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

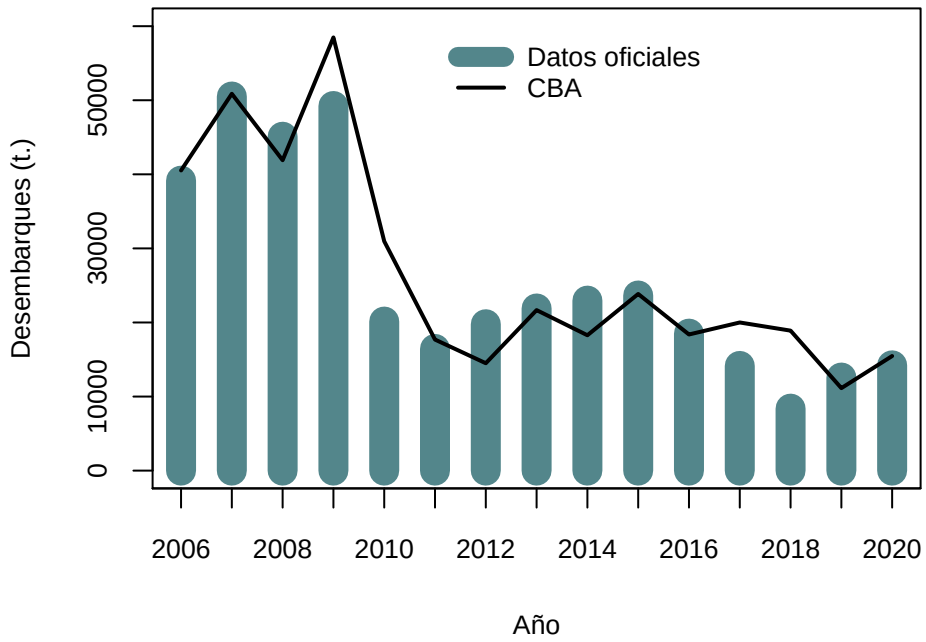
```
setwd(dir.1)
###############################################################################################
# MODELO BASE
###############################################################################################
#modelo base junio 2020 - Hito 2
data0b        <- lisread(paste(dir.1,"MTT0520.dat", 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

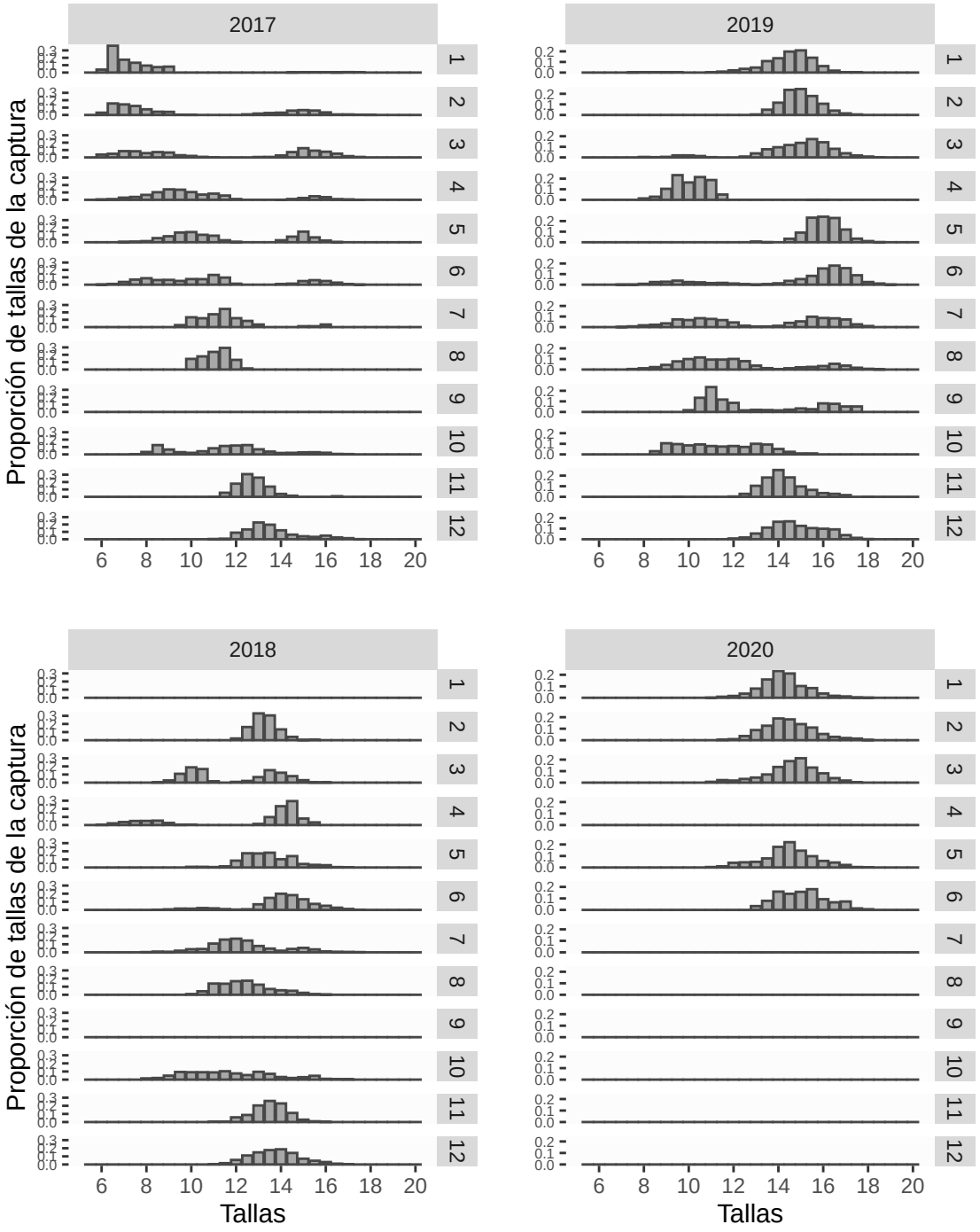
1. Antecedentes

```
year<-seq(2006,2020,1)
desemb<-c(39146,50506,45078,49225,20123,16429,19763,21888,22951,23643,18495,14134,8366,12565,14213)
cuota<-c(40522,50872,41904,58481,30966,17693,14500,21670,18276,23848,18380,20000,18897,11137,15471)


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(2000,2021,2
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)
```



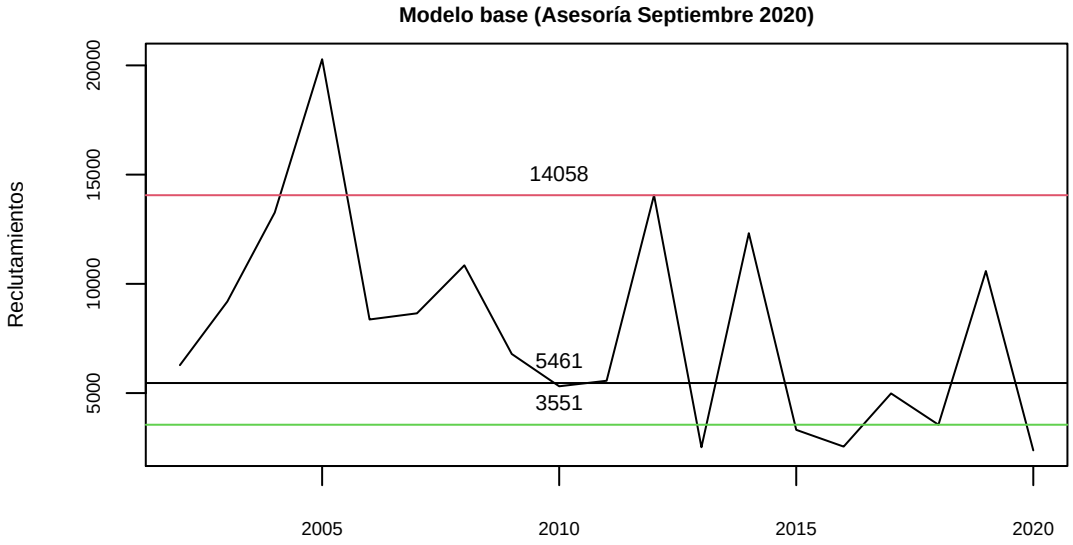

```
datafrec<-read.table(paste(getwd(),"/Tallasmensuales.txt",sep=""),header = FALSE, sep = "")

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
0.0
0.1
0.2
0.3

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
```

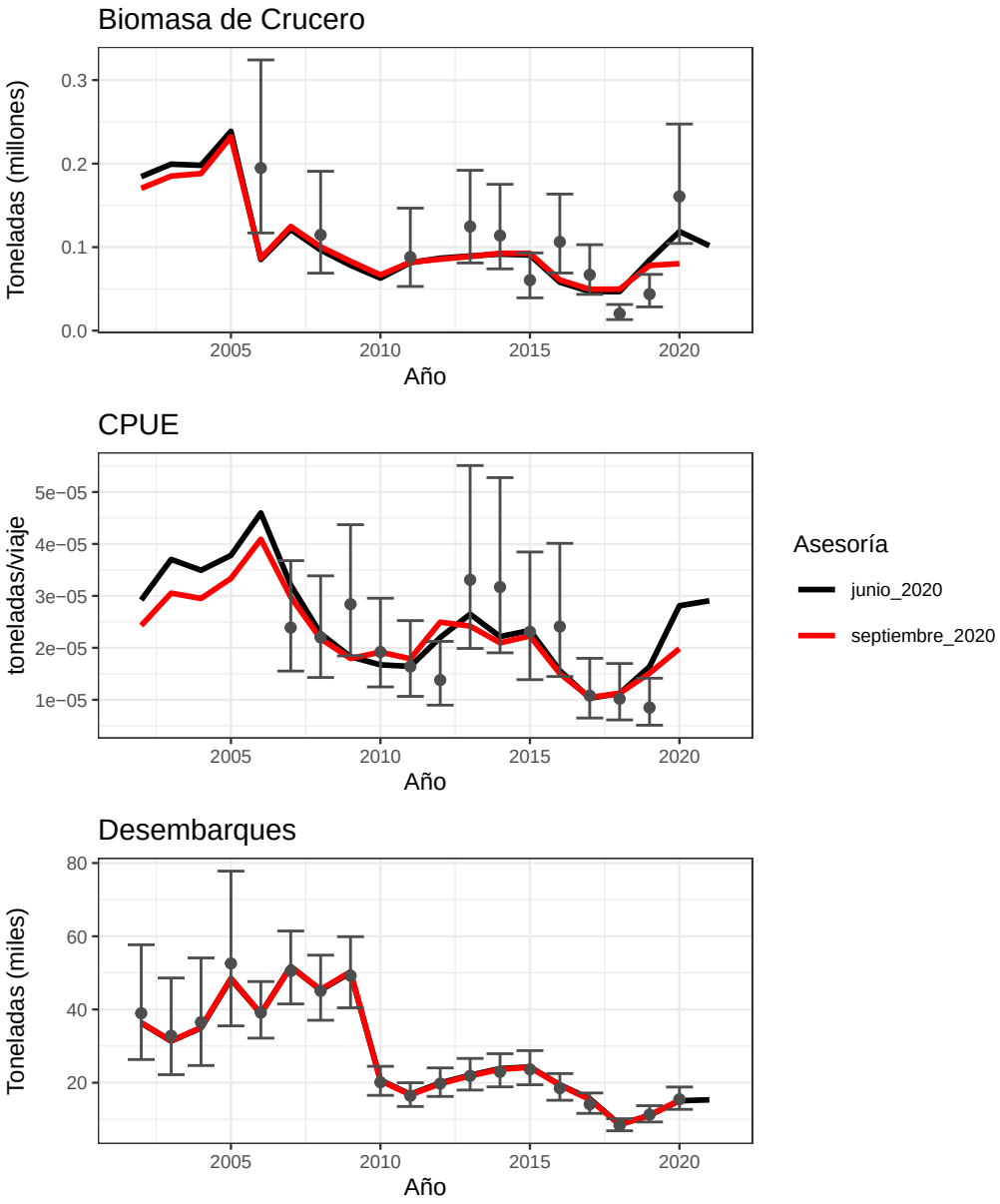


3. RESULTADOS OBJETIVO 1

3.1. Ajustes del modelo a los datos de índices

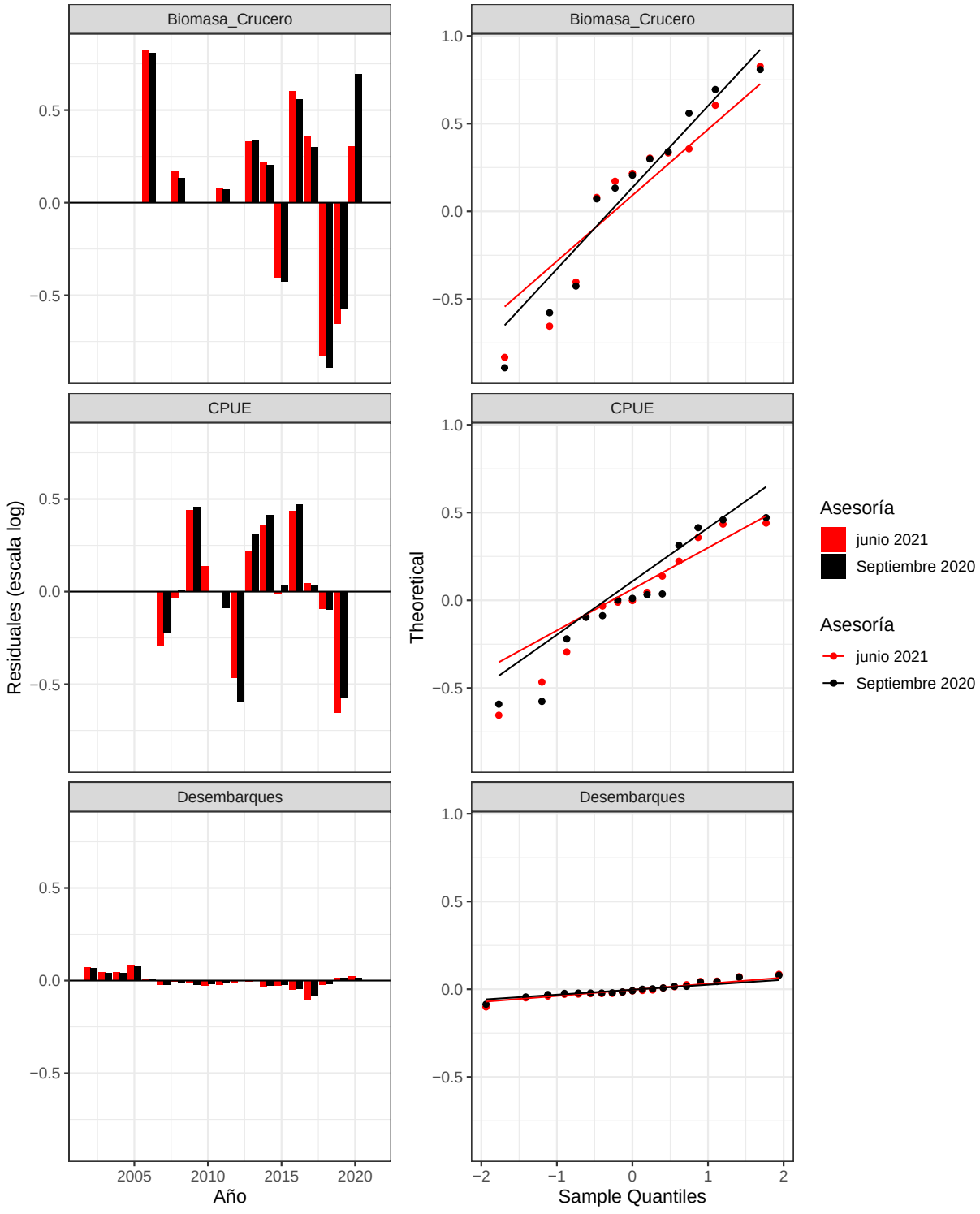
```
##################################################################################################
# AREGLOS DE DATOS
##################################################################################################

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)
```

```r
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

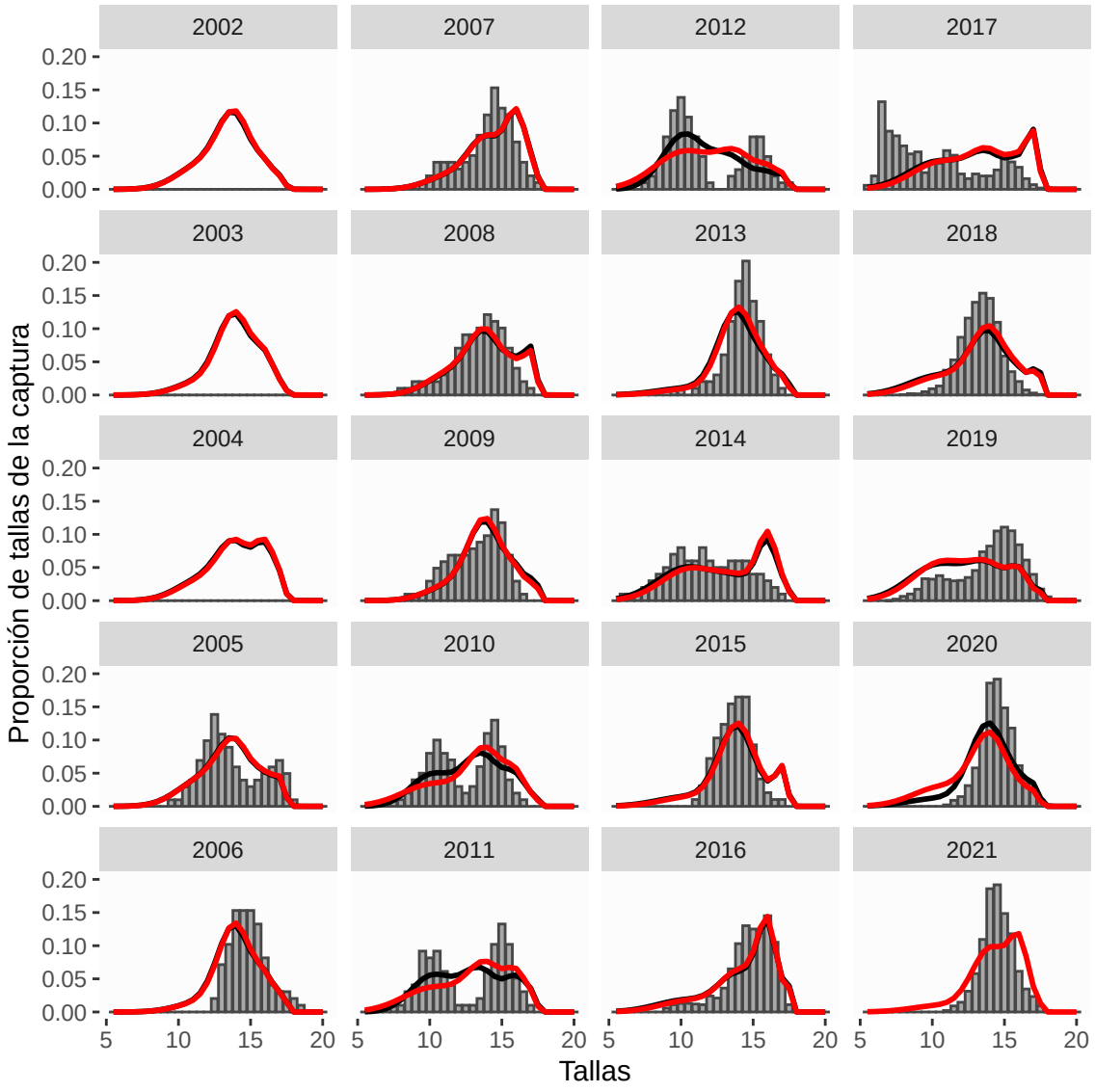
```
#############################################################################################
# AREGLOS DE DATOS
#############################################################################################

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)
Año
Theoretical
Sample Quantiles
Asesoría
junio 2021
Septiembre 2020
Asesoría
junio 2021
Septiembre 2020

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

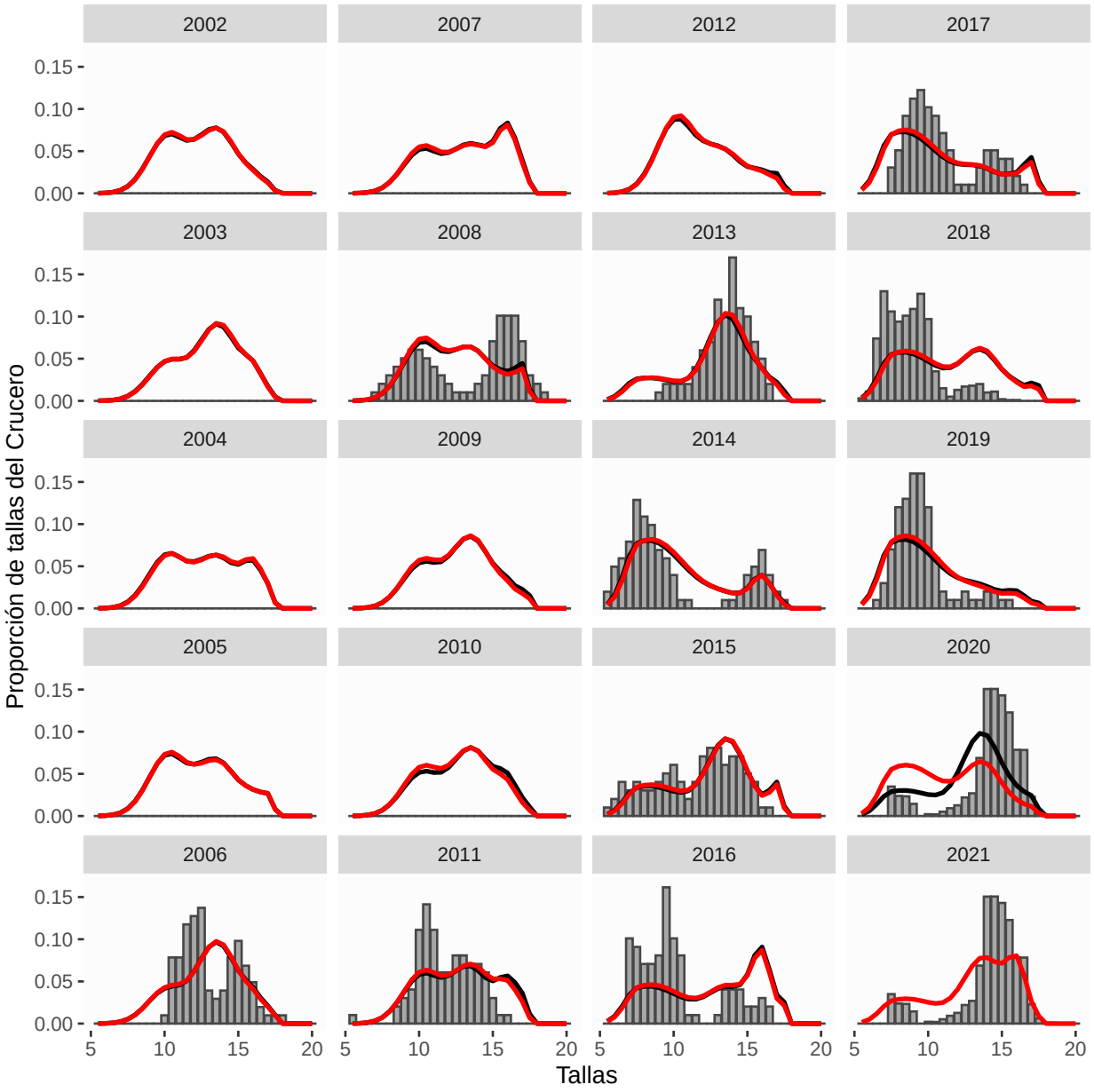
FLOTA

```
#################################################################################################
# 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
Proporción de tallas de la captura
0.20
0.15
0.10
0.05
0.00
5
10
15
20
Tallas

CRUCERO

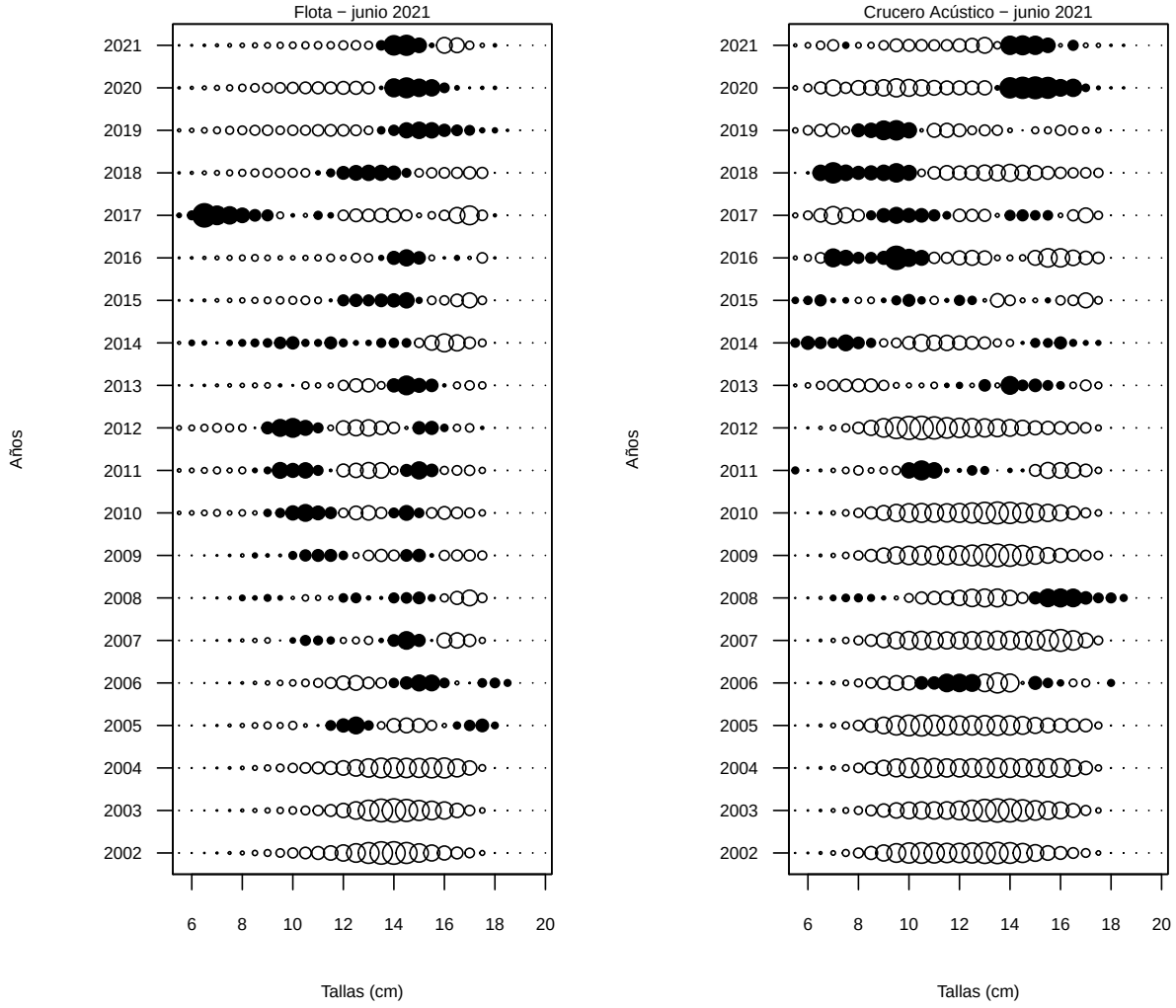
```
#############################################################################################
# AREGLOS DE DATOS
#############################################################################################
age     <-seq(5.5,20,0.5)
nage    <-length(age)

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){
```

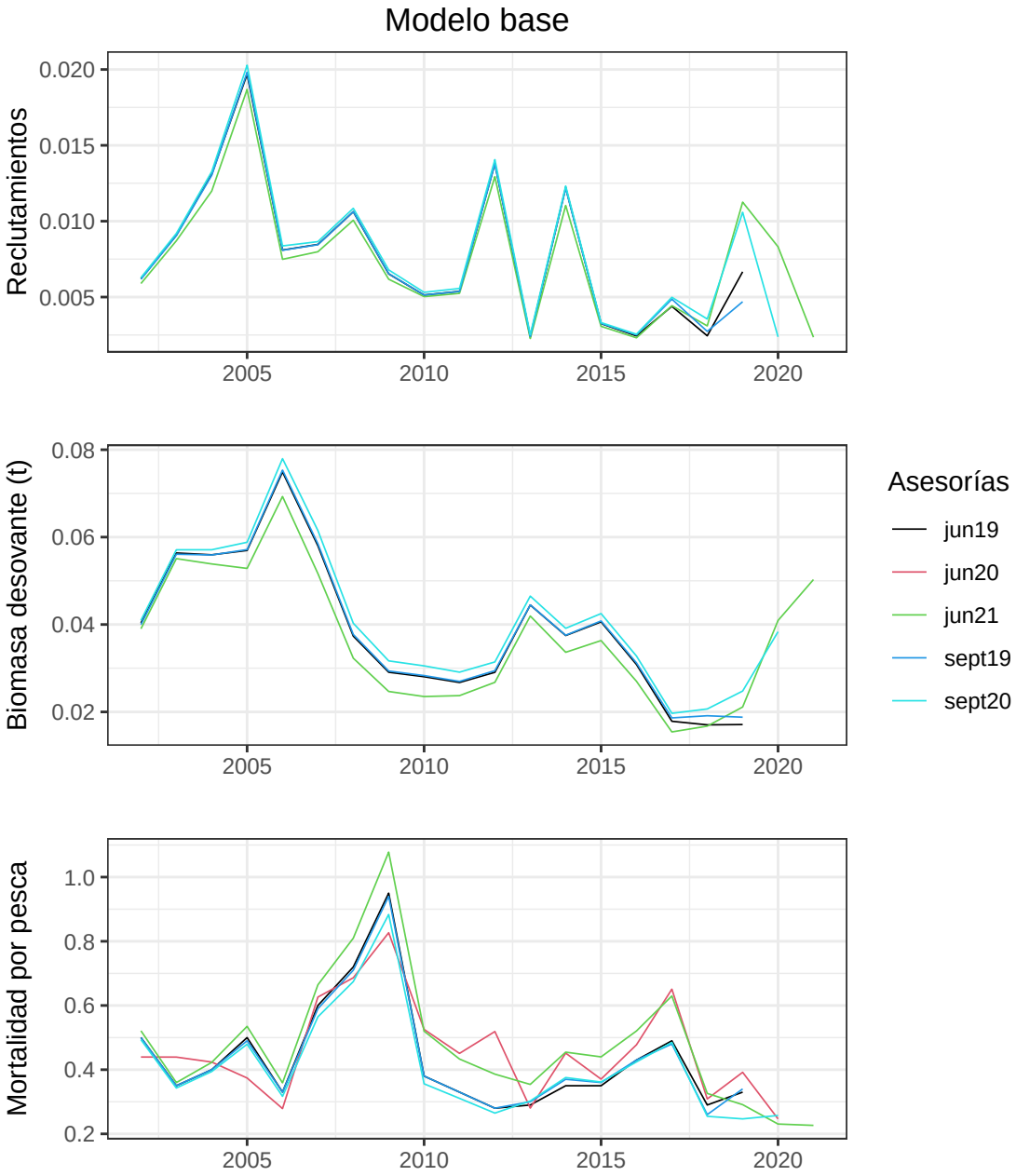
```
    if(vol>0){points(age[m],anos[n],pch=19,cex=2*sqrt(vol),col=1)}
    if(vol<0){points(age[m],anos[n],pch=1,cex=2*sqrt(vol*-1),col=1)}
}}}
mtext("Crucero Acústico - junio 2021",side=3,cex=cx)
mtext("Tallas (cm)",side=1,line=3.2,cex=cx);posi<-seq(1,57,by=4)
axis(2,at=anos,labels=anos,las=2,cex=cx)
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
1.0
0.8
0.6
0.4
0.2
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))
```

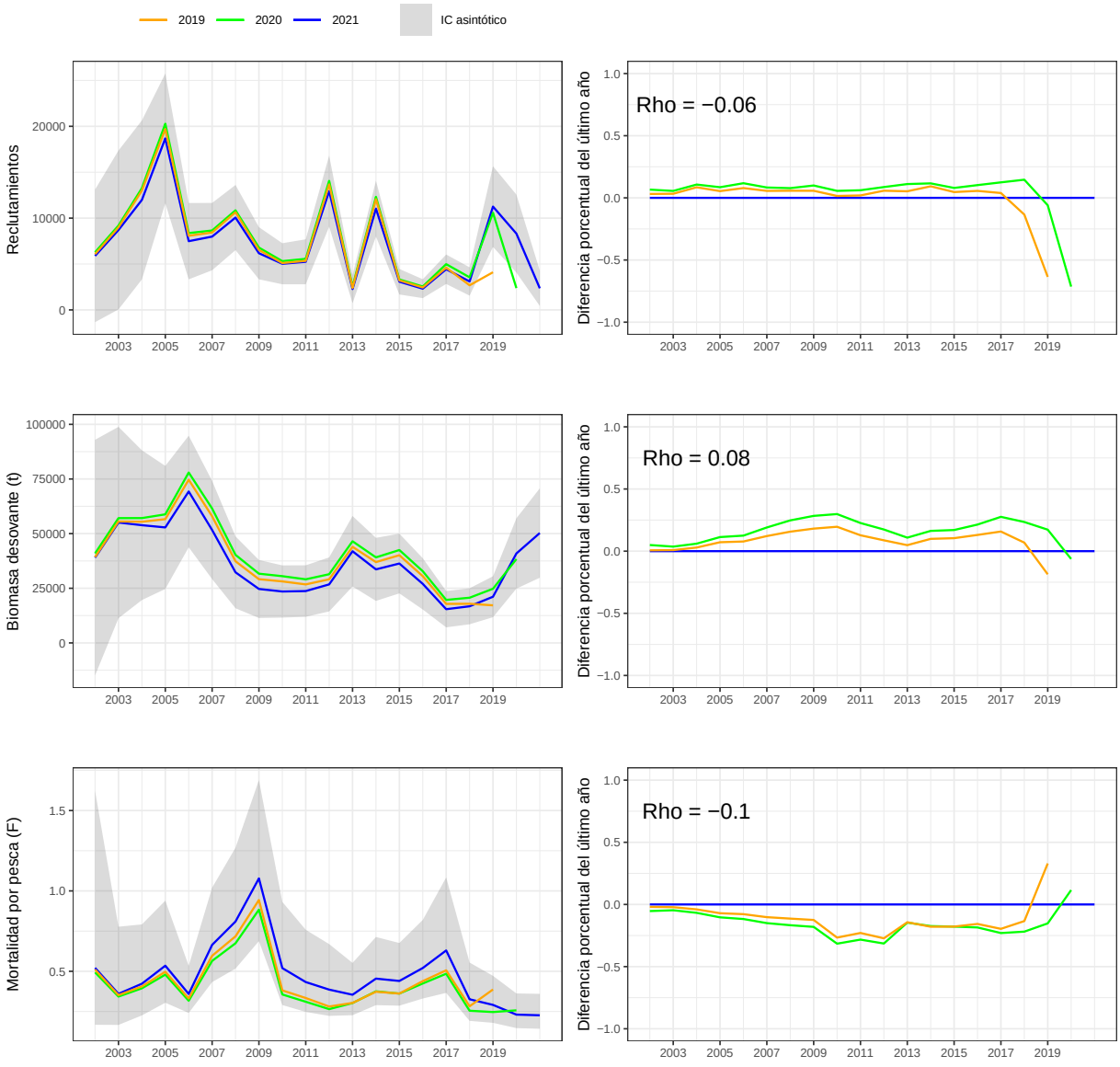
```
#########################################################################################
# AREGLOS DE DATOS
#########################################################################################
dir<-paste(dir.0,"/RetrospectivobaseJun",sep="")
setwd(dir)
admb<-"MTT0621"
#####################################################################################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

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
```

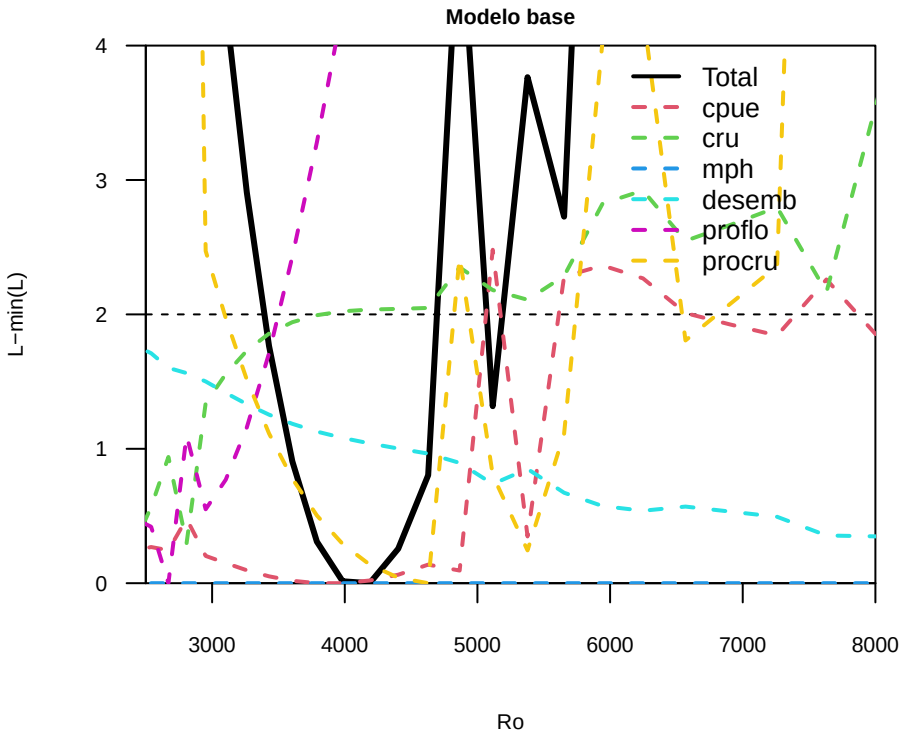
```
#############################################################################################
Rt <- ggplot(Rt_retro) +
      geom_ribbon(aes(ymin=lower, ymax=upper, x=x, fill = "IC asintótico"), alpha = 0.2)+
      geom_line(aes(y=y1, x=x, colour = year_retros[nretros]), size=0.5)+
      geom_line(aes(y=y2, 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
Diferencia porcentual del último año
Rho = −0.06
Biomasa desovante (t)
Rho = 0.08
Mortalidad por pesca (F)
Rho = −0.1

3.7. Perfil de verosimilitud

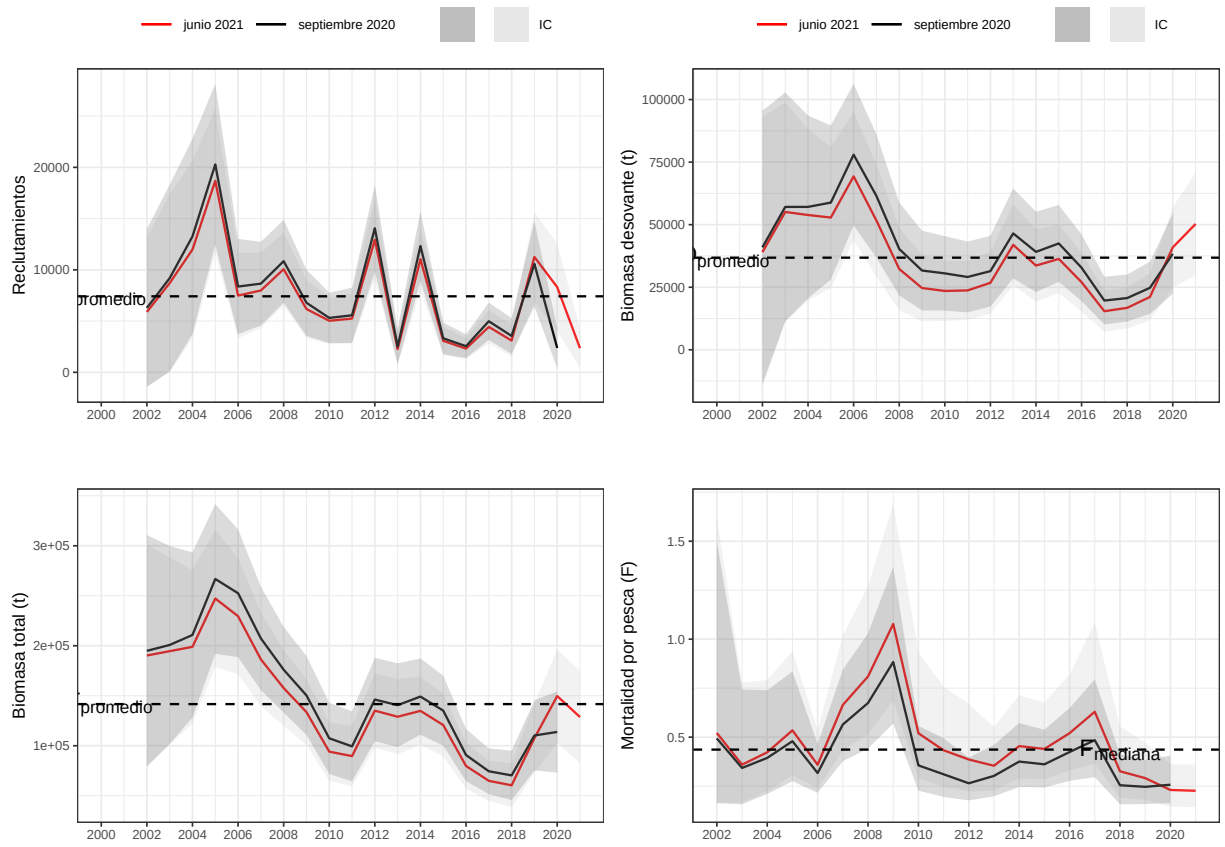
```
#########################################################################################
# AREGLOS DE DATOS
#########################################################################################
admb<-"MTT0621"
dir<-paste(dir.0,"/VerosimilitudbaseJun",sep="")
setwd(dir)
#####################################################################################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

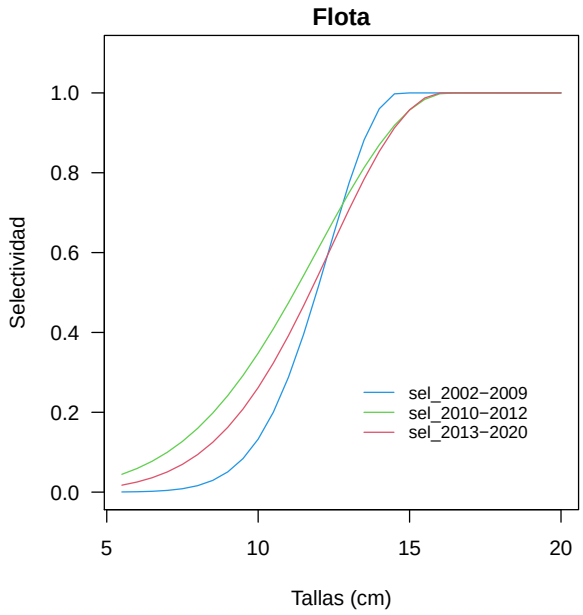
3.8. Sensibilidad a la actualización de datos

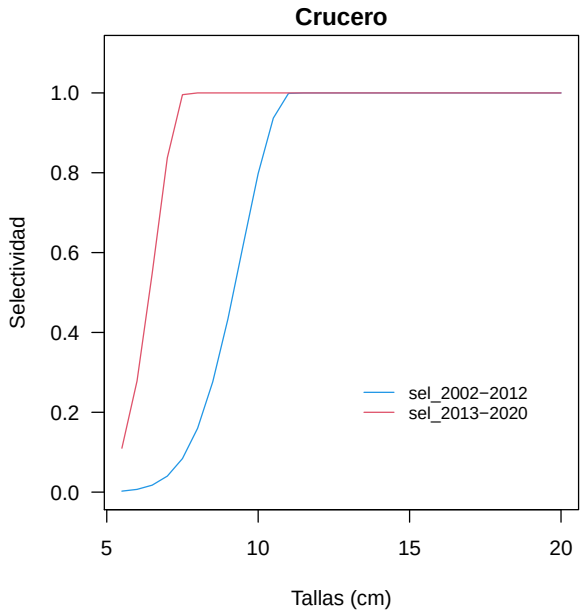
4. RESULTADOS OBJETIVO 2

4.1. Indicadores del stock

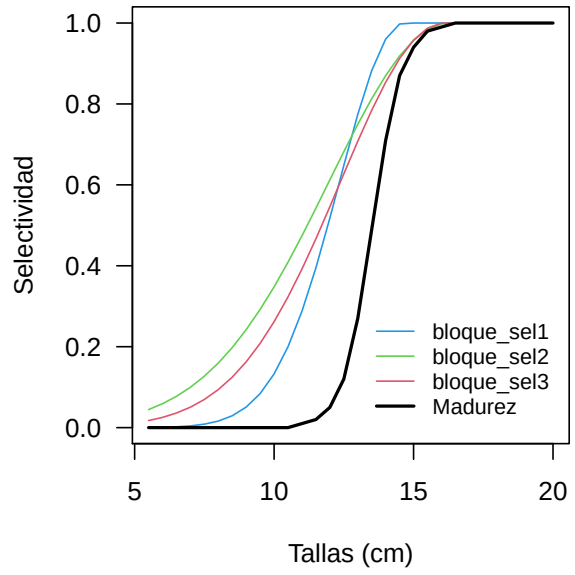


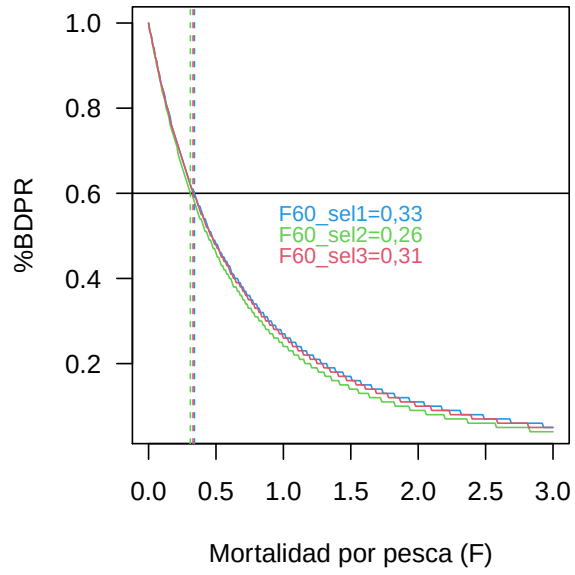

```
par(mfrow=c(1,2),mar=c(4,4,1,1)+0.5)

# 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



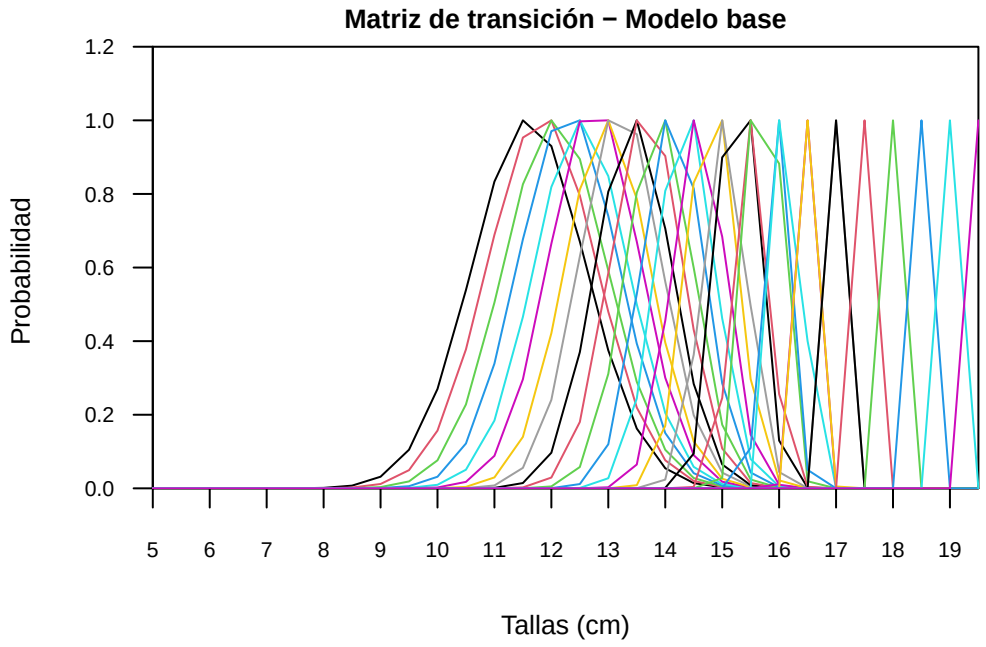


5. RESULTADOS OBJETIVO 3

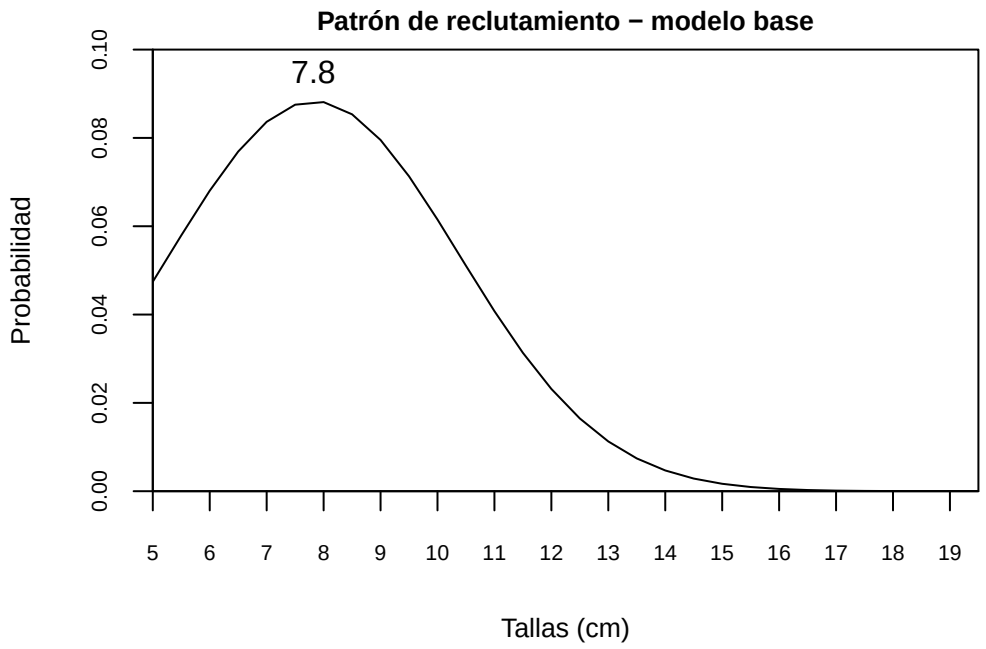
6. RESULTADOS OBJETIVO 4

6.1. Matriz de transición de crecimiento talla-talla (Modelo base)

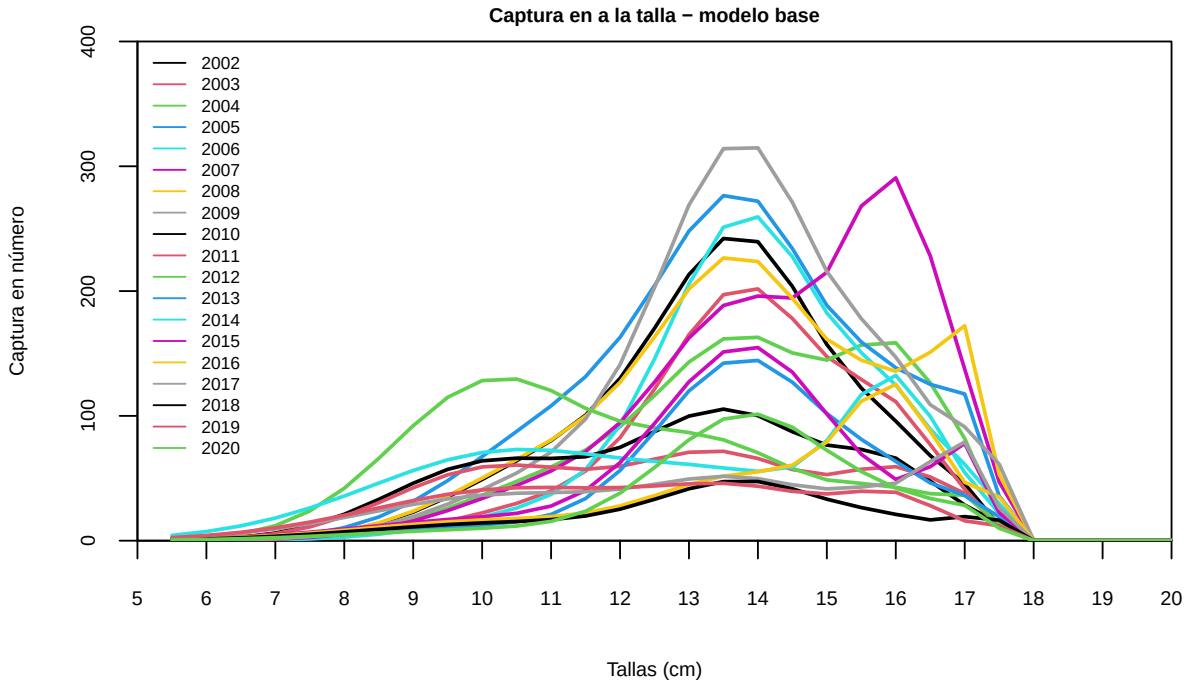
```
# Clave edad talla -------------------------------------------
# Arreglos
yrs     <- rep0$Years
nyrs    <- length(yrs)
tallas  <- seq(5,19.5,0.5)
ntallas <- length(tallas)
age     <- seq(0,4,1)
nage    <- length(age)

x  <-c(yrs,rev(yrs))
x1 <-c(yrs[1],yrs[nyrs]+1,nyrs+1/2) #xaxp
x2 <-c(yrs[1]-1,yrs[nyrs]+1) #xlim

par(mfrow=c(1,1),mar=c(4,4,1,1)+0.5,oma=c(0,0,0,0))
plot(tallas,rep0$MatrizTrans[1,],type="n",las=1, ylim=c(0, 1.2),cex.axis=0.7,cex.lab=0.8,cex.main=0.8, 
ylab="Probabilidad ",xlab="Tallas (cm)",main="Matriz de transición - Modelo base", xaxp=c(3,20,34/2))
for(i in 1:ntallas){lines(tallas,rep0$MatrizTrans[i,]/max(rep0$MatrizTrans[i,]),col=i)}
```




```
par(mfrow=c(1,1),mar=c(4,4,1,1)+0.5,oma=c(0,0,0,0))
plot(tallas,rep0$Fun_rec_talla,type="l",ylab="Probabilidad",xlab="Tallas (cm)",
     main="Patrón de reclutamiento - modelo base",
     ylim=c(0,0.1),xaxp=c(3,20,34/2),cex.axis=0.7,cex.lab=0.8,cex.main=0.8,
     xaxs= "i",yaxs= "i",)
     text(exp(2.119)-0.5,0.095,round(exp(2.119)-0.5,1))
```



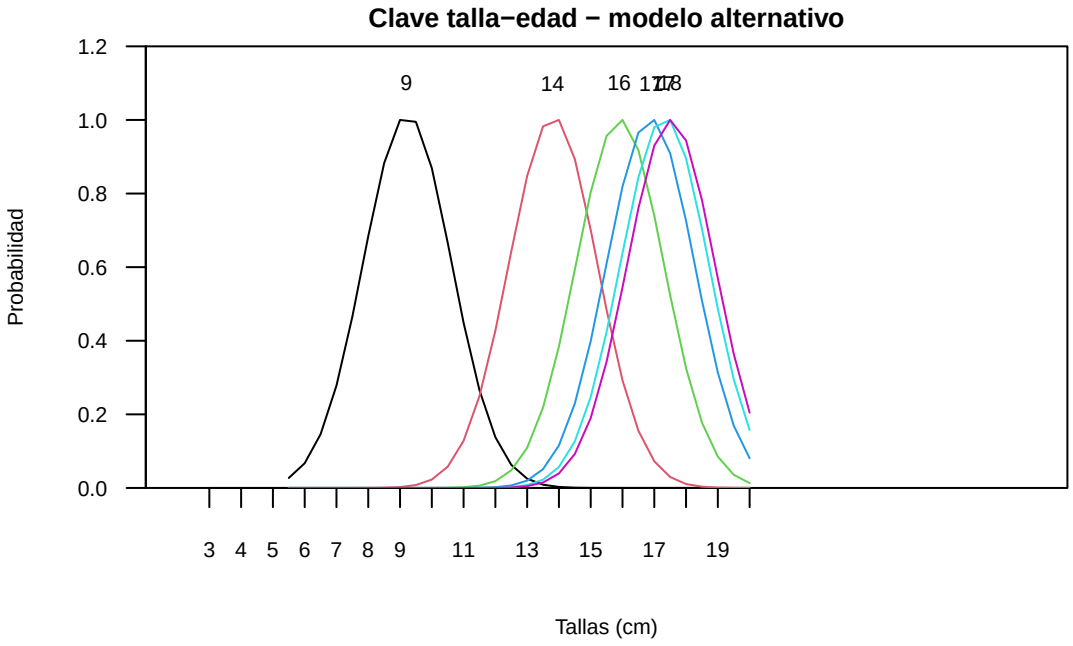

```
tallas     <- seq(5.5,20,0.5)
ntallas    <- length(tallas)
N          <- rep0$pred_Ctot
year       <- data.0$Ind[,1]
nyear      <- length(year)

par(mfrow=c(1,1),mar=c(4,4,1,1)+0.5)
plot(tallas,N[1,],type="l",ylab="Captura en número", xlab="Tallas (cm)",
     ylim=c(0,400),xlim=c(5,20),main="Captura en a la talla - modelo base",
     xaxp=c(3,20,34/2),cex.lab=0.7,cex.axis=0.7,cex.main=0.7, xaxs= "i",yaxs= "i")
for(i in 1:19){
  lines(tallas,N[i,],col=i,lwd=2)}
  legend(5,400,year,col=1:19,lwd=1,bty="n",cex=0.6)
```




```
age     <-seq(5.5,20,0.5)
nage    <-length(age)

etf_obs <- data.frame(rep0$Abundancia_talla)
yearf   <- rep0$Years
nyearf  <- length(yearf)

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

  fig1 <- ggplot(filter(mat, type=='obs')) +
          geom_bar(aes(x = edad, y = value), stat="identity", fill='gray66', color = 'gray28')+
          labs(title="Modelo base",x = 'Tallas', y = 'Abundancia total') +
          theme(panel.background = element_rect(fill ="gray99")) +
          theme(panel.grid=element_line(color=NA))
  fig1
```

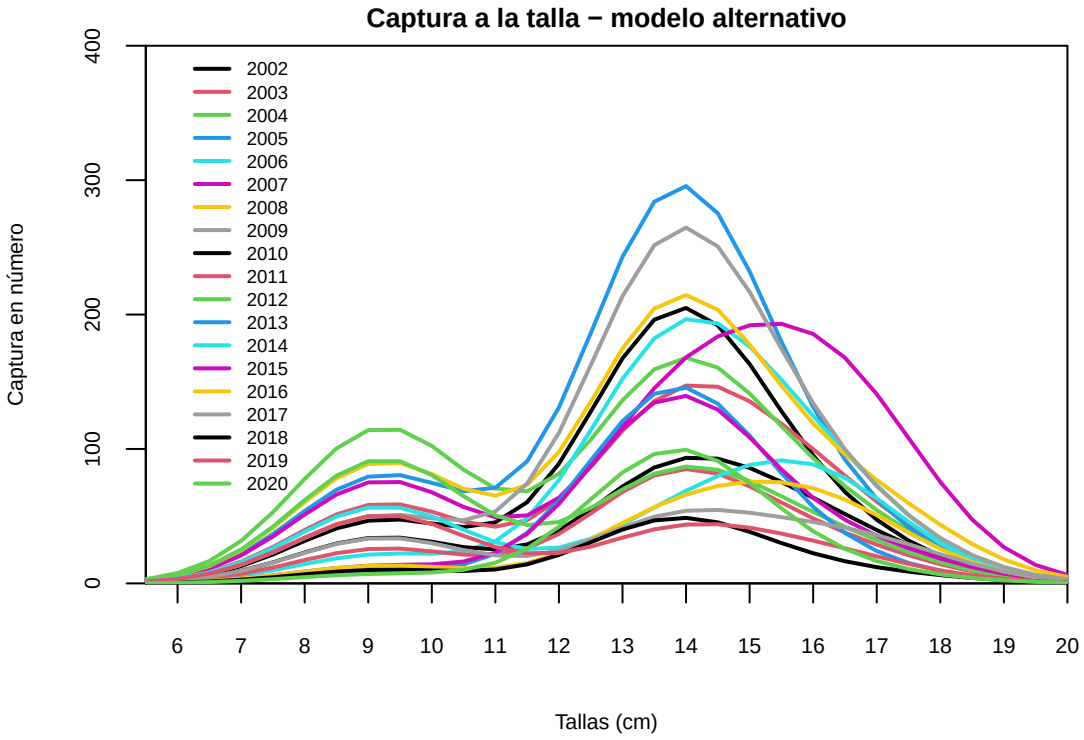
6.2. Clave talla-edad simulada en modelo alternativo

```
# Clave edad talla ------------------------------------------
# Arreglos
yrs     <- rep.0$YRS
nyrs    <- length(yrs)
tallas  <- data0$Tallas
ntallas <- length(tallas)
age     <- data0$Edades
nage    <- length(age)

x  <-c(yrs,rev(yrs))
x1 <-c(yrs[1],yrs[nyrs]+1,nyrs+1/2) #xaxp
x2 <-c(yrs[1]-1,yrs[nyrs]+1) #xlim

  par(mfrow=c(1,1),mar=c(4,4,1,1)+0.5,oma=c(0,0,0,0))
  plot(tallas,rep1$Prob_talla[1,],type="n",las=1, ylim=c(0, 1.2),
       cex.lab=0.7,cex.axis=0.7,cex.main=0.8,
       ylab="Probabilidad",xlab="Tallas (cm)",main="Clave talla-edad - modelo alternativo",
       xaxp=c(3,20,34/2), xaxs= "i",yaxs= "i",)
  for(i in 1:nage){lines(tallas,rep.0$Prob_talla[i,]/max(rep.0$Prob_talla[i,]),col=i)}
  text(round(rep.0$mu_edad,1),1.1,round(rep.0$mu_edad,0),cex=0.7)
```




```
tallas     <-seq(5.5,20,0.5)
ntallas    <-length(tallas)
N          <-rep.0$Capt_age
year      <-data0$Ind[,1]
nyear     <-length(year)

par(mfrow=c(1,1),mar=c(4,4,1,1)+0.5)
plot(tallas,N[1,],type="l",ylab="Captura en número",xlab="Tallas (cm)",ylim=c(0,400),
     main="Captura a la talla - modelo alternativo",
```

```
    cex.lab=0.7,cex.axis=0.7,cex.main=0.8,xaxp=c(3,20,34/2),xaxs= "i",yaxs= "i",)
for(i in 1:19){
  lines(tallas,N[i,],col=i,lwd=2)}
  legend(6,400,year,col=1:19,lwd=2,bty="n",cex=0.6)
```

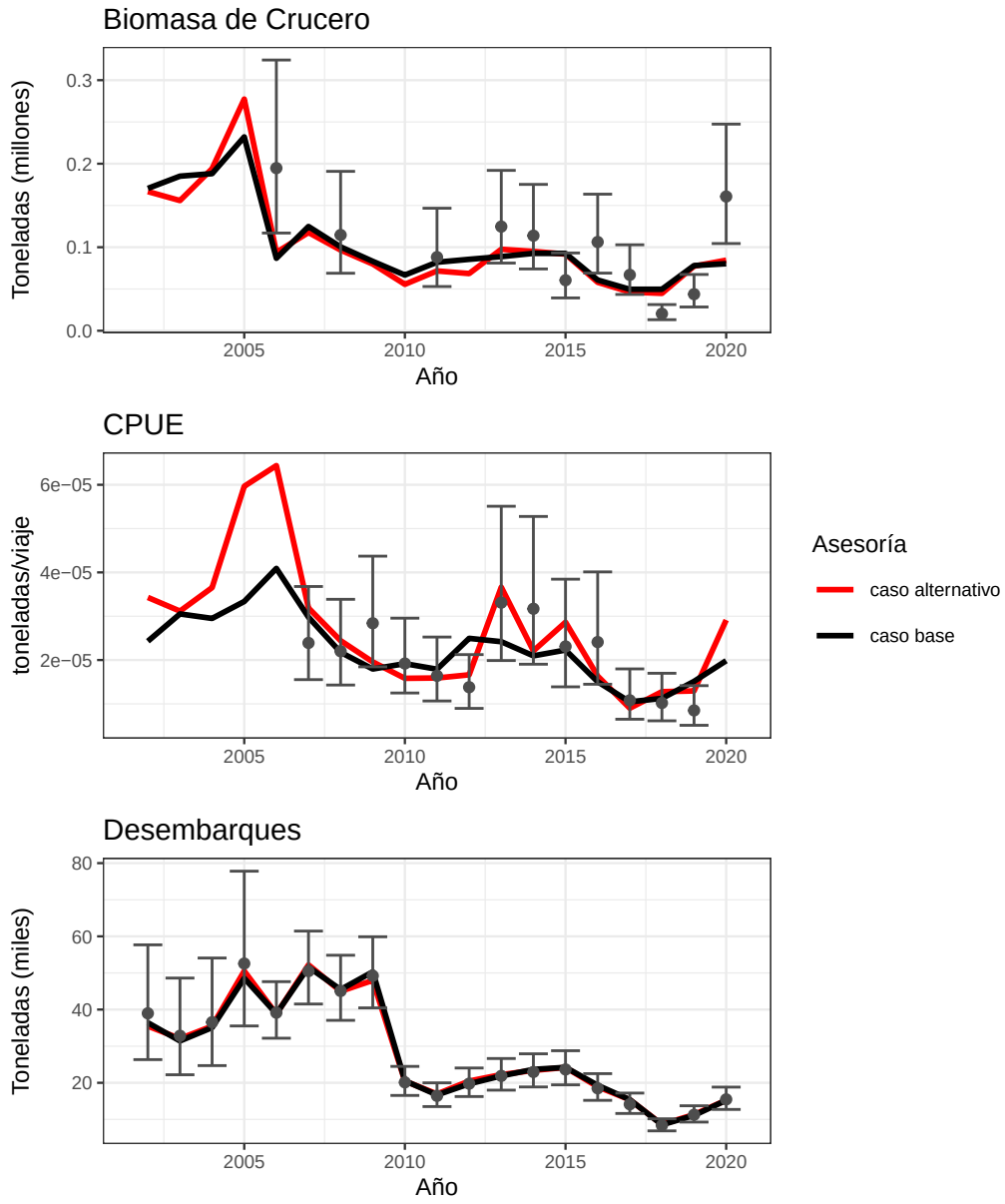



```
age     <- seq(5.5,20,0.5)
nage    <- length(age)
etf_obs <- data.frame(rep.0$Ntallas)
yearf   <- rep.0$YRS
nyearf  <- length(yearf)

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

 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(title="Modelo alternativo", x = 'Tallas', y = 'Abundancia total') +
          theme(panel.background = element_rect(fill ="gray99")) +
          theme(panel.grid=element_line(color=NA))
 fig1
```

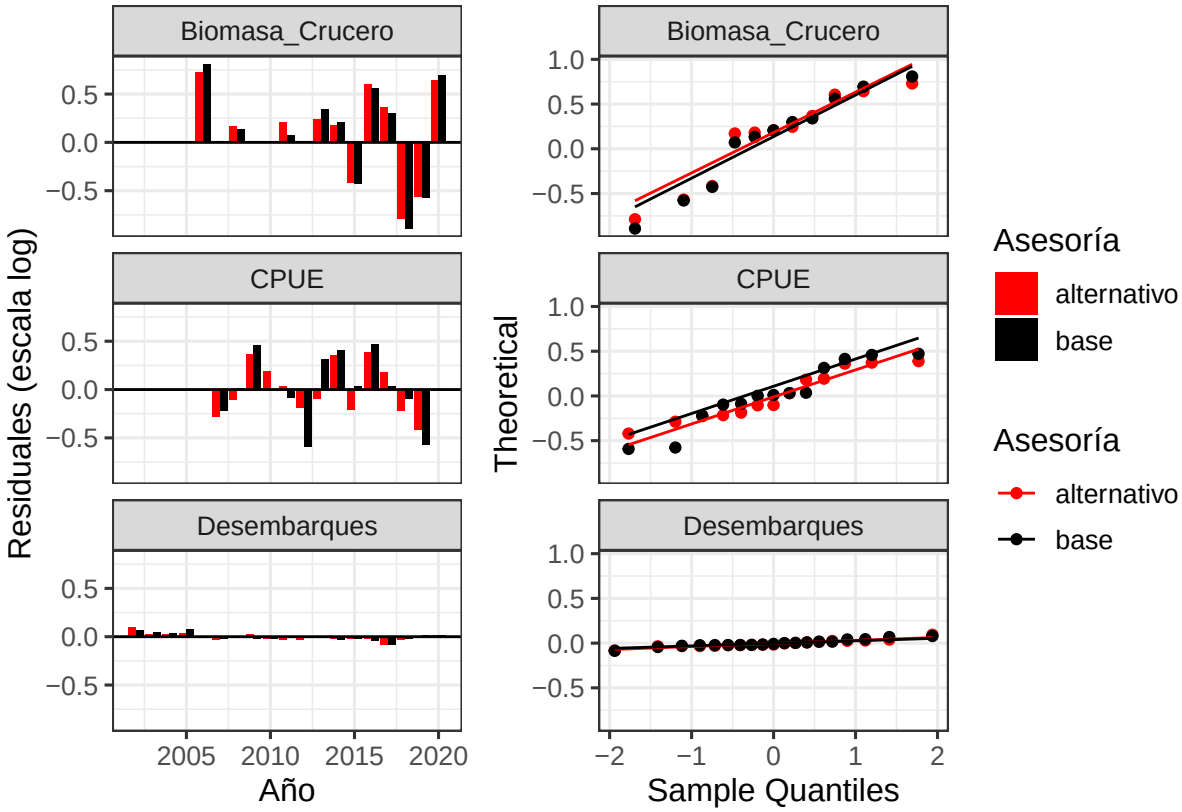
6.3. Comparación del ajuste y residuales del modelo base y alternativo a los datos

```
library(patchwork)

yrs   <- rep0$Years
nyrs  <- length(yrs)
lasty <- yrs[nyrs]
cvCB   <-data.0$Ind[,7]
cvcpue <-data.0$Ind[,5]
cvdes  <-data.0$Ind[,3]

ind_obs  <- cbind(rep0$Bcru_obs,rep0$CPUE_obs, rep0$Desemb_obs); ind_obs[ind_obs==0] <- NA
colnames(ind_obs) <- c('Biomasa_Crucero', 'CPUE', 'Desembarques')
ind      <- data.frame(ind_obs) %>% mutate(Asesoría='observado') %>%
            mutate (yrs= yrs) %>% melt(id.var=c('yrs', 'Asesoría'))

ind_jun   <- cbind(c(rep.0$reclan_pred), c(rep.0$cpue_pred), c(rep.0$desemb_pred)) ;
colnames(ind_jun) <- c('Biomasa_Crucero', 'CPUE', 'Desembarques')
junio     <- data.frame(ind_jun) %>% mutate (Asesoría='caso alternativo') %>%
              mutate (yrs= yrs)  %>% melt(id.var=c('yrs', 'Asesoría'))

ind_sept  <- cbind(rep0$Bcru_pred, rep0$CPUE_pred, rep0$Desemb_pred) ;
colnames(ind_sept) <- c('Biomasa_Crucero', 'CPUE', 'Desembarques')
sept      <- data.frame(ind_sept) %>% mutate (Asesoría='caso base') %>%
             mutate (yrs= yrs)  %>% melt(id.var=c('yrs', 'Asesoría'))

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


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('red',"black")) +
        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('red',"black")) +
        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)
```

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

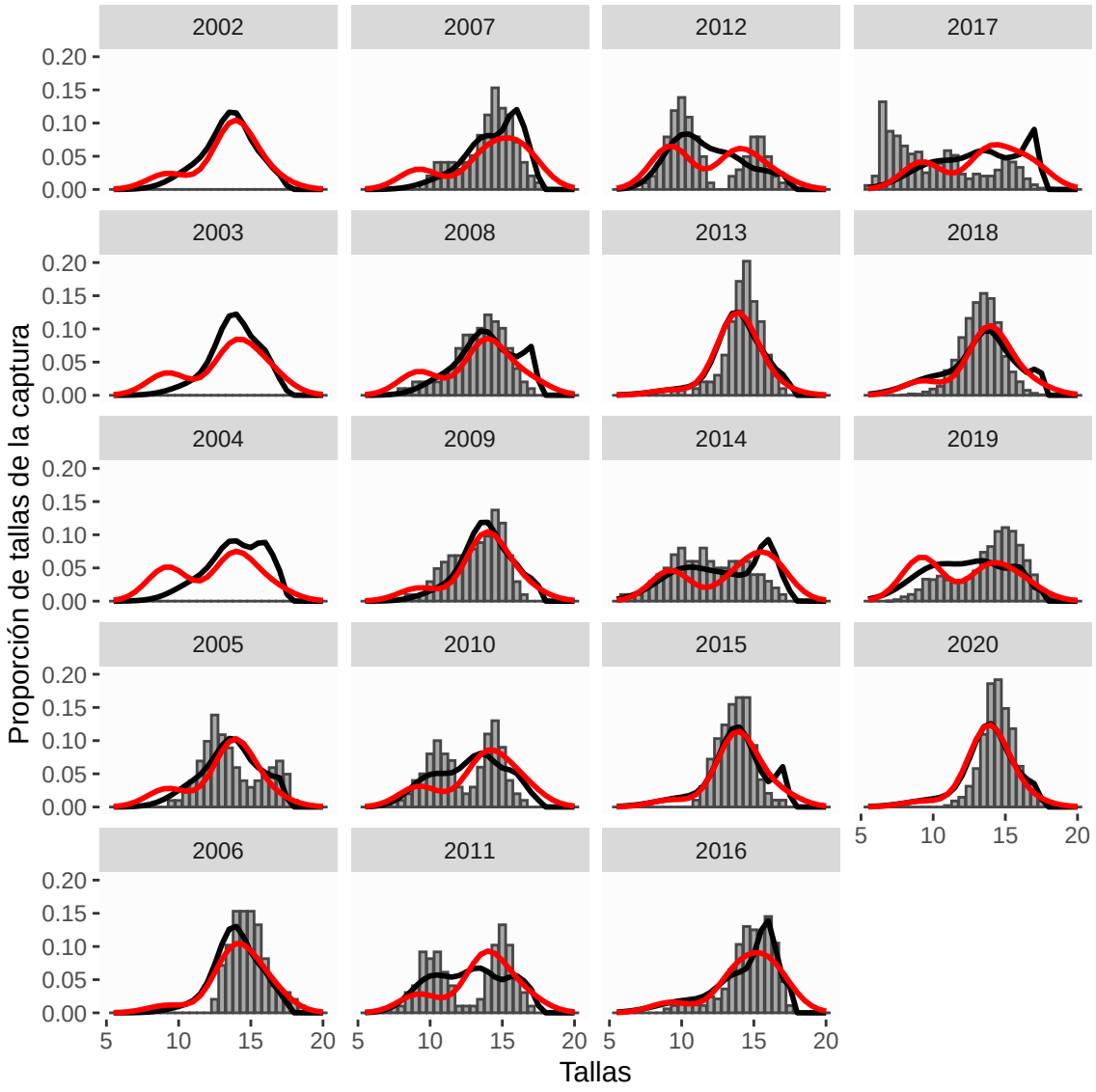


```r
# Análisis de Residuales Indices

# Arreglos MAET - MATT
Res_maet <- data.frame(log(ind_obs) - log(ind_jun)) %>%
            mutate(yrs = yrs) %>% mutate(Asesoría = 'alternativo')
Res_matt <- data.frame(log(ind_obs) - log(ind_sept)) %>%
            mutate(yrs = yrs) %>% mutate(Asesoría = 'base')

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)


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")
```



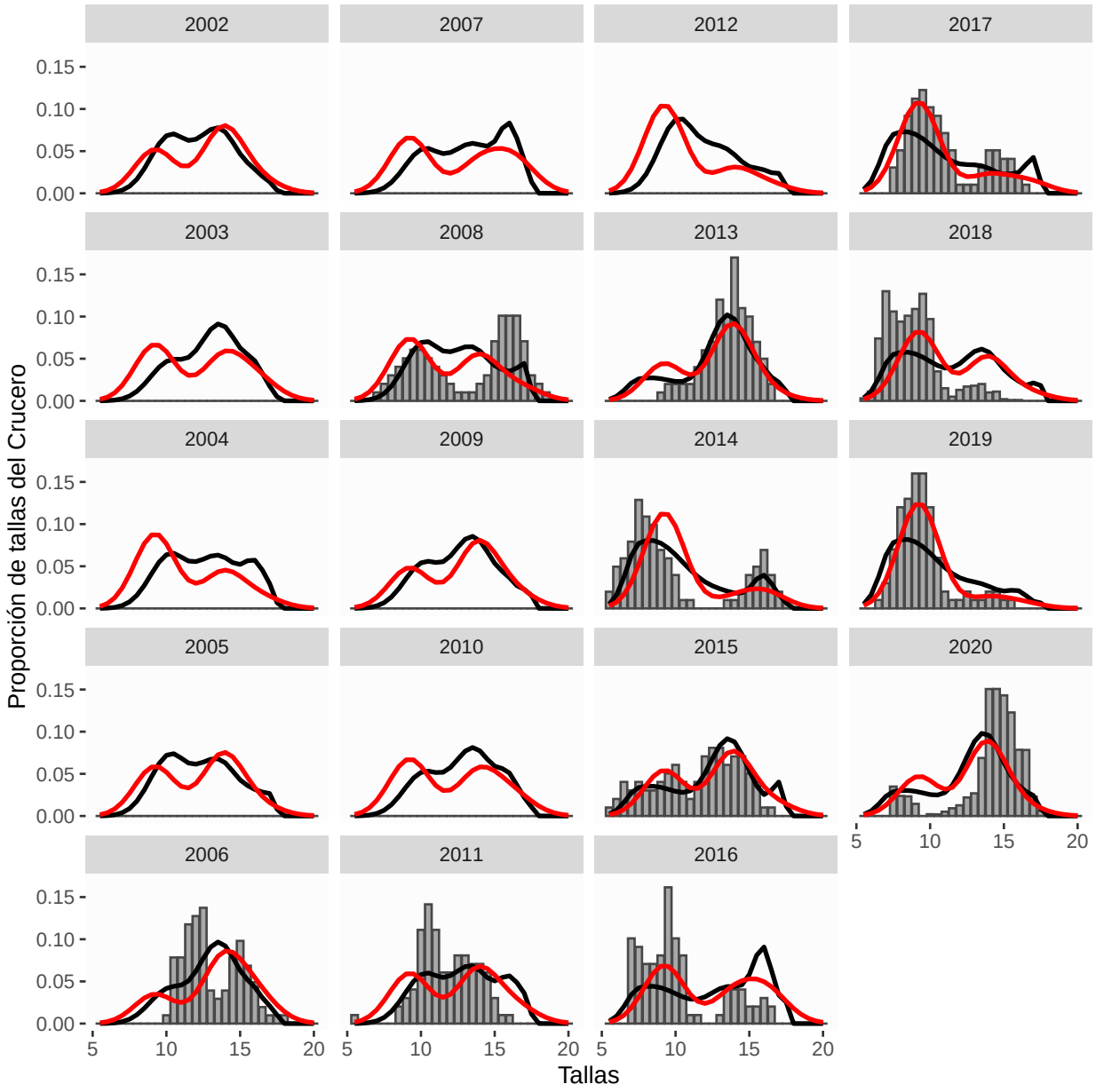

```
age     <-seq(5.5,20,0.5)
nage    <-length(age)
etf_obs <- data.frame(rep0$Propfl_obs)
etf_pre <- rep0$Propfl_pred

etf_obs_alt <- data.frame(rep.0$pf_obs)
etf_pre_alt <- rep.0$pf_pred

yearf   <- rep0$Years
nyearf  <-length(yearf)

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

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

 mat  <- rbind(obs,pred,pred_alt)

 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
 fig1b <- fig1 + geom_line(data = filter(mat, type=='pred'), aes(x = edad, y = value), color = 'black',
 fig1b <- fig1b + geom_line(data = filter(mat, type=='pred_alt'), aes(x = edad, y = value), color = 're
```

```
fig1b + theme(panel.background = element_rect(fill ="gray99")) + theme(panel.grid=element_line(color=N
```



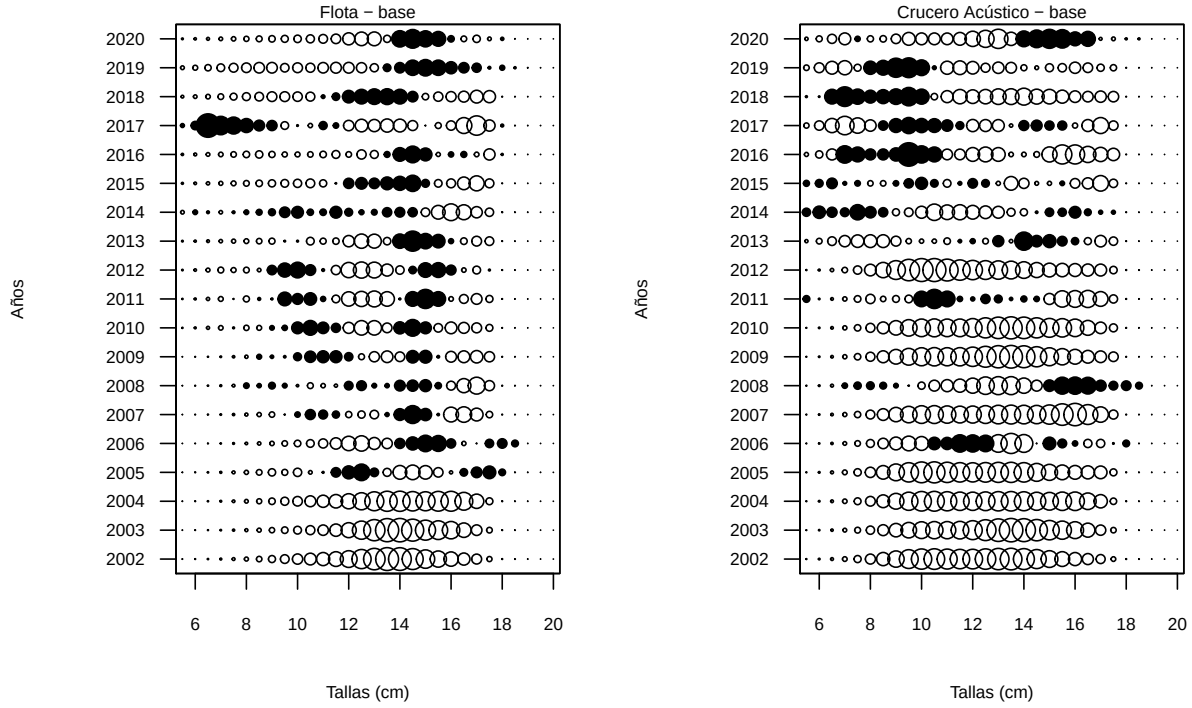

```
age     <-seq(5.5,20,0.5)
nage    <-length(age)
etc_obs <- data.frame(rep0$Propcru_obs)
etc_pre <- rep0$Propcru_pred

etc_obs_alt <- data.frame(rep.0$pobs_RECLAN)
etc_pre_alt <- rep.0$ppred_RECLAN

yearc   <- rep0$Years
nyearc  <-length(yearc)

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

```
            mutate(edad = rep(age, each=nyearf)) %>% mutate(type='pred')

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

mat  <- rbind(obs,pred,pred_alt)

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
fig1b <- fig1 + geom_line(data = filter(mat, type=='pred'), aes(x = edad, y = value),color = 'black',
fig1b <- fig1b + geom_line(data = filter(mat, type=='pred_alt'), aes(x = edad, y = value),color = 'red
fig1b + theme(panel.background = element_rect(fill ="gray99")) + theme(panel.grid=element_line(color=N
```



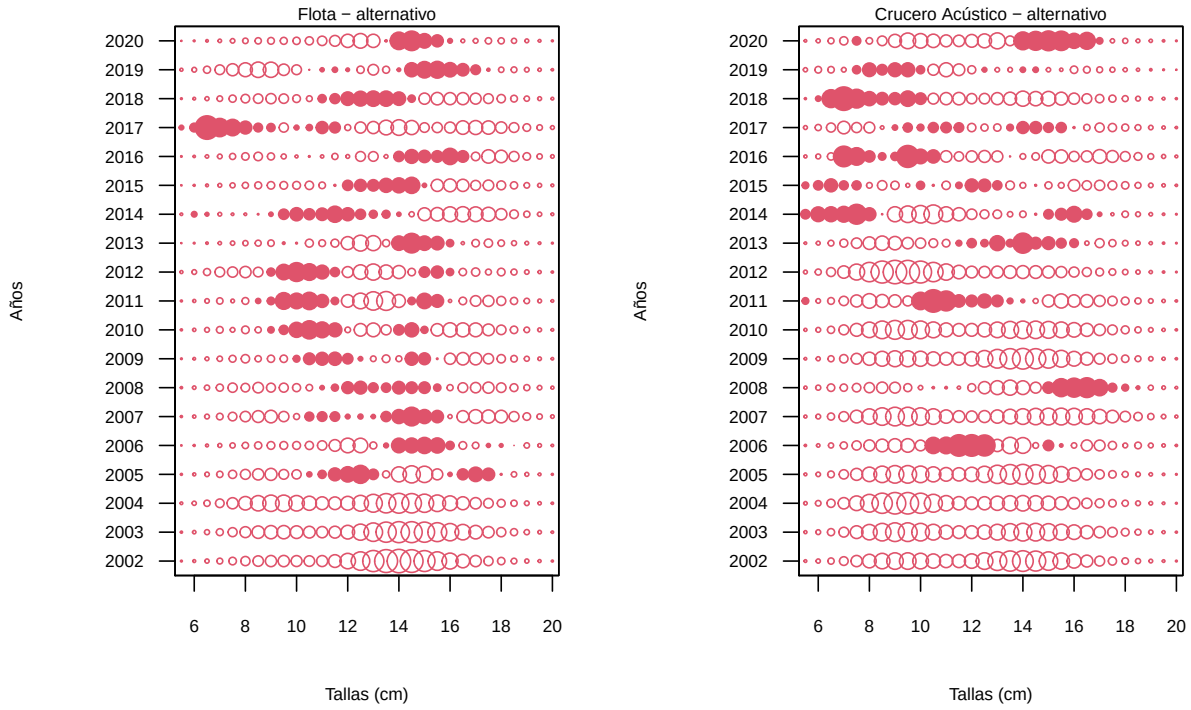

```
par(mfcol=c(1,2))
cx<-0.7
#Flota
#modelo base
age     <-seq(5.5,20,0.5)
nage    <-length(age)
anos    <-rep0$Years
obsF    <-rep0$Propfl_obs
preF    <-rep0$Propfl_pred
resF    <-obsF-preF

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

```
for(j in 1:dd[1]){for(k in 1:dd[2]){val<-resF[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 - base",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()

#Crucero base
age  <-seq(5.5,20,0.5)
nage <-length(age)
anos <-rep0$Years
obsB <-rep0$Propcru_obs
preB <-rep0$Propcru_pred
resB <-obsB-preB

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

for(j in 1:dd[1]){for(k in 1:dd[2]){val<-resB[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 - base",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()
```




```
par(mfcol=c(1,2))
#Flota
cx<-0.7
# modelo alternativo
obsF_alt    <-rep.0$pf_obs
preF_alt    <-rep.0$pf_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=2)}
    if(vol<0){points(age[m],anos[n],pch=1,cex=2*sqrt(vol*-1),col=2)}
}}}

mtext("Flota - alternativo",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)
```

```r
box()

#Crucero alternativo

obsB_alt <-rep.0$pobs_RECLAN
preB_alt <-rep.0$ppred_RECLAN
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=2)}
    if(vol<0){points(age[m],anos[n],pch=1,cex=2*sqrt(vol*-1),col=2)}
}}}
mtext("Crucero Acústico - alternativo",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()
```



6.4. Comparación de las tendencias poblacionales del modelo base y alternativo

```
Tsard<- read.table(paste(dir.0,"/funciones/T0918.txt",sep=""),sep="",na="NA",fill=T) #se debe actualiza
# Probar 3 bloques de selectividad

nyears0 <- length(rep0$Years)
Dat        <- list()
Dat$M     <- 0.83
Dat$Tspw    <- 0.58
Dat$Mad   <- data.0$Madurez
Dat$Sel   <- rep0$Selflo_talla[nyears0,] #bloque 1=[1,], bloque 2=[9,], bloque 3=[19,]
Dat$Wmed    <- data.0$Pesos_medios
Dat$Pre   <- rep0$Fun_rec_talla
Ta        <- as.matrix(Tsard)
talla     <- data.0$Tallas
edad      <- seq(0,4,1)
Fmort     <- seq(0,3,0.01)
R0          <- 1

source(paste(dir.0,"/funciones/Fun_Pbrs.R",sep=""))
PBRs <- SPRFmort(R0,Fmort,talla,edad,Dat)
FRMS<-subset(PBRs,PBRs[,4]==0.60)[1]

#Pbrs modelo base
#B0 <- Bmed/pB_Fmh
BDo <- rep0$BD_virgen_LP
# Paso 5: Obtenci?n de Bmrs
BRMS <- BDo*0.55
```

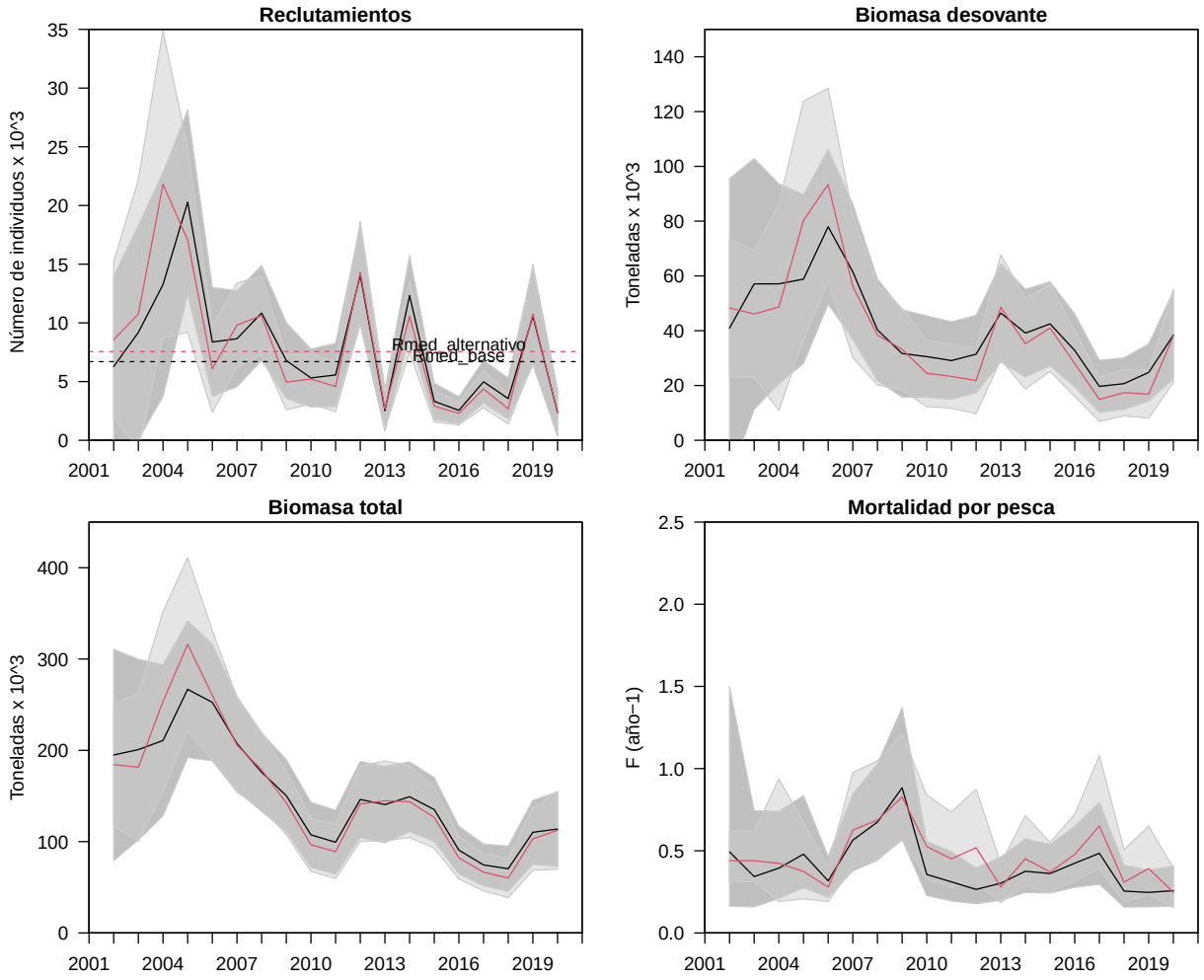
```r
# Paso 6: Obtrencion de Blim
BDlim<- BDo*0.275

Pbrs<-rbind(BDo,BRMS,BDlim,FRMS)

#PBRs modelo alternativo
#B0 <- Bmed/pB_Fmh
BDo0 <- rep.0$Bo
# Paso 5: Obtenci?n de Bmrs
BRMS0 <- BDo0*0.55
# Paso 6: Obtrencion de Blim
BDlim0<- BDo0*0.275
FRMS0<-exp(subset(std.0,name=="log_Fref")$value[1])
Pbrs0<-rbind(BDo0,BRMS0,BDlim0,FRMS0)
```

```r
years0  <- rep0$Years; nyears0 <- length(years0)
x0      <-c(years0,rev(years0))
x0_1    <-c(2000,2021,21) #xaxp

#modelo base
Ro0            <- subset(std0,name=="log_Rmed")$value
Reclutas0     <- subset(std0,name=="Reclutas")$value
Reclutas0std  <- subset(std0,name=="Reclutas")$std
logdesvRt0    <- subset(std0,name=="log_desv_Rt")$value
logdesvRt0std <- subset(std0,name=="log_desv_Rt")$std
Bt0           <- subset(std0,name=="BT")$value
Bt0std        <- subset(std0,name=="BT")$std
SSBt0         <- subset(std0,name=="BD")$value
SSBt0std      <- subset(std0,name=="BD")$std
Ft0           <- subset(std0,name=="log_F")$value
Ft0std        <- subset(std0,name=="log_F")$std

#arreglos polígono
rt0      <- c((Reclutas0-1.96*Reclutas0std),
              rev(Reclutas0+1.96*Reclutas0std))
logdrt0  <- c((logdesvRt0-1.96*logdesvRt0std),
              rev(logdesvRt0+1.96*logdesvRt0std))
bt0      <- c((Bt0-1.96*Bt0std),
              rev((Bt0+1.96*Bt0std)))
ssbt0    <- c((SSBt0-1.96*SSBt0std),
              rev((SSBt0+1.96*SSBt0std)))
ft0      <- c(exp((Ft0)-1.96*(Ft0std)),
              rev(exp((Ft0)+1.96*(Ft0std))))

#modelo alternativo
Ro.0           <- subset(std.0,name=="log_Ro")$value
Reclutas.0     <- subset(std.0,name=="Reclutas")$value
Reclutas.0std  <- subset(std.0,name=="Reclutas")$std
logdesvRt.0    <- subset(std.0,name=="log_desv_Rt")$value
logdesvRt.0std <- subset(std.0,name=="log_desv_Rt")$std
Bt.0           <- subset(std.0,name=="BT")$value
Bt.0std        <- subset(std.0,name=="BT")$std
SSBt.0         <- subset(std.0,name=="BD")$value
SSBt.0std      <- subset(std.0,name=="BD")$std
```

```
Ft.0           <- subset(std.0,name=="log_F")$value
Ft.0std        <- subset(std.0,name=="log_F")$std

#arreglos polígono
rt.0      <- c((Reclutas.0-1.96*Reclutas.0std),
              rev(Reclutas.0+1.96*Reclutas.0std))
logdrt.0  <- c((logdesvRt.0-1.96*logdesvRt.0std),
              rev(logdesvRt.0+1.96*logdesvRt.0std))
bt.0      <- c((Bt.0-1.96*Bt.0std),
              rev((Bt.0+1.96*Bt.0std)))
ssbt.0    <- c((SSBt.0-1.96*SSBt.0std),
              rev((SSBt.0+1.96*SSBt.0std)))
ft.0      <- c(exp((Ft.0)-1.96*(Ft.0std)),
              rev(exp((Ft.0)+1.96*(Ft.0std))))
```

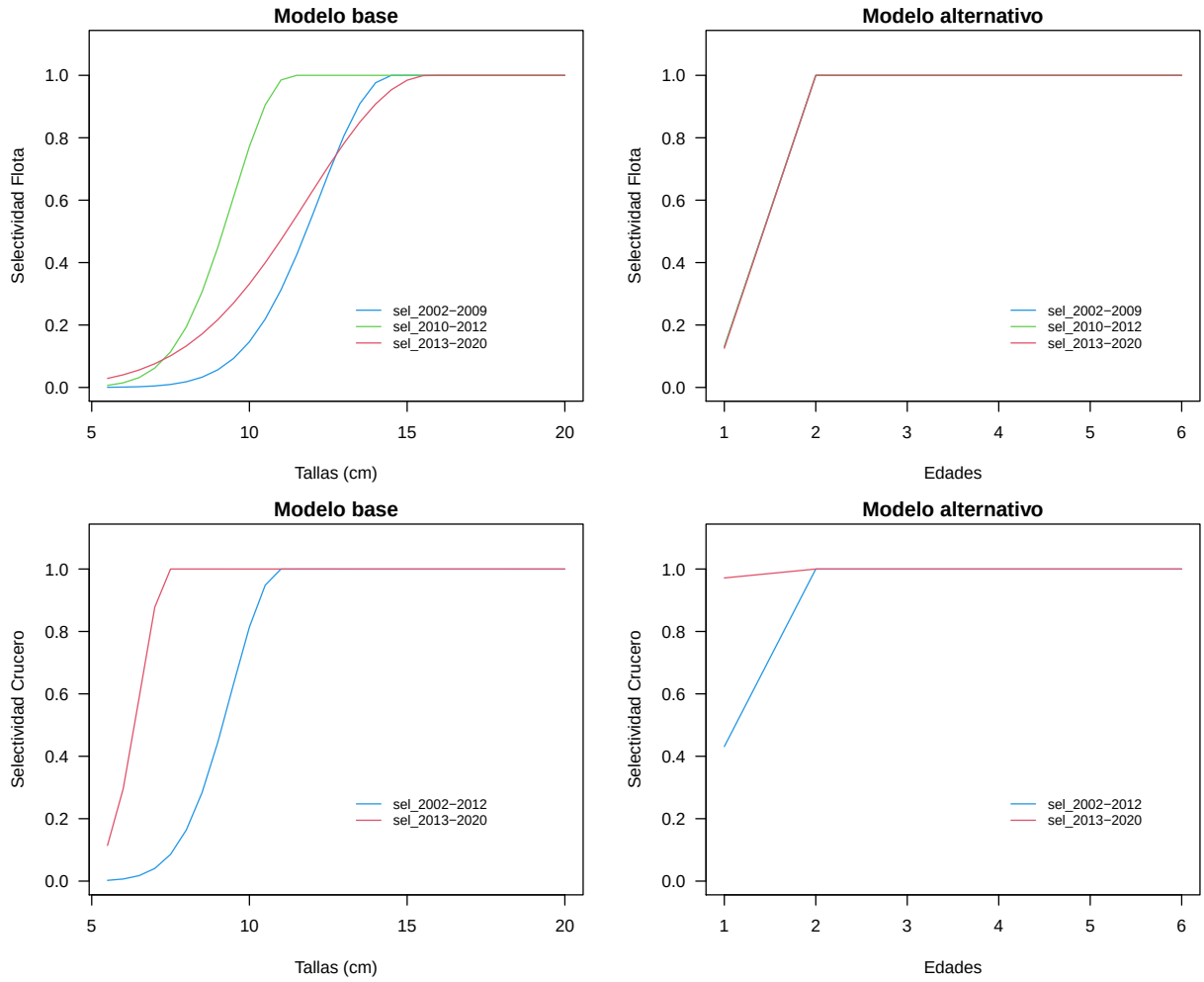
```
par(mfcol=c(2,2),mar=c(2,4,1,1)+0.5)
    plot(x0,rt0/1000 , type="n", xaxp=x0_1,cex.axis=1.1,xaxs= "i",yaxs= "i",
    main="Reclutamientos",ylim=c(0,35),xlim=c(2001,2021),
    ylab=" Número de individuos x 10^3",las=1,xlab="Año",cex.lab=1.1)
    polygon(x0, rt0/1000 , col=gray(.5,0.5), border="gray80")
    polygon(x0, rt.0/1000 , col=gray(.8,0.5), border="gray80")
    lines(years0,Reclutas0/1000,lwd=1,col=1,lty=1)
    lines(years0,Reclutas.0/1000,lwd=1,col=2,lty=1)
    abline(h=exp(Ro0+0.5*0.6^2)/1000,col=1,lty=2)
  abline(h=exp(Ro.0+0.5*0.6^2)/1000,col=2,lty=2)
  text(2016,c(exp(Ro0+0.5*0.6^2)/1000,
              exp(Ro.0+0.5*0.6^2)/1000)+0.5,
            c("Rmed_base","Rmed_alternativo"))
box()

plot(x0,bt0/1000,type="n",cex.axis=1.1,xaxs="i",yaxs="i",las=1,
     xlim=c(2001,2021),xaxp=x0_1,ylim=c(0,450),cex.lab=1.1,
     main="Biomasa total",ylab="Toneladas x 10^3",xlab="Año")
    polygon(x0,bt0/1000,col=gray(.5,0.5), border="gray80")
    polygon(x0,bt.0/1000,col=gray(.8,0.5), border="gray80")
    lines(years0,Bt0/1000,lwd=1,col=1,lty=1)
    lines(years0,Bt.0/1000,lwd=1,col=2,lty=1)
box()

plot(x0,ssbt0/1000,type="n",cex.axis=1.1,xaxs="i",yaxs="i",las=1,
     xlim=c(2001,2021),xaxp=x0_1,ylim=c(0,150),cex.lab=1.1,
     main="Biomasa desovante",ylab="Toneladas x 10^3",xlab="Año")
    polygon(x0,ssbt0/1000,col=gray(.5,0.5), border="gray80")
    polygon(x0,ssbt.0/1000,col=gray(.8,0.5), border="gray80")
    lines(years0,SSBt0/1000,lwd=1,col=1,lty=1)
    lines(years0,SSBt.0/1000,lwd=1,col=2,lty=1)
box()

plot(x0, ft0, xaxp=x0_1,cex.axis=1.1,xaxs= "i",yaxs= "i",ylim=c(0,2.5),
    main="Mortalidad por pesca",xlim=c(2001,2021),type="n", ylab="F (año-1)",las=1,xlab="Año",cex.lab=1
    polygon(x0, ft0,  col=gray(.5,0.5), border="gray80")
    polygon(x0, ft.0,  col=gray(.8,0.5), border="gray80")
    lines(years0,exp(Ft0),lwd=1,col=1,lty=1)
    lines(years0,exp(Ft.0),lwd=1,col=2,lty=1)
```

```
box()
```




```
par(mfrow=c(2,2),mar=c(4,4,1,1)+0.5)
plot(rep0$Tallas,rep0$Selflo_talla[1,],type="l",las=1,col=4,ylim=c(0,1.1),
     ylab="Selectividad Flota",xlab="Tallas (cm)",main="Modelo base")
lines(rep0$Tallas,rep0$Selflo_talla[9,],type="l",col=3)
lines(rep0$Tallas,rep0$Selflo_talla[nyears0,],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")

plot(data0$Edades,rep.0$Sflo_age[1,],type="l",las=1,col=4,ylim=c(0,1.1),
     ylab="Selectividad Flota",xlab="Edades",main="Modelo alternativo")
lines(data0$Edades,rep.0$Sflo_age[9,],type="l",col=3)
lines(data0$Edades,rep.0$Sflo_age[nyears0,],type="l",col=2)
legend(4,0.3,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")

plot(rep0$Tallas,rep0$Selcru_talla[1,],type="l",las=1,col=4,ylim=c(0,1.1),
     ylab="Selectividad Crucero",xlab="Tallas (cm)",main="Modelo base")
lines(rep0$Tallas,rep0$Selcru_talla[nyears0,],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")

plot(data0$Edades,rep.0$Scru_age[1,],type="l",las=1,col=4,ylim=c(0,1.1),
     ylab="Selectividad Crucero",xlab="Edades",main="Modelo alternativo")
lines(data0$Edades,rep.0$Scru_age[nyears0,],type="l",col=2)
legend(4,0.3,c("sel_2002-2012","sel_2013-2020"),
       col=c(4,2),lwd=c(1,1),cex=0.8,bty="n")
```




```
Tsard<- read.table(paste(getwd(),"/funciones/T0918.txt",sep=""),sep="",na="NA",fill=T) #se debe actuali
# Probar 3 bloques de selectividad
source(paste(getwd(),"/funciones/Fun_Pbrs.R",sep=""))

nyears1<-length(rep0$Years)

Dat<-list()
Dat$M     <- 0.83
Dat$Tspw    <- 0.58
Dat$Mad   <- data.0$Madurez
Dat$Wmed    <- data.0$Pesos_medios
Dat$Pre   <- rep0$Fun_rec_talla
Ta        <- as.matrix(Tsard)
```

```
talla     <- data.0$Tallas
edad      <- seq(0,4,1)
Fmort     <- seq(0,3,0.01)
R0          <- 1

#Calculo de FRMS para cada bloque de selectividad
Dat$Sel   <- rep0$Selflo_talla[1,] #bloque 1=[1,], bloque 2=[9,], bloque 3=[19,]
PBRsb1    <- SPRFmort(R0,Fmort,talla,edad,Dat)
FRMSb1    <- subset(PBRsb1,PBRsb1[,4]==0.60)[1]

Dat$Sel   <- rep0$Selflo_talla[10,] #bloque 1=[1,], bloque 2=[9,], bloque 3=[19,]
PBRsb2    <- SPRFmort(R0,Fmort,talla,edad,Dat)
FRMSb2    <- subset(PBRsb2,PBRsb2[,4]==0.60)[1]

Dat$Sel   <- rep0$Selflo_talla[nyears1,] #bloque 1=[1,], bloque 2=[9,], bloque 3=[19,]
PBRsb3    <- SPRFmort(R0,Fmort,talla,edad,Dat)
FRMSb3    <- subset(PBRsb3,PBRsb3[,4]==0.60)[1]

FrmsPorBloque<-rbind(Frms_bloque1=FRMSb1,
                     Frms_bloque2=FRMSb2,
                     Frms_bloque3=FRMSb3)
#FrmsPorBloque

# PBRs Modelo base
BDo    <- rep0$BD_virgen_LP
BRMS   <- BDo*0.55
BDlim  <- BDo*0.275
FRMS   <- data.0$Ind[nyears1,13]
```

```
#PBRs Modelo alternativo
BDo.0    <- rep.0$Bo
BRMS.0   <- BDo.0*0.55
BDlim.0  <- BDo.0*0.275
FRMS.0   <- exp(subset(std.0,name=="log_Fref")$value[3])
```

```
par(mfcol=c(1,2),mar=c(4,4,1,1)+0.5)
plot(rep0$Tallas,rep0$Selflo_talla[1,],type="l",las=1,col=4,
     ylab="Selectividad",xlab="Tallas (cm)")
lines(rep0$Tallas,rep0$Selflo_talla[9,],type="l",col=3)
lines(rep0$Tallas,rep0$Selflo_talla[nyears1,],type="l",col=2)
lines(rep0$Tallas,data.0$Madurez,lwd=2)
legend(13,0.3,c("bloque_sel1","bloque_sel2","bloque_sel3","Madurez"),
       col=c(4,3,2,1),lwd=c(1,1,1,2),cex=0.8,bty="n")

plot(PBRsb1[,1],PBRsb1[,4],type="l",ylab="%BDPR",xlab="Mortalidad por pesca (F)",lwd=1,las=1,col=4)
lines(PBRsb2[,1],PBRsb2[,4],col=3,lwd=1)
lines(PBRsb3[,1],PBRsb3[,4],col=2,lwd=1)
abline(h=0.6,col=1,lty=1)
abline(v=c(FRMSb1,FRMSb2,FRMSb3),col=c(4,3,2),lty=2)
    text(1.5,c(0.55,0.50,0.45),c("F60_sel1=0,33", "F60_sel2=0,26","F60_sel3=0,31"),cex=0.8,col=c(4,3,2))
```

```
yrs     <- rep0$Years
nyrs    <- length(yrs)
tallas  <- seq(5,19.5,0.5)
```

```
ntallas <- length(tallas)
age     <- seq(0,4,1)
nage    <- length(age)

x  <-c(yrs,rev(yrs))
x1 <-c(yrs[1],yrs[nyrs]+1,nyrs+1/2) #xaxp
x2 <-c(yrs[1]-1,yrs[nyrs]+1) #xlim
years.0    <-rep.0$YRS

################################################
#modelo base
################################################
Rpr0     <-subset(std0,name=="RPR")$value
Rpr0std  <-subset(std0,name=="RPR")$std
Frpr0    <-subset(std0,name=="Frpr")$value
Frpr0std <-subset(std0,name=="Frpr")$std

rpr0     <-c((Rpr0-1.96*Rpr0std),
         rev((Rpr0+1.96*Rpr0std)));
frpr0    <-c((Frpr0-1.96*Frpr0std),
         rev((Frpr0+1.96*Frpr0std)))

################################################
#modelo alternativo
################################################
Rpr.0     <-subset(std.0,name=="RPRrms")$value
Rpr.0std  <-subset(std.0,name=="RPRrms")$std
Frpr.0    <-subset(std.0,name=="Frpr")$value
Frpr.0std <-subset(std.0,name=="Frpr")$std

rpr.0     <-c((Rpr.0-1.96*Rpr.0std),
          rev((Rpr.0+1.96*Rpr.0std)));
frpr.0    <-c((Frpr.0-1.96*Frpr.0std),
          rev((Frpr.0+1.96*Frpr.0std)))

#########################################################################################
### *MODELO BASE*
#########################################################################################
# biomasa desovante vs BDrms
#########################################################################################
xbs1 <-rnorm(1000, mean = Rpr0[length(years.0)],
                    sd = Rpr0std[length(years.0)])

xbs  <-seq(min(xbs1),max(xbs1),0.005)

ybs  <-dnorm(xbs, mean = Rpr0[length(years.0)],
                  sd = Rpr0std[length(years.0)])

icbs <-qnorm(c(0.05,0.95,0.5),
             Rpr0[length(years.0)],
             Rpr0std[length(years.0)])

xxbs <-c(xbs[xbs>=icbs[1]&xbs<=icbs[2]],
```

```
     rev(xbs[xbs>=icbs[1]&xbs<=icbs[2]]))

yybs <-c(ybs[xbs>=icbs[1]&xbs<=icbs[2]],
     rep(0,length(ybs[xbs>=icbs[1]&xbs<=icbs[2]])))

##############################################################################################
# mortalidad por pesca vs Frms
##############################################################################################
xfs1 <- rnorm(1000, mean = Frpr0[length(years.0)],
                      sd = Frpr0std[length(years.0)])

xfs  <-seq(min(xfs1),
           max(xfs1),0.005)

yfs  <-dnorm(xfs, mean = Frpr0[length(years.0)],
                    sd = Frpr0std[length(years.0)])

icfs <-qnorm(c(0.05,0.95,0.5),
             Frpr0[length(years.0)],
             Frpr0std[length(years.0)])

xxfs <-c(xfs[xfs>=icfs[1]&xfs<=icfs[2]],
     rev(xfs[xfs>=icfs[1]&xfs<=icfs[2]]))

yyfs <-c(yfs[xfs>=icfs[1]&xfs<=icfs[2]],
     rep(0,length(yfs[xfs>=icfs[1]&xfs<=icfs[2]])))

##############################################################################################
### *MODELO ALTERNATIVO*
##############################################################################################
# biomasa desovante vs BDrms
##############################################################################################
xbm1 <- rnorm(1000, mean = Rpr.0[length(years.0)],
                      sd = Rpr.0std[length(years.0)])

xbm  <- seq(min(xbm1),
           max(xbm1),0.005)

ybm  <- dnorm(xbm, mean = Rpr.0[length(years.0)],
                     sd = Rpr.0std[length(years.0)])

icbm <- qnorm(c(0.05,0.95,0.5),
             Rpr.0[length(years.0)],
             Rpr.0std[length(years.0)])

xxbm <- c(xbm[xbm>=icbm[1]&xbm<=icbm[2]],
      rev(xbm[xbm>=icbm[1]&xbm<=icbm[2]]))

yybm <- c(ybm[xbm>=icbm[1]&xbm<=icbm[2]],
      rep(0,length(ybm[xbm>=icbm[1]&xbm<=icbm[2]])))

##############################################################################################
# mortalidad por pesca vs Frms
```

```
#############################################################################################
xfm1 <-rnorm(1000, mean = Frpr.0[length(years.0)],
                    sd = Frpr.0std[length(years.0)])

xfm  <-seq(min(xfm1),
           max(xfm1),0.005)

yfm  <-dnorm(xfm, mean = Frpr.0[length(years.0)],
                   sd = Frpr.0std[length(years.0)])

icfm <-qnorm(c(0.05,0.95,0.5),
             Frpr.0[length(years.0)],
             Frpr.0std[length(years.0)])

xxfm <-c(xfm[xfm>=icfm[1]&xfm<=icfm[2]],
     rev(xfm[xfm>=icfm[1]&xfm<=icfm[2]]))

yyfm <-c(yfm[xfm>=icfm[1]&xfm<=icfm[2]],
     rep(0,length(yfm[xfm>=icfm[1]&xfm<=icfm[2]])))



#############################################################################################
### *Probabilidad de estar bajo BRMS*
#############################################################################################
# MBASE
pa1<-pnorm(1,Rpr0[length(years.0)],
             Rpr0std[length(years.0)],
             lower.tail = TRUE,log.p = F)
# MALTERNATIVO
pa2<-pnorm(1,Rpr.0[length(years.0)],
             Rpr.0std[length(years.0)],
             lower.tail = TRUE,log.p = F)

#############################################################################################
### *Probabilidad de estar bajo FRMS*
#############################################################################################
# MBASE
pb1<-1-pnorm(1,Frpr0[length(years.0)],
               Frpr0std[length(years.0)],
               lower.tail = TRUE,log.p = F)

# MALTERNATIVO
pb2<-1-pnorm(1,Frpr.0[length(years.0)],
               Frpr.0std[length(years.0)],
               lower.tail = TRUE,log.p = F)

#############################################################################################
### *Probabilidad de estar en zona de sobreexplotacion*
#############################################################################################
# MBASE
pc1<-pnorm(0.9,Rpr0[length(years.0)],
               Rpr0std[length(years.0)],
```

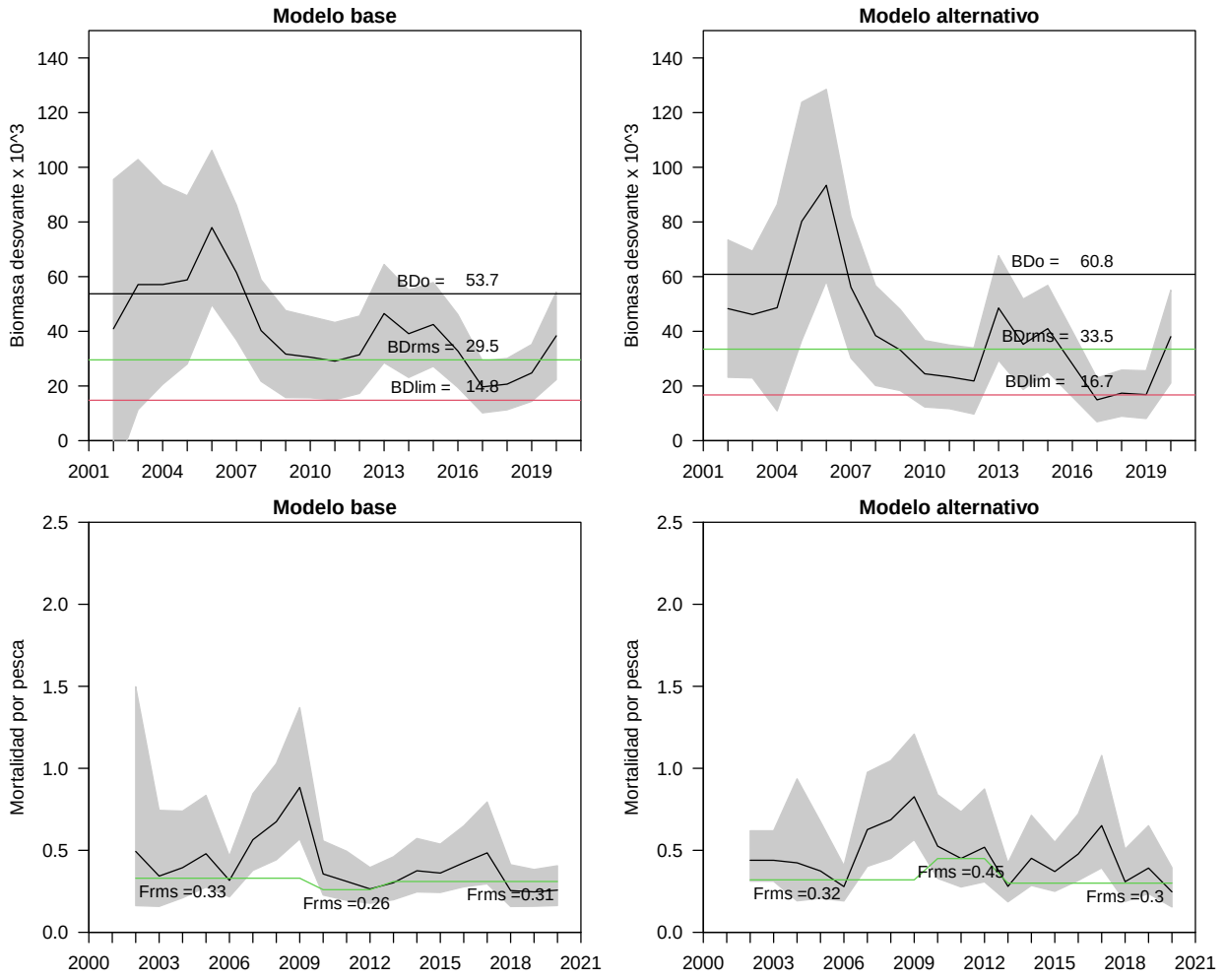
```
               lower.tail = TRUE,log.p = F)

# MALTERNATIVO
pc2<-pnorm(0.9,Rpr.0[length(years.0)],
               Rpr.0std[length(years.0)],
               lower.tail = TRUE,log.p = F)

##############################################################################################
### *Probabilidad de estar en zona de colapso*
##############################################################################################
# MBASE
pd1<-pnorm(0.5,Rpr0[length(years.0)],
               Rpr0std[length(years.0)],
               lower.tail = TRUE,log.p = F)

# MALTERNATIVO
pd2<-pnorm(0.5,Rpr.0[length(years.0)],
               Rpr.0std[length(years.0)],
               lower.tail = TRUE,log.p = F)

##############################################################################################
### *Probailidad de sobrepesca*
##############################################################################################
# MBASE
pe1<-1-pnorm(1.1,Frpr0[length(years.0)],
                 Frpr0std[length(years.0)],
                 lower.tail = TRUE,log.p = F)

# MALTERNATIVO
pe2<-1-pnorm(1.1,Frpr.0[length(years.0)],
                 Frpr.0std[length(years.0)],
                 lower.tail = TRUE,log.p = F)
```

```
PBRs<-round(rbind("BD~0~"=c(BDo,BDo.0)/1000,
                  "BD~RMS~"=c(BRMS,BRMS.0)/1000,
                  "BD~LIM~"=c(BDlim,BDlim.0)/1000,
                  "F~RMS~"=c(FRMS,FRMS.0),
                  "p(BD~2020~<BD~RMS)~"=round(c(pa1,pa2),2),
                  "p(F~2020~>F~RMS~)"=round(c(pb1,pb2),2),
                  "*p(sobreexplotación)*"=round(c(pc1,pc2),2),
                  "*p(agotado/colapsado)*"=round(c(pd1,pd2),2),
                  "*p(sobrepesca)*"=round(c(pe1,pe2),2)),3)

colnames(PBRs)<-c("base","alternativo")
kable(PBRs)
```

	base	alternativo
BD_0	53.725	60.844
BD_{RMS}	29.549	33.464
BD_{LIM}	14.774	16.732
F_{RMS}	0.310	0.298
$p(BD_{2020}<BD_{RMS})$	0.080	0.250
$p(F_{2020}>F_{RMS})$	0.190	0.200

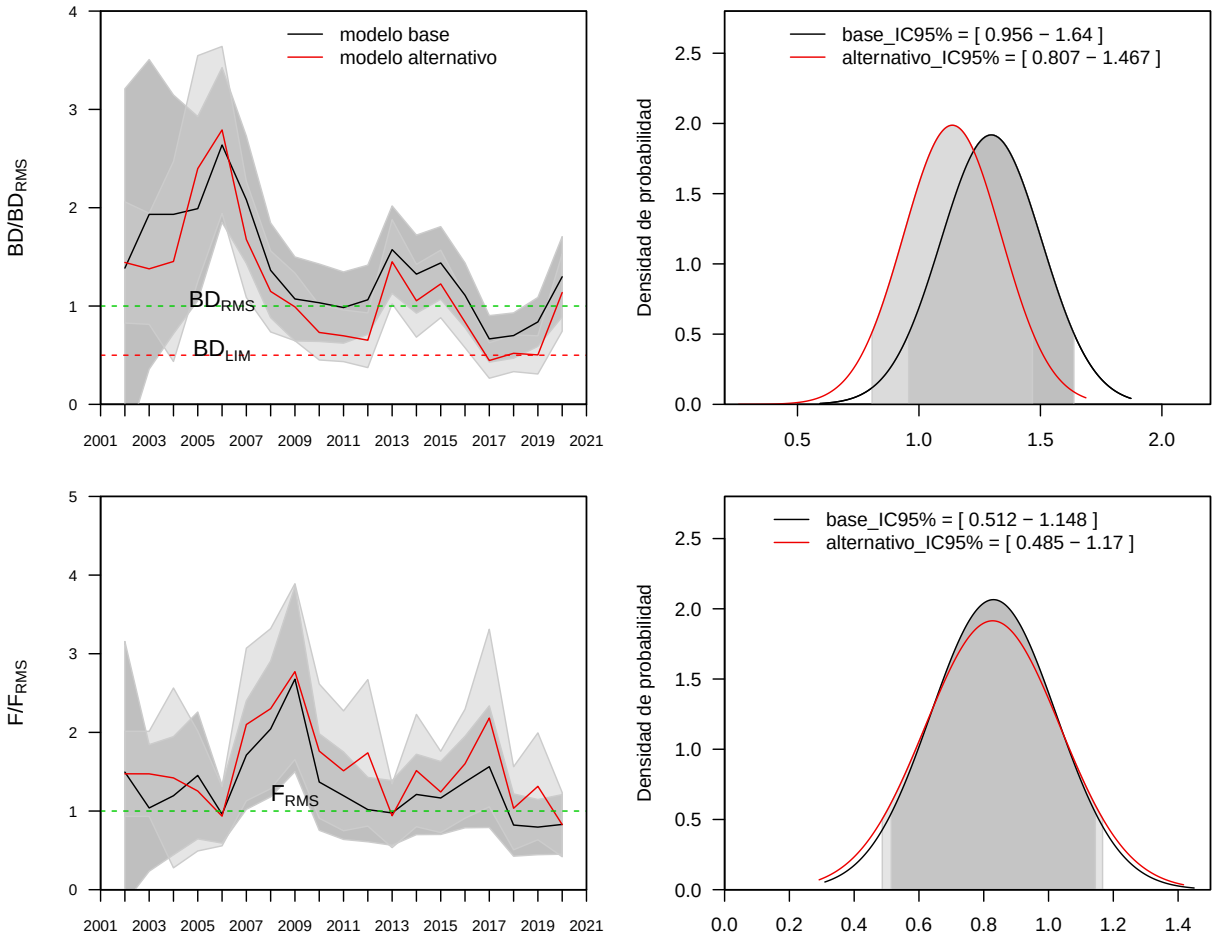
	base	alternativo
p(sobreexplotación)	0.030	0.120
p(agotado/colapsado)	0.000	0.000
p(sobrepesca)	0.080	0.100

```
#-------------------------------------------------------------------------------
# MODELO BASE
#-------------------------------------------------------------------------------
  par(mfcol=c(2,2),mar=c(2,4,1,1)+0.5)
  plot(x0,ssbt0/1000,type="n",cex.axis=1.1,xaxs="i",yaxs="i",
       xlim=c(2001,2021),xaxp=x0_1,ylim=c(0,150),las=1,cex.lab=1.1,
       main="Modelo base",ylab="Biomasa desovante x 10^3",xlab="Año")
  polygon(x0,ssbt0/1000,col=gray(.6,0.5), border="gray80")
    lines(years0,SSBt0/1000,lwd=1,col=1,lty=1)
    abline(h=c(BDo,BRMS,BDlim)/1000,col=c(1,3,2))
  text(rep(2017,3),(c(BDo,BRMS,BDlim)/1000)+5,round(c(BDo,BRMS,BDlim)/1000,1))
  text(rep(2014.5,3),(c(BDo,BRMS,BDlim)/1000)+5,c("BDo =","BDrms =","BDlim ="))

  plot(x0, ft0, xaxp=x0_1,cex.axis=1.1,xaxs= "i",yaxs= "i",ylim=c(0,2.5),
    main="Modelo base",xlim=c(2000,2021),type="n", ylab="Mortalidad por pesca",las=1,xlab="Año",cex.lab=
    polygon(x0, ft0,  col=gray(.6,0.5), border="gray80")
    lines(years0,exp(Ft0),lwd=1,col=1,lty=1)
    lines(years0,data.0$Ind[,13], col=3)
    text(c(2004,2011,2018),
         c(FRMSb1,FRMSb2,FRMSb3)-0.08,
         paste("Frms =", c(FRMSb1,FRMSb2,FRMSb3),sep=""))

#-------------------------------------------------------------------------------
# MODELO ALTERNATIVO
#-------------------------------------------------------------------------------
    plot(x0,ssbt.0/1000,type="n",cex.axis=1.1,xaxs="i",yaxs="i",xlim=c(2001,2021),
         xaxp=x0_1,ylim=c(0,150),
    main="Modelo alternativo",ylab="Biomasa desovante x 10^3",
    las=1,xlab="Año",cex.lab=1.1)
    polygon(x0,ssbt.0/1000,col=gray(.6,0.5), border="gray80")
    lines(years.0,SSBt.0/1000,lwd=1,col=1,lty=1)
    abline(h=c(BDo.0,BRMS.0,BDlim.0)/1000,col=c(1,3,2))
    text(rep(2017,3),(c(BDo.0,BRMS.0,BDlim.0)/1000)+5,round(c(BDo.0,BRMS.0,BDlim.0)/1000,1))
  text(rep(2014.5,3),(c(BDo.0,BRMS.0,BDlim.0)/1000)+5,c("BDo =","BDrms =","BDlim ="))

    plot(x0, ft.0, xaxp=x0_1,cex.axis=1.1,xaxs= "i",yaxs= "i",ylim=c(0,2.5),
    main="Modelo alternativo",xlim=c(2000,2021),type="n",
    ylab="Mortalidad por pesca",las=1,xlab="Año",cex.lab=1.1)
    polygon(x0, ft.0,  col=gray(.6,0.5), border="gray80")
    lines(years.0,exp(Ft.0),lwd=1,col=1,lty=1)
  lines(years.0,data0$Ind[,13], col=3)
  text(c(2004,2011,2018),c(data0$Ind[1,13],data0$Ind[9,13],data0$Ind[19,13])-0.08,paste("Frms =", c(data
```




```
par(mfcol=c(2,2),mar=c(2,4,1,1)+0.5)
    plot(x0, rpr.0,type="n",ylim=c(0,4),cex.axis=0.8,xaxs="i",yaxs="i",
         xlim=c(2001,2021),xaxp=x0_1,ylab=expression("BD/BD"[RMS]),
         las=1,xlab="Año",cex.lab=1.1)
polygon(x0,rpr0, col=gray(.5,0.5),border="gray80")
polygon(x0,rpr.0, col=gray(.8,0.5),border="gray80")
lines(years.0,Rpr0,lwd=1,col=1,lty=1)#base
lines(years.0,Rpr.0,lwd=1,col="red2",lty=1) #alternativo
abline(h=c(0.5,1),lty=2,col=c("red","green3"))
text(c(2006,2006),c(0.5,1)+0.05,c(expression("BD"[LIM]),expression("BD"[RMS])),cex=1.2)
legend(2008,4,c("modelo base","modelo alternativo"),lty=c(1,1),col=c("black","red2"),bty="n",lwd=1)
box()

plot(x0,frpr.0,type="n",ylim=c(0,5),cex.axis=0.8,xaxs="i",yaxs="i",
     xlim=c(2001,2021),xaxp=x0_1, ylab=expression("F/F"[RMS]),
     las=1,xlab="Año",cex.lab=1.1)
polygon(x0,frpr0,col=gray(.5,0.5), border="gray80")
polygon(x0,frpr.0,col=gray(.8,0.5), border="gray80")
lines(years.0,Frpr0,lwd=1,col=1,lty=1)    #base
lines(years.0,Frpr.0,lwd=1,col="red2",lty=1) #alternativo
abline(h=1,lty=2,col="green3")
text(2009,1+0.2,expression("F"[RMS]),cex=1.2)
```

```
box()

plot(xbs,ybs,type="l",ylab="Densidad de probabilidad",xaxs="i",
    xlab=expression("BD"[last]*"/BD"[RMS]),las=1,yaxs= "i",ylim=c(0,2.8),xlim=c(0.2,2.2))
polygon(xxbs,yybs,col=gray(0.5,0.5),border="gray80")
polygon(xxbm,yybm,col=gray(0.8,0.7),border="gray80")
lines(xbs,ybs,lwd=1,lty=1)
lines(xbm,ybm,lwd=1,col="red2",lty=1)
legend(0.4,2.8,c(paste("base_IC95% = [",round(icbs[1],3),"-",round(icbs[2],3),"]",sep=" "),paste("alter
box()

plot(xfs,yfs,type="n",ylab="Densidad de probabilidad",xaxs="i",
    xlab=expression("F"[last]*"/F"[RMS]),las=1,yaxs= "i",ylim=c(0,2.8),xlim=c(0,1.5))
polygon(xxfs,yyfs,col=gray(0.5,0.5),border="gray80")
polygon(xxfm,yyfm,col=gray(0.8,0.5),border="gray80")
lines(xfs,yfs,lwd=1,lty=1)
lines(xfm,yfm,lwd=1,col="red2",lty=1)
legend(0.1,2.8,c(paste("base_IC95% = [",round(icfs[1],3),"-",round(icfs[2],3),"]",sep=" "),paste("alter
box()
```

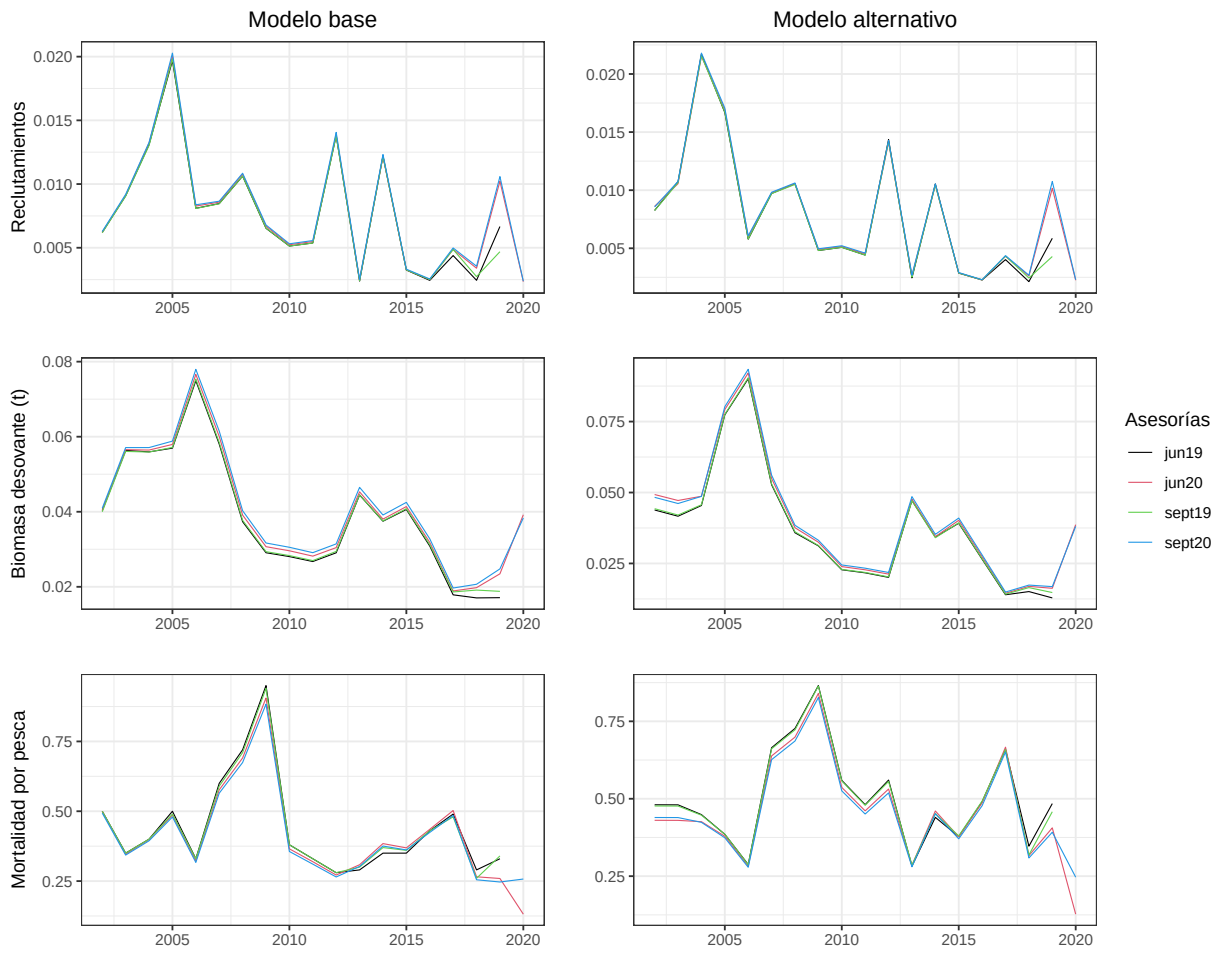


6.5. Comparación con asesorías previas

```
years.0   <- data0$Ind[,1]  ; nyears.0  <- data0$nanos

R_jun19   <- c(6215,9079,13095,19689,8096,8467,10623,6528,5133,5375,
               13802,2383,12211,3249,2441,4388,2445,6665,NA)

R_sept19  <- c(6174,9049,13026,19810,8084,8452,10630,6544,5134,
               5369,13770,2410,12176,3261,2505,4861,2735,4690,NA)

BD_jun19  <- c(40355,56370,55954,56952,74917,58016,37351,29081,
                28055,26737,29062,44469,37477,40608,30858,17861,17043,17109,NA)

BD_sept19 <- c(39991,56080,55914,57142,75339,58468,37718,29360,
                28317,26985,29433,44484,37546,40817,31226,18630,19126,18793,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)

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)

#-------------------------------------------------------------------------------
#modelo base
#-------------------------------------------------------------------------------
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=rep.0b$Reclutamiento,
                    SSBt=rep.0b$Biomasa_desovante,
                    Ft=rep.0b$F)%>%
         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=rep0$Reclutamiento,
                    SSBt=rep0$Biomasa_desovante,
                    Ft=rep0$F)%>%
         mutate(Series=rep("sept20",nyears.0))%>%
```

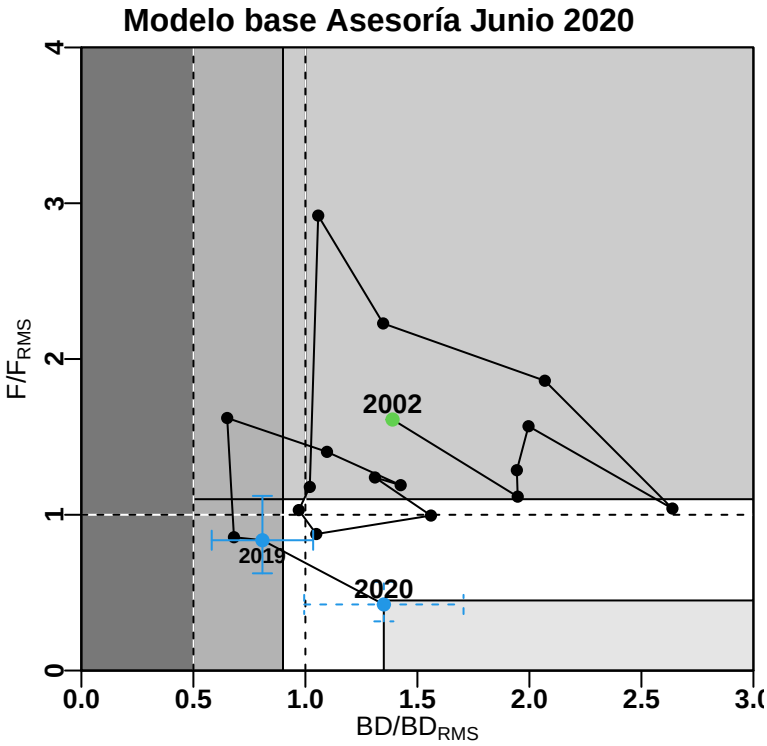
```
         mutate(Modelo=rep("M_base",nyears.0))%>%
         melt(id.var=c('years', 'Series','Modelo'))

#-------------------------------------------------------------------------------
#modelo alternativo
#-------------------------------------------------------------------------------
dat3b <- data.frame(years=years.0,
                    Rt=c(rep.3$Reclutas,NA),
                    SSBt=c(rep.3$BD,NA),
                    Ft=c(rep.3$F,NA))%>%
         mutate(Series=rep("jun19",nyears.0))%>%
         mutate(Modelo=rep("M_alternativo",nyears.0))%>%
         melt(id.var=c('years', 'Series','Modelo'))

dat2b <- data.frame(years=years.0,
                    Rt=c(rep.2$Reclutas,NA),
                    SSBt=c(rep.2$BD,NA),
                    Ft=c(rep.2$F,NA))%>%
         mutate(Series=rep("sept19",nyears.0))%>%
         mutate(Modelo=rep("M_alternativo",nyears.0))%>%
         melt(id.var=c('years', 'Series','Modelo'))

dat1b <- data.frame(years=years.0,
                    Rt=rep.1$Reclutas,
                    SSBt=rep.1$BD,
                    Ft=rep.1$F)%>%
         mutate(Series=rep("jun20",nyears.0))%>%
         mutate(Modelo=rep("M_alternativo",nyears.0))%>%
         melt(id.var=c('years', 'Series','Modelo'))

dat0b <- data.frame(years=years.0,
                    Rt=rep.0$Reclutas,
                    SSBt=rep.0$BD,
                    Ft=rep.0$F)%>%
         mutate(Series=rep("sept20",nyears.0))%>%
         mutate(Modelo=rep("M_alternativo",nyears.0))%>%
         melt(id.var=c('years', 'Series','Modelo'))

data <- data.frame(rbind(dat3b,dat2b,dat1b,dat0b,dat3c,dat2c,dat1c,dat0c))

#-------------------------------------------------------------------------------
# Modelo base
#-------------------------------------------------------------------------------
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="none")

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")

#-------------------------------------------------------------------------------
# Modelo alternativo
#-------------------------------------------------------------------------------
f4<- ggplot(data %>% filter(variable=='Rt',Modelo=='M_alternativo'),aes(years,value/10^6)) +
     geom_line(aes(colour=Series), size=0.3)+
     labs(x = '', y = '',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 alternativo')+
     theme(plot.title = element_text(hjust = 0.5),legend.position="none")

f5<- ggplot(data %>% filter(variable=='SSBt',Modelo=='M_alternativo'),aes(years,value/10^6)) +
     geom_line(aes(colour=Series), size=0.3)+
     labs(x = '', y = '',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))

f6<- ggplot(data %>% filter(variable=='Ft',Modelo=='M_alternativo'),aes(years,value)) +
     geom_line(aes(colour=Series), size=0.3)+
     labs(x = '', y = '',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)  | (f4/f5/f6)
```

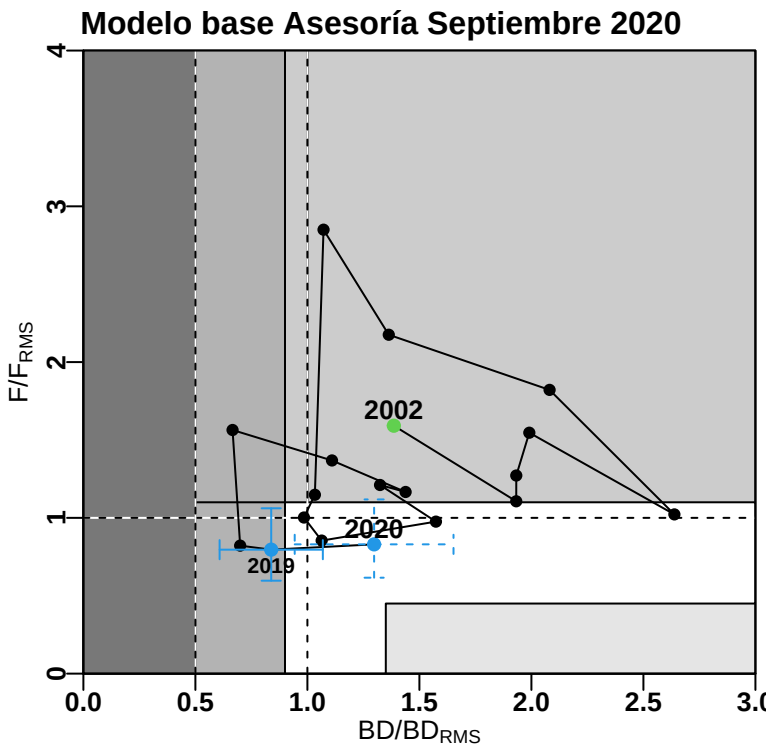



```
source(paste(getwd(),"/funciones/Fn_DiagramaFase.R",sep=""))
name1<-"Modelo base Asesoría Junio 2020"
years1<-rep.0b$Years

SSBt1         <- subset(std.0b,name=="BD")$value
SSBt1std      <- subset(std.0b,name=="BD")$std
Ft1           <- subset(std.0b,name=="log_F")$value
Ft1std        <- subset(std.0b,name=="log_F")$std
BDo     <- rep.0b$BD_virgen_LP
BRMS1   <- BDo*0.55
FRMS1   <- data0b$Ind[nyears1,13]

DiagramaFase(name1,FRMS1,BRMS1,SSBt1,SSBt1std,Ft1,Ft1std,years1)
#cruz del año previo
lastB1    <- SSBt1[nyears1-1]/BRMS1
lastB     <- SSBt1[nyears1-1]
lastF     <- exp(Ft1[nyears1-1])/FRMS1
# Calculate confidence intervals
Qmult     <- -qnorm((1-(80/100))/2.0)
sbSE      <- SSBt1std[nyears1-1]
sb95      <- c(lastB-Qmult*sbSE,lastB+Qmult*sbSE)
B95       <- sb95/BRMS1
```

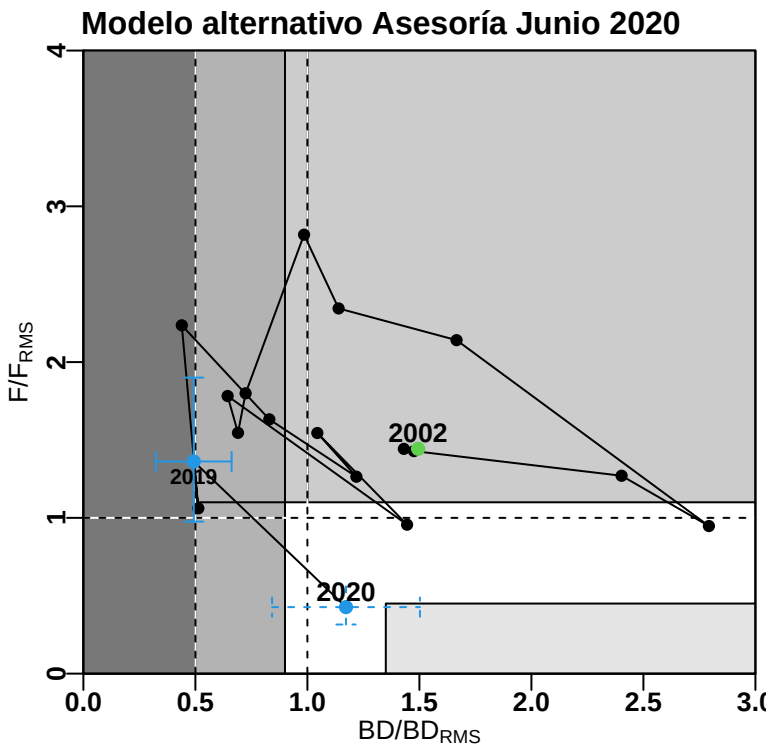
```
FvSE     <- Ft1std[nyears1-1]
F95      <- c(lastF*exp(-Qmult*FvSE),lastF*exp(Qmult*FvSE))
arrows(x0=B95[1],y0=lastF,x1=B95[2],y1=lastF,length=0.05,angle=90,col=4,lwd=1,code=3)
arrows(x0=lastB1,y0=F95[1],x1=lastB1,y1=F95[2],length=0.05,angle=90,col=4,lwd=1,code=3)
points(lastB1,lastF,pch=19,col=4)
text(lastB1,lastF-0.1,years0[nyears0-1],cex=0.8)
```




```
source(paste(getwd(),"/funciones/Fn_DiagramaFase.R",sep=""))
name<-"Modelo base Asesoría Septiembre 2020"
DiagramaFase(name,FRMS,BRMS,SSBt0,SSBt0std,Ft0,Ft0std,years0)
#cruz del año previo
lastB1    <- SSBt0[nyears0-1]/BRMS
lastB     <- SSBt0[nyears0-1]
lastF     <- exp(Ft0[nyears0-1])/FRMS
# Calculate confidence intervals
Qmult     <- -qnorm((1-(80/100))/2.0)
sbSE      <- SSBt0std[nyears0-1]
sb95      <- c(lastB-Qmult*sbSE,lastB+Qmult*sbSE)
B95       <- sb95/BRMS
FvSE      <- Ft0std[nyears0-1]
F95       <- c(lastF*exp(-Qmult*FvSE),lastF*exp(Qmult*FvSE))
arrows(x0=B95[1],y0=lastF,x1=B95[2],y1=lastF,length=0.05,angle=90,col=4,lwd=1,code=3)
arrows(x0=lastB1,y0=F95[1],x1=lastB1,y1=F95[2],length=0.05,angle=90,col=4,lwd=1,code=3)
points(lastB1,lastF,pch=19,col=4)
text(lastB1,lastF-0.1,years0[nyears0-1],cex=0.8)
```

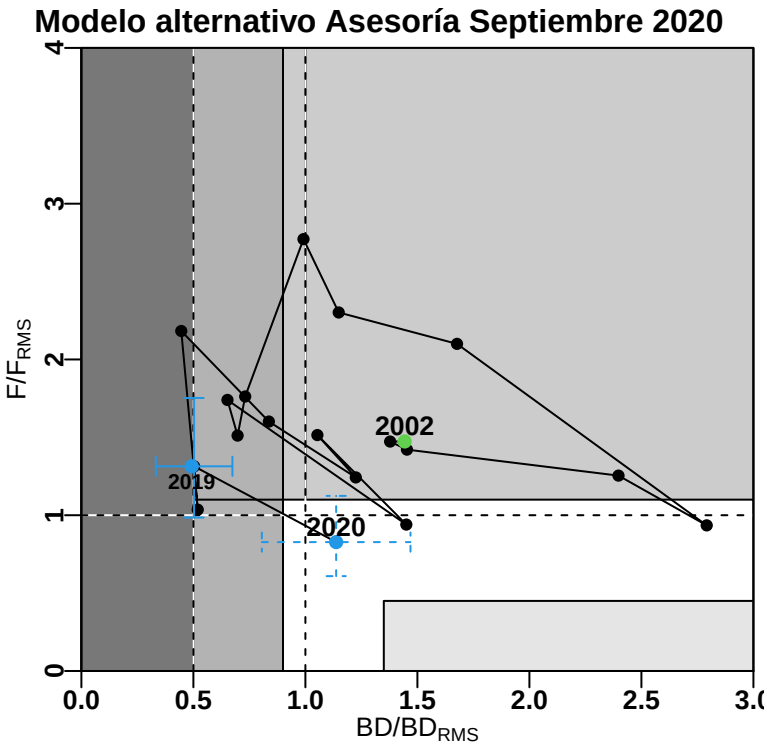



```
source(paste(getwd(),"/funciones/Fn_DiagramaFase.R",sep=""))
name1<-"Modelo alternativo Asesoría Junio 2020"
years1<-rep.1$YRS
SSBt1          <- subset(std.1,name=="BD")$value
SSBt1std       <- subset(std.1,name=="BD")$std
Ft1            <- subset(std.1,name=="log_F")$value
Ft1std         <- subset(std.1,name=="log_F")$std
BDo1     <- rep.1$Bo
BRMS1    <- BDo1*0.55
FRMS1    <- exp(subset(std.1,name=="log_Fref")$value[1])

DiagramaFase(name1,FRMS1,BRMS1,SSBt1,SSBt1std,Ft1,Ft1std,years1)
#cruz del año previo
lastB1     <- SSBt1[nyears1-1]/BRMS1
lastB     <- SSBt1[nyears1-1]
lastF     <- exp(Ft1[nyears1-1])/FRMS1
# Calculate confidence intervals
Qmult     <- -qnorm((1-(80/100))/2.0)
sbSE      <- SSBt1std[nyears1-1]
sb95      <- c(lastB-Qmult*sbSE,lastB+Qmult*sbSE)
B95       <- sb95/BRMS1
FvSE      <- Ft1std[nyears1-1]
F95       <- c(lastF*exp(-Qmult*FvSE),lastF*exp(Qmult*FvSE))
arrows(x0=B95[1],y0=lastF,x1=B95[2],y1=lastF,length=0.05,angle=90,col=4,lwd=1,code=3)
arrows(x0=lastB1,y0=F95[1],x1=lastB1,y1=F95[2],length=0.05,angle=90,col=4,lwd=1,code=3)
points(lastB1,lastF,pch=19,col=4)
text(lastB1,lastF-0.1,years0[nyears0-1],cex=0.8)
```




```
years.0  <- rep.0$YRS
BDo.0    <- rep.0$Bo
BRMS.0   <- BDo.0*0.55
BDlim.0  <- BDo.0*0.275
FRMS.0         <- exp(subset(std.0,name=="log_Fref")$value[3])

SSBt.0         <- subset(std.0,name=="BD")$value
SSBt.0std      <- subset(std.0,name=="BD")$std
Ft.0           <- subset(std.0,name=="log_F")$value
Ft.0std        <- subset(std.0,name=="log_F")$std

source(paste(getwd(),"/funciones/Fn_DiagramaFase.R",sep=""))

name0<-"Modelo alternativo Asesoría Septiembre 2020"
DiagramaFase(name0,FRMS.0,BRMS.0,SSBt.0,SSBt.0std,Ft.0,Ft.0std,years.0)

#cruz del año previo
lastB.0    <- SSBt.0[nyears.0-1]/BRMS.0
lastB     <- SSBt.0[nyears.0-1]
lastF     <- exp(Ft.0[nyears.0-1])/FRMS.0

# Calculate confidence intervals
Qmult    <- -qnorm((1-(80/100))/2.0)
sbSE     <- SSBt.0std[nyears1-1]

sb95     <- c(lastB-Qmult*sbSE,
              lastB+Qmult*sbSE)

B95      <- sb95/BRMS.0
```

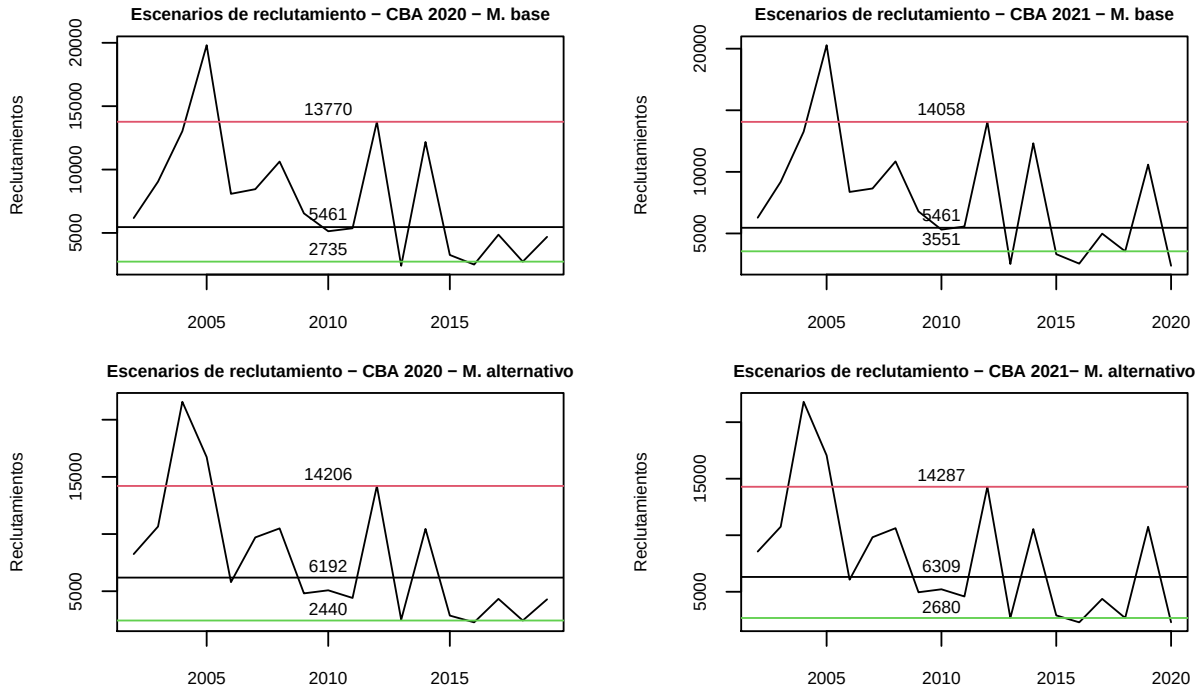
```
FvSE     <- Ft0std[nyears.0-1]

F95      <- c(lastF*exp(-Qmult*FvSE),
              lastF*exp(Qmult*FvSE))

arrows(x0=B95[1],
       y0=lastF,
       x1=B95[2],
       y1=lastF,
       length=0.05,angle=90,col=4,lwd=1,code=3)

arrows(x0=lastB.0,
       y0=F95[1],
       x1=lastB.0,
       y1=F95[2],
       length=0.05,angle=90,col=4,lwd=1,code=3)

points(lastB1,lastF,pch=19,col=4)
text(lastB1,lastF-0.1,years.0[nyears.0-1],cex=0.8)
```



Comparación de la proyección de la Captura Biológicamente Aceptable (CBA inicial - Hito 1)

```
dirb<-paste(dir.0,"/cba_septiembre2019_base",sep="")
setwd(dirb)
reps1b     <- reptoRlist("MTT0819s1.rep")
reps2b     <- reptoRlist("MTT0819s2.rep")
reps3b     <- reptoRlist("MTT0819s3.rep")
```

```r
dira<-paste(dir.0,"/cba_septiembre2019_alternativo",sep="")
setwd(dira)
reps1a     <- reptoRlist("MAT0919s1.rep")
reps2a     <- reptoRlist("MAT0919s2.rep")
reps3a     <- reptoRlist("MAT0919s3.rep")


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

# modelo base
plot(reps1b$Years,reps1b$Reclutamiento,type="l",ylab="Reclutamientos",xlab="Años",main="Escenarios de re
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

# modelo alternativo
plot(reps1a$YRS,reps1a$Reclutas,type="l",ylab="Reclutamientos",xlab="Años",main="Escenarios de reclutami
abline(h=c(reps1a$Rproy,reps2a$Rproy,reps3a$Rproy),col=c(1,2,3))
text(2010,c(reps1a$Rproy,reps2a$Rproy,reps3a$Rproy)+1000,round(c(reps1a$Rproy,reps2a$Rproy,reps3a$Rproy

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

dira<-paste(dir.0,"/cba_septiembre2020_alternativo",sep="")
setwd(dira)
reps1a     <- reptoRlist("MAT0920s1.rep")
reps2a     <- reptoRlist("MAT0920s2.rep")
reps3a     <- reptoRlist("MAT0920s3.rep")


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

# modelo base
plot(reps1b$Years,reps1b$Reclutamiento,type="l",ylab="Reclutamientos",xlab="Años",main="Escenarios de re
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

# modelo alternativo
plot(reps1a$YRS,reps1a$Reclutas,type="l",ylab="Reclutamientos",xlab="Años",main="Escenarios de reclutami
abline(h=c(reps1a$Rproy,reps2a$Rproy,reps3a$Rproy),col=c(1,2,3))
text(2010,c(reps1a$Rproy,reps2a$Rproy,reps3a$Rproy)+1000,round(c(reps1a$Rproy,reps2a$Rproy,reps3a$Rproy
```



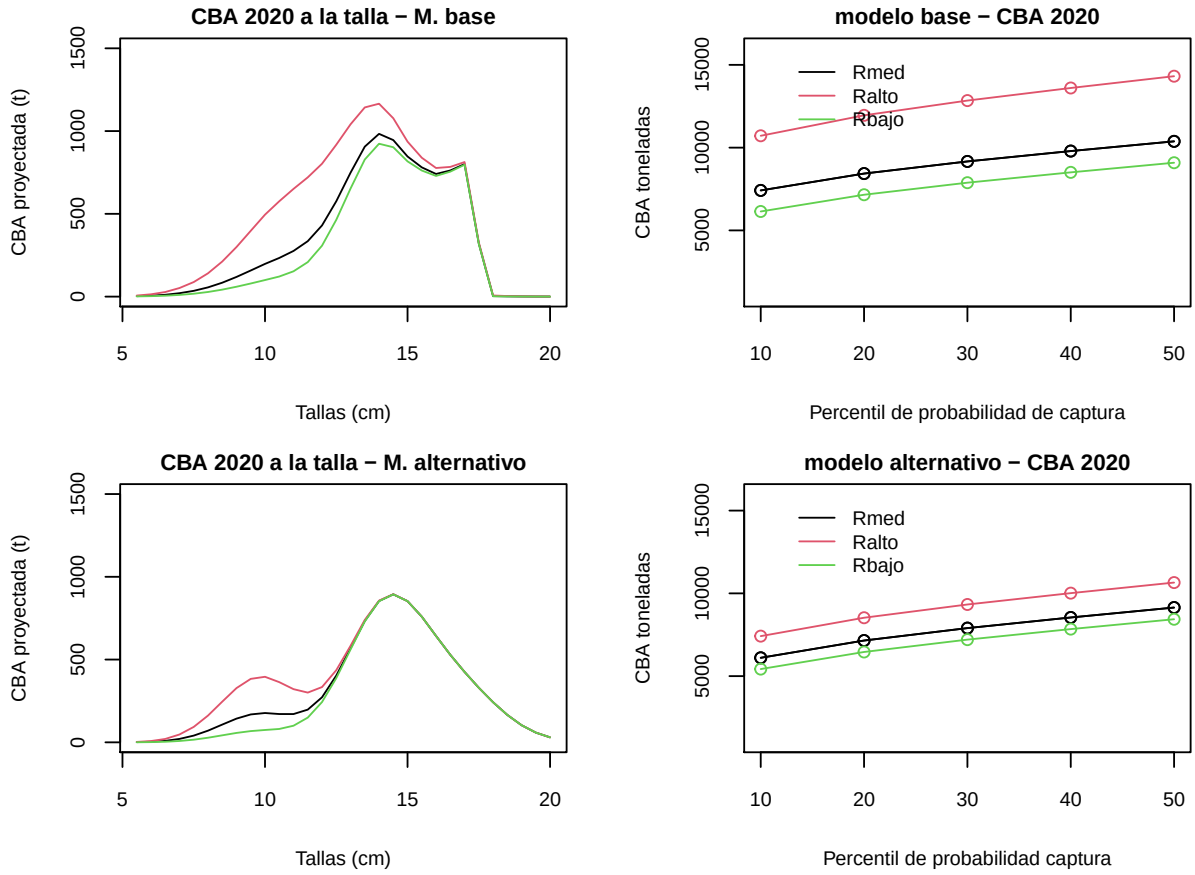

```
dir<-paste(dir.0,"/cba_septiembre2019_base",sep="")
admb<-"/MTT0819"

stds1b     <- read.table(paste(dir,admb,"s1.std", sep=''),header=T,sep="",na="NA",fill=T)
stds2b     <- read.table(paste(dir,admb,"s2.std", sep=''),header=T,sep="",na="NA",fill=T)
stds3b     <- read.table(paste(dir,admb,"s3.std", sep=''),header=T,sep="",na="NA",fill=T)
# es tres porque proyecté solo un año
# es 11 cuando proyecto 5 años
cbas1b     <- subset(stds1b ,name=="Yp")$value[4]
cbas1bstd  <- subset(stds1b ,name=="Yp")$std[4] #reclutamiento medios
cbas2b     <- subset(stds2b ,name=="Yp")$value[4]
cbas2bstd  <- subset(stds2b ,name=="Yp")$std[4] #reclutamiento medios
cbas3b     <- subset(stds3b ,name=="Yp")$value[4]
cbas3bstd  <- subset(stds3b ,name=="Yp")$std[4] #reclutamiento medios

q       <- seq(0.1,0.5,0.1)  # niveles de riesgo (cuantiles)
nq      <- length(q)
CBAs1b     <- rep(0,nq)
CBAs2b     <- rep(0,nq)
CBAs3b   <- rep(0,nq)
buffer1b   <- rep(0,nq)
buffer2b   <- rep(0,nq)
buffer3b   <- rep(0,nq)

for(j in 1:nq){
  CBAs1b[j]<-qnorm(q[j],cbas1b,cbas1bstd )
  CBAs2b[j]<-qnorm(q[j],cbas2b,cbas2bstd )
  CBAs3b[j]<-qnorm(q[j],cbas3b,cbas3bstd )
  }
for(j in 1:nq){
    buffer1b[j] <-round(1-CBAs1b[j]/CBAs1b[5],2)
```

```
    buffer2b[j] <-round(1-CBAs2b[j]/CBAs2b[5],2)
    buffer3b[j] <-round(1-CBAs3b[j]/CBAs3b[5],2)
  }

tCBA1<-cbind(percentil=c(seq(10,50,10)),CBA_Rmed=round(CBAs1b,0),CBA_Ralto=round(CBAs2b,0),CBA_Rbajo=rou
#kable((tCBA1))
tCBA2<-cbind(percentil=c(seq(10,50,10)),CBA_Ralto=round(CBAs2b,0),Resguardo=buffer2b)
#kable((tCBA2))
tCBA3<-cbind(percentil=c(seq(10,50,10)),CBA_Rbajo=round(CBAs3b,0),Resguardo=buffer3b)
#kable((tCBA3))
```

```
dir<-paste(dir.0,"/cba_septiembre2019_alternativo",sep="")
admb<-"/MAT0919"

stds1a     <- read.table(paste(dir,admb,"s1.std", sep=''),header=T,sep="",na="NA",fill=T)
stds2a     <- read.table(paste(dir,admb,"s2.std", sep=''),header=T,sep="",na="NA",fill=T)
stds3a     <- read.table(paste(dir,admb,"s3.std", sep=''),header=T,sep="",na="NA",fill=T)

cbas1a     <- subset(stds1a ,name=="CBAp")$value[3]
cbas1astd  <- subset(stds1a ,name=="CBAp")$std[3] #reclutamiento medios
cbas2a     <- subset(stds2a ,name=="CBAp")$value[3]
cbas2astd  <- subset(stds2a ,name=="CBAp")$std[3] #reclutamiento medios
cbas3a     <- subset(stds3a ,name=="CBAp")$value[3]
cbas3astd  <- subset(stds3a ,name=="CBAp")$std[3] #reclutamiento medios

q       <- seq(0.1,0.5,0.1)  # niveles de riesgo (cuantiles)
nq      <- length(q)
CBAs1a     <- rep(0,nq)
CBAs2a     <- rep(0,nq)
CBAs3a   <- rep(0,nq)
buffer1a   <- rep(0,nq)
buffer2a   <- rep(0,nq)
buffer3a   <- rep(0,nq)

for(j in 1:nq){
  CBAs1a[j]<-qnorm(q[j],cbas1a,cbas1astd )
  CBAs2a[j]<-qnorm(q[j],cbas2a,cbas2astd )
  CBAs3a[j]<-qnorm(q[j],cbas3a,cbas3astd )
  }
for(j in 1:nq){
    buffer1a[j] <-round(1-CBAs1a[j]/CBAs1a[5],2)
    buffer2a[j] <-round(1-CBAs2a[j]/CBAs2a[5],2)
    buffer3a[j] <-round(1-CBAs3a[j]/CBAs3a[5],2)
  }

tCBA1<-cbind(percentil=c(seq(10,50,10)),CBA_Rmed=round(CBAs1a,0),CBA_Ralto=round(CBAs2a,0),CBA_Rbajo=rou
#kable((tCBA1))
tCBA2<-cbind(percentil=c(seq(10,50,10)),CBA_Ralto=round(CBAs2a,0),Resguardo=buffer2a)
#kable((tCBA2))
tCBA3<-cbind(percentil=c(seq(10,50,10)),CBA_Rbajo=round(CBAs3a,0),Resguardo=buffer3a)
#kable((tCBA3))
```

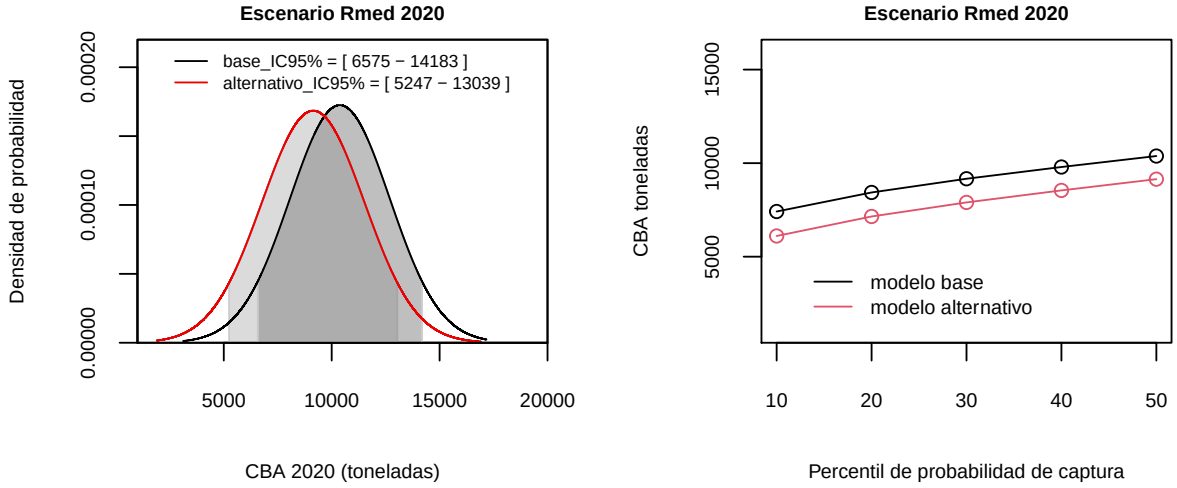
```
dirb<-paste(dir.0,"/cba_septiembre2019_base",sep="")
setwd(dirb)
```

```
reps1b     <- reptoRlist("MTT0819s1.rep")
reps2b     <- reptoRlist("MTT0819s2.rep")
reps3b     <- reptoRlist("MTT0819s3.rep")

dira<-paste(dir.0,"/cba_septiembre2019_alternativo",sep="")
setwd(dira)
reps1a     <- reptoRlist("MAT0919s1.rep")
reps2a     <- reptoRlist("MAT0919s2.rep")
reps3a     <- reptoRlist("MAT0919s3.rep")

tallas<-seq(5.5,20,0.5)

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

plot(tallas,reps1b$CTPp,type="l",ylim=c(0,1500),main="CBA 2020 a la talla - M. base",
     ylab="CBA proyectada (t)",xlab="Tallas (cm)",cex.axis=0.8,cex.main=0.9,cex.lab=0.8)
lines(tallas,reps2b$CTPp,col=2)
lines(tallas,reps3b$CTPp,col=3)

plot(tallas,reps1a$CTPp,type="l",ylim=c(0,1500),main="CBA 2020 a la talla - M. alternativo",
     ylab="CBA proyectada (t)",xlab="Tallas (cm)",cex.axis=0.8,cex.main=0.9,cex.lab=0.8)
lines(tallas,reps2a$CTPp,col=2)
lines(tallas,reps3a$CTPp,col=3)


plot(seq(10,50,10),CBAs1b,type="o", ylab="CBA toneladas",xlab="Percentil de probabilidad de captura",ma
lines(seq(10,50,10),CBAs1b,type="o",col=1)
lines(seq(10,50,10),CBAs2b,type="o",col=2)
lines(seq(10,50,10),CBAs3b,type="o",col=3)
legend(12,16000,c("Rmed","Ralto","Rbajo"),col=c(1,2,3),lwd=1,bty="n",cex=0.8)


plot(seq(10,50,10),CBAs1a,type="o", ylab="CBA toneladas",xlab="Percentil de probabilidad captura",main=
lines(seq(10,50,10),CBAs1a,type="o",col=1)
lines(seq(10,50,10),CBAs2a,type="o",col=2)
lines(seq(10,50,10),CBAs3a,type="o",col=3)
legend(12,16000,c("Rmed","Ralto","Rbajo"),col=c(1,2,3),lwd=1,bty="n",cex=0.8)
```




```
### *modelo base*
xcb1 <-rnorm(1000, mean = cbas1b, sd = cbas1bstd)
xcb  <-seq(min(xcb1),max(xcb1),0.5)
ycb  <-dnorm(xcb, mean = cbas1b, sd =cbas1bstd)
iccb <-qnorm(c(0.05,0.95,0.5),cbas1b,cbas1bstd)
xxcb <-c(xcb[xcb>=iccb[1]&xcb<=iccb[2]],rev(xcb[xcb>=iccb[1]&xcb<=iccb[2]]))
yycb <-c(ycb[xcb>=iccb[1]&xcb<=iccb[2]],rep(0,length(ycb[xcb>=iccb[1]&xcb<=iccb[2]])))

### *modelo altarnativo*
xca1 <-rnorm(1000, mean = cbas1a, sd = cbas1astd)
xca  <-seq(min(xca1),max(xca1),0.5)
yca  <-dnorm(xca, mean = cbas1a, sd =cbas1astd)
icca <-qnorm(c(0.05,0.95,0.5),cbas1a,cbas1astd)
xxca <-c(xca[xca>=icca[1]&xca<=icca[2]],rev(xca[xca>=icca[1]&xca<=icca[2]]))
yyca <-c(yca[xca>=icca[1]&xca<=icca[2]],rep(0,length(yca[xca>=icca[1]&xca<=icca[2]])))

par(mfcol=c(1,2),mar=c(4,4,1,1)+0.5)
plot(xca,yca,type="l",ylab="Densidad de probabilidad",xaxs="i",yaxs= "i",ylim=c(0,0.00022),xlim=c(1000,1
polygon(xxca,yyca,col=gray(0.8,0.7),border="gray80")
polygon(xxcb,yycb,col=gray(0.5,0.5),border="gray80")
lines(xcb,ycb,lwd=1,lty=1)
lines(xca,yca,lwd=1,col="red2",lty=1)
legend(2000,0.00022,c(paste("base_IC95% = [",round(iccb[1],0),"-",round(iccb[2],0),"]",sep=" "),paste("a
box()
```

```
plot(seq(10,50,10),CBAs1b,type="o", ylab="CBA toneladas",xlab="Percentil de probabilidad de captura",ma
lines(seq(10,50,10),CBAs1a,type="o",col=2)
legend(12,5000,c("modelo base","modelo alternativo"),col=c(1,2),lwd=1,bty="n",cex=0.7)
```



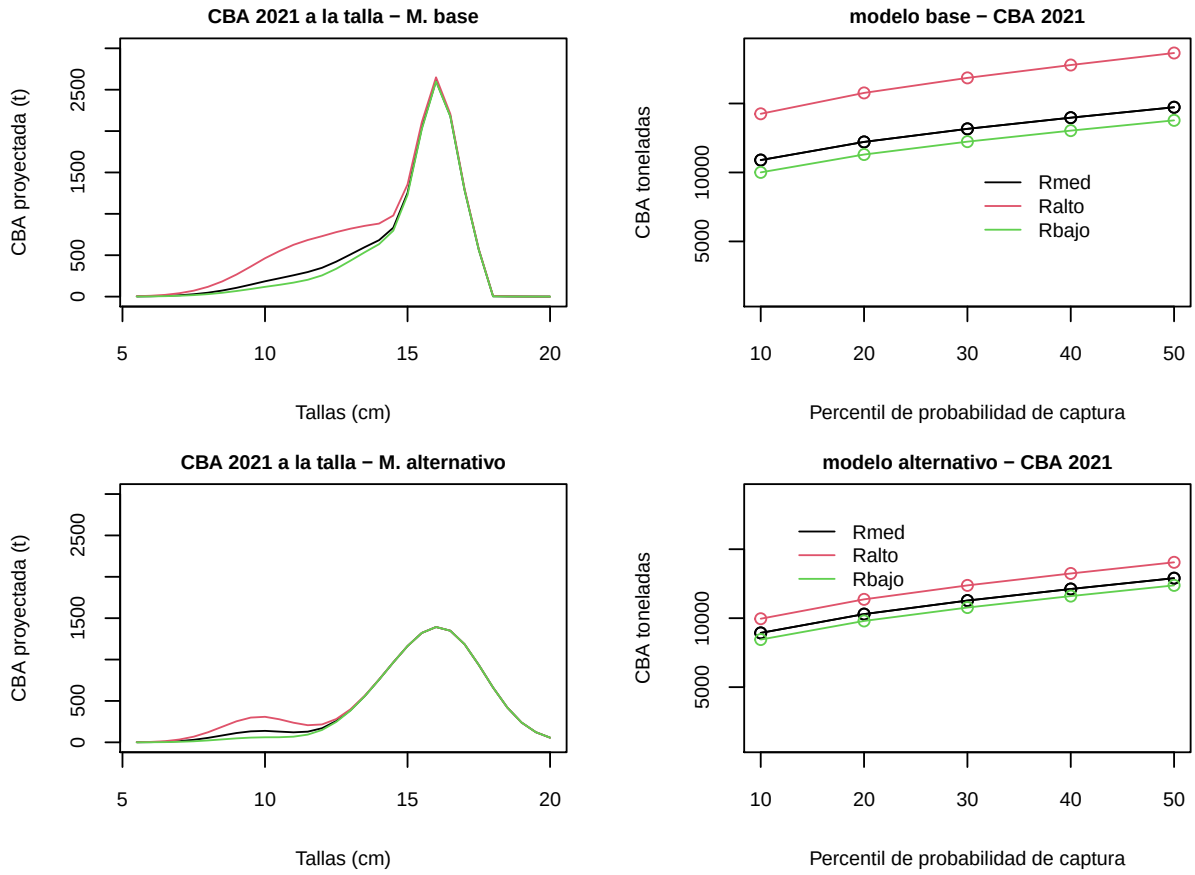

```
dir<-paste(dir.0,"/cba_septiembre2020_base",sep="")
admb<-"/MTT0920"

stds1b     <- read.table(paste(dir,admb,"s1.std", sep=''),header=T,sep="",na="NA",fill=T)
stds2b     <- read.table(paste(dir,admb,"s2.std", sep=''),header=T,sep="",na="NA",fill=T)
stds3b     <- read.table(paste(dir,admb,"s3.std", sep=''),header=T,sep="",na="NA",fill=T)
# es tres porque proyecté solo un año
# es 11 cuando proyecto 5 años
cbas1b     <- subset(stds1b ,name=="Yp")$value[3]
cbas1bstd  <- subset(stds1b ,name=="Yp")$std[3] #reclutamiento medios
cbas2b     <- subset(stds2b ,name=="Yp")$value[3]
cbas2bstd  <- subset(stds2b ,name=="Yp")$std[3] #reclutamiento medios
cbas3b     <- subset(stds3b ,name=="Yp")$value[3]
cbas3bstd  <- subset(stds3b ,name=="Yp")$std[3] #reclutamiento medios

q       <- seq(0.1,0.5,0.1)  # niveles de riesgo (cuantiles)
nq      <- length(q)
CBAs1b     <- rep(0,nq)
CBAs2b     <- rep(0,nq)
CBAs3b   <- rep(0,nq)
buffer1b   <- rep(0,nq)
buffer2b   <- rep(0,nq)
buffer3b   <- rep(0,nq)

for(j in 1:nq){
  CBAs1b[j]<-qnorm(q[j],cbas1b,cbas1bstd )
  CBAs2b[j]<-qnorm(q[j],cbas2b,cbas2bstd )
  CBAs3b[j]<-qnorm(q[j],cbas3b,cbas3bstd )
  }
for(j in 1:nq){
    buffer1b[j] <-round(1-CBAs1b[j]/CBAs1b[5],2)
    buffer2b[j] <-round(1-CBAs2b[j]/CBAs2b[5],2)
```

```
    buffer3b[j] <-round(1-CBAs3b[j]/CBAs3b[5],2)
  }

tCBA1<-cbind(percentil=c(seq(10,50,10)),CBA_Rmed=round(CBAs1b,0),CBA_Ralto=round(CBAs2b,0),CBA_Rbajo=rou
#kable((tCBA1))
tCBA2<-cbind(percentil=c(seq(10,50,10)),CBA_Ralto=round(CBAs2b,0),Resguardo=buffer2b)
#kable((tCBA2))
tCBA3<-cbind(percentil=c(seq(10,50,10)),CBA_Rbajo=round(CBAs3b,0),Resguardo=buffer3b)
#kable((tCBA3))
```

```
dir<-paste(dir.0,"/cba_septiembre2020_alternativo",sep="")
admb<-"/MAT0920"

stds1a     <- read.table(paste(dir,admb,"s1.std", sep=''),header=T,sep="",na="NA",fill=T)
stds2a     <- read.table(paste(dir,admb,"s2.std", sep=''),header=T,sep="",na="NA",fill=T)
stds3a     <- read.table(paste(dir,admb,"s3.std", sep=''),header=T,sep="",na="NA",fill=T)

cbas1a     <- subset(stds1a ,name=="CBAp")$value[3]
cbas1astd  <- subset(stds1a ,name=="CBAp")$std[3] #reclutamiento medios
cbas2a     <- subset(stds2a ,name=="CBAp")$value[3]
cbas2astd  <- subset(stds2a ,name=="CBAp")$std[3] #reclutamiento medios
cbas3a     <- subset(stds3a ,name=="CBAp")$value[3]
cbas3astd  <- subset(stds3a ,name=="CBAp")$std[3] #reclutamiento medios

q       <- seq(0.1,0.5,0.1)  # niveles de riesgo (cuantiles)
nq      <- length(q)
CBAs1a     <- rep(0,nq)
CBAs2a     <- rep(0,nq)
CBAs3a   <- rep(0,nq)
buffer1a   <- rep(0,nq)
buffer2a   <- rep(0,nq)
buffer3a   <- rep(0,nq)

for(j in 1:nq){
  CBAs1a[j]<-qnorm(q[j],cbas1a,cbas1astd )
  CBAs2a[j]<-qnorm(q[j],cbas2a,cbas2astd )
  CBAs3a[j]<-qnorm(q[j],cbas3a,cbas3astd )
  }
for(j in 1:nq){
    buffer1a[j] <-round(1-CBAs1a[j]/CBAs1a[5],2)
    buffer2a[j] <-round(1-CBAs2a[j]/CBAs2a[5],2)
    buffer3a[j] <-round(1-CBAs3a[j]/CBAs3a[5],2)
  }

tCBA1<-cbind(percentil=c(seq(10,50,10)),CBA_Rmed=round(CBAs1a,0),CBA_Ralto=round(CBAs2a,0),CBA_Rbajo=rou
#kable((tCBA1))
tCBA2<-cbind(percentil=c(seq(10,50,10)),CBA_Ralto=round(CBAs2a,0),Resguardo=buffer2a)
#kable((tCBA2))
tCBA3<-cbind(percentil=c(seq(10,50,10)),CBA_Rbajo=round(CBAs3a,0),Resguardo=buffer3a)
#kable((tCBA3))
```

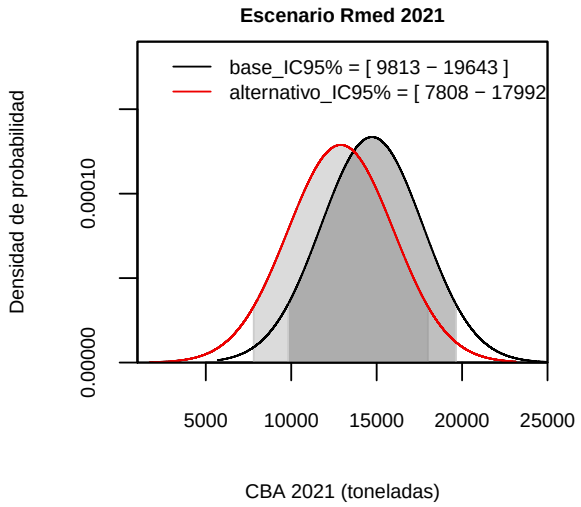
```
dirb<-paste(dir.0,"/cba_septiembre2020_base",sep="")
setwd(dirb)
reps1b     <- reptoRlist("MTT0920s1.rep")
```

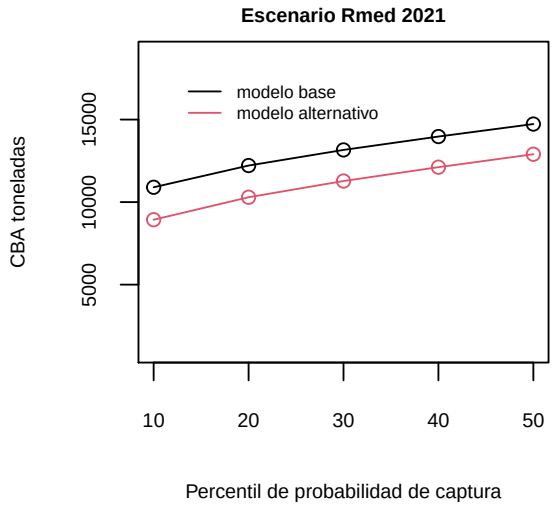
```
reps2b     <- reptoRlist("MTT0920s2.rep")
reps3b     <- reptoRlist("MTT0920s3.rep")

dira<-paste(dir.0,"/cba_septiembre2020_alternativo",sep="")
setwd(dira)
reps1a     <- reptoRlist("MAT0920s1.rep")
reps2a     <- reptoRlist("MAT0920s2.rep")
reps3a     <- reptoRlist("MAT0920s3.rep")


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

plot(tallas,reps1b$CTPp,type="l",ylim=c(0,3000),main="CBA 2021 a la talla - M. base",
     ylab="CBA proyectada (t)",xlab="Tallas (cm)",cex.axis=0.8,cex.main=0.8,cex.lab=0.8)
lines(tallas,reps2b$CTPp,col=2)
lines(tallas,reps3b$CTPp,col=3)

plot(tallas,reps1a$CTPp,type="l",ylim=c(0,3000),main="CBA 2021 a la talla - M. alternativo",
     ylab="CBA proyectada (t)",xlab="Tallas (cm)",cex.axis=0.8,cex.main=0.8,cex.lab=0.8)
lines(tallas,reps2a$CTPp,col=2)
lines(tallas,reps3a$CTPp,col=3)

plot(seq(10,50,10),CBAs1b,type="o", ylab="CBA toneladas",xlab="Percentil de probabilidad de captura",ma
lines(seq(10,50,10),CBAs1b,type="o",col=1)
lines(seq(10,50,10),CBAs2b,type="o",col=2)
lines(seq(10,50,10),CBAs3b,type="o",col=3)
legend(30,11000,c("Rmed","Ralto","Rbajo"),col=c(1,2,3),lwd=1,bty="n",cex=0.8)


plot(seq(10,50,10),CBAs1a,type="o", ylab="CBA toneladas",xlab="Percentil de probabilidad de captura",ma
lines(seq(10,50,10),CBAs1a,type="o",col=1)
lines(seq(10,50,10),CBAs2a,type="o",col=2)
lines(seq(10,50,10),CBAs3a,type="o",col=3)
legend(12,18000,c("Rmed","Ralto","Rbajo"),col=c(1,2,3),lwd=1,bty="n",cex=0.8)
```




```
### *modelo base*
xcb1 <-rnorm(1000, mean = cbas1b, sd = cbas1bstd)
xcb  <-seq(min(xcb1),max(xcb1),0.5)
ycb  <-dnorm(xcb, mean = cbas1b, sd =cbas1bstd)
iccb <-qnorm(c(0.05,0.95,0.5),cbas1b,cbas1bstd)
xxcb <-c(xcb[xcb>=iccb[1]&xcb<=iccb[2]],rev(xcb[xcb>=iccb[1]&xcb<=iccb[2]]))
yycb <-c(ycb[xcb>=iccb[1]&xcb<=iccb[2]],rep(0,length(ycb[xcb>=iccb[1]&xcb<=iccb[2]])))

### *modelo altarnativo*
xca1 <-rnorm(1000, mean = cbas1a, sd = cbas1astd)
xca  <-seq(min(xca1),max(xca1),0.5)
yca  <-dnorm(xca, mean = cbas1a, sd =cbas1astd)
icca <-qnorm(c(0.05,0.95,0.5),cbas1a,cbas1astd)
xxca <-c(xca[xca>=icca[1]&xca<=icca[2]],rev(xca[xca>=icca[1]&xca<=icca[2]]))
yyca <-c(yca[xca>=icca[1]&xca<=icca[2]],rep(0,length(yca[xca>=icca[1]&xca<=icca[2]])))

par(mfcol=c(1,2),mar=c(4,4,1,1)+0.5)
plot(xca,yca,type="l",ylab="Densidad de probabilidad",xaxs="i",yaxs= "i",ylim=c(0,0.00019),xlim=c(1000,1
polygon(xxca,yyca,col=gray(0.8,0.7),border="gray80")
polygon(xxcb,yycb,col=gray(0.5,0.5),border="gray80")
lines(xcb,ycb,lwd=1,lty=1)
lines(xca,yca,lwd=1,col="red2",lty=1)
legend(2000,0.00019,c(paste("base_IC95% = [",round(iccb[1],0),"-",round(iccb[2],0),"]",sep=" "),paste("a
box()
```

```
plot(seq(10,50,10),CBAs1b,type="o", ylab="CBA toneladas",xlab="Percentil de probabilidad de captura",ma
lines(seq(10,50,10),CBAs1a,type="o",col=2)
legend(12,18000,c("modelo base","modelo alternativo"),col=c(1,2),lwd=1,bty="n",cex=0.6)
```






```
### *modelo base*
xcb1 <-rnorm(1000, mean = cbas0, sd = cbas0std)
xcb  <-seq(min(xcb1),max(xcb1),0.5)
ycb  <-dnorm(xcb, mean = cbas0, sd =cbas0std)
iccb <-qnorm(c(0.05,0.95,0.5),cbas0,cbas0std)
xxcb <-c(xcb[xcb>=iccb[1]&xcb<=iccb[2]],rev(xcb[xcb>=iccb[1]&xcb<=iccb[2]]))
yycb <-c(ycb[xcb>=iccb[1]&xcb<=iccb[2]],rep(0,length(ycb[xcb>=iccb[1]&xcb<=iccb[2]])))

### *modelo altarnativo*
xca1 <-rnorm(1000, mean = cbas1, sd = cbas1std)
xca  <-seq(min(xca1),max(xca1),0.5)
yca  <-dnorm(xca, mean = cbas1, sd =cbas1std)
icca <-qnorm(c(0.05,0.95,0.5),cbas1,cbas1std)
xxca <-c(xca[xca>=icca[1]&xca<=icca[2]],rev(xca[xca>=icca[1]&xca<=icca[2]]))
yyca <-c(yca[xca>=icca[1]&xca<=icca[2]],rep(0,length(yca[xca>=icca[1]&xca<=icca[2]])))

par(mfcol=c(3,1),mar=c(4,4,1,1)+0.5)

tallas<-seq(5.5,20,0.5)
#par(mfcol=c(1,1),mar=c(4,4,1,1)+0.5)
plot(tallas,rep1$CTP,type="l",ylim=c(0,3000),main="CBA 2020 a la talla",
     ylab="CBA 2020 (t)",xlab="Tallas (cm)",col=2,cex.axis=0.7,cex.main=0.7,cex.lab=0.7)
lines(tallas,rep0$CTP,type="l",ylim=c(0,3000),col=1)

plot(xca,yca,type="l",ylab="Densidad de probabilidad",xaxs="i",yaxs= "i",ylim=c(0,0.00015),xlim=c(5000,
polygon(xxca,yyca,col=gray(0.8,0.7),border="gray80")
polygon(xxcb,yycb,col=gray(0.5,0.5),border="gray80")
lines(xcb,ycb,lwd=1,lty=1)
lines(xca,yca,lwd=1,col="red2",lty=1)
legend(5000,0.00015,c(paste("base_IC95% = [",round(iccb[1],0),"-",round(iccb[2],0),"]",sep=" "),paste("
box()
```

```
plot(seq(10,50,10),CBAs0,type="o", ylab="CBA toneladas",xlab="Percentil de probabilidad de captura",mai
lines(seq(10,50,10),CBAs1,type="o",col=2)
legend(20,12000,c("modelo base","modelo alternativo"),col=c(1,2),lwd=1,bty="n",cex=0.7)
```