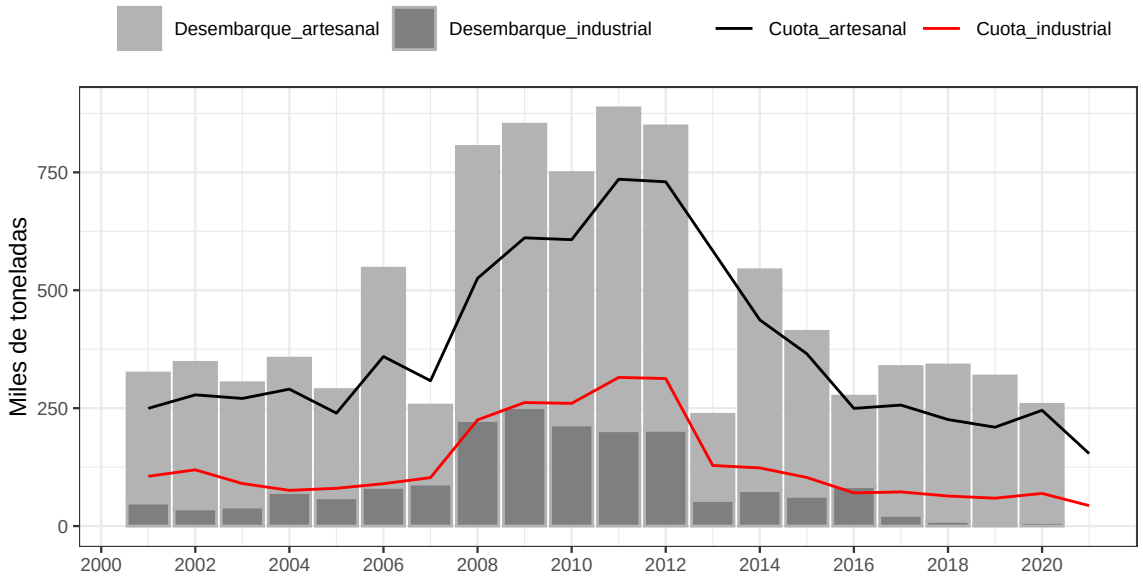
Figuras y Tablas para Tercer Informe de sardina común Centro sur

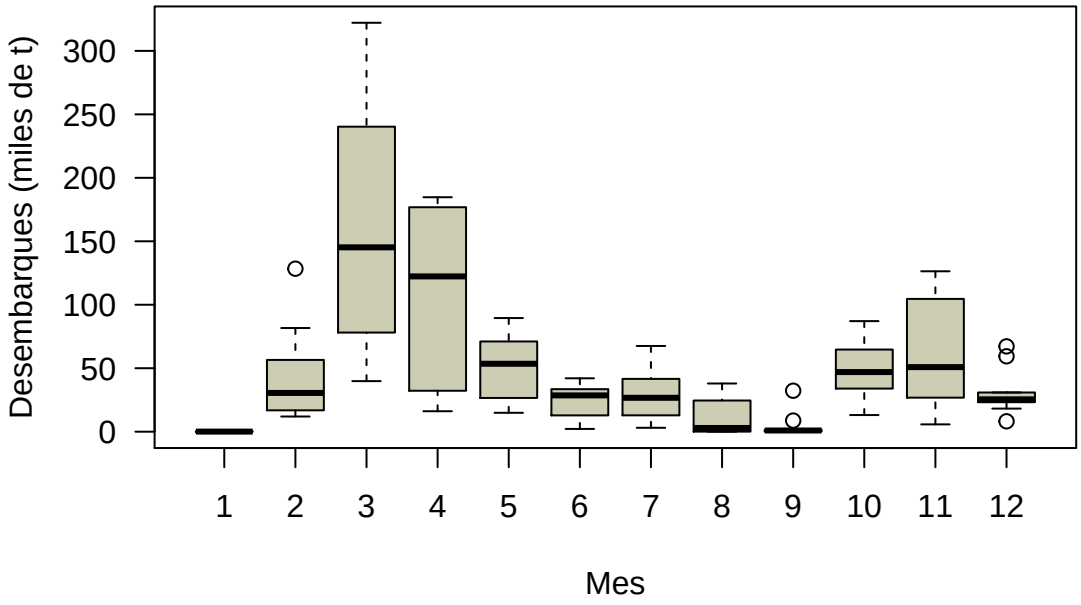
1. ANTECEDENTES

```
years<-seq(1990,2020,1)
dataDesem  <- ant$des_oficialesvscorregidos
Tdesem  <- data.frame(years,dataDesem[,1:2],rep(median(dataDesem[,2]),length(dataDesem[,2])))
colnames(Tdesem) <- c("Years",
                      "Desembarques_oficiales",
                      "Desembarques_oficales_corregidos",
                      "Mediana_desembarques_corregidos")

des_Of_corr <- data.frame(Tdesem) %>% mutate(Registros="desembarques") %>% melt(id.var=c("Years","Registros"))

ggplot(des_Of_corr)+
  geom_line(aes(Years,value/1000,colour=variable))+
  annotate("text", x=2011, y=(round(median(Tdesem[,3]),0)/1000)+30,
  label=paste(round(median(Tdesem[,3]/1000),0),"mil toneladas"))+
  scale_colour_manual(values=c('blue',"black","red")) +
  labs(x = '', y = 'Desembarques (miles de toneladas)',colour="") +
  scale_x_continuous(breaks = seq(from = 1990, to = 2020, by = 2)) +
  theme_bw(base_size=9) +
  theme(plot.title = element_text(hjust = 0.5),legend.position="top")
```

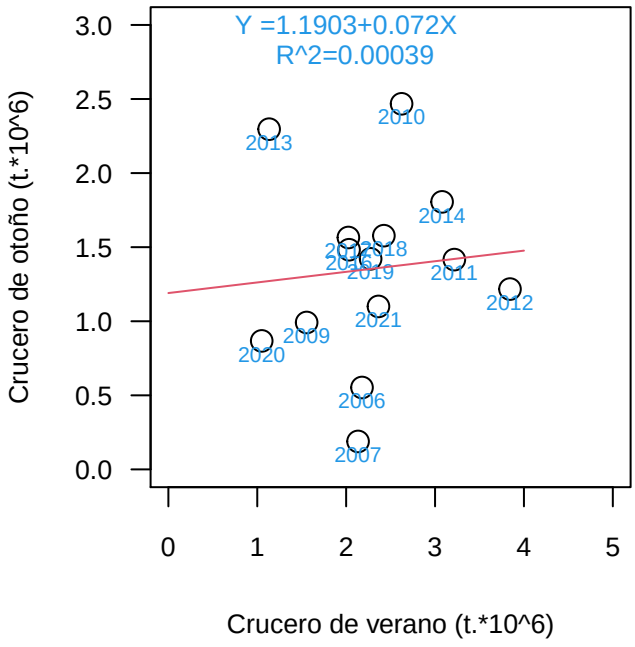
```r
dataDesem2  <- data.frame(ant$year_cuota,ant$des_art,ant$des_ind)
colnames(dataDesem2) <- c("Years",
                          "Desembarque_artesanal",
                          "Desembarque_industrial")

dataDesem3  <- data.frame(ant$year_cuota,
                          ant$cuot_art,
                          ant$cuot_ind)

colnames(dataDesem3) <- c("Years",
                          "Cuota_artesanal",
                          "Cuota_industrial")

des_art_ind   <- data.frame(dataDesem2) %>%
                          mutate(Registros="desembarques") %>%
                          melt(id.var=c("Years","Registros"))

cuota_art_ind <- data.frame(dataDesem3) %>%
                           mutate(Registros=c("cuotas")) %>%
                           melt(id.var=c("Years","Registros"))

ggplot(des_art_ind)+
  geom_bar(aes(x=Years, y =value/1000,fill=variable), stat="identity",color = 'gray70') +
  geom_line(data = cuota_art_ind, aes(x = Years, y = value/1000, colour=variable)) +
  scale_fill_manual(values=c('gray70',"gray50")) +
  scale_color_manual(values=c('black',"red")) +
  labs(x = '', y = 'Miles de toneladas',fill="",color="") +
  scale_x_continuous(breaks = seq(from = 2000, to = 2020, by = 2)) +
  theme_bw(base_size=8.9) +
  theme(plot.title = element_text(hjust = 0.5),legend.position="top")
```



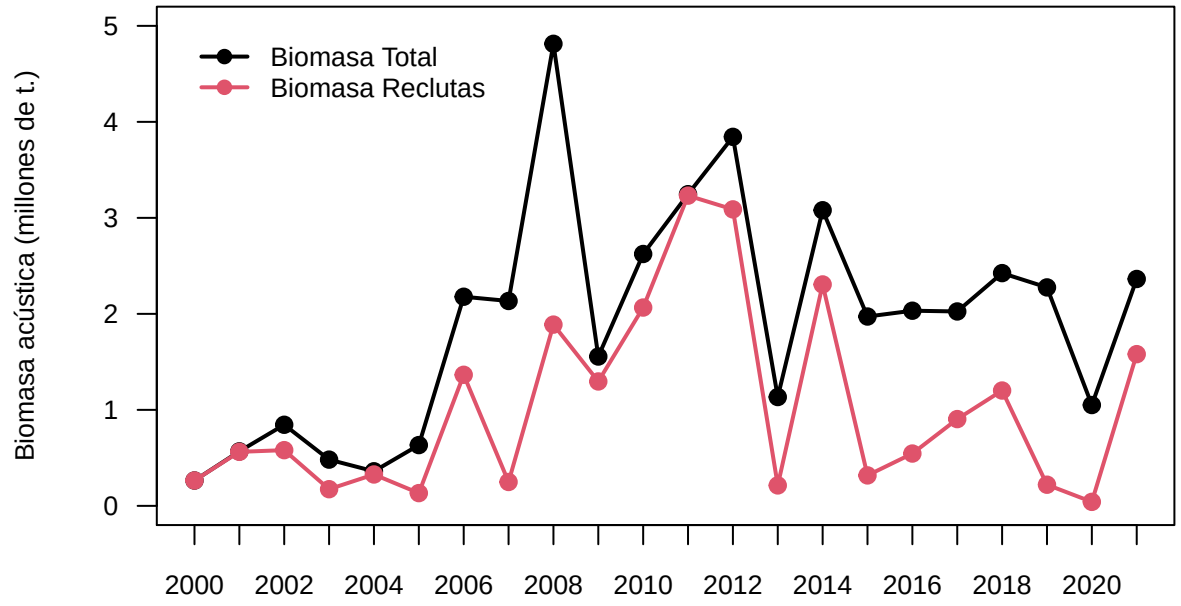
```r
ano<-ant$desembarques_sernapesca[,1]
des_mes<-data.frame(mes=rep(seq(1,12,1),27),ano=gl(27,12,labels=ano),desem=c(t(ant$desembarques_sernapesca[,2:13])))

par(mfcol=c(1,1),mar=c(4,4,1,1))
boxplot(des_mes$desem[145:264]/10^3~des_mes$mes[145:264],las=1,xlab="Mes",
    ylab="Desembarques (miles de t)",col="lightyellow3")
```



```
x<-rep1$reclasobs[rep1$reclasobs>0&rep1$pelacesobs>0]/10^6
y<-rep1$pelacesobs[rep1$reclasobs>0&rep1$pelacesobs>0]/10^6
years<-rep1$years

par(mar=c(4,4,1,1))
plot(x,y,las=1,cex=1.5,xlab="Crucero de verano (t.*10^6)",ylab="Crucero de otoño (t.*10^6)",xlim=c(0,5),ylim=c(0,3),cex.lab=0.8,
text(x,y-0.09,years[rep1$reclasobs>0&rep1$pelacesobs>0],cex=0.7,col=4)

model0<-lm(y~x)
y0<-predict(model0,data.frame(x=seq(0,4,0.1)),interval="prediction",level = 0.98)
lines(seq(0,4,0.1),y0[,1],col=2)
#summary(model0)
text(2,3,paste("Y =",round(model0$coefficients[1],4),"+",round(model0$coefficients[2],3),"X",sep=""),col=4,cex=0.8)
text(2.1,2.8, "R^2=0.00039",col=4,cex=0.8)
```

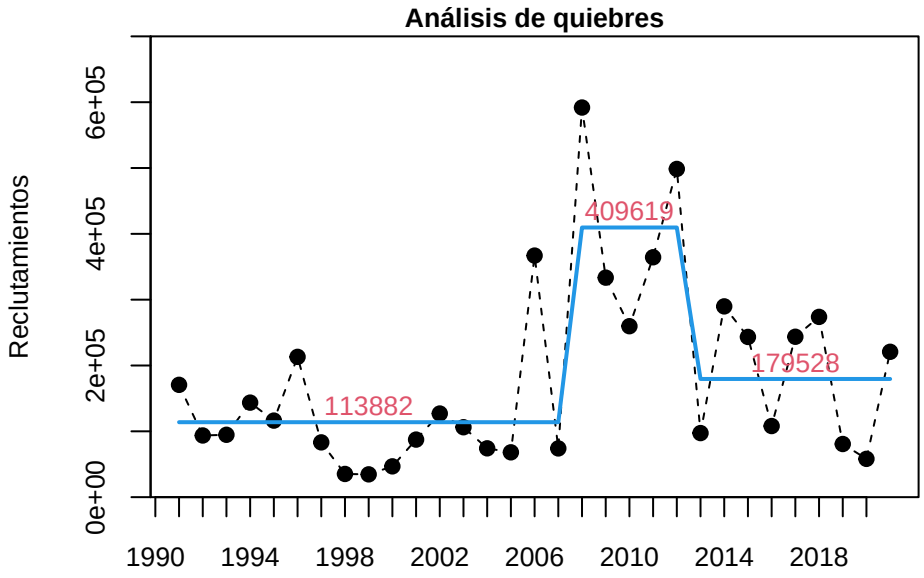


```r
anorecl<-ant$reclas_BT_BR_AT_AR[,1]
BTreclas<-ant$reclas_BT_BR_AT_AR[,2]
BRreclas<-ant$reclas_BT_BR_AT_AR[,3]
ATreclas<-ant$reclas_BT_BR_AT_AR[,4]
anopela<-ant$pelaces_BT_AT[,1]
BTpela<-ant$pelaces_BT_AT[,2]
ATpela<-ant$pelaces_BT_AT[,3]

par(mar=c(2,4,1,1)+0.5)
plot(anorecl,BTreclas/1000000,ylim=c(0,5),xaxp=c(2000,2021,21),las=1,ylab="Biomasa acústica (millones de t.)",xlab="",type="o",p
lines(anorecl,BRreclas/1000000,type="o",pch=19,col=2,lwd=2)
legend(2000, 5,c("Biomasa Total","Biomasa Reclutas"),pch=19,lwd=2,col=c(1,2),bty="n",cex=0.8)
```

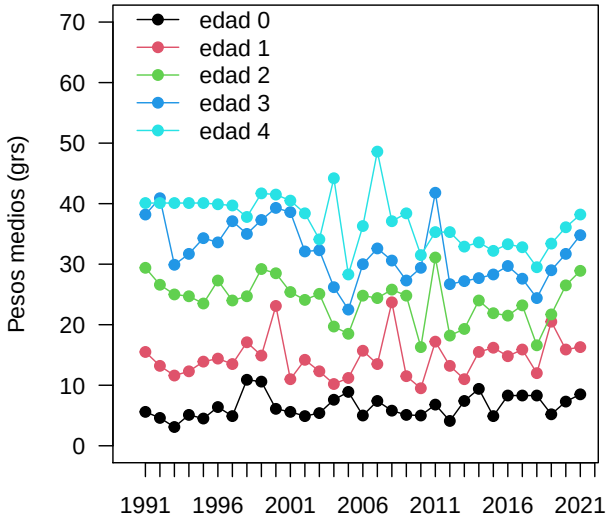


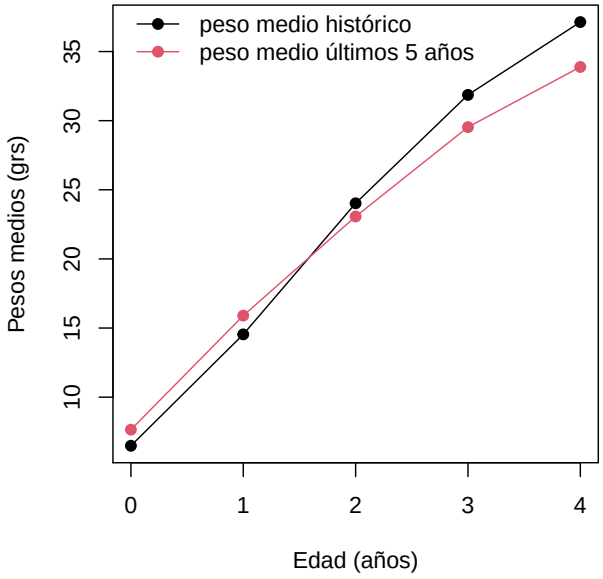
2. METODOLOGÍA

```
library(strucchange)
years     <- rep1$years
nyears    <- length(years)
bp.nile   <- breakpoints(rep1$Reclutas ~ 1)
fm0       <- lm(rep1$Reclutas ~ 1)
fm1       <- lm(rep1$Reclutas ~ breakfactor(bp.nile, breaks = 2))
quiebres3 <- fitted(fm1)

par(mfrow=c(1,1),mar=c(2,4,1,1))
plot(years,rep1$Reclutas,type="l",lty=2,pch=19,ylim=c(0,700000),
     xaxp=c(1990,2020,30),yaxs="i",xlab="",ylab="Reclutamientos",main="Análisis de quiebres",cex.main=0.8,cex.axis=0.8,cex.lab=0
points(years,rep1$Reclutas,col=1,pch=19)
lines(years,quiebres3,lwd=2,col=4)
text(c(1999,2010,2017),c(fitted(fm1)[1],fitted(fm1)[18],fitted(fm1)[23])+25000,round(c(fitted(fm1)[1],fitted(fm1)[18],fitted(fm1
```



```r
years1  <-rep1$years
nyears1 <-length(years1)
age     <-seq(0,4,1)
nage    <-length(age)
pobsF   <-rep1$pf_obs

#Proporcion observada
WmedF <-dat1$Wmed
WiniF <-dat1$Wini
#Proporciones
Wm    <-c(WmedF); Wm[Wm==0]  <-NA
Wi    <-c(WiniF); Wi[Wi==0]  <-NA

x1 <-c(years1[1],years1[nyears1]+1,nyears1+1/2)
#Proporci?n de edad
par(mar=c(4,4,2,1),mfrow=c(1,2))
# pesos medios
plot(years1,WmedF[,1],type="n",las=1,ylim=c(0,70),xlim=c(1990,years1[nyears1]),ylab="Pesos medios (grs)",xlab="",xaxp=x1,main="")
for(i in 1:5){
lines(years1,WmedF[,i],col=i,type="o", pch=19)}
legend(1990,75,c("edad 0","edad 1","edad 2","edad 3","edad 4"),pch=19,lwd=1,col=1:5,bty="n")


plot(age,colMeans(WmedF),type="o",pch=19,ylab="Pesos medios (grs)",xlab="Edad (años)")
lines(age,colMeans(WmedF[(nyears1-5):nyears1,]),col=2,type="o",pch=19)
legend(0,39,c("peso medio histórico","peso medio últimos 5 años"),pch=19,lwd=1,col=c(1,2),bty="n")
```



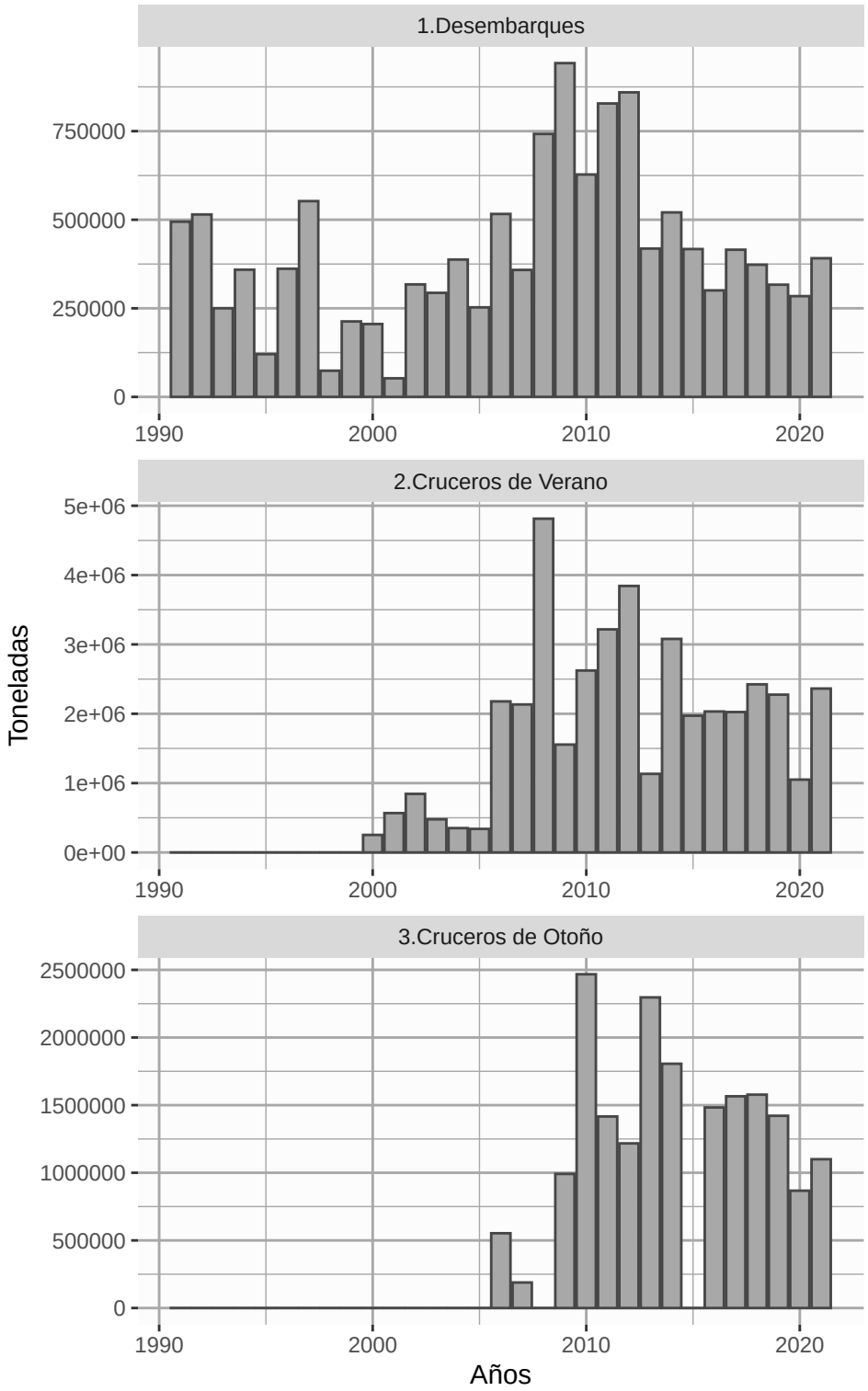


Año.biológico	Desembarques.t.	Porcentaje.descarte	Captura.descartada.t.	Captura.total.t.
1990-91	494567	0%	0	494567
1991-92	514787	0%	0	514787
1992-93	250237	0%	0	250237
1993-94	358949	0%	0	358949
1994-95	120608	0%	0	120608
1995-96	361735	0%	0	361735
1996-97	552515	0%	0	552515
1997-98	73892	0%	0	73892
1998-99	212993	0%	0	212993
1999-00	205616	0%	0	205616
2000-01	50451	4%	2018	52469
2001-02	305257	4%	12210	317467
2002-03	282360	4%	11294	293654
2003-04	372689	4%	14908	387597
2004-05	242976	4%	9719	252695
2005-06	496438	4%	19858	516296
2006-07	344596	4%	13784	358380
2007-08	713623	4%	28545	742168
2008-09	905818	4%	36233	942051
2009-10	603450	4%	24138	627588
2010-11	796319	4%	31853	828172
2011-12	826505	4%	33060	859565
2012,13	402507	4%	16100	418607
2013-14	500641	4%	20026	520667
2014-15	401201	4%	16048	417249
2015-16	289013	4%	11561	300574
2016-17	399415	4%	15977	415391
2017-18	348574	7%	24400	372974
2018-19	301557	5%	15078	316634
2019-20	273376	4%	10935	284311
2020-21	376245	4%	15050	391294

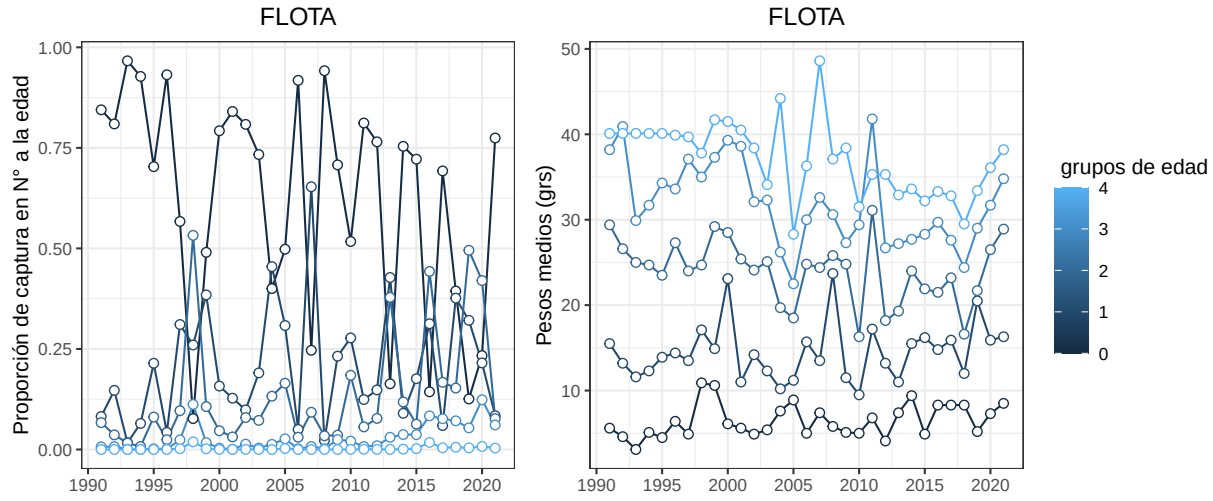
3. RESULTADOS

```
setwd(dir.1)
years  <- rep1$years
nyears <- dat1$nanos
x2      <-c(years,rev(years))
x1_2    <-c(years[1],years[nyears]+1,nyears+1/2) #xaxp
x2_2    <-c(years[1]-1,years[nyears]+1) #xlim

ydesembarques<-rep1$years[rep1$desembarqueobs>0]
yreclas      <-rep1$years[rep1$reclasobs>0]
ypelaces     <-rep1$years[rep1$pelacesobs>0]
ycompflota   <-rep1$years[rowSums(rep1$pf_obs)>0]
ycompreclas  <-rep1$years[rowSums(rep1$pobs_RECLAS)>0]
ycomppelaces <-rep1$years[rowSums(rep1$pobs_PELACES)>0]
ypesomedio   <-rep1$years[rowSums(dat1$Wmed)>0]
ypesoinicial <-rep1$years[rowSums(dat1$Wini)>0]

par(mfrow=c(1,1),mar=c(2,2,1,1)+0.5)
plot(years,rep(0,length(years)),type="n",ylim=c(0,9),ylab="",xlab="",xaxp=x1_2,axes=F,xlim=c(1991,2027.5))
abline(v=2022)
points(ydesembarques,rep(1,length(ydesembarques)),lwd=15,col=1)
points(yreclas,rep(2,length(yreclas)),lwd=15,col=2)
points(ypelaces,rep(3,length(ypelaces)),lwd=15,col=3)
points(ycompflota,rep(4,length(ycompflota)),lwd=15,col=4)
points(ycompreclas,rep(5,length(ycompreclas)),lwd=15,col=5)
points(ycomppelaces,rep(6,length(ycomppelaces)),lwd=15,col=6)
points(ypesomedio,rep(7,length(ypesomedio)),lwd=15,col=7)
points(ypesoinicial,rep(8,length(ypesoinicial)),lwd=15,col=8)

ejey<-c("Desembarques","Biom_Cru_verano","Biom_Cru_otoño","CompEdad Flota","CompEdad C.verano","CompEdad C.otoño","Peso medio Fl

#legend()
axis(1,years,xaxp=x1_2)
text(rep(2025.5,8),1:8,ejey,cex=0.8)

box()
```

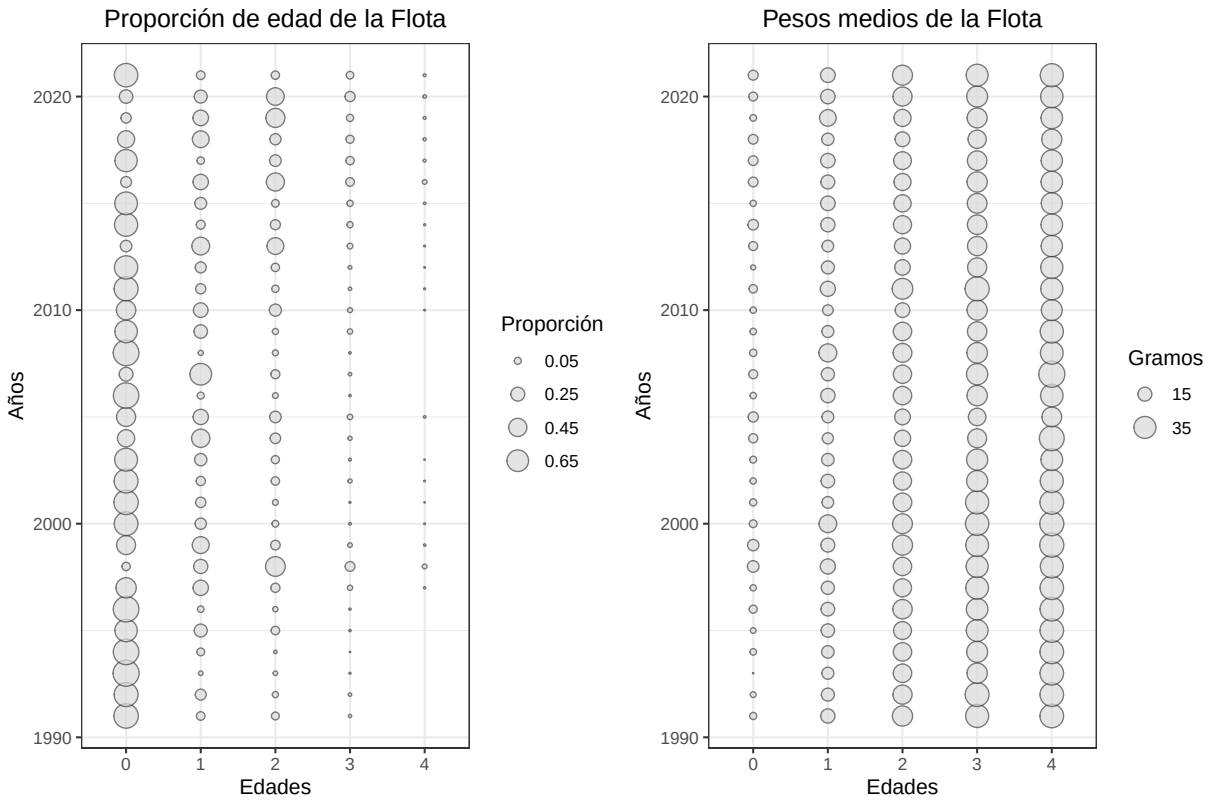
```
des_obs <- data.frame(rep1$desembarqueobs)
bc_obs  <- data.frame(rep1$reclasobs)
bp_obs  <- data.frame(rep1$pelacesobs)
yearc   <- rep1$years
nyearc  <-length(yearc)

 obsC  <- as.data.frame(bc_obs) %>%
                        mutate(year=yearc) %>%
                        melt(id.vars='year') %>%
                        mutate(type='2.Cruceros de Verano')

 obsP  <- as.data.frame(bp_obs) %>%
                        mutate(year=yearc) %>%
                        melt(id.vars='year') %>%
                        mutate(type='3.Cruceros de Otoño')

 obsD  <- as.data.frame(des_obs) %>%
                        mutate(year=yearc) %>%
                        melt(id.vars='year') %>%
                        mutate(type='1.Desembarques')

 Bcru  <-rbind(obsC,obsP,obsD)

p <- ggplot()  +
  geom_bar(data=Bcru, aes(x=year, y =value), stat="identity", fill='gray66',
                  color = 'gray28') +
    facet_wrap(~type,scale="free",dir = 'v', as.table = TRUE) + labs(x="Años", y="Toneladas")
p +  theme(panel.background = element_rect(fill ="gray99")) + theme(panel.grid=element_line(color="gray66"))
```


1.Desembarques
750000
500000
250000
0
1990
2000
2010
2020
2.Cruceros de Verano
5e+06
4e+06
3e+06
2e+06
1e+06
0e+00
Toneladas
3.Cruceros de Otoño
2500000
2000000
1500000
1000000
500000
Años

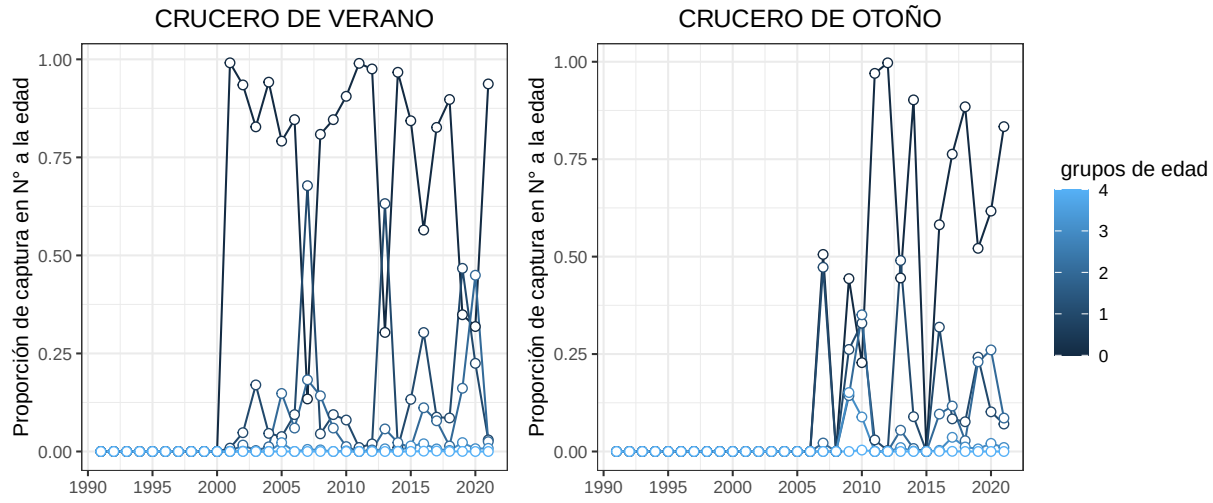
```r
years    <- rep1$years
nyears   <- length(years)
age      <- seq(0,4,1)
nage     <- length(age)
WmedF    <- dat1$Wmed
WiniF    <- dat1$Wini
pobsF    <- rep1$pf_obs

WmedF <- as.data.frame(WmedF) %>%
                       mutate(years=years) %>%
                       melt(id.vars='years') %>%
                       mutate(edad = rep(age, each=nyears)) %>%
                       mutate(type='WmedF')

pobsF <- as.data.frame(pobsF) %>%
                       mutate(years=years) %>%
                       melt(id.vars='years') %>%
                       mutate(edad = rep(age, each=nyears)) %>%
                       mutate(type='pobsF')


f1<-ggplot(pobsF, aes(x = years, y = value, group=edad,colour=edad))+
  geom_line() +
  geom_point( size=2, shape=21, fill="white") +
  labs(x = '', y = 'Proporción de captura en N° a la edad',fill="",color=" grupos de edad") +
  scale_x_continuous(breaks = seq(from = 1990, to = 2020, by = 5)) +
  ggtitle("FLOTA")+
  theme_bw(base_size=11) +
  theme(plot.title = element_text(hjust = 0.5),legend.position="none")

f2<-ggplot(WmedF, aes(x = years, y = value, group=edad,colour=edad))+
  geom_line() +
  geom_point( size=2, shape=21, fill="white") +
  labs(x = '', y = 'Pesos medios (grs)',fill="",color=" grupos de edad") +
  scale_x_continuous(breaks = seq(from = 1990, to = 2020, by = 5)) +
   ggtitle("FLOTA")+
  theme_bw(base_size=11) +
  theme(plot.title = element_text(hjust = 0.5))

f1 + f2
```



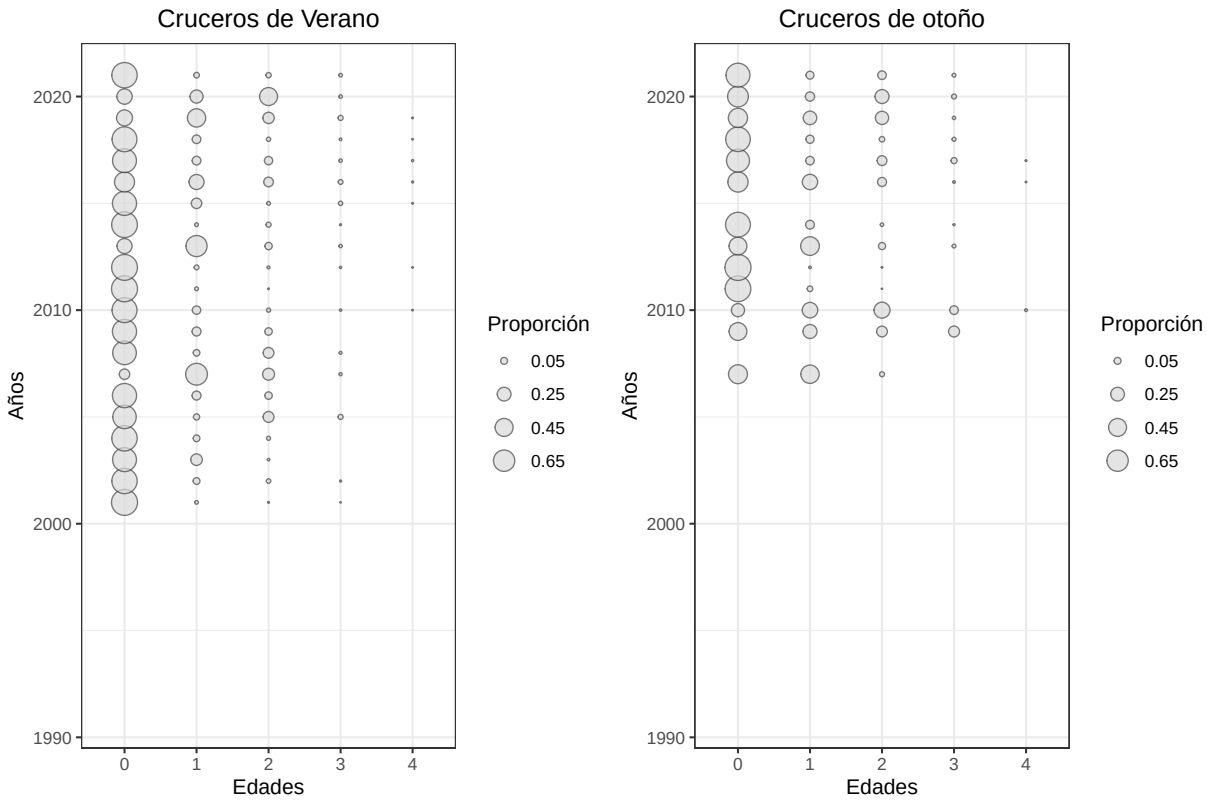
```r
pobsF    <- rep1$pf_obs
pF       <- c(pobsF); pF[pF==0]  <-NA
WmedF    <- dat1$Wmed
Wm       <- c(WmedF); Wm[Wm==0]  <-NA

years    <- rep1$years
nyears   <- dat1$nanos
age      <- seq(0,4,1)
nage     <- length(age)

anos <- rep(years,length(age))
edad <- gl((length(age)),length(years),label=age)

datosProp=data.frame(x=edad,y=anos,tamanio=pF)
datosWmed=data.frame(x=edad,y=anos,tamanio=Wm )

g1 <- ggplot (datosProp,aes(x,y)) +
     geom_point(aes(size=tamanio),color = 'gray25',shape=21, fill="gray85",alpha = 0.7) +
     scale_size_continuous(breaks = seq(0.05,0.65,0.2),range=c(0,6))+
     labs(x = 'Edades', y = 'Años',size="Proporción") +
     ggtitle("Proporción de edad de la Flota")+
     theme_bw(base_size=11) +
     theme(plot.title = element_text(hjust = 0.5))

g2 <- ggplot (datosWmed,aes(x,y)) +
      geom_point(aes(size=tamanio),color = 'gray25',shape=21, fill="gray85",alpha=0.7) +
      scale_size_continuous(breaks = seq(15,75,20),range=c(0,6))+
      labs(x = 'Edades', y = 'Años',size="Gramos") +
      ggtitle("Pesos medios de la Flota")+
      theme_bw(base_size=11) +
      theme(plot.title = element_text(hjust = 0.5))

g1 + g2
```


Proporción de edad de la Flota
Años
2020
2010
2000
1990
0
1
2
3
4
Edades
Proporción
0.05
0.25
0.45
0.65
Pesos medios de la Flota
Años
2020
2010
2000
1990
0
1
2
3
4
Edades
Gramos
15
35

```
years    <- rep1$years
nyears   <- dat1$nanos
age      <- seq(0,4,1)
nage     <- length(age)
pobsR    <- rep1$pobs_RECLAS
pobsP    <- rep1$pobs_PELACES


pobsR <- as.data.frame(pobsR) %>%
                        mutate(years=years) %>%
                        melt(id.vars='years') %>%
                        mutate(edad = rep(age, each=nyears)) %>%
                        mutate(type='pobsR')

pobsP <- as.data.frame(pobsP) %>%
                        mutate(years=years) %>%
                        melt(id.vars='years') %>%
                        mutate(edad = rep(age, each=nyears)) %>%
                        mutate(type='pobsP')


f1<-ggplot(pobsR, aes(x = years, y = value, group=edad,colour=edad))+
  geom_line() +
  geom_point( size=2, shape=21, fill="white") +
  labs(x = '', y = 'Proporción de captura en N° a la edad',fill="",color=" grupos de edad") +
  scale_x_continuous(breaks = seq(from = 1990, to = 2020, by = 5)) +
  ggtitle("CRUCERO DE VERANO")+
  theme_bw(base_size=11) +
  theme(plot.title = element_text(hjust = 0.5),legend.position="none")

f2<-ggplot(pobsP, aes(x = years, y = value, group=edad,colour=edad))+
  geom_line() +
  geom_point( size=2, shape=21, fill="white") +
  labs(x = '', y = 'Proporción de captura en N° a la edad',fill="",color=" grupos de edad") +
  scale_x_continuous(breaks = seq(from = 1990, to = 2020, by = 5)) +
  ggtitle("CRUCERO DE OTOÑO")+
  theme_bw(base_size=11) +
  theme(plot.title = element_text(hjust = 0.5))

f1 + f2
```



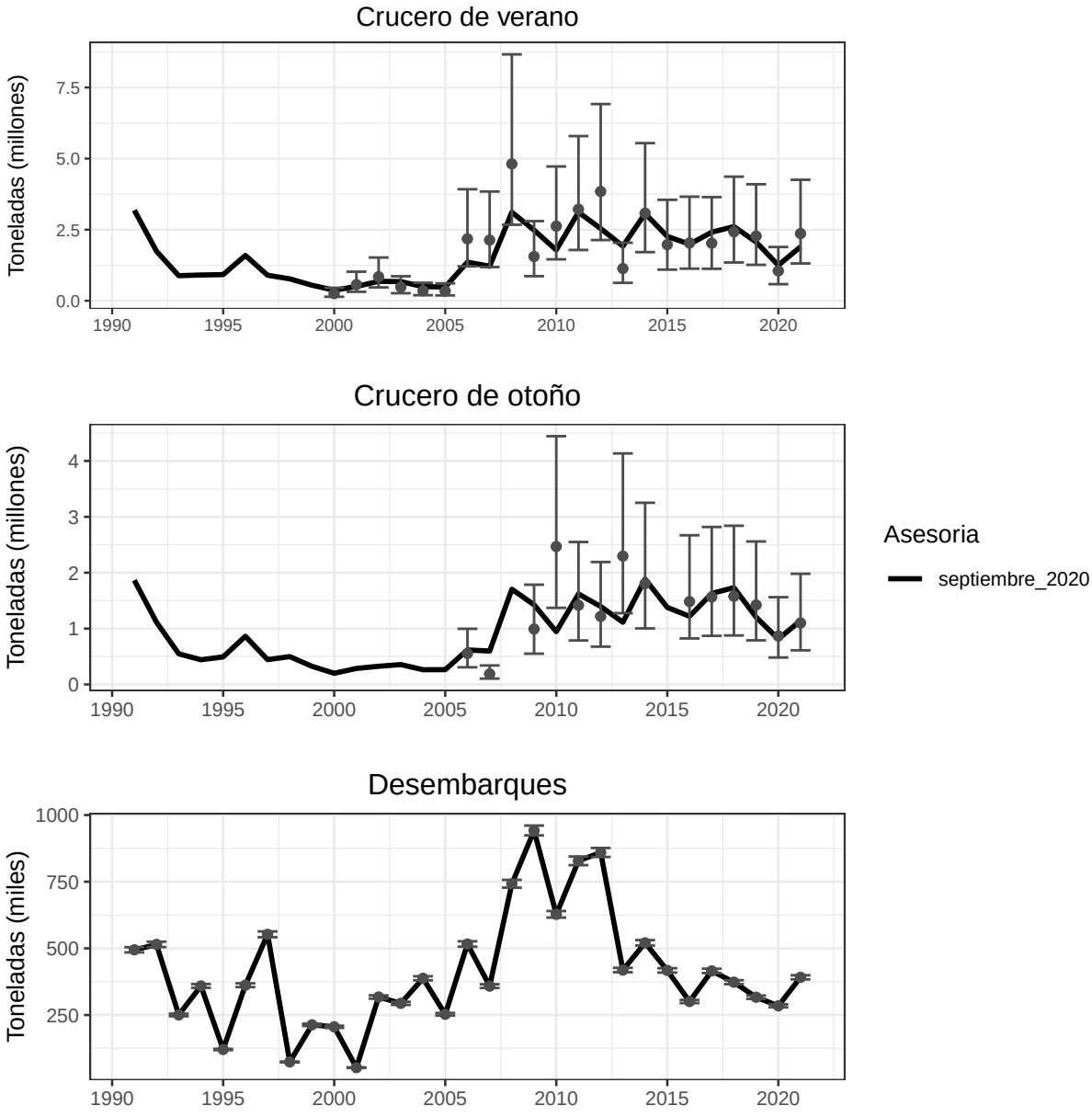
```r
pobsR    <- rep1$pobs_RECLAS
pR       <- c(pobsR); pR[pR==0]  <-NA
pobsP    <- rep1$pobs_PELACES
pP       <- c(pobsP); pP[pP==0]  <-NA

years    <- rep1$years
nyears   <- dat1$nanos
age      <- seq(0,4,1)
nage     <- length(age)

anos <- rep(years,length(age))
edad <- gl((length(age)),length(years),label=age)

datosPropR=data.frame(x=edad,y=anos,tamanio=pR)
datosPropP=data.frame(x=edad,y=anos,tamanio=pP )

g1 <- ggplot (datosPropR,aes(x,y)) +
     geom_point(aes(size=tamanio),color = 'gray25',shape=21, fill="gray85",alpha = 0.7) +
     scale_size_continuous(breaks = seq(0.05,0.65,0.2),range=c(0,6))+
     labs(x = 'Edades', y = 'Años',size="Proporción") +
     ggtitle("Cruceros de Verano")+
     theme_bw(base_size=11) +
     theme(plot.title = element_text(hjust = 0.5))

g2 <- ggplot (datosPropP,aes(x,y)) +
      geom_point(aes(size=tamanio),color = 'gray25',shape=21, fill="gray85",alpha=0.7) +
      scale_size_continuous(breaks = seq(0.05,0.65,0.2),range=c(0,6))+
      labs(x = 'Edades', y = 'Años',size="Proporción") +
      ggtitle("Cruceros de otoño")+
      theme_bw(base_size=11) +
      theme(plot.title = element_text(hjust = 0.5))

g1 + g2
```


Cruceros de Verano
Años
2020
2010
2000
1990
0
1
2
3
4
Edades
Proporción
0.05
0.25
0.45
0.65
Cruceros de otoño
Años
2020
2010
2000
1990
0
1
2
3
4
Edades
Proporción
0.05
0.25
0.45
0.65

3.1. Ajuste del modelo a los datos

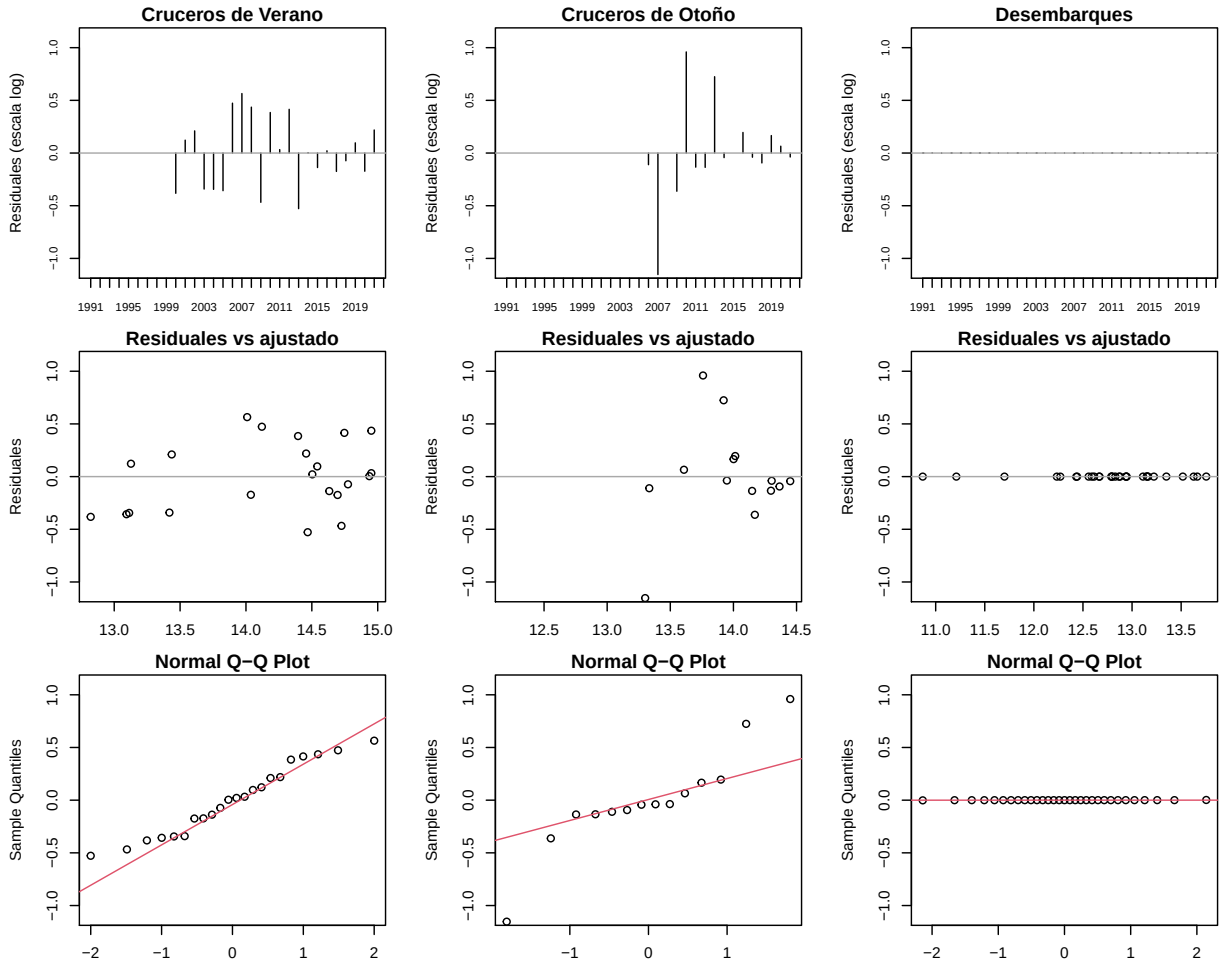
```
yrs   <- rep1$years
nyrs  <- length(yrs)
lasty <- yrs[nyrs]
cvBcV   <-0.30
cvBcO   <-0.30
cvdes   <-0.01

#-------------------------------------------------------------------------------
ind_obs           <- cbind(c(rep1$reclasobs),
                           c(rep1$pelacesobs),
                           c(rep1$desembarqueobs)); ind_obs[ind_obs==0] <- NA
colnames(ind_obs) <- c('Crucero_verano',
                       'Crucero_otoño',
                       'Desembarques')
#-------------------------------------------------------------------------------
ind_sept           <- cbind(c(rep1$reclaspred),
                            c(rep1$pelacespred),
                            c(rep1$desembarquepred))
colnames(ind_sept) <- c('Crucero_verano',
                        'Crucero_otoño',
                        'Desembarques')

ind               <- data.frame(ind_obs) %>%
                     mutate(Asesoria='observado') %>%
                     mutate (yrs= yrs) %>%
                     melt(id.var=c('yrs', 'Asesoria'))
#=============================================================
sept               <- data.frame(ind_sept) %>%
                      mutate (Asesoria='septiembre_2020') %>%
                      mutate (yrs= yrs)  %>%
                      melt(id.var=c('yrs', 'Asesoria'))
#-------------------------------------------------------------------------------
base1 <- data.frame(rbind(ind, sept))
#####################################################################################################
# FIGURAS
#####################################################################################################
BcV <- ggplot(base1 %>% filter(Asesoria!='observado', variable=='Crucero_verano'),
       aes(yrs,value/1000000)) +
       geom_line(aes(colour=Asesoria), size=0.8) +
       scale_colour_manual(values=c('black')) +
       geom_point(data = base1 %>% filter(Asesoria=='observado', variable=='Crucero_verano'),
       aes(yrs,value/1000000), shape = 19, colour = 'gray30') +
       geom_errorbar(data = base1 %>% filter(Asesoria=='observado', variable=='Crucero_verano'),
       aes(ymin = value*exp(-1.96*cvBcO)*10^-6, ymax = value*exp(1.96*cvBcO)*10^-6), color = 'gray30') +
       scale_x_continuous(breaks = seq(from = 1985, to = 2021, by = 5)) +
       labs(x = '', y = 'Toneladas (millones)') +
       theme_bw(base_size=9) +
       ggtitle('Crucero de verano')+
       theme(plot.title = element_text(hjust = 0.5),legend.position="none")

BcV2 <- ggplot(base1 %>% filter(Asesoria!='observado', variable=='Crucero_verano'),
       aes(yrs,value/1000000)) +
       geom_line(aes(linetype = Asesoria, color=Asesoria, size=Asesoria, stat='identity')) +
       scale_linetype_manual(values=c( "solid")) +
       scale_colour_manual(values=c('black')) +
       scale_size_manual(values=c(1, 1, 1)) +
       geom_point(data = base1 %>% filter(Asesoria=='observado', variable=='Crucero_verano'),
       aes(yrs,value/1000000), shape = 19, colour = 'gray30') +
       geom_errorbar(data = base1 %>% filter(Asesoria=='observado', variable=='Crucero_verano'),
       aes(ymin = value*exp(-1.96*cvBcO)*10^-6, ymax = value*exp(1.96*cvBcO)*10^-6), color = 'gray30') +
       scale_x_continuous(breaks = seq(from = 1985, to = 2021, by = 5)) +
       labs(x = '', y = 'Toneladas (millones)') +
       theme_bw(base_size=9) +
       ggtitle('Crucero de verano')+
       theme(plot.title = element_text(hjust = 0.5),legend.position="none")
```

```r
BcP <- ggplot(base1 %>% filter(Asesoria!='observado', variable=='Crucero_otoño'),
       aes(yrs,value/1000000)) +
       geom_line(aes(colour=Asesoria), size=0.8) +
       scale_colour_manual(values=c('black'),name="Asesorías") +
       scale_linetype_manual(values=c("solid")) +
       geom_point(data = base1 %>% filter(Asesoria=='observado', variable=='Crucero_otoño'),
       aes(yrs,value/1000000), shape = 19, colour = 'gray30') +
       geom_errorbar(data = base1 %>% filter(Asesoria=='observado', variable=='Crucero_otoño'),
       aes(ymin = value*exp(-1.96*cvBcV)*10^-6, ymax = value*exp(1.96*cvBcV)*10^-6), color = 'gray30') +
       scale_x_continuous(breaks = seq(from = 1985, to = 2021, by = 5)) +
       labs(x = '', y = 'Toneladas (millones)') +
       theme_bw(base_size=9) +
       ggtitle('Crucero de otoño')+
       theme(plot.title = element_text(hjust = 0.5))

BcP2 <- ggplot(base1 %>% filter(Asesoria!='observado', variable=='Crucero_otoño'),
       aes(yrs,value/1000000)) +
       geom_line(aes(linetype = Asesoria, color=Asesoria, size=Asesoria, stat='identity'))+
       scale_linetype_manual(values=c("solid")) +
       scale_colour_manual(values=c('black')) +
       scale_size_manual(values=c(1, 1, 1)) +
       geom_point(data = base1 %>% filter(Asesoria=='observado', variable=='Crucero_otoño'),
       aes(yrs,value/1000000), shape = 19, colour = 'gray30') +
       geom_errorbar(data = base1 %>% filter(Asesoria=='observado', variable=='Crucero_otoño'),
       aes(ymin = value*exp(-1.96*cvBcV)*10^-6, ymax = value*exp(1.96*cvBcV)*10^-6), color = 'gray30') +
       scale_x_continuous(breaks = seq(from = 1985, to = 2021, by = 5)) +
       labs(x = '', y = 'Toneladas (millones)') +
       theme_bw(base_size=10) +
       ggtitle('Crucero de otoño')+
       theme(plot.title = element_text(hjust = 0.5))


d   <- ggplot(base1 %>% filter(Asesoria!='observado', variable=='Desembarques'),
       aes(yrs,value/1000)) +
       geom_line(aes(colour=Asesoria), size=0.8) +
       scale_colour_manual(values=c('black')) +
       scale_linetype_manual(values=c("solid"))+
       geom_point(data = base1 %>% filter(Asesoria=='observado', variable=='Desembarques'),
       aes(yrs,value/1000), shape = 19, colour = 'gray30') +
       geom_errorbar(data = base1 %>% filter(Asesoria=='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 = 2021, by = 5)) +
       labs(x = '', y = 'Toneladas (miles)') +
       theme_bw(base_size=10) +
       ggtitle('Desembarques') +
       theme(plot.title = element_text(hjust = 0.5),legend.position="none")

d2   <- ggplot(base1 %>% filter(Asesoria!='observado', variable=='Desembarques'),
       aes(yrs,value/1000)) +
       geom_line(aes(linetype = Asesoria, color=Asesoria, size=Asesoria, stat='identity')) +
       scale_linetype_manual(values=c("solid")) +
       scale_colour_manual(values=c('black')) +
       scale_size_manual(values=c(1, 1, 1)) +
       geom_point(data = base1 %>% filter(Asesoria=='observado', variable=='Desembarques'),
       aes(yrs,value/1000), shape = 19, colour = 'gray30') +
       geom_errorbar(data = base1 %>% filter(Asesoria=='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 = 2021, by = 5)) +
       labs(x = '', y = 'Toneladas (miles)') +
       theme_bw(base_size=10) +
       ggtitle('Desembarques') +
       theme(plot.title = element_text(hjust = 0.5),legend.position="none")


BcV2/BcP2/d2 + plot_layout(guides="collect")
```

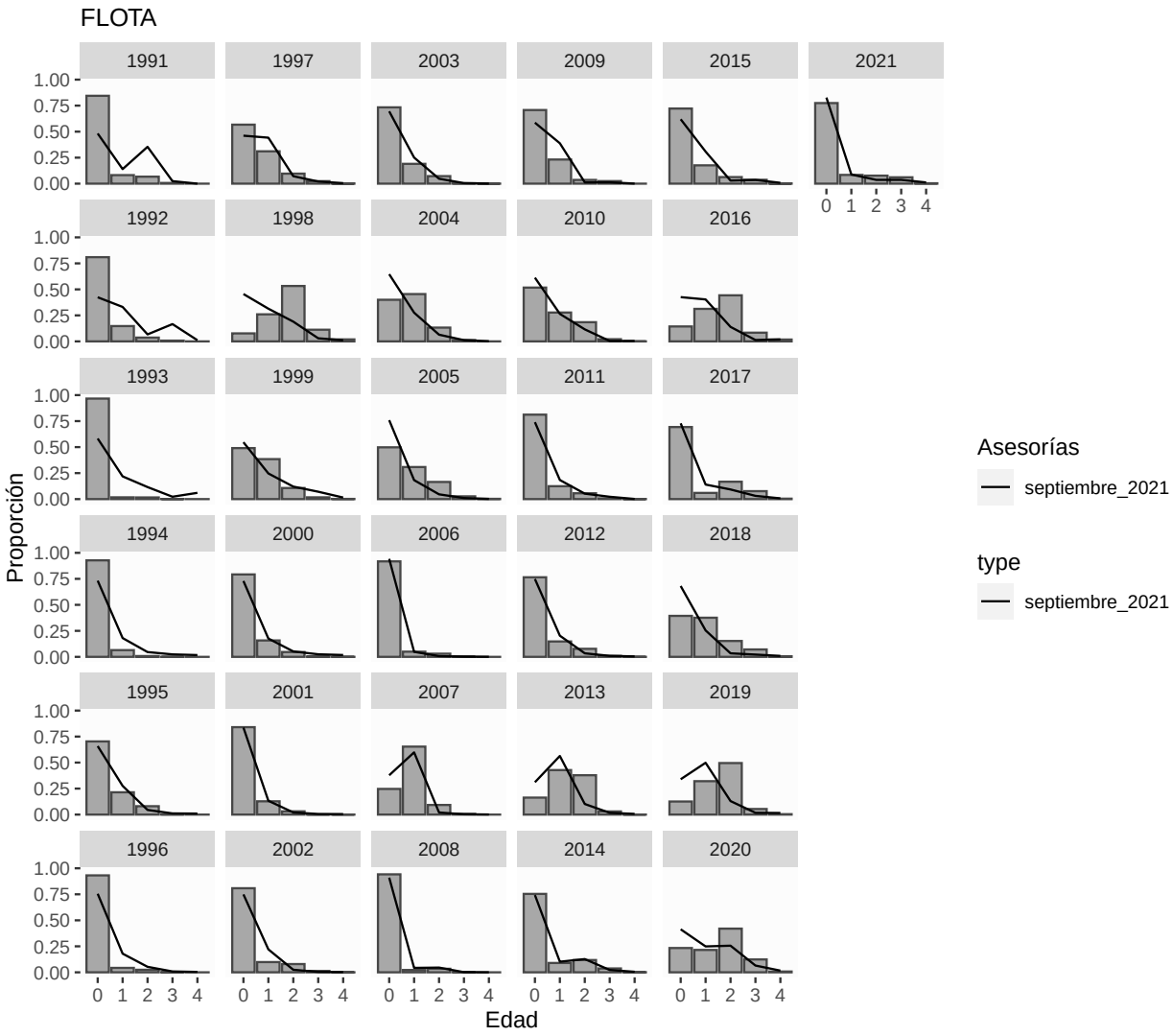

Crucero de verano
Toneladas (millones)
7.5
5.0
2.5
0.0
1990
1995
2000
2005
2010
2015
2020
Crucero de otoño
Toneladas (millones)
4
3
2
1
0
Asesoria
septiembre_2020
Desembarques
Toneladas (miles)
1000
750
500
250

```
# I. INDICES DE ABUNDANCIA                                                    #
years  <- dat1$Ind[,1]
nyears <- dat1$nanos
age    <- seq(0,4,1)
nage   <- dat1$nedades
Amax   <- dat1$nedades
Age    <- seq(0,4,1)
#Observado
obsR <- rep1$reclasobs       ;obsR[obsR<=1] <-NA
obsP <- rep1$pelacesobs      ;obsP[obsP<=1] <-NA
obsM <- rep1$mphobs          ;obsM[obsM<=1] <-NA
obsD <- rep1$desembarqueobs
#predicho                   #stdpredicho
predR <- rep1$reclaspred
predP <- rep1$pelacespred
predM <- rep1$mphpred
predD <- rep1$desembarquepred
#Residuos
Res_reclas   <- log(obsR)-log(predR)
Res_Pelaces  <- log(obsP)-log(predP)
Res_MPH      <- log(obsM)-log(predM)
Res_Desemb   <- log(obsD)-log(predD)

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

cvreclas <- rep(0.30,nyears)
cvpela   <- rep(0.30,nyears)
cvdes    <- rep(0.01,nyears)

obsR95i <- obsR*exp(-1.96*cvreclas)
obsR95s <- obsR*exp(1.96*cvreclas)
obsP95i <- obsP*exp(-1.96*cvpela)
obsP95s <- obsP*exp(1.96*cvpela)
obsD95i <- obsD*exp(-1.96*cvdes)
obsD95s <- obsD*exp(1.96*cvdes)
```

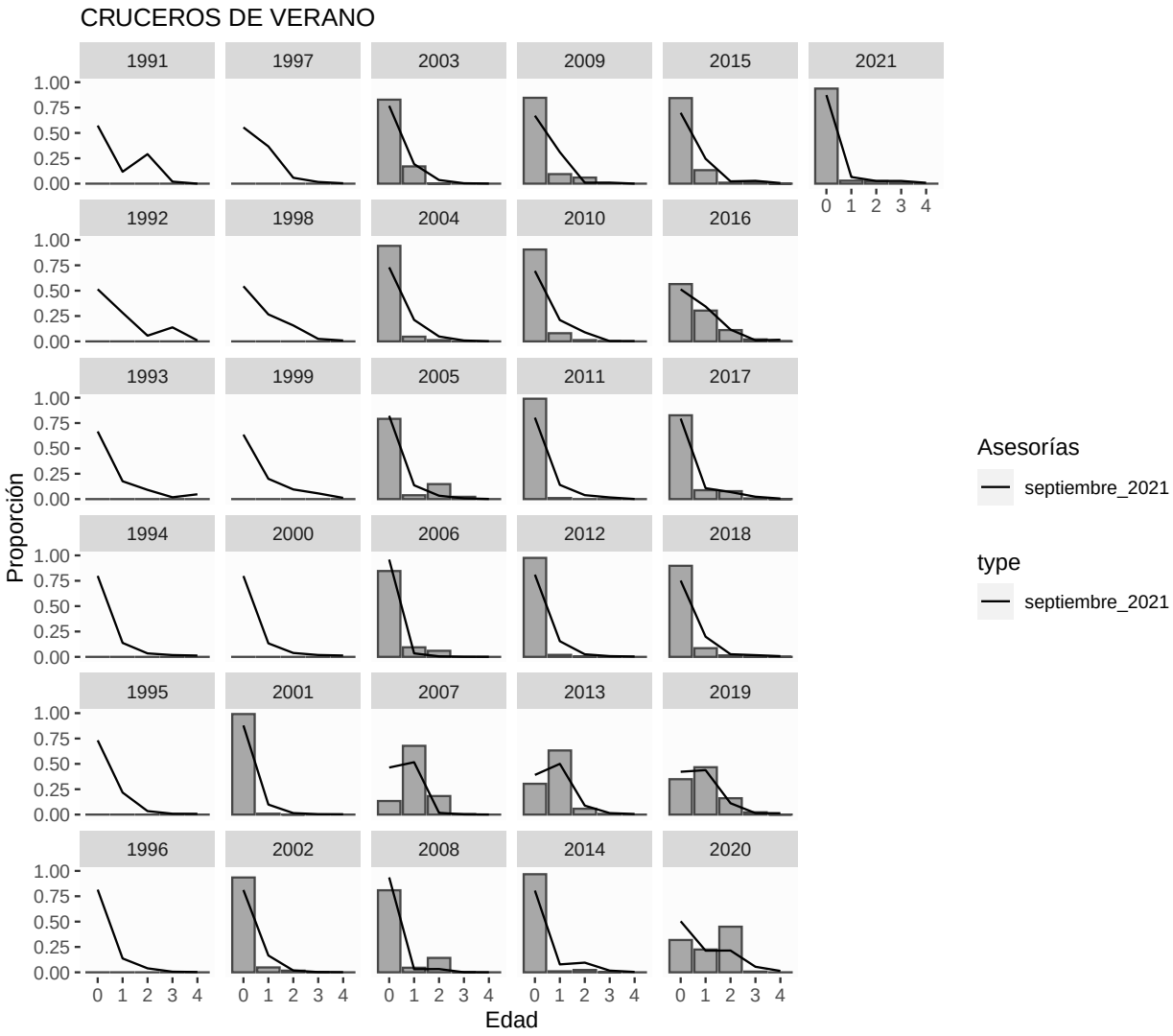
```r
par(mfcol=c(3,3),mar=c(2,4,1,1)+0.5)

 plot(years,Res_reclas,xaxp=x1,cex.axis=0.8,ylim=c(-1.1,1.1),type="h",main="Cruceros de Verano",ylab="Residuales (escala log)",x
    #mtext("b)",side=3,line=0.25,adj=-0.15,cex=1.5)
    abline(h=0,col="darkgray")
    plot(log(predR),Res_reclas, ylim=c(-1.1,1.1),main="Residuales vs ajustado",ylab="Residuales",xlab="Valor ajustado")
    abline(h=0,col="darkgray")
    #hist(Res_reclas,xlab="Residuales",ylab="Frecuencia",main="Histograma de Residuos")
    qqnorm(Res_reclas,ylim=c(-1.1,1.1)); qqline(Res_reclas, col = 2)

    plot(years,Res_Pelaces,xaxp=x1,ylim=c(-1.1,1.1),cex.axis=0.8,type="h",main="Cruceros de Otoño",ylab="Residuales (escala log)
    #mtext("b)",side=3,line=0.25,adj=-0.15,cex=1.5)
    abline(h=0,col="darkgray")
    plot(log(predP),Res_Pelaces,ylim=c(-1.1,1.1), main="Residuales vs ajustado",ylab="Residuales",xlab="Valor ajustado")
    abline(h=0,col="darkgray")
    #hist(Res_Pelaces,xlab="Residuales",ylab="Frecuencia",main="Histograma de Residuos")
    qqnorm(Res_Pelaces,ylim=c(-1.1,1.1)); qqline(Res_Pelaces, col = 2)

  plot(years,Res_Desemb,xaxp=x1,cex.axis=0.8,ylim=c(-1.1,1.1),type="h",main="Desembarques",ylab="Residuales (escala log)",xlab="
#    mtext("b)",side=3,line=0.25,adj=-0.15,cex=1.5)
    abline(h=0,col="darkgray")
    plot(log(predD),Res_Desemb, ylim=c(-1.1,1.1),main="Residuales vs ajustado",ylab="Residuales",xlab="Valor ajustado")
    abline(h=0,col="darkgray")
    #hist(Res_Desemb,xlab="Residuales",ylab="Frecuencia",main="Histograma de Residuos")
    qqnorm(Res_Desemb,ylim=c(-1.1,1.1)); qqline(Res_Desemb, col = 2)
```



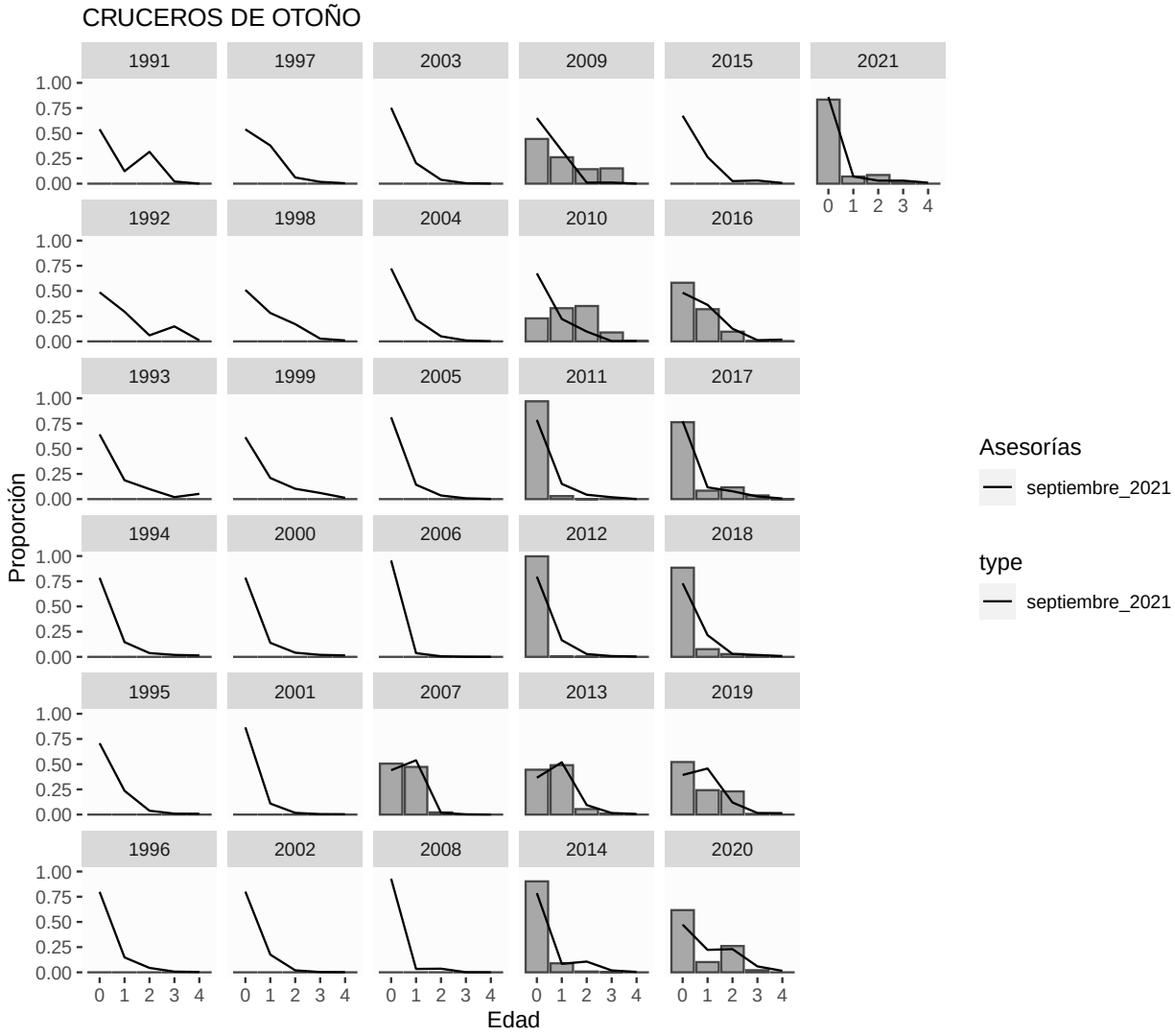
```r
years   <- dat1$Ind[,1]
nyears  <- length(years)
age     <- seq(0,4,1)
nage    <- length(age)

etcf1_obs <- data.frame(rep1$pf_obs)
etcf1_pre <- rbind(rep1$pf_pred)


 obs     <- as.data.frame(etcf1_obs) %>%
            mutate(year=years) %>%
            melt(id.vars='year') %>%
            mutate(edad = rep(age, each=nyears)) %>%
            mutate(type='obs')

 pred_sep <- as.data.frame(etcf1_pre) %>%
             mutate(year=years) %>%
             melt(id.vars='year') %>%
             mutate(edad = rep(age, each=nyears)) %>%
             mutate(type='septiembre_2021')


  mat  <- rbind(obs,pred_sep)

  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 = 'Edad', y = 'Proporción') +
          geom_line(data = mat %>% filter(type != 'obs'), aes(x = edad, y = value, colour=type,
          linetype = type, stat='identity')) +
          scale_linetype_manual(values=c('solid')) +
          scale_colour_manual(values=c('black'),name="Asesorías") +
          theme(panel.background = element_rect(fill ="gray99")) +
          theme(panel.grid=element_line(color=NA)) +
          ggtitle("FLOTA") + theme(plot.title = element_text(size = 12))
  fig1
```


FLOTA
1991
1997
2003
2009
2015
2021
1992
1998
2004
2010
2016
1993
1999
2005
2011
2017
1994
2000
2006
2012
2018
1995
2001
2007
2013
2019
1996
2002
2008
2014
2020
1.00
0.75
0.50
0.25
0.00
0 1 2 3 4
Proporción
Edad
Asesorías
septiembre_2021
type
septiembre_2021

```r
years   <- dat1$Ind[,1]
nyears  <- length(years)
age     <- seq(0,4,1)
nage    <- length(age)

etcf1_obs <- data.frame(rep1$pobs_RECLAS)
etcf1_pre <- rbind(rep1$ppred_RECLAS)


 obs        <- as.data.frame(etcf1_obs) %>%
               mutate(year=years) %>%
               melt(id.vars='year') %>%
               mutate(edad = rep(age, each=nyears)) %>%
               mutate(type='obs')

 pred_sep   <- as.data.frame(etcf1_pre) %>%
               mutate(year=years) %>%
               melt(id.vars='year') %>%
               mutate(edad = rep(age, each=nyears)) %>%
               mutate(type='septiembre_2021')


  mat  <- rbind(obs,pred_sep)

  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 = 'Edad', y = 'Proporción') +
          geom_line(data = mat %>% filter(type != 'obs'), aes(x = edad, y = value, colour=type,
          linetype = type, stat='identity')) +
          scale_linetype_manual(values=c('solid')) +
          scale_colour_manual(values=c('black'),name="Asesorías") +
          theme(panel.background = element_rect(fill ="gray99")) +
          theme(panel.grid=element_line(color=NA)) +
          ggtitle("CRUCEROS DE VERANO") + theme(plot.title = element_text(size = 12))
  fig1
```

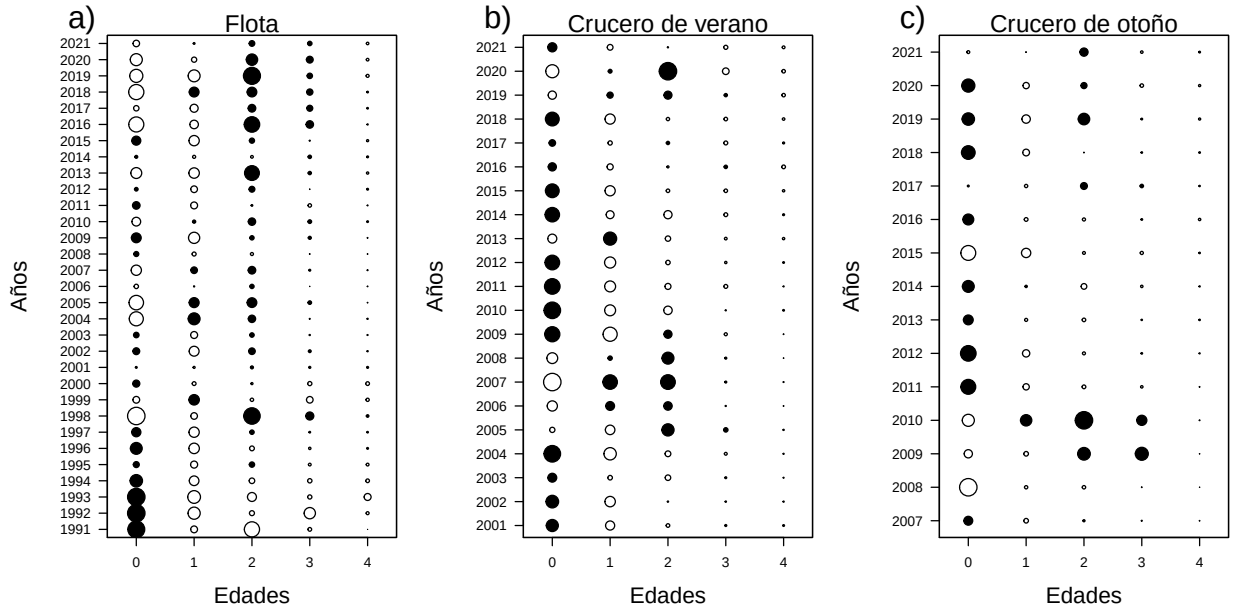

CRUCEROS DE VERANO
1991
1997
2003
2009
2015
2021
1992
1998
2004
2010
2016
1993
1999
2005
2011
2017
1994
2000
2006
2012
2018
1995
2001
2007
2013
2019
1996
2002
2008
2014
2020
Proporción
1.00
0.75
0.50
0.25
0.00
0 1 2 3 4
Edad
Asesorías
septiembre_2021
type
septiembre_2021

```r
years   <- dat1$Ind[,1]
nyears  <- length(years)
age     <- seq(0,4,1)
nage    <- length(age)

etcf1_obs <- data.frame(rep1$pobs_PELACES)
etcf1_pre <- rbind(rep1$ppred_PELACES)


 obs       <- as.data.frame(etcf1_obs) %>%
              mutate(year=years) %>%
              melt(id.vars='year') %>%
              mutate(edad = rep(age, each=nyears)) %>%
              mutate(type='obs')

 pred_sep   <- as.data.frame(etcf1_pre) %>%
               mutate(year=years) %>%
               melt(id.vars='year') %>%
               mutate(edad = rep(age, each=nyears)) %>%
               mutate(type='septiembre_2021')


  mat  <- rbind(obs,pred_sep)

  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 = 'Edad', y = 'Proporción') +
          geom_line(data = mat %>% filter(type != 'obs'), aes(x = edad, y = value, colour=type,
          linetype = type, stat='identity')) +
          scale_linetype_manual(values=c('solid')) +
          scale_colour_manual(values=c('black'),name="Asesorías") +
          theme(panel.background = element_rect(fill ="gray99")) +
          theme(panel.grid=element_line(color=NA)) +
          ggtitle("CRUCEROS DE OTOÑO") + theme(plot.title = element_text(size = 12))
  fig1
```


CRUCEROS DE OTOÑO
1991
1997
2003
2009
2015
2021
1992
1998
2004
2010
2016
1993
1999
2005
2011
2017
1994
2000
2006
2012
2018
1995
2001
2007
2013
2019
1996
2002
2008
2014
2020
Proporción
1.00
0.75
0.50
0.25
0.00
0 1 2 3 4
Edad
Asesorías
septiembre_2021
type
septiembre_2021

```
ppredF<-rep1$pf_pred
ppredR<-rep1$ppred_RECLAS
ppredP<-rep1$ppred_PELACES

#DESEMBARQUES
anos <-dat1$Ind[,1]
obsF <-pobsF
preF <-ppredF
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(mfrow=c(1,3),mar=c(5.4,6.7,2,1),cex.axis=1,cex.lab=1.1)
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=2.82*sqrt(vol),col=1)}
    if(vol<0){points(age[m],anos[n],pch=1,cex=2.82*sqrt(vol*-1),col=1)}
}}}

mtext("Flota",side=3,cex=1.2)
mtext("Edades",side=1,line=3.2,cex=1.1);posi<-seq(1,57,by=4)
axis(2,at=anos,labels=anos,las=2)
mtext("Años",side=2,line=4.7,cex=1.1)
    mtext("a)",side=3,line=0.25,adj=-0.15,cex=1.5)
box()

# RECLAS
anos<-years[11:nyears]
obsR <-pobsR[11:nyears,]
preR <-ppredR[11:nyears,]
resR <-obsR-preR

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

for(j in 1:dd[1]){for(k in 1:dd[2]){val<-resR[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=1,cex.lab=1.1)
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=2.82*sqrt(vol),col=1)}
    if(vol<0){points(age[m],anos[n],pch=1,cex=2.82*sqrt(vol*-1),col=1)}
}}}
mtext("Crucero de verano",side=3,cex=1.2)
mtext("Edades",side=1,line=3.2,cex=1.1);posi<-seq(1,57,by=4)
axis(2,at=anos,labels=anos,las=2)
mtext("Años",side=2,line=4.7,cex=1.1)
mtext("b)",side=3,line=0.25,adj=-0.15,cex=1.5)
box()

# PELACES
anos<-years[17:nyears]
obsP <-pobsP[17:nyears,]
preP <-ppredP[17:nyears,]
```

```
resP <-obsP-preP

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

for(j in 1:dd[1]){for(k in 1:dd[2]){val<-resP[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=1,cex.lab=1.1)
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=2.82*sqrt(vol),col=1)}
    if(vol<0){points(age[m],anos[n],pch=1,cex=2.82*sqrt(vol*-1),col=1)}
}}}
mtext("Crucero de otoño",side=3,cex=1.2)
mtext("Edades",side=1,line=3.2,cex=1.1);posi<-seq(1,57,by=4)
axis(2,at=anos,labels=anos,las=2)
mtext("Años",side=2,line=4.7,cex=1.1)
mtext("c)",side=3,line=0.25,adj=-0.15,cex=1.5)
box()
```

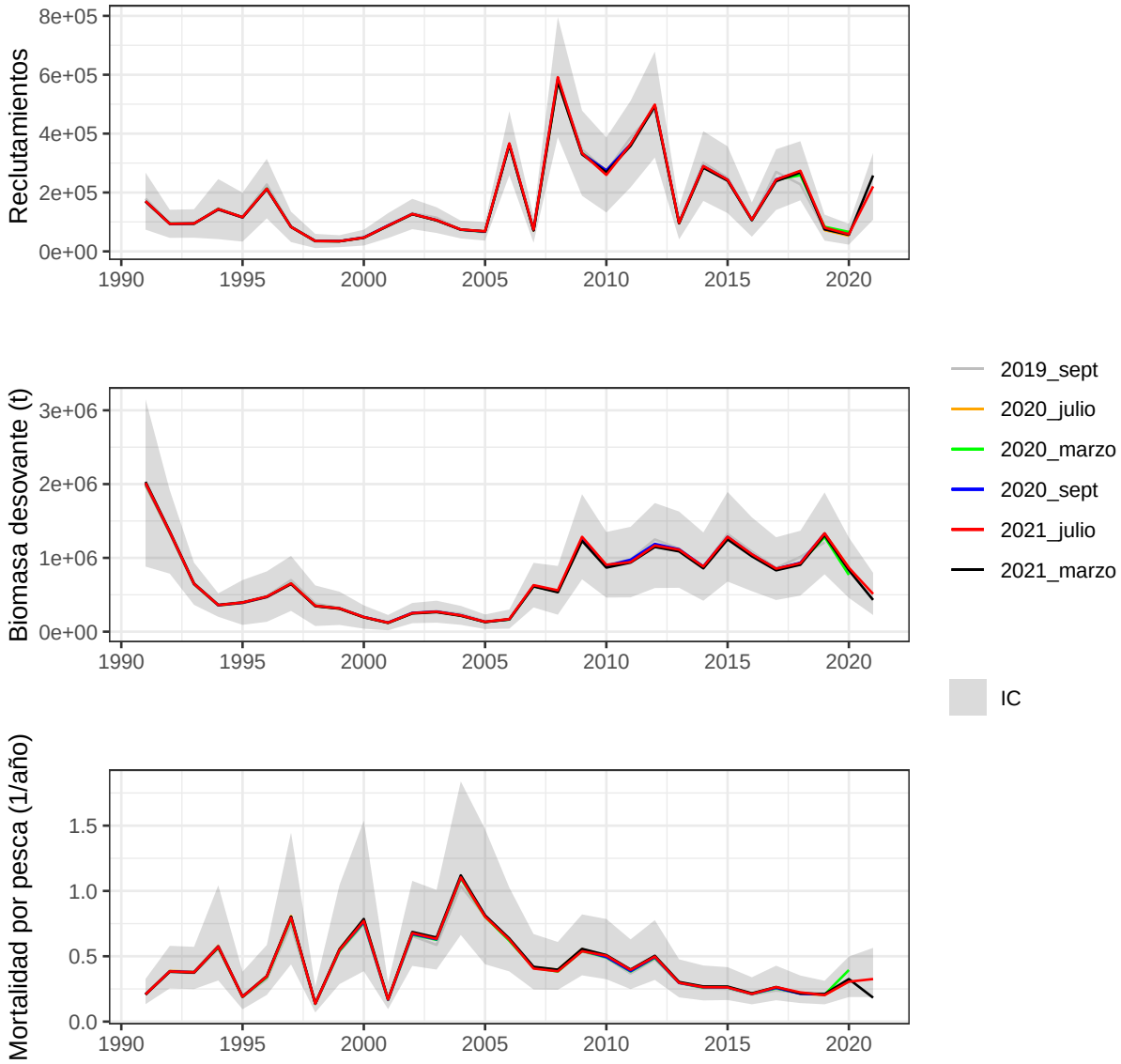


3.2. Comparación con asesorías previas

```
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=="SSB")$value
BD1std   <- subset(std1,name=="SSB")$std
Ft1      <- subset(std1,name=="log_Ft")$value
Ft1std   <- subset(std1,name=="log_Ft")$std

VarPob<- 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))
```

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

sept18 <-paste(dir,"/MAE0918.rep",sep="")
mar19  <-paste(dir,"/MAE0319.rep",sep="")
jul19  <-paste(dir,"/MAE0719.rep",sep="")
sept19 <-paste(dir,"/MAE0919.rep",sep="")
mar20  <-paste(dir,"/MAE0320.rep",sep="")
jul20  <-paste(dir,"/MAE0720.rep",sep="")
sept20 <-paste(dir,"/MAE0920.rep",sep="")
mar21  <-paste(dir.1,"/MAE0321.rep",sep="")
jul21  <-paste(dir.1,"/MAE0721.rep",sep="")

#================================================================================#
rep_sept18 <- reptoRlist(sept18)
rep_mar19  <- reptoRlist(mar19)
rep_jul19  <- reptoRlist(jul19)
rep_sept19 <- reptoRlist(sept19)
rep_mar20 <- reptoRlist(mar20)
rep_jul20 <- reptoRlist(jul20)
rep_sept20 <- reptoRlist(sept20)
rep_mar21  <- reptoRlist(mar21)
rep_jul21  <- reptoRlist(jul21)
#================================================================================#
years  <- rep_jul21$years
nyears <- length(years)
x  <-c(years,rev(years))
x1 <-c(years[1],years[nyears]+1,nyears+1/2) #xaxp
x2 <-c(years[1]-1,years[nyears]+1) #xlim

 Rtcomp <- data.frame(x=years,
                          Rt_sept18=c(rep_sept18$Reclutas,NA,NA,NA),
                          Rt_mar19=c(rep_mar19$Reclutas,NA,NA),
                          Rt_jul19=c(rep_jul19$Reclutas,NA,NA),
                          Rt_sept19=c(rep_sept19$Reclutas,NA,NA),
                          Rt_mar20=c(rep_mar20$Reclutas,NA),
                          Rt_jul20=c(rep_jul20$Reclutas,NA),
                          Rt_sept20=c(rep_sept20$Reclutas,NA),
                          Rt_mar21=c(rep_mar21$Reclutas),
                          Rt_jul21=c(rep_jul21$Reclutas))

 SSBtcomp <- data.frame(x=years,
                          SSBt_sept18=c(rep_sept18$SSB,NA,NA,NA),
                          SSBt_mar19=c(rep_mar19$SSB,NA,NA),
                          SSBt_jul19=c(rep_jul19$SSB,NA,NA),
                          SSBt_sept19=c(rep_sept19$SSB,NA,NA),
                          SSBt_mar20=c(rep_mar20$SSB,NA),
                          SSBt_jul20=c(rep_jul20$SSB,NA),
                          SSBt_sept20=c(rep_sept20$SSB,NA),
                          SSBt_mar21=c(rep_mar21$SSB),
                          SSBt_jul21=c(rep_jul21$SSB))

 Ftcomp <- data.frame(x=years,
                          Ft_sept18=c(rep_sept18$Ftot,NA,NA,NA),
                          Ft_mar19=c(rep_mar19$Ftot,NA,NA),
                          Ft_jul19=c(rep_jul19$Ftot,NA,NA),
                          Ft_sept19=c(rep_sept19$Ftot,NA,NA),
                          Ft_mar20=c(rep_mar20$Ftot,NA),
                          Ft_jul20=c(rep_jul20$Ftot,NA),
                          Ft_sept20=c(rep_sept20$Ftot,NA),
                          Ft_mar21=c(rep_mar21$Ftot),
                          Ft_jul21=c(rep_jul21$Ftot))
```

```r
year_retros <- c("2021_julio","2021_marzo","2020_sept","2020_julio","2020_marzo","2019_sept")
nretros <-6


#Retrospectivo tradicional
Rt <- ggplot(Rtcomp) +
    geom_ribbon(data=VarPob,aes(ymin=lowerRt1, ymax=upperRt1, x=x, fill = "IC"), alpha = 0.2)+
    geom_line(aes(y=Rt_sept19, x=x, colour = year_retros[nretros]), size=0.5)+
    geom_line(aes(y=Rt_mar20, x=x, colour = year_retros[nretros-1]), size=0.5)+
    geom_line(aes(y=Rt_jul20, x=x, colour = year_retros[nretros-2]), size=0.5)+
    geom_line(aes(y=Rt_sept20, x=x, colour = year_retros[nretros-3]), size=0.5)+
    geom_line(aes(y=Rt_mar21, x=x, colour = year_retros[nretros-4]), size=0.5)+
    geom_line(aes(y=Rt_jul21, x=x, colour = year_retros[nretros-5]), size=0.5)+
    labs(x = '', y = 'Reclutamientos ',colour='Asesorías')  +
    scale_x_continuous(breaks = seq(from = 1990, to = 2021, by = 5)) +
    scale_colour_manual("",values=c("gray","orange","green","blue","red","black"))+
    scale_fill_manual("",values=c("grey30"))+
    theme_bw(base_size=11) +
     ggtitle('')+
     theme(plot.title = element_text(hjust = 0.5),legend.position="none")

BD <- ggplot(SSBtcomp) +
     geom_ribbon(data=VarPob,aes(ymin=lowerBD1, ymax=upperBD1, x=x, fill = "IC"), alpha = 0.2)+
     geom_line(aes(y=SSBt_sept19, x=x, colour = year_retros[nretros]), size=0.5)+
    geom_line(aes(y=SSBt_mar20, x=x, colour = year_retros[nretros-1]), size=0.5)+
    geom_line(aes(y=SSBt_jul20, x=x, colour = year_retros[nretros-2]), size=0.5)+
    geom_line(aes(y=SSBt_sept20, x=x, colour = year_retros[nretros-3]), size=0.5)+
    geom_line(aes(y=SSBt_mar21, x=x, colour = year_retros[nretros-4]), size=0.5)+
    geom_line(aes(y=SSBt_jul21, x=x, colour = year_retros[nretros-5]), size=0.5)+
    labs(x = '', y = 'Biomasa desovante (t)',colour='Asesorías')  +
    scale_x_continuous(breaks = seq(from = 1990, to = 2021, by = 5)) +
    scale_colour_manual("",values=c("gray","orange","green","blue","red","black"))+
    scale_fill_manual("",values=c("grey30"))+
    theme_bw(base_size=11) +
     ggtitle('')+
     theme(plot.title = element_text(hjust = 0.5))

Ft <- ggplot(Ftcomp) +
    geom_ribbon(data=VarPob,aes(ymin=lowerFt1, ymax=upperFt1, x=x, fill = "IC"), alpha = 0.2)+
    geom_line(aes(y=Ft_sept19, x=x, colour = year_retros[nretros]), size=0.5)+
    geom_line(aes(y=Ft_mar20, x=x, colour = year_retros[nretros-1]), size=0.5)+
    geom_line(aes(y=Ft_jul20, x=x, colour = year_retros[nretros-2]), size=0.5)+
    geom_line(aes(y=Ft_sept20, x=x, colour = year_retros[nretros-3]), size=0.5)+
    geom_line(aes(y=Ft_mar21, x=x, colour = year_retros[nretros-4]), size=0.5)+
    geom_line(aes(y=Ft_jul21, x=x, colour = year_retros[nretros-5]), size=0.5)+
    labs(x = '', y = 'Mortalidad por pesca (1/año)',colour='Asesorías')  +
    scale_x_continuous(breaks = seq(from = 1990, to = 2021, by = 5)) +
    scale_colour_manual("",values=c("gray","orange","green","blue","red","black"))+
    scale_fill_manual("",values=c("grey30"))+
    theme_bw(base_size=11) +
    ggtitle('')+
    theme(plot.title = element_text(hjust = 0.5),legend.position="none")

Rt/BD/Ft
```


Reclutamientos
8e+05
6e+05
4e+05
2e+05
0e+00
1990
1995
2000
2005
2010
2015
2020
Biomasa desovante (t)
3e+06
2e+06
1e+06
0e+00
Mortalidad por pesca (1/año)
1.5
1.0
0.5
0.0
2019_sept
2020_julio
2020_marzo
2020_sept
2021_julio
2021_marzo
IC

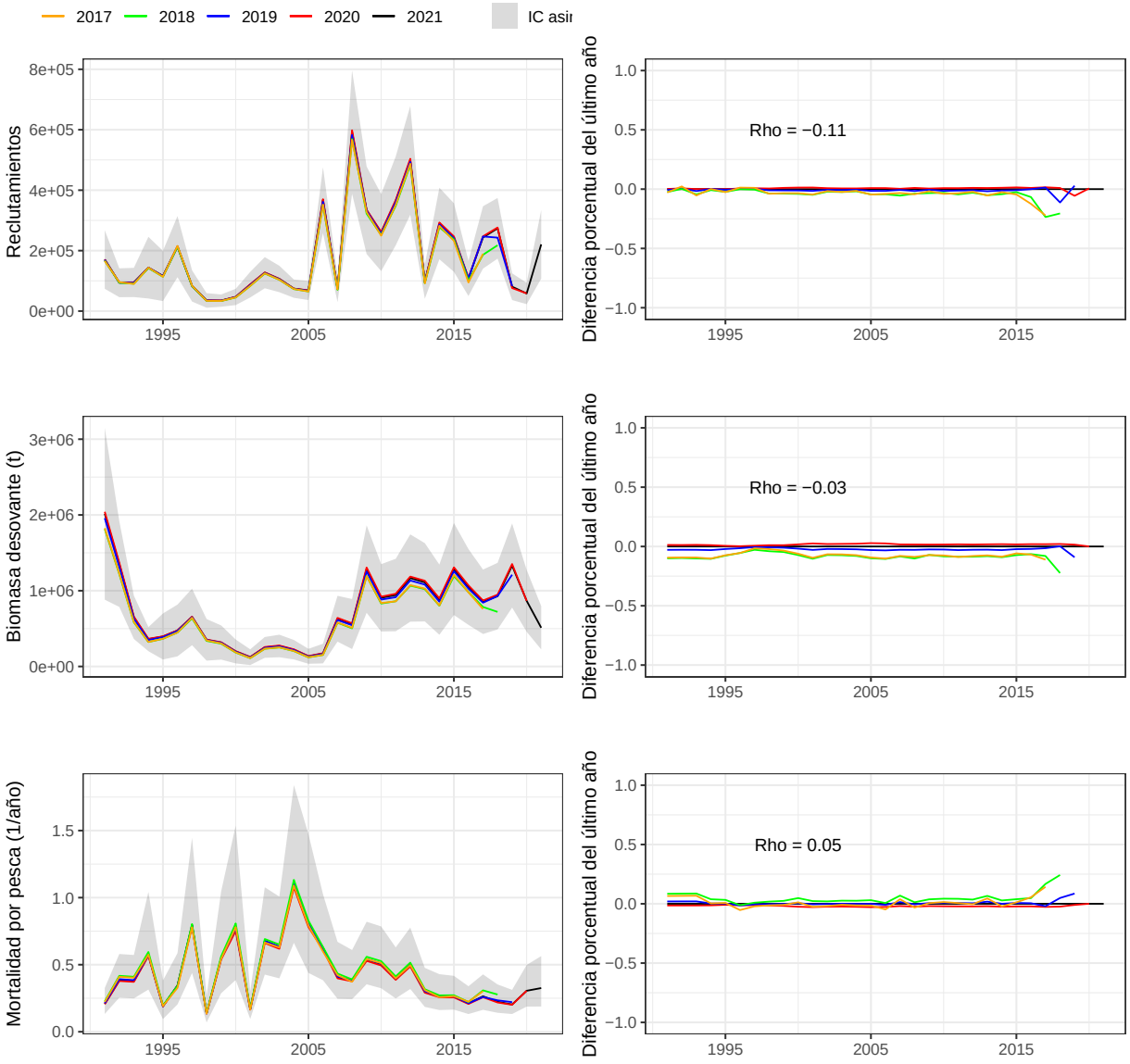
3.3. Análisis retrospectivo

```
dir<-paste(dir.0,"/Retrospectivo_sept",sep="")
setwd(dir)
admb<-"MAE0921"

years<-rep1$years
nyears<-length(years)
retros<-seq(1,5)
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$Reclutas,rep(NA,i-1))
  retroBD[,i+1] <- c(rep$SSB,rep(NA,i-1))
  retroF[,i+1]  <- c(rep$Ftot,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)

 # Arreglo datos

#Para retrospectivo tradicional
Rt_retro<- data.frame(x=years,
                      y1=retroR[,2],
                      y2=retroR[,3],
                      y3=retroR[,4],
                      y4=retroR[,5],
                      y5=retroR[,6],
                      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],
                      y4=retroBD[,5],
                      y5=retroBD[,6],
                      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],
                      y4=retroF[,5],
                      y5=retroF[,6],
```

```
                    lower = exp(Ft1 -1.96*Ft1std),
                    upper = exp(Ft1 +1.96*Ft1std))

#Para restrospectivo relativo
Rt_retroRel<- data.frame(x=years,
                         y1=rel.diff.r[,1],
                         y2=rel.diff.r[,2],
                         y3=rel.diff.r[,3],
                         y4=rel.diff.r[,4],
                         y5=rel.diff.r[,5])
BD_retroRel<- data.frame(x=years,
                         y1=rel.diff.ssb[,1],
                         y2=rel.diff.ssb[,2],
                         y3=rel.diff.ssb[,3],
                         y4=rel.diff.ssb[,4],
                         y5=rel.diff.ssb[,5])
Ft_retroRel<- data.frame(x=years,
                         y1=rel.diff.f[,1],
                         y2=rel.diff.f[,2],
                         y3=rel.diff.f[,3],
                         y4=rel.diff.f[,4],
                         y5=rel.diff.f[,5])
```

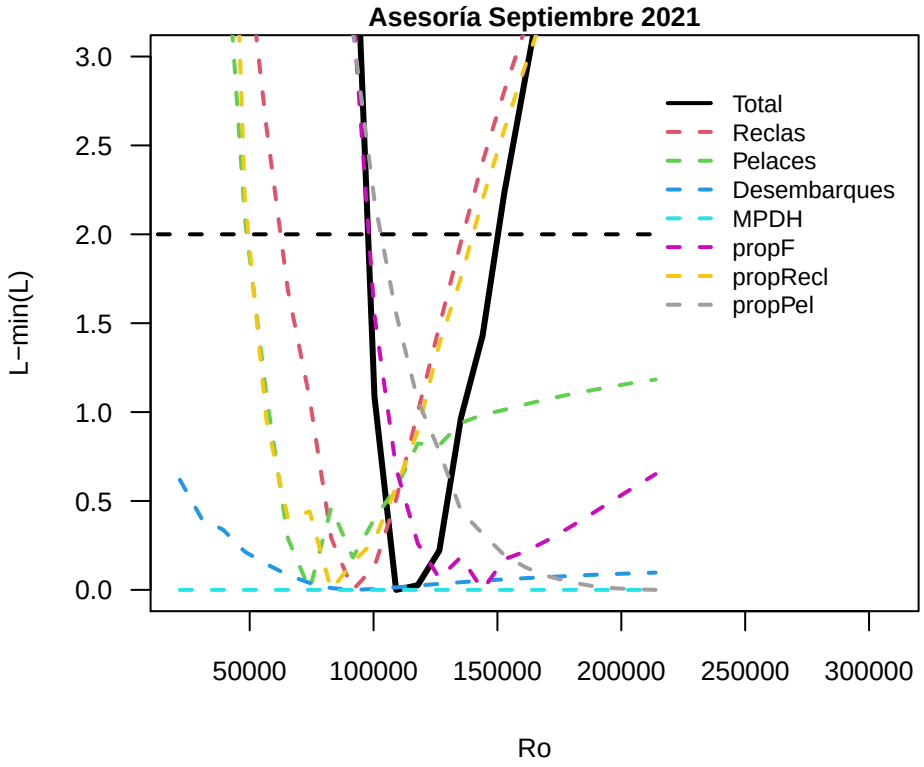
```
#Retrospectivo tradicional
Rt <- ggplot(Rt_retro) +
    geom_ribbon(aes(ymin=lower, ymax=upper, x=x, fill = "IC asintótico"), alpha = 0.2)+
    geom_line(aes(y=y1, x=x, colour = year_retros[nretros]), size=0.5)+
    geom_line(aes(y=y2, x=x, colour = year_retros[nretros-1]), size=0.5)+
    geom_line(aes(y=y3, x=x, colour = year_retros[nretros-2]), size=0.5)+
    geom_line(aes(y=y4, x=x, colour = year_retros[nretros-3]), size=0.5)+
    geom_line(aes(y=y5, x=x, colour = year_retros[nretros-4]), size=0.5)+
    labs(x = '', y = 'Reclutamientos ',colour='Asesorías')  +
    scale_x_continuous(breaks = seq(from = 1995, to = 2020, by = 10)) +
    scale_colour_manual("",values=c("orange","green","blue","red","black"))+
    scale_fill_manual("",values=c("grey30"))+
    theme_bw(base_size=12) +
     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)+
    geom_line(aes(y=y4, x=x, colour = year_retros[nretros-3]), size=0.5)+
    geom_line(aes(y=y5, x=x, colour = year_retros[nretros-4]), size=0.5)+
    labs(x = '', y = 'Biomasa desovante (t)',colour='Asesorías')  +
    scale_x_continuous(breaks = seq(from = 1995, to = 2020, by = 10)) +
    scale_colour_manual("",values=c("orange","green","blue","red","black"))+
    scale_fill_manual("",values=c("grey30"))+
    theme_bw(base_size=12) +
     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)+
    geom_line(aes(y=y4, x=x, colour = year_retros[nretros-3]), size=0.5)+
    geom_line(aes(y=y5, x=x, colour = year_retros[nretros-4]), size=0.5)+
    labs(x = '', y = 'Mortalidad por pesca (1/año)',colour='Asesorías')  +
    scale_x_continuous(breaks = seq(from = 1995, to = 2020, by = 10)) +
    scale_colour_manual("",values=c("orange","green","blue","red","black"))+
    scale_fill_manual("",values=c("grey30"))+
    theme_bw(base_size=12) +
    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)+
    geom_line(aes(y=y4, x=x, colour = year_retros[nretros-3]), size=0.5)+
    geom_line(aes(y=y5, x=x, colour = year_retros[nretros-4]), size=0.5)+
   annotate("text", x=2000, y=0.5,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 = 10)) +
    scale_colour_manual("",values=c("orange","green","blue","red","black"))+
    scale_fill_manual("",values=c("grey30"))+
    theme_bw(base_size=12) +
     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)+
    geom_line(aes(y=y4, x=x, colour = year_retros[nretros-3]), size=0.5)+
```

```
    geom_line(aes(y=y5, x=x, colour = year_retros[nretros-4]), size=0.5)+
   annotate("text", x=2000, y=0.5,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 = 10)) +
    scale_colour_manual("",values=c("orange","green","blue","red","black"))+
    scale_fill_manual("",values=c("grey30"))+
    theme_bw(base_size=12) +
     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)+
    geom_line(aes(y=y4, x=x, colour = year_retros[nretros-3]), size=0.5)+
    geom_line(aes(y=y5, x=x, colour = year_retros[nretros-4]), size=0.5)+
   annotate("text", x=2000, y=0.5,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 = 10)) +
    scale_colour_manual("",values=c("orange","green","blue","red","black"))+
    scale_fill_manual("",values=c("grey30"))+
    theme_bw(base_size=12) +
    ggtitle('')+
    theme(plot.title = element_text(hjust = 0.5),legend.position="none")

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


2017
2018
2019
2020
2021
IC asi
Reclutamientos
8e+05
6e+05
4e+05
2e+05
0e+00
1995
2005
2015
Diferencia porcentual del último año
1.0
0.5
0.0
−0.5
−1.0
Rho = −0.11
Biomasa desovante (t)
3e+06
2e+06
1e+06
0e+00
Rho = −0.03
Mortalidad por pesca (1/año)
1.5
1.0
0.5
0.0
Rho = 0.05

3.4. Perfil de verosimilitud

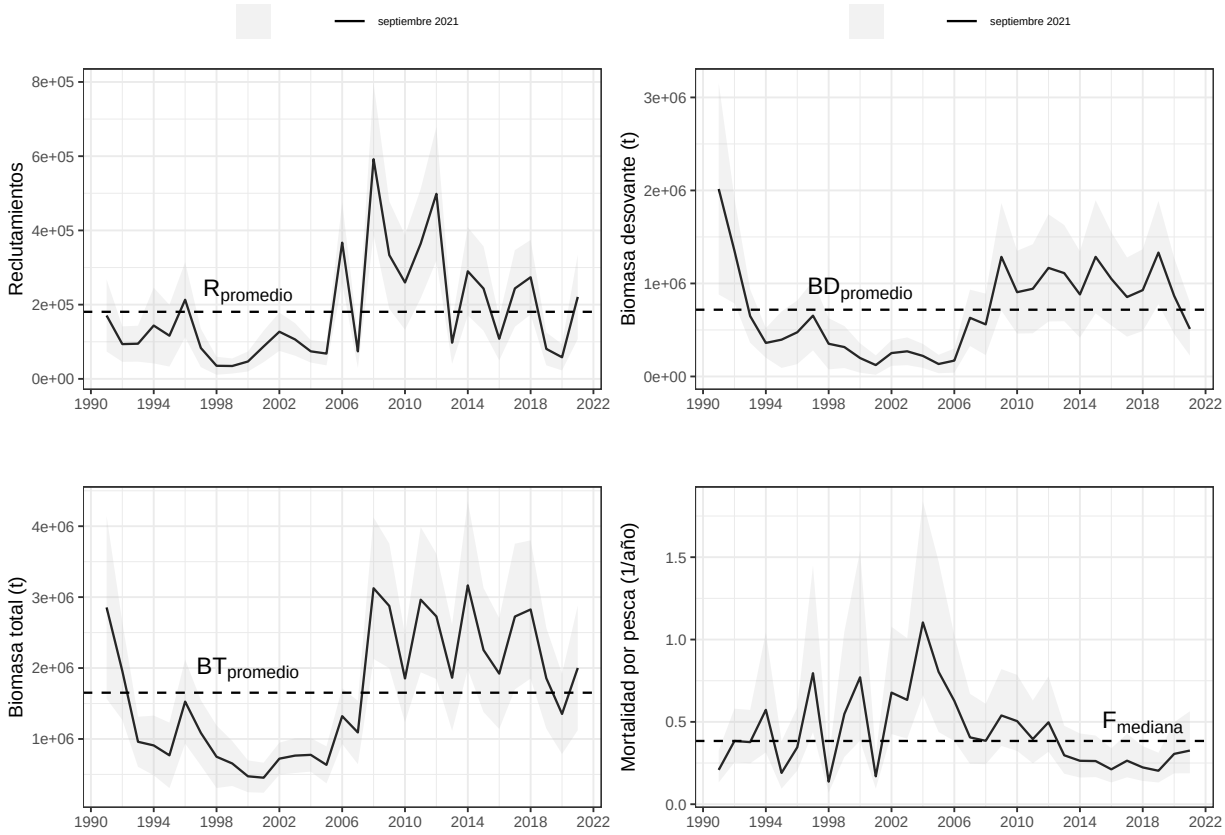
```
dir<-paste(dir.0,"/Verosimilitud_sept",sep="")
setwd(dir)

casos <-23
logRo    <- rep(0,casos)
likeval  <- matrix(ncol=15,nrow=casos)
slikeval <- matrix(ncol=16,nrow=casos)

for(i in 1:casos){
report      <- reptoRlist(paste(dir,"/MAE0921s",i,".rep",sep=""))
logRo[i]    <- report$log_Ro
likeval[i,] <- report$likeval}

like    <- data.frame(round(likeval,3),Total=apply(likeval,1,sum))
minLik  <- apply(like,2,min)                          # busca el mínimo
for(i in 1:16){slikeval[,i]<-like[,i]-minLik[i]}    # Estandarización

names<-c("Ro","Reclas","Pelaces","Desembarques","MPDH","propF",
    "propRecl","propPel","prepPelTall","DesvRt","qreclas","qpela","PenFt",
    "PenFspr","NA","NA","Total")
# Tabla verosimilitud
TLk1 <- data.frame(exp(logRo),like);colnames(TLk1)<-names
# Tabla estandarizada
TLk2 <- data.frame(exp(logRo),slikeval);colnames(TLk2)<-names

par(mar=c(4,4,1,1))
plot(TLk2$Ro,TLk2$Total,type="l",lwd=3,ylim=c(0,3),xlim=c(10^4,32*10^4),
    xaxs= "i",  ylab="L-min(L)",xlab="Ro",las=1,main='Asesoría Septiembre 2021',cex.main=0.8,cex.axis=0.8,cex.lab=0.8)
lines(c(0,TLk2$Ro),rep(2,casos+1),lty=2,lwd=2)
for(i in 2:8){lines(TLk2$Ro,TLk2[,i],col=i,lty=2,lwd=2)}
#for(i in 9:14){lines(TLk2$Ro,TLk2[,i],col=i,lty=3,lwd=2)}
legend(210000,2.9,names[c(17,2:8)],col=1:8,lty=c(1,rep(2,7)),lwd=2,bty="n",cex=0.75)
```




```
#legend(230000,1.5,names[9:14],col=9:14,lty=3,lwd=2,bty="n",cex=0.8)
```

3.5. Variables poblacionales

```
years1<-rep1$years
nyears1<-length(years1)

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

VarPobSep<- data.frame(x=years1, 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))
```


septiembre 2021
Reclutamientos
$R_{promedio}$
Biomasa desovante (t)
$BD_{promedio}$
Biomasa total (t)
$BT_{promedio}$
Mortalidad por pesca (1/año)
$F_{mediana}$

```r
yearsb<-c("1990/91","1991/92","1992/93","1993/94","1994/95","1995/96","1996/97","1997/98","1998/99","1999/00","2000/01","2001/02

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


VarPobl1<- cbind('Año'=yearsb,
                 "$BD_{sept}$"=c(BD1),
                 "$BT_{sept}$"=c(BT1),
                 "$R_{sept}$"=c(Rt1),
                 "$F_{sept}$"=c(round(exp(Ft1),3)))
kable(VarPobl1)
```

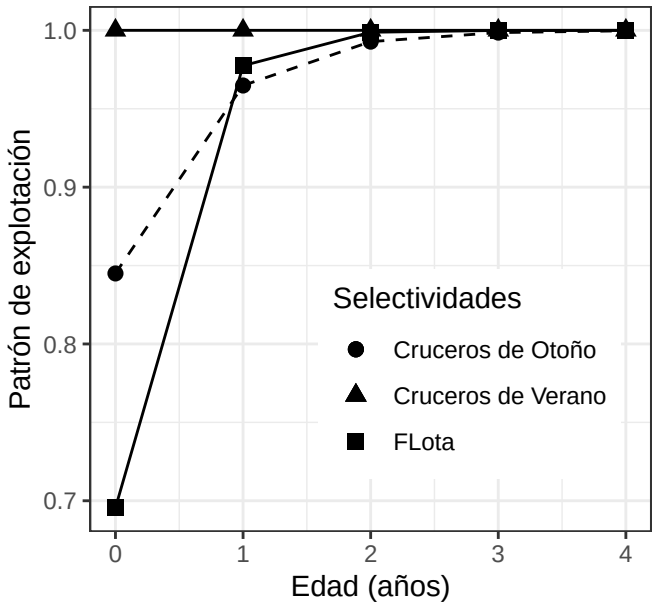
Año	BD_{sept}	BT_{sept}	R_{sept}	F_{sept}
1990/91	2015500	2854600	170640	0.208
1991/92	1351100	1957000	93685	0.384
1992/93	648900	960130	94732	0.377
1993/94	360660	908710	143610	0.573
1994/95	395590	769120	116300	0.19
1995/96	475140	1526600	213120	0.346
1996/97	653820	1086100	83214	0.796
1997/98	351480	749450	35261	0.137
1998/99	316170	654160	34643	0.548
1999/00	198250	473350	46792	0.77
2000/01	122360	453530	87440	0.169
2001/02	251600	722230	127030	0.678
2002/03	270550	765100	106220	0.633
2003/04	221020	775920	74160	1.104
2004/05	133950	634680	68098	0.804
2005/06	170390	1321700	366990	0.628
2006/07	630220	1091800	74055	0.406
2007/08	560080	3125400	591890	0.385
2008/09	1285700	2875900	333490	0.539
2009/10	906150	1852800	259700	0.505
2010/11	942980	2963700	364440	0.395
2011/12	1167300	2728000	498580	0.498
2012/13	1111200	1863000	97326	0.297
2013/14	881820	3165800	289820	0.264
2014/15	1286100	2254300	243380	0.262
2015/16	1049300	1921400	108020	0.212
2016/17	853910	2726200	243660	0.264
2017/18	928190	2826000	273830	0.223
2018/19	1331900	1856000	80727	0.203
2019/20	866510	1352600	58188	0.306
2020/21	511110	2000600	220800	0.326

```r
#setwd(dir.basedatos)
write.csv(VarPobl1, file="Tabla_20_indicadorespoblacionales.csv")
#setwd(dir.1)
```

```
# Reclutimientos asesoría marzo 2021
Rprom_1991_2007<-mean(Rt1[1:17])
Rprom_2008_2012<-mean(Rt1[18:22])
Rprom_2013_2021<-mean(Rt1[23:31])
Rprom_2013_2020<-mean(Rt1[23:30])
Rprom_historico<-mean(Rt1)

Rprom<-rbind(Rprom_1991_2007,
      Rprom_2008_2012,
      Rprom_2013_2021,
      Rprom_2013_2020,
      Rprom_historico)

#diferencia del Rúltimo año y los promedios de los tres períodos principales
Rlast_1991_2007<-1-(Rt1[31]/Rprom_1991_2007)
Rlast_2008_2012<-1-(Rt1[31]/Rprom_2008_2012)
Rlast_2013_2021<-1-(Rt1[31]/Rprom_2013_2021)
Rlast_2013_2020<-1-(Rt1[31]/Rprom_2013_2020)
Rlast_historico<-1-(Rt1[31]/Rprom_historico)

difR<-rbind(Rlast_1991_2007,
      Rlast_2008_2012,
      Rlast_2013_2021,
      Rlast_2013_2020,
      Rlast_historico)

# Biomasa total (BT) asesoría marzo 2021
BTprom_1991_2007<-mean(BT1[1:17])
BTprom_2008_2012<-mean(BT1[18:22])
BTprom_2013_2021<-mean(BT1[23:31])
BTprom_2013_2020<-mean(BT1[23:30])
BTprom_historico<-mean(BT1)

BTprom<-rbind(BTprom_1991_2007,
      BTprom_2008_2012,
      BTprom_2013_2021,
      BTprom_2013_2020,
      BTprom_historico)

#diferencia del BT último año y los promedios de los tres períodos principales
BTlast_1991_2007<-1-(BT1[31]/BTprom_1991_2007)
BTlast_2008_2012<-1-(BT1[31]/BTprom_2008_2012)
BTlast_2013_2021<-1-(BT1[31]/BTprom_2013_2021)
BTlast_2013_2020<-1-(BT1[31]/BTprom_2013_2020)
BTlast_historico<-1-(BT1[31]/BTprom_historico)

difBT<- rbind(BTlast_1991_2007,
      BTlast_2008_2012,
      BTlast_2013_2021,
      BTlast_2013_2020,
      BTlast_historico)


# Biomasa desovante (BD) asesoría marzo 2021

BDprom_1991_2007<-mean(BD1[1:17])
BDprom_2008_2012<-mean(BD1[18:22])
BDprom_2013_2021<-mean(BD1[23:31])
BDprom_2013_2020<-mean(BD1[23:30])
BDprom_historico<-mean(BD1)

BDprom<-rbind(BDprom_1991_2007,
      BDprom_2008_2012,
      BDprom_2013_2021,
      BDprom_2013_2020,
      BDprom_historico)
```

```r
#diferencia del BD último año y los promedios de los tres períodos principales
BDlast_1991_2007<-1-(BD1[31]/BDprom_1991_2007)
BDlast_2008_2012<-1-(BD1[31]/BDprom_2008_2012)
BDlast_2013_2021<-1-(BD1[31]/BDprom_2013_2021)
BDlast_2013_2020<-1-(BD1[31]/BDprom_2013_2020)
BDlast_historico<-1-(BD1[31]/BDprom_historico)

difBD<-rbind(BDlast_1991_2007,
      BDlast_2008_2012,
      BDlast_2013_2021,
      BDlast_2013_2020,
      BDlast_historico)


diferencias<-cbind(difR,difBT,difBD,Rprom,BTprom,BDprom)
colnames(diferencias)<-c("difRt","difBT","difBD","Rprom","BTprom","BDprom")
diferencias

write.csv(diferencias, file="Tabla_20_diferencias.csv")
```

```
sel_Flota<-rep1$Sel_flota[1,]
sel_CruV <-rep1$Sel_reclas[1,]
sel_CruO <-rep1$Sel_pelaces[1,]

g1 <- ggplot () +
     #lineas
     geom_line(aes(x=age,y=sel_Flota))+
     geom_line(aes(x=age,y=sel_CruV))+
     geom_line(aes(x=age,y=sel_CruO),linetype="dashed")+
     #puntos
     geom_point(aes(x=age,y=sel_Flota,shape="FLota"),size=2.5) +
     geom_point(aes(x=age,y=sel_CruV,shape="Cruceros de Verano"),size=2.5) +
     geom_point(aes(x=age,y=sel_CruO,shape="Cruceros de Otoño"),size=2.5) +
     #parámetros
     labs(x = 'Edad (años)', y = 'Patrón de explotación',shape="Selectividades") +
     ggtitle("")+
     theme_bw(base_size=11) +
     theme(plot.title = element_text(hjust = 0.5),legend.justification=c(1.1,0), legend.position=c(1,0.1))
g1
```



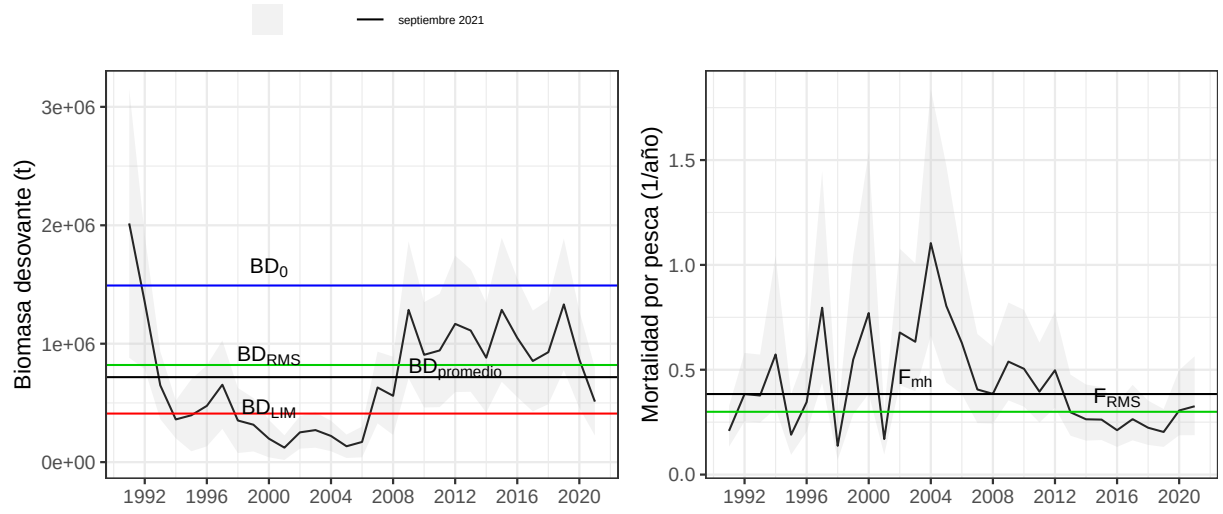
3.6. Puntos biológicos de referencia

```
#PBR año biologico
Amax        <- dat1$nedades
Fmort       <- seq(0,3.5,0.02)
nf          <- length(Fmort)
R0            <- 1
#datos de entrada
Dat<-list()
Dat$M           <- dat1$par[5]
Dat$Tspw      <- dat1$Dt[3]
Dat$Mad     <- dat1$madurezsexual
Dat$Wmed      <- colMeans(dat1$Wmed)
Dat$Wini      <- colMeans(dat1$Wini)
Dat$Sel     <- rep1$Sel_flota[1,]

Rmed1        <- mean(Rt1,na.rm = T)
Bmed1        <- mean(BD1,na.rm = T)
Fmedian1     <- exp(median(Ft1,na.rm = T))

Bobj        <-c(.85,.80,.60,.55,.52,.50,.45,.40,.30,.325,0.425)
Fobj        <- optim(par=rep(0.,11),fn=SPRFpbr,method='BFGS')

SPR1            <- SPRFmort(Rmed1,c(0,Fobj$par,Fmedian1,rep1$Ftot[25]),Amax,Dat)
pSPR_Fmh1    <- as.numeric(SPR1[13,4])                    # Paso 2: Cálculo de la curva SPR
pB_Fmh1      <- pSPR_Fmh1-0.05                            # Paso 3: Aproximación obtención de %BD(Fmh)
SPRcurv1        <- SPRFmort(R0,Fmort,Amax,Dat)
```

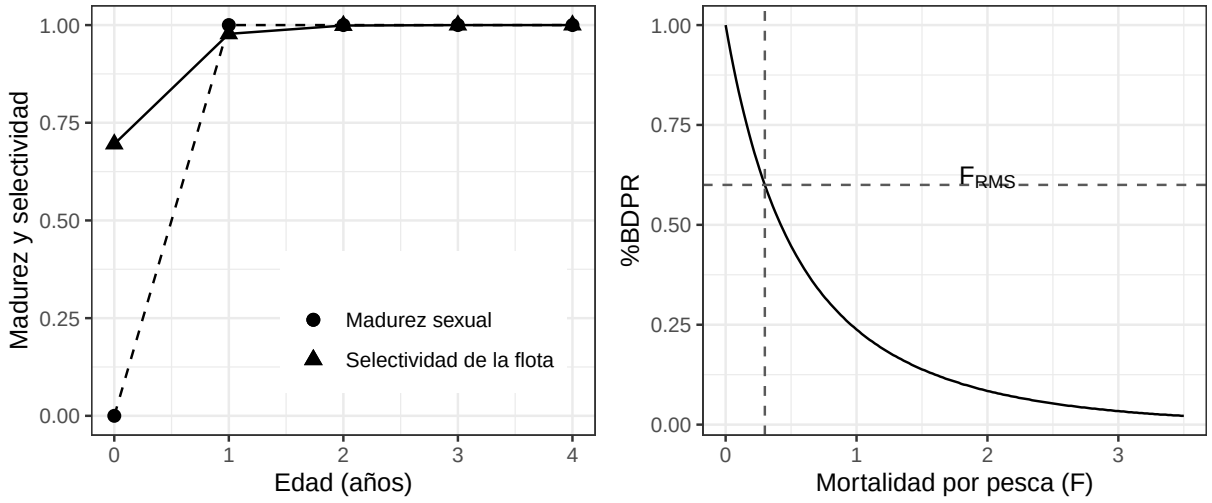
```
# ASESORÍA DE SEPTIEMBRE
Bo1           <- rep1$SSBpbr[1]                    # Paso 4: Obtenci?n de Bo
BRMS1         <- rep1$SSBpbr[3]                    # Paso 5: Obtenci?n de Brms = 60%SPRo = 55%Bo
FRMS1         <- rep1$Fs[2]
BLIM1         <- Bo1*0.275                         # Paso 6: Obtenci?n de Blim = 20%Bo
FLIM1         <- rep1$Fs[3]                        # Paso 6: Obtenci?n de Flim = 30%SPRo
SpB1          <- BD1                              # BD serie hist?rica de evaluaci?n de stock
SpBSE1        <- BD1std                           # desviaci?n estandar BD
ln_Fyr1       <- Ft1                               # logaritmo de Ft
ln_FSE1       <- Ft1std                            # logaritmo de la desviaci?n standar de Ft
```

```
Tabla3.1<-rbind( "BDpromedio"=c(round(Bmed1/10^3,0)),
                 "Fmh"=c(round(Fmedian1,2)),
                 "%BDPR_Fmh"=c(pSPR_Fmh1*100),
                 "%BDPR_F~RMS~"=c(60),
                 "%BD_Fmh"=c(pB_Fmh1*100),
                 "%BD_F~RMS~"=c(55),
                 "BDo"=c(round(Bo1/10^3,0)),
                 "BD55%"=c(round(BRMS1/10^3,0)),
                 "BD27.5%"=c(round(BLIM1/10^3,0)))

colnames(Tabla3.1)<-c("Septiembre")
kable(Tabla3.1, align = 'c')

write.csv(Tabla3.1, file="Tabla21_PBRsporasesoria.csv")
```

```r
BD <- ggplot() +
     geom_line(data=VarPobSep,aes(y=BD1, x=x, colour = "septiembre 2021"), size=0.5)+
     geom_ribbon(data=VarPobSep,aes(ymin=lowerBD1, ymax=upperBD1, x=x, fill = ""), alpha = 0.2)+
     geom_hline(yintercept = c(BRMS1,BLIM1,Bo1,Bmed1),colour=c('green3','red','blue','black'))+
     annotate("text", x=c(rep(2000,3),2012), y=c(BRMS1*1.1,BLIM1*1.1,Bo1*1.1,Bmed1*1.1),
              label=c(expression("BD"[RMS]),expression("BD"[LIM]),expression("BD"[0]),expression("BD"[promedio]))) +
     labs(x = '', y = 'Biomasa desovante (t)',colour='Asesorías')  +
     scale_x_continuous(breaks = seq(from = 1960, to = 2022, by = 4)) +
     scale_colour_manual("",values=c("black"))+
     scale_fill_manual("",values=c('gray75'))+
     theme_bw(base_size=12) +
     ggtitle('')+
     theme(plot.title = element_text(hjust = 0.5),legend.position="top",legend.text = element_text(size=6))

Ft <- ggplot() +
    geom_line(data=VarPobSep,aes(y=Ft1, x=x, colour = "septiembre 2021"), size=0.5)+
    geom_ribbon(data=VarPobSep,aes(ymin=lowerFt1, ymax=upperFt1, x=x, fill = ""), alpha = 0.2)+
     geom_hline(yintercept = c(FRMS1,median(VarPobSep$Ft1)),colour=c('green3','black')) +
     annotate("text", x=c(2016,2003), y=c(FRMS1*1.02, median(exp(ln_Fyr1)))*1.2, label=c(expression("F"[RMS]), expression("F"[mh
    labs(x = '', y = 'Mortalidad por pesca (1/año)',colour='Asesorías')  +
    scale_x_continuous(breaks = seq(from = 1960, to = 2022, by = 4)) +
    scale_colour_manual("",values=c("black"))+
    scale_fill_manual("",values=c('gray75'))+
    theme_bw(base_size=12) +
     ggtitle('')+
     theme(plot.title = element_text(hjust = 0.5),legend.position="none")

BD + Ft
```



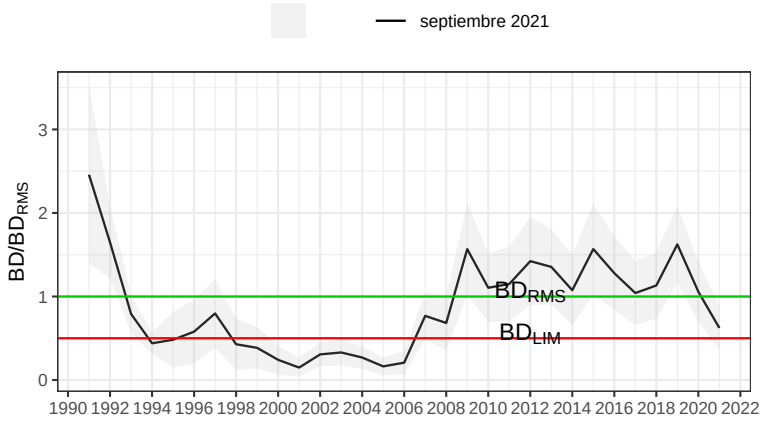
```
sel_Flota <- rep1$Sel_flota[1,]
madurez   <- dat1$madurezsexual
Fspr      <- SPRcurv1[,1]
BDspr     <- SPRcurv1[,4]

g1 <- ggplot () +
     #lineas
     geom_line(aes(x=age,y=sel_Flota))+
     geom_line(aes(x=age,y=madurez),linetype="dashed")+
     #puntos
     geom_point(aes(x=age,y=sel_Flota,shape="Selectividad de la flota"),size=2.5) +
     geom_point(aes(x=age,y=madurez,shape="Madurez sexual"),size=2.5) +
     #parámetros
     labs(x = 'Edad (años)', y = 'Madurez y selectividad',shape="") +
     ggtitle("")+
     theme_bw(base_size=11) +
     theme(plot.title = element_text(hjust = 0.5),legend.justification=c(1.1,0), legend.position=c(1,0.1))


g2 <- ggplot () +
     geom_line(aes(x=Fspr,y=BDspr))+
     geom_hline(yintercept = 0.6,colour=c('gray35'),linetype="dashed") +
     geom_vline(xintercept = FRMS1,colour=c('gray35'),linetype="dashed") +
     annotate("text", x=2, y=0.6+0.02,label=c(expression("F"[RMS]))) +
     labs(x = 'Mortalidad por pesca (F)', y = '%BDPR',shape="") +
     ggtitle("")+
     theme_bw(base_size=11) +
     theme(plot.title = element_text(hjust = 0.5),legend.justification=c(1.1,0), legend.position=c(1,0.1))
g1 + g2
```



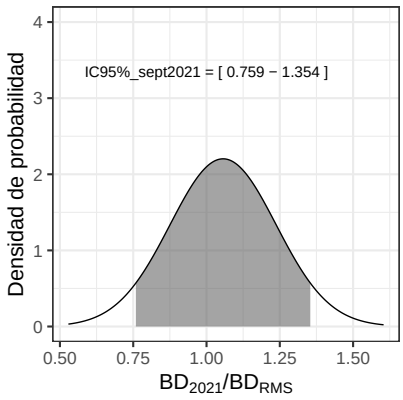
```
years1<-rep1$years
nyears1<-length(years1)
#para serie histórica
Rpr1     <- c(subset(std1,name=="RPRequ3")$value);
Rpr1std  <- c(subset(std1,name=="RPRequ3")$std)
Frpr1    <- c(subset(std1,name=="Frpr")$value);
Frpr1std <- c(subset(std1,name=="Frpr")$std)

EstatusSep<- data.frame(x=years1,
                        Rpr1=Rpr1,
                        Frpr1=Frpr1,
                        lowerRpr1  = (Rpr1 - 1.96*Rpr1std ),
                        upperRpr1  = (Rpr1 +1.96*Rpr1std ),
                        lowerFrpr1 = (Frpr1 -1.96*Frpr1std),
                        upperFrpr1 = (Frpr1 +1.96*Frpr1std))

#Para densidad de probabilidad
rprSEPT     <-subset(std1,name=="RPRequ3")$value[nyears1-1]
rprSEPTstd  <-subset(std1,name=="RPRequ3")$std[nyears1-1]
FrprSEPT    <-subset(std1,name=="Frpr")$value[nyears1-1]
FrprSEPTstd <-subset(std1,name=="Frpr")$std[nyears1-1]

# biomasa desovante vs BDrms
xbs1 <-rnorm(1000, mean = rprSEPT, sd = rprSEPTstd)
xbs  <-seq(min(xbs1),max(xbs1),0.005)
ybs  <-dnorm(xbs, mean = rprSEPT, sd =rprSEPTstd)
icbs <-qnorm(c(0.05,0.95,0.5),rprSEPT,rprSEPTstd)

# mortalidad por pesca vs Frms
xfs1 <- rnorm(1000, mean = FrprSEPT, sd = FrprSEPTstd)
xfs  <-seq(min(xfs1),max(xfs1),0.005)
yfs  <-dnorm(xfs, mean = FrprSEPT, sd =FrprSEPTstd)
icfs <-qnorm(c(0.05,0.95,0.5),FrprSEPT,FrprSEPTstd)

#distribución probabilidad
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]])))

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]])))

densb_bs  <- data.frame(x=xxbs, y=yybs , t=rep('a', length(xxbs)), r=seq(1,length(xxbs),1))
densb_fs  <- data.frame(x=xxfs, y=yyfs , t=rep('a', length(xxfs)), r=seq(1,length(xxfs),1))

### *Probabilidad de estar bajo BRMS*
#Asesoría Septiembre #P(BD<BDrms)
pa_sept<-pnorm(1,rprSEPT,rprSEPTstd,lower.tail = TRUE,log.p = F)
### *Probabilidad de estar bajo FRMS*
#Asesoría Septiembre #P(F>Frms)
pb_sept<-1-pnorm(1,FrprSEPT,FrprSEPTstd,lower.tail = TRUE,log.p = F)
### *Probabilidad de estar en zona de sobreexplotacion*
#Asesoría Septiembre #P(BD<BDrms)
pc_sept<-pnorm(0.9,rprSEPT,rprSEPTstd,lower.tail = TRUE,log.p = F)
### *Probabilidad de estar en zona de colapso*
#Asesoría Septiembre #P(BD<BDrms)
pd_sept<-pnorm(0.5,rprSEPT,rprSEPTstd,lower.tail = TRUE,log.p = F)
### *Probailidad de sobrepesca*
#Asesoría Septiembre #P(F>Frms)
pe_sept<-1-pnorm(1.1,FrprSEPT,FrprSEPTstd,lower.tail = TRUE,log.p = F)
```

```
BD_BDrms <- ggplot() +
     geom_line(data=EstatusSep,aes(y=Rpr1, x=x, colour = "septiembre 2021"), size=0.5)+
     geom_ribbon(data=EstatusSep,aes(ymin=lowerRpr1, ymax=upperRpr1, x=x, fill = ""), alpha = 0.2)+
     geom_hline(yintercept = c(1,0.5),colour=c('green3','red'))+
     annotate("text", x=c(2012,2012), y=c(1,0.5)+0.06,
     label=c(expression("BD"[RMS]),expression("BD"[LIM]))) +
     labs(x = '', y = expression("BD/BD"[RMS]),colour='Asesorías',tag="a)")  +
     scale_x_continuous(breaks = seq(from = 1960, to = 2062, by = 2)) +
     scale_colour_manual("",values=c("black"))+
     scale_fill_manual("",values=c('gray75'))+
     theme_bw(base_size=10) +
     ggtitle('')+
     theme(plot.title = element_text(hjust = 0.5),legend.position="top")

F_Frms <- ggplot() +
     geom_line(data=EstatusSep,aes(y=Frpr1, x=x, colour = "septiembre 2021"), size=0.5)+
     geom_ribbon(data=EstatusSep,aes(ymin=lowerFrpr1, ymax=upperFrpr1, x=x, fill = ""), alpha = 0.2)+
     geom_hline(yintercept = 1,colour=c('green3')) +
     annotate("text", x=2012, y=1+0.25,label=c(expression("F"[RMS]))) +
     labs(x = '', y = expression("F/F"[RMS]),colour='Asesorías',tag="c)")  +
     scale_x_continuous(breaks = seq(from = 1960, to = 2062, by = 2)) +
     scale_colour_manual("",values=c("black"))+
     scale_fill_manual("",values=c('gray75'))+
     theme_bw(base_size=10) +
     ggtitle('')+
     theme(plot.title = element_text(hjust = 0.5),legend.position="none")

fig_desnb<- ggplot() + lims(y=c(0,4)) +
     geom_polygon(data=densb_bs,aes(x=x, y=y, group=t,alpha=0.9),fill="gray35")+
     geom_line(aes(xbs,ybs), size=0.3,color="black")+
     annotate("text", x=c(1), y=c(3.35), colour = c("black"), size = 2.5,
     label=c(paste("IC95%_sept2021 = [",round(icbs[1],3),"-",round(icbs[2],3),"]",sep=" "))) +
     labs(x = expression("BD"[2021]*"/BD"[RMS]), y = 'Densidad de probabilidad',tag="b)")  +
     scale_colour_manual("",values=c("black"))+
     scale_fill_manual("",values=c('gray75'))+
     theme_bw(base_size=10) +
     theme(plot.title = element_text(hjust = 0.5),legend.position="none")

fig_desnf<- ggplot() + lims(y=c(0,3))+
     geom_polygon(data=densb_fs,aes(x=x, y=y, group=t,alpha=0.9),fill="gray35")+
     geom_line(aes(xfs,yfs), size=0.3,color="black")+
     annotate("text", x=c(0.9), y=c(2.6), colour = c("black"), size = 2.5,
     label=c(paste("IC95%_sept2021  = [",round(icfs[1],3),"-",round(icfs[2],3),"]",sep=" "))) +
     labs(x = expression("F"[2021]*"/F"[RMS]), y = 'Densidad de probabilidad',tag="d)")  +
     theme_bw(base_size=10) +
     theme(plot.title = element_text(hjust = 0.5),legend.position="none")


 {(BD_BDrms / F_Frms)   | (fig_desnb/fig_desnf)} +  plot_layout(ncol=2,widths=c(2,1))
```

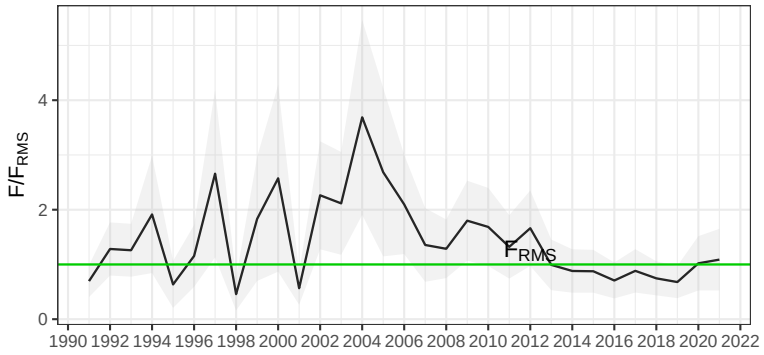
a)


septiembre 2021
BD/BD_RMS
BD_RMS
BD_LIM
0
1
2
3
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020 2022

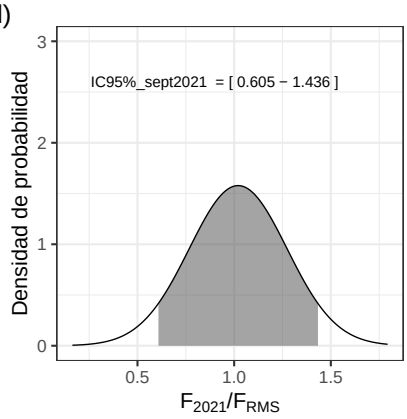
b)


IC95%_sept2021 = [0.759 − 1.354]
Densidad de probabilidad
0
1
2
3
4
0.50 0.75 1.00 1.25 1.50
BD_2021/BD_RMS

c)


F/F_RMS
F_RMS
0
2
4
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020 2022

d)


IC95%_sept2021 = [0.605 − 1.436]
Densidad de probabilidad
0
1
2
3
0.5 1.0 1.5
F_2021/F_RMS

```r
yearsb<-c("1990/91","1991/92","1992/93","1993/94","1994/95","1995/96","1996/97","1997/98","1998/99","1999/00","2000/01","2001/02

VarPobl2<- cbind('Años'=yearsb,
                 "$F/F_{RMS_{sept}}$"=c(round(exp(Ft1)/FRMS1,3)),
                 "$BD/BD_{RMS_{sept}}$"=c(round(BD1/BRMS1,3)))
kable(VarPobl2, align = 'c')
```

Años	$F/F_{RMS_{sept}}$	$BD/BD_{RMS_{sept}}$
1990/91	0.696	2.457
1991/92	1.283	1.647
1992/93	1.259	0.791
1993/94	1.913	0.44
1994/95	0.635	0.482
1995/96	1.155	0.579
1996/97	2.658	0.797
1997/98	0.458	0.429
1998/99	1.831	0.385
1999/00	2.573	0.242
2000/01	0.566	0.149
2001/02	2.263	0.307
2002/03	2.116	0.33
2003/04	3.687	0.269
2004/05	2.685	0.163
2005/06	2.096	0.208
2006/07	1.355	0.768
2007/08	1.286	0.683
2008/09	1.799	1.568
2009/10	1.685	1.105
2010/11	1.321	1.15
2011/12	1.662	1.423
2012/13	0.992	1.355
2013/14	0.881	1.075
2014/15	0.875	1.568
2015/16	0.707	1.279
2016/17	0.883	1.041
2017/18	0.746	1.132
2018/19	0.679	1.624
2019/20	1.021	1.056
2020/21	1.088	0.623

```r
#setwd(dir.basedatos)
write.csv(VarPobl2, file="Tabla_22_indicesReduccion.csv")
#setwd(dir.1)
```

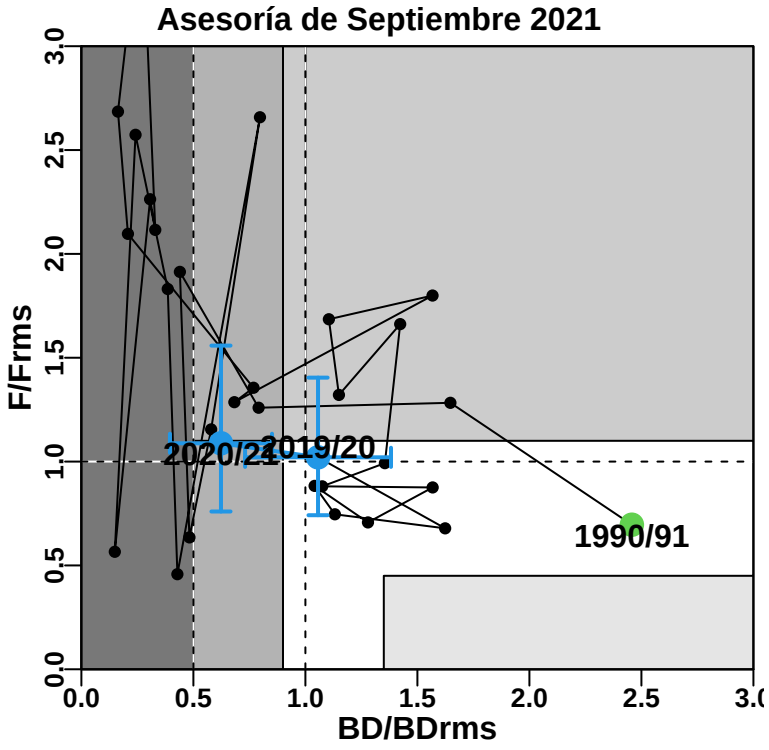
```r
yearsb<-c("1990/91","1991/92","1992/93","1993/94","1994/95","1995/96","1996/97","1997/98","1998/99","1999/00","2000/01","2001/02

VarPobl2b<- cbind('Años'=yearsb,
                 "$Y/BT_{sept}$"=c(round(rep1$desembarquepred/BT1,3)),
                 "$C/N_{sept}$"=c(round(c(rowSums(rep1$pred_Ctot)/rowSums(rep1$N),NA),3)))
kable(VarPobl2b, align = 'c')
```

Años	Y/BT_{sept}	C/N_{sept}
1990/91	0.173	0.101
1991/92	0.263	0.179
1992/93	0.261	0.167
1993/94	0.395	0.23
1994/95	0.157	0.087
1995/96	0.237	0.147
1996/97	0.509	0.321
1997/98	0.099	0.069
1998/99	0.326	0.233
1999/00	0.435	0.292
2000/01	0.116	0.074
2001/02	0.44	0.262

Años	Y/BT_{sept}	C/N_{sept}
2002/03	0.384	0.252
2003/04	0.5	0.389
2004/05	0.398	0.3
2005/06	0.391	0.235
2006/07	0.328	0.189
2007/08	0.237	0.155
2008/09	0.327	0.227
2009/10	0.339	0.213
2010/11	0.279	0.167
2011/12	0.315	0.203
2012/13	0.225	0.147
2013/14	0.164	0.116
2014/15	0.185	0.119
2015/16	0.156	0.104
2016/17	0.152	0.116
2017/18	0.132	0.101
2018/19	0.171	0.103
2019/20	0.21	0.146
2020/21	0.196	0.137
1990/91	0.173	NA

```
#setwd(dir.basedatos)
write.csv(VarPobl2b, file="Tabla_23_tasasExplotacion.csv")
#setwd(dir.1)
```

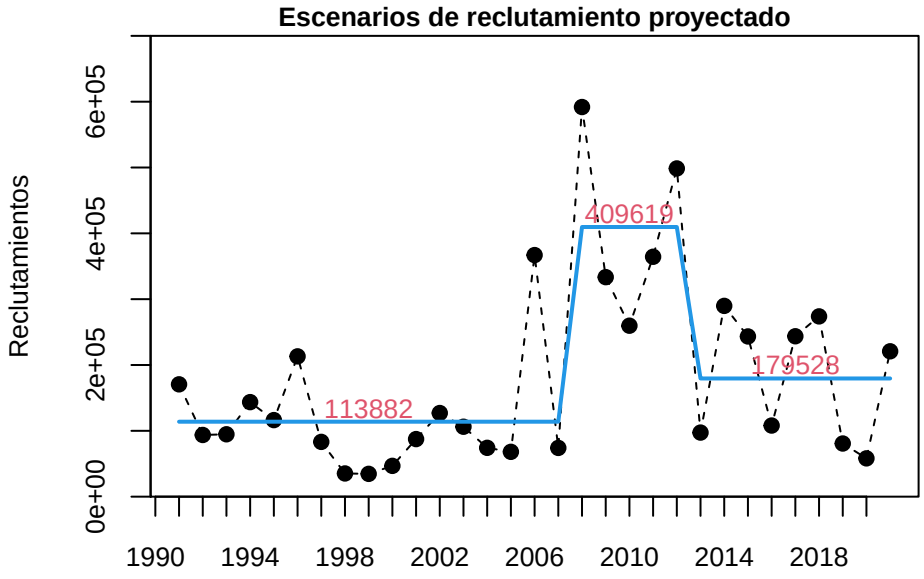
```r
source(paste(dir.fun,"Fn_DiagramaFase2.R",sep=""))
name1<-"Asesoría de Septiembre 2021"
years1<-rep1$years
nyears1<-length(years1)

DiagramaFase2(name1,
              years1[1:nyears1-1],
              SpB1[1:nyears1-1],
              SpBSE1[1:nyears1-1],
              ln_Fyr1[1:nyears1-1],
              ln_FSE1[1:nyears1-1],
              SpB1[nyears1],
              SpBSE1[nyears1],
              ln_Fyr1[nyears1],
              ln_FSE1[nyears1],
              FRMS1,
              BRMS1,
              BLIM1,
              FLIM1,
              color=F,
              dir.1,
              etiqueta=F,
              preliminar=F,
              completo=T)

text(c(SpB1[1]/BRMS1,SpB1[nyears1]/BRMS1,SpB1[nyears1-1]/BRMS1),
     c(exp(ln_Fyr1[1])/FRMS1-0.05,exp(ln_Fyr1[nyears1])/FRMS1-0.05,exp(ln_Fyr1[nyears1-1])/FRMS1+0.05), c("1990/91","2020/21","2
```



```
Tabla4.1<-rbind("Año biológico"=c("2020/21"),
                "$F_{RMS}$"=c(round(FRMS1,2)),
                "$BD_{RMS}$"=c(round(BRMS1/10^3,0)),
                "$BD_{LIM}$"=c(round(BLIM1/10^3,0)),
                "$p(BD_{last}<BD_{RMS})$"=round(c(pa_sept),2),
                "$p(F_{last}>F_{RMS})$"=round(c(pb_sept),2),
                "$p(sobre-explotación)$"=round(c(pc_sept),2),
                "$p(agotado/colapsado)$"=round(c(pd_sept),2),
                "$p(sobrepesca)$"=round(c(pe_sept),2))
colnames(Tabla4.1)<-c("Septiembre 2021")
kable(Tabla4.1,align='c')
```

	Septiembre 2021
Año biológico	2020/21
F_{RMS}	0.3
BD_{RMS}	820
BD_{LIM}	410
$p(BD_{last} < BD_{RMS})$	0.38
$p(F_{last} > F_{RMS})$	0.53
$p(sobre - explotación)$	0.19
$p(agotado/colapsado)$	0
$p(sobrepesca)$	0.38

3.8. CBA 2021 Inicial (Asesoría de septiembre 2020)



	1991-2007	2008-2012	2013-2020
mean	345100	518600	373660
std	64494	89754	79587
10%	262448	403576	271665
20%	290820	443061	306678
30%	311279	471533	331925
40%	328761	495861	353497
50%	345100	518600	373660

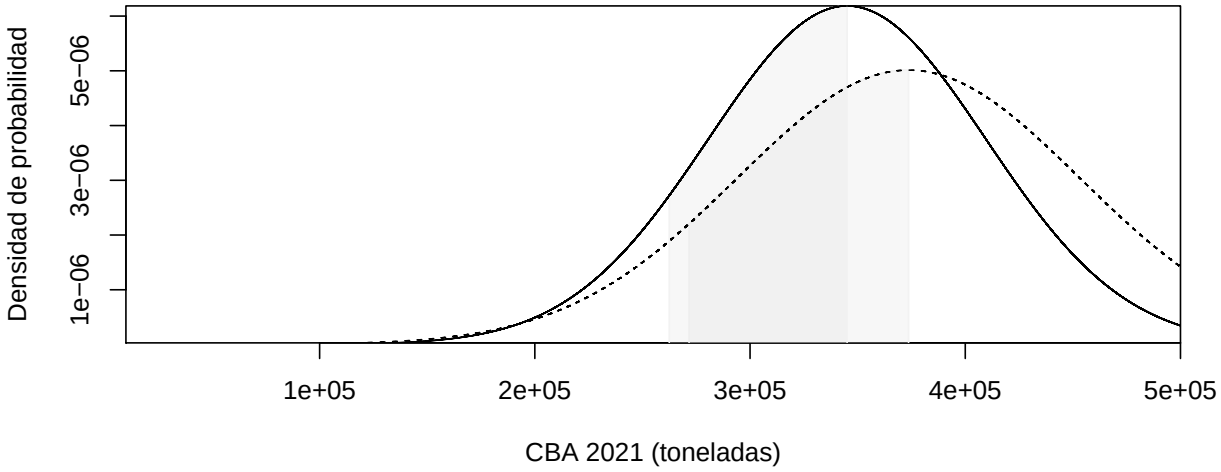
	1991-2007	2008-2012	2013-2020
10%	0.24	0.22	0.27
20%	0.16	0.15	0.18

	1991-2007	2008-2012	2013-2020
30%	0.10	0.09	0.11
40%	0.05	0.04	0.05
50%	0.00	0.00	0.00

	1991-2007	2008-2012	2013-2020
10%	257199	395504	266232
20%	285004	434200	300544
30%	305054	462102	325286
40%	322185	485944	346427
50%	338198	508228	366187

	1991-2007	2008-2012	2013-2020
10%	246701	379361	255365
20%	273371	416477	288277
30%	292603	443241	312009
40%	309035	466109	332287
50%	324394	487484	351240

```
#####################################################
# Asesoría septiembre R1
#####################################################
#  densidad de probabilidad
xbs1a <-rnorm(1000, mean = CBAp_sept[1], sd = CBApstd_sept[1])
xbsa  <-seq(min(xbs1a),max(xbs1a),0.5)
ybsa  <-dnorm(xbsa, mean = CBAp_sept[1], sd =CBApstd_sept[1])
icbsa <-qnorm(c(0.10,0.50,0.5),CBAp_sept[1],CBApstd_sept[1])

#distribución probabilidad
xxbsa      <- c(xbsa[xbsa>=icbsa[1]&xbsa<=icbsa[2]],
                rev(xbsa[xbsa>=icbsa[1]&xbsa<=icbsa[2]]))
yybsa      <- c(ybsa[xbsa>=icbsa[1]&xbsa<=icbsa[2]],
                rep(0,length(ybsa[xbsa>=icbsa[1]&xbsa<=icbsa[2]])))

densb_bsa  <- data.frame(x=xxbsa, y=yybsa , t=rep('a', length(xxbsa)), r=seq(1,length(xxbsa),1))

#####################################################
# Asesoría septiembre R2
#####################################################
#  densidad de probabilidad
xbs1b <-rnorm(1000, mean = CBAp_sept[3], sd = CBApstd_sept[3])
xbsb  <-seq(min(xbs1b),max(xbs1b),0.5)
ybsb  <-dnorm(xbsb, mean = CBAp_sept[3], sd = CBApstd_sept[3])
icbsb <-qnorm(c(0.10,0.50,0.5),CBAp_sept[3],CBApstd_sept[3])

#distribución probabilidad
xxbsb      <- c(xbsb[xbsb>=icbsb[1]&xbsb<=icbsb[2]],
                rev(xbsb[xbsb>=icbsb[1]&xbsb<=icbsb[2]]))
yybsb      <- c(ybsb[xbsb>=icbsb[1]&xbsb<=icbsb[2]],
                rep(0,length(ybsb[xbsb>=icbsb[1]&xbsb<=icbsb[2]])))

densb_bsb  <- data.frame(x=xxbsb, y=yybsb , t=rep('a', length(xxbsb)), r=seq(1,length(xxbsb),1))

plot(xbsa,ybsa ,type="n",ylab="Densidad de probabilidad",xaxs="i",yaxs= "i",xlab="CBA 2021 (toneladas)", main="",xlim=c(10000,50
polygon(xxbsb,yybsb,col=gray(0.9,0.3),border="gray95")
polygon(xxbsa,yybsa,col=gray(0.9,0.3),border="gray95")
lines(xbsb,ybsb,lwd=1,lty=2,col=1)
lines(xbsa,ybsa,lwd=1,lty=1,col=1)
legend(1000,0.00017,c("CBA2021_Hito1_Rbajo","CBA2021_Hito1_Rreciente"),lwd=c(2,1),col=c(1,2),lty=c(1,1),bty="n",cex=0.8)
text(904.3,0.0022,"Crms")
```

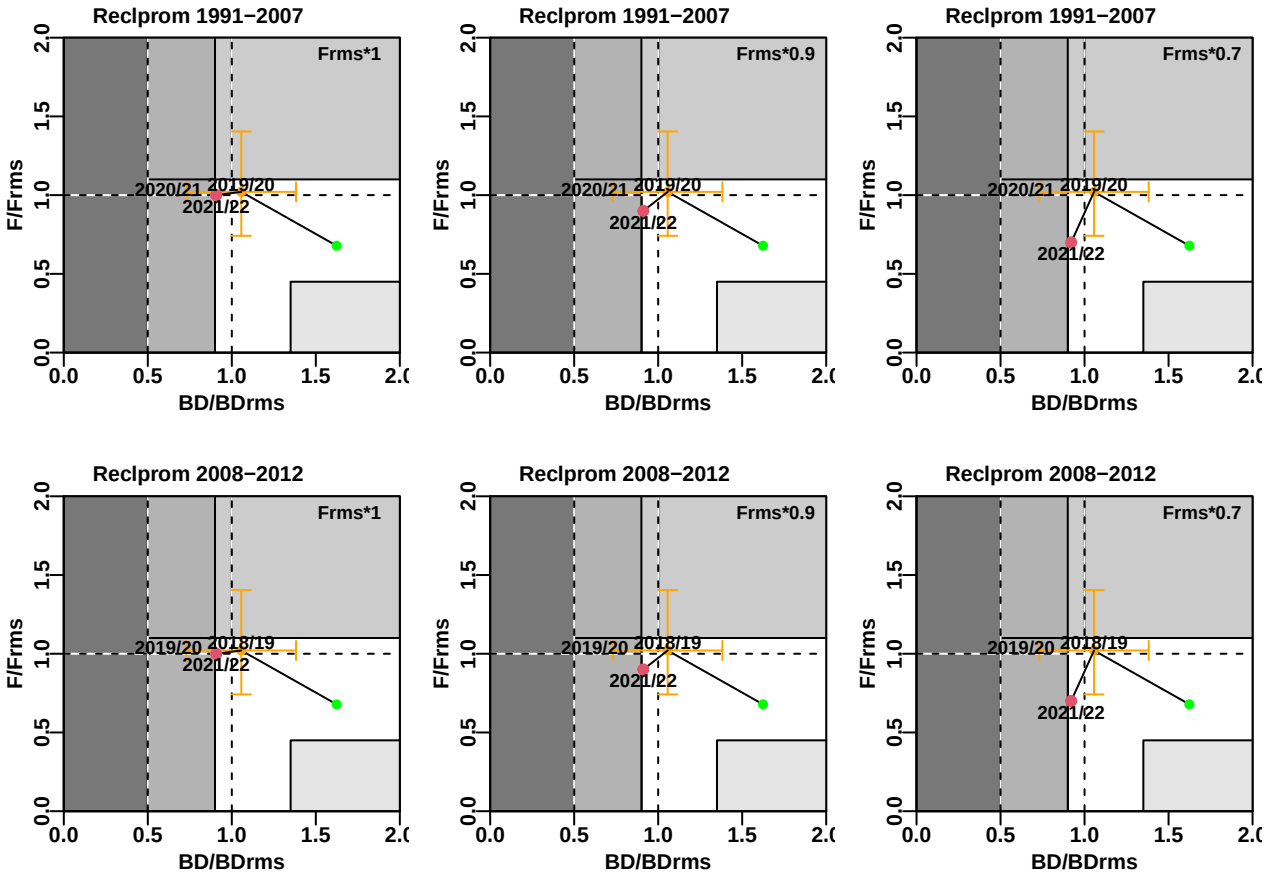

Densidad de probabilidad
1e−06
3e−06
5e−06
1e+05
2e+05
3e+05
4e+05
5e+05
CBA 2021 (toneladas)

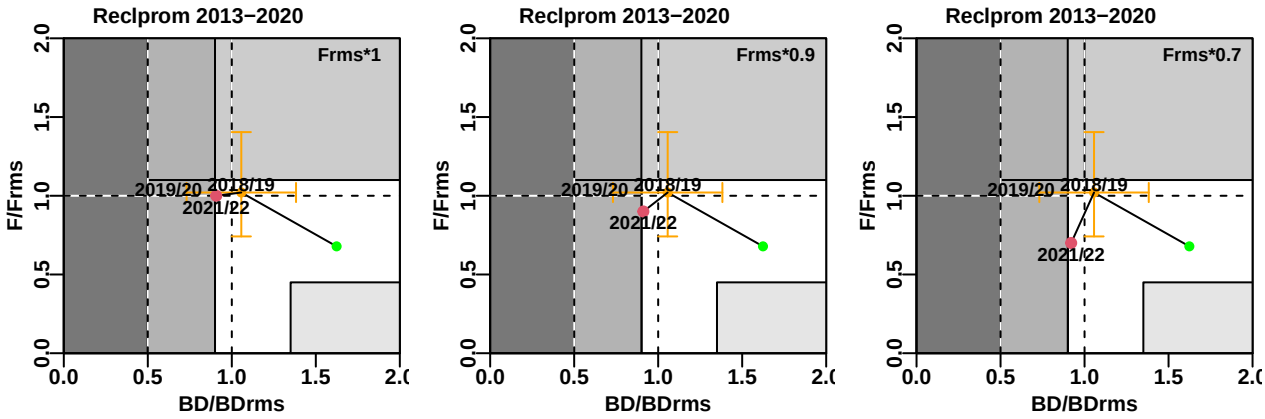
4.0. Proyección del stock (Asesoría de septiembre 2020)

	1991-2007[F_{RMS}*1]	[F_{RMS}*0.9]	[F_{RMS}*0.7]
p(sobre-explotación)_2018/19	0.19	0.19	0.19
p(colapso)_2018/19	0.00	0.00	0.00
p(sobre-explotación)_2020/21	0.98	0.98	0.98
p(colapso)_2020/21	0.18	0.18	0.18
p(sobre-explotación)_2021/22	0.49	0.48	0.46
p(colapso)_2021/22	0.04	0.03	0.03

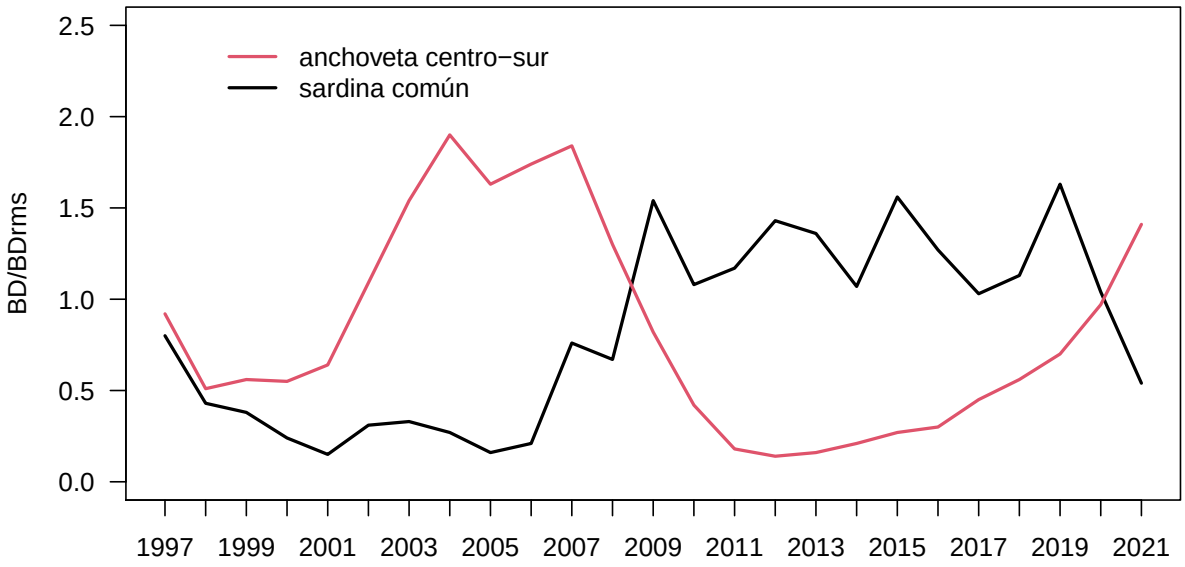
	2008-2012[F_{RMS}*1]	[F_{RMS}*0.9]	[F_{RMS}*0.7]
p(sobre-explotación)_2018/19	0.19	0.19	0.19
p(colapso)_2018/19	0.00	0.00	0.00
p(sobre-explotación)_2020/21	0.98	0.98	0.98
p(colapso)_2020/21	0.18	0.18	0.18
p(sobre-explotación)_2021/22	0.49	0.48	0.46
p(colapso)_2021/22	0.04	0.03	0.03

	2013-2020[F_{RMS}*1]	[F_{RMS}*0.9]	[F_{RMS}*0.7]
p(sobre-explotación)_2018/19	0.19	0.19	0.19
p(colapso)_2018/19	0.00	0.00	0.00
p(sobre-explotación)_2020/21	0.98	0.98	0.98
p(colapso)_2020/21	0.18	0.18	0.18
p(sobre-explotación)_2021/22	0.49	0.48	0.46
p(colapso)_2021/22	0.04	0.03	0.03




Reclprom 2013−2020
Frms*1
2019/20
2018/19
2021/22
F/Frms
BD/BDrms
0.0
0.5
1.0
1.5
2.0
Reclprom 2013−2020
Frms*0.9
2019/20
2018/19
2021/22
F/Frms
BD/BDrms
Reclprom 2013−2020
Frms*0.7
2019/20
2018/19
2021/22
F/Frms
BD/BDrms

5. DISCUSIÓN



u‘ñ“’pñl’kñ0kñ3plñpñ o0

- ¿Cuánto se sobrepasa el RMS en la captura 2020/21?

Por lo tanto, podríamos concluir que la causa de exceder el objetivo de manejo Frms para el año 2020/21 se debe al remanente de cuota autorizado.

¿Cuál es la captura semestral del año biológico 2020/21 y la captura descartada?

- CBA recomendada 2021 = 251.316 t
- Desembarque 1er semestre 2021 = 22% sobre CBA recomendada (306.406 t)

¿Cuál debería haber sido la captura para un F_{RMS}?

La captura 2020/21 al RMS debería ser 359.250 (C_{RMS}) - 14.370 (4%descarte) = 344.880 t

Por lo tanto, de las 344.880 t que se podían capturar entre el 2020/21, si consideramos que durante el 2do semestre 2020 se capturaron 69.839 t, entonces, durante el 1er semetre 2021 la captura no debería haber superado las 275.041 t. Se sobrepasó en torno a las 31 mil toneladas la captura biológicamente aceptable 2020/21.

Sobre las estacionalidad de las capturas

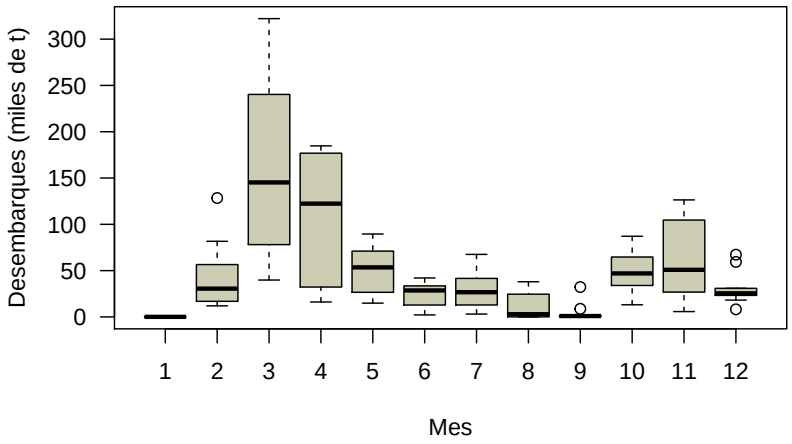


Figure 1: Capturas mensuales de sardina común realizadas entre 2007-2021, registradas por SERNAPESCA en la zona centro-sur.

- Revisar la estacionalidad de la captura en año biológico

```
prop1ersemestre<-c(0.81,   0.70,   0.65,   0.77,   0.47,   0.81,   0.72,   0.81,   0.85,   0.90,   0.8

plot(seq(1991,2021),prop1ersemestre,type="o",ylab="Proporción de captura 1er semestre (año biológico",x
```

Separar la Captura en año biológico para revisar el efecto de la Captura 2020/21 sobre el cálculo de CBA en año calendario

Qué pasaría si los usuarios deciden no capturar durante el 2do semestres y traspasar ese remanente de cuota para el 1er semestre del siguiente año???

cuál es la captura biológicamente aceptable 2021/2022