

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 ALTER-NATIVO

```
#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")

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")
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)

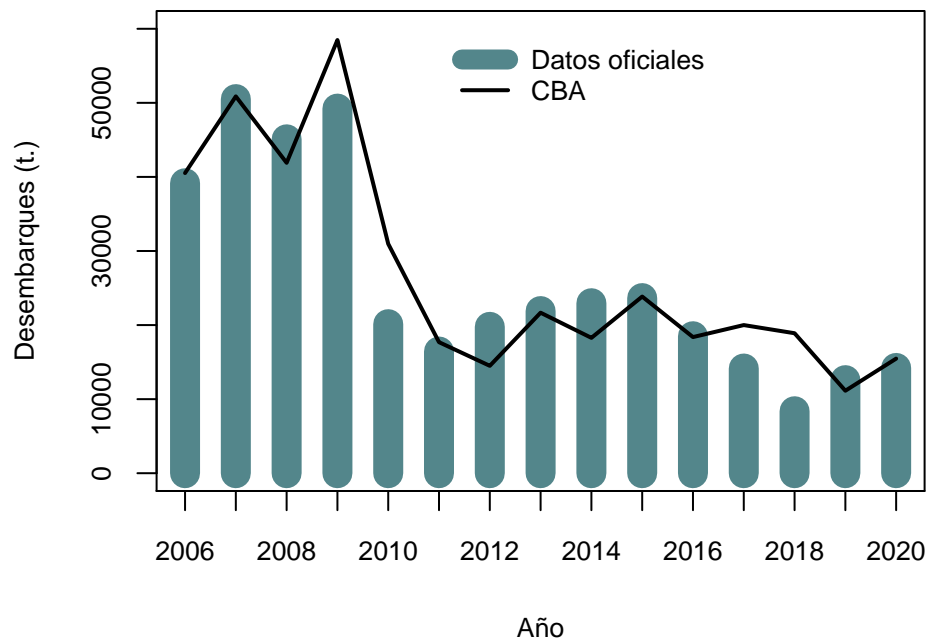
#modelo alternativo junio 2019 - Hito 2
data3      <- lisread(paste(dir.1,"MAT0619.dat", sep='/'));
names(data3) <- str_trim(names(data3), side="right")
rep.3      <- reptoRlist("MAT0619.rep")
std.3      <- read.table("MAT0619.std",header=T,sep="",na="NA",fill=T)
```

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','mes'),
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, size = 10)) +
  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))

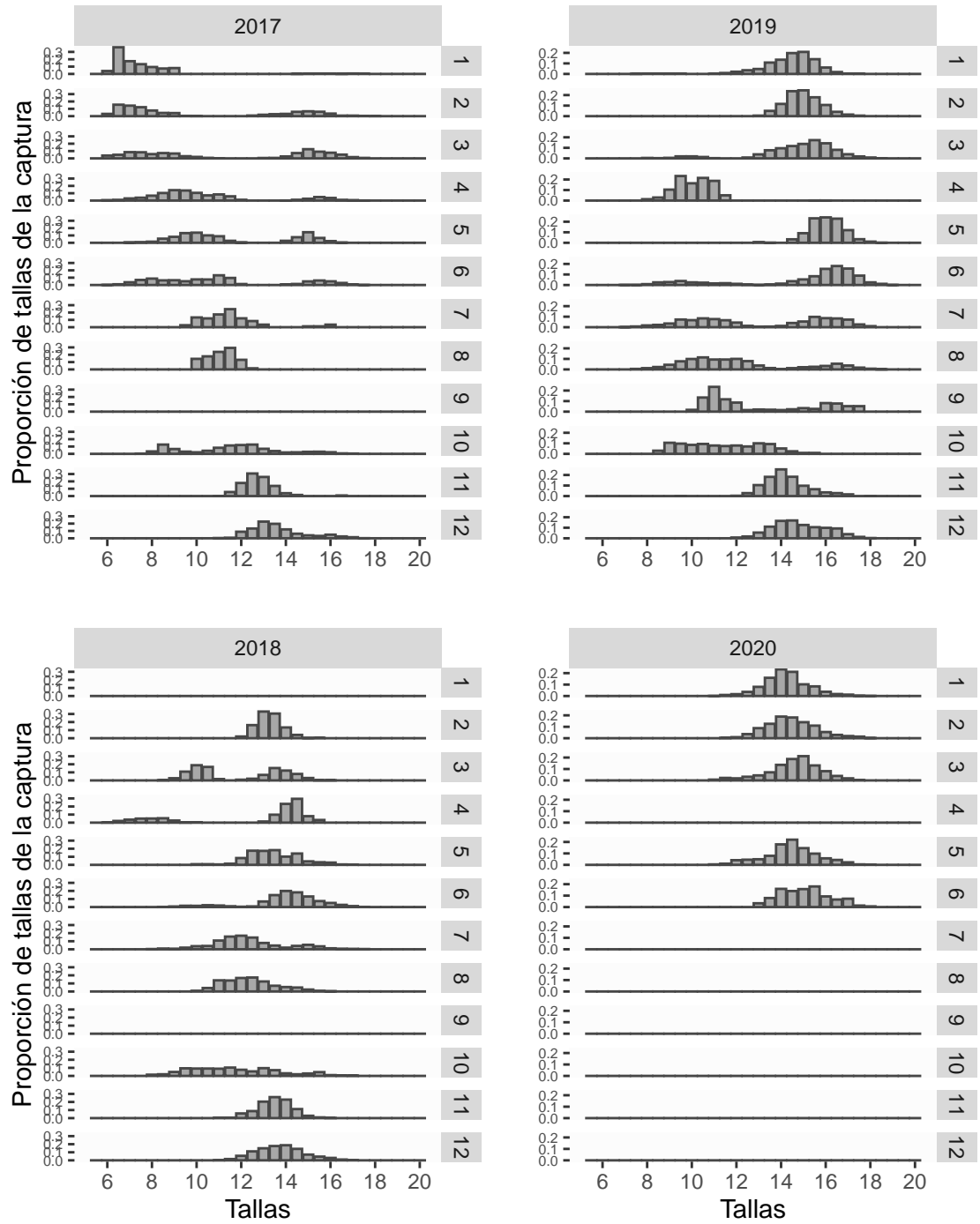
fig1 <- ggplot(filter(obs,year==2018)) +
  geom_bar(aes(x = talla, y = value), stat="identity", fill='gray66', color = 'gray28') +
  facet_grid(mes~year) +
  labs(x = 'Tallas', y = 'Proporción de tallas de la captura') +
  theme(panel.background = element_rect(fill = "gray99"),axis.text.y = element_text(hjust = 1, s
  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, s
  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, s
  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

```

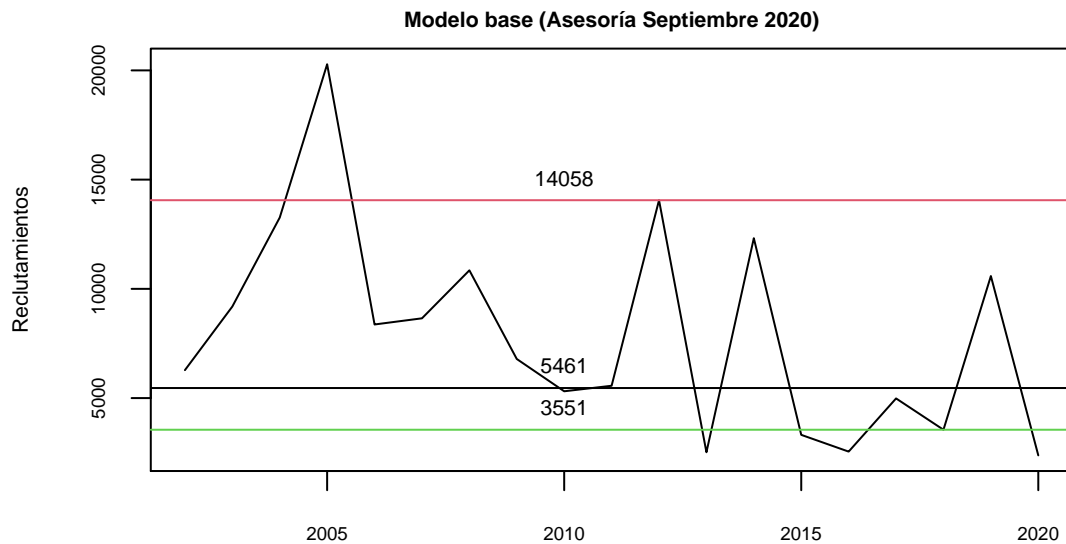


2. Metodología

```
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 (Asesoría Septiembre 2020)",col="black",lty=1)
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(8.6053e+000),reps2b$Reclutamiento[11],reps3b$Reclutamiento[17])),col=c(1,2,3))
```



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] <- NA
colnames(ind_obs) <- c('Biomasa_Crucero', 'CPUE', 'Desembarques')

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

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

ind <- data.frame(ind_obs) %>% mutate(Asesoría='observado') %>%
  mutate (yrs= yrs) %>% melt(id.var=c('yrs', 'Asesoría'))
junio <- data.frame(ind_jun) %>% mutate (Asesoría='junio_2020') %>%
  mutate (yrs= yrs) %>% melt(id.var=c('yrs', 'Asesoría'))
sept <- data.frame(ind_sept) %>% mutate (Asesoría='septiembre_2020') %>%
  mutate (yrs= yrs) %>% melt(id.var=c('yrs', 'Asesoría'))

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

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

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

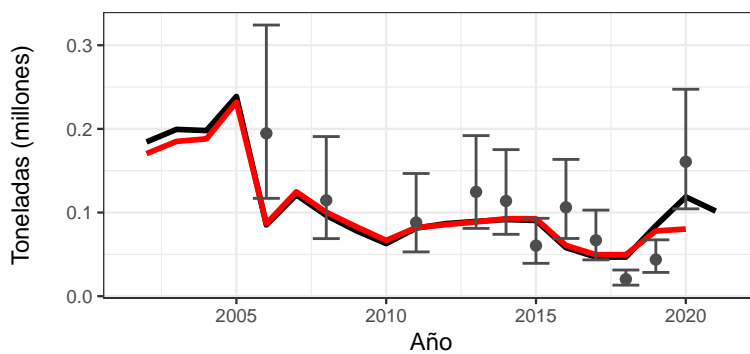


```
f2 <- ggplot(base1 %>% filter(Asesoría!='observado', variable=='CPUE'),
  aes(yrs,value/1000000)) +
  geom_line(aes(colour=Asesoría), size=1) +
  scale_colour_manual(values=c('black','red')) +
  geom_point(data = base1 %>% filter(Asesoría=='observado',
    variable=='CPUE'),
  aes(yrs,value/1000000), shape = 19, colour = 'gray30') +
  geom_errorbar(data = base1 %>% filter(Asesoría=='observado',
    variable=='CPUE'),
  aes(ymin = value*exp(-1.96*cvcpcue)*10^-6,
    ymax = value*exp(1.96*cvcpcue)*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)

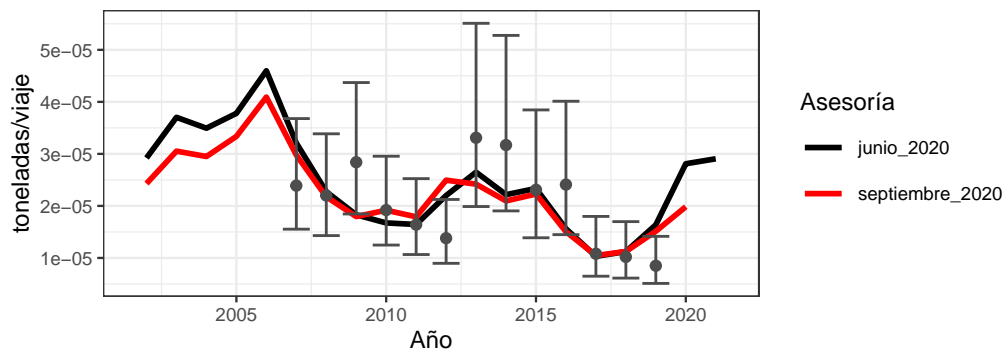
f3 <- ggplot(base1 %>% filter(Asesoría!='observado', variable=='Desembarques'),
  aes(yrs,value/1000)) + geom_line(aes(colour=Asesoría), size=1) +
  scale_colour_manual(values=c('black','red')) +
  geom_point(data = base1 %>% filter(Asesoría=='observado',
    variable=='Desembarques'),
  aes(yrs,value/1000), 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")
```

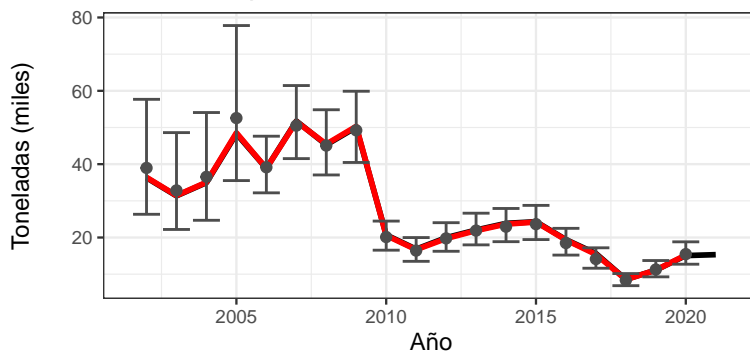
Biomasa de Crucero



CPUE



Desembarques



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
#####

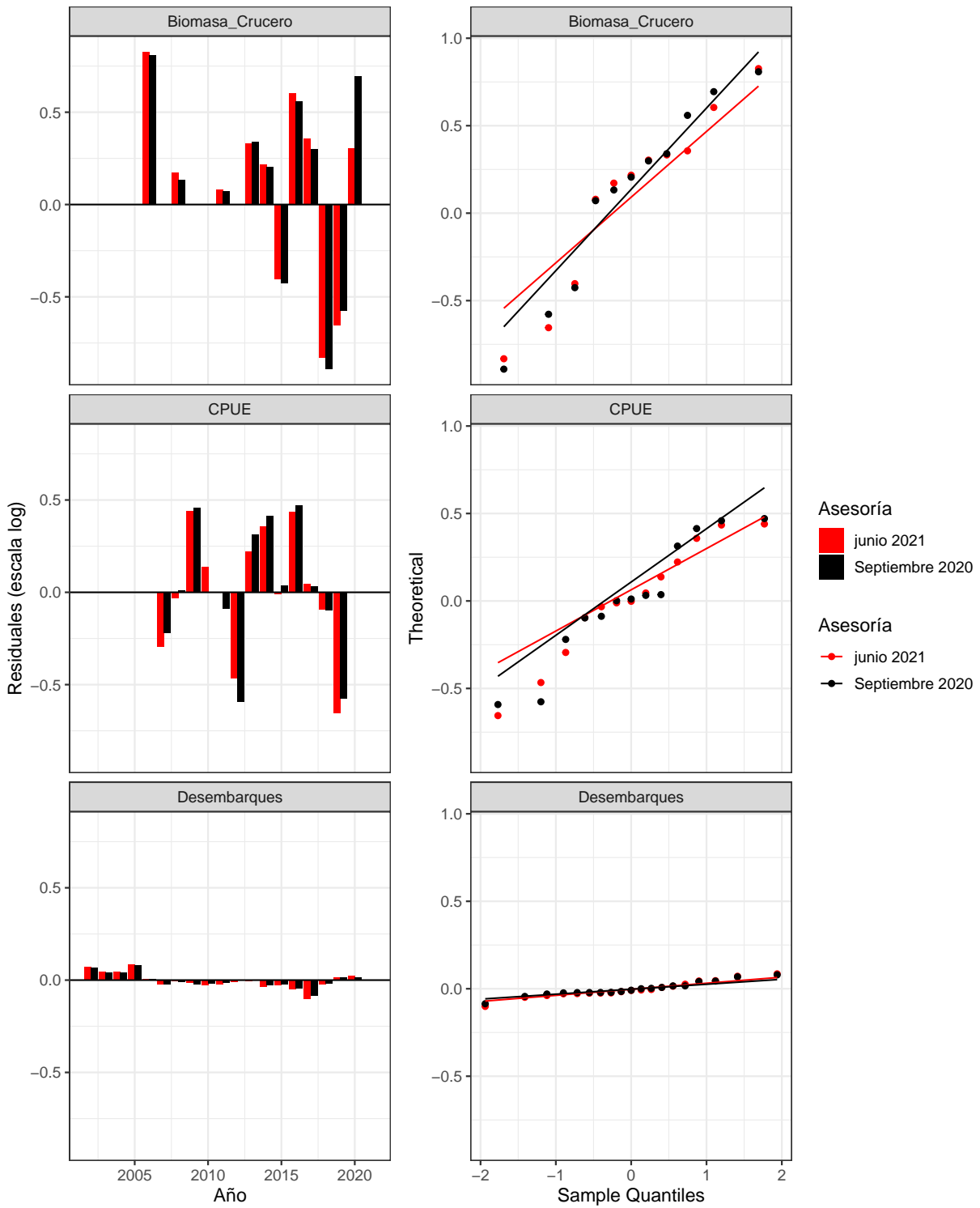
r1 <- ggplot(Res, aes(yrs,value)) +
  geom_bar(aes(fill=Asesoría), stat='identity', position='dodge') +
  scale_fill_manual(values=c("red","black"))+
  geom_hline(yintercept = 0) +
  facet_wrap(. ~ variable, ncol = 1) +
  labs(x= 'Año', y = 'Residuales (escala log)') +
  theme_bw(base_size=12)

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)

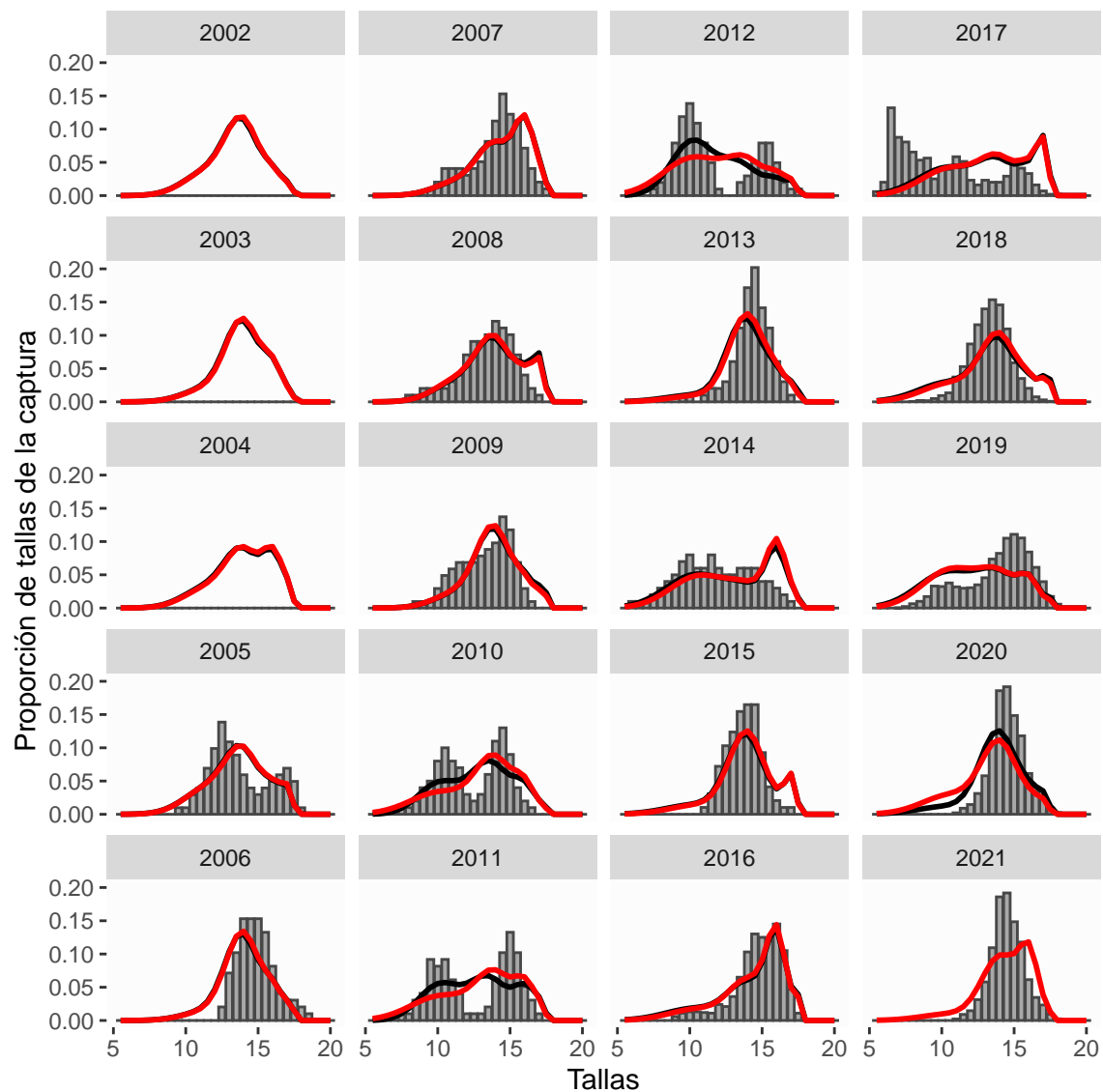
r1+r4 + plot_layout(guides="collect")
```



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

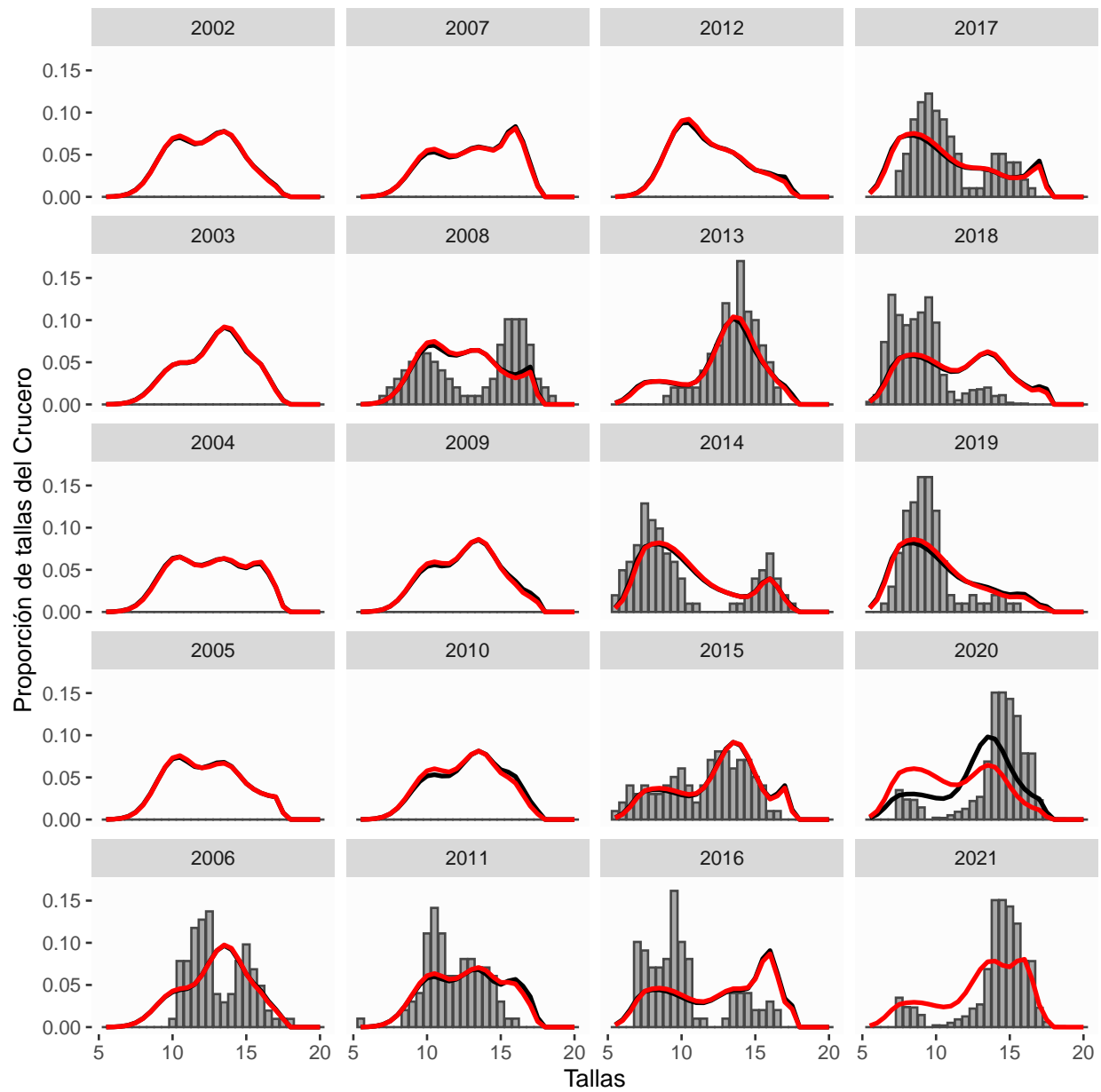
FLOTA

```
#####  
# 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
```



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
```



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])

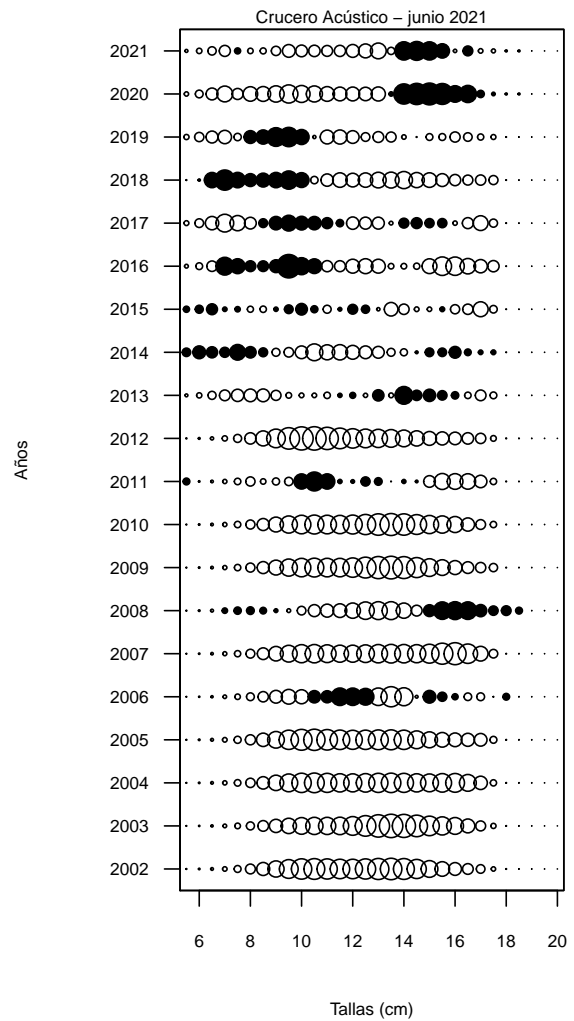
for(j in 1:dd[1]){for(k in 1:dd[2]){val<-resB_alt[j,k]
if(val>0){est[j,k]<-val/rng[2]}
else{est[j,k]<-val/rng[1]*-1}}}

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$Ind[,1] ; nyyears.1 <- data.1$nanos  
years.0 <- data.1$Ind[,1] ; nyyears.0 <- data.1$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",nyyears.0))%>%mutate(Modelo=rep("M_base",nyyears.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",nyyears.0))%>%mutate(Modelo=rep("M_base",nyyears.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",nyyears.0))%>%mutate(Modelo=rep("M_base",nyyears.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",nyyears.0))%>%mutate(Modelo=rep("M_base",nyyears.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",nyyears.0))%>%mutate(Modelo=rep("M_base",nyyears.1))%>%
```

```

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

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

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

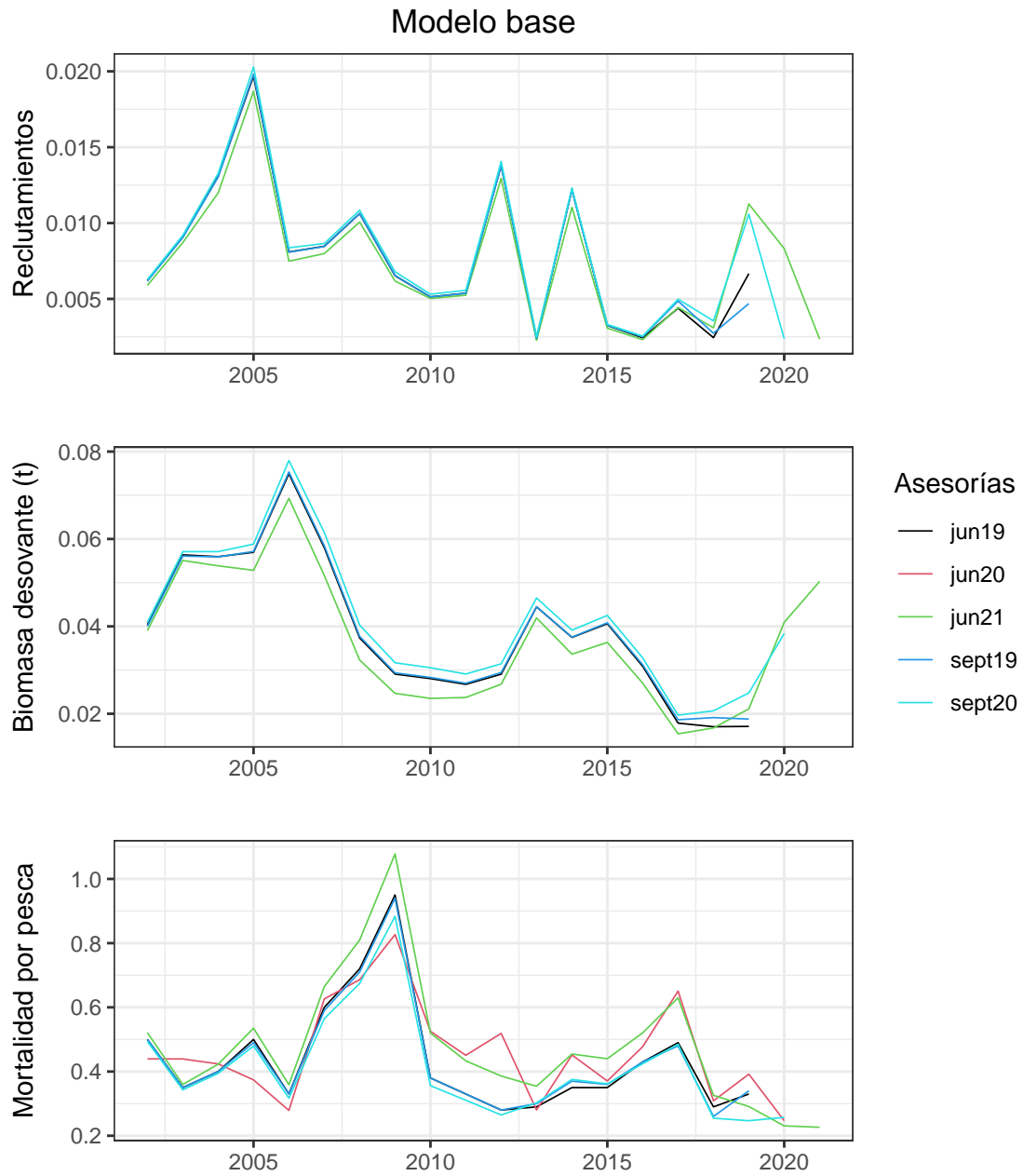
f1<- ggplot(data %>% filter(variable=='Rt',Modelo=='M_base'),
            aes(years,value/10^6)) +
  geom_line(aes(colour=Series), size=0.3)+
  labs(x = '', y = 'Reclutamientos',colour='Asesorías') +
  scale_x_continuous(breaks = seq(from = 1990, to = 2020, by = 5)) +
  scale_colour_manual(values=seq(1,5,1))+
  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)

```



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 retrospectivo 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) +

```



```

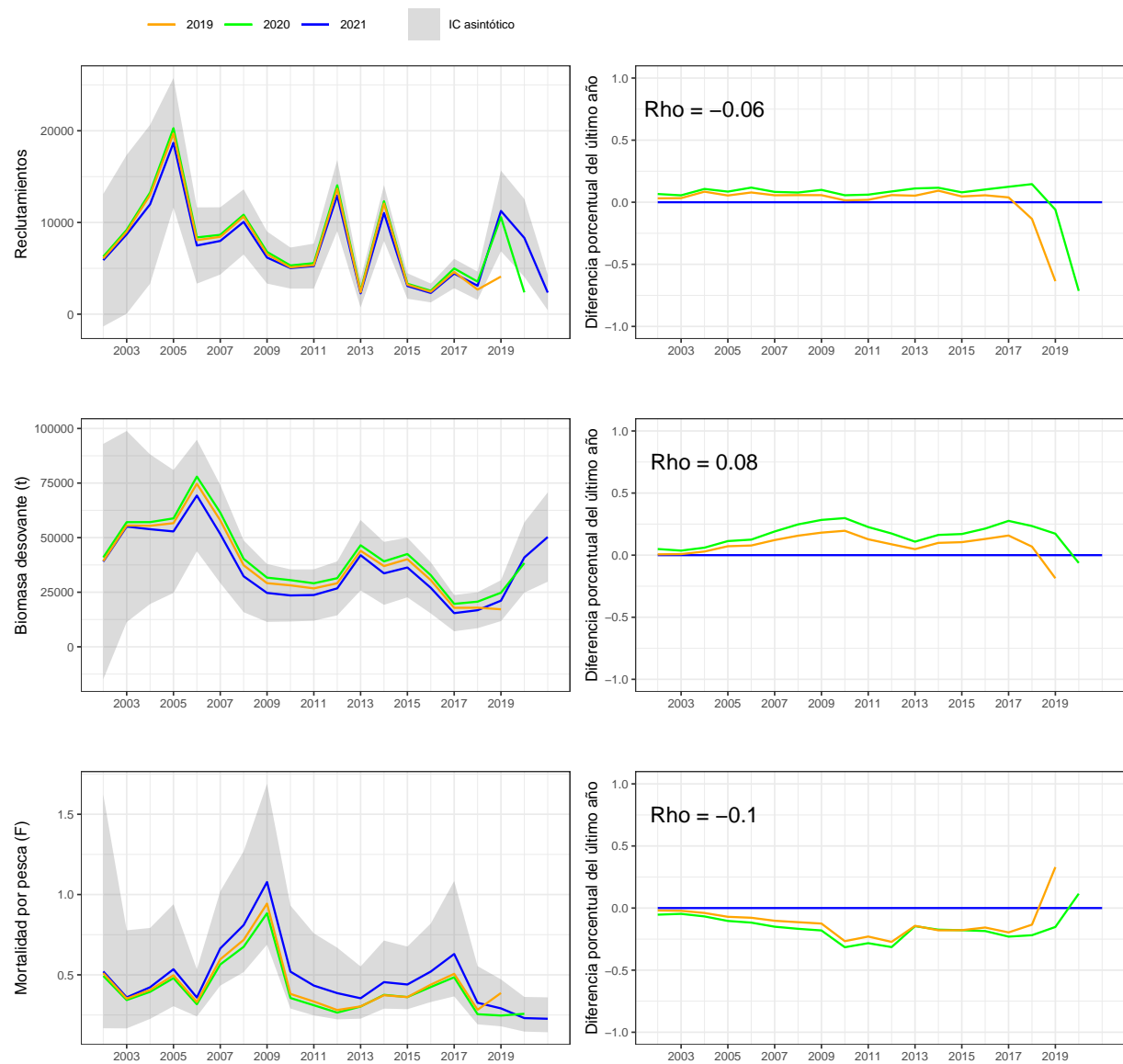
ggtitle('')+
theme(plot.title = element_text(hjust = 0.5),legend.position="none")

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

```



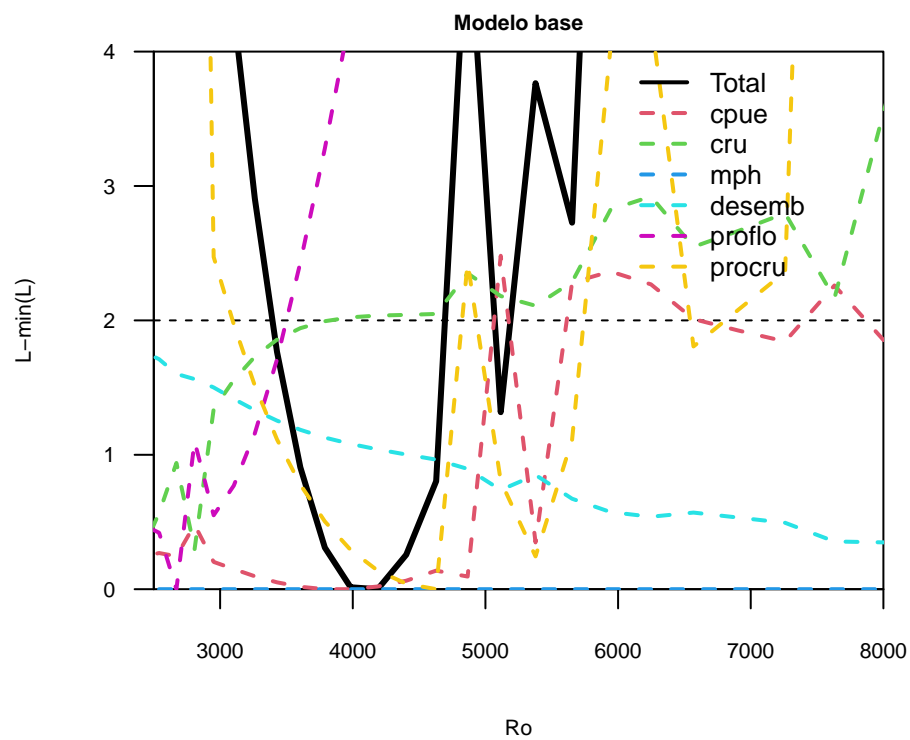
3.7. Perfil de verosimilitud

```
#####
# 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]} # Estandarizaci?n
#=====
# 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)
```



3.8. Sensibilidad a la actualización de datos

4. RESULTADOS OBJETIVO 2

4.1. Indicadores del stock

5. RESULTADOS OBJETIVO 3

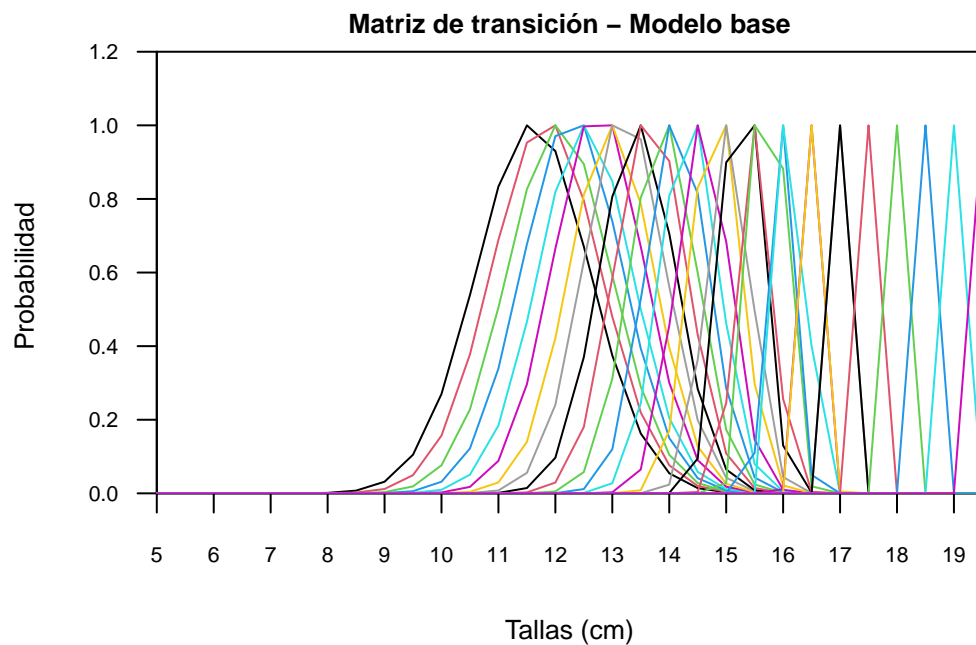
6. RESULTADOS OBJETIVO 4

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

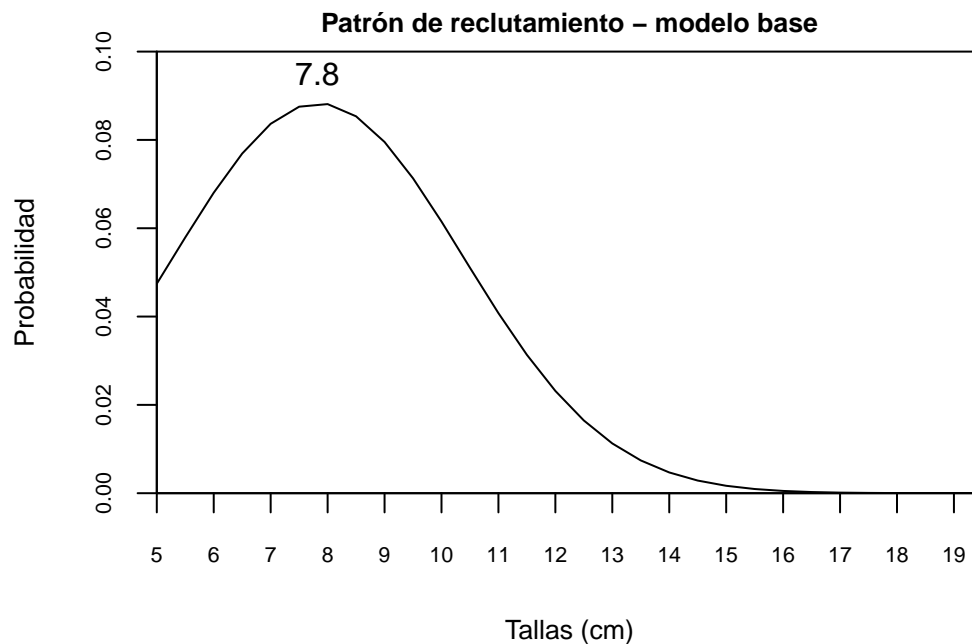
```
# Clave edad talla -----
# Arreglos
yrs    <- rep0$Years
nyrs   <- length(yrs)
tallas <- seq(5,19.5,0.5)
ntallas <- length(tallas)
age    <- seq(0,4,1)
nage   <- length(age)

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))
```

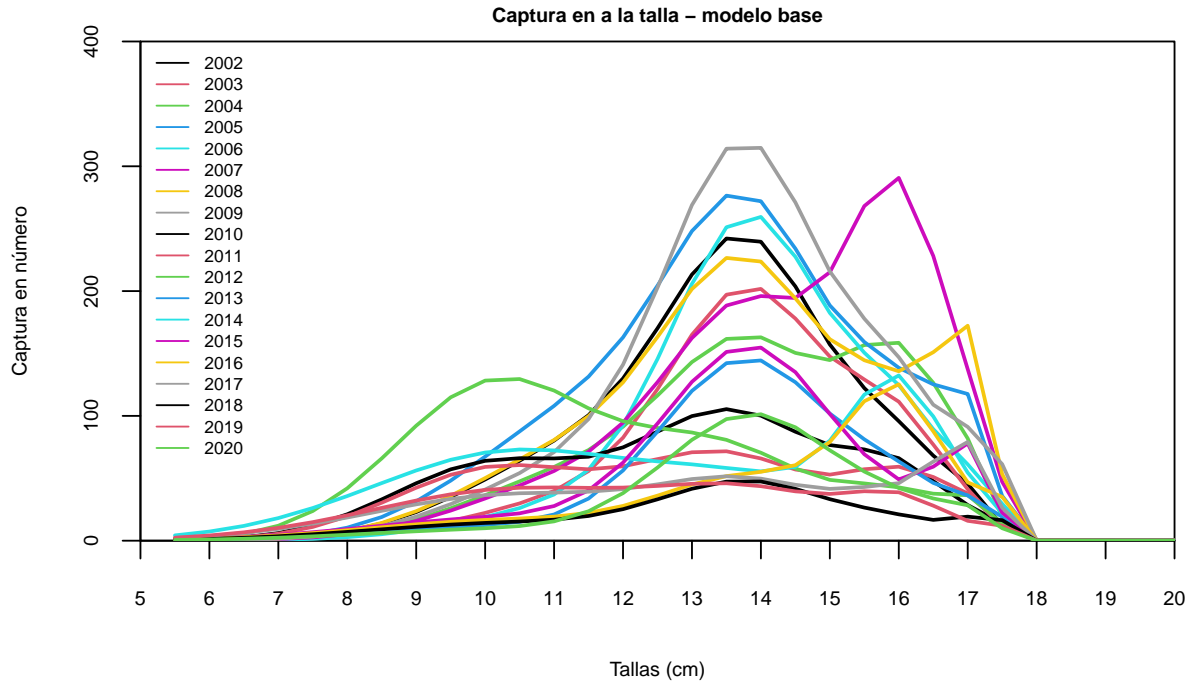



```

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))

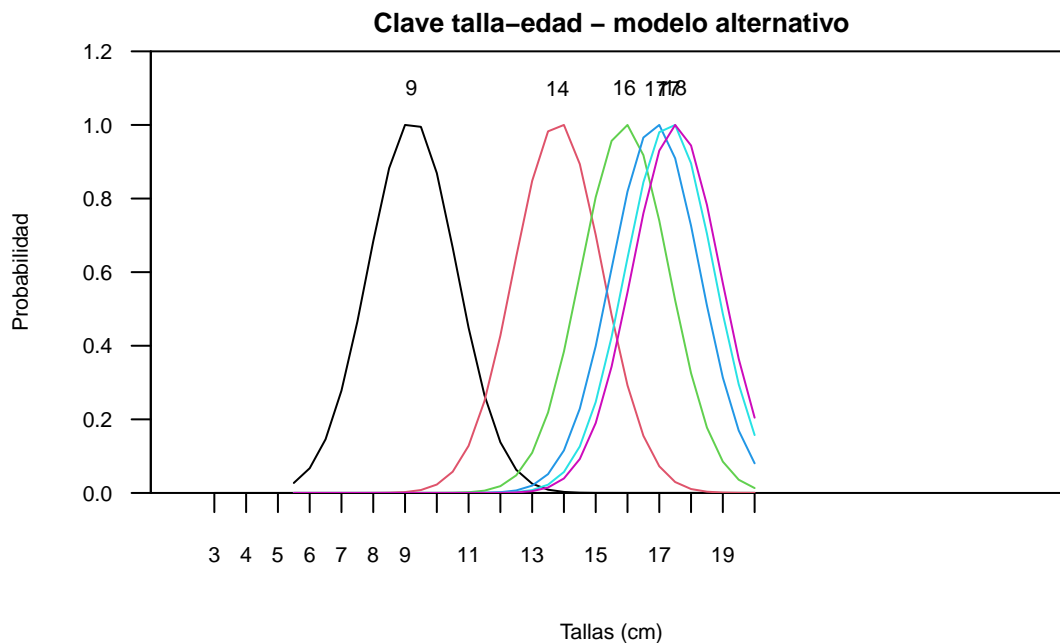
fig1
```

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,rep.0$Prob_talla[1,],type="n",las=1, ylim=c(0, 1.2),
     cex.lab=0.7,cex.axis=0.7,cex.main=0.8,
     ylab="Probabilidad",xlab="Tallas (cm)",main="Clave talla-edad - modelo alternativo",
     xaxp=c(3,20,34/2), xaxs= "i", yaxs= "i",)
for(i in 1:nage){lines(tallas,rep.0$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)
```



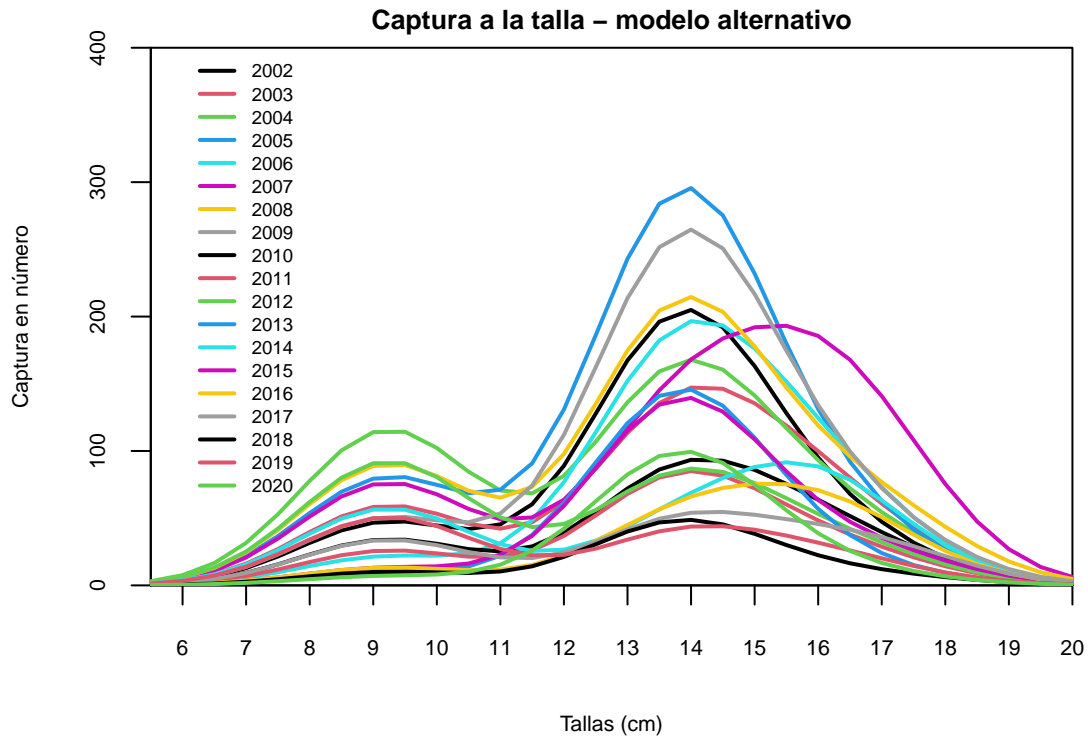
```
tallas      <-seq(5.5,20,0.5)
ntallas     <-length(tallas)
N           <-rep.0$Capt_age
year        <-data0$Ind[,1]
nyear       <-length(year)

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))

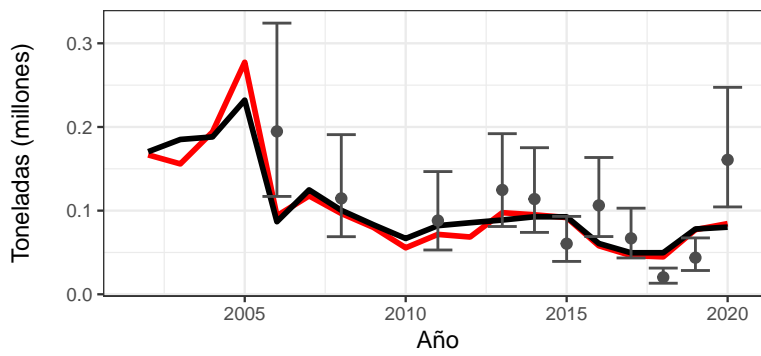
f1 <- ggplot(base1 %>% filter(Asesoría!='observado', variable=='Biomasa_Crucero'),
  aes(yrs,value/1000000)) + geom_line(aes(colour=Asesoría), size=1) +
  scale_colour_manual(values=c('red',"black")) +
  geom_point(data = base1 %>% filter(Asesoría=='observado', variable=='Biomasa_Crucero'),
  aes(yrs,value/1000000), 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)
```

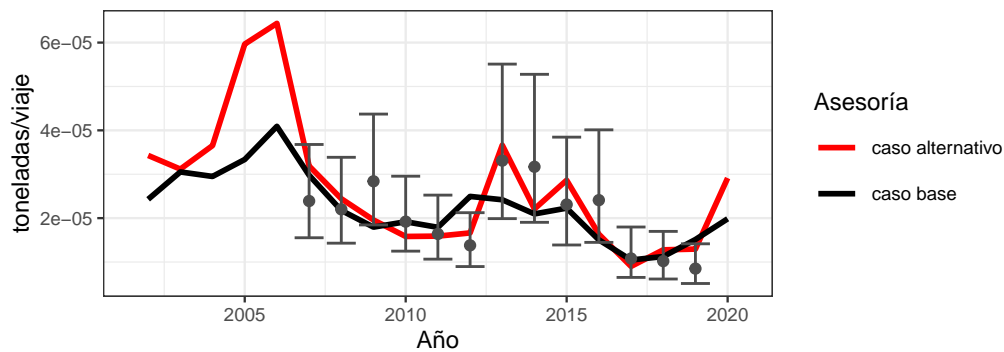
```
f3 <- ggplot(base1 %>% filter(Asesoría!='observado', variable=='Desembarques'),
  aes(yrs,value/1000)) + geom_line(aes(colour=Asesoría), size=1) +
  scale_colour_manual(values=c('red',"black")) +
  geom_point(data = base1 %>% filter(Asesoría=='observado', variable=='Desembarques'),
  aes(yrs,value/1000), 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")
```

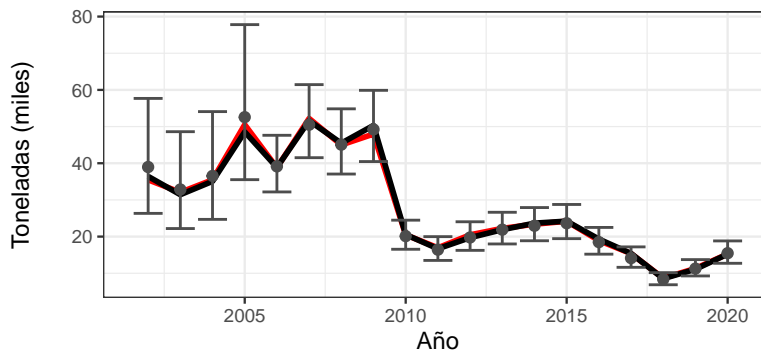
Biomasa de Crucero



CPUE



Desembarques



```

# 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)

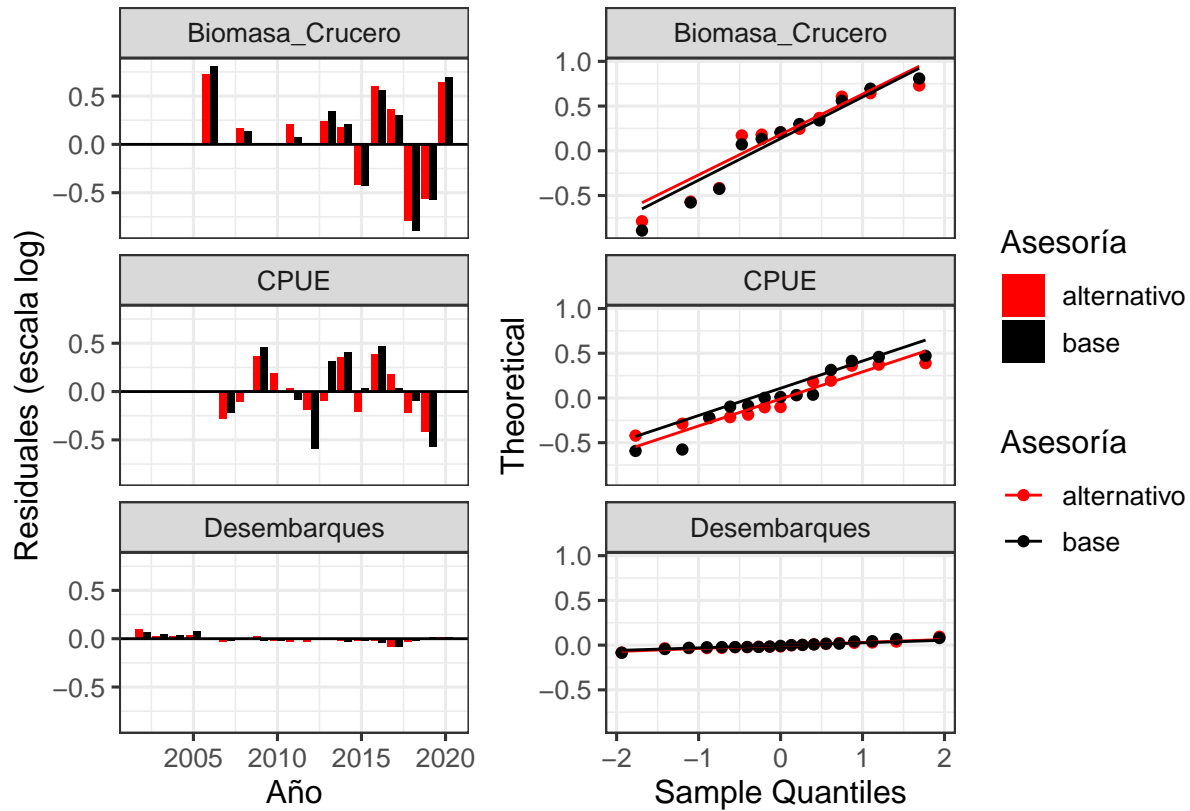
r2 <- ggplot(Res2, aes(predm,value)) +
  geom_point(aes(colour=Asesoría), size = 1.5) +
  scale_colour_manual(values=c('red',"black")) +
  geom_hline(yintercept = 0) +
  facet_wrap(. ~ variable, ncol = 1) +
  labs(x= 'Predicho (log)', y = 'Residuales') +
  theme_bw(base_size=12)

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')

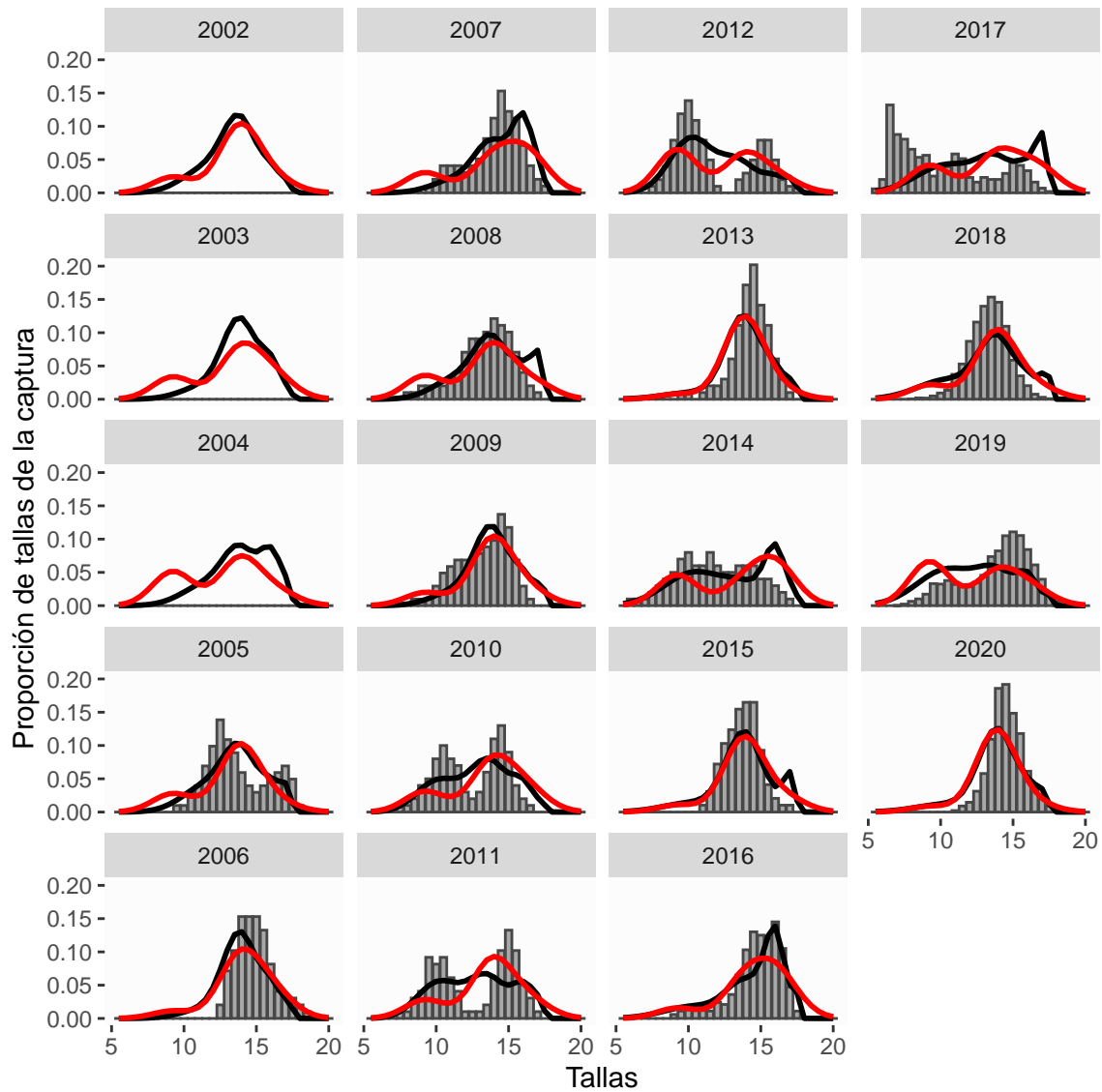
pred_alt <- as.data.frame(etf_pre_alt) %>% mutate(year=yearf) %>% melt(id.vars='year') %>%
  mutate(edad = rep(age, each=nyearf)) %>% mutate(type='pred_alt')

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 = 'red')
```



```
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') %>%
```

```

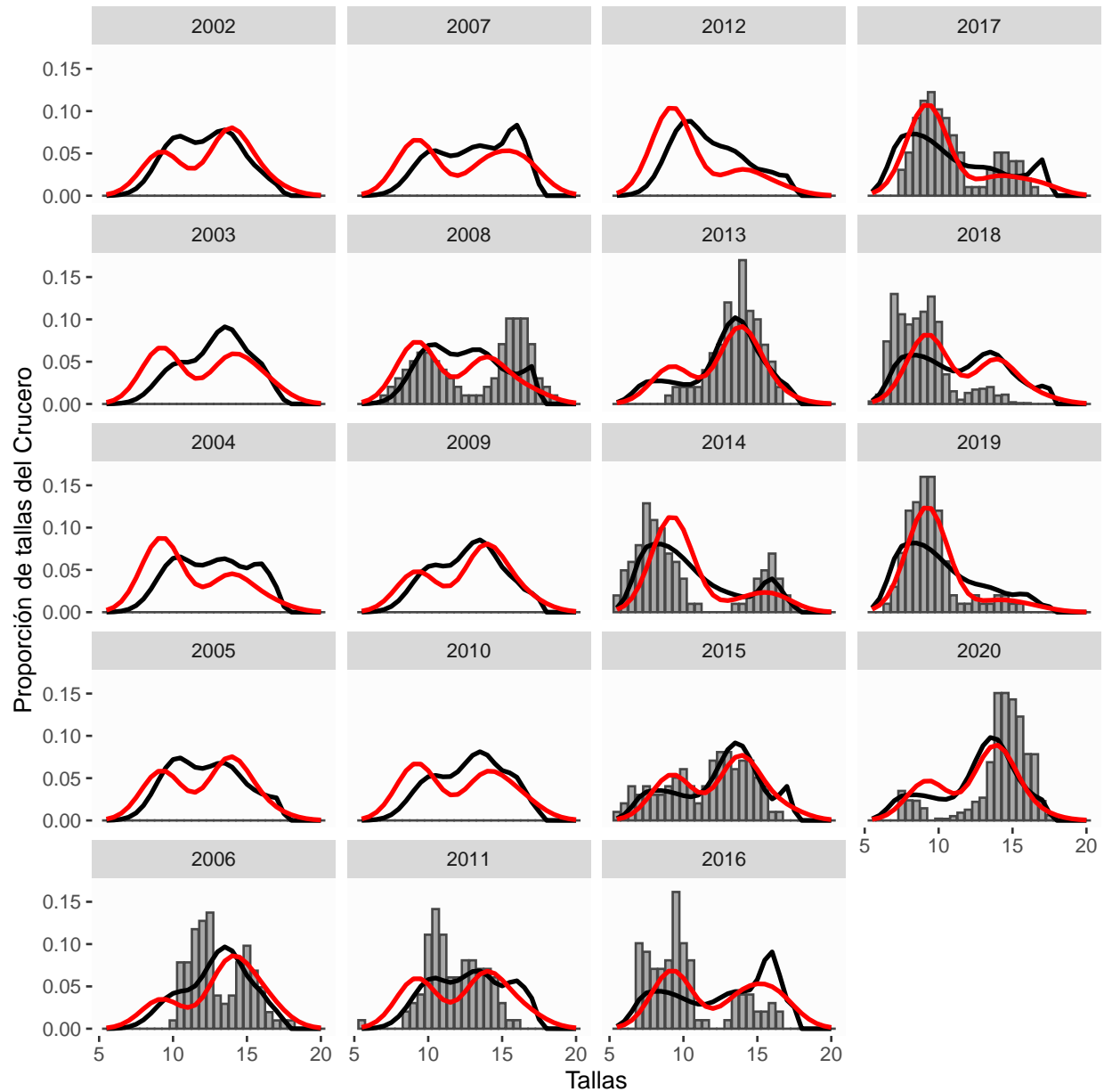
mutate(edad = rep(age, each=nyearf)) %>% mutate(type='pred')

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', size = 1)
fig1b <- fig1b + geom_line(data = filter(mat, type=='pred_alt'), aes(x = edad, y = value),color = 'red', size = 1)
fig1b + theme(panel.background = element_rect(fill = "gray99")) + theme(panel.grid=element_line(color="black", size=0.5))

```



```

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

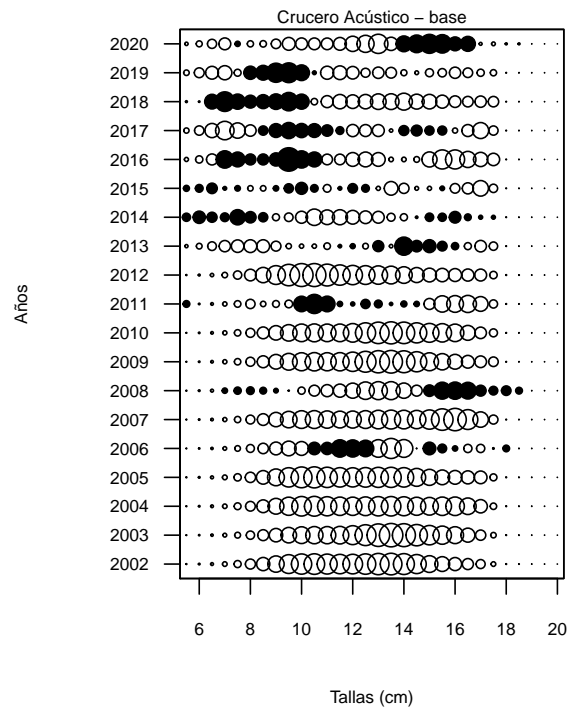
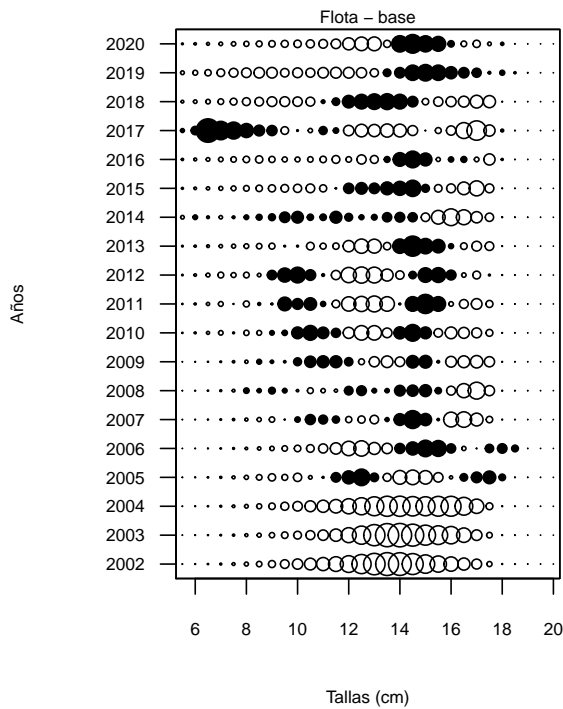
rng <-range(resB,na.rm=T)
dd <-dim(resB)
est <-matrix(NA,nrow=dd[1],ncol=dd[2])

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)

```

```

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()

```

