

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")
```

LEE SALIDAS DE ASESORÍAS PREVIAS MODELO BASE Y ALTER-NATIVO

```
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)

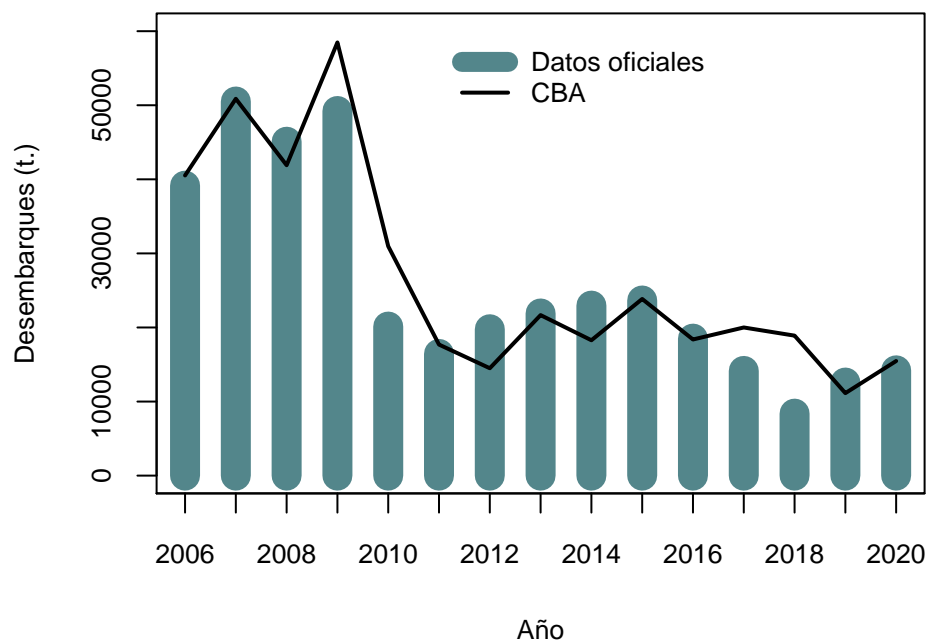
```

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, 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))

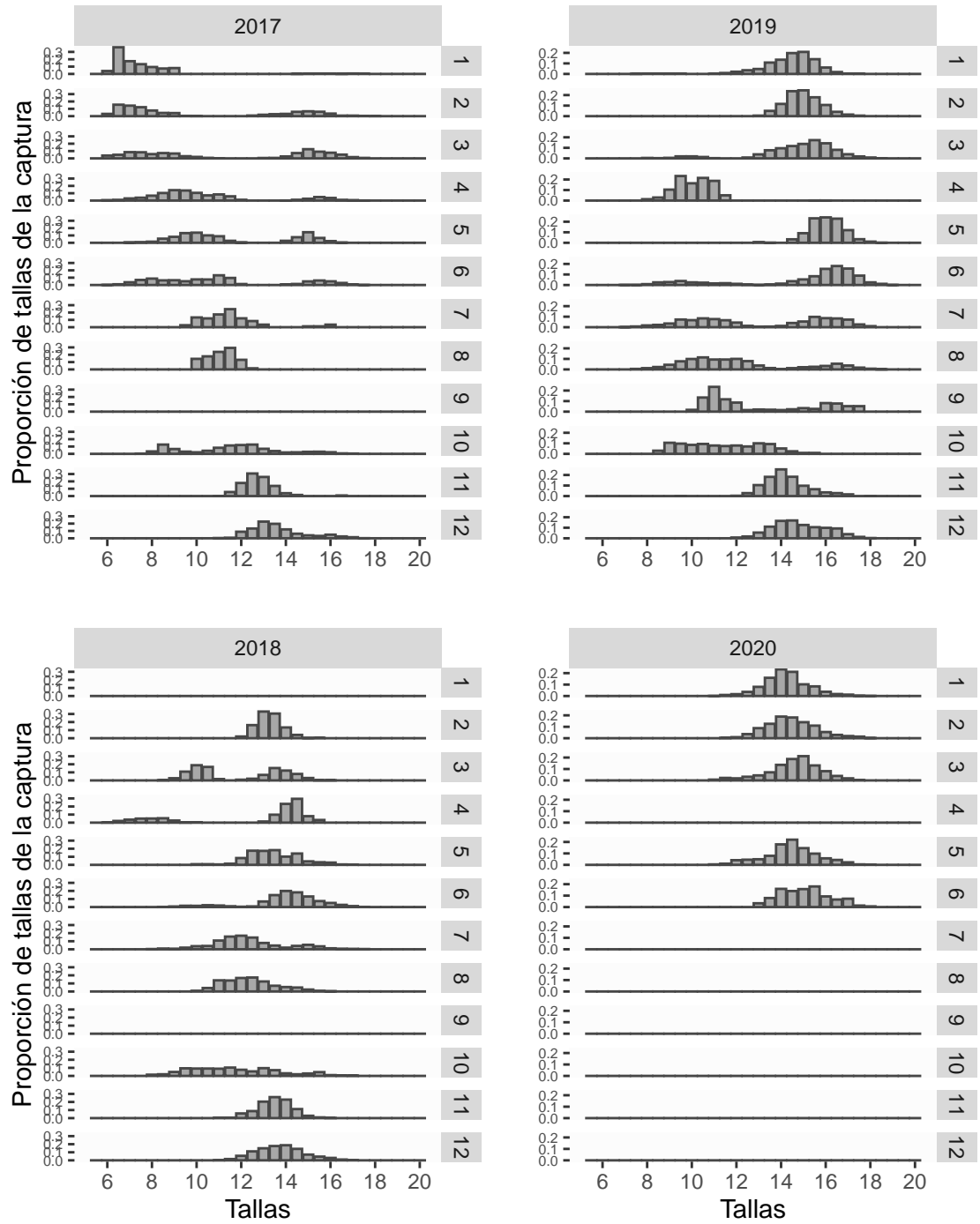
fig1 <-  ggplot(filter(obs,year==2018)) +
geom_bar(aes(x = talla, y = value), stat="identity", fill='gray66', color = 'gray28') +
facet_grid(mes~year) +
labs(x = 'Tallas', y = 'Proporción de tallas de la captura') +
theme(panel.background = element_rect(fill = "gray99"),axis.text.y = element_text(hjust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

```

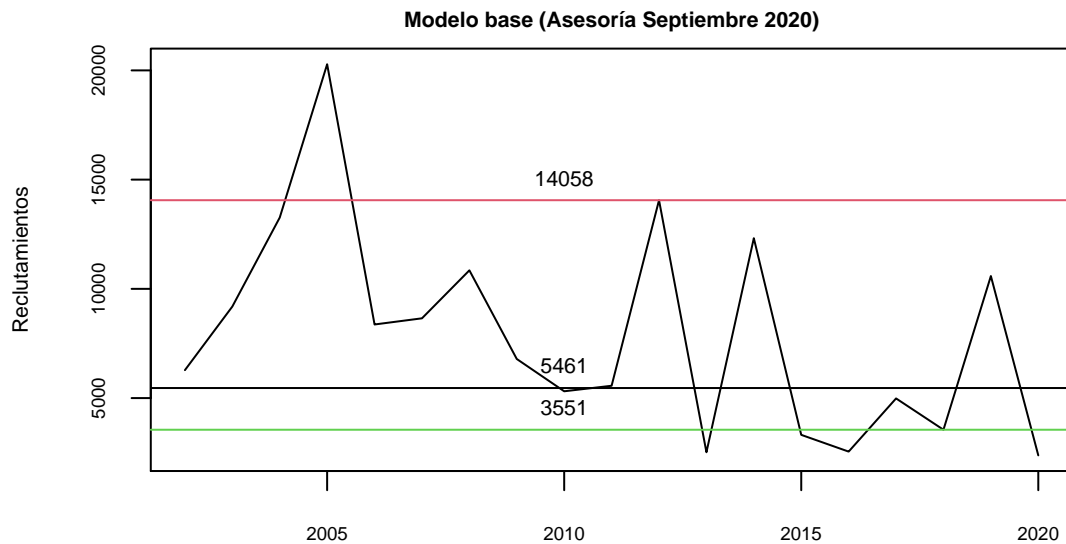


2. Metodología

```
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)
```

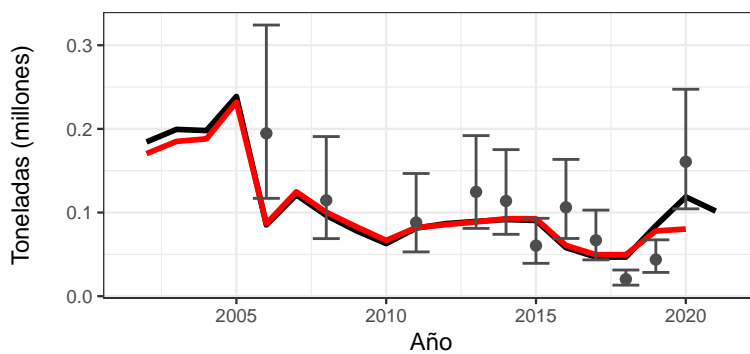


```
f2 <- ggplot(base1 %>% filter(Asesoría!='observado', variable=='CPUE'),
  aes(yrs,value/1000000)) +
  geom_line(aes(colour=Asesoría), size=1) +
  scale_colour_manual(values=c('black','red')) +
  geom_point(data = base1 %>% filter(Asesoría=='observado',
    variable=='CPUE'),
  aes(yrs,value/1000000), 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)

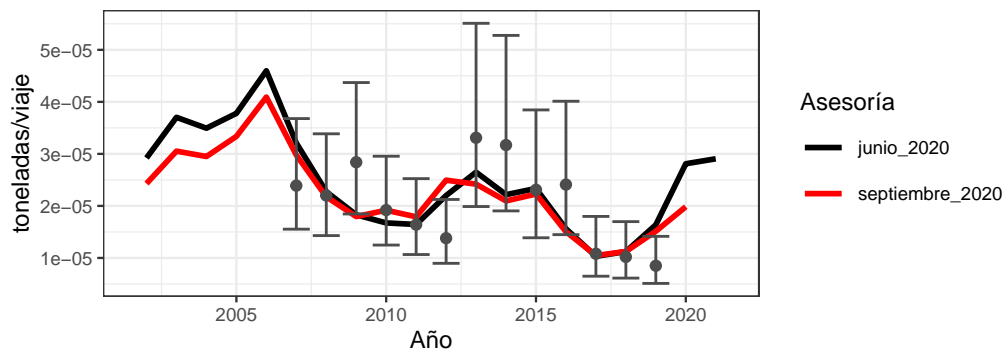
f3 <- ggplot(base1 %>% filter(Asesoría!='observado', variable=='Desembarques'),
  aes(yrs,value/1000)) + geom_line(aes(colour=Asesoría), size=1) +
  scale_colour_manual(values=c('black','red')) +
  geom_point(data = base1 %>% filter(Asesoría=='observado',
    variable=='Desembarques'),
  aes(yrs,value/1000),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

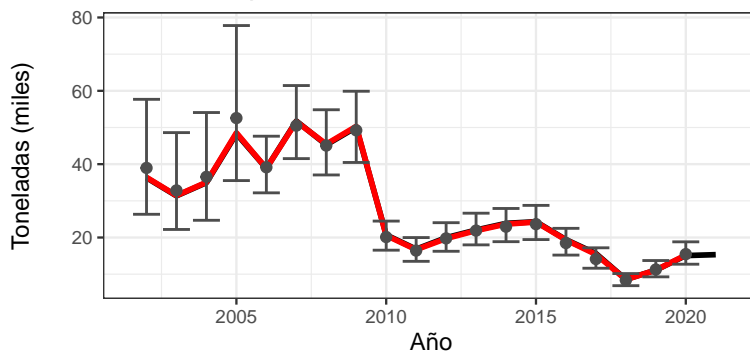
Biomasa de Crucero



CPUE

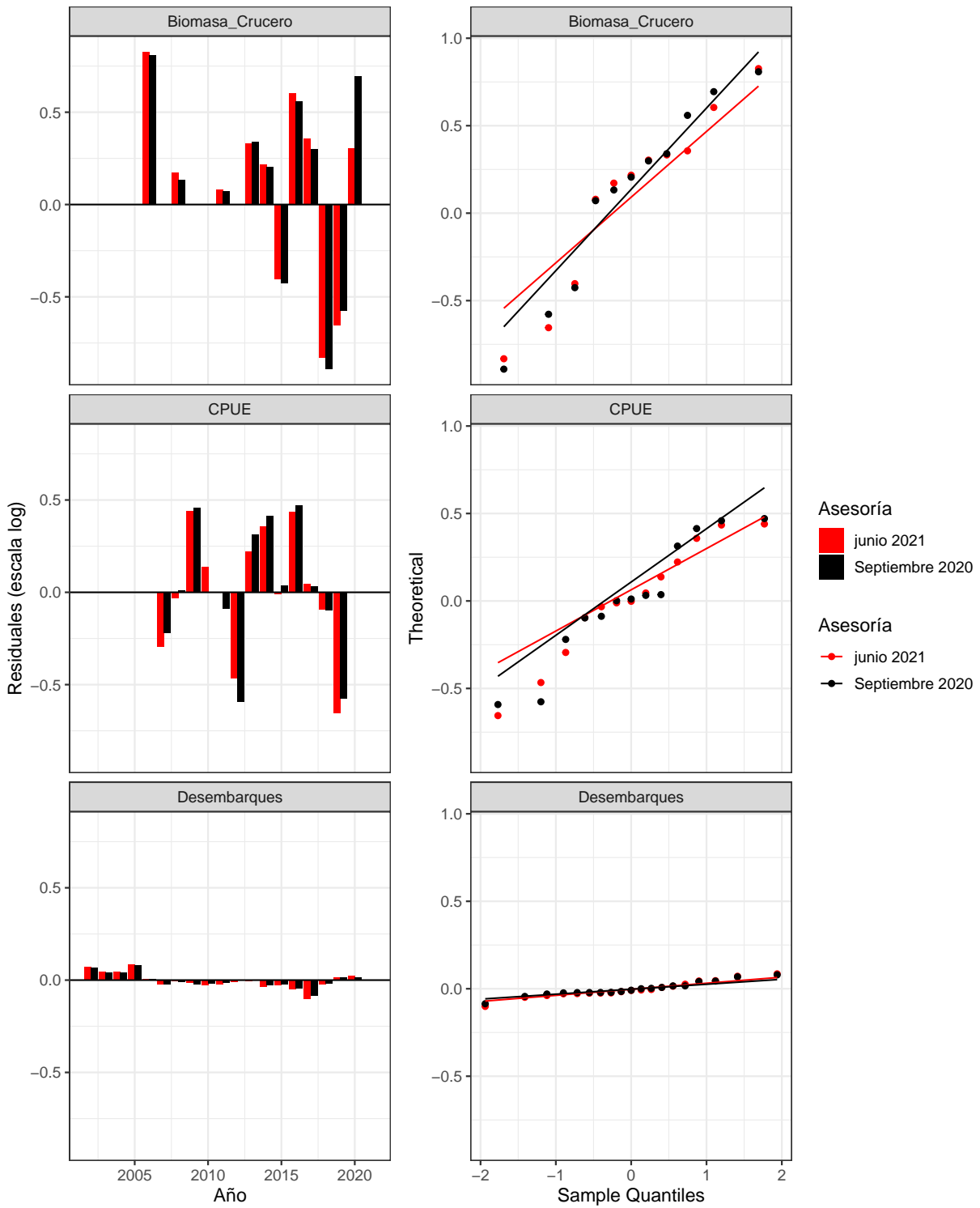


Desembarques



3.2. Análisis de Residuales de los índices

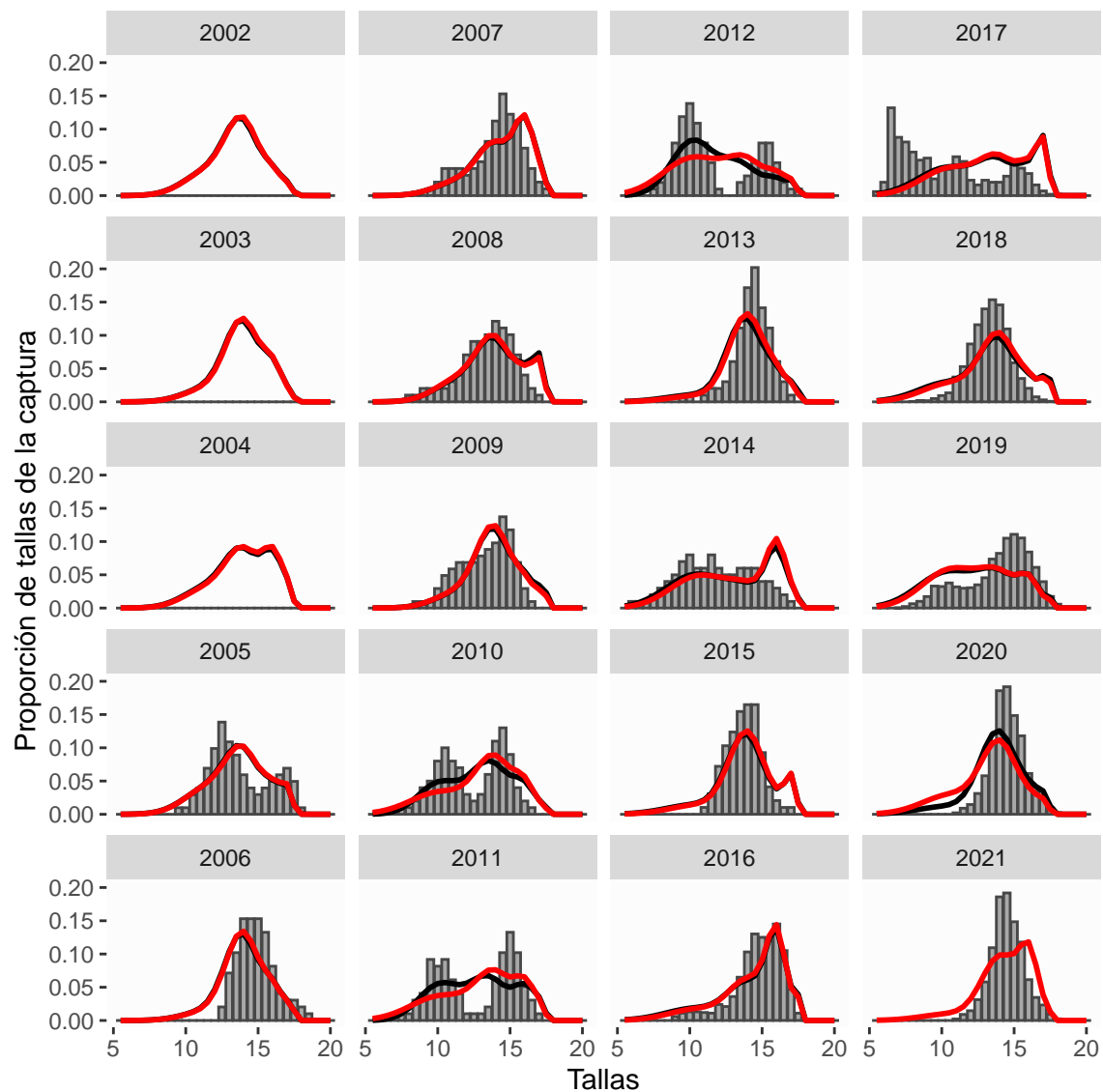
```
#####  
# AREGLOS DE DATOS  
#####  
  
Res_maet <- data.frame(log(ind_obs) - log(ind_jun)) %>%  
  mutate(yrs = yrs) %>% mutate(Asesoría = 'junio 2021')  
Res_matt <- data.frame(log(ind_obs) - log(ind_sept)) %>%  
  mutate(yrs = yrs) %>% mutate(Asesoría = 'Septiembre 2020')  
  
Res      <- rbind(Res_maet, 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

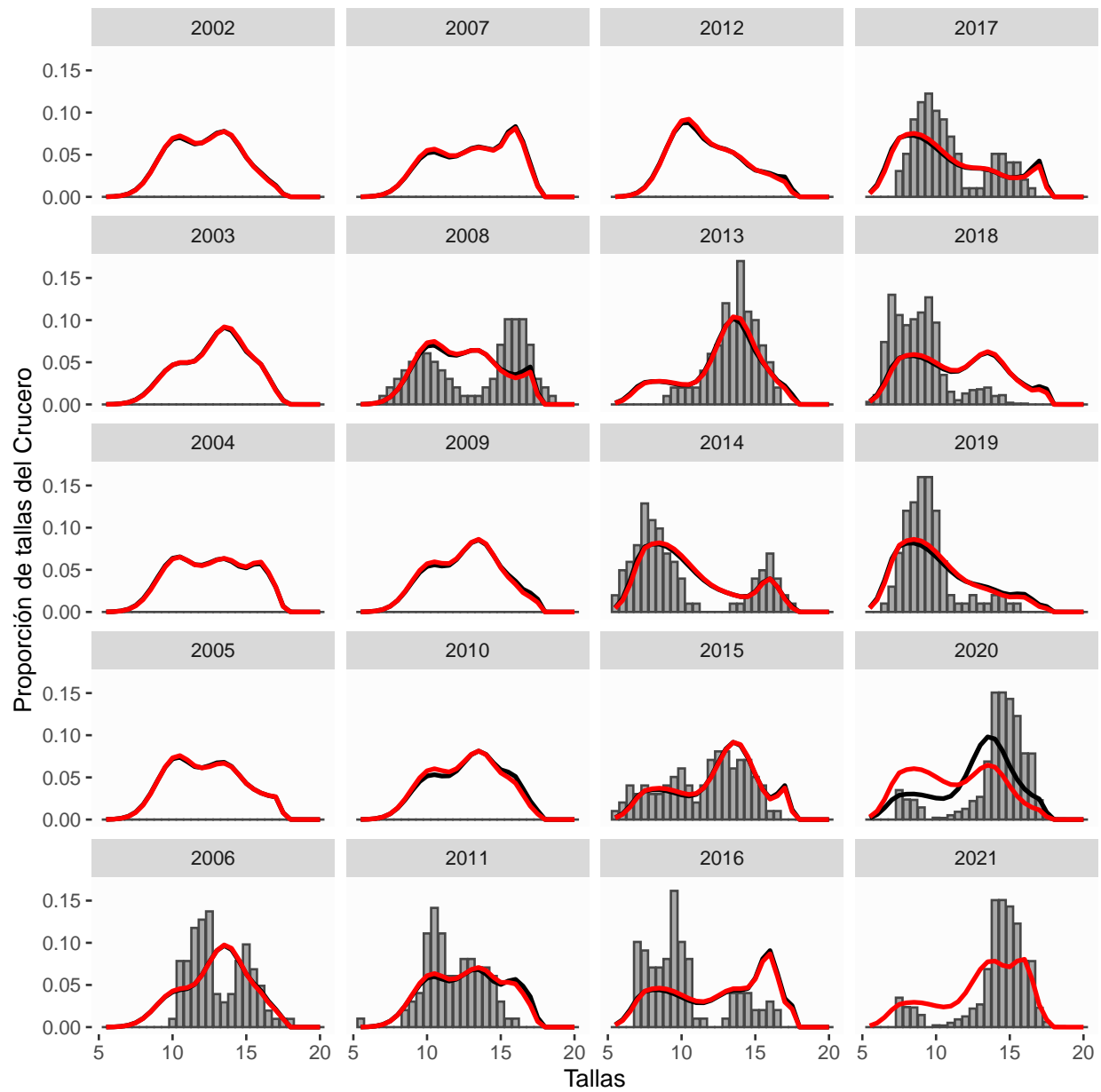
FLOTA

```
#####  
# 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])

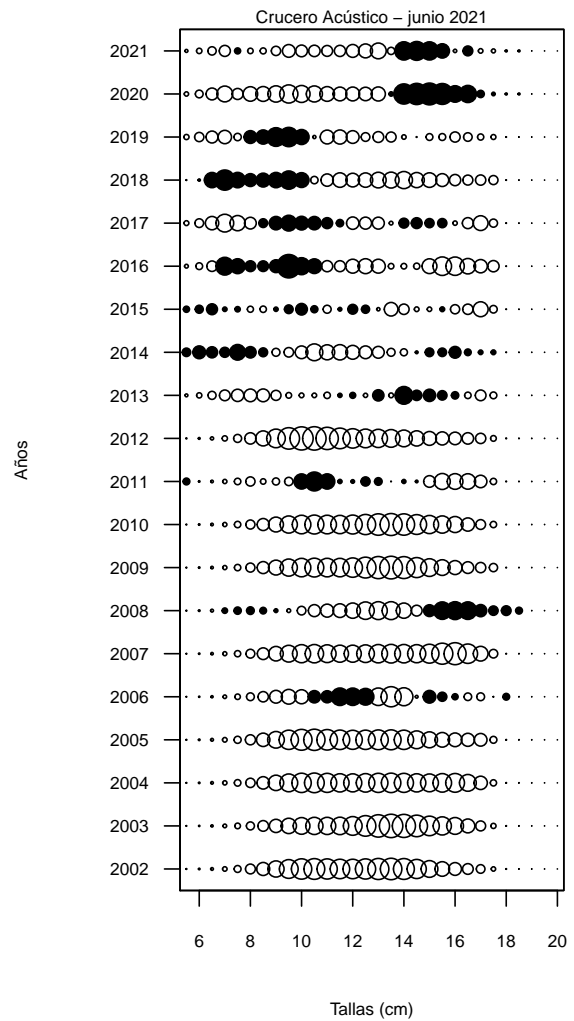
for(j in 1:dd[1]){for(k in 1:dd[2]){val<-resB_alt[j,k]
if(val>0){est[j,k]<-val/rng[2]}
else{est[j,k]<-val/rng[1]*-1}}}

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
#####

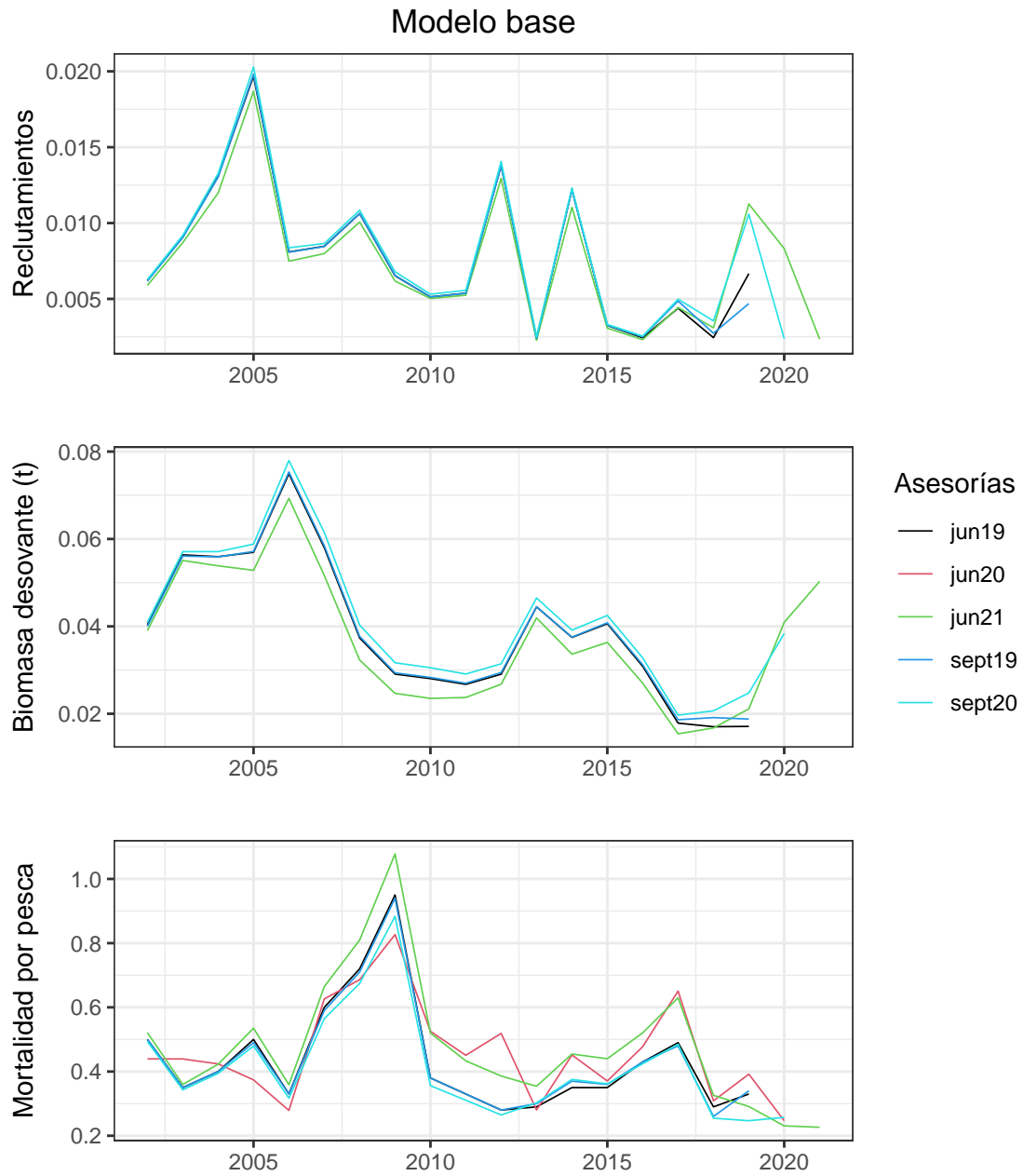
f1<- ggplot(data %>% filter(variable=='Rt',Modelo=='M_base'),
            aes(years,value/10^6)) +
  geom_line(aes(colour=Series), size=0.3)+
  labs(x = '', y = 'Reclutamientos',colour='Asesorías') +
  scale_x_continuous(breaks = seq(from = 1990, to = 2020, by = 5)) +
  scale_colour_manual(values=seq(1,5,1))+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

```



```

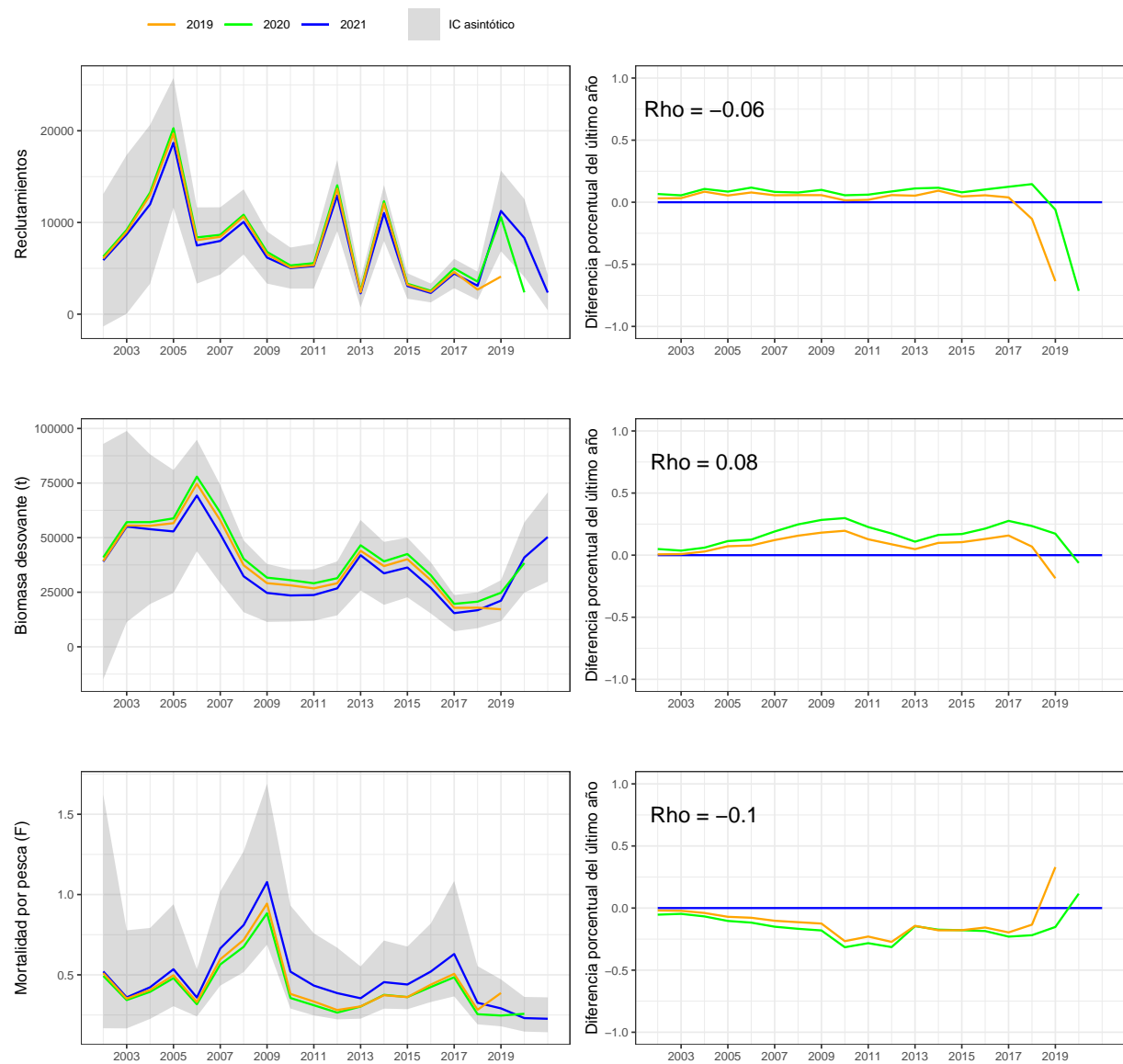
ggtitle('')+
theme(plot.title = element_text(hjust = 0.5),legend.position="none")

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

```



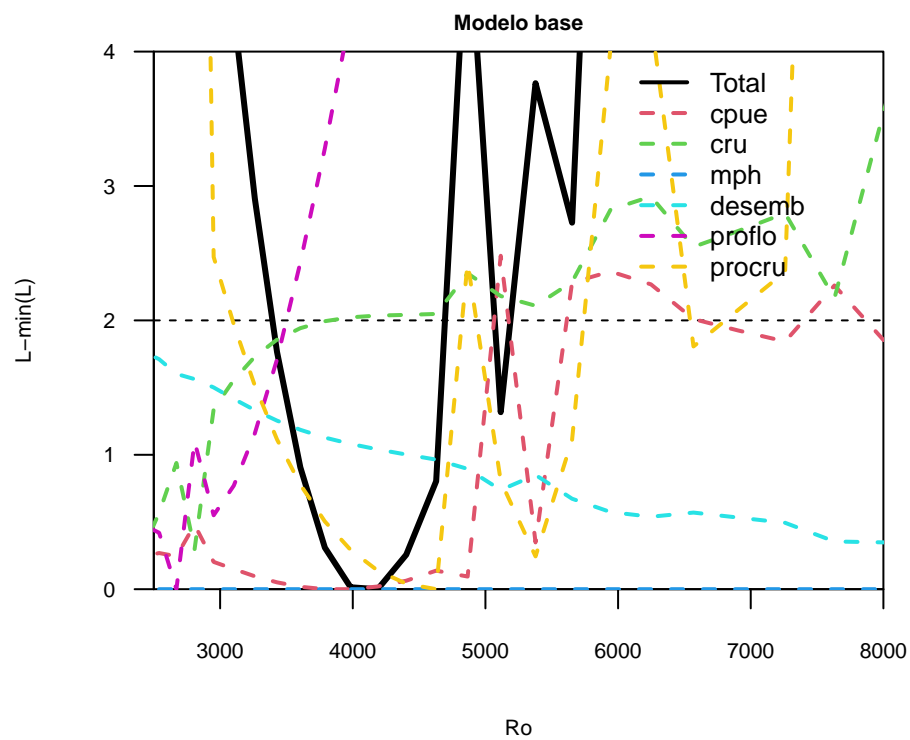
3.7. Perfil de verosimilitud

```
#####
# 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]} # Estandarizaci3n
#=====
# 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

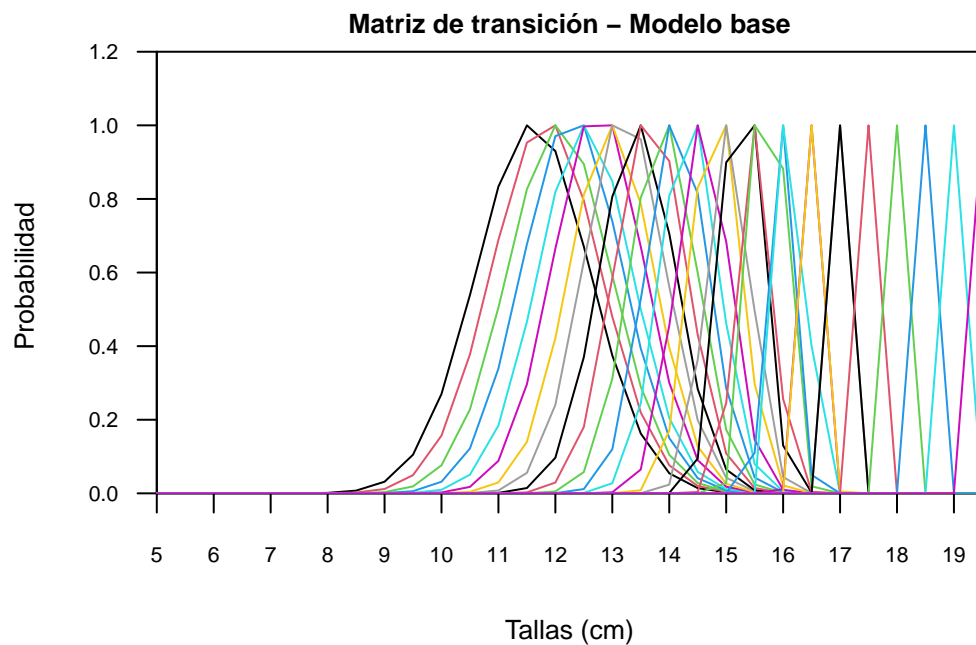
6. RESULTADOS OBJETIVO 4

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

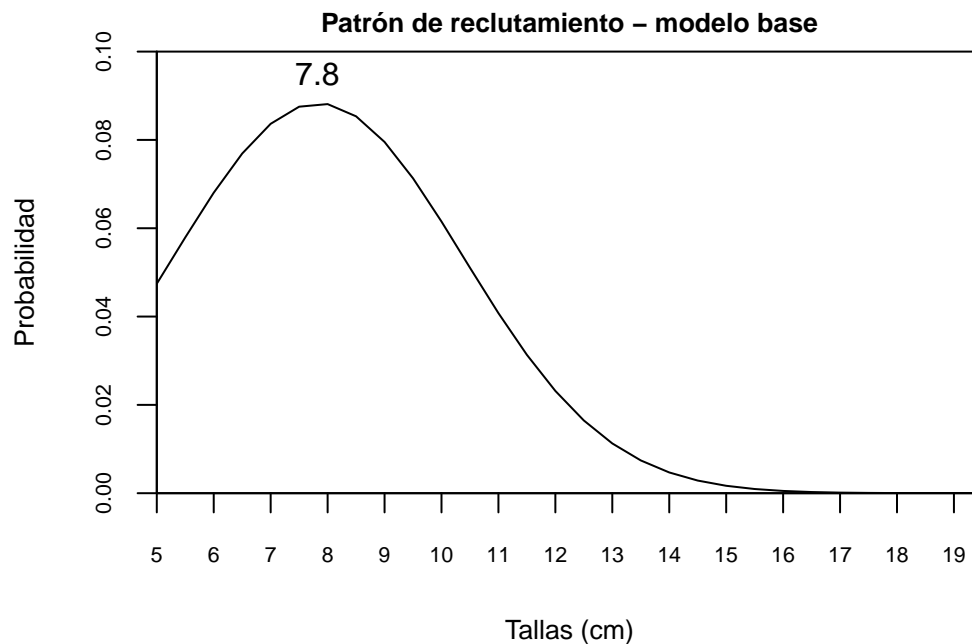
```
# Clave edad talla -----
# Arreglos
yrs    <- rep0$Years
nyrs   <- length(yrs)
tallas <- seq(5,19.5,0.5)
ntallas <- length(tallas)
age    <- seq(0,4,1)
nage   <- length(age)

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))
```

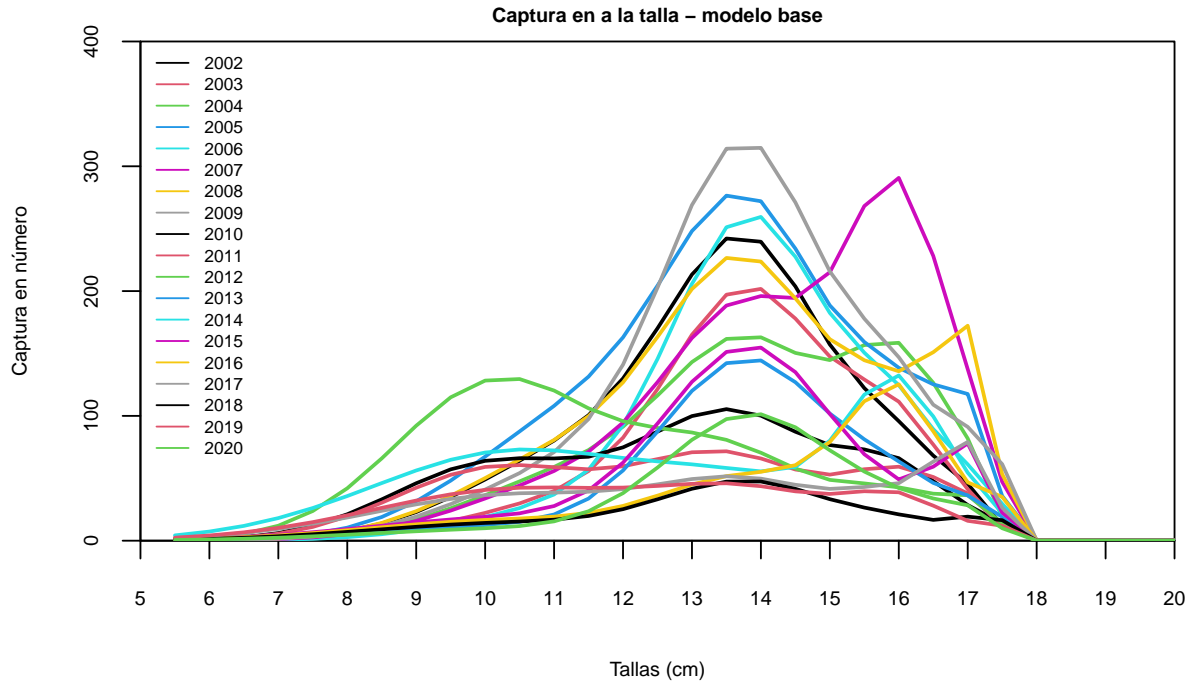



```

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))

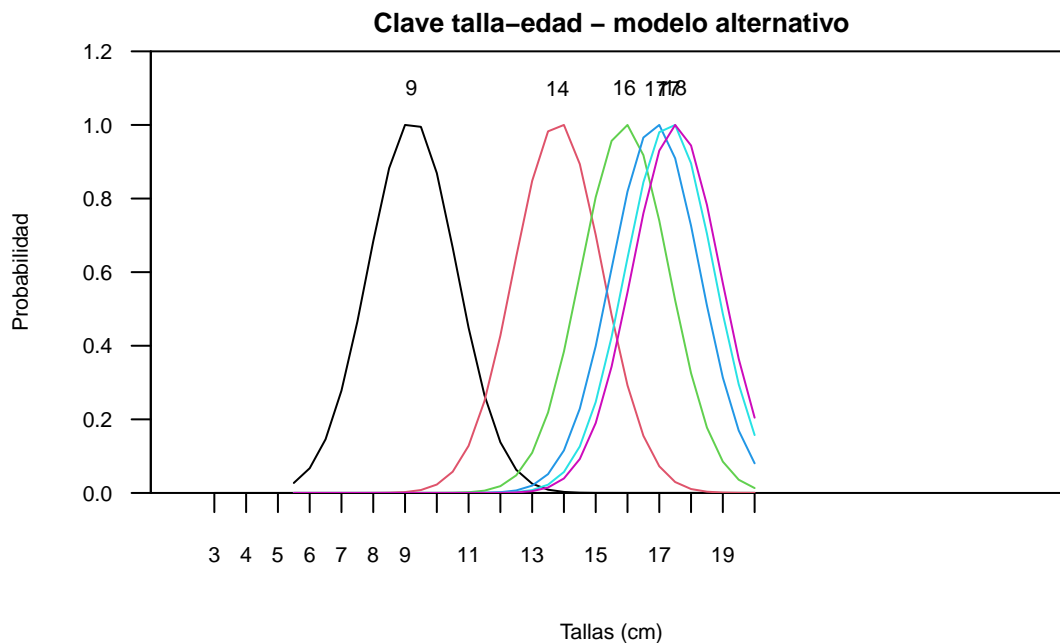
fig1
```

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)
```



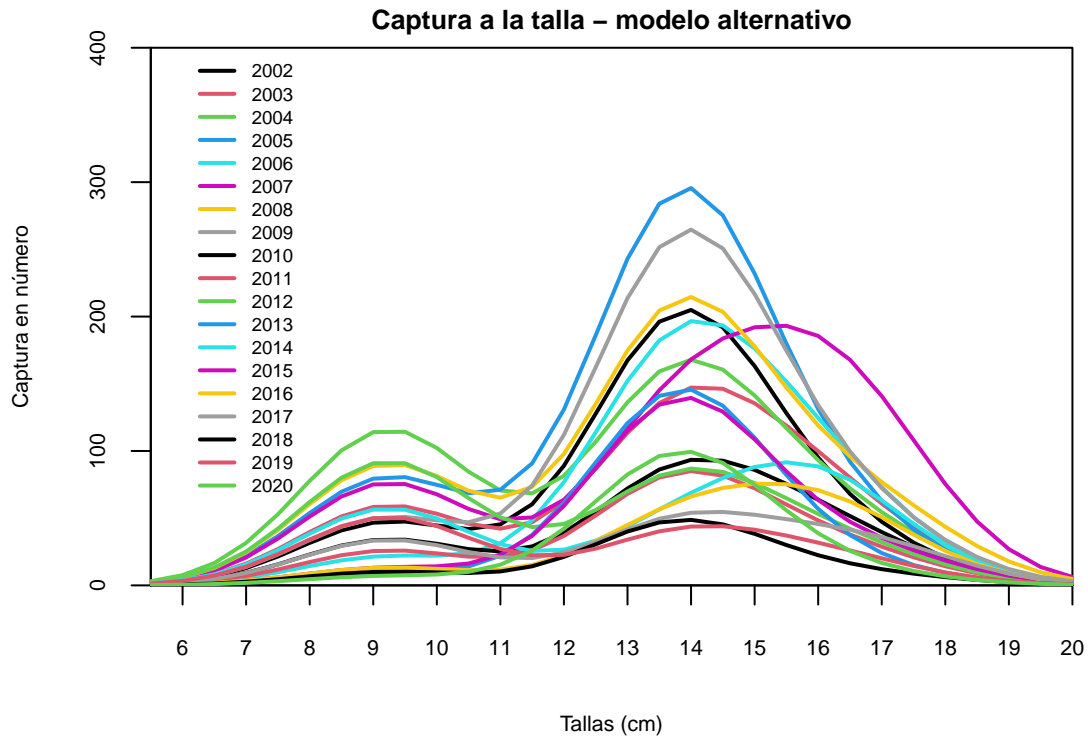
```
tallas      <-seq(5.5,20,0.5)
ntallas     <-length(tallas)
N           <-rep.0$Capt_age
year        <-data0$Ind[,1]
nyear       <-length(year)

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))

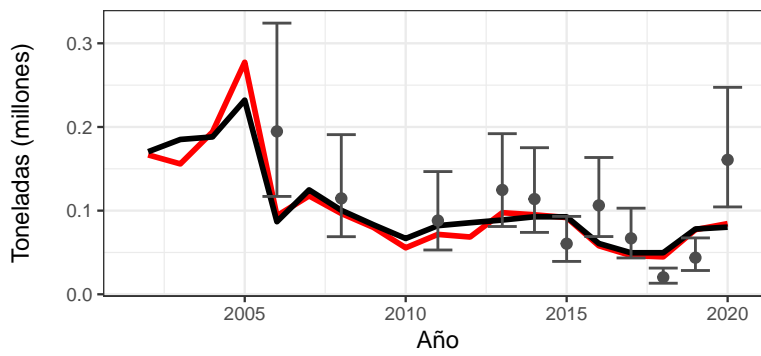
f1 <- ggplot(base1 %>% filter(Asesoría!='observado', variable=='Biomasa_Crucero'),
  aes(yrs,value/1000000)) + geom_line(aes(colour=Asesoría), size=1) +
  scale_colour_manual(values=c('red',"black")) +
  geom_point(data = base1 %>% filter(Asesoría=='observado', variable=='Biomasa_Crucero'),
  aes(yrs,value/1000000),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

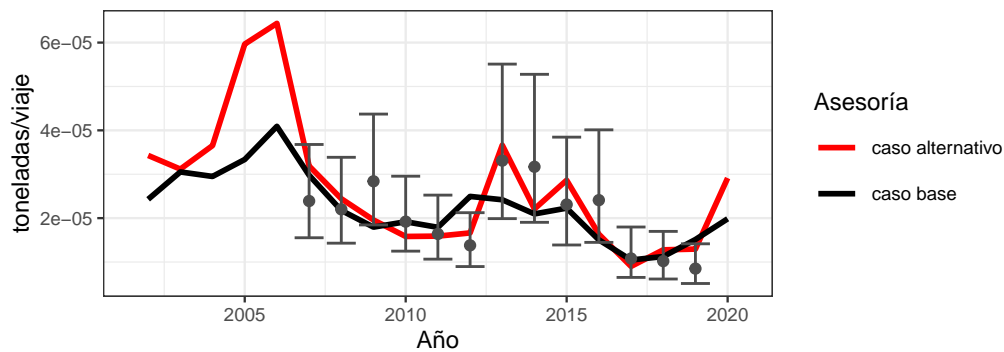
```
f3 <- ggplot(base1 %>% filter(Asesoría!='observado', variable=='Desembarques'),
  aes(yrs,value/1000)) + geom_line(aes(colour=Asesoría), size=1) +
  scale_colour_manual(values=c('red',"black")) +
  geom_point(data = base1 %>% filter(Asesoría=='observado', variable=='Desembarques'),
  aes(yrs,value/1000),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

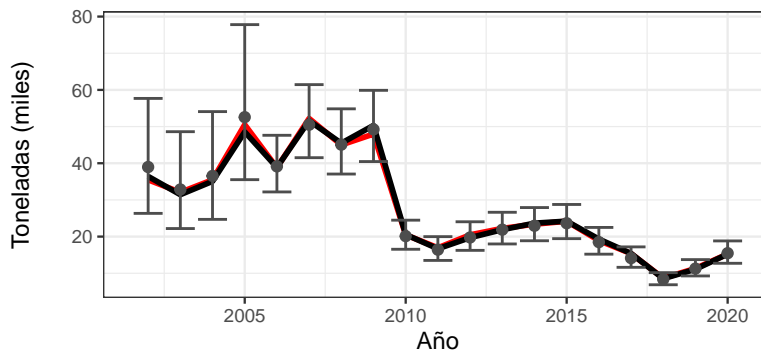
Biomasa de Crucero



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)

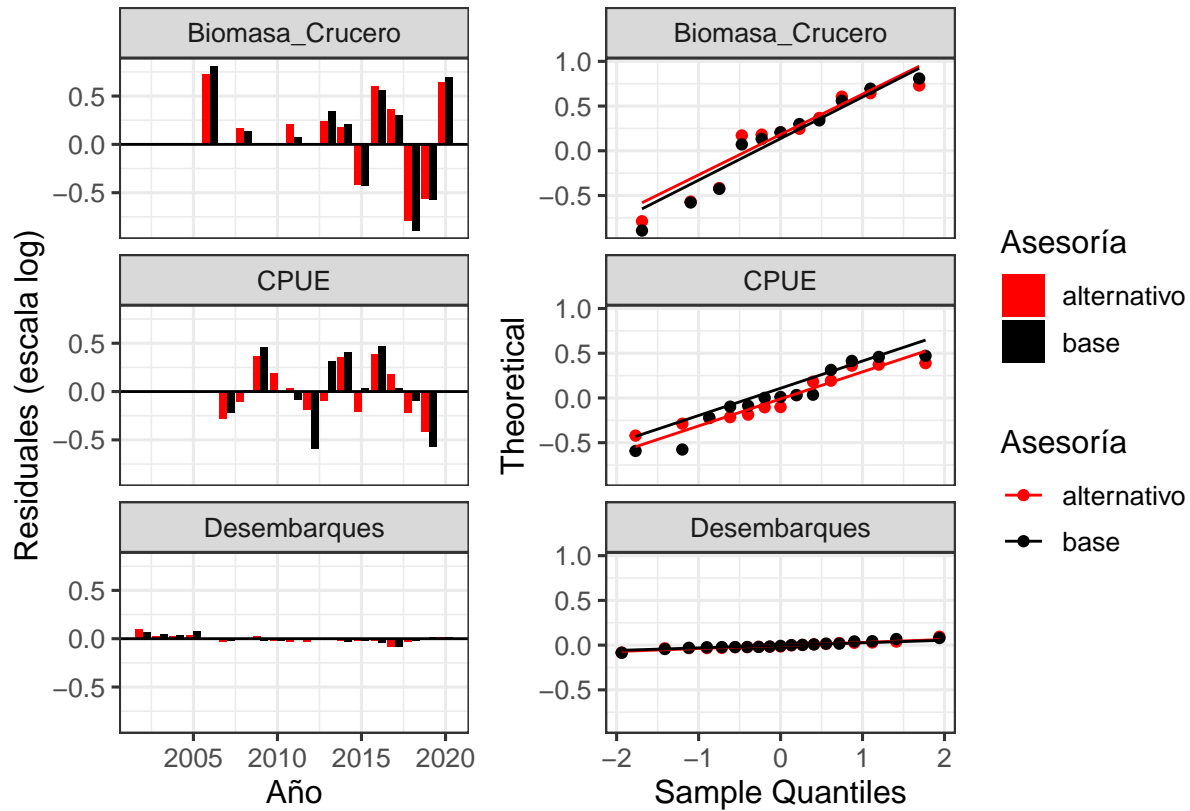
r2 <- ggplot(Res2, aes(predm,value)) +
  geom_point(aes(colour=Asesoría), size = 1.5) +
  scale_colour_manual(values=c('red',"black")) +
  geom_hline(yintercept = 0) +
  facet_wrap(. ~ variable, ncol = 1) +
  labs(x= 'Predicho (log)', y = 'Residuales') +
  theme_bw(base_size=12)

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')

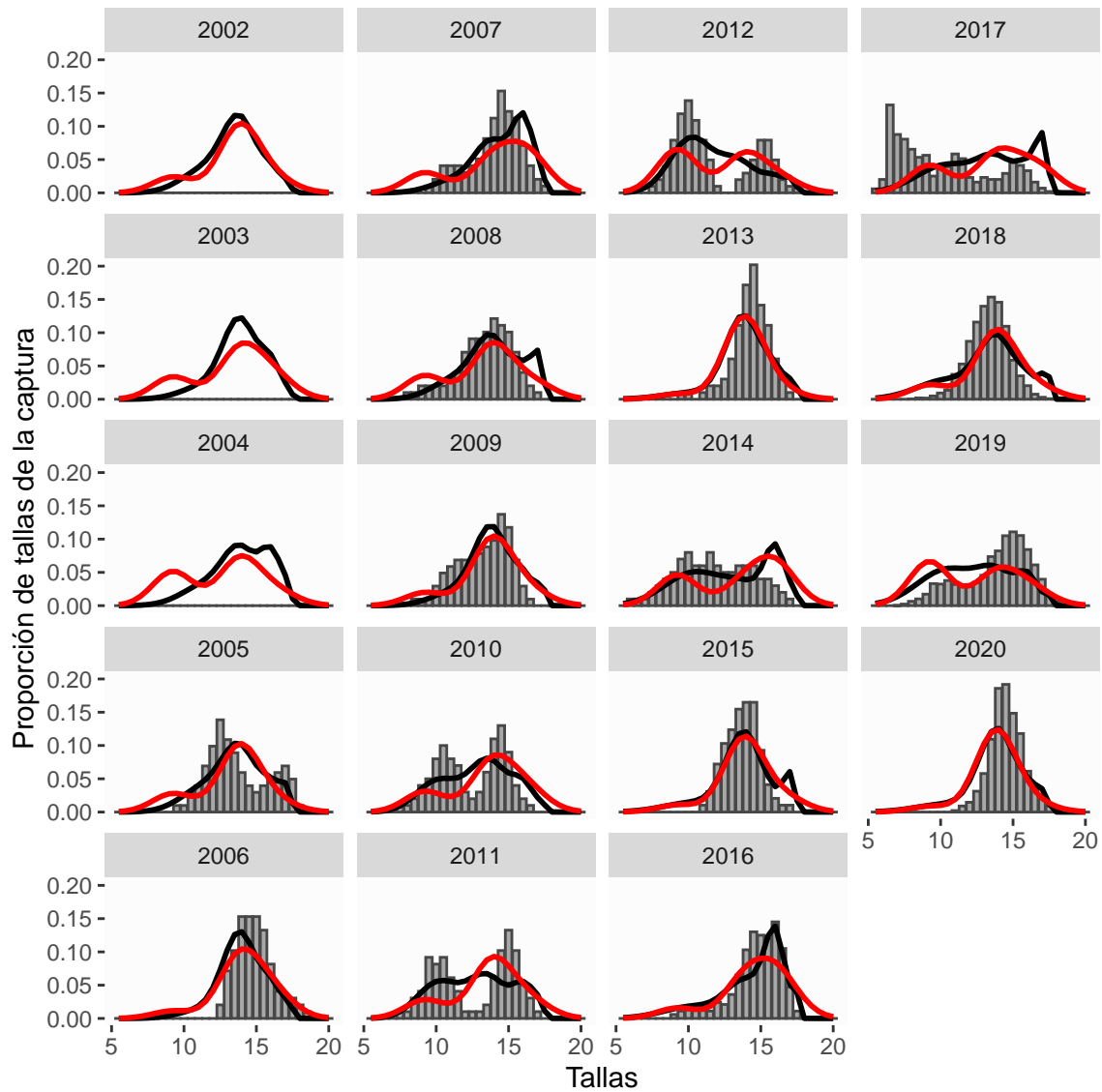
pred_alt <- as.data.frame(etf_pre_alt) %>% mutate(year=yearf) %>% melt(id.vars='year') %>%
  mutate(edad = rep(age, each=nyearf)) %>% mutate(type='pred_alt')

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') %>%
```

```

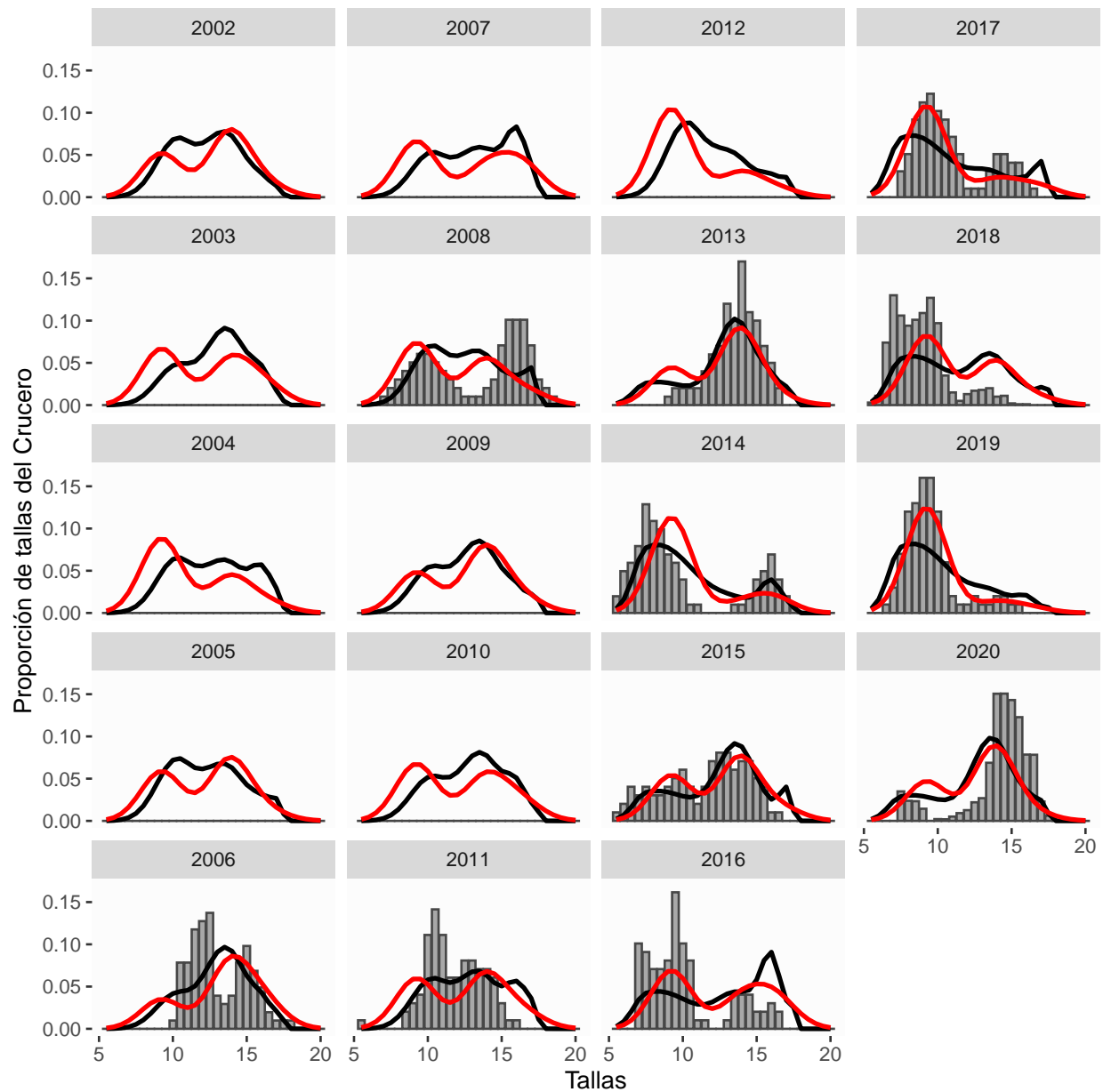
mutate(edad = rep(age, each=nyearf)) %>% mutate(type='pred')

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()

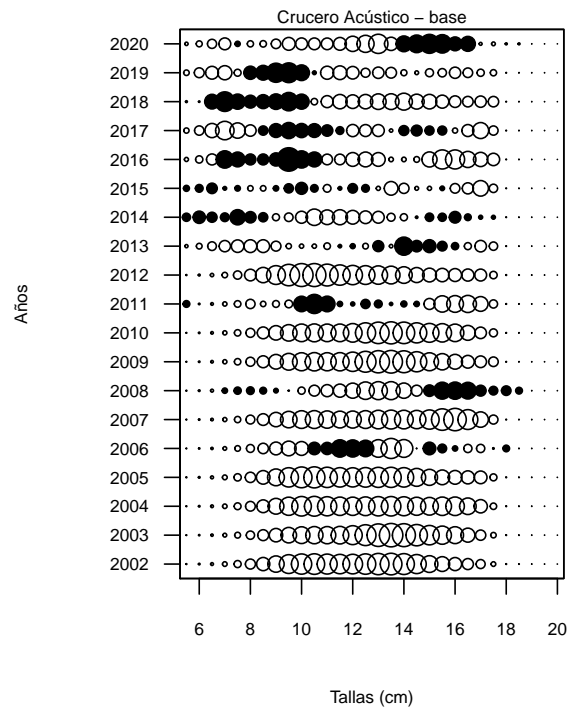
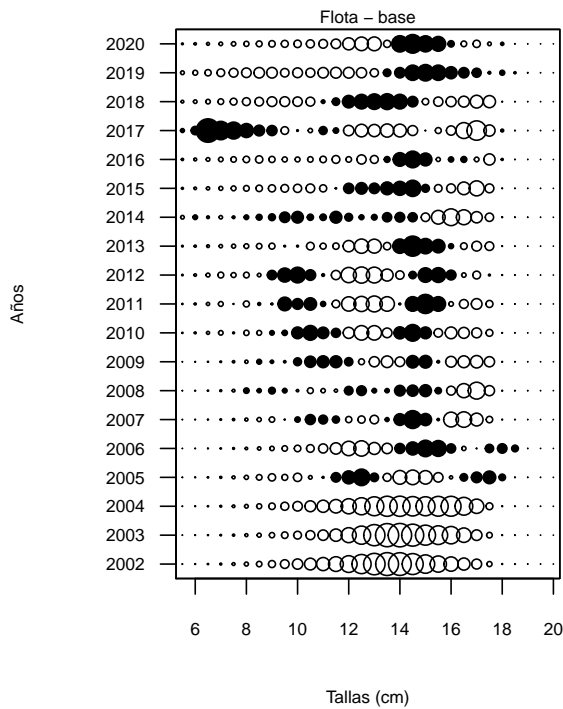
#Crucero base
age <-seq(5.5,20,0.5)
nage <-length(age)
anos <-rep0$Years
obsB <-rep0$Propcru_obs
preB <-rep0$Propcru_pred
resB <-obsB-preB

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

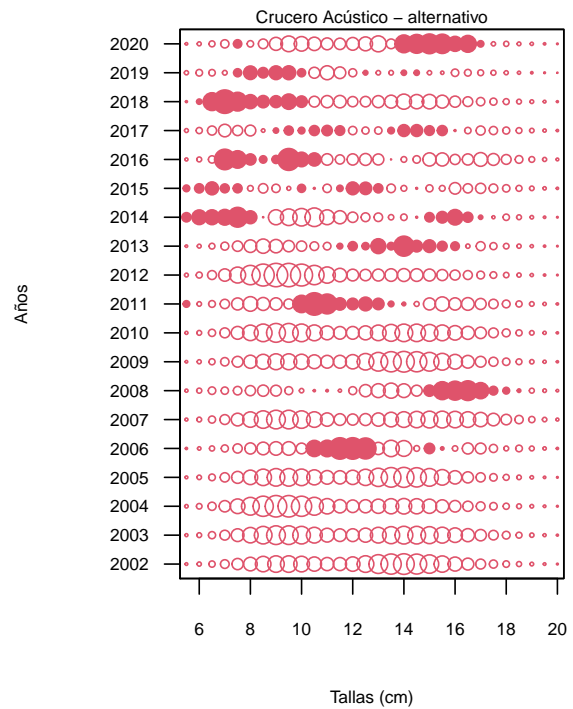
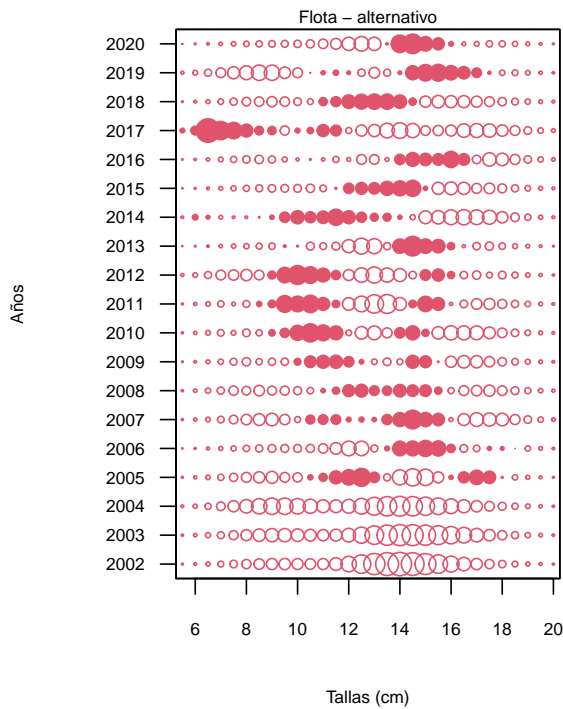
obsB_alt <-rep.0$pobs_RECLAN
preB_alt <-rep.0$ppred_RECLAN
resB_alt <-obsB_alt-preB_alt

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()

```



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 actualizar
# 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)
RO <- 1
```

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

```
#Pbrs modelo base
#BO <- Bmed/pB_Fmh
BDo <- rep0$BD_virgen_LP
# Paso 5: Obtención de Bmrs
BRMS <- BDo*0.55
```

```

# Paso 6: Obtencion de Blim
BDlim<- BDo*0.275

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

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

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 103",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*0.62)/1000,col=1,lty=2)
abline(h=exp(Ro.0+0.5*0.62)/1000,col=2,lty=2)
text(2016,c(exp(Ro0+0.5*0.62)/1000,
            exp(Ro.0+0.5*0.62)/1000)+0.5,
     c("Rmed_base","Rmed_alternativo"))
box()

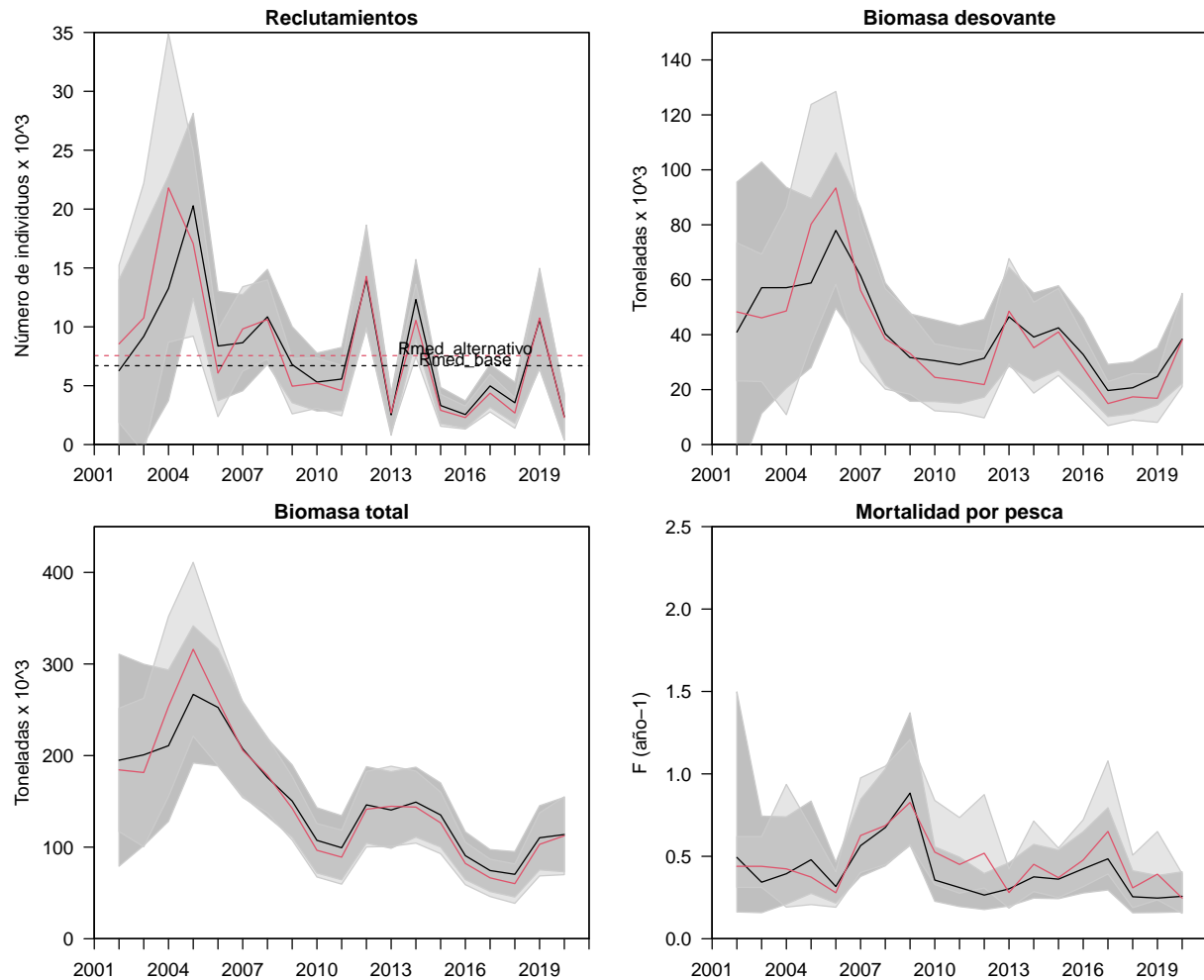
plot(x0,bt0/1000,type="n",cex.axis=1.1,xaxs="i",yaxs="i",las=1,
     xlim=c(2001,2021),xaxp=x0_1,ylim=c(0,450),cex.lab=1.1,
     main="Biomasa total",ylab="Toneladas x 103",xlab="Año")
polygon(x0,bt0/1000,col=gray(.5,0.5), border="gray80")
polygon(x0,bt.0/1000,col=gray(.8,0.5), border="gray80")
lines(years0,Bt0/1000,lwd=1,col=1,lty=1)
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 103",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=1.1)
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()



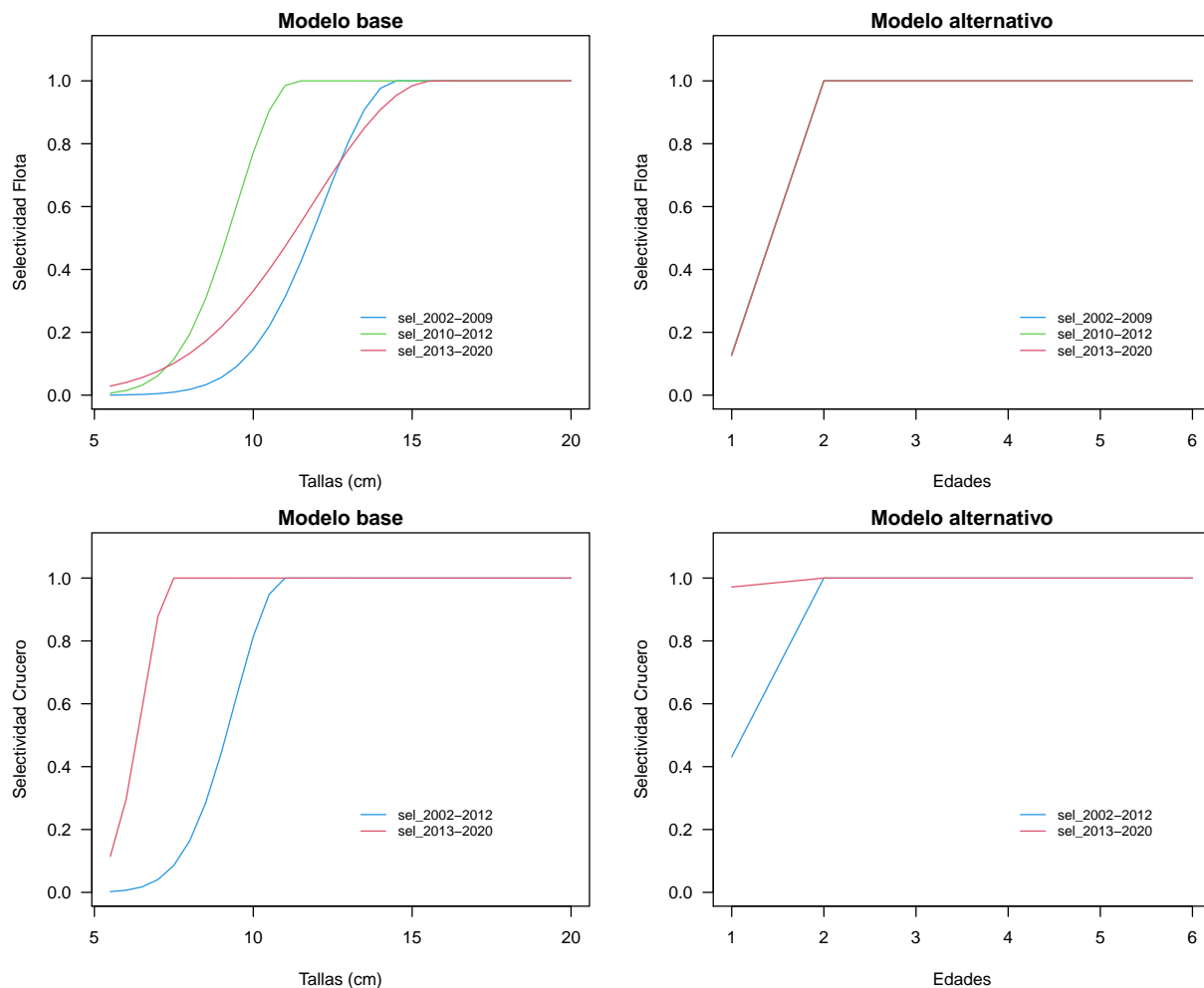
```
par(mfrow=c(2,2),mar=c(4,4,1,1)+0.5)
plot(rep0$Tallas,rep0$Selflo_talla[1,],type="l",las=1,col=4,ylim=c(0,1.1),
     ylab="Selectividad Flota",xlab="Tallas (cm)",main="Modelo base")
lines(rep0$Tallas,rep0$Selflo_talla[9,],type="l",col=3)
lines(rep0$Tallas,rep0$Selflo_talla[nyears0,],type="l",col=2)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

```

```
#####
xfrm1 <-rnorm(1000, mean = Frpr.0[length(years.0)],
             sd = Frpr.0std[length(years.0)])

xfrm <-seq(min(xfrm1),
          max(xfrm1),0.005)

yfrm <-dnorm(xfrm, 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(xfrm[xfrm>=icfm[1]&xfrm<=icfm[2]],
        rev(xfrm[xfrm>=icfm[1]&xfrm<=icfm[2]]))

yyfm <-c(yfrm[xfrm>=icfm[1]&xfrm<=icfm[2]],
        rep(0,length(yfrm[xfrm>=icfm[1]&xfrm<=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)
# ALTERNATIVO
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)
# ALTERNATIVO
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)

# ALTERNATIVO
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)

# ALTERNATIVO
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)

# ALTERNATIVO
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
$p(\text{sobreexplotación})$	0.030	0.120
$p(\text{agotado/colapsado})$	0.000	0.000
$p(\text{sobrepesca})$	0.080	0.100

```
#-----
# MODELO BASE
#-----

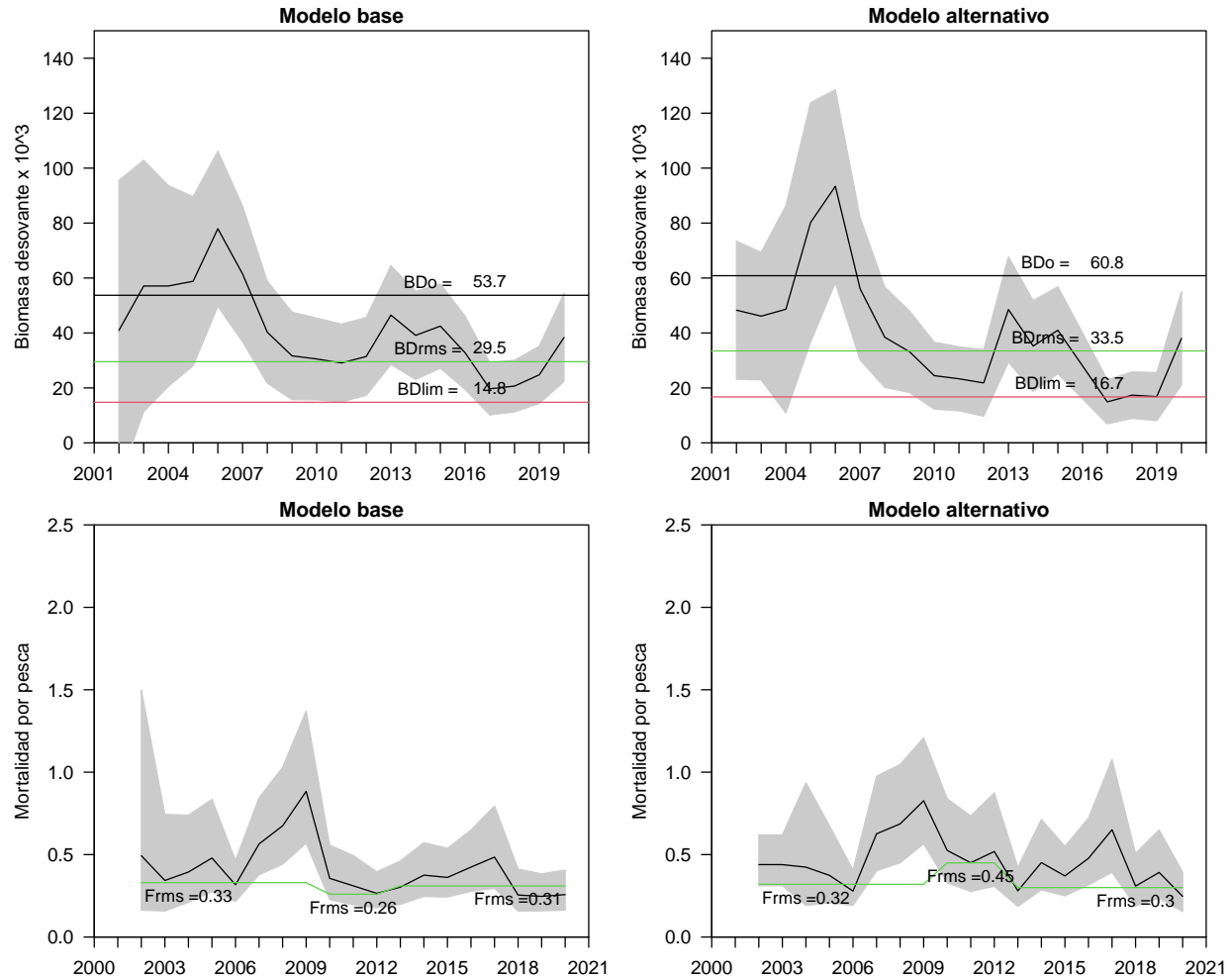
par(mfcol=c(2,2),mar=c(2,4,1,1)+0.5)
plot(x0,ssbt0/1000,type="n",cex.axis=1.1,xaxs="i",yaxs="i",
      xlim=c(2001,2021),xaxp=x0_1,ylim=c(0,150),las=1,cex.lab=1.1,
      main="Modelo base",ylab="Biomasa desovante x 10^3",xlab="Año")
polygon(x0,ssbt0/1000,col=gray(.6,0.5), border="gray80")
lines(years0,SSBt0/1000,lwd=1,col=1,lty=1)
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=1.1)
polygon(x0, ft0, col=gray(.6,0.5), border="gray80")
lines(years0,exp(Ft0),lwd=1,col=1,lty=1)
lines(years0,data0$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(data0$Ind[1,13],data0$Ind[9,13],data0$Ind[19,13])
```



```

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()

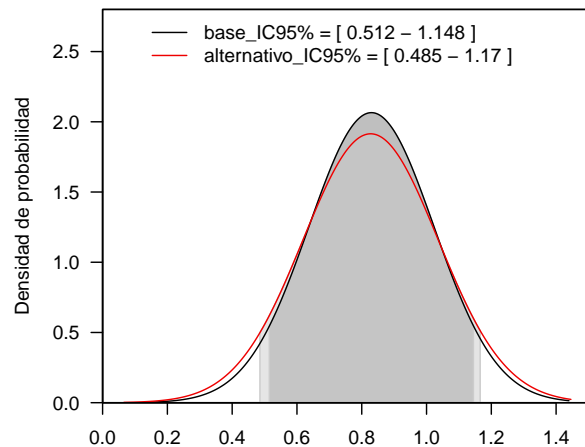
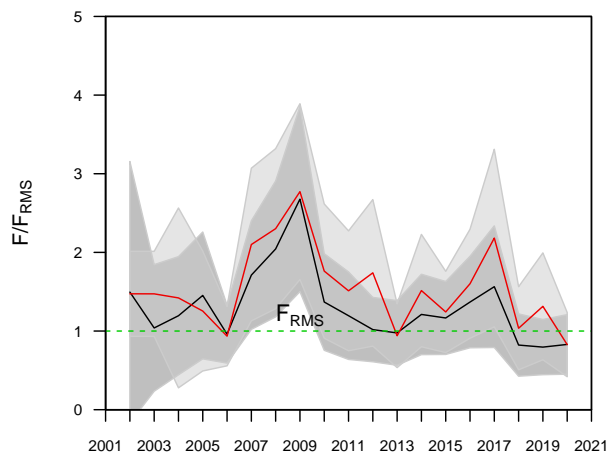
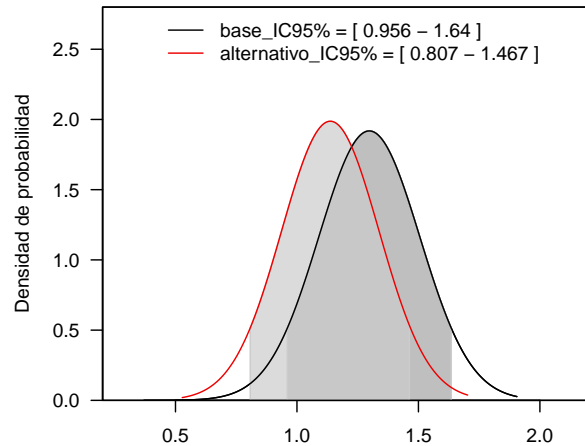
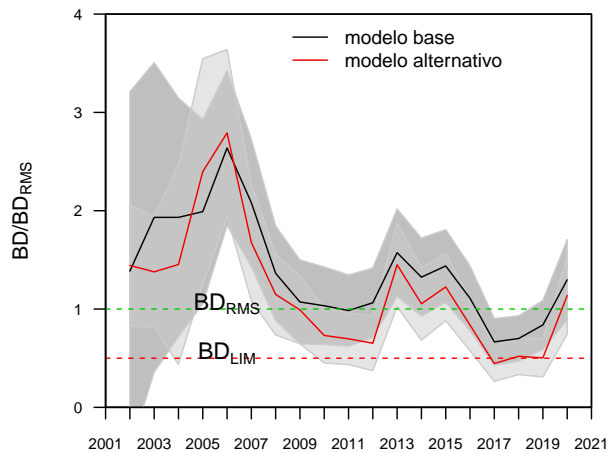
plot(x0,frpr.0,type="n",ylim=c(0,5),cex.axis=0.8,xaxs="i",yaxs="i",
     xlim=c(2001,2021),xaxp=x0_1, ylab=expression("F/F" [RMS]),
     las=1,xlab="Año",cex.lab=1.1)
polygon(x0,frpr0,col=gray(.5,0.5), border="gray80")
polygon(x0,frpr.0,col=gray(.8,0.5), border="gray80")
lines(years.0,Frpr0,lwd=1,col=1,lty=1) #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("altern
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("altern
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")

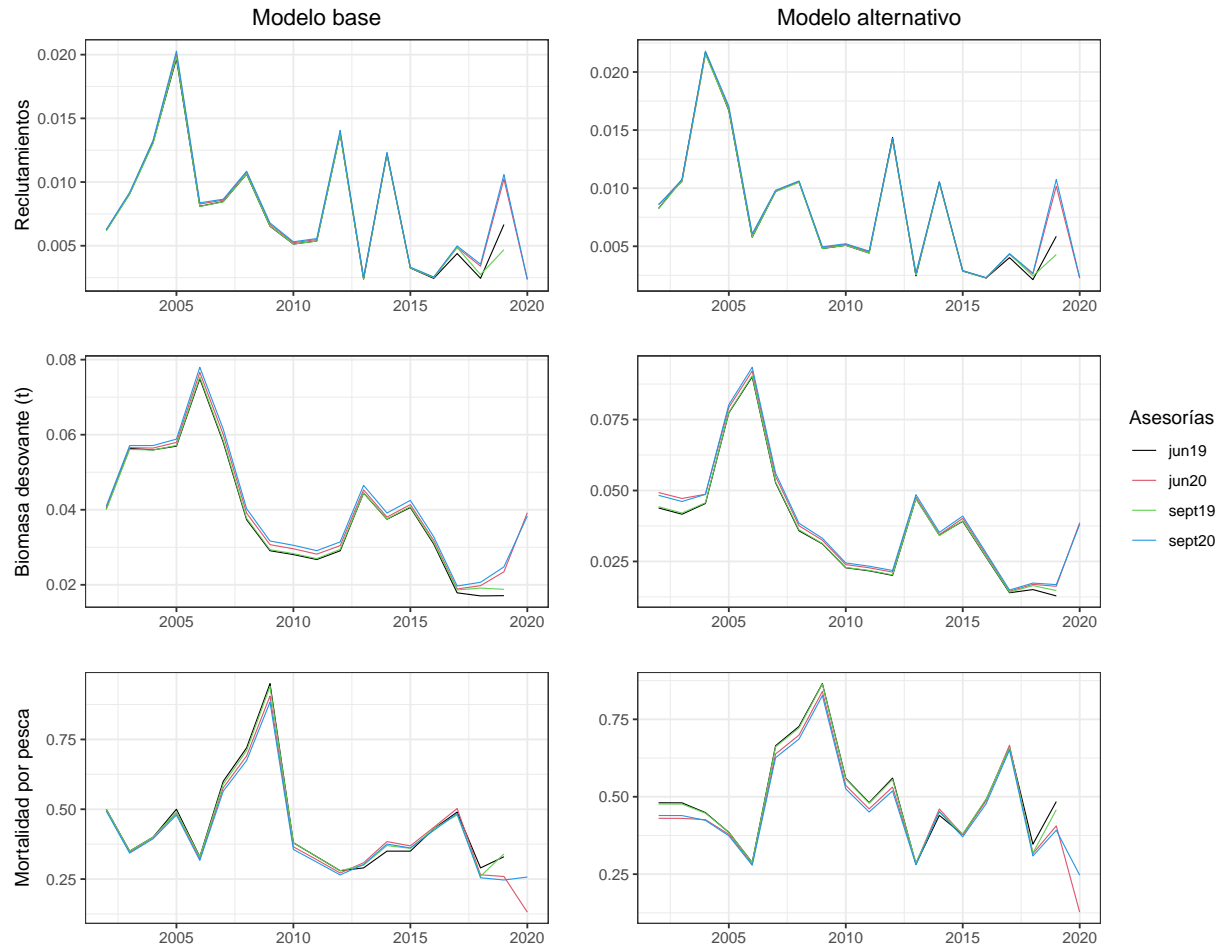
#-----
# Modelo alternativo
#-----
f4<- ggplot(data %>% filter(variable=='Rt',Modelo=='M_alternativo'),aes(years,value/10^6)) +
geom_line(aes(colour=Series), size=0.3)+
labs(x = '', y = '',colour='Asesorías') +
scale_x_continuous(breaks = seq(from = 1990, to = 2020, by = 5)) +
scale_colour_manual(values=seq(1,5,1))+
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

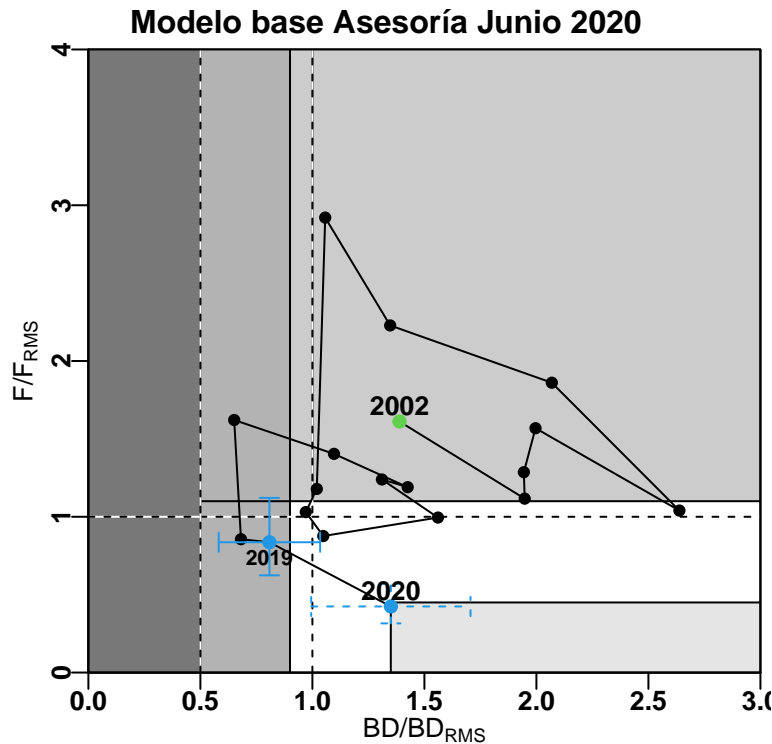
SSBt1      <- subset(std.0b,name=="BD")$value
SSBt1std   <- subset(std.0b,name=="BD")$std
Ft1        <- subset(std.0b,name=="log_F")$value
Ft1std     <- subset(std.0b,name=="log_F")$std
BDo        <- rep.0b$BD_virgen_LP
BRMS1      <- BDo*0.55
FRMS1      <- data0b$Ind[nyears1,13]

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)

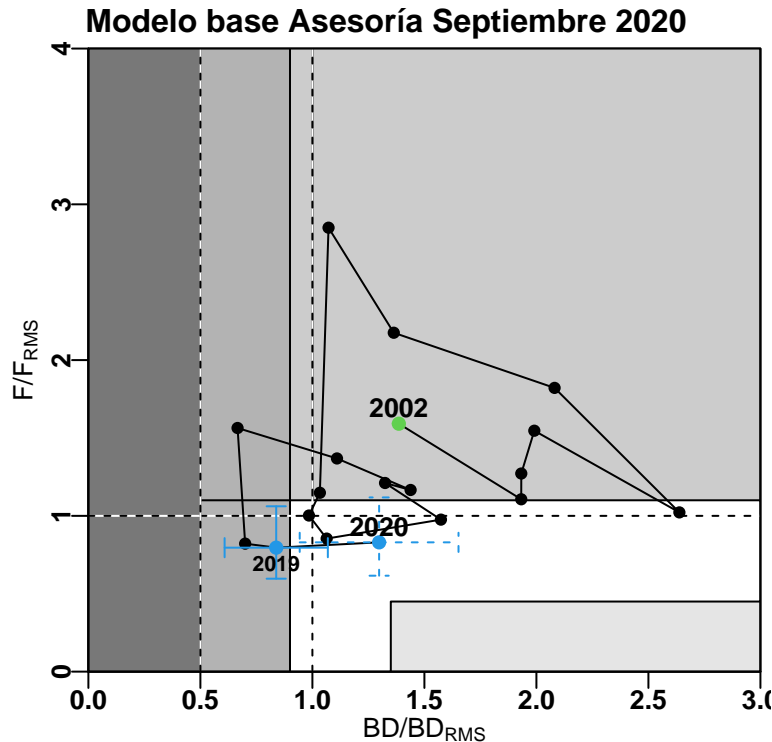
```



```

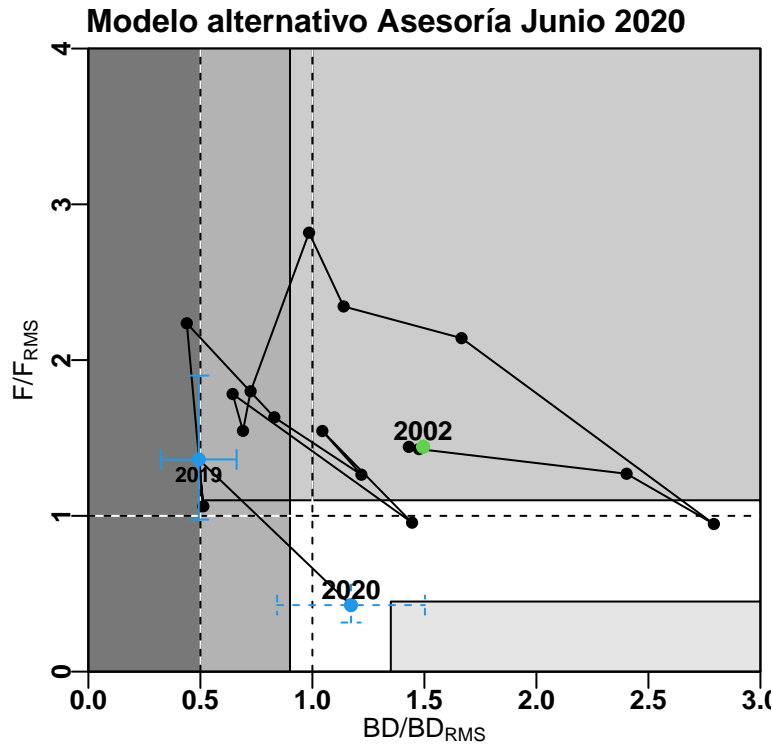
source(paste(getwd(), "/funciones/Fn_DiagramaFase.R", sep=""))
name<-"Modelo base Asesoría Septiembre 2020"
DiagramaFase(name,FRMS,BRMS,SSBt0,SSBt0std,Ft0,Ft0std,years0)
#cruz del año previo
lastB1    <- SSBt0[nyears0-1]/BRMS
lastB     <- SSBt0[nyears0-1]
lastF     <- exp(Ft0[nyears0-1])/FRMS
# Calculate 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")$std
BDol       <- rep.1$Bo
BRMS1      <- BDol*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]

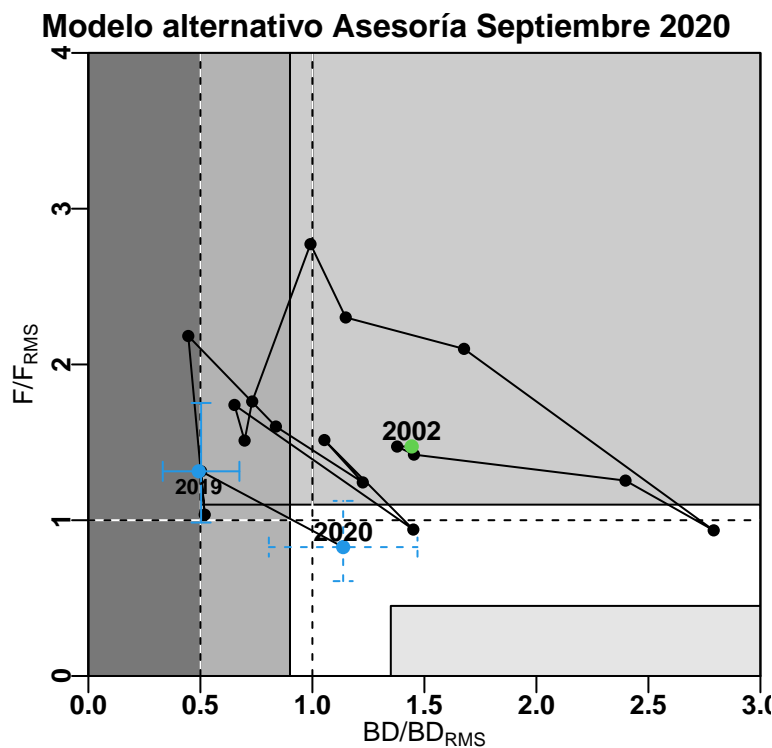
F95       <- c(lastF*exp(-Qmult*FvSE),
               lastF*exp(Qmult*FvSE))

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")

```

```

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 r
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 reclutam
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")

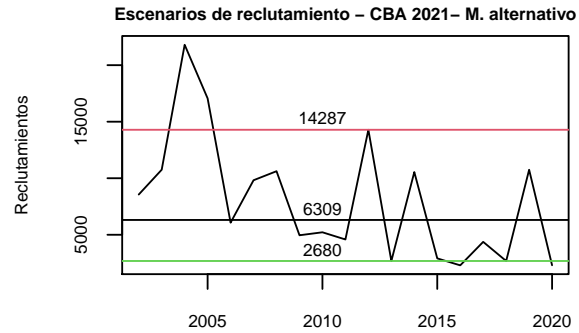
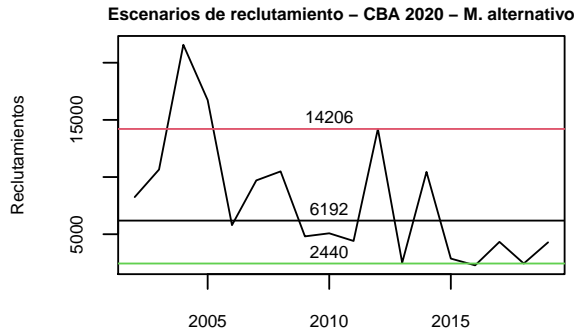
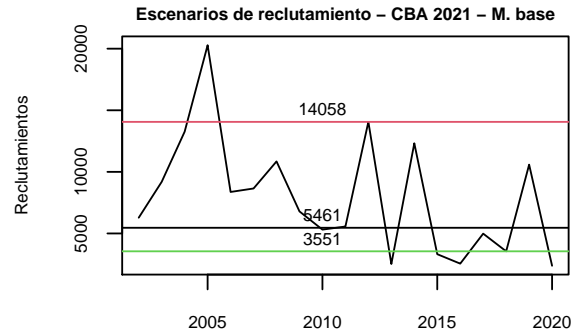
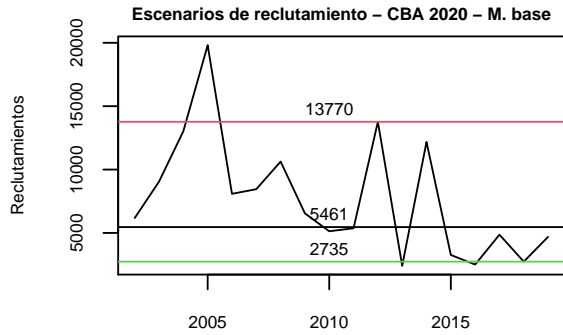
dira<-paste(dir.0,"/cba_septiembre2020_alternativo",sep="")
setwd(dira)
reps1a    <- reptoRlist("MAT0920s1.rep")
reps2a    <- reptoRlist("MAT0920s2.rep")
reps3a    <- reptoRlist("MAT0920s3.rep")

#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 r
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 reclutam
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=round(CBAs3b,0))
#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=round(CBAs3a,0))
#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)

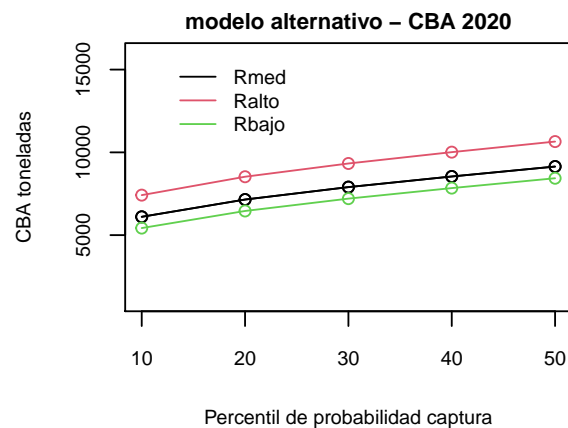
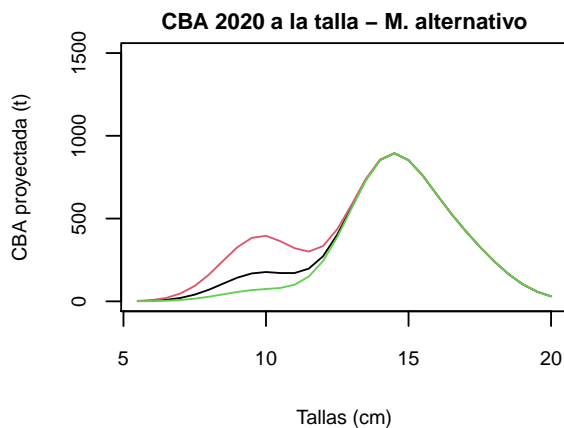
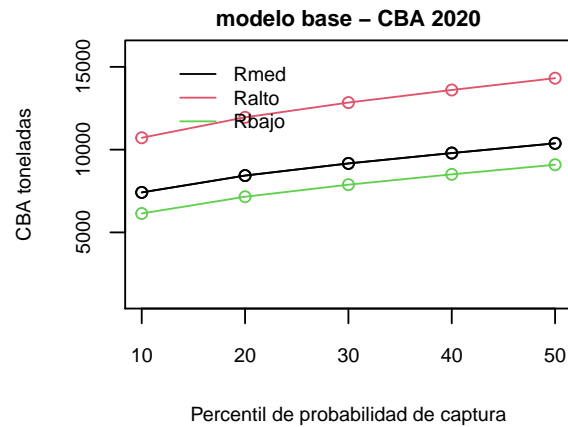
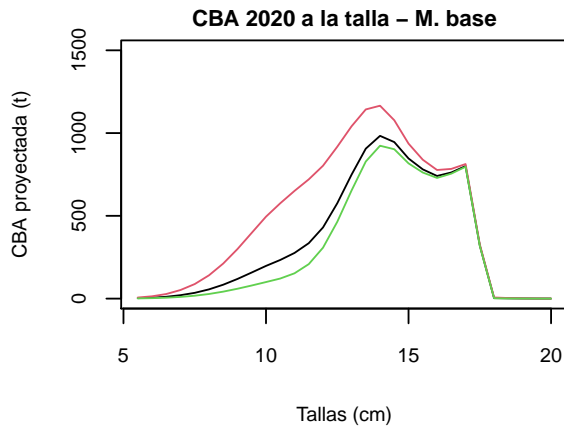
plot(tallas,reps1b$CTPp,type="l",ylim=c(0,1500),main="CBA 2020 a la talla - M. base",
      ylab="CBA proyectada (t)",xlab="Tallas (cm)",cex.axis=0.8,cex.main=0.9,cex.lab=0.8)
lines(tallas,reps2b$CTPp,col=2)
lines(tallas,reps3b$CTPp,col=3)

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)

```



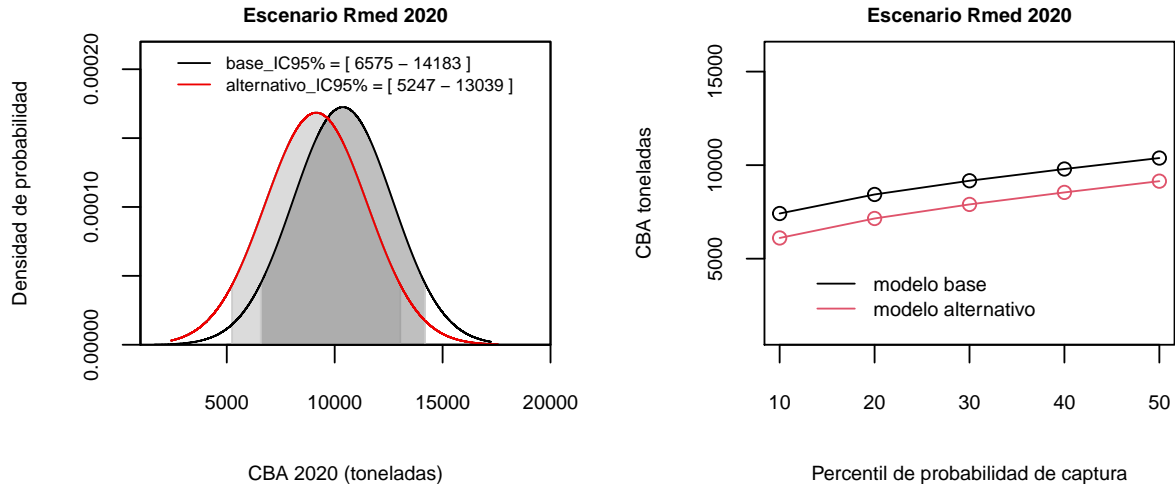
```
### *modelo base*
xcb1 <-rnorm(1000, mean = cbas1b, sd = cbas1bstd)
xcb <-seq(min(xcb1),max(xcb1),0.5)
ycb <-dnorm(xcb, mean = cbas1b, sd =cbas1bstd)
iccb <-qnorm(c(0.05,0.95,0.5),cbas1b,cbas1bstd)
xxcb <-c(xcb[xcb>=iccb[1]&xcb<=iccb[2]],rev(xcb[xcb>=iccb[1]&xcb<=iccb[2]]))
yycb <-c(ycb[xcb>=iccb[1]&xcb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

### *modelo alternativo*
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(1000,5000))
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(2000,0.00022,c(paste("base_IC95% = [",round(iccb[1],0),"-",round(iccb[2],0),"]",sep=" "),paste("alt_IC95% = [",round(icca[1],0),"-",round(icca[2],0),"]",sep=" ")),bty="n",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=round(CBAs3b,0))
#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=round(CBAs3a,0))
#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)

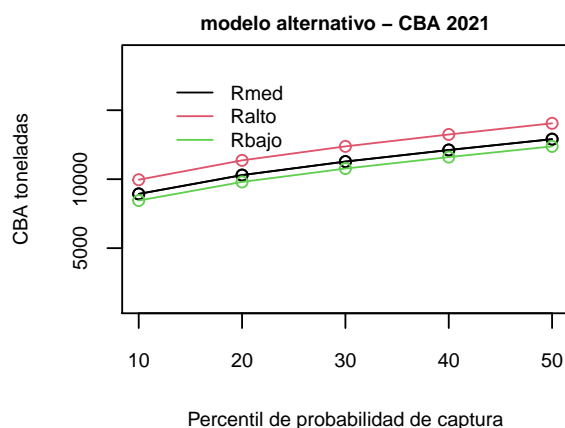
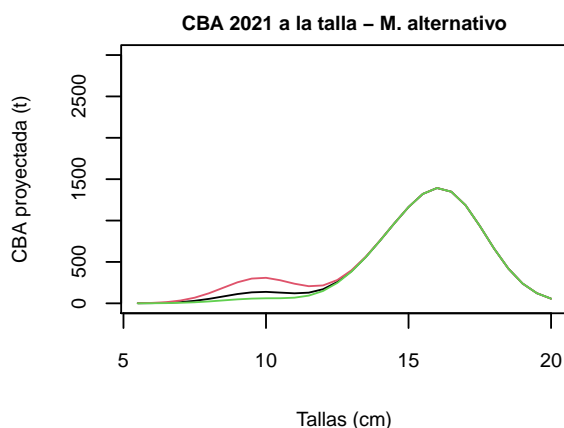
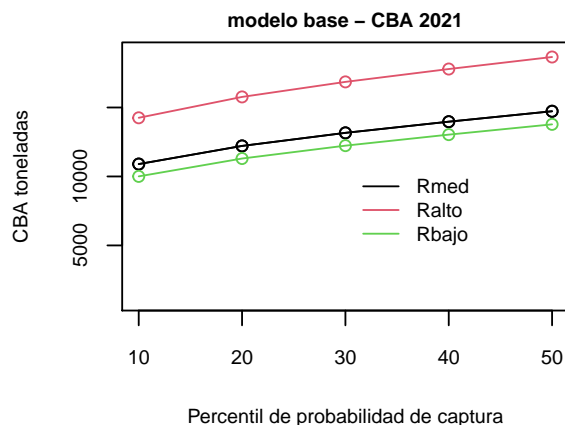
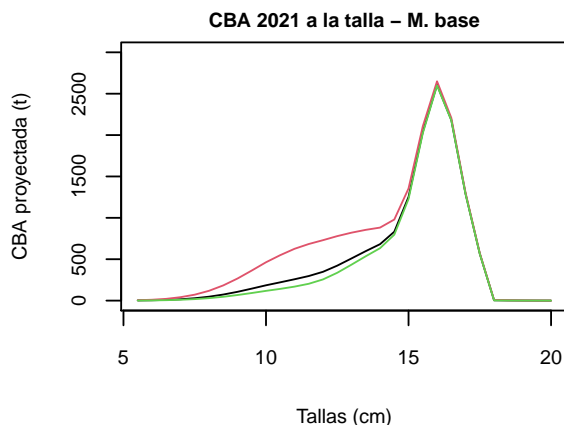
plot(tallas, reps1b$CTPp, type="l", ylim=c(0,3000), main="CBA 2021 a la talla - M. base",
      ylab="CBA proyectada (t)", xlab="Tallas (cm)", cex.axis=0.8, cex.main=0.8, cex.lab=0.8)
lines(tallas, reps2b$CTPp, col=2)
lines(tallas, reps3b$CTPp, col=3)

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)

```

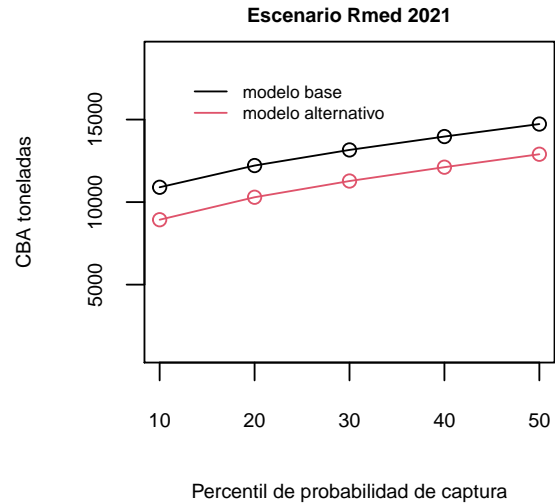
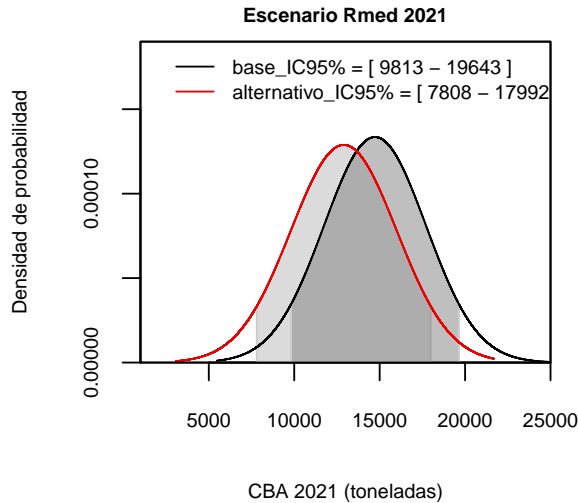


```
### *modelo base*
xcb1 <-rnorm(1000, mean = cbas1b, sd = cbas1bstd)
xcb <-seq(min(xcb1),max(xcb1),0.5)
ycb <-dnorm(xcb, mean = cbas1b, sd =cbas1bstd)
iccb <-qnorm(c(0.05,0.95,0.5),cbas1b,cbas1bstd)
xxcb <-c(xcb[xcb>=iccb[1]&xcb<=iccb[2]],rev(xcb[xcb>=iccb[1]&xcb<=iccb[2]]))
yycb <-c(ycb[xcb>=iccb[1]&xcb<=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(1000,5000))
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(2000,0.00019,c(paste("base_IC95% = [",round(iccb[1],0),"-",round(iccb[2],0),"]",sep=" "),paste("base_IC95% = [",round(icca[1],0),"-",round(icca[2],0),"]",sep=" ")),bty="n",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 alternativo*
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)
```

