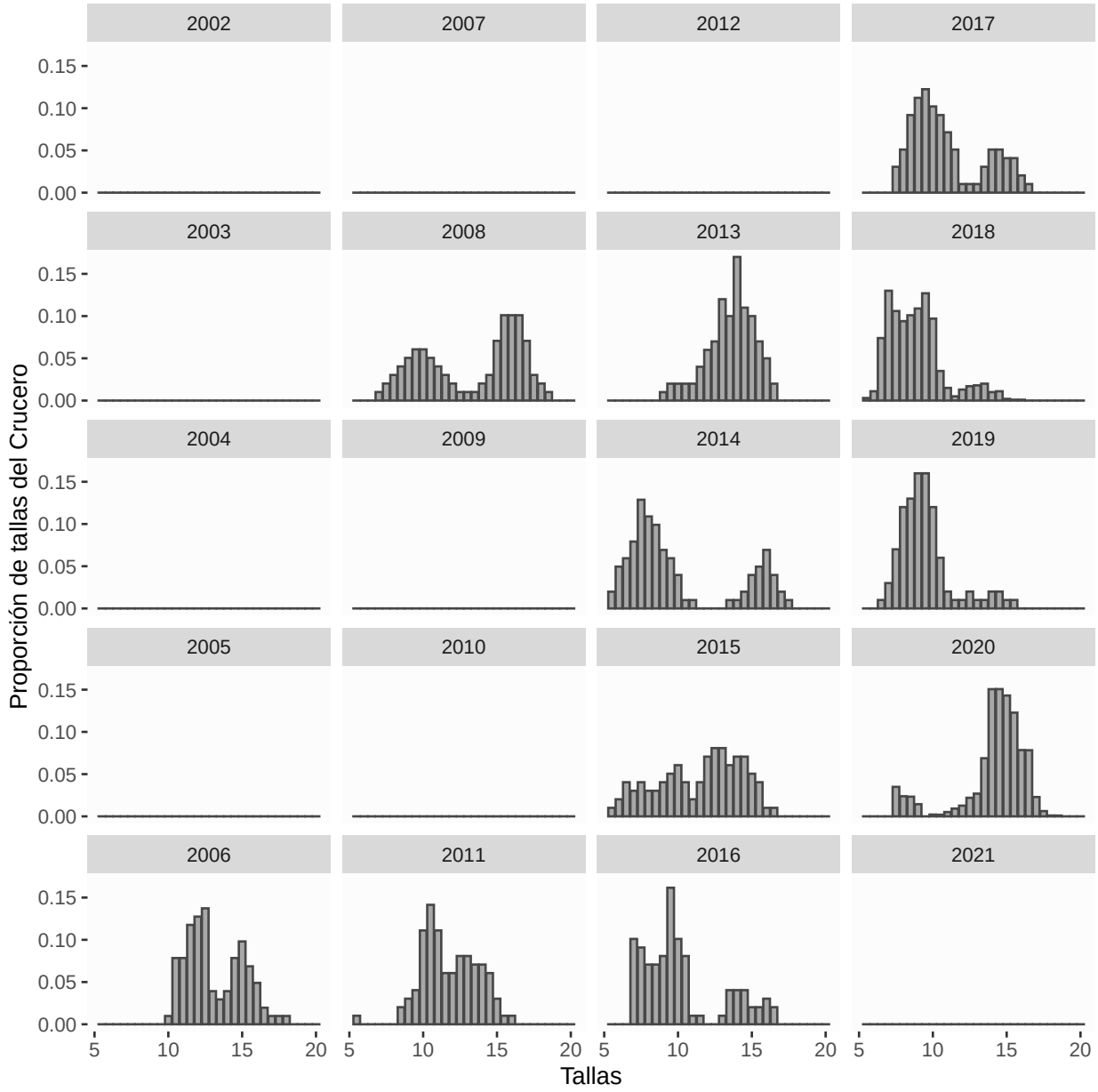
```r
#############################################################################################
age     <-seq(5.5,20,0.5)
nage    <-length(age)
etf_obs_jun <- data.frame(rep1$Propfl_obs)


yearf   <- rep1$Years
nyearf  <- length(yearf)

 obs       <- as.data.frame(etf_obs_jun) %>% mutate(year=yearf) %>% melt(id.vars='year') %>%
              mutate(edad = rep(age, each=nyearf)) %>% mutate(type='obs')

 mat  <- rbind(obs)

#############################################################################################
# GRAFICAS
#############################################################################################
 fig1 <- ggplot(filter(mat, type=='obs')) +
         geom_bar(aes(x = edad, y = value),
                  stat="identity", fill='gray66', color = 'gray28') +
         facet_wrap(~year, dir = 'v', as.table = TRUE) +
         labs(x = 'Tallas', y = 'Proporción de tallas de la captura') +
         theme(panel.background = element_rect(fill ="gray99")) +
         theme(panel.grid=element_line(color=NA))
 fig1
```



ESTRUCTURA DE TALLAS DEL CRUCERO

```
##############################################################################################
# AREGLOS DE DATOS
##############################################################################################
age     <-seq(5.5,20,0.5)
nage    <-length(age)
etc_obs_jun <- data.frame(rep1$Propcru_obs)
yearc   <- rep1$Years
nyearc  <-length(yearc)

 obs      <- as.data.frame(etc_obs_jun) %>% mutate(year=yearc) %>% melt(id.vars='year') %>%
             mutate(edad = rep(age, each=nyearc)) %>% mutate(type='obs')
 mat  <- rbind(obs)

##############################################################################################
# GRAFICAS
```

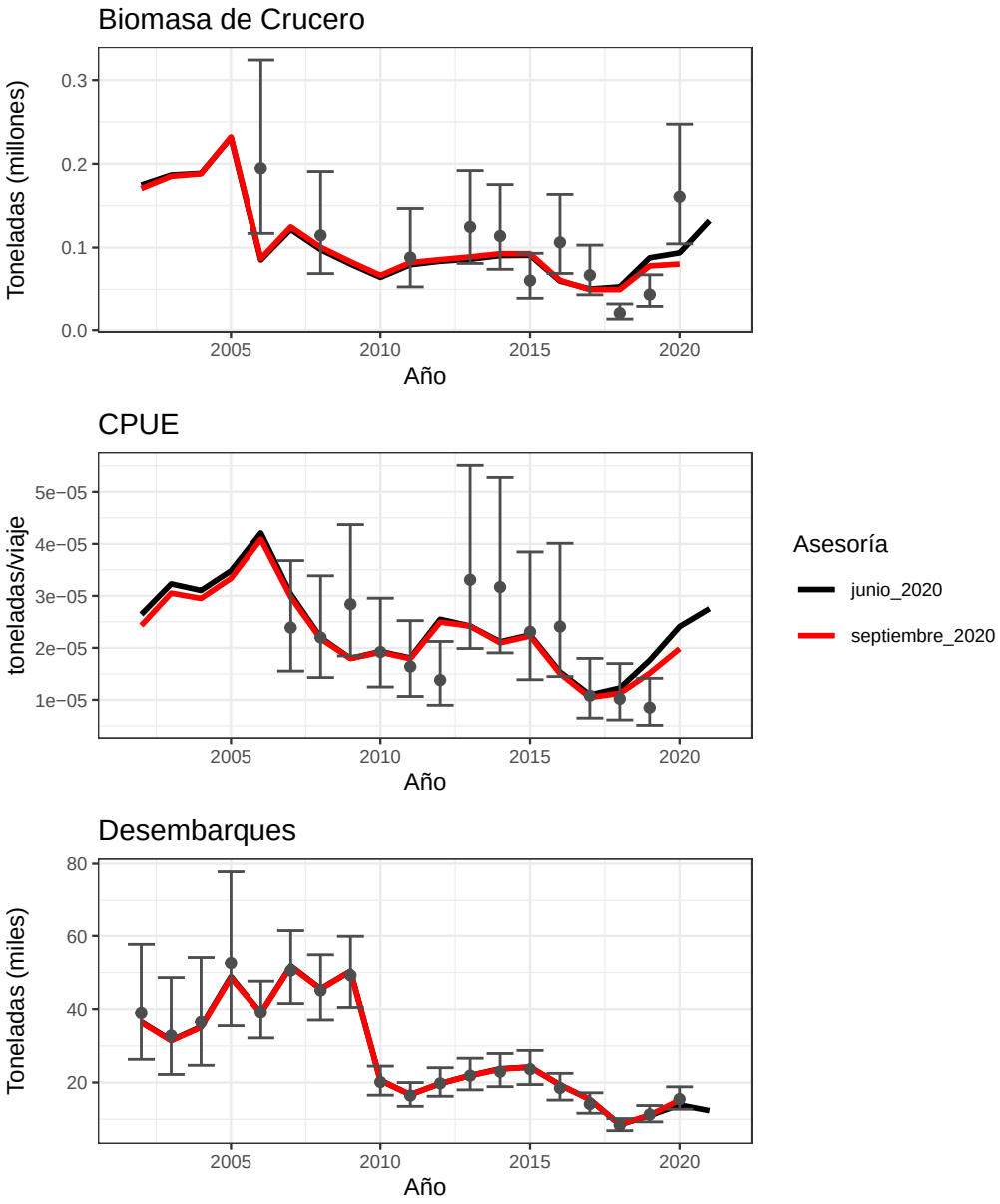
```
##############################################################################################
fig1 <- ggplot(filter(mat, type=='obs')) +
        geom_bar(aes(x = edad, y = value),
                 stat="identity", fill='gray66', color = 'gray28') +
        facet_wrap(~year, dir = 'v', as.table = TRUE) +
        labs(x = 'Tallas', y = 'Proporción de tallas del Crucero') +
        theme(panel.background = element_rect(fill ="gray99")) +
        theme(panel.grid=element_line(color=NA))
fig1
```



3.2. Ajustes del modelo a los datos de índices

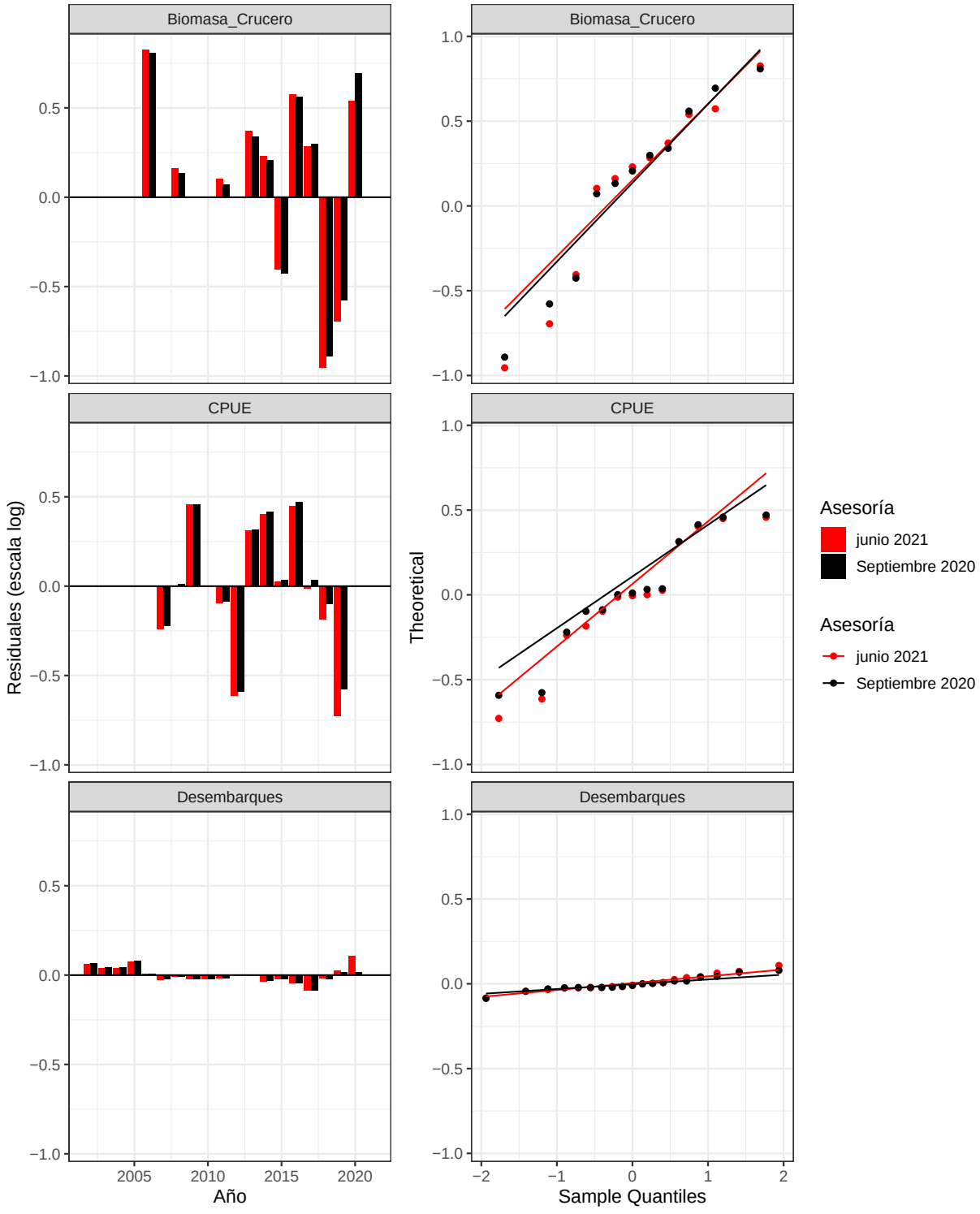
```
##################################################################################################
# AREGLOS DE DATOS
##################################################################################################

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]

ind_obs  <- cbind(c(rep0$Bcru_obs,NA),c(rep0$CPUE_obs,NA),c(rep0$Desemb_obs,NA)); ind_obs[ind_obs==0] <-
colnames(ind_obs) <- c('Biomasa_Crucero', 'CPUE', 'Desembarques')

ind_jun   <- cbind(c(rep1$Bcru_pred), c(rep1$CPUE_pred), c(rep1$Desemb_pred))
colnames(ind_jun) <- c('Biomasa_Crucero', 'CPUE', 'Desembarques')

ind_sept <- cbind(c(rep0$Bcru_pred,NA), c(rep0$CPUE_pred,NA), c(rep0$Desemb_pred,NA))
colnames(ind_sept) <- c('Biomasa_Crucero', 'CPUE', 'Desembarques')

ind     <- data.frame(ind_obs) %>% mutate(Asesoría='observado') %>%
           mutate (yrs= yrs) %>% melt(id.var=c('yrs', 'Asesoría'))
junio   <- data.frame(ind_jun) %>% mutate (Asesoría='junio_2020') %>%
           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(ind,junio, sept))

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

f1 <- ggplot(base1 %>% filter(Asesoría!='observado', variable=='Biomasa_Crucero'),
        aes(yrs,value/1000000)) +
        geom_line(aes(colour=Asesoría), size=1) +
        scale_colour_manual(values=c('black','red')) +
        geom_point(data = base1 %>% filter(Asesoría=='observado',
                                           variable=='Biomasa_Crucero'),
        aes(yrs,value/1000000), shape = 19, colour = 'gray30') +
        geom_errorbar(data = base1 %>% filter(Asesoría=='observado',
                                              variable=='Biomasa_Crucero'),
        aes(ymin = value*exp(-1.96*cvCB)*10^-6,
            ymax = value*exp(1.96*cvCB)*10^-6), color = 'gray30') +
        scale_x_continuous(breaks = seq(from = 1985, to = 2020, by = 5)) +
        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), size=1) +
        scale_colour_manual(values=c('black','red')) +
        geom_point(data = base1 %>% filter(Asesoría=='observado',
                                           variable=='CPUE'),
        aes(yrs,value/1000000), shape = 19, colour = 'gray30') +
        geom_errorbar(data = base1 %>% filter(Asesoría=='observado',
                                              variable=='CPUE'),
        aes(ymin = value*exp(-1.96*cvcpue)*10^-6,
            ymax = value*exp(1.96*cvcpue)*10^-6), color = 'gray30') +
        scale_x_continuous(breaks = seq(from = 1985, to = 2020, by = 5)) +
        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), size=1) +
        scale_colour_manual(values=c('black','red')) +
        geom_point(data = base1 %>% filter(Asesoría=='observado',
                                           variable=='Desembarques'),
        aes(yrs,value/1000), shape = 19, colour = 'gray30') +
        geom_errorbar(data = base1 %>% filter(Asesoría=='observado',
                                              variable=='Desembarques'),
        aes(ymin = value*exp(-1.96*cvdes)*10^-3,
            ymax = value*exp(1.96*cvdes)*10^-3), color = 'gray30') +
        scale_x_continuous(breaks = seq(from = 1985, to = 2020, by = 5)) +
        labs(title='Desembarques', x = 'Año', y = 'Toneladas (miles)') +
        theme_bw(base_size=9)

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


Biomasa de Crucero
Toneladas (millones)
0.0
0.1
0.2
0.3
2005
2010
2015
2020
Año
CPUE
toneladas/viaje
1e−05
2e−05
3e−05
4e−05
5e−05
2005
2010
2015
2020
Año
Asesoría
junio_2020
septiembre_2020
Desembarques
Toneladas (miles)
20
40
60
80
2005
2010
2015
2020
Año

3.2. Análisis de Residuales de los índices

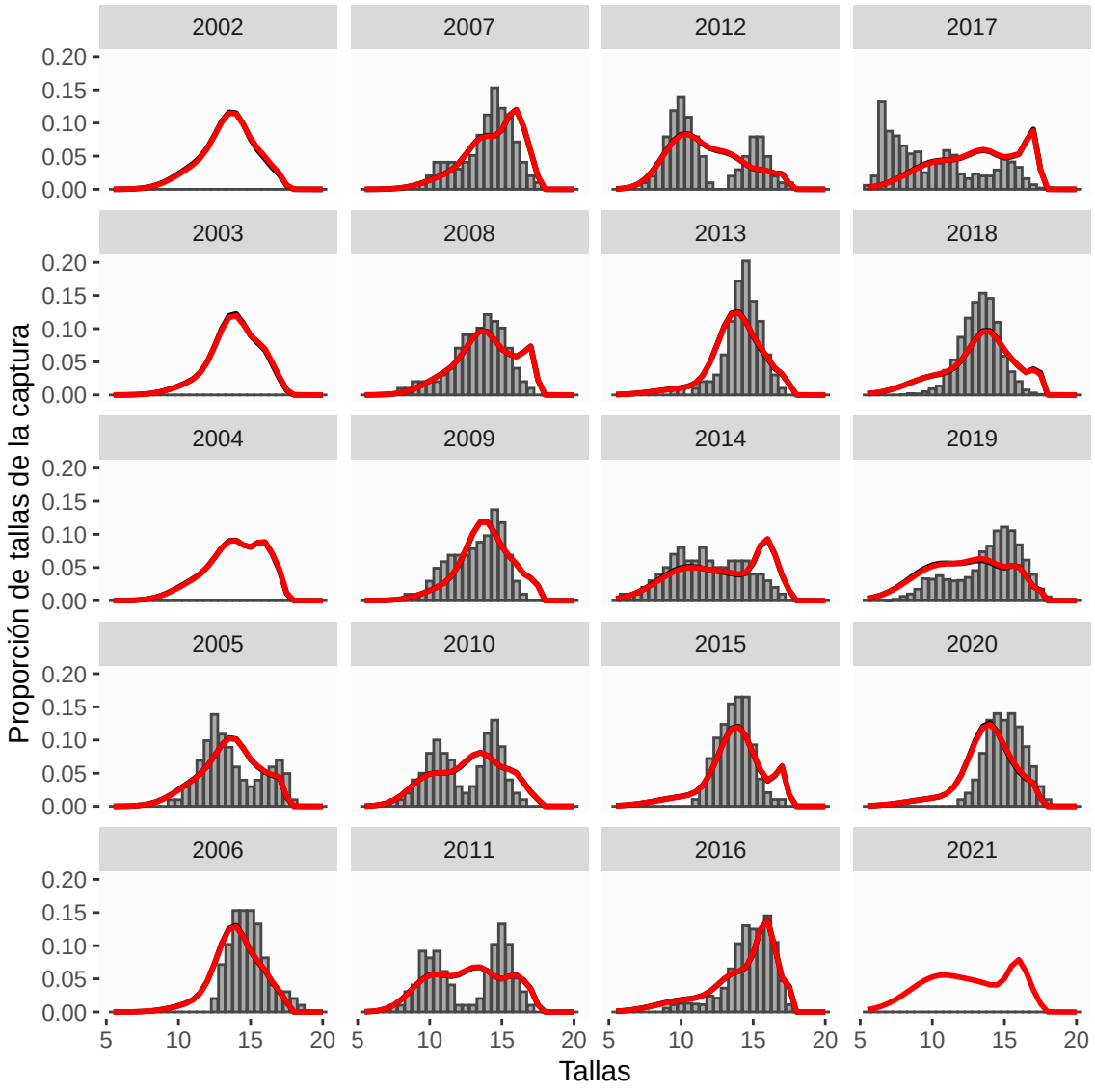
```
#############################################################################################
# AREGLOS DE DATOS
#############################################################################################

Res_maet <- data.frame(log(ind_obs) - log(ind_jun)) %>%
            mutate(yrs = yrs) %>% mutate(Asesoría = 'junio 2021')
Res_matt <- data.frame(log(ind_obs) - log(ind_sept)) %>%
            mutate(yrs = yrs) %>% mutate(Asesoría = 'Septiembre 2020')

Res      <- rbind(Res_maet, Res_matt) %>% melt(id.vars= c('yrs','Asesoría'))
pred     <- base1 %>% filter(Asesoría!='observado') %>% mutate (pred = log(value))
predm    <- pred$pred
Res2     <- cbind(Res,predm)

#############################################################################################
# GRAFICAS
#############################################################################################
r1 <- ggplot(Res, aes(yrs,value)) +
      geom_bar(aes(fill=Asesoría), stat='identity', position='dodge') +
      scale_fill_manual(values=c("red","black"))+
      geom_hline(yintercept = 0) +
      facet_wrap(. ~ variable,  ncol = 1) +
      labs(x= 'Año', y = 'Residuales (escala log)') +
      theme_bw(base_size=12)

r2 <- ggplot(Res2, aes(predm,value)) +
      geom_point(aes(colour=Asesoría), size = 1.5) +
      scale_colour_manual(values=c('red',"black")) +
      geom_hline(yintercept = 0) +
      facet_wrap(. ~ variable, ncol = 1) +
      labs(x= 'Predicho (log)', y = 'Residuales') +
      theme_bw(base_size=12)

r3 <- ggplot(Res, aes(value, colour=Asesoría)) +
      geom_histogram(fill='white', position  = 'dodge') +
      facet_wrap(. ~ variable, ncol = 1) +
      labs(x= 'Residuales', y ='Histograma de Residuos (Frecuencia)') +
      theme_bw(base_size=12)

r4 <- ggplot(Res, aes(sample = value, colour = Asesoría)) +
      stat_qq() +
      stat_qq_line() +
      scale_colour_manual(values=c('red',"black")) +
      facet_wrap(. ~ variable, ncol = 1) +
      labs(x= 'Sample Quantiles', y ='Theoretical') +
      theme_bw(base_size=12)

 r1+r4 + plot_layout(guides="collect")
```


Biomasa_Crucero
CPUE
Desembarques
Residuales (escala log)
Theoretical
Año
Sample Quantiles
Asesoría
junio 2021
Septiembre 2020
Asesoría
junio 2021
Septiembre 2020

3.3. Ajustes del modelo a los datos de Composiciones de tallas

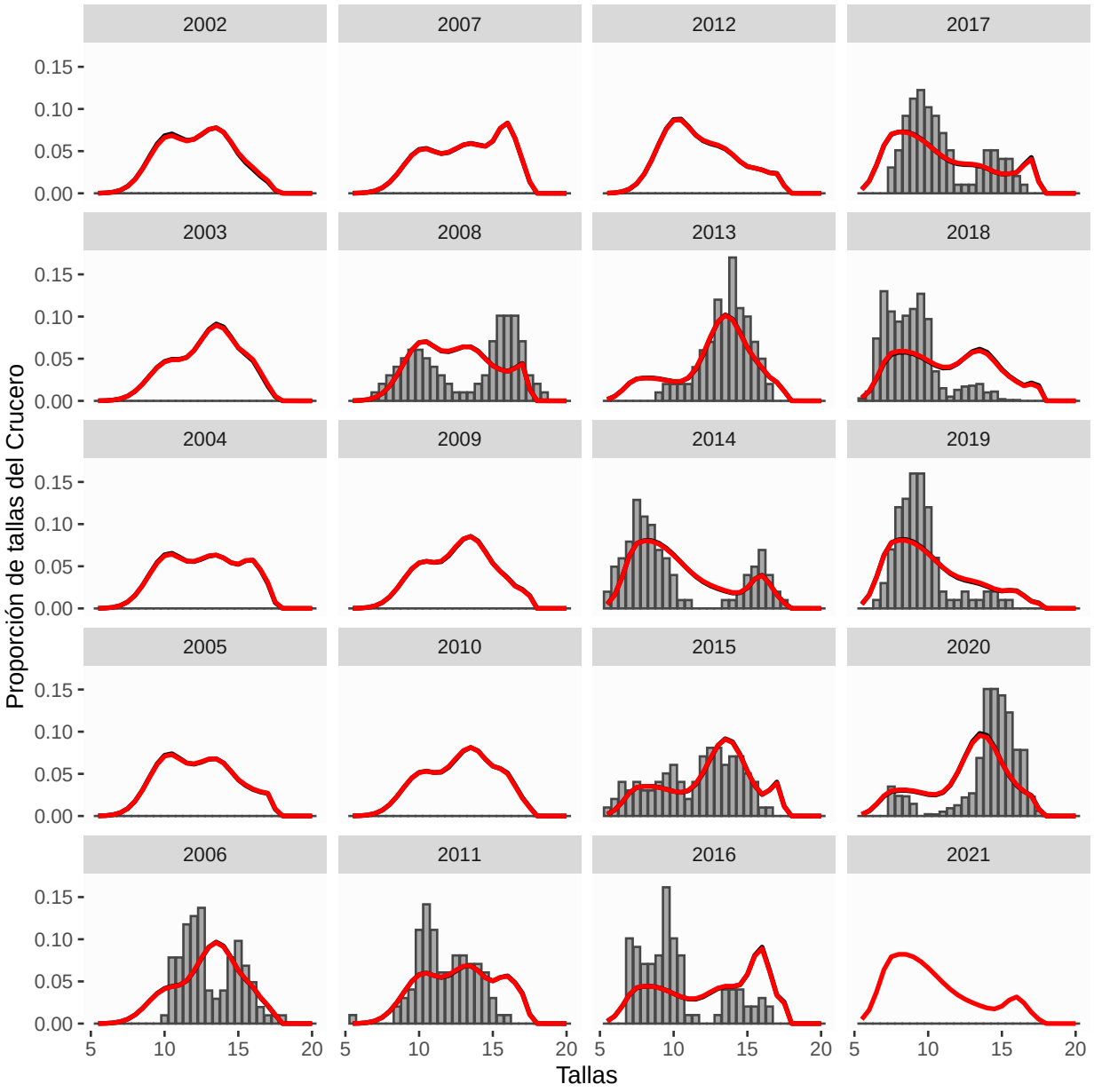
FLOTA

```
#################################################################################################
# AREGLOS DE DATOS
#################################################################################################
age     <-seq(5.5,20,0.5)
nage    <-length(age)

etf_obs_jun <- data.frame(rep1$Propfl_obs)
etf_pre_jun <- rep1$Propfl_pred

etf_obs_sept <- data.frame(rbind(rep0$Propfl_obs,rep(NA,nage)))
etf_pre_sept <- data.frame(rbind(rep0$Propfl_pred,rep(NA,nage)))

yearf   <- rep1$Years
nyearf  <- length(yearf)

 obs       <- as.data.frame(etf_obs_jun) %>% mutate(year=yearf) %>% melt(id.vars='year') %>%
              mutate(edad = rep(age, each=nyearf)) %>% mutate(type='obs')
 pred_jun  <- as.data.frame(etf_pre_jun) %>% mutate(year=yearf) %>% melt(id.vars='year') %>%
              mutate(edad = rep(age, each=nyearf)) %>% mutate(type='pred_jun')
 pred_sept <- as.data.frame(etf_pre_sept) %>% mutate(year=yearf) %>% melt(id.vars='year') %>%
              mutate(edad = rep(age, each=nyearf)) %>% mutate(type='pred_sept')

 mat  <- rbind(obs,pred_jun,pred_sept)

#################################################################################################
# GRAFICAS
#################################################################################################
 fig1 <- ggplot(filter(mat, type=='obs')) +
         geom_bar(aes(x = edad, y = value),
                  stat="identity", fill='gray66', color = 'gray28') +
         facet_wrap(~year, dir = 'v', as.table = TRUE) +
         labs(x = 'Tallas', y = 'Proporción de tallas de la captura') +
         geom_line(data = filter(mat, type=='pred_sept'),
                   aes(x = edad, y = value), color = 'black', size = 1) +
         geom_line(data = filter(mat, type=='pred_jun'),
                   aes(x = edad, y = value), color = 'red', size = 1) +
         theme(panel.background = element_rect(fill ="gray99")) +
         theme(panel.grid=element_line(color=NA))
 fig1
```


2002
2007
2012
2017
2003
2008
2013
2018
2004
2009
2014
2019
2005
2010
2015
2020
2006
2011
2016
2021
0.20
0.15
0.10
0.05
0.00
5
10
15
20
Proporción de tallas de la captura
Tallas

CRUCERO

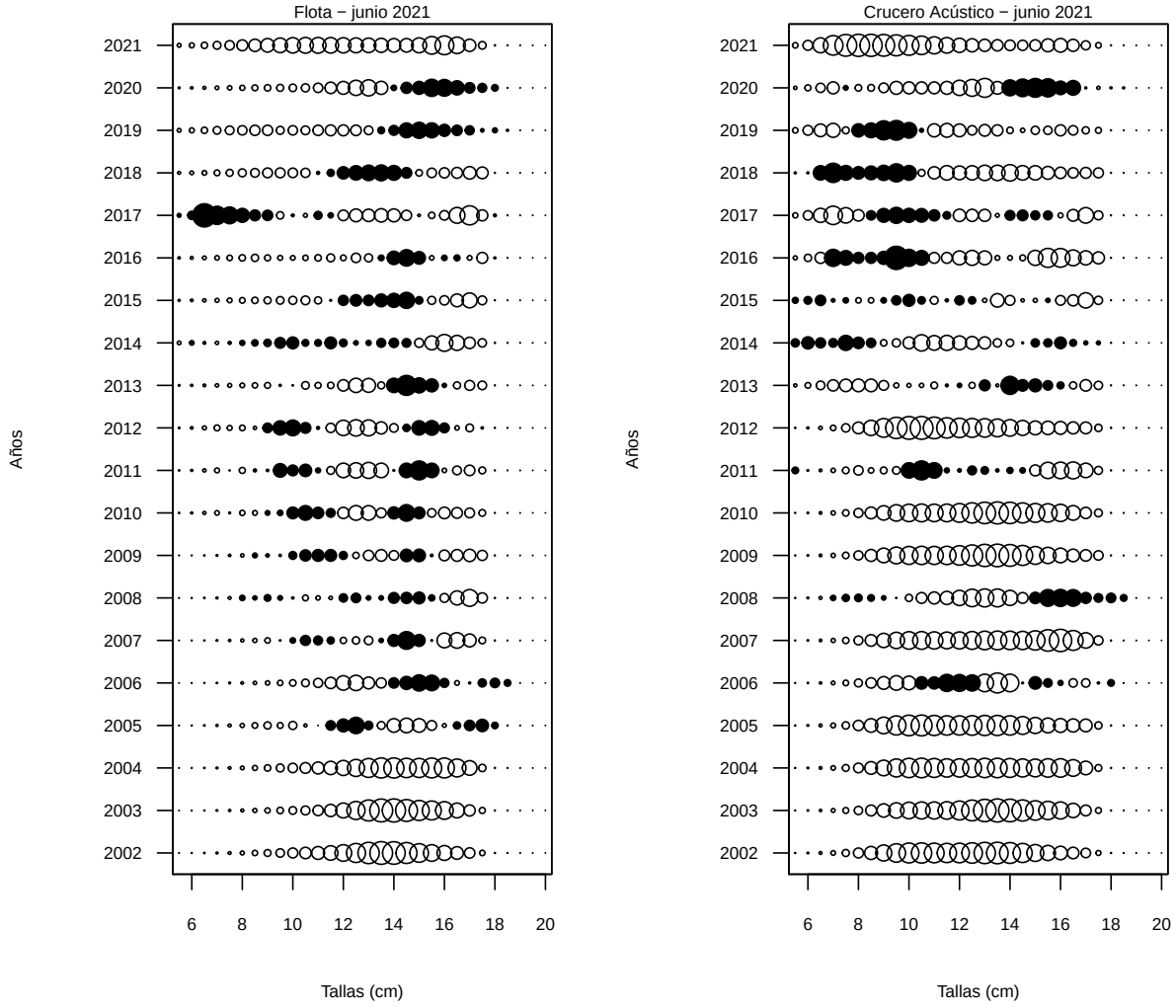
```
#########################################################################################
# AREGLOS DE DATOS
#########################################################################################
age     <-seq(5.5,20,0.5)
nage    <-length(age)

etc_obs_sept <- data.frame(rbind(rep0$Propcru_obs,rep(NA,nage)))
etc_pre_sept <- data.frame(rbind(rep0$Propcru_pred,rep(NA,nage)))

etc_obs_jun <- data.frame(rep1$Propcru_obs)
etc_pre_jun <- rep1$Propcru_pred

yearc   <- rep1$Years
nyearc  <-length(yearc)

 obs      <- as.data.frame(etc_obs_jun) %>% mutate(year=yearc) %>% melt(id.vars='year') %>%
             mutate(edad = rep(age, each=nyearc)) %>% mutate(type='obs')

 pred_jun <- as.data.frame(etc_pre_jun) %>% mutate(year=yearc) %>% melt(id.vars='year') %>%
             mutate(edad = rep(age, each=nyearf)) %>% mutate(type='pred_jun')

 pred_sept <- as.data.frame(etc_pre_sept) %>% mutate(year=yearc) %>% melt(id.vars='year') %>%
              mutate(edad = rep(age, each=nyearf)) %>% mutate(type='pred_sept')

 mat  <- rbind(obs,pred_jun,pred_sept)

#########################################################################################
# GRAFICAS
#########################################################################################
 fig1 <- ggplot(filter(mat, type=='obs')) +
         geom_bar(aes(x = edad, y = value),
                  stat="identity", fill='gray66', color = 'gray28') +
         facet_wrap(~year, dir = 'v', as.table = TRUE) +
         labs(x = 'Tallas', y = 'Proporción de tallas del Crucero') +
         geom_line(data = filter(mat, type=='pred_sept'),
                   aes(x = edad, y = value),color = 'black', size = 1) +
         geom_line(data = filter(mat, type=='pred_jun'),
                   aes(x = edad, y = value),color = 'red', size = 1) +
         theme(panel.background = element_rect(fill ="gray99")) +
         theme(panel.grid=element_line(color=NA))
 fig1
```


2002
2007
2012
2017
2003
2008
2013
2018
2004
2009
2014
2019
2005
2010
2015
2020
2006
2011
2016
2021
0.15
0.10
0.05
0.00
5
10
15
20
Proporción de tallas del Crucero
Tallas

3.4. Análisis de Residuales de Composiciones de tallas

```
par(mfcol=c(1,2))
#Flota
cx<-0.7
#############################################################################################
# Residuales Flota
#############################################################################################
anos        <-rep1$Years
obsF_alt    <-rep1$Propfl_obs
preF_alt    <-rep1$Propfl_pred
resF_alt    <-obsF_alt-preF_alt

rng <-range(resF_alt,na.rm=T)
dd  <-dim(resF_alt)
est <-matrix(NA,nrow=dd[1],ncol=dd[2])

for(j in 1:dd[1]){for(k in 1:dd[2]){val<-resF_alt[j,k]
if(val>0){est[j,k]<-val/rng[2]}
else{est[j,k]<-val/rng[1]*-1}}}

par(mar=c(5.4,6.7,2,1),cex.axis=cx,cex.lab=cx)
image(age,anos,t(est),col=0,yaxt="n",xlab="",ylab="")
ee  <-dim(est)
for(n in 1:ee[1]){for(m in 1:ee[2]){vol<-est[n,m]
if(is.na(vol)==FALSE){
    if(vol>0){points(age[m],anos[n],pch=19,cex=2*sqrt(vol),col=1)}
    if(vol<0){points(age[m],anos[n],pch=1,cex=2*sqrt(vol*-1),col=1)}
}}}
mtext("Flota - junio 2021",side=3,cex=cx)
mtext("Tallas (cm)",side=1,line=3.2,cex=cx);posi<-seq(1,57,by=4)
axis(2,at=anos,labels=anos,las=2,cex=cx)
mtext("Años",side=2,line=4.7,cex=cx)
box()
#############################################################################################
# Residuales Cruceros
#############################################################################################
obsB_alt <-rep1$Propcru_obs
preB_alt <-rep1$Propcru_pred
resB_alt <-obsB_alt-preB_alt

rng <-range(resB_alt,na.rm=T)
dd  <-dim(resB_alt)
est <-matrix(NA,nrow=dd[1],ncol=dd[2])

for(j in 1:dd[1]){for(k in 1:dd[2]){val<-resB_alt[j,k]
if(val>0){est[j,k]<-val/rng[2]}
else{est[j,k]<-val/rng[1]*-1}}}

par(mar=c(5.4,6.7,2,1),cex.axis=cx,cex.lab=cx)
image(age,anos,t(est),col=0,yaxt="n",xlab="",ylab="")
ee  <-dim(est)
for(n in 1:ee[1]){for(m in 1:ee[2]){vol<-est[n,m]
if(is.na(vol)==FALSE){
```

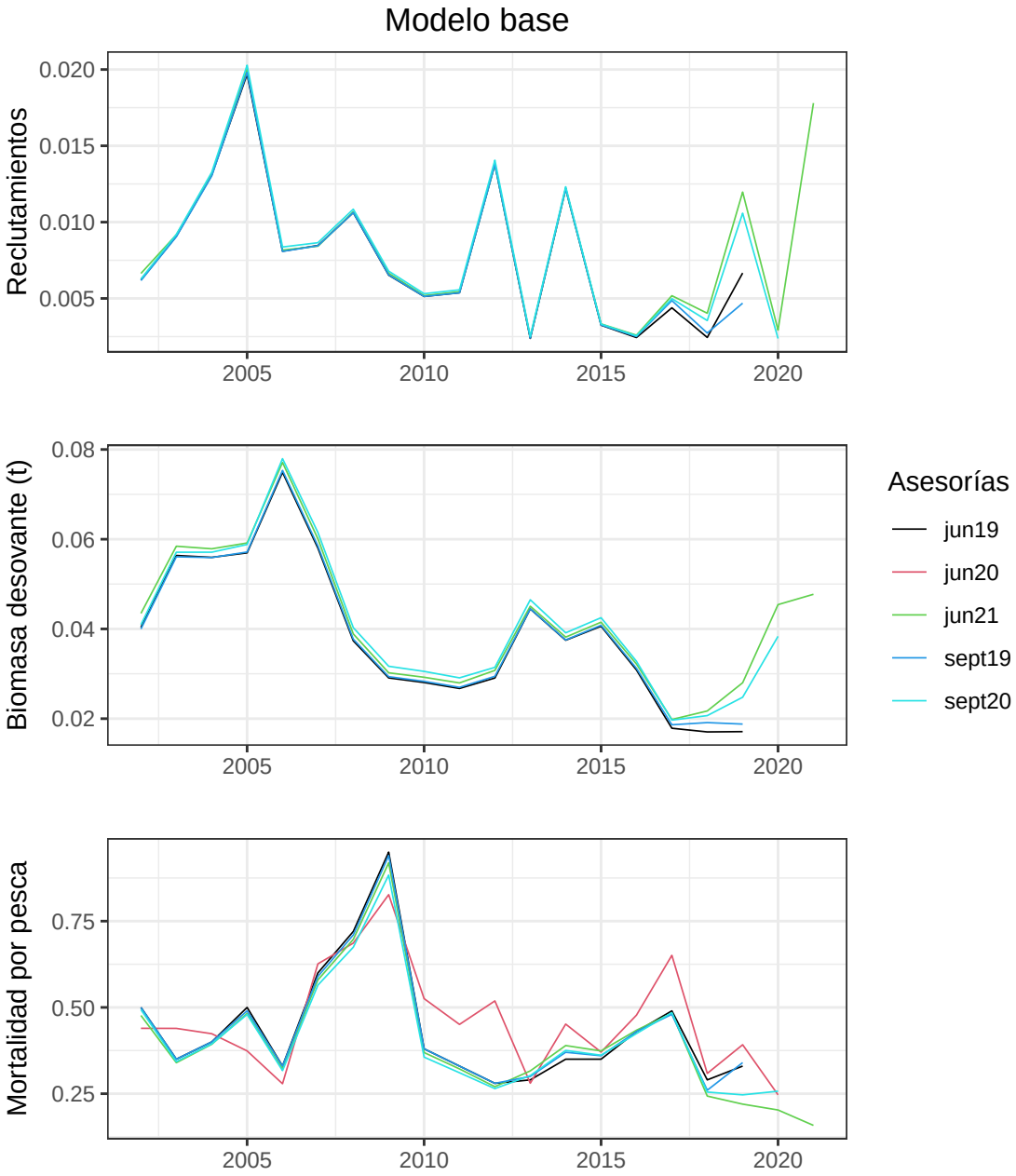
```
    if(vol>0){points(age[m],anos[n],pch=19,cex=2*sqrt(vol),col=1)}
    if(vol<0){points(age[m],anos[n],pch=1,cex=2*sqrt(vol*-1),col=1)}
}}}
mtext("Crucero Acústico - junio 2021",side=3,cex=cx)
mtext("Tallas (cm)",side=1,line=3.2,cex=cx);posi<-seq(1,57,by=4)
axis(2,at=anos,labels=anos,las=2,cex=cx)
mtext("Años",side=2,line=4.7,cex=cx)
box()
```



3.5. Comparación con evaluaciones anteriores

```
#############################################################################################
# AREGLOS DE DATOS
#############################################################################################
years.1   <- data.1$Ind[,1]  ; nyears.1  <- data.1$nanos
years.0   <- data.1$Ind[,1]  ; nyears.0  <- data.1$nanos

R_jun19   <- c(6215,9079,13095,19689,8096,8467,10623,6528,5133,5375,13802,2383,12211,
               3249,2441,4388,2445,6665,NA,NA)
R_sept19  <- c(6174,9049,13026,19810,8084,8452,10630,6544,5134,5369,13770,2410,12176,
               3261,2505,4861,2735,4690,NA,NA)
BD_jun19  <- c(40355,56370,55954,56952,74917,58016,37351,29081,28055,26737,29062,44469,
               37477,40608,30858,17861,17043,17109,NA,NA)
BD_sept19 <- c(39991,56080,55914,57142,75339,58468,37718,29360,28317,26985,29433,44484,
               37546,40817,31226,18630,19126,18793,NA,NA)
F_jun19   <- c(0.5,0.35,0.4,0.5,0.33,0.6,0.72,0.95,0.38,0.33,0.28,0.29,0.35,0.35,0.43,
               0.49,0.29,0.33,NA,NA)
F_sept19  <- c(0.5,0.35,0.4,0.49,0.33,0.59,0.71,0.94,0.38,0.33,0.28,0.3,0.37,0.36,0.43,
               0.48,0.26,0.34,NA,NA)

dat3c <- data.frame(years=years.0,
                    Rt=c(R_jun19),
                    SSBt=c(BD_jun19),
                    Ft=c(F_jun19))%>%
         mutate(Series=rep("jun19",nyears.0))%>%mutate(Modelo=rep("M_base",nyears.0))%>%
         melt(id.var=c('years', 'Series','Modelo'))

dat2c <- data.frame(years=years.0,
                    Rt=c(R_sept19),
                    SSBt=c(BD_sept19),
                    Ft=c(F_sept19))%>%
         mutate(Series=rep("sept19",nyears.0))%>%mutate(Modelo=rep("M_base",nyears.0))%>%
         melt(id.var=c('years', 'Series','Modelo'))

dat1c <- data.frame(years=years.0,
                    Rt=c(rep.0$Reclutamiento,NA),
                    SSBt=c(rep.0$Biomasa_desovante,NA),
                    Ft=c(rep.0$F,NA))%>%
         mutate(Series=rep("jun20",nyears.0))%>%mutate(Modelo=rep("M_base",nyears.0))%>%
         melt(id.var=c('years', 'Series','Modelo'))

dat0c <- data.frame(years=years.0,
                    Rt=c(rep0$Reclutamiento,NA),
                    SSBt=c(rep0$Biomasa_desovante,NA),
                    Ft=c(rep0$F,NA))%>%
         mutate(Series=rep("sept20",nyears.0))%>%mutate(Modelo=rep("M_base",nyears.0))%>%
         melt(id.var=c('years', 'Series','Modelo'))

datc <- data.frame(years=years.1,
                   Rt=c(rep1$Reclutamiento),
                   SSBt=c(rep1$Biomasa_desovante),
                   Ft=c(rep1$F))%>%
         mutate(Series=rep("jun21",nyears.0))%>%mutate(Modelo=rep("M_base",nyears.1))%>%
```

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

data <- data.frame(rbind(dat3c,dat2c,dat1c,dat0c,datc))

#############################################################################################
# GRAFICAS
#############################################################################################
f1<- ggplot(data %>% filter(variable=='Rt',Modelo=='M_base'),
            aes(years,value/10^6)) +
     geom_line(aes(colour=Series), size=0.3)+
     labs(x = '', y = 'Reclutamientos',colour='Asesorías')  +
     scale_x_continuous(breaks = seq(from = 1990, to = 2020, by = 5)) +
     scale_colour_manual(values=seq(1,5,1))+
     theme_bw(base_size=11) +
     ggtitle('Modelo base')+
     theme(plot.title = element_text(hjust = 0.5),legend.position="none")

f2<- ggplot(data %>% filter(variable=='SSBt',Modelo=='M_base'),
            aes(years,value/10^6)) +
     geom_line(aes(colour=Series), size=0.3)+
     labs(x = '', y = 'Biomasa desovante (t)',colour='Asesorías')  +
     scale_x_continuous(breaks = seq(from = 1990, to = 2020, by = 5)) +
     scale_colour_manual(values=seq(1,5,1))+
     theme_bw(base_size=11) +
     theme(plot.title = element_text(hjust = 0.5),legend.position="right")

f3<- ggplot(data %>% filter(variable=='Ft',Modelo=='M_base'),
            aes(years,value)) +
     geom_line(aes(colour=Series), size=0.3)+
     labs(x = '', y = 'Mortalidad por pesca',colour='Asesorías')  +
     scale_x_continuous(breaks = seq(from = 1990, to = 2020, by = 5)) +
     scale_colour_manual(values=seq(1,5,1))+
     theme_bw(base_size=11) +
     theme(plot.title = element_text(hjust = 0.5),legend.position="none")

 (f1/f2/f3)
```


Modelo base
Reclutamientos
0.020
0.015
0.010
0.005
2005
2010
2015
2020
Biomasa desovante (t)
0.08
0.06
0.04
0.02
Mortalidad por pesca
0.75
0.50
0.25
Asesorías
jun19
jun20
jun21
sept19
sept20

3.6. Análisis retrospectivo

```
years<-rep1$Years
nyears<-length(years)

Rt1      <- subset(std1,name=="Reclutas")$value
Rt1std   <- subset(std1,name=="Reclutas")$std
BT1      <- subset(std1,name=="BT")$value
BT1std   <- subset(std1,name=="BT")$std
BD1      <- subset(std1,name=="BD")$value
BD1std   <- subset(std1,name=="BD")$std
Ft1      <- subset(std1,name=="log_F")$value
Ft1std   <- subset(std1,name=="log_F")$std

VarPob_jun<- data.frame(x=years, Rt1=Rt1,BT1=BT1,BD1=BD1,Ft1=exp(Ft1),
         lowerRt1 = (Rt1 -1.96*Rt1std), upperRt1 = (Rt1+1.96*Rt1std),
         lowerBT1 = (BT1 -1.96*BT1std), upperBT1 = (BT1+1.96*BT1std),
         lowerBD1 = (BD1 -1.96*BD1std), upperBD1 = (BD1+1.96*BD1std),
         lowerFt1 = exp(Ft1 -1.96*Ft1std), upperFt1 = exp(Ft1+1.96*Ft1std))
```

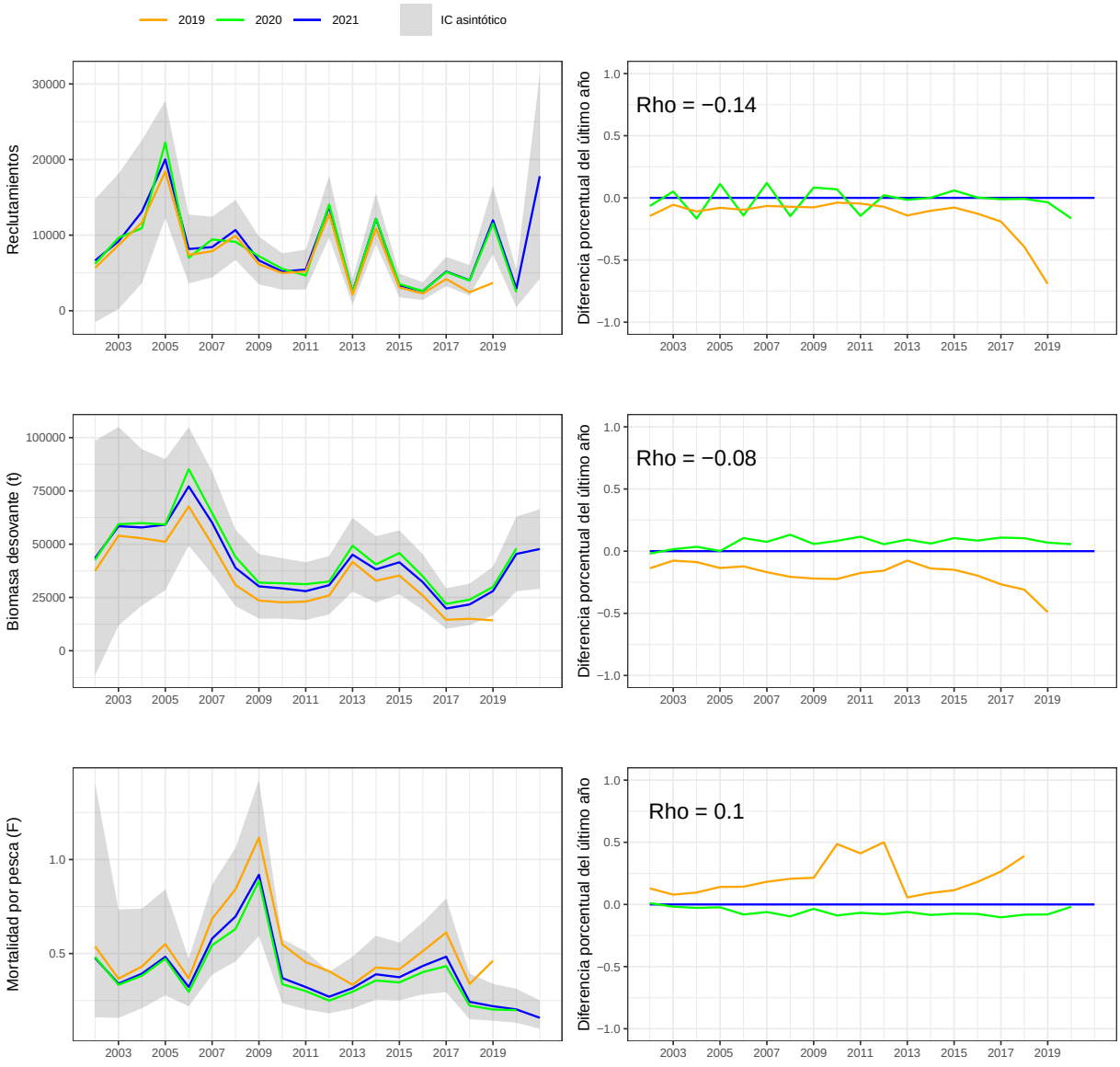
```
#########################################################################################
# AREGLOS DE DATOS
#########################################################################################
dir<-paste(dir.0,"/RetrospectivobaseJun",sep="")
setwd(dir)
admb<-"MTT0621"
#########################################################################################

years       <- rep1$Years
nyears      <- length(years)
retros      <- seq(1,3)
nretros     <- length(retros)
year_retros <- as.factor(years[(nyears-(nretros-1)):nyears])

retroR      <- matrix(0,nrow=nyears,ncol=nretros+1)
retroBD     <- matrix(0,nrow=nyears,ncol=nretros+1)
retroF      <- matrix(0,nrow=nyears,ncol=nretros+1)

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

#########################################################################################
# retrospectivo relativo (cálculo)
#########################################################################################
    mohn.r       <- rep(NA, nretros)
    rel.diff.r   <- matrix(NA, nrow=nyears, ncol=(nretros))
    mohn.ssb     <- rep(NA, nretros)
    rel.diff.ssb <- matrix(NA, nrow=nyears, ncol=(nretros))
    mohn.f       <- rep(NA, nretros)
    rel.diff.f   <- matrix(NA, nrow=nyears, ncol=(nretros))
```

```
    for(j in 1:nretros){
      rel.diff.r[,j]   <- (retroR[,(j+1)]-retroR[,2])/retroR[,2]
      mohn.r[j]        <- rel.diff.r[(nyears-j),j]
      rel.diff.ssb[,j] <- (retroBD[,(j+1)]-retroBD[,2])/retroBD[,2]
      mohn.ssb[j]      <- rel.diff.ssb[(nyears-j),j]
      rel.diff.f[,j]   <- (retroF[,(j+1)]-retroF[,2])/retroF[,2]
      mohn.f[j]        <- rel.diff.f[(nyears-j),j]}

    ave.mohn.r    <- mean(mohn.r)
    ave.mohn.ssb  <- mean(mohn.ssb)
    ave.mohn.f    <- mean(mohn.f)

##############################################################################################
# Para retrospectivo tradicional
##############################################################################################
Rt_retro <- data.frame(x=years,
                       y1=retroR[,2],
                       y2=retroR[,3],
                       y3=retroR[,4],
                       lower = (Rt1 -1.96*Rt1std),
                       upper = (Rt1+1.96*Rt1std))
BD_retro <- data.frame(x=years,
                       y1=retroBD[,2],
                       y2=retroBD[,3],
                       y3=retroBD[,4],
                       lower = (BD1 -1.96*BD1std),
                       upper = (BD1+1.96*BD1std))
Ft_retro <- data.frame(x=years,
                       y1=retroF[,2],
                       y2=retroF[,3],
                       y3=retroF[,4],
                       lower = exp(Ft1-1.96*Ft1std),
                       upper = exp(Ft1+1.96*Ft1std))

##############################################################################################
# Para restrospectivo relativo
##############################################################################################
Rt_retroRel <- data.frame(x=years,
                          y1=rel.diff.r[,1],
                          y2=rel.diff.r[,2],
                          y3=rel.diff.r[,3])
BD_retroRel <- data.frame(x=years,
                          y1=rel.diff.ssb[,1],
                          y2=rel.diff.ssb[,2],
                          y3=rel.diff.ssb[,3])
Ft_retroRel <- data.frame(x=years,
                          y1=rel.diff.f[,1],
                          y2=rel.diff.f[,2],
                          y3=rel.diff.f[,3])
```

```
##############################################################################################
# GRAFICAS
##############################################################################################
#Retrospectivo tradicional
```

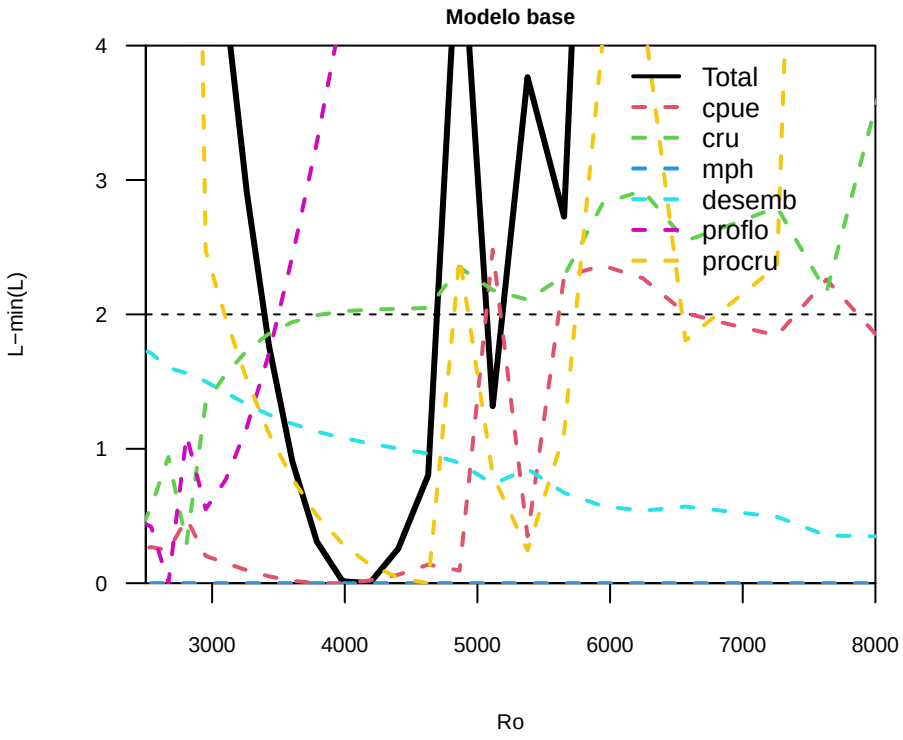
```
##############################################################################################
Rt <- ggplot(Rt_retro) +
      geom_ribbon(aes(ymin=lower, ymax=upper, x=x, fill = "IC asintótico"), alpha = 0.2)+
      geom_line(aes(y=y1, x=x, colour = year_retros[nretros]), size=0.5)+
      geom_line(aes(y=y2, x=x, colour = year_retros[nretros-1]), size=0.5)+
      geom_line(aes(y=y3, x=x, colour = year_retros[nretros-2]), size=0.5)+
      labs(x = '', y = 'Reclutamientos ',colour='Asesorías')  +
      scale_x_continuous(breaks = seq(from = 1995, to = 2020, by = 2)) +
      scale_colour_manual("",values=c("orange","green","blue","red","black"))+
      scale_fill_manual("",values=c("grey30"))+
      theme_bw(base_size=8) +
      ggtitle('')+
      theme(plot.title = element_text(hjust = 0.5),legend.position="top")

BD <- ggplot(BD_retro) +
      geom_ribbon(aes(ymin=lower, ymax=upper, x=x, fill = ""), alpha = 0.2)+
      geom_line(aes(y=y1, x=x, colour = year_retros[nretros]), size=0.5)+
      geom_line(aes(y=y2, x=x, colour = year_retros[nretros-1]), size=0.5)+
      geom_line(aes(y=y3, x=x, colour = year_retros[nretros-2]), size=0.5)+
      labs(x = '', y = 'Biomasa desovante (t)',colour='Asesorías')  +
      scale_x_continuous(breaks = seq(from = 1995, to = 2020, by = 2)) +
      scale_colour_manual("",values=c("orange","green","blue","red","black"))+
      scale_fill_manual("",values=c("grey30"))+
      theme_bw(base_size=8) +
      ggtitle('')+
      theme(plot.title = element_text(hjust = 0.5),legend.position="none")

Ft <- ggplot(Ft_retro) +
      geom_ribbon(aes(ymin=lower, ymax=upper, x=x, fill = ""), alpha = 0.2)+
      geom_line(aes(y=y1, x=x, colour = year_retros[nretros]), size=0.5)+
      geom_line(aes(y=y2, x=x, colour = year_retros[nretros-1]), size=0.5)+
      geom_line(aes(y=y3, x=x, colour = year_retros[nretros-2]), size=0.5)+
      labs(x = '', y = 'Mortalidad por pesca (F)',colour='Asesorías')  +
      scale_x_continuous(breaks = seq(from = 1995, to = 2020, by = 2)) +
      scale_colour_manual("",values=c("orange","green","blue","red","black"))+
      scale_fill_manual("",values=c("grey30"))+
      theme_bw(base_size=8) +
      ggtitle('')+
      theme(plot.title = element_text(hjust = 0.5),legend.position="none")

##############################################################################################
#Retrospectivo relativo
##############################################################################################
Rtrel <- ggplot(Rt_retroRel) + lims(y=c(-1,1)) +
    geom_line(aes(y=y1, x=x, colour = year_retros[nretros]), size=0.5)+
    geom_line(aes(y=y2, x=x, colour = year_retros[nretros-1]), size=0.5)+
    geom_line(aes(y=y3, x=x, colour = year_retros[nretros-2]), size=0.5)+
   annotate("text", x=2004, y=0.75,label=paste("Rho =",round(ave.mohn.r,2))) +
    labs(x = '', y = 'Diferencia porcentual del último año',colour='Asesorías')  +
    scale_x_continuous(breaks = seq(from = 1995, to = 2020, by = 2)) +
    scale_colour_manual("",values=c("orange","green","blue","red","black"))+
    scale_fill_manual("",values=c("grey30"))+
    theme_bw(base_size=8) +
```

```
     ggtitle('')+
     theme(plot.title = element_text(hjust = 0.5),legend.position="none")

BDrel <- ggplot(BD_retroRel) + lims(y=c(-1,1)) +
     geom_line(aes(y=y1, x=x, colour = year_retros[nretros]), size=0.5)+
    geom_line(aes(y=y2, x=x, colour = year_retros[nretros-1]), size=0.5)+
    geom_line(aes(y=y3, x=x, colour = year_retros[nretros-2]), size=0.5)+
   annotate("text", x=2004, y=0.75,label=paste("Rho =",round(ave.mohn.ssb,2))) +
    labs(x = '', y = 'Diferencia porcentual del último año',colour='Asesorías')  +
    scale_x_continuous(breaks = seq(from = 1995, to = 2020, by = 2)) +
    scale_colour_manual("",values=c("orange","green","blue","red","black"))+
    scale_fill_manual("",values=c("grey30"))+
    theme_bw(base_size=8) +
     ggtitle('')+
     theme(plot.title = element_text(hjust = 0.5),legend.position="none")

Ftrel <- ggplot(Ft_retroRel) + lims(y=c(-1,1)) +
    geom_line(aes(y=y1, x=x, colour = year_retros[nretros]), size=0.5)+
    geom_line(aes(y=y2, x=x, colour = year_retros[nretros-1]), size=0.5)+
    geom_line(aes(y=y3, x=x, colour = year_retros[nretros-2]), size=0.5)+
   annotate("text", x=2004, y=0.75,label=paste("Rho =",round(ave.mohn.f,2))) +
    labs(x = '', y = 'Diferencia porcentual del último año',colour='Asesorías')  +
    scale_x_continuous(breaks = seq(from = 1995, to = 2020, by = 2)) +
    scale_colour_manual("",values=c("orange","green","blue","red","black"))+
    scale_fill_manual("",values=c("grey30"))+
    theme_bw(base_size=8) +
    ggtitle('')+
    theme(plot.title = element_text(hjust = 0.5),legend.position="none")

Rt/BD/Ft |Rtrel/BDrel/Ftrel
```


2019
2020
2021
IC asintótico
Reclutamientos
Biomasa desovante (t)
Mortalidad por pesca (F)
Diferencia porcentual del último año
Rho = −0.14
Rho = −0.08
Rho = 0.1

3.7. Perfil de verosimilitud

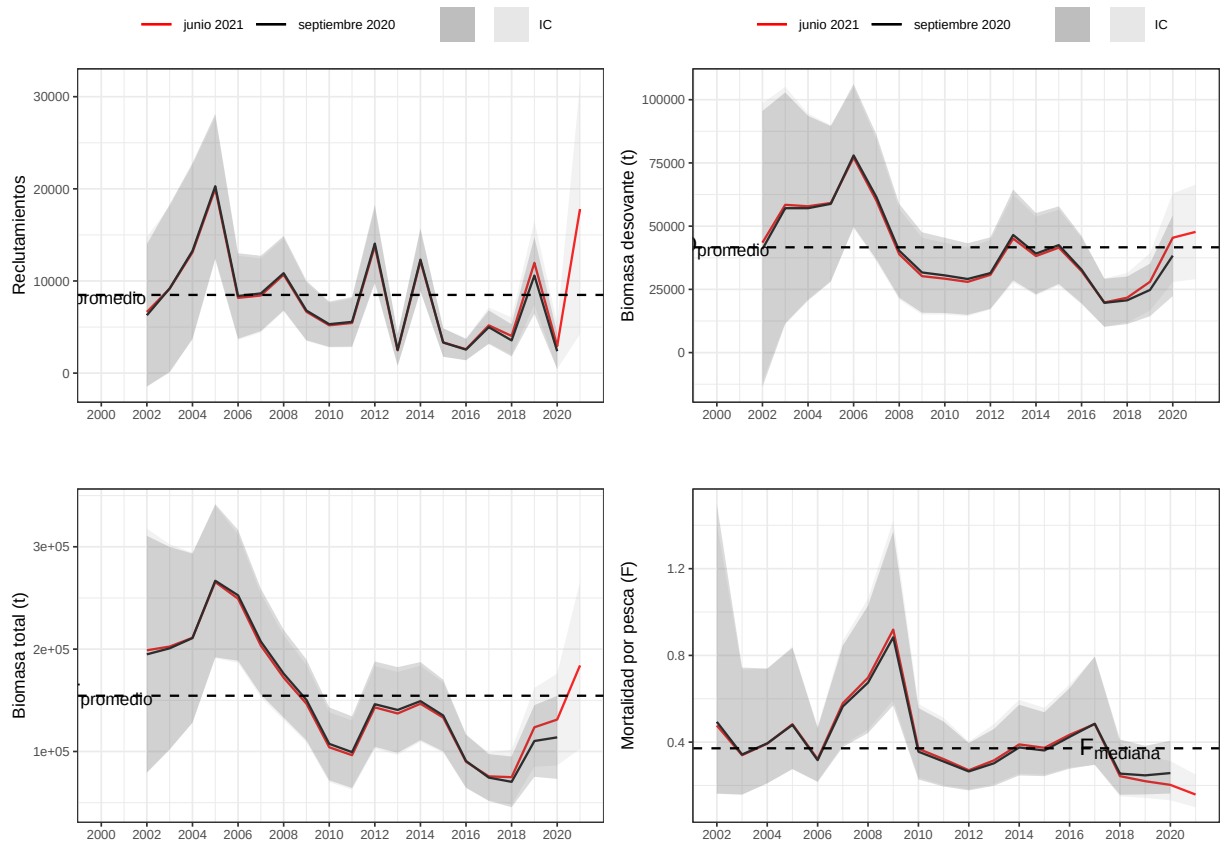
```
#########################################################################################
# AREGLOS DE DATOS
#########################################################################################
admb<-"MTT0621"
dir<-paste(dir.0,"/VerosimilitudbaseJun",sep="")
setwd(dir)
#########################################################################################
  casos <-35
  logRo    <- rep(0,casos)
  likeval  <- matrix(ncol=9,nrow=casos)
  slikeval <- matrix(ncol=10,nrow=casos)

  for(i in 1:casos){
    rep         <- reptoRlist(paste(admb,"s",i,".rep",sep=""))
    data        <- readLines(paste(admb,"s",i,".dat", sep=''),encoding="UTF-8")
    logRo[i]    <- as.numeric(data[161])
    likeval[i,] <- rep$Likeval}
  #=======================================================================================
  # SEXTO PASO: ESTANDARIZAR VEROSIMILITUD
  #=======================================================================================
  like    <- data.frame(round(likeval,3),Total=apply(likeval,1,sum))
  minLik  <- apply(like,2,min)                          # busca el minimo
  for(i in 1:10){slikeval[,i]<-like[,i]-minLik[i]}    # Estandarizacin
  #=======================================================================================
  # ULTIMO PASO: GUARDAR TABLAS Y FIGURA
  #=======================================================================================
  names<-c("Ro","cpue", "cru","mph",    "desemb",   "proflo",   "procru",
           "desvRo",    "desNo",    "Lo", "Total")
  # Tabla verosimilitud
  TLk1 <- data.frame(exp(logRo),like);
  colnames(TLk1)<-names
  # Tabla estandarizada
  TLk2 <- data.frame(exp(logRo),slikeval);
  colnames(TLk2)<-names

#########################################################################################
# GRAFICAS
#########################################################################################
  par(mar=c(4,4,1,1)+0.5)
  plot(TLk2$Ro,TLk2$Total,type="l",lwd=3,ylim=c(0,4),xlim=c(2500,8000),
       xaxs= "i",yaxs= "i", ylab="L-min(L)",xlab="Ro", las=1,
       main="Modelo base",cex.main=0.7,cex.axis=0.7,cex.lab=0.7)
  abline(h=2,col=1,lty=2)
   for(i in 2:7){
  lines(TLk2$Ro,TLk2[,i],col=i,lty=2,lwd=2)}
  legend(6000,4,names[c(11,2:7)],col=1:8,lty=c(1,rep(2,7)),
          lwd=2,bty="n",cex=0.8)
```


Modelo base
L−min(L)
Ro
Total
cpue
cru
mph
desemb
proflo
procru
0
1
2
3
4
3000
4000
5000
6000
7000
8000

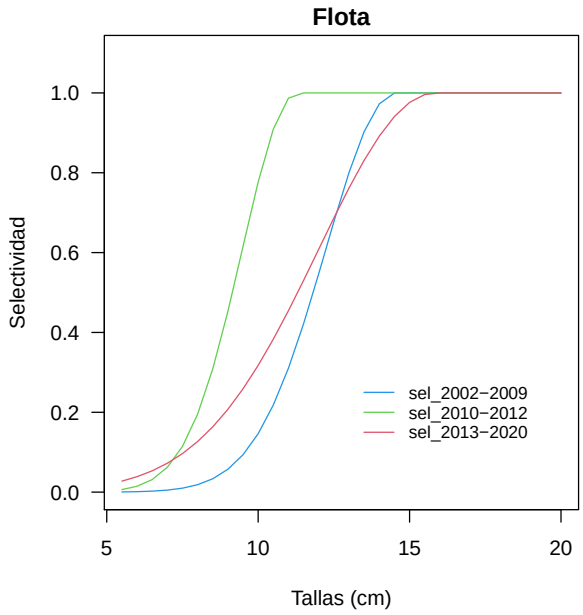
3.8. Sensibilidad a la actualización de datos

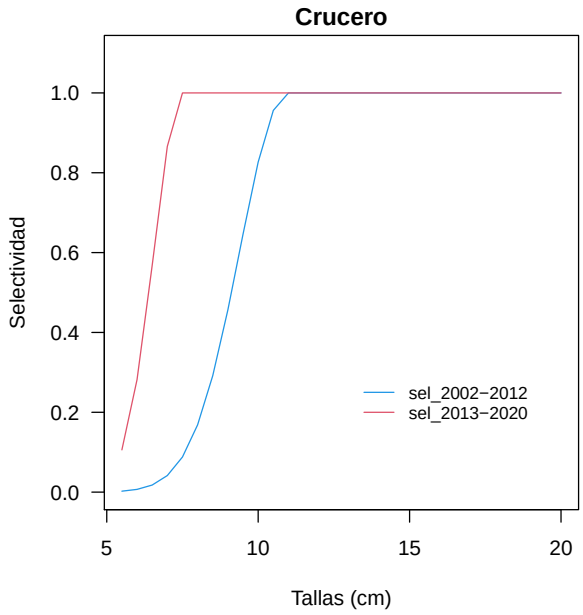
4. RESULTADOS OBJETIVO 2

4.1. Indicadores del stock

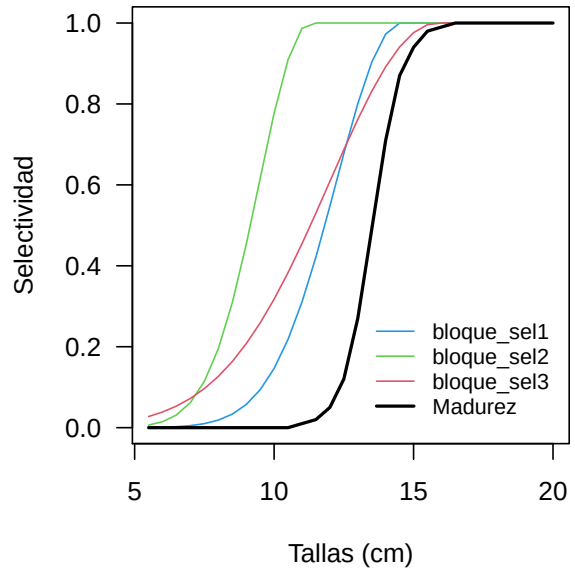


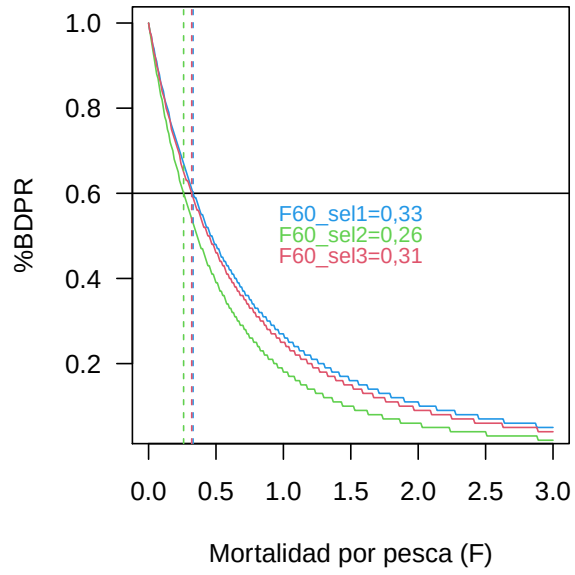

```
par(mfrow=c(1,2),mar=c(4,4,1,1)+0.5)

# ASESORÍA JUNIO 2021
plot(rep1$Tallas,rep1$Selflo_talla[1,],type="l",las=1,col=4,ylim=c(0,1.1),
     ylab="Selectividad",xlab="Tallas (cm)",main="Flota")
lines(rep1$Tallas,rep1$Selflo_talla[9,],type="l",col=3)
lines(rep1$Tallas,rep1$Selflo_talla[nyears1,],type="l",col=2)
legend(13,0.3,c("sel_2002-2009","sel_2010-2012","sel_2013-2020"),
       col=c(4,3,2),lwd=c(1,1,1),cex=0.8,bty="n")

# ASESORÍA JUNIO 2021
plot(rep1$Tallas,rep1$Selcru_talla[1,],type="l",las=1,col=4,ylim=c(0,1.1),
     ylab="Selectividad",xlab="Tallas (cm)",main="Crucero")
lines(rep1$Tallas,rep1$Selcru_talla[nyears1,],type="l",col=2)
legend(13,0.3,c("sel_2002-2012","sel_2013-2020"),
       col=c(4,2),lwd=c(1,1),cex=0.8,bty="n")
```





4.2. Estados de explotación





5. RESULTADOS OBJETIVO 3