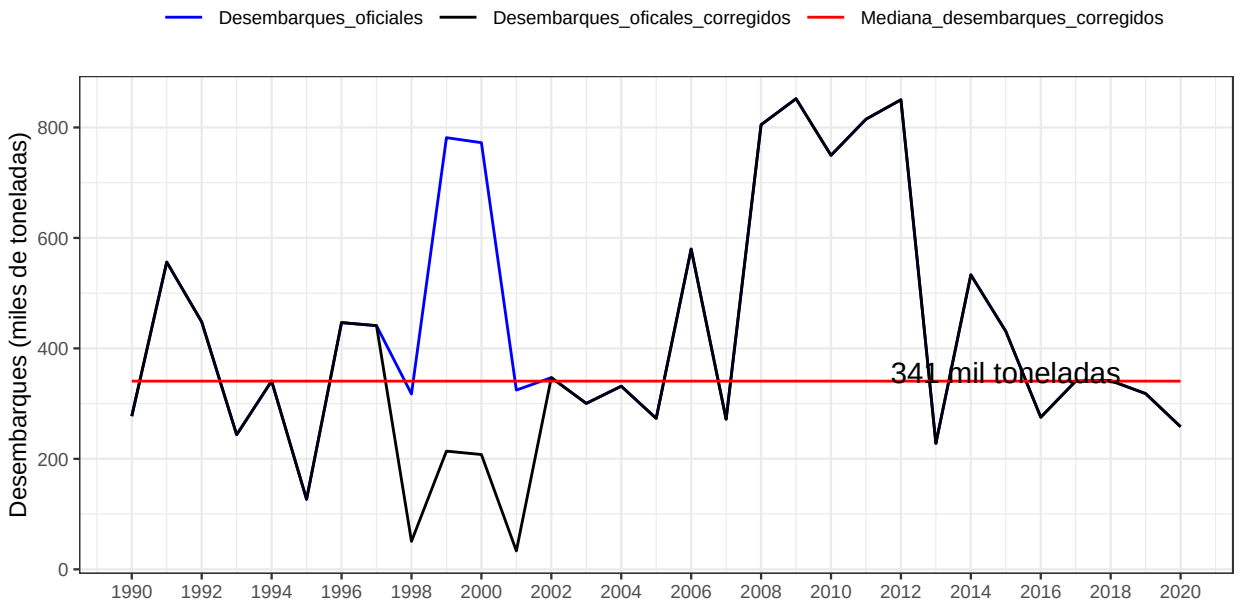
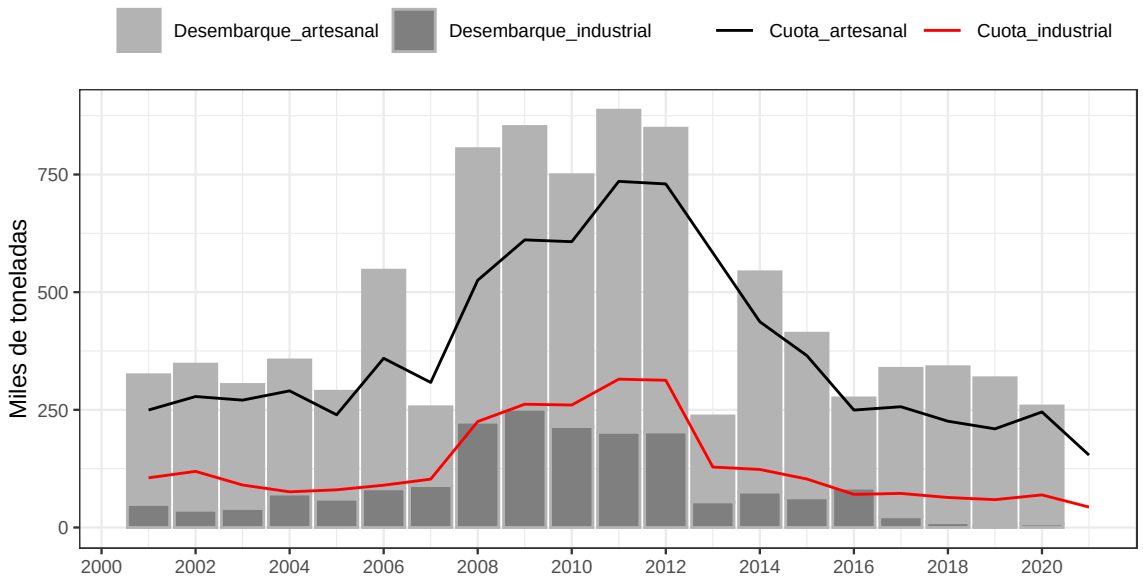
Figuras y Tablas para Tercer Informe de sardina común Centro sur

1. ANTECEDENTES

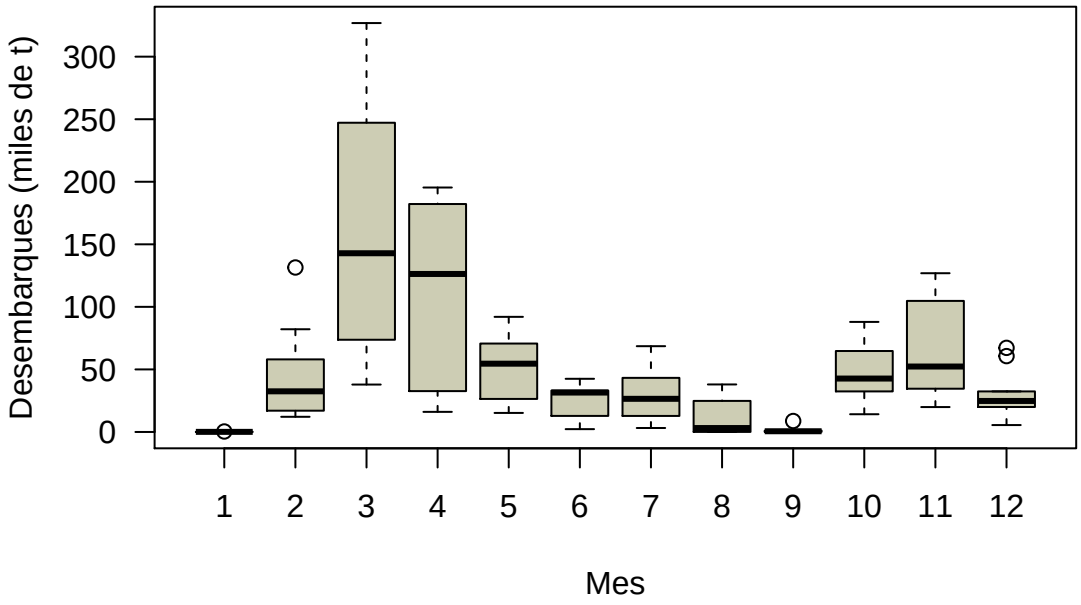
```
years<-seq(1990,2020,1)
dataDesem  <- ant$des_oficialesvscorregidos
Tdesem  <- data.frame(years,dataDesem[,1:2],rep(median(dataDesem[,2]),length(dataDesem[,2])))
colnames(Tdesem) <- c("Years",
                      "Desembarques_oficiales",
                      "Desembarques_oficales_corregidos",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

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

ggplot(des_Of_corr)+
  geom_line(aes(Years,value/1000,colour=variable))+
  annotate("text", x=2015, y=(round(median(Tdesem[,3]),0)/1000)+15,
  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")
```



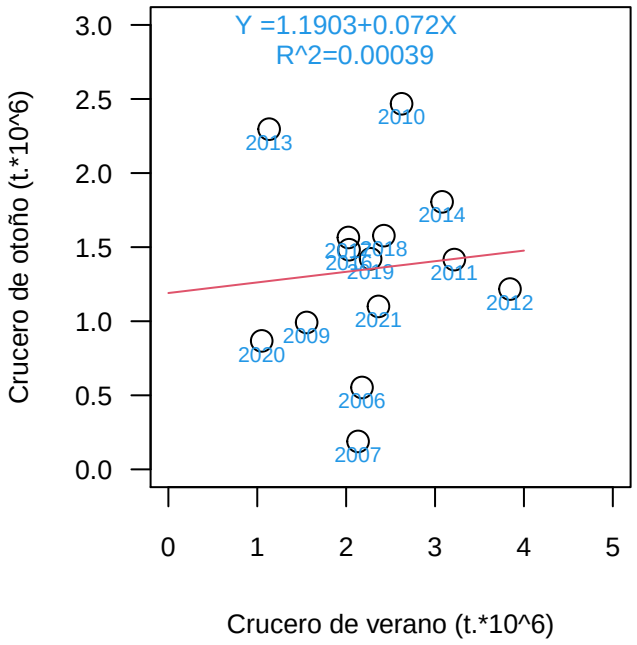
```r
dataDesem2  <- data.frame(ant$year_cuota,ant$des_art,ant$des_ind)
colnames(dataDesem2) <- c("Years",
                          "Desembarque_artesanal",
                          "Desembarque_industrial")

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=9) +
  theme(plot.title = element_text(hjust = 0.5),legend.position="top")
```



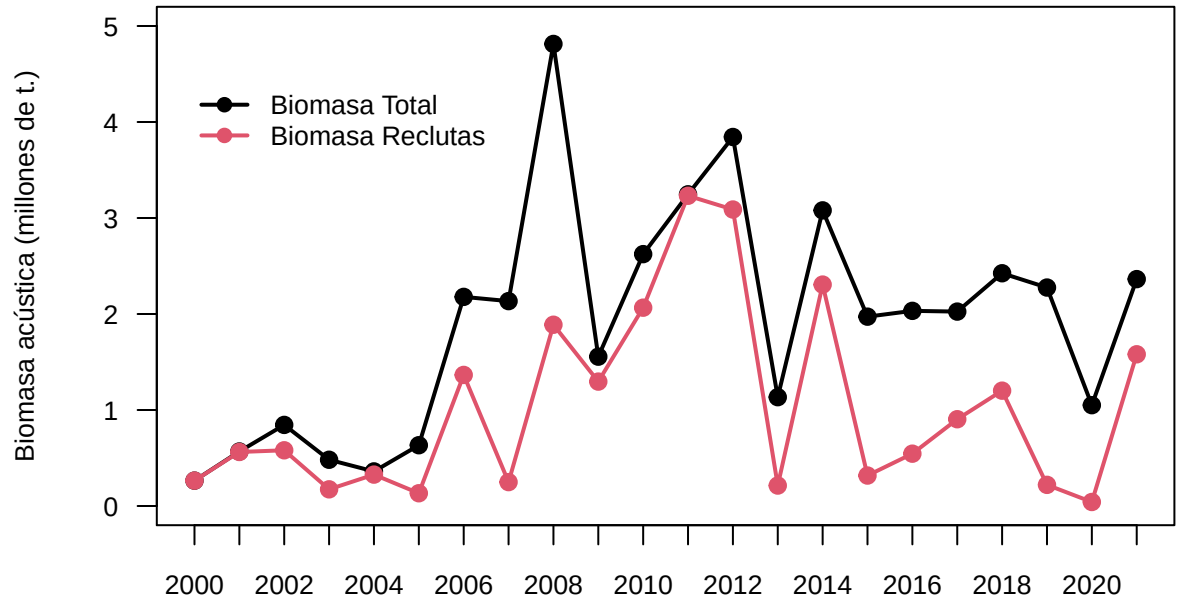
```r
ano<-ant$desembarques_sernapesca[,1]
des_mes<-data.frame(mes=rep(seq(1,12,1),22),ano=gl(22,12,labels=ano),desem=c(t(ant$desembarques_sernapes

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<-rep3$reclasobs[rep3$reclasobs>0&rep3$pelacesobs>0]/10^6
y<-rep3$pelacesobs[rep3$reclasobs>0&rep3$pelacesobs>0]/10^6
years<-rep3$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)
text(x,y-0.09,years[rep3$reclasobs>0&rep3$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=""),co
text(2.1,2.8, "R^2=0.00039",col=4,cex=0.8)
```

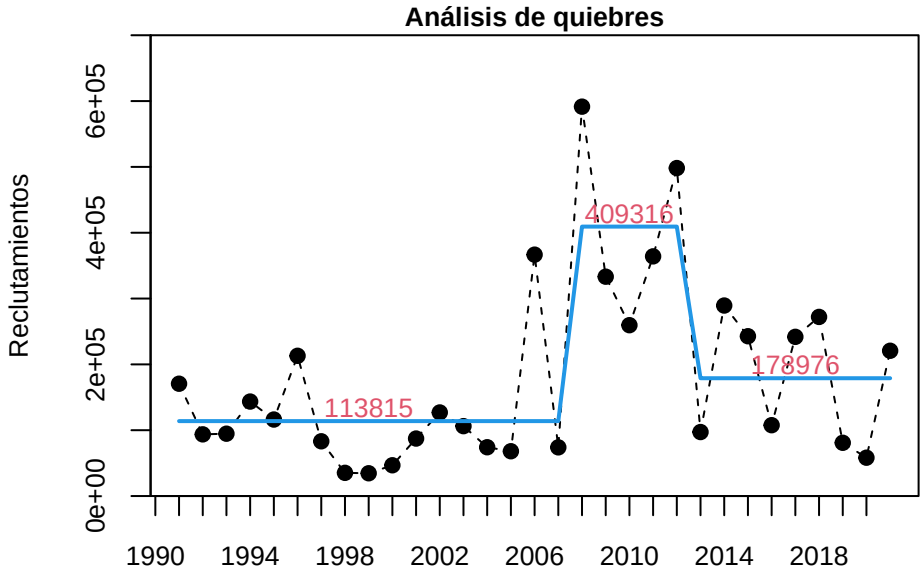


```r
anorecl<-ant$reclas_BT_BR_AT_AR[,1]
BTreclas<-ant$reclas_BT_BR_AT_AR[,2]
BRreclas<-ant$reclas_BT_BR_AT_AR[,3]
ATreclas<-ant$reclas_BT_BR_AT_AR[,4]
anopela<-ant$pelaces_BT_AT[,1]
BTpela<-ant$pelaces_BT_AT[,2]
ATpela<-ant$pelaces_BT_AT[,3]

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 d
lines(anorecl,BRreclas/1000000,type="o",pch=19,col=2,lwd=2)
legend(2000,4.5,c("Biomasa Total","Biomasa Reclutas"),pch=19,lwd=2,col=c(1,2),bty="n",cex=0.8)
```

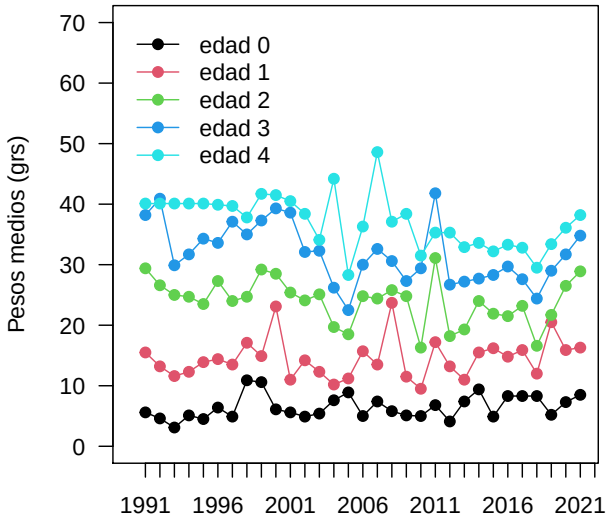


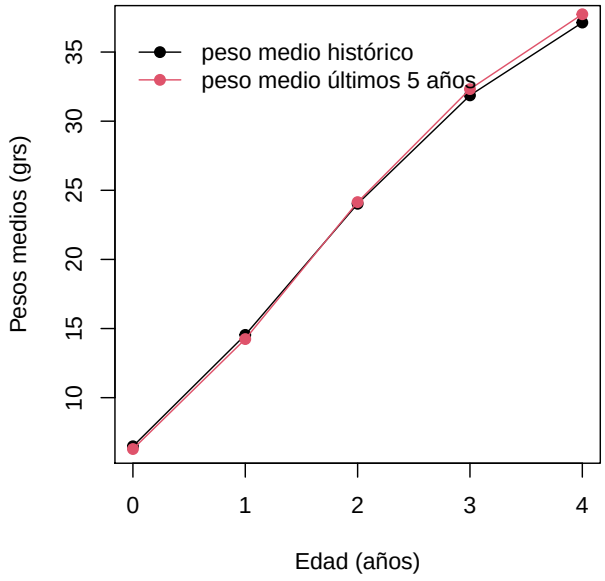
2. METODOLOGÍA

```
library(strucchange)
years     <- rep3$years
nyears    <- length(years)
bp.nile   <- breakpoints(rep3$Reclutas ~ 1)
fm0       <- lm(rep3$Reclutas ~ 1)
fm1       <- lm(rep3$Reclutas ~ breakfactor(bp.nile, breaks = 2))
quiebres3 <- fitted(fm1)

par(mfrow=c(1,1),mar=c(2,4,1,1))
plot(years,rep3$Reclutas,type="l",lty=2,pch=19,ylim=c(0,700000),
     xaxp=c(1990,2020,30),yaxs="i",xlab="",ylab="Reclutamientos",main="Análisis de quiebres",cex.main=0
points(years,rep3$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])+20000,round(c(fitted(fm1)[1],f
```



```r
years3  <-rep3$years
nyears3 <-length(years3)
age     <-seq(0,4,1)
nage    <-length(age)
pobsF   <-rep3$pf_obs

#Proporcion observada
WmedF <-dat3$Wmed
WiniF <-dat3$Wini
#Proporciones
Wm    <-c(WmedF); Wm[Wm==0]  <-NA
Wi    <-c(WiniF); Wi[Wi==0]  <-NA

x1 <-c(years3[1],years3[nyears3]+1,nyears3+1/2)
#Proporci?n de edad
par(mar=c(4,4,2,1),mfrow=c(1,2))
# pesos medios
plot(years3,WmedF[,1],type="n",las=1,ylim=c(0,70),xlim=c(1990,years3[nyears3]),ylab="Pesos medios (grs)"
for(i in 1:5){
lines(years3,WmedF[,i],col=i,type="o", pch=19)}
legend(1990,71,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[nyears3-5:nyears3,]),col=2,type="o",pch=19)
legend(0,37,c("peso medio histórico","peso medio últimos 5 años"),pch=19,lwd=1,col=c(1,2),bty="n")
```



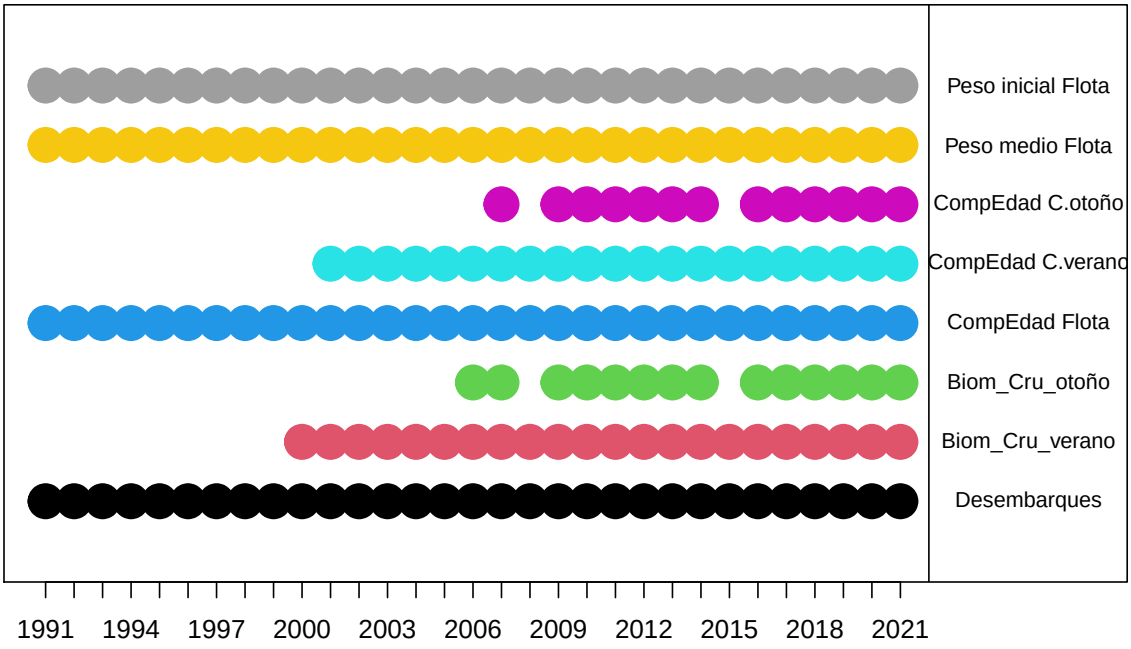


Año.biológico	Desembarques.t.	Porcentaje.descarte	Captura.descartada.t.	Captura.total.t.
1990-91	494567	0%	0	494567
1991-92	514787	0%	0	514787
1992-93	250237	0%	0	250237
1993-94	358949	0%	0	358949

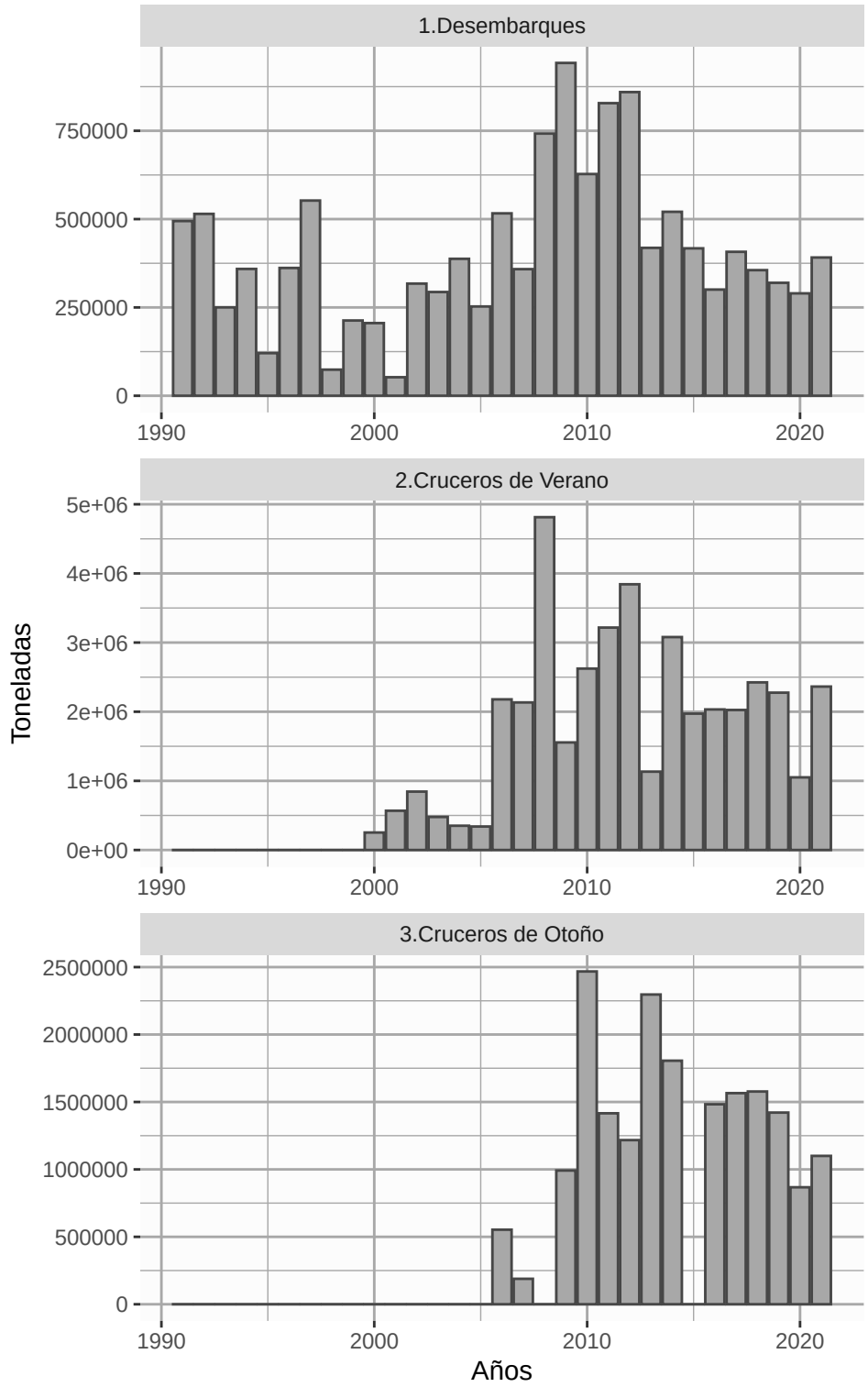
Año.biológico	Desembarques.t.	Porcentaje.descarte	Captura.descartada.t.	Captura.total.t.
1994-95	361735	0%	0	361735
1995-96	120608	0%	0	120608
1996-97	552515	0%	0	552515
1997-98	73892	0%	0	73892
1998-99	212993	0%	0	212993
1999-00	205616	0%	0	205616
2000-01	50451	4%	2018	52469
2001-02	305257	4%	12210	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	2%	7988	407403
2017-18	348574	2%	6971	355545
2018-19	301557	6%	18093	319650
2019-20	273376	6%	16403	289779
2020-21	210827	4%	8433	219260

3. RESULTADOS

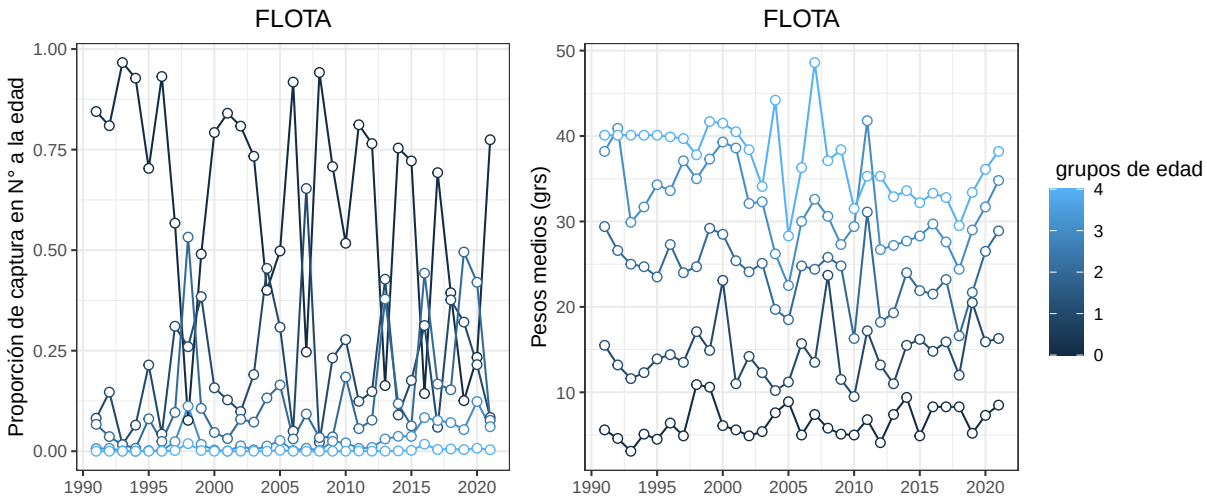
```
setwd(dir.1)
years  <- rep3$years
nyears <- dat3$nanos
x2      <-c(years,rev(years))
x1_2    <-c(years[1],years[nyears]+1,nyears+1/2) #xaxp
x2_2    <-c(years[1]-1,years[nyears]+1) #xlim

ydesembarques<-rep3$years[rep3$desembarqueobs>0]
yreclas      <-rep3$years[rep3$reclasobs>0]
ypelaces     <-rep3$years[rep3$pelacesobs>0]
ycompflota   <-rep3$years[rowSums(rep3$pf_obs)>0]
ycompreclas  <-rep3$years[rowSums(rep3$pobs_RECLAS)>0]
ycomppelaces <-rep3$years[rowSums(rep3$pobs_PELACES)>0]
ypesomedio   <-rep3$years[rowSums(dat3$Wmed)>0]
ypesoinicial <-rep3$years[rowSums(dat3$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

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

box()
```


Peso inicial Flota
Peso medio Flota
CompEdad C.otoño
CompEdad C.verano
CompEdad Flota
Biom_Cru_otoño
Biom_Cru_verano
Desembarques
1991
1994
1997
2000
2003
2006
2009
2012
2015
2018
2021

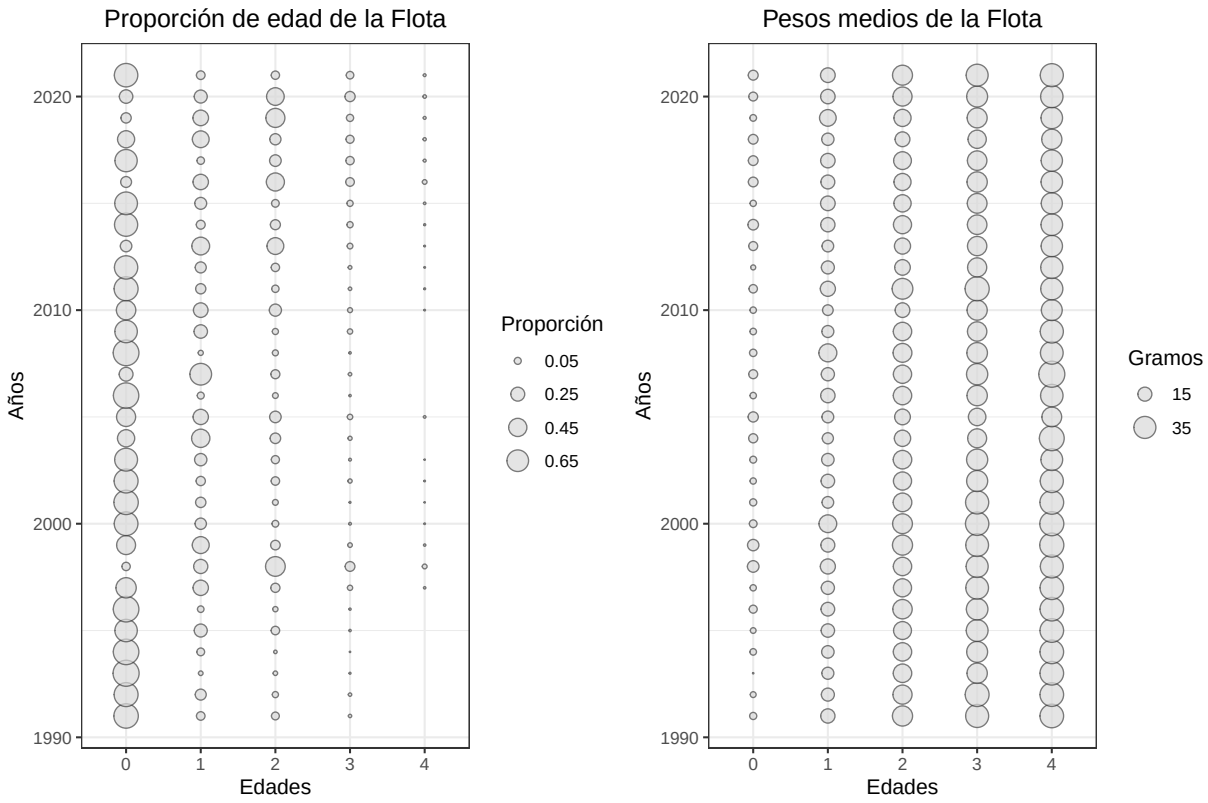
```r
des_obs <- data.frame(rep3$desembarqueobs)
bc_obs  <- data.frame(rep3$reclasobs)
bp_obs  <- data.frame(rep3$pelacesobs)
yearc   <- rep3$years
nyearc  <-length(yearc)

 obsC  <- as.data.frame(bc_obs) %>% mutate(year=yearc) %>% melt(id.vars='year') %>% mutate(type='2.Cruc
 obsP  <- as.data.frame(bp_obs) %>% mutate(year=yearc) %>% melt(id.vars='year') %>% mutate(type='3.Cruc
 obsD  <- as.data.frame(des_obs) %>% mutate(year=yearc) %>% melt(id.vars='year') %>% mutate(type='1.Des
 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="gray
```


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

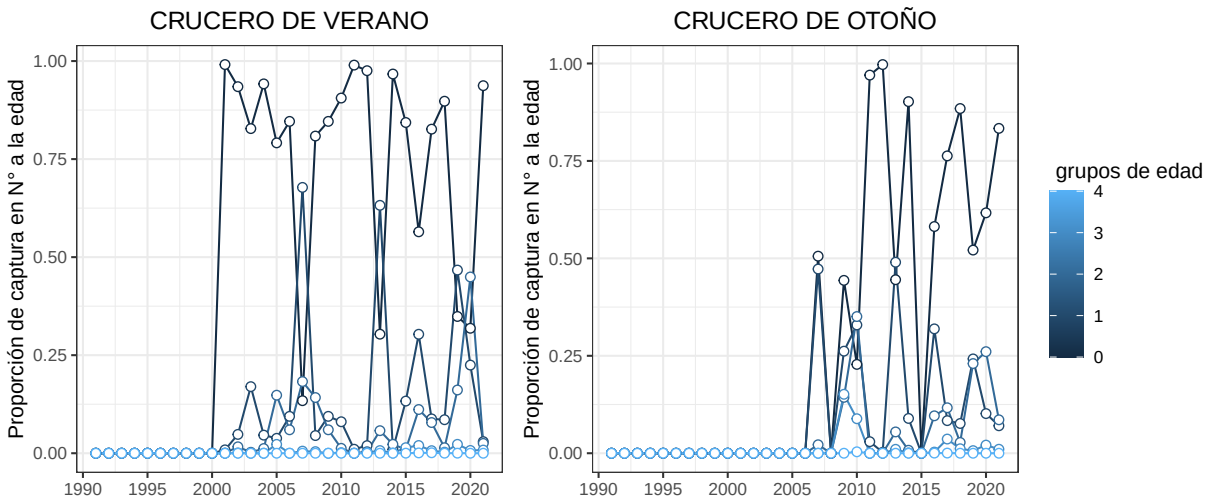
```r
years    <- rep3$years
nyears   <- length(years)
age      <- seq(0,4,1)
nage     <- length(age)
WmedF    <- dat3$Wmed
WiniF    <- dat3$Wini
pobsF    <- rep3$pf_obs

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
```


FLOTA
Proporción de captura en N° a la edad
1.00
0.75
0.50
0.25
0.00
1990
1995
2000
2005
2010
2015
2020
FLOTA
Pesos medios (grs)
50
40
30
20
10
grupos de edad
4
3
2
1
0

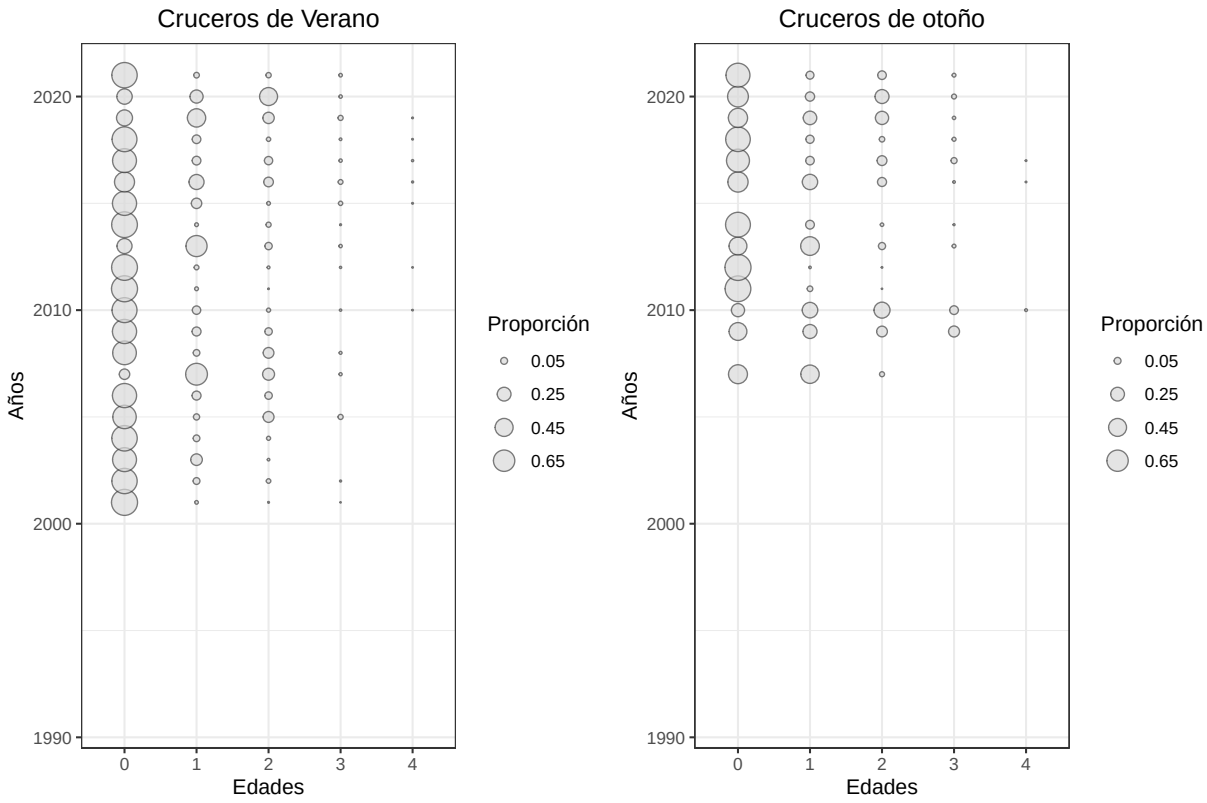
```r
pobsF    <- rep3$pf_obs
pF       <- c(pobsF); pF[pF==0]  <-NA
WmedF    <- dat3$Wmed
Wm       <- c(WmedF); Wm[Wm==0]  <-NA

years    <- rep3$years
nyears   <- dat3$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

```r
years    <- rep3$years
nyears   <- dat3$nanos
age      <- seq(0,4,1)
nage     <- length(age)
pobsR    <- rep3$pobs_RECLAS
pobsP    <- rep3$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
```


CRUCERO DE VERANO
CRUCERO DE OTOÑO
Proporción de captura en N° a la edad
1.00
0.75
0.50
0.25
0.00
1990
1995
2000
2005
2010
2015
2020
grupos de edad
4
3
2
1
0

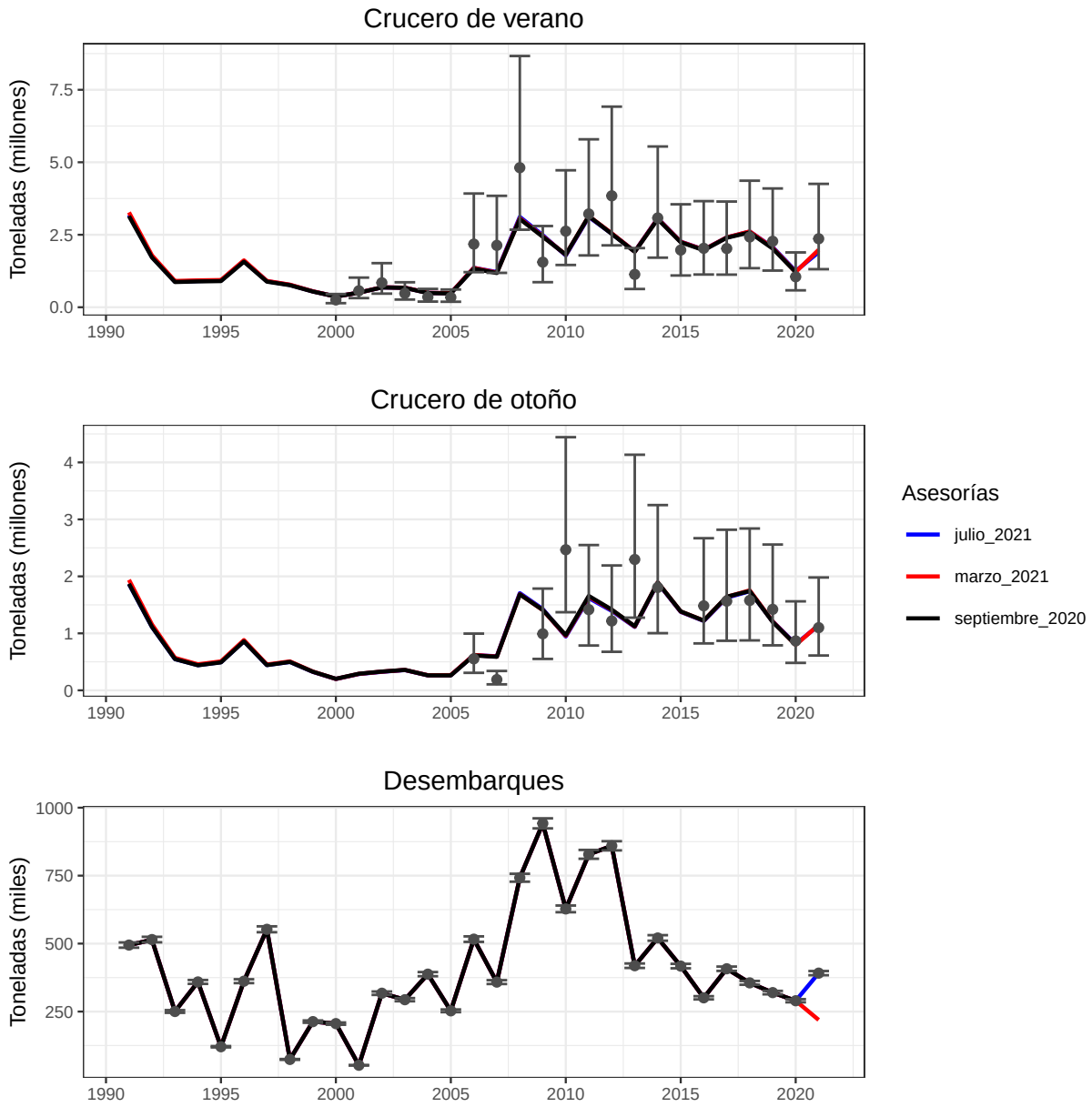
```
pobsR    <- rep3$pobs_RECLAS
pR       <- c(pobsR); pR[pR==0]  <-NA
pobsP    <- rep3$pobs_PELACES
pP       <- c(pobsP); pP[pP==0]  <-NA

years    <- rep3$years
nyears   <- dat3$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

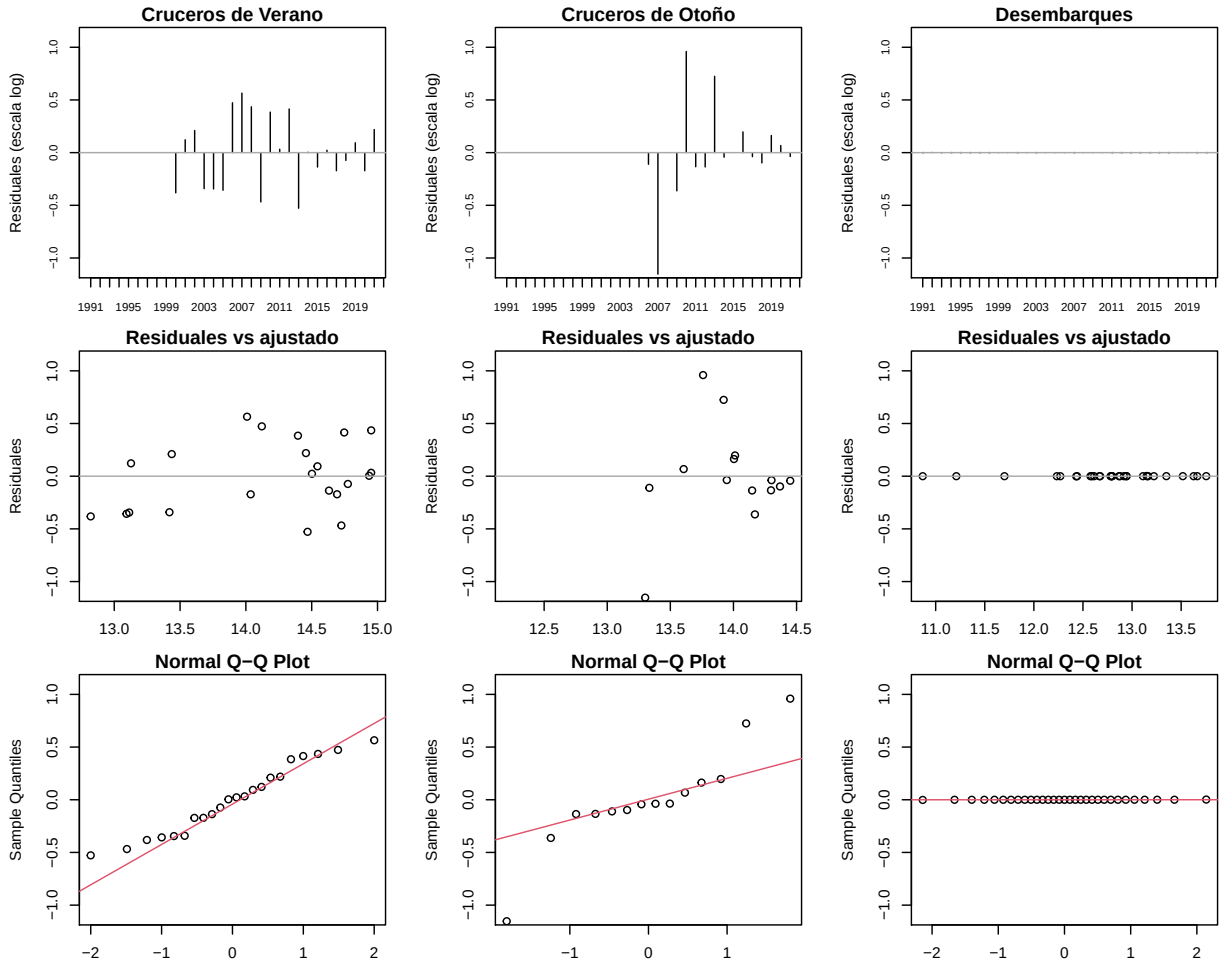
```
yrs   <- rep3$years
nyrs  <- length(yrs)
lasty <- yrs[nyrs]
cvBcV   <-0.30
cvBcO   <-0.30
cvdes   <-0.01

#-------------------------------------------------------------------------------------
ind_obs           <- cbind(c(rep3$reclasobs),
                           c(rep3$pelacesobs),
                           c(rep3$desembarqueobs)); ind_obs[ind_obs==0] <- NA
colnames(ind_obs) <- c('Crucero_verano',
                       'Crucero_otoño',
                       'Desembarques')
#-------------------------------------------------------------------------------------
ind_sept           <- cbind(c(rep1$reclaspred,NA),
                            c(rep1$pelacespred,NA),
                            c(rep1$desembarquepred,NA))
colnames(ind_sept) <- c('Crucero_verano',
                        'Crucero_otoño',
                        'Desembarques')
#-------------------------------------------------------------------------------------
ind_marzo           <- cbind(c(rep2$reclaspred),
                             c(rep2$pelacespred),
                             c(rep2$desembarquepred))
colnames(ind_marzo) <- c('Crucero_verano',
                         'Crucero_otoño',
                         'Desembarques')
#-------------------------------------------------------------------------------------
ind_julio           <- cbind(c(rep3$reclaspred),
                             c(rep3$pelacespred),
                             c(rep3$desembarquepred))
colnames(ind_julio) <- 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'))
#=====================================================================
marzo             <- data.frame(ind_marzo) %>%
                     mutate (Asesoria='marzo_2021') %>%
                     mutate (yrs= yrs)  %>%
                     melt(id.var=c('yrs', 'Asesoria'))
#=====================================================================
julio             <- data.frame(ind_julio) %>%
```

```
                      mutate (Asesoria='julio_2021') %>%
                      mutate (yrs= yrs)  %>%
                      melt(id.var=c('yrs', 'Asesoria'))
#-------------------------------------------------------------------------------
base1 <- data.frame(rbind(ind, sept,marzo,julio))
#################################################################################################################
# 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('blue','red','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")

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('blue','red','black'),name="Asesorías") +
       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))

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('blue','red','black')) +
       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=9) +
       ggtitle('Desembarques') +
       theme(plot.title = element_text(hjust = 0.5),legend.position="none")

BcV/BcP/d + plot_layout(guides="collect")
```

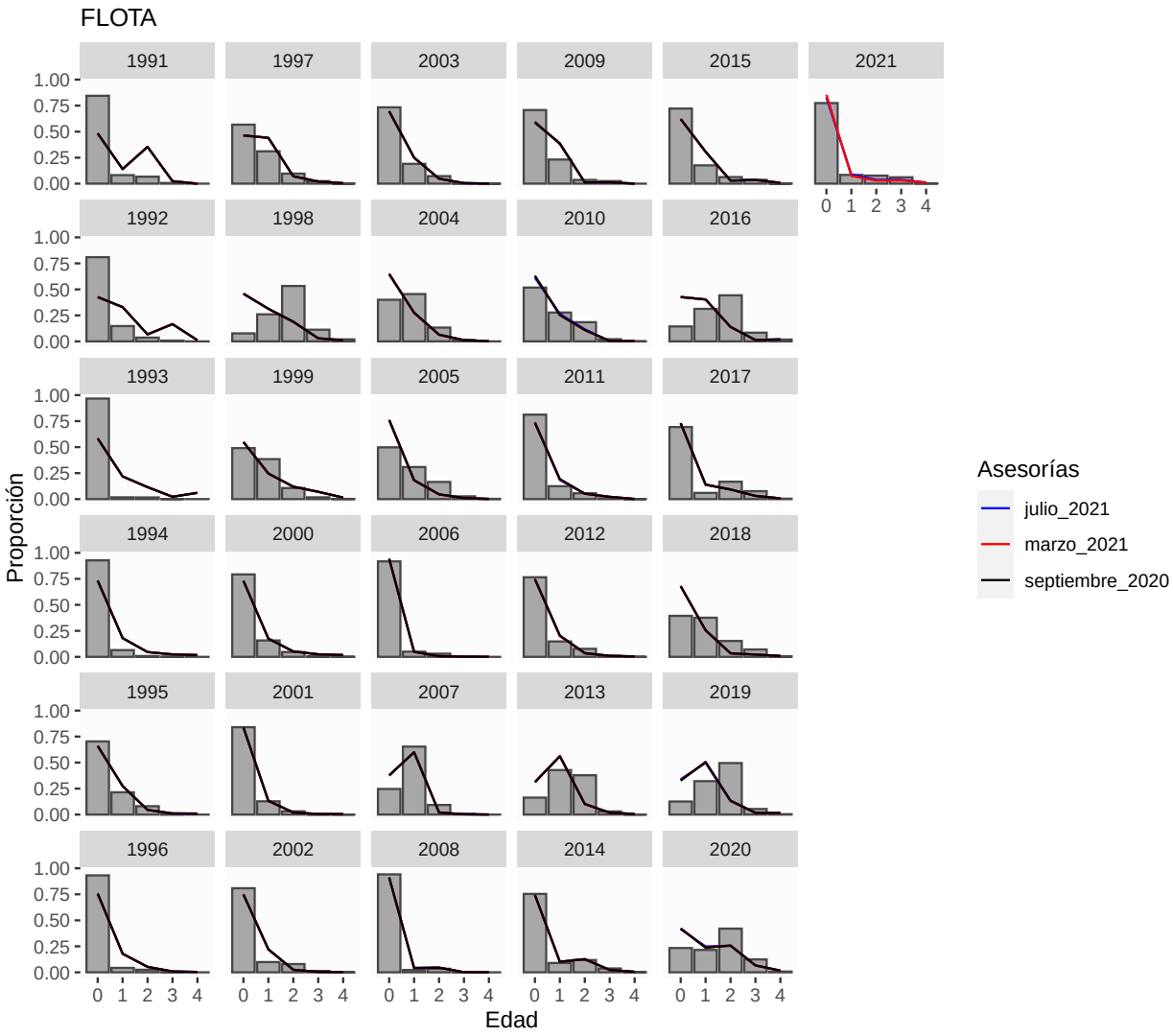

Crucero de verano
Toneladas (millones)
7.5
5.0
2.5
0.0
1990
1995
2000
2005
2010
2015
2020
Crucero de otoño
Toneladas (millones)
4
3
2
1
0
Asesorías
julio_2021
marzo_2021
septiembre_2020
Desembarques
Toneladas (miles)
1000
750
500
250

```
# I. INDICES DE ABUNDANCIA                                                    #
years  <- dat3$Ind[,1]
nyears <- dat3$nanos
age    <- seq(0,4,1)
nage   <- dat3$nedades
Amax   <- dat3$nedades
Age    <- seq(0,4,1)
#Observado
obsR <- rep3$reclasobs       ;obsR[obsR<=1] <-NA
obsP <- rep3$pelacesobs      ;obsP[obsP<=1] <-NA
obsM <- rep3$mphobs          ;obsM[obsM<=1] <-NA
obsD <- rep3$desembarqueobs
#predicho                   #stdpredicho
predR <- rep3$reclaspred
predP <- rep3$pelacespred
predM <- rep3$mphpred
predD <- rep3$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)
```

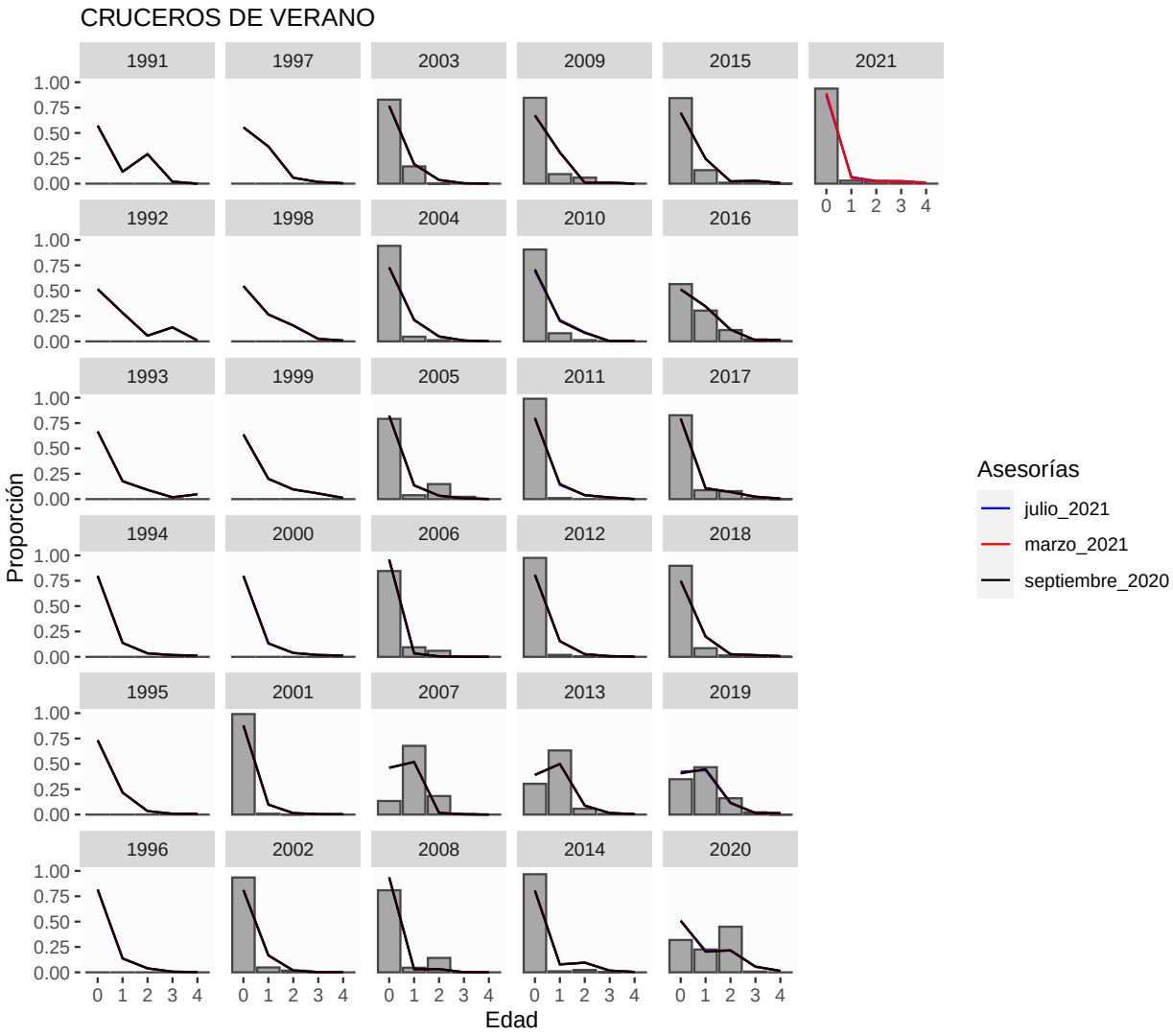
```r
par(mfcol=c(3,3),mar=c(2,4,1,1)+0.5)

 plot(years,Res_reclas,xaxp=x1,cex.axis=0.8,ylim=c(-1.1,1.1),type="h",main="Cruceros de Verano",ylab="R
    #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="
    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
    #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=
    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="Residua
#   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="
    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)
```


Cruceros de Verano
Cruceros de Otoño
Desembarques
Residuales (escala log)
Residuales vs ajustado
Residuales
Normal Q−Q Plot
Sample Quantiles

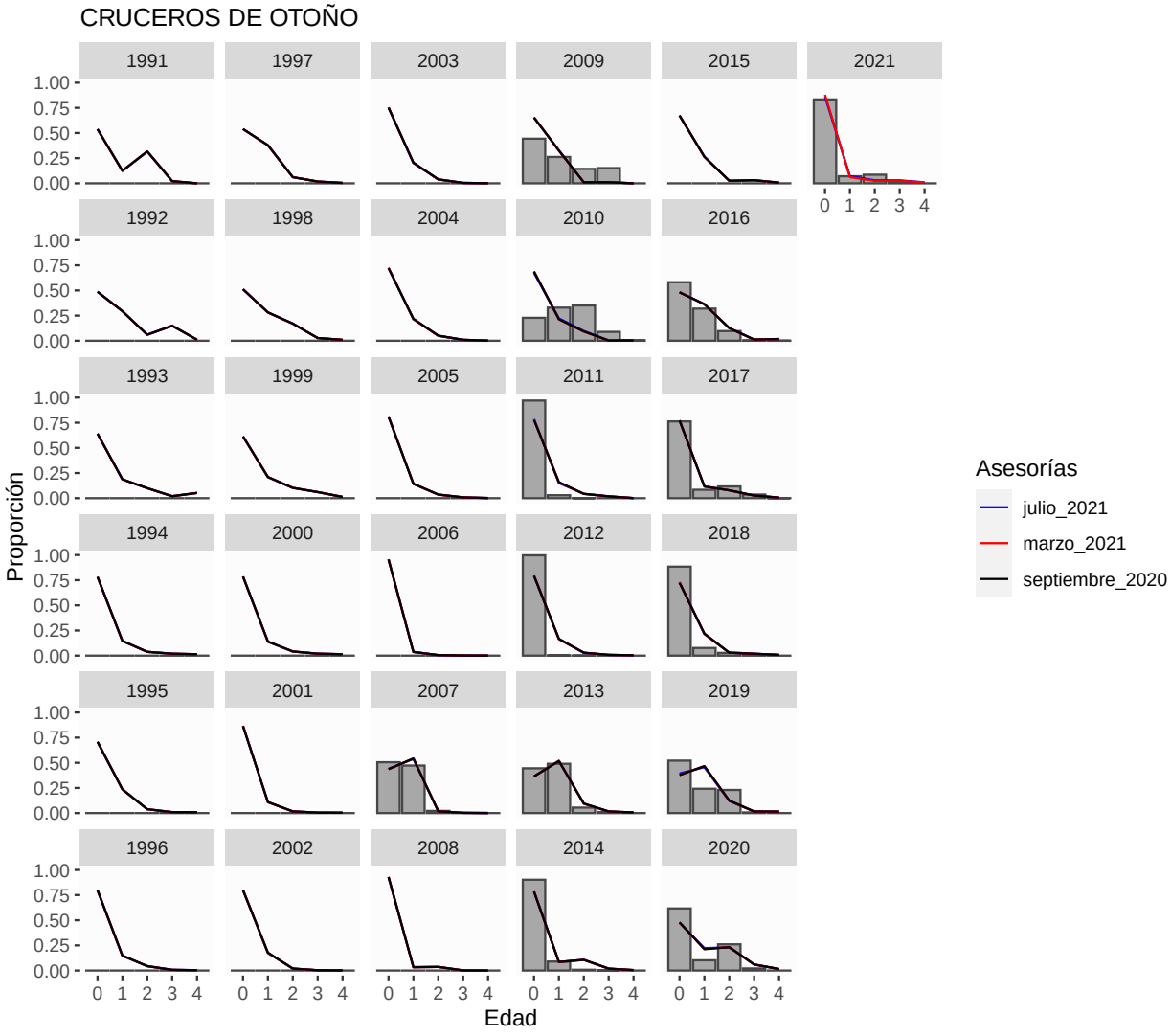
```r
years   <- dat3$Ind[,1]
nyears  <- length(years)
age     <- seq(0,4,1)
nage    <- length(age)

etcf1_obs <- data.frame(rep3$pf_obs)
etcf1_pre <- rbind(rep1$pf_pred,rep(NA,nage))
etcf2_pre <- rep2$pf_pred
etcf3_pre <- rep3$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_2020')

 pred_marzo <- as.data.frame(etcf2_pre) %>%
               mutate(year=years) %>%
               melt(id.vars='year') %>%
               mutate(edad = rep(age, each=nyears)) %>%
               mutate(type='marzo_2021')

 pred_julio <- as.data.frame(etcf3_pre) %>%
               mutate(year=years) %>%
               melt(id.vars='year') %>%
               mutate(edad = rep(age, each=nyears)) %>%
               mutate(type='julio_2021')

  mat  <- rbind(obs,pred_sep,pred_marzo,pred_julio)

  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)) +
          scale_colour_manual(values=c('blue','red','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
julio_2021
marzo_2021
septiembre_2020

```r
years   <- dat3$Ind[,1]
nyears  <- length(years)
age     <- seq(0,4,1)
nage    <- length(age)

etcf1_obs <- data.frame(rep3$pobs_RECLAS)
etcf1_pre <- rbind(rep1$ppred_RECLAS,rep(NA,nage))
etcf2_pre <- rep2$ppred_RECLAS
etcf3_pre <- rep3$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_2020')

 pred_marzo <- as.data.frame(etcf2_pre) %>%
               mutate(year=years) %>%
               melt(id.vars='year') %>%
               mutate(edad = rep(age, each=nyears)) %>%
               mutate(type='marzo_2021')

 pred_julio <- as.data.frame(etcf3_pre) %>%
               mutate(year=years) %>%
               melt(id.vars='year') %>%
               mutate(edad = rep(age, each=nyears)) %>%
               mutate(type='julio_2021')

  mat  <- rbind(obs,pred_sep,pred_marzo,pred_julio)

  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)) +
          scale_colour_manual(values=c('blue','red','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
```

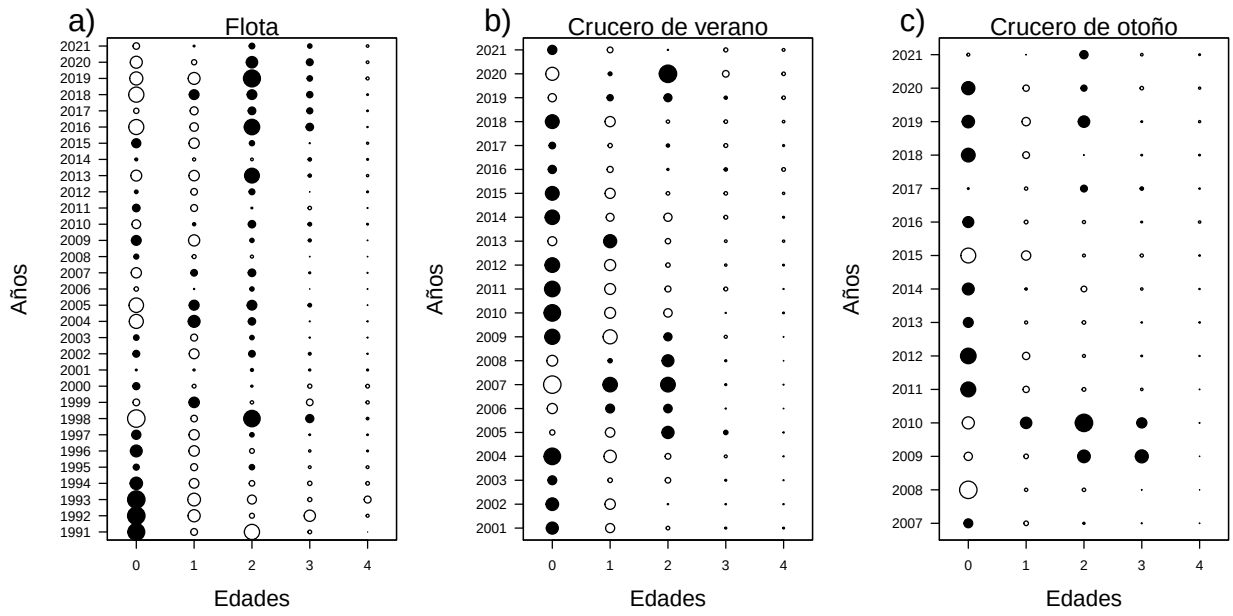

CRUCEROS DE VERANO
1991
1997
2003
2009
2015
2021
1992
1998
2004
2010
2016
1993
1999
2005
2011
2017
1994
2000
2006
2012
2018
1995
2001
2007
2013
2019
1996
2002
2008
2014
2020
Proporción
1.00
0.75
0.50
0.25
0.00
0 1 2 3 4
Edad
Asesorías
julio_2021
marzo_2021
septiembre_2020

```r
years   <- dat3$Ind[,1]
nyears  <- length(years)
age     <- seq(0,4,1)
nage    <- length(age)

etcf1_obs <- data.frame(rep3$pobs_PELACES)
etcf1_pre <- rbind(rep1$ppred_PELACES,rep(NA,nage))
etcf2_pre <- rep2$ppred_PELACES
etcf3_pre <- rep3$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_2020')

 pred_marzo <- as.data.frame(etcf2_pre) %>%
               mutate(year=years) %>%
               melt(id.vars='year') %>%
               mutate(edad = rep(age, each=nyears)) %>%
               mutate(type='marzo_2021')

 pred_julio <- as.data.frame(etcf3_pre) %>%
               mutate(year=years) %>%
               melt(id.vars='year') %>%
               mutate(edad = rep(age, each=nyears)) %>%
               mutate(type='julio_2021')

  mat  <- rbind(obs,pred_sep,pred_marzo,pred_julio)

  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)) +
          scale_colour_manual(values=c('blue','red','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
julio_2021
marzo_2021
septiembre_2020

```
ppredF<-rep3$pf_pred
ppredR<-rep3$ppred_RECLAS
ppredP<-rep3$ppred_PELACES

#DESEMBARQUES
anos <-dat3$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()
```


a)
Flota
b)
Crucero de verano
c)
Crucero de otoño
Años
Edades

3.2. Comparación con asesorías previas

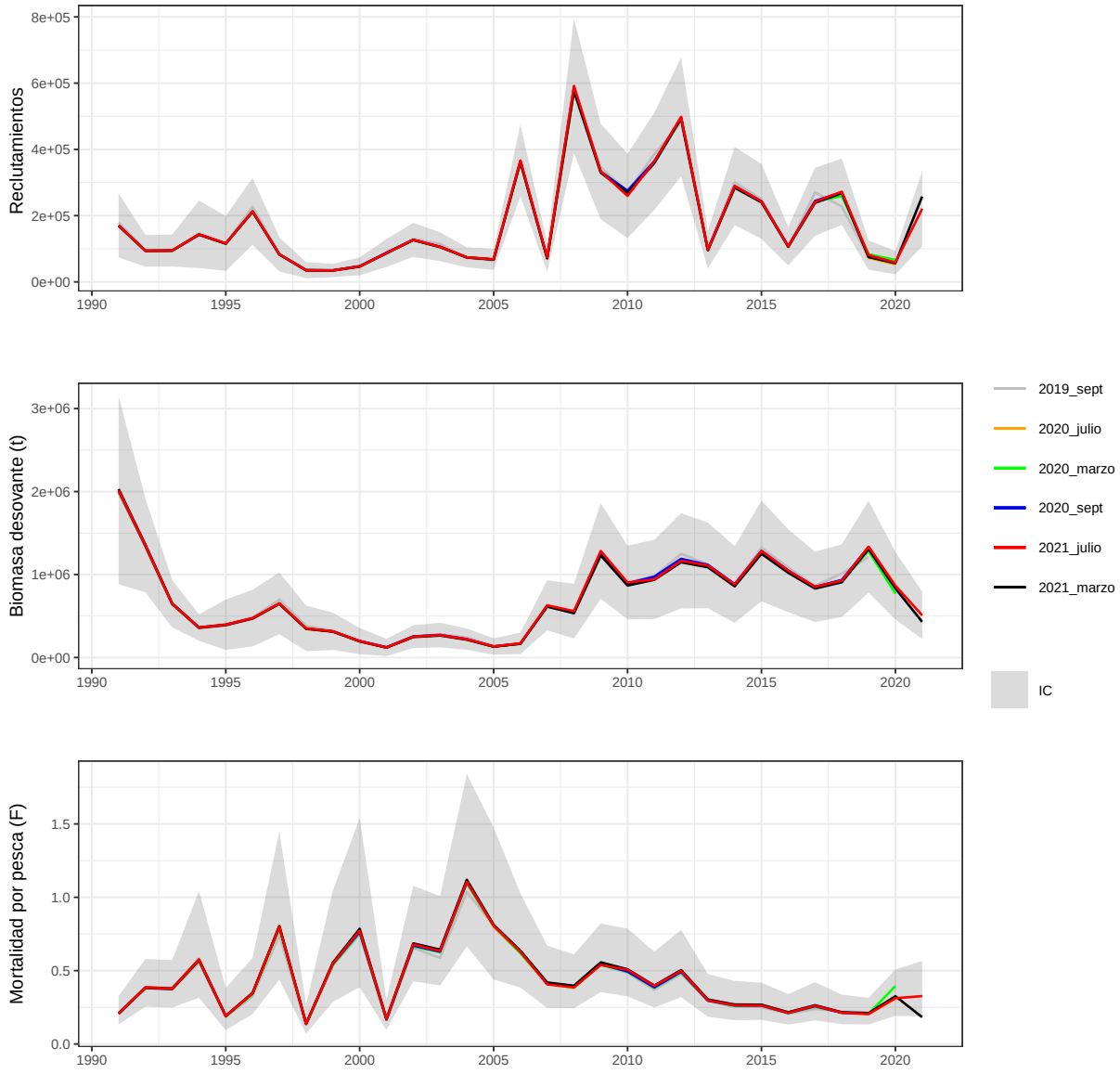
```
years<-rep3$years
nyears<-length(years)

Rt3      <- subset(std3,name=="Reclutas")$value
Rt3std   <- subset(std3,name=="Reclutas")$std
BT3      <- subset(std3,name=="BT")$value
BT3std   <- subset(std3,name=="BT")$std
BD3      <- subset(std3,name=="SSB")$value
BD3std   <- subset(std3,name=="SSB")$std
Ft3      <- subset(std3,name=="log_Ft")$value
Ft3std   <- subset(std3,name=="log_Ft")$std

VarPob<- data.frame(x=years,
                    Rt3=Rt3,
                    BT3=BT3,
                    BD3=BD3,
                    Ft3=exp(Ft3),
         lowerRt3 = (Rt3 -1.96*Rt3std),
         upperRt3 = (Rt3 +1.96*Rt3std),
         lowerBT3 = (BT3 -1.96*BT3std),
         upperBT3 = (BT3 +1.96*BT3std),
         lowerBD3 = (BD3 -1.96*BD3std),
         upperBD3 = (BD3 +1.96*BD3std),
         lowerFt3 = exp(Ft3 -1.96*Ft3std),
         upperFt3 = exp(Ft3 +1.96*Ft3std))
```

```
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=lowerRt3, ymax=upperRt3, 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=8) +
     ggtitle('')+
     theme(plot.title = element_text(hjust = 0.5),legend.position="none")

BD <- ggplot(SSBtcomp) +
     geom_ribbon(data=VarPob,aes(ymin=lowerBD3, ymax=upperBD3, 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=8) +
     ggtitle('')+
     theme(plot.title = element_text(hjust = 0.5))

Ft <- ggplot(Ftcomp) +
    geom_ribbon(data=VarPob,aes(ymin=lowerFt3, ymax=upperFt3, 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 (F)',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=8) +
    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 (F)
1.5
1.0
0.5
0.0
2019_sept
2020_julio
2020_marzo
2020_sept
2021_julio
2021_marzo
IC

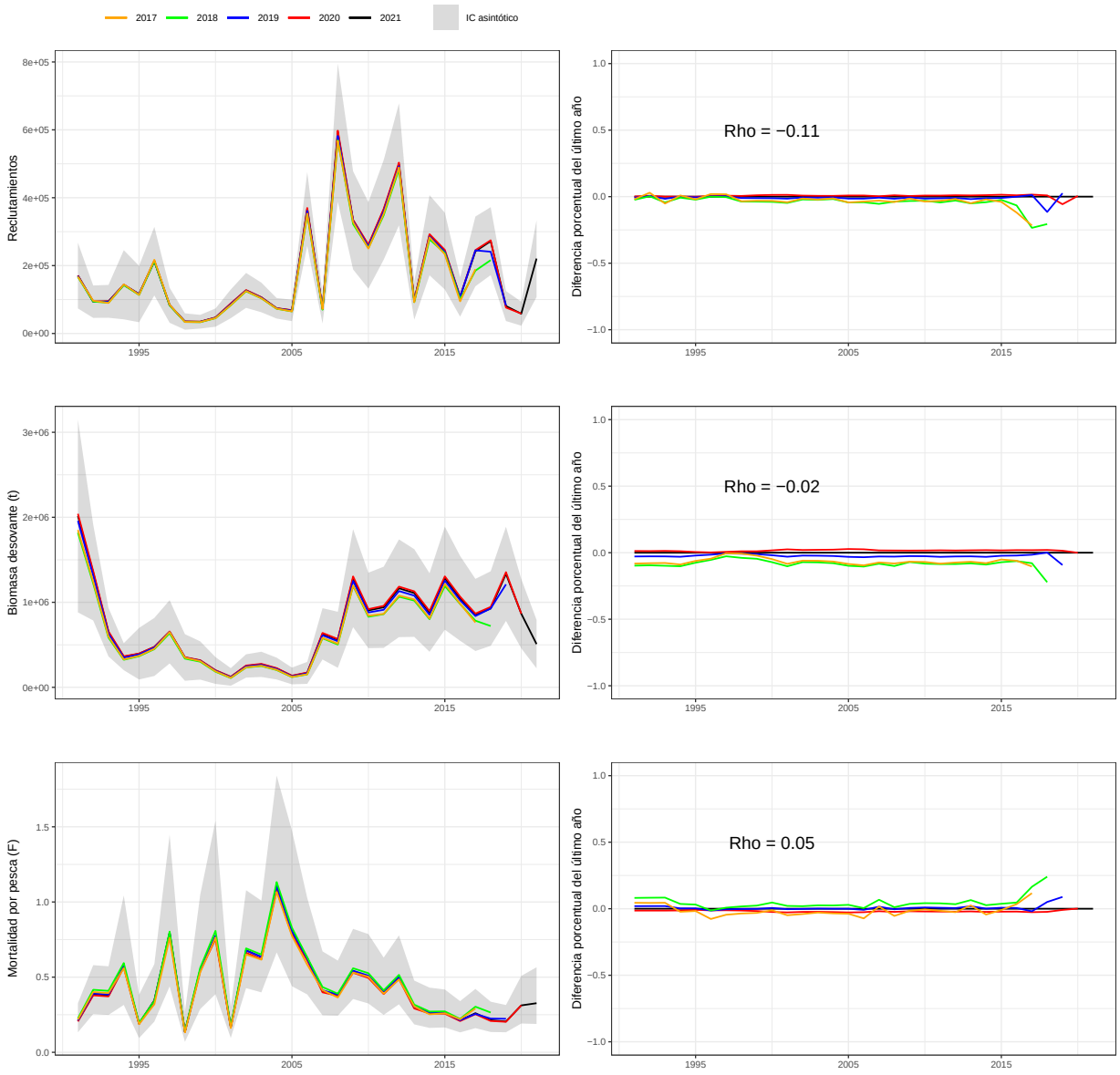
3.3. Análisis retrospectivo

```
dir<-paste(dir.0,"/Retrospectivo_jul",sep="")
setwd(dir)
admb<-"MAE0721"

years<-rep3$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 = (Rt3 -1.96*Rt3std),
                      upper = (Rt3 +1.96*Rt3std))
```

```
BD_retro<- data.frame(x=years,
                      y1=retroBD[,2],
                      y2=retroBD[,3],
                      y3=retroBD[,4],
                      y4=retroBD[,5],
                      y5=retroBD[,6],
                      lower = (BD3 -1.96*BD3std),
                      upper = (BD3 +1.96*BD3std))
Ft_retro<- data.frame(x=years,
                      y1=retroF[,2],
                      y2=retroF[,3],
                      y3=retroF[,4],
                      y4=retroF[,5],
                      y5=retroF[,6],
                      lower = exp(Ft3 -1.96*Ft3std),
                      upper = exp(Ft3 +1.96*Ft3std))

#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])
```

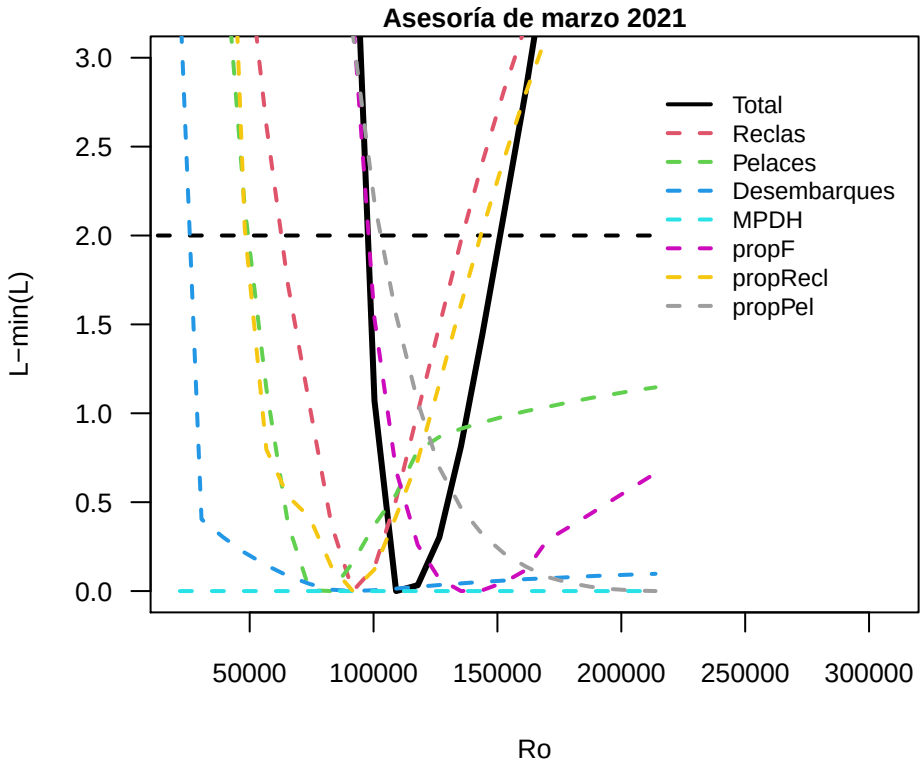
```
#Retrospectivo tradicional
Rt <- ggplot(Rt_retro) +
    geom_ribbon(aes(ymin=lower, ymax=upper, x=x, fill = "IC asintótico"), alpha = 0.2)+
    geom_line(aes(y=y1, x=x, colour = year_retros[nretros]), size=0.5)+
    geom_line(aes(y=y2, x=x, colour = year_retros[nretros-1]), size=0.5)+
    geom_line(aes(y=y3, 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=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)+
    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=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)+
    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 (F)',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=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)+
    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=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)+
    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=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)+
    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=8) +
    ggtitle('')+
    theme(plot.title = element_text(hjust = 0.5),legend.position="none")

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


2017
2018
2019
2020
2021
IC asintótico
Reclutamientos
Biomasa desovante (t)
Mortalidad por pesca (F)
Diferencia porcentual del último año
Rho = −0.11
Rho = −0.02
Rho = 0.05
1995
2005
2015

3.4. Perfil de verosimilitud

```
dir<-paste(dir.0,"/Verosimilitud_jul",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,"/MAE0721s",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 de marzo 2021',cex.main=0.8,cex.axis=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)
```



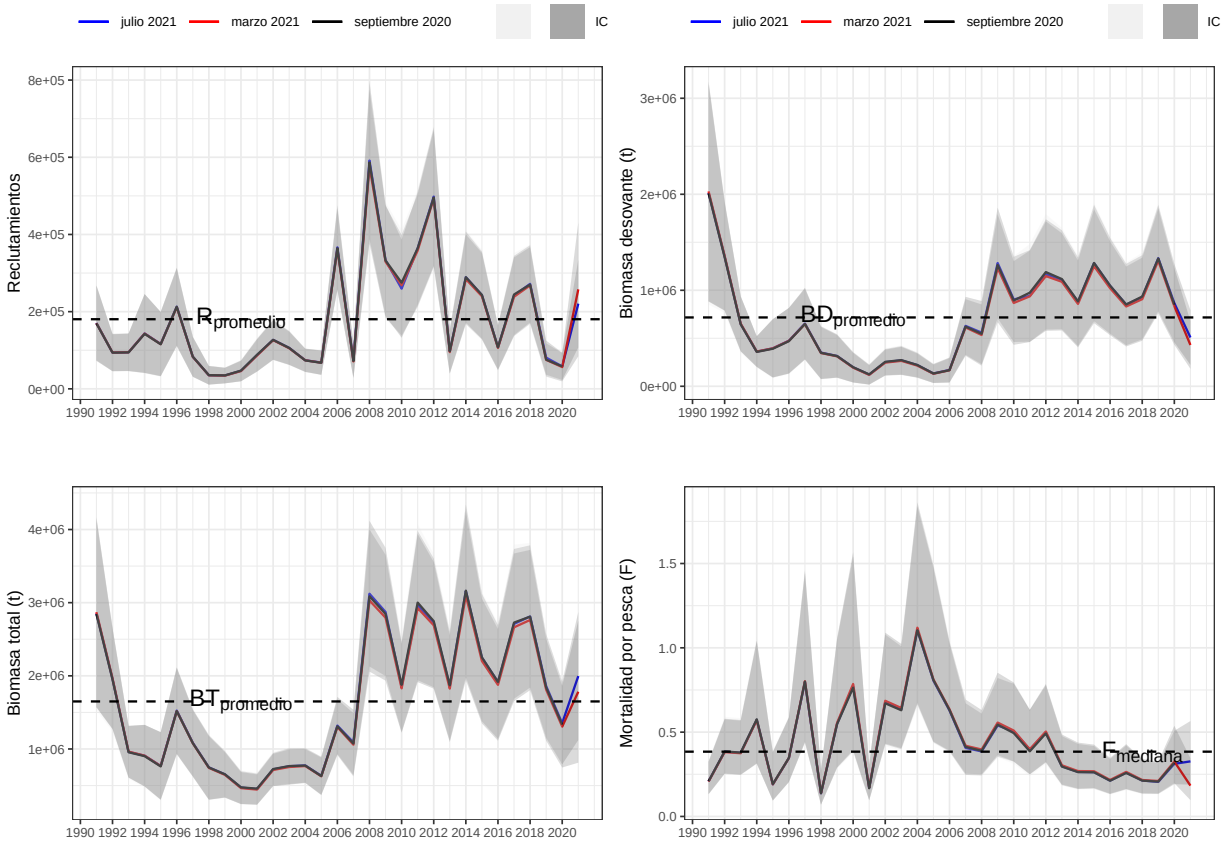

```
#legend(230000,1.5,names[9:14],col=9:14,lty=3,lwd=2,bty="n",cex=0.8)
```

3.5. Variables poblacionales

```
years1<-rep3$years
nyears1<-length(years1)

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

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))
```

```
years2<-rep2$years
nyears2<-length(years2)

Rt2      <- subset(std2,name=="Reclutas")$value
Rt2std   <- subset(std2,name=="Reclutas")$std
BT2      <- subset(std2,name=="BT")$value
BT2std   <- subset(std2,name=="BT")$std
BD2      <- subset(std2,name=="SSB")$value
BD2std   <- subset(std2,name=="SSB")$std
Ft2      <- subset(std2,name=="log_Ft")$value
Ft2std   <- subset(std2,name=="log_Ft")$std

VarPobMar<- data.frame(x=years2,
                       Rt2=Rt2,
                       BT2=BT2,
                       BD2=BD2,
                       Ft2=exp(Ft2),
         lowerRt2 = (Rt2 -1.96*Rt2std),
         upperRt2 = (Rt2+1.96*Rt2std),
         lowerBT2 = (BT2 -1.96*BT2std),
         upperBT2 = (BT2+1.96*BT2std),
         lowerBD2 = (BD2 -1.96*BD2std),
         upperBD2 = (BD2+1.96*BD2std),
         lowerFt2 = exp(Ft2 -1.96*Ft2std),
         upperFt2 = exp(Ft2+1.96*Ft2std))
```

```
years3   <- rep3$years
nyears3  <- length(years3)

Rt3      <- subset(std3,name=="Reclutas")$value
Rt3std   <- subset(std3,name=="Reclutas")$std
BT3      <- subset(std3,name=="BT")$value
BT3std   <- subset(std3,name=="BT")$std
BD3      <- subset(std3,name=="SSB")$value
BD3std   <- subset(std3,name=="SSB")$std
Ft3      <- subset(std3,name=="log_Ft")$value
Ft3std   <- subset(std3,name=="log_Ft")$std

VarPobJul<- data.frame(x=years3,
                       Rt3=Rt3,
                       BT3=BT3,
                       BD3=BD3,
                       Ft3=exp(Ft3),
         lowerRt3 = (Rt3 -1.96*Rt3std),
         upperRt3 = (Rt3 +1.96*Rt3std),
         lowerBT3 = (BT3 -1.96*BT3std),
         upperBT3 = (BT3 +1.96*BT3std),
         lowerBD3 = (BD3 -1.96*BD3std),
         upperBD3 = (BD3 +1.96*BD3std),
         lowerFt3 = exp(Ft3 -1.96*Ft3std),
         upperFt3 = exp(Ft3 +1.96*Ft3std))
```


julio 2021
marzo 2021
septiembre 2020
IC
Reclutamientos
$R_{promedio}$
Biomasa desovante (t)
$BD_{promedio}$
Biomasa total (t)
$BT_{promedio}$
Mortalidad por pesca (F)
$F_{mediana}$

```
yearsb<-c("1990/91","1991/92","1992/93","1993/94","1994/95","1995/96","1996/97","1997/98","1998/99","19

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


Rt2      <- subset(std2,name=="Reclutas")$value
Rt2std   <- subset(std2,name=="Reclutas")$std
BT2      <- subset(std2,name=="BT")$value
BT2std   <- subset(std2,name=="BT")$std
BD2      <- subset(std2,name=="SSB")$value
BD2std   <- subset(std2,name=="SSB")$std
Ft2      <- subset(std2,name=="log_Ft")$value
Ft2std   <- subset(std2,name=="log_Ft")$std


Rt3      <- subset(std3,name=="Reclutas")$value
Rt3std   <- subset(std3,name=="Reclutas")$std
BT3      <- subset(std3,name=="BT")$value
BT3std   <- subset(std3,name=="BT")$std
BD3      <- subset(std3,name=="SSB")$value
BD3std   <- subset(std3,name=="SSB")$std
Ft3      <- subset(std3,name=="log_Ft")$value
Ft3std   <- subset(std3,name=="log_Ft")$std



VarPobl1<- cbind('Año'=yearsb,
                 "$BD_{sept}$"=c(BD1),
                 "$BD_{marzo}$"=c(BD2),
                 "$BD_{julio}$"=c(BD3),
                 "$BT_{sept}$"=c(BT1),
                 "$BT_{marzo}$"=c(BT2),
                 "$BT_{julio}$"=c(BT3),
                 "$R_{sept}$"=c(Rt1),
                 "$R_{marzo}$"=c(Rt2),
                 "$R_{julio}$"=c(Rt3),
                 "$F_{sept}$"=c(round(exp(Ft1),3)),
                 "$F_{marzo}$"=c(round(exp(Ft2),3)),
                 "$F_{julio}$"=c(round(exp(Ft3),3)))
kable(VarPobl1)
```

Año	BD_{sept}	BD_{marzo}	BD_{julio}	BT_{sept}	BT_{marzo}	BT_{julio}	R_{sept}	R_{marzo}	R_{julio}	F_{sept}	F_{marzo}	F_{julio}
1990/91	2008700	2030000	2015300	2844200	2870400	2854300	169670	170120	170630	0.209	0.207	0.208
1991/92	1344500	1358500	1350900	1949500	1966700	1956800	93768	94041	93682	0.386	0.382	0.384
1992/93	645250	652550	648820	955290	964360	960030	94409	94707	94725	0.379	0.375	0.377
1993/94	358150	362070	360600	902180	909000	908400	142470	143180	143530	0.576	0.57	0.573

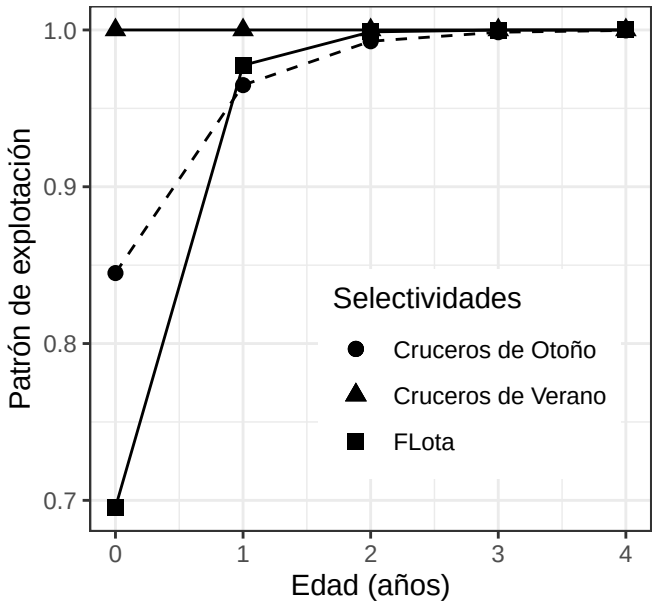
Año	BD_{sept}	BD_{marzo}	BD_{julio}	BT_{sept}	BT_{marzo}	BT_{julio}	R_{sept}	R_{marzo}	R_{julio}	F_{sept}	F_{marzo}	F_{julio}
1994/95	390940	395090	395360	761620	767170	768660	115500	115760	116230	0.192	0.19	0.19
1995/96	469770	473120	474780	1518000	1517100	1525800	212650	211490	213020	0.347	0.347	0.346
1996/97	648700	647450	653280	1080200	1077600	1085400	83311	82828	83158	0.8	0.803	0.797
1997/98	348370	346010	351000	746840	741130	748560	35378	35062	35226	0.137	0.138	0.137
1998/99	314830	311640	315700	653870	646260	653380	34847	34292	34611	0.547	0.555	0.549
1999/00	198580	194090	197840	475590	465230	472670	47251	46073	46748	0.764	0.786	0.772
2000/01	123590	118470	122050	457800	444970	452850	88252	86319	87353	0.167	0.172	0.17
2001/02	254560	246340	251190	725490	713020	721540	126940	126130	126970	0.671	0.686	0.678
2002/03	272510	264590	270110	766550	753550	764360	105990	105110	106170	0.63	0.643	0.634
2003/04	221470	215090	220630	773620	767100	775240	73689	73955	74125	1.104	1.12	1.106
2004/05	132870	130190	133660	629360	626840	633930	67496	67638	68038	0.809	0.813	0.805
2005/06	167690	166450	170010	1310300	1299600	1320300	364340	361230	366690	0.631	0.636	0.629
2006/07	621470	612730	629200	1074400	1058400	1090200	72290	70839	73959	0.412	0.419	0.407
2007/08	546580	533910	558930	3087000	3029800	3122400	586530	576230	591500	0.389	0.397	0.385
2008/09	1263800	1230300	1284000	2846100	2794700	2872900	332590	329460	333220	0.545	0.557	0.539
2009/10	894040	867720	904670	1877000	1828600	1850700	275020	268470	259540	0.494	0.509	0.505
2010/11	974810	936800	941410	3000800	2926400	2960200	364240	358290	364100	0.386	0.398	0.396
2011/12	1189500	1147700	1165300	2747600	2690600	2724700	495590	492960	498210	0.493	0.504	0.498
2012/13	1116600	1088100	1109400	1869900	1824500	1860300	97434	95115	97216	0.296	0.303	0.298
2013/14	883910	857790	880190	3164100	3096700	3161000	289240	284180	289420	0.263	0.269	0.264
2014/15	1284500	1250400	1283600	2252000	2202700	2249700	243240	240020	242790	0.262	0.268	0.263
2015/16	1047700	1021300	1046400	1916400	1876300	1915700	107500	106000	107630	0.212	0.217	0.212
2016/17	851980	831090	851360	2728000	2663200	2709900	244410	238570	241840	0.258	0.264	0.26
2017/18	934650	907150	926840	2809100	2763000	2811800	270150	267990	272080	0.213	0.216	0.213
2018/19	1331300	1307200	1334800	1841000	1811000	1860400	75649	75099	80881	0.207	0.21	0.205
2019/20	849310	832960	866180	1333000	1305400	1353600	58067	56309	58250	0.319	0.326	0.312
2020/21	NA	430060	508480	NA	1782600	1996700	NA	257750	220680	NA	0.183	0.327

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

```r
# Reclutimientos asesoría marzo 2021
Rprom_1991_2007<-mean(Rt3[1:17])
Rprom_2008_2012<-mean(Rt3[18:22])
Rprom_2013_2021<-mean(Rt3[23:31])
Rprom_2013_2020<-mean(Rt3[23:30])
Rprom_historico<-mean(Rt3)

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-(Rt3[31]/Rprom_1991_2007)
Rlast_2008_2012<-1-(Rt3[31]/Rprom_2008_2012)
Rlast_2013_2021<-1-(Rt3[31]/Rprom_2013_2021)
Rlast_2013_2020<-1-(Rt3[31]/Rprom_2013_2020)
Rlast_historico<-1-(Rt3[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(BT3[1:17])
BTprom_2008_2012<-mean(BT3[18:22])
BTprom_2013_2021<-mean(BT3[23:31])
BTprom_2013_2020<-mean(BT3[23:30])
BTprom_historico<-mean(BT3)

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-(BT3[31]/BTprom_1991_2007)
BTlast_2008_2012<-1-(BT3[31]/BTprom_2008_2012)
BTlast_2013_2021<-1-(BT3[31]/BTprom_2013_2021)
BTlast_2013_2020<-1-(BT3[31]/BTprom_2013_2020)
BTlast_historico<-1-(BT3[31]/BTprom_historico)

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

```r
# Biomasa desovante (BD) asesoría marzo 2021

BDprom_1991_2007<-mean(BD3[1:17])
BDprom_2008_2012<-mean(BD3[18:22])
BDprom_2013_2021<-mean(BD3[23:31])
BDprom_2013_2020<-mean(BD3[23:30])
BDprom_historico<-mean(BD3)

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

#diferencia del BD último año y los promedios de los tres períodos principales
BDlast_1991_2007<-1-(BD3[31]/BDprom_1991_2007)
BDlast_2008_2012<-1-(BD3[31]/BDprom_2008_2012)
BDlast_2013_2021<-1-(BD3[31]/BDprom_2013_2021)
BDlast_2013_2020<-1-(BD3[31]/BDprom_2013_2020)
BDlast_historico<-1-(BD3[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")
```

```r
sel_Flota<-rep3$Sel_flota[1,]
sel_CruV <-rep3$Sel_reclas[1,]
sel_CruO <-rep3$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.
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)
```

```r
#PBR año biologico
Amax        <- dat2$nedades
Fmort       <- seq(0,3.5,0.02)
nf          <- length(Fmort)
R0            <- 1
#datos de entrada
Dat<-list()
Dat$M           <- dat2$par[5]
Dat$Tspw      <- dat2$Dt[3]
Dat$Mad     <- dat2$madurezsexual
Dat$Wmed      <- colMeans(dat2$Wmed)
Dat$Wini      <- colMeans(dat2$Wini)
Dat$Sel     <- rep2$Sel_flota[1,]

Rmed2        <- mean(Rt2)
Bmed2        <- mean(BD2)
Fmedian2     <- exp(median(Ft2))

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

SPR2            <- SPRFmort(Rmed2,c(0,Fobj$par,Fmedian2,rep2$Ftot[25]),Amax,Dat)
pSPR_Fmh2    <- as.numeric(SPR2[13,4])                    # Paso 2: Cálculo de la curva SPR
pB_Fmh2      <- pSPR_Fmh2-0.05                            # Paso 3: Aproximación obtención de %BD(Fmh)
SPRcurv2        <- SPRFmort(R0,Fmort,Amax,Dat)
```

```r
#PBR año biologico
Amax        <- dat3$nedades
Fmort       <- seq(0,3.5,0.02)
nf          <- length(Fmort)
R0            <- 1
#datos de entrada
Dat<-list()
Dat$M           <- dat3$par[5]
Dat$Tspw      <- dat3$Dt[3]
Dat$Mad     <- dat3$madurezsexual
Dat$Wmed      <- colMeans(dat3$Wmed)
Dat$Wini      <- colMeans(dat3$Wini)
Dat$Sel     <- rep3$Sel_flota[1,]

Rmed3        <- mean(Rt3)
Bmed3        <- mean(BD3)
Fmedian3     <- exp(median(Ft3))

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

SPR3            <- SPRFmort(Rmed3,c(0,Fobj$par,Fmedian3,rep3$Ftot[25]),Amax,Dat)
pSPR_Fmh3    <- as.numeric(SPR3[13,4])                    # Paso 2: Cálculo de la curva SPR
pB_Fmh3      <- pSPR_Fmh3-0.05                            # Paso 3: Aproximación obtención de %BD(Fmh)
SPRcurv3        <- SPRFmort(R0,Fmort,Amax,Dat)
```

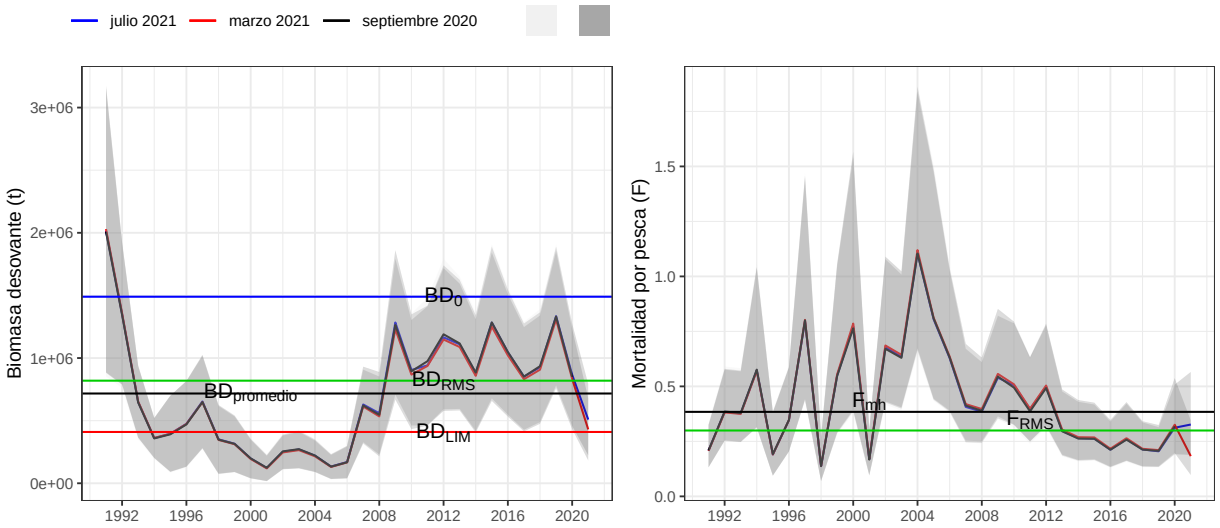
```r
# ASESORÍA DE SEPTIEMBRE
Bo1           <- rep1$SSBpbr[1]                          # Paso 4: Obtenci?n de Bo
BRMS1         <- rep1$SSBpbr[3]                          # Paso 5: Obtenci?n de Brms = 60%SPRo = 55%Bo
FRMS1         <- rep1$Fs[2]
BLIM1         <- Bo1*0.275                               # Paso 6: Obtenci?n de Blim = 20%Bo
FLIM1         <- rep1$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
```

```
# ASESORÍA DE SEPTIEMBRE
Bo2           <- rep2$SSBpbr[1]                    # Paso 4: Obtenci?n de Bo
BRMS2         <- rep2$SSBpbr[3]                    # Paso 5: Obtenci?n de Brms = 60%SPRo = 55%Bo
FRMS2         <- rep2$Fs[2]
BLIM2         <- Bo2*0.275                         # Paso 6: Obtenci?n de Blim = 20%Bo
FLIM2         <- rep2$Fs[3]                        # Paso 6: Obtenci?n de Flim = 30%SPRo
SpB2          <- BD2                              # BD serie hist?rica de evaluaci?n de stock
SpBSE2        <- BD2std                           # desviaci?n estandar BD
ln_Fyr2       <- Ft2                               # logaritmo de Ft
ln_FSE2       <- Ft2std                            # logaritmo de la desviaci?n standar de Ft
```

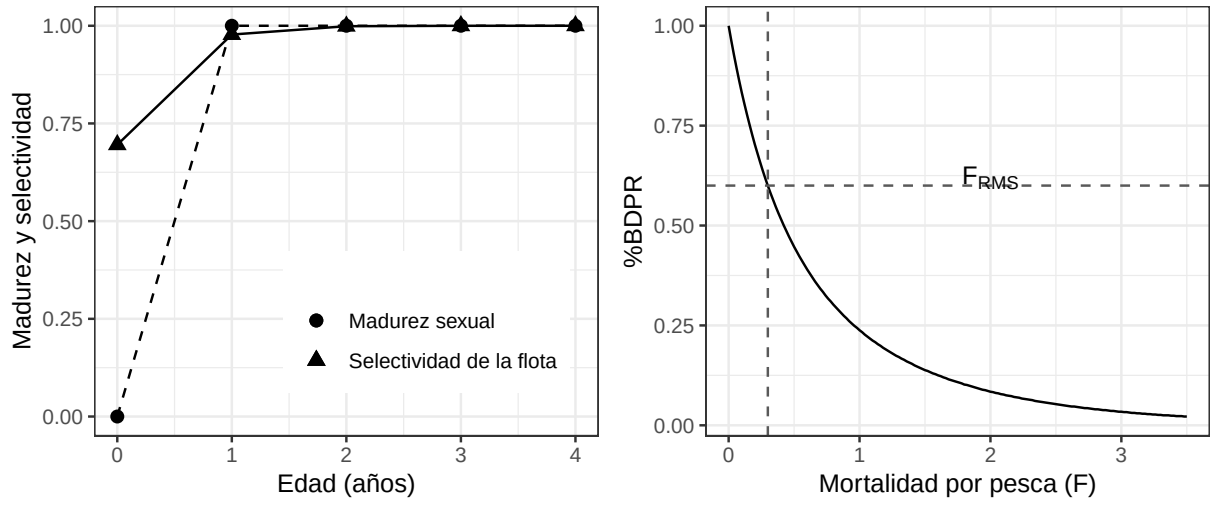
```
# ASESORÍA DE SEPTIEMBRE
Bo3           <- rep3$SSBpbr[1]                    # Paso 4: Obtenci?n de Bo
BRMS3         <- rep3$SSBpbr[3]                    # Paso 5: Obtenci?n de Brms = 60%SPRo = 55%Bo
FRMS3         <- rep3$Fs[2]
BLIM3         <- Bo3*0.275                         # Paso 6: Obtenci?n de Blim = 20%Bo
FLIM3         <- rep3$Fs[3]                        # Paso 6: Obtenci?n de Flim = 30%SPRo
SpB3          <- BD3                              # BD serie hist?rica de evaluaci?n de stock
SpBSE3        <- BD3std                           # desviaci?n estandar BD
ln_Fyr3       <- Ft3                               # logaritmo de Ft
ln_FSE3       <- Ft3std                            # logaritmo de la desviaci?n standar de Ft
```

```
Tabla3.1<-rbind( "BDpromedio"=c(round(Bmed1/10^3,0),
                                round(Bmed2/10^3,0),
                                round(Bmed3/10^3,0)),
                 "Fmh"=c(round(Fmedian1,2),
                         round(Fmedian2,2),
                         round(Fmedian3,2)),
                 "%BDPR_Fmh"=c(pSPR_Fmh1*100,
                               pSPR_Fmh2*100,
                               pSPR_Fmh3*100),
                 "%BDPR_F~RMS~"=c(60,
                                  60,
                                  60),
                 "%BD_Fmh"=c(pB_Fmh1*100,
                             pB_Fmh2*100,
                             pB_Fmh3*100),
                 "%BD_F~RMS~"=c(55,
                                55,
                                55),
                 "BDo"=c(round(Bo1/10^3,0),
                         round(Bo2/10^3,0),
                         round(Bo3/10^3,0)),
                 "BD55%"=c(round(BRMS1/10^3,0),
                           round(BRMS2/10^3,0),
                           round(BRMS3/10^3,0)),
                 "BD27.5%"=c(round(BLIM1/10^3,0),
                             round(BLIM2/10^3,0),
                             round(BLIM3/10^3,0)))

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

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

```
BD <- ggplot() +
     geom_line(data=VarPobJul,aes(y=BD3, x=x, colour = "julio 2021"), size=0.5)+
     geom_line(data=VarPobMar,aes(y=BD2, x=x, colour = "marzo 2021"), size=0.5)+
     geom_line(data=VarPobSep,aes(y=BD1, x=x, colour = "septiembre 2020"), size=0.5)+
     geom_ribbon(data=VarPobJul,aes(ymin=lowerBD3, ymax=upperBD3, x=x, fill = "IC"), alpha = 0.2)+
     geom_ribbon(data=VarPobMar,aes(ymin=lowerBD2, ymax=upperBD2, x=x, fill = "IC"), alpha = 0.2)+
     geom_ribbon(data=VarPobSep,aes(ymin=lowerBD1, ymax=upperBD1, x=x, fill = ""), alpha = 0.2)+
     geom_hline(yintercept = c(BRMS3,BLIM3,Bo3,Bmed3),colour=c('green3','red','blue','black'))+
     annotate("text", x=c(rep(2012,3),2000), y=c(BRMS3,BLIM3,Bo3,Bmed3),
              label=c(expression("BD"[RMS]),expression("BD"[LIM]),expression("BD"[0]),expression("BD"[p
     labs(x = '', y = 'Biomasa desovante (t)',colour='Asesorías')  +
     scale_x_continuous(breaks = seq(from = 1960, to = 2022, by = 4)) +
     scale_colour_manual("",values=c('blue','red',"black"))+
     scale_fill_manual("",values=c("grey90","grey30",'gray75'))+
     theme_bw(base_size=10) +
     ggtitle('')+
     theme(plot.title = element_text(hjust = 0.5),legend.position="top")

Ft <- ggplot() +
    geom_line(data=VarPobJul,aes(y=Ft3, x=x, colour = "julio 2021"), size=0.5)+
    geom_line(data=VarPobMar,aes(y=Ft2, x=x, colour = "marzo 2021"), size=0.5)+
    geom_line(data=VarPobSep,aes(y=Ft1, x=x, colour = "septiembre 2020"), size=0.5)+
    geom_ribbon(data=VarPobJul,aes(ymin=lowerFt3, ymax=upperFt3, x=x, fill = "IC"), alpha = 0.2)+
    geom_ribbon(data=VarPobMar,aes(ymin=lowerFt2, ymax=upperFt2, x=x, fill = "IC"), alpha = 0.2)+
    geom_ribbon(data=VarPobSep,aes(ymin=lowerFt1, ymax=upperFt1, x=x, fill = ""), alpha = 0.2)+
     geom_hline(yintercept = c(FRMS3,median(VarPobJul$Ft3)),colour=c('green3','black')) +
     annotate("text", x=c(2011,2001), y=c(FRMS3,median(exp(ln_Fyr3)))+0.05,label=c(expression("F"[RMS])
    labs(x = '', y = 'Mortalidad por pesca (F)',colour='Asesorías')  +
    scale_x_continuous(breaks = seq(from = 1960, to = 2022, by = 4)) +
    scale_colour_manual("",values=c('blue','red',"black"))+
    scale_fill_manual("",values=c("grey90","grey30",'gray75'))+
    theme_bw(base_size=10) +
     ggtitle('')+
     theme(plot.title = element_text(hjust = 0.5),legend.position="none")

BD + Ft
```


julio 2021
marzo 2021
septiembre 2020
Biomasa desovante (t)
3e+06
2e+06
1e+06
0e+00
1992
1996
2000
2004
2008
2012
2016
2020
BD0
BDRMS
BDpromedio
BDLIM
Mortalidad por pesca (F)
1.5
1.0
0.5
0.0
Fmh
FRMS

```r
sel_Flota <- rep3$Sel_flota[1,]
madurez   <- dat3$madurezsexual
Fspr      <- SPRcurv3[,1]
BDspr     <- SPRcurv3[,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.


g2 <- ggplot () +
     geom_line(aes(x=Fspr,y=BDspr))+
     geom_hline(yintercept = 0.6,colour=c('gray35'),linetype="dashed") +
     geom_vline(xintercept = FRMS3,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.
g1 + g2
```



```
years1<-rep2$years
nyears1<-length(years1)
#para serie histórica
Rpr1     <- c(subset(std1,name=="RPRequ3")$value,NA);
Rpr1std  <- c(subset(std1,name=="RPRequ3")$std,NA)
Frpr1    <- c(subset(std1,name=="Frpr")$value,NA);
Frpr1std <- c(subset(std1,name=="Frpr")$std,NA)

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)
```

3.7. Estatus

```
years2<-rep2$years
nyears2<-length(years2)

#para serie histórica indicadores del estatus
Rpr2     <- subset(std2,name=="RPRequ3")$value;
Rpr2std  <- subset(std2,name=="RPRequ3")$std
Frpr2    <- subset(std2,name=="Frpr")$value;
Frpr2std <- subset(std2,name=="Frpr")$std

EstatusMar<- data.frame(x=years2,
                        Rpr2=Rpr2,
                        Frpr2=Frpr2,
         lowerRpr2  = (Rpr2 - 1.96*Rpr2std ),
         upperRpr2   = (Rpr2 +1.96*Rpr2std ),
         lowerFrpr2 = (Frpr2 -1.96*Frpr2std),
         upperFrpr2 = (Frpr2+1.96*Frpr2std))

#Para densidad de probabilidad
rprMARZO     <-subset(std2,name=="RPRequ3")$value[nyears2]
rprMARZOstd  <-subset(std2,name=="RPRequ3")$std[nyears2]
FrprMARZO    <-subset(std2,name=="Frpr")$value[nyears2]
FrprMARZOstd <-subset(std2,name=="Frpr")$std[nyears2]
# biomasa desovante vs BDrms - densidad de probabilidad
xbm1 <-rnorm(1000, mean = rprMARZO, sd = rprMARZOstd)
xbm  <-seq(min(xbm1),max(xbm1),0.005)
ybm  <-dnorm(xbm, mean = rprMARZO, sd =rprMARZOstd)
icbm <-qnorm(c(0.05,0.95,0.5),rprMARZO,rprMARZOstd)
# mortalidad por pesca vs Frms - densidad de probabilidad
xfm1 <- rnorm(1000, mean = FrprMARZO, sd = FrprMARZOstd)
xfm  <-seq(min(xfm1),max(xfm1),0.005)
yfm  <-dnorm(xfm, mean = FrprMARZO, sd =FrprMARZOstd)
icfm <-qnorm(c(0.05,0.95,0.5),FrprMARZO,FrprMARZOstd)
#distribución probabilidad
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]])))

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

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

densb_bm  <- data.frame(x=xxbm, y=yybm , t=rep('a', length(xxbm)), r=seq(1,length(xxbm),1))
densb_fm  <- data.frame(x=xxfm, y=yyfm , t=rep('a', length(xxfm)), r=seq(1,length(xxfm),1))

### *Probabilidad de estar bajo BRMS*
#Asesoría marzo #P(BD<BDrms)
pa_mar<-pnorm(1,rprMARZO,rprMARZOstd,lower.tail = TRUE,log.p = F)
### *Probabilidad de estar bajo FRMS*
```

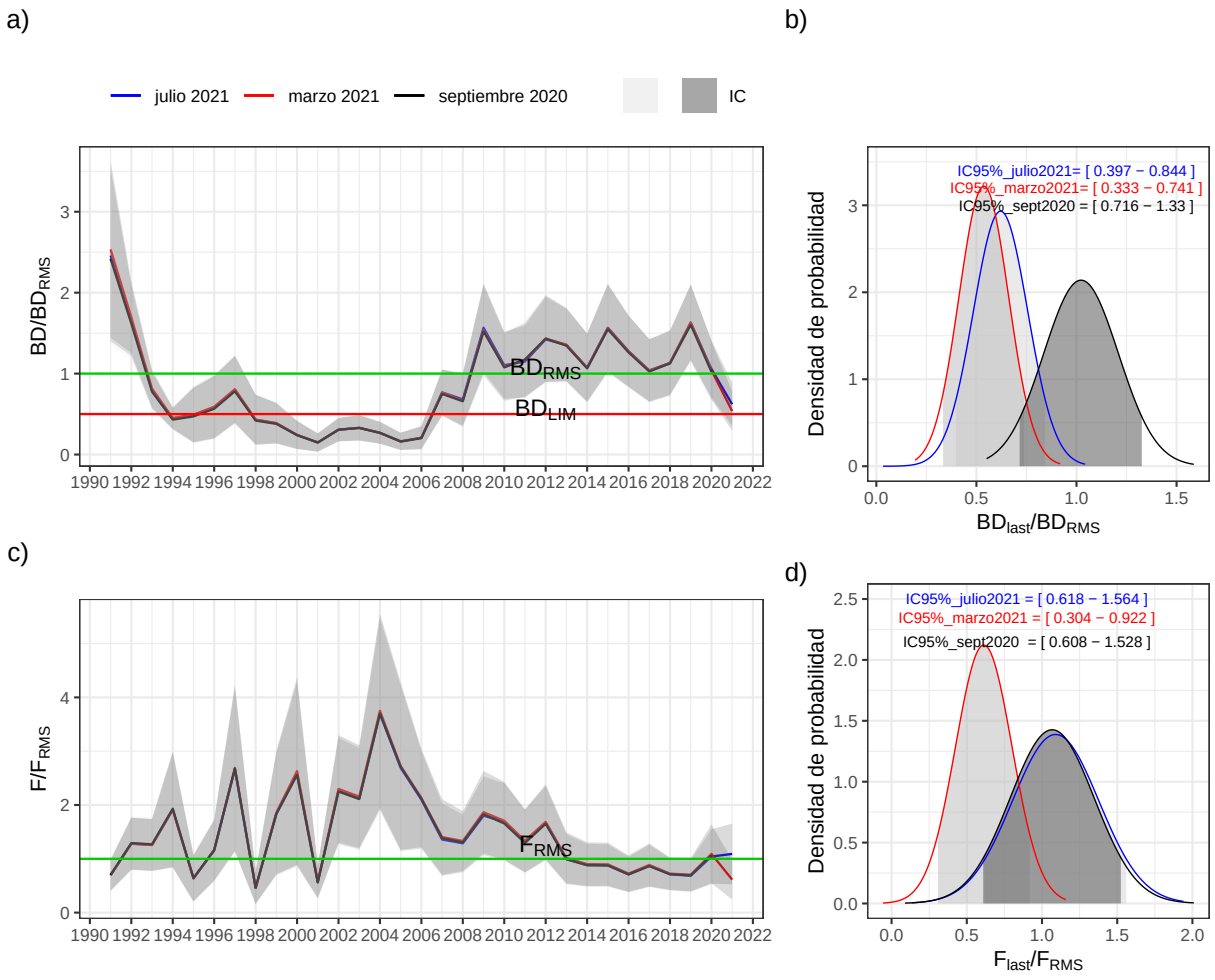
```
#Asesoría marzo #P(F>Frms)
pb_mar<-1-pnorm(1,FrprMARZO,FrprMARZOstd,lower.tail = TRUE,log.p = F)
### *Probabilidad de estar en zona de sobreexplotacion*
#Asesoría marzo #P(BD<BDrms)
pc_mar<-pnorm(0.9,rprMARZO,rprMARZOstd,lower.tail = TRUE,log.p = F)
### *Probabilidad de estar en zona de colapso*
#Asesoría marzo #P(BD<BDrms)
pd_mar<-pnorm(0.5,rprMARZO,rprMARZOstd,lower.tail = TRUE,log.p = F)
### *Probailidad de sobrepesca*
#Asesoría marzo #P(F>Frms)
pe_mar<-1-pnorm(1.1,FrprMARZO,FrprMARZOstd,lower.tail = TRUE,log.p = F)
```

```
years3  <-rep3$years
nyears3 <-length(years3)

#para serie histórica indicadores del estatus
Rpr3     <- subset(std3,name=="RPRequ3")$value;
Rpr3std  <- subset(std3,name=="RPRequ3")$std
Frpr3    <- subset(std3,name=="Frpr")$value;
Frpr3std <- subset(std3,name=="Frpr")$std

EstatusJul<- data.frame(x=years3,
                        Rpr3=Rpr3,
                        Frpr3=Frpr3,
         lowerRpr3   = (Rpr3  -1.96*Rpr3std ),
         upperRpr3   = (Rpr3 +1.96*Rpr3std ),
         lowerFrpr3  = (Frpr3 -1.96*Frpr3std),
         upperFrpr3  = (Frpr3 +1.96*Frpr3std))

#Para densidad de probabilidad
rprJULIO     <-subset(std3,name=="RPRequ3")$value[nyears3]
rprJULIOstd  <-subset(std3,name=="RPRequ3")$std[nyears3]
FrprJULIO    <-subset(std3,name=="Frpr")$value[nyears3]
FrprJULIOstd <-subset(std3,name=="Frpr")$std[nyears3]
# biomasa desovante vs BDrms - densidad de probabilidad
xbj1 <-rnorm(1000, mean = rprJULIO, sd = rprJULIOstd)
xbj  <-seq(min(xbj1),max(xbj1),0.005)
ybj  <-dnorm(xbj, mean = rprJULIO, sd =rprJULIOstd)
icbj <-qnorm(c(0.05,0.95,0.5),rprJULIO,rprJULIOstd)
# mortalidad por pesca vs Frms - densidad de probabilidad
xfj1 <- rnorm(1000, mean = FrprJULIO, sd = FrprJULIOstd)
xfj  <-seq(min(xfj1),max(xfj1),0.005)
yfj  <-dnorm(xfj, mean = FrprJULIO, sd =FrprJULIOstd)
icfj <-qnorm(c(0.05,0.95,0.5),FrprJULIO,FrprJULIOstd)
#distribución probabilidad
xxbj      <- c(xbj[xbj>=icbj[1]&xbj<=icbj[2]],rev(xbj[xbj>=icbj[1]&xbj<=icbj[2]]))
yybj      <- c(ybj[xbj>=icbj[1]&xbj<=icbj[2]],rep(0,length(ybj[xbj>=icbj[1]&xbj<=icbj[2]])))
xxfj      <- c(xfj[xfj>=icfj[1]&xfj<=icfj[2]],rev(xfj[xfj>=icfj[1]&xfj<=icfj[2]]))
yyfj      <- c(yfj[xfj>=icfj[1]&xfj<=icfj[2]],rep(0,length(yfj[xfj>=icfj[1]&xfj<=icfj[2]])))

densb_bj  <- data.frame(x=xxbj, y=yybj , t=rep('a', length(xxbj)), r=seq(1,length(xxbj),1))
densb_fj  <- data.frame(x=xxfj, y=yyfj , t=rep('a', length(xxfj)), r=seq(1,length(xxfj),1))

### *Probabilidad de estar bajo BRMS*
```

```r
#Asesoría julio #P(BD<BDrms)
pa_jul<-pnorm(1,rprJULIO,rprJULIOstd,lower.tail = TRUE,log.p = F)
### *Probabilidad de estar bajo FRMS*
#Asesoría julio#P(F>Frms)
pb_jul<-1-pnorm(1,FrprJULIO,FrprJULIOstd,lower.tail = TRUE,log.p = F)
### *Probabilidad de estar en zona de sobreexplotacion*
#Asesoría julio #P(BD<BDrms)
pc_jul<-pnorm(0.9,rprJULIO,rprJULIOstd,lower.tail = TRUE,log.p = F)
### *Probabilidad de estar en zona de colapso*
#Asesoría julio #P(BD<BDrms)
pd_jul<-pnorm(0.5,rprJULIO,rprJULIOstd,lower.tail = TRUE,log.p = F)
### *Probailidad de sobrepesca*
#Asesoría julio #P(F>Frms)
pe_jul<-1-pnorm(1.1,FrprJULIO,FrprJULIOstd,lower.tail = TRUE,log.p = F)
```

```
BD_BDrms <- ggplot() +
     geom_line(data=EstatusJul,aes(y=Rpr3, x=x, colour = "julio 2021"), size=0.5)+
     geom_line(data=EstatusMar,aes(y=Rpr2, x=x, colour = "marzo 2021"), size=0.5)+
     geom_line(data=EstatusSep,aes(y=Rpr1, x=x, colour = "septiembre 2020"), size=0.5)+
     geom_ribbon(data=EstatusJul,aes(ymin=lowerRpr3, ymax=upperRpr3, x=x, fill = "IC"), alpha = 0.2)+
     geom_ribbon(data=EstatusMar,aes(ymin=lowerRpr2, ymax=upperRpr2, x=x, fill = "IC"), alpha = 0.2)+
     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('blue','red',"black"))+
     scale_fill_manual("",values=c("grey90","grey30",'gray75'))+
     theme_bw(base_size=10) +
     ggtitle('')+
     theme(plot.title = element_text(hjust = 0.5),legend.position="top")

F_Frms <- ggplot() +
    geom_line(data=EstatusJul,aes(y=Frpr3, x=x, colour = "julio 2021"), size=0.5)+
    geom_line(data=EstatusMar,aes(y=Frpr2, x=x, colour = "marzo 2021"), size=0.5)+
    geom_line(data=EstatusSep,aes(y=Frpr1, x=x, colour = "septiembre 2020"), size=0.5)+
    geom_ribbon(data=EstatusJul,aes(ymin=lowerFrpr3, ymax=upperFrpr3, x=x, fill = "IC"), alpha = 0.2)+
    geom_ribbon(data=EstatusMar,aes(ymin=lowerFrpr2, ymax=upperFrpr2, x=x, fill = "IC"), alpha = 0.2)+
    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('blue','red',"black"))+
    scale_fill_manual("",values=c("grey90","grey30",'gray75'))+
    theme_bw(base_size=10) +
     ggtitle('')+
     theme(plot.title = element_text(hjust = 0.5),legend.position="none")

fig_desnb<- ggplot() + lims(y=c(0,3.5)) +
     geom_polygon(data=densb_bj,aes(x=x, y=y, group=t,alpha=0.9),fill="gray85")+
     geom_polygon(data=densb_bm,aes(x=x, y=y, group=t,alpha=0.9),fill="gray75")+
     geom_polygon(data=densb_bs,aes(x=x, y=y, group=t,alpha=0.9),fill="gray35")+
     geom_line(aes(xbj,ybj), size=0.3,color="blue")+
     geom_line(aes(xbm,ybm), size=0.3,color="red")+
     geom_line(aes(xbs,ybs), size=0.3,color="black")+
     annotate("text", x=c(1,1,1), y=c(3.4,3.2,3), colour = c('blue',"red","black"), size = 2.5,
              label=c(paste("IC95%_julio2021= [",round(icbj[1],3),"-",round(icbj[2],3),"]",sep=" "),
                      paste("IC95%_marzo2021= [",round(icbm[1],3),"-",round(icbm[2],3),"]",sep=" "),
                      paste("IC95%_sept2020 = [",round(icbs[1],3),"-",round(icbs[2],3),"]",sep=" "))) +
     labs(x = expression("BD"[last]*"/BD"[RMS]), y = 'Densidad de probabilidad',tag="b)")  +
     scale_colour_manual("",values=c('blue','red',"black"))+
     scale_fill_manual("",values=c("grey90","grey30",'gray75'))+
     theme_bw(base_size=10) +
     theme(plot.title = element_text(hjust = 0.5),legend.position="none")

fig_desnf<- ggplot() + lims(y=c(0,2.5))+
```

```
    geom_polygon(data=densb_fj,aes(x=x, y=y, group=t,alpha=0.9,fill = ""),fill="gray85")+
    geom_polygon(data=densb_fm,aes(x=x, y=y, group=t,alpha=0.9,fill = ""),fill="gray75")+
    geom_polygon(data=densb_fs,aes(x=x, y=y, group=t,alpha=0.9),fill="gray35")+
    geom_line(aes(xfj,yfj), size=0.3,color="blue")+
    geom_line(aes(xfm,yfm), size=0.3,color="red")+
    geom_line(aes(xfs,yfs), size=0.3,color="black")+
    annotate("text", x=c(0.9,0.9,0.9), y=c(2.5,2.35,2.15), colour = c('blue',"red","black"), size = 2.5
             label=c(paste("IC95%_julio2021 = [",round(icfj[1],3),"-",round(icfj[2],3),"]",sep=" "),
                     paste("IC95%_marzo2021 = [",round(icfm[1],3),"-",round(icfm[2],3),"]",sep=" "),
                     paste("IC95%_sept2020  = [",round(icfs[1],3),"-",round(icfs[2],3),"]",sep=" "))) +
    labs(x = expression("F"[last]*"/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))
```



```r
yearsb<-c("1990/91","1991/92","1992/93","1993/94","1994/95","1995/96","1996/97","1997/98","1998/99","19

VarPobl2<- cbind('Años'=yearsb,
                 "$F/F_{RMS_{sept}}$"=c(round(exp(Ft1)/FRMS1,3)),
                 "$F/F_{RMS_{marzo}}$"=c(round(exp(Ft2)/FRMS2,3)),
                 "$F/F_{RMS_{julio}}$"=c(round(exp(Ft3)/FRMS3,3)),
                 "$BD/BD_{RMS_{sept}}$"=c(round(BD1/BRMS1,3)),
                 "$BD/BD_{RMS_{marzo}}$"=c(round(BD2/BRMS2,3)),
                 "$BD/BD_{RMS_{julio}}$"=c(round(BD3/BRMS3,3)))
kable(VarPobl2, align = 'c')
```

Años	$F/F_{RMS_{sept}}$	$F/F_{RMS_{marzo}}$	$F/F_{RMS_{julio}}$	$BD/BD_{RMS_{sept}}$	$BD/BD_{RMS_{marzo}}$	$BD/BD_{RMS_{julio}}$
1990/91	0.7	0.693	0.696	2.419	2.534	2.46
1991/92	1.293	1.279	1.283	1.619	1.696	1.649
1992/93	1.27	1.256	1.259	0.777	0.815	0.792
1993/94	1.931	1.911	1.914	0.431	0.452	0.44
1994/95	0.643	0.637	0.636	0.471	0.493	0.483
1995/96	1.164	1.161	1.156	0.566	0.591	0.58
1996/97	2.682	2.689	2.66	0.781	0.808	0.797
1997/98	0.461	0.464	0.458	0.42	0.432	0.428
1998/99	1.835	1.859	1.834	0.379	0.389	0.385
1999/00	2.561	2.632	2.578	0.239	0.242	0.241
2000/01	0.56	0.576	0.567	0.149	0.148	0.149
2001/02	2.249	2.299	2.266	0.307	0.308	0.307
2002/03	2.111	2.155	2.118	0.328	0.33	0.33
2003/04	3.701	3.751	3.692	0.267	0.269	0.269
2004/05	2.713	2.724	2.69	0.16	0.163	0.163
2005/06	2.116	2.131	2.099	0.202	0.208	0.208
2006/07	1.383	1.405	1.358	0.748	0.765	0.768
2007/08	1.305	1.331	1.288	0.658	0.667	0.682
2008/09	1.825	1.865	1.802	1.522	1.536	1.567
2009/10	1.657	1.707	1.688	1.077	1.083	1.104
2010/11	1.295	1.335	1.323	1.174	1.17	1.149
2011/12	1.651	1.688	1.664	1.433	1.433	1.422
2012/13	0.991	1.016	0.994	1.345	1.358	1.354
2013/14	0.881	0.901	0.882	1.065	1.071	1.074
2014/15	0.878	0.898	0.877	1.547	1.561	1.567
2015/16	0.71	0.726	0.709	1.262	1.275	1.277
2016/17	0.865	0.886	0.87	1.026	1.038	1.039
2017/18	0.713	0.725	0.712	1.126	1.133	1.131
2018/19	0.693	0.705	0.684	1.603	1.632	1.629
2019/20	1.068	1.091	1.042	1.023	1.04	1.057
2020/21	NA	0.613	1.091	NA	0.537	0.621

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

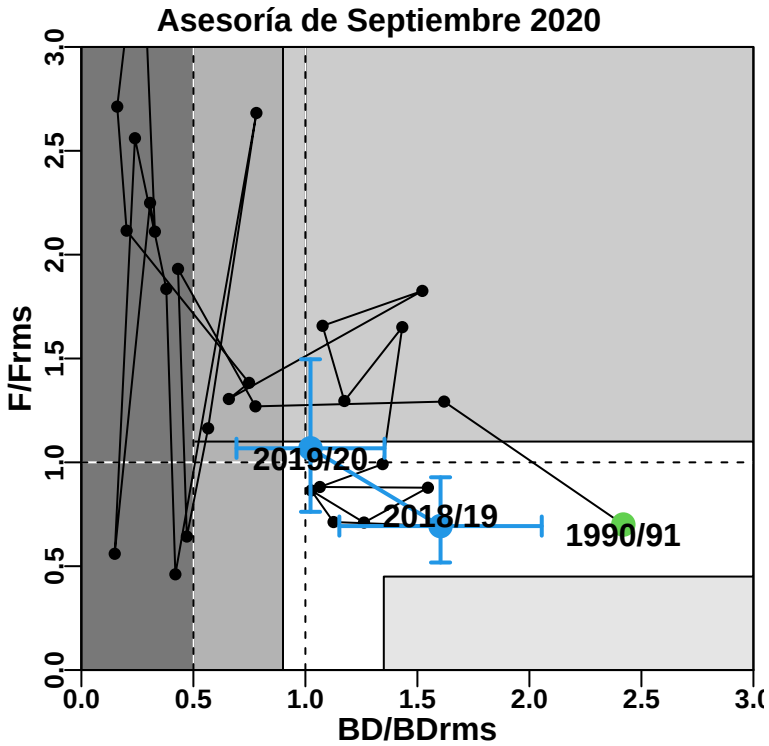
```r
yearsb<-c("1990/91","1991/92","1992/93","1993/94","1994/95","1995/96","1996/97","1997/98","1998/99","19

VarPobl2b<- cbind('Años'=yearsb,
                 "$Y/BT_{sept}$"=c(round(rep1$desembarquepred/BT1,3)),
```

```
                  "$Y/BT_{marzo}$"=c(round(rep2$desembarquepred/BT2,3)),
                 "$Y/BT_{julio}$"=c(round(rep3$desembarquepred/BT3,3)),
                 "$C/N_{sept}$"=c(round(c(rowSums(rep1$pred_Ctot)/rowSums(rep1$N),NA),3)),
                  "$C/N_{marzo}$"=c(round(rowSums(rep2$pred_Ctot)/rowSums(rep2$N),3)),
                 "$C/N_{julio}$"=c(round(rowSums(rep3$pred_Ctot)/rowSums(rep3$N),3)))
kable(VarPobl2b, align = 'c')
```

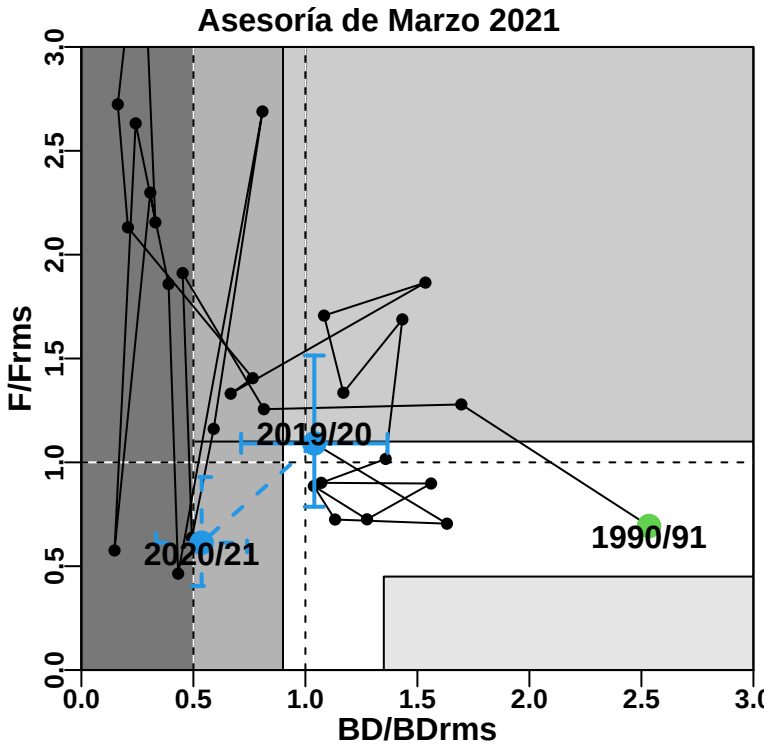
Años	Y/BT_{sept}	Y/BT_{marzo}	Y/BT_{julio}	C/N_{sept}	C/N_{marzo}	C/N_{julio}
1990/91	0.174	0.172	0.173	0.102	0.101	0.101
1991/92	0.264	0.261	0.263	0.179	0.178	0.179
1992/93	0.262	0.26	0.261	0.169	0.167	0.167
1993/94	0.398	0.395	0.395	0.232	0.23	0.23
1994/95	0.158	0.157	0.157	0.088	0.088	0.087
1995/96	0.238	0.238	0.237	0.148	0.149	0.147
1996/97	0.512	0.513	0.509	0.323	0.324	0.321
1997/98	0.099	0.1	0.099	0.069	0.069	0.069
1998/99	0.326	0.33	0.326	0.233	0.236	0.233
1999/00	0.432	0.442	0.435	0.291	0.298	0.293
2000/01	0.115	0.118	0.116	0.074	0.076	0.074
2001/02	0.438	0.445	0.44	0.261	0.266	0.263
2002/03	0.383	0.39	0.384	0.252	0.256	0.252
2003/04	0.501	0.505	0.5	0.39	0.394	0.389
2004/05	0.401	0.403	0.399	0.302	0.304	0.3
2005/06	0.394	0.397	0.391	0.237	0.239	0.235
2006/07	0.334	0.339	0.329	0.193	0.196	0.19
2007/08	0.24	0.245	0.238	0.158	0.161	0.156
2008/09	0.331	0.337	0.328	0.229	0.234	0.227
2009/10	0.334	0.343	0.339	0.209	0.215	0.214
2010/11	0.276	0.283	0.28	0.164	0.169	0.167
2011/12	0.313	0.319	0.315	0.202	0.206	0.203
2012/13	0.224	0.229	0.225	0.147	0.15	0.147
2013/14	0.165	0.168	0.165	0.116	0.119	0.116
2014/15	0.185	0.189	0.185	0.119	0.122	0.119
2015/16	0.157	0.16	0.157	0.104	0.107	0.104
2016/17	0.149	0.153	0.15	0.114	0.117	0.115
2017/18	0.127	0.129	0.126	0.097	0.098	0.097
2018/19	0.174	0.176	0.172	0.105	0.107	0.104
2019/20	0.217	0.222	0.214	0.152	0.155	0.149
2020/21	NA	0.123	0.196	NA	0.08	0.137

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

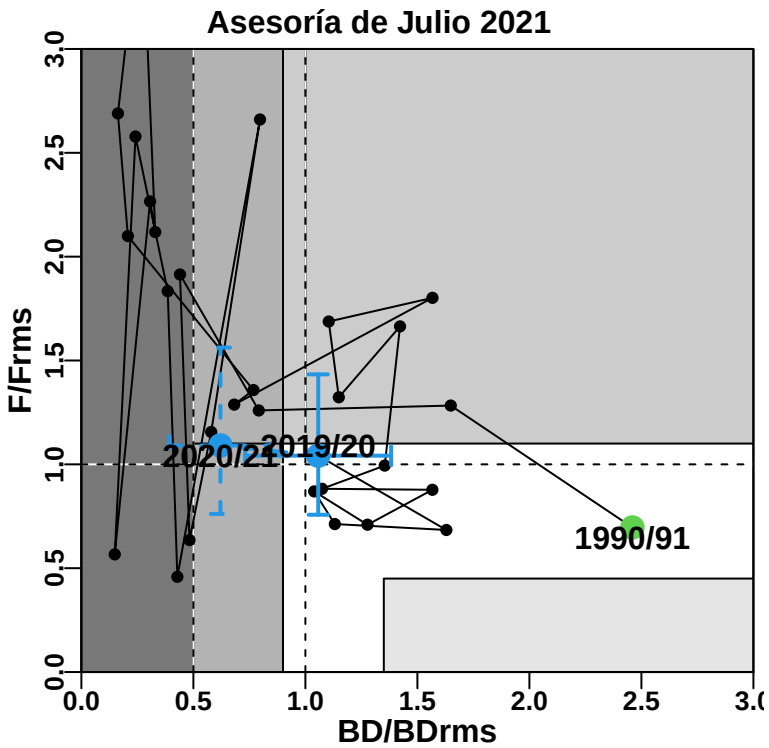
```r
source(paste(dir.fun,"Fn_DiagramaFase2.R",sep=""))
name1<-"Asesoría de Septiembre 2020"
years1<-rep1$years
nyears1<-length(years1)

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),
```



```r
source(paste(dir.fun,"Fn_DiagramaFase2.R",sep=""))
name2<-"Asesoría de Marzo 2021"
years2<-rep2$years
nyears2<-length(years2)

DiagramaFase2(name2,
              years2[1:nyears2-1],
              SpB2[1:nyears2-1],
              SpBSE2[1:nyears2-1],
              ln_Fyr2[1:nyears2-1],
              ln_FSE2[1:nyears2-1],
              SpB2[nyears2],
              SpBSE2[nyears2],
              ln_Fyr2[nyears2],
              ln_FSE2[nyears2],
              FRMS2,
              BRMS2,
              BLIM2,
              FLIM2,
              color=F,
              dir.1,
              etiqueta=F,
              preliminar=T,
              completo=F)

text(c(SpB2[1]/BRMS2,SpB2[nyears2]/BRMS2,SpB2[nyears2-1]/BRMS2),
     c(exp(ln_Fyr2[1])/FRMS2-0.05,exp(ln_Fyr2[nyears2])/FRMS2-0.05,exp(ln_Fyr2[nyears2-1])/FRMS2+0.05),
```



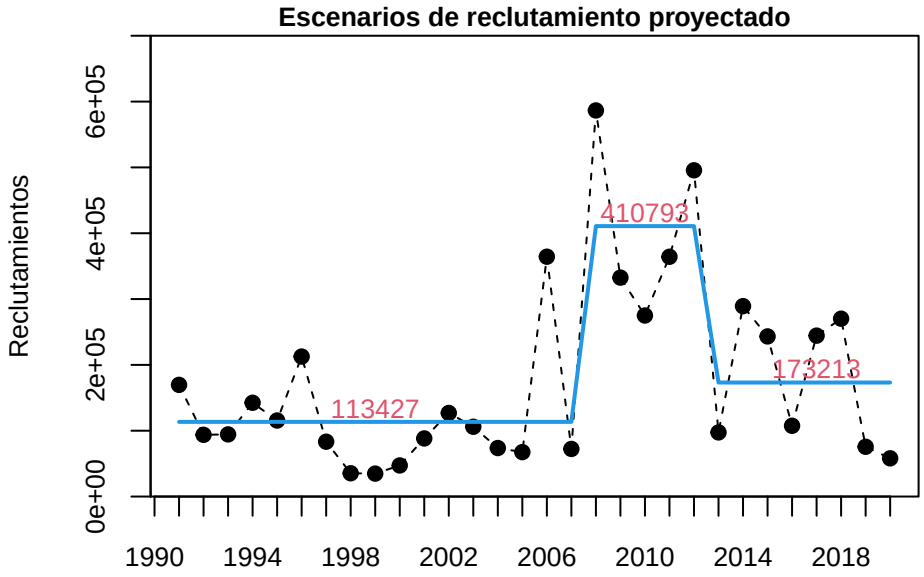
```
source(paste(dir.fun,"Fn_DiagramaFase2.R",sep=""))
name3<-"Asesoría de Julio 2021"
years3<-rep3$years
nyears3<-length(years3)

DiagramaFase2(name3,
              years3[1:nyears3-1],
              SpB3[1:nyears3-1],
              SpBSE3[1:nyears3-1],
              ln_Fyr3[1:nyears3-1],
              ln_FSE3[1:nyears3-1],
              SpB3[nyears3],
              SpBSE3[nyears3],
              ln_Fyr3[nyears3],
              ln_FSE3[nyears3],
              FRMS3,
              BRMS3,
              BLIM3,
              FLIM3,
              color=F,
              dir.1,
              etiqueta=F,
              preliminar=T,
              completo=F)

text(c(SpB3[1]/BRMS3,SpB3[nyears3]/BRMS3,SpB3[nyears3-1]/BRMS3),
     c(exp(ln_Fyr3[1])/FRMS3-0.05,exp(ln_Fyr3[nyears3])/FRMS3-0.05,exp(ln_Fyr3[nyears3-1])/FRMS3+0.05),
```



```
Tabla4.1<-rbind("Año biológico"=c("2019/20",
                                  "2020/21",
                                  "2020/21"),
                "$F_{RMS}$"=c(round(FRMS1,2),
                              round(FRMS2,2),
                              round(FRMS3,2)),
                "$BD_{RMS}$"=c(round(BRMS1/10^3,0),
                               round(BRMS2/10^3,0),
                               round(BRMS3/10^3,0)),
                "$BD_{LIM}$"=c(round(BLIM1/10^3,0),
                               round(BLIM2/10^3,0),
                               round(BLIM3/10^3,0)),
                "$p(BD_{last}<BD_{RMS})$"=round(c(pa_sept,
                                                  pa_mar,
                                                  pa_jul),2),
                "$p(F_{last}>F_{RMS})$"=round(c(pb_sept,
                                                pb_mar,
                                                pb_jul),2),
                "$p(sobre-explotación)$"=round(c(pc_sept,
                                                 pc_mar,
                                                 pc_jul),2),
                "$p(agotado/colapsado)$"=round(c(pd_sept,
                                                 pd_mar,
                                                 pd_jul),2),
                "$p(sobrepesca)$"=round(c(pe_sept,
                                          pe_mar,
                                          pe_jul),2))
colnames(Tabla4.1)<-c("Septiembre 2020","Marzo 2021","Julio 2021")
kable(Tabla4.1,align='c')
```

	Septiembre 2020	Marzo 2021	Julio 2021
Año biológico	2019/20	2020/21	2020/21
F_{RMS}	0.3	0.3	0.3
BD_{RMS}	830	801	819
BD_{LIM}	415	401	410
$p(BD_{last} < BD_{RMS})$	0.45	1	1
$p(F_{last} > F_{RMS})$	0.6	0.02	0.62
$p(sobre - explotación)$	0.26	1	0.98
$p(agotado/colapsado)$	0	0.38	0.19
$p(sobrepesca)$	0.45	0	0.49

3.8. CBA 2021 Inicial (Asesoría de septiembre 2020)



	1991-2007	2008-2012	2013-2020
mean	250260	447840	300810
std	42769	73667	60397
10%	195449	353432	223408
20%	214265	385840	249979
30%	227832	409209	269138
40%	239425	429177	285509
50%	250260	447840	300810

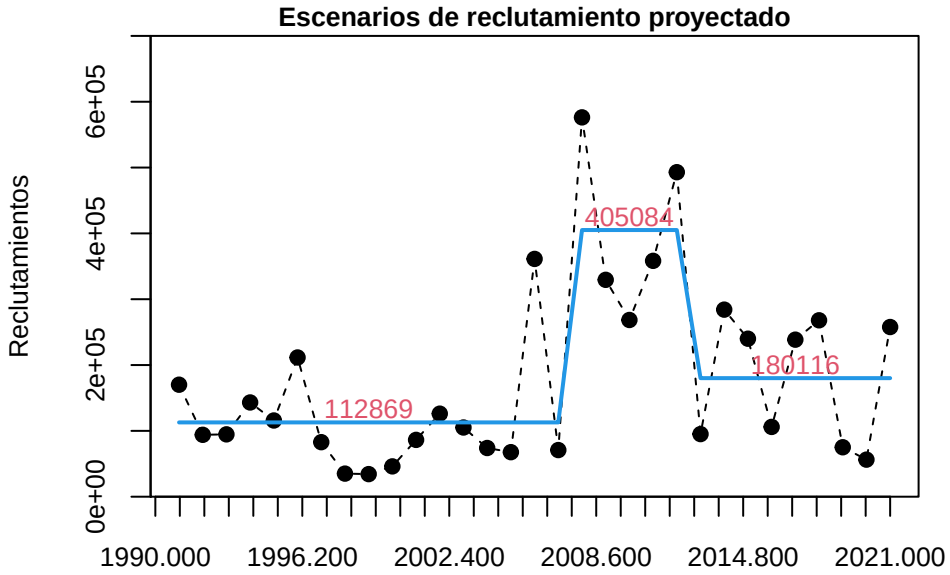
	1991-2007	2008-2012	2013-2020
10%	0.22	0.21	0.26
20%	0.14	0.14	0.17
30%	0.09	0.09	0.11
40%	0.04	0.04	0.05
50%	0.00	0.00	0.00

	1991-2007	2008-2012	2013-2020
10%	191540	346363	218940
20%	209979	378123	244979
30%	223275	401025	263755
40%	234636	420593	279798
50%	245255	438883	294794

	1991-2007	2008-2012	2013-2020
10%	183722	332226	210004
20%	201409	362690	234980
30%	214162	384656	252990

	1991-2007	2008-2012	2013-2020
40%	225059	403426	268378
50%	235244	420970	282761

3.9. Primera revisión CBA 2021 (Asesoría de marzo 2021)



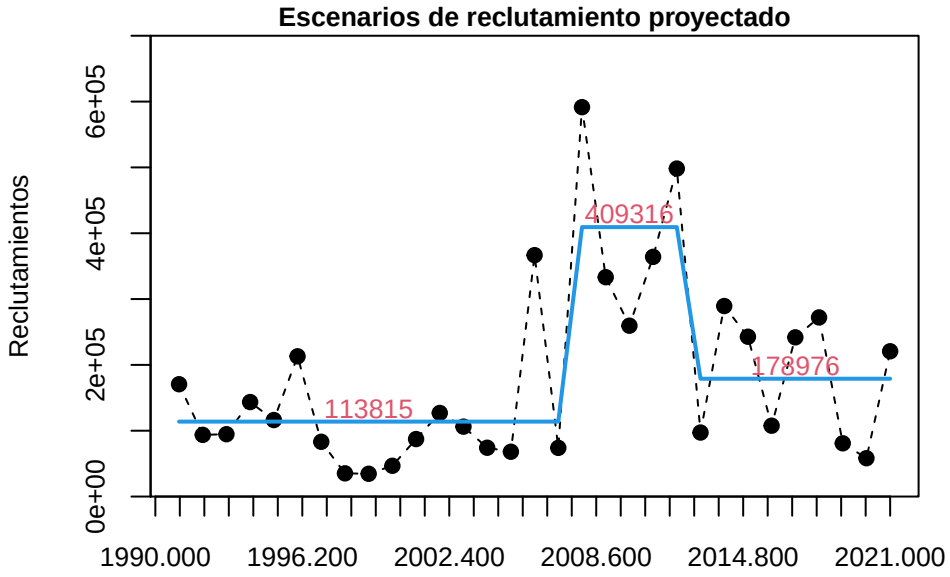
	1991-2007	2008-2012	2013-2021
mean	271720	313030	279570
std	29384	34291	33911
10%	234063	269084	236111
20%	246990	284170	251030
30%	256311	295048	261787
40%	264276	304342	270979
50%	271720	313030	279570

	1991-2007	2008-2012	2013-2021
10%	0.14	0.14	0.16
20%	0.09	0.09	0.10
30%	0.06	0.06	0.06
40%	0.03	0.03	0.03
50%	0.00	0.00	0.00

	1991-2007	2008-2012	2013-2021
10%	224700	258321	226667
20%	237110	272803	240989
30%	246059	283246	251316
40%	253705	292169	260140
50%	260851	300509	268387

	1991-2007	2008-2012	2013-2021
10%	22	-22	8
20%	18	-25	3
30%	15	-26	-1
40%	13	-28	-3
50%	11	-29	-5

4.0. Segunda revisión CBA 2021 (Asesoría de julio 2021)



	1991-2007	2008-2012	2013-2021
mean	378510	419740	385160
std	22214	28128	25792
10%	350042	383693	352106
20%	359814	396067	363453
30%	366861	404990	371635
40%	372882	412614	378626
50%	378510	419740	385160

	1991-2007	2008-2012	2013-2021
10%	0.08	0.09	0.09
20%	0.05	0.06	0.06
30%	0.03	0.04	0.04
40%	0.01	0.02	0.02
50%	0.00	0.00	0.00

	1991-2007	2008-2012	2013-2021
10%	336040	368345	338022
20%	345422	380224	348915
30%	352187	388790	356769
40%	357967	396109	363481
50%	363370	402950	369754

	1991-2007	2008-2012	2013-2021
10%	83	11	61
20%	72	5	48
30%	64	1	41

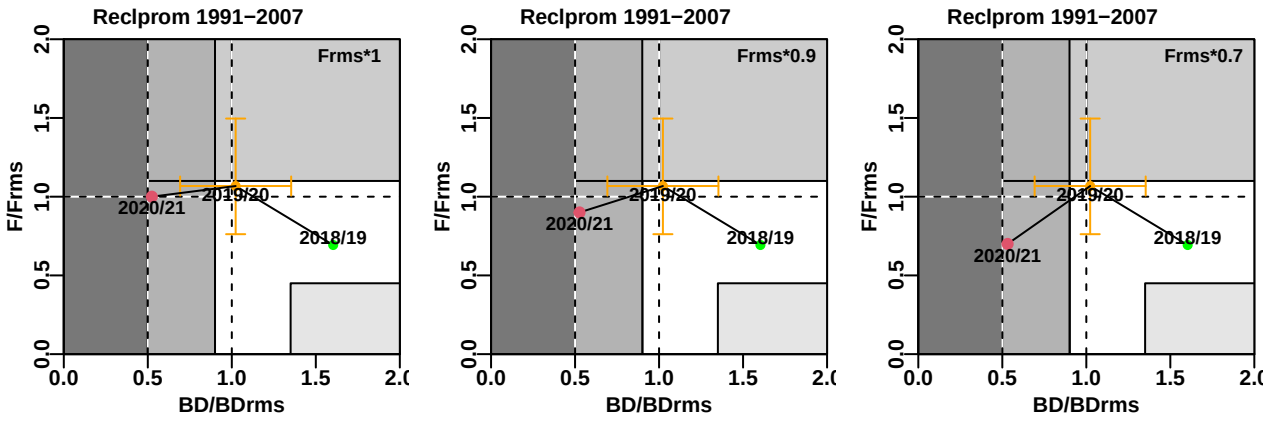
	1991-2007	2008-2012	2013-2021
40%	59	-2	35
50%	54	-4	31

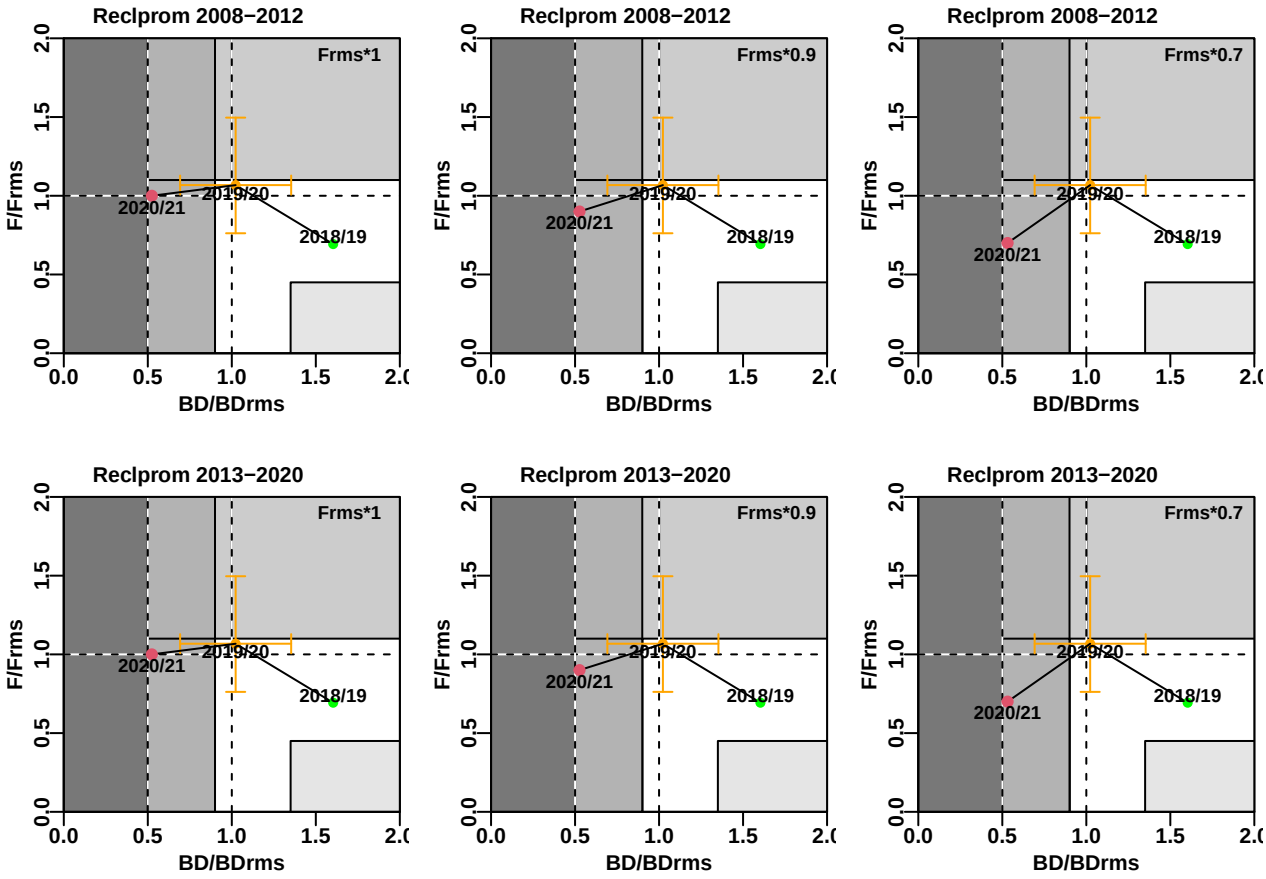
4.0. Proyección del stock (Asesoría de septiembre 2020)

	1991-2007[F_{RMS}*1]	[F_{RMS}*0.9]	[F_{RMS}*0.7]
p(sobre-explotación)_2018/19	0.00	0.00	0.00
p(colapso)_2018/19	0.00	0.00	0.00
p(sobre-explotación)_2019/20	0.26	0.26	0.26
p(colapso)_2019/20	0.00	0.00	0.00
p(sobre-explotación)_2020/21	1.00	1.00	1.00
p(colapso)_2020/21	0.42	0.41	0.40

	2008-2012[F_{RMS}*1]	[F_{RMS}*0.9]	[F_{RMS}*0.7]
p(sobre-explotación)_2018/19	0.00	0.00	0.00
p(colapso)_2018/19	0.00	0.00	0.00
p(sobre-explotación)_2019/20	0.26	0.26	0.26
p(colapso)_2019/20	0.00	0.00	0.00
p(sobre-explotación)_2020/21	1.00	1.00	1.00
p(colapso)_2020/21	0.42	0.41	0.40

	2013-2020[F_{RMS}*1]	[F_{RMS}*0.9]	[F_{RMS}*0.7]
p(sobre-explotación)_2018/19	0.00	0.00	0.00
p(colapso)_2018/19	0.00	0.00	0.00
p(sobre-explotación)_2019/20	0.26	0.26	0.26
p(colapso)_2019/20	0.00	0.00	0.00
p(sobre-explotación)_2020/21	1.00	1.00	1.00
p(colapso)_2020/21	0.42	0.41	0.40

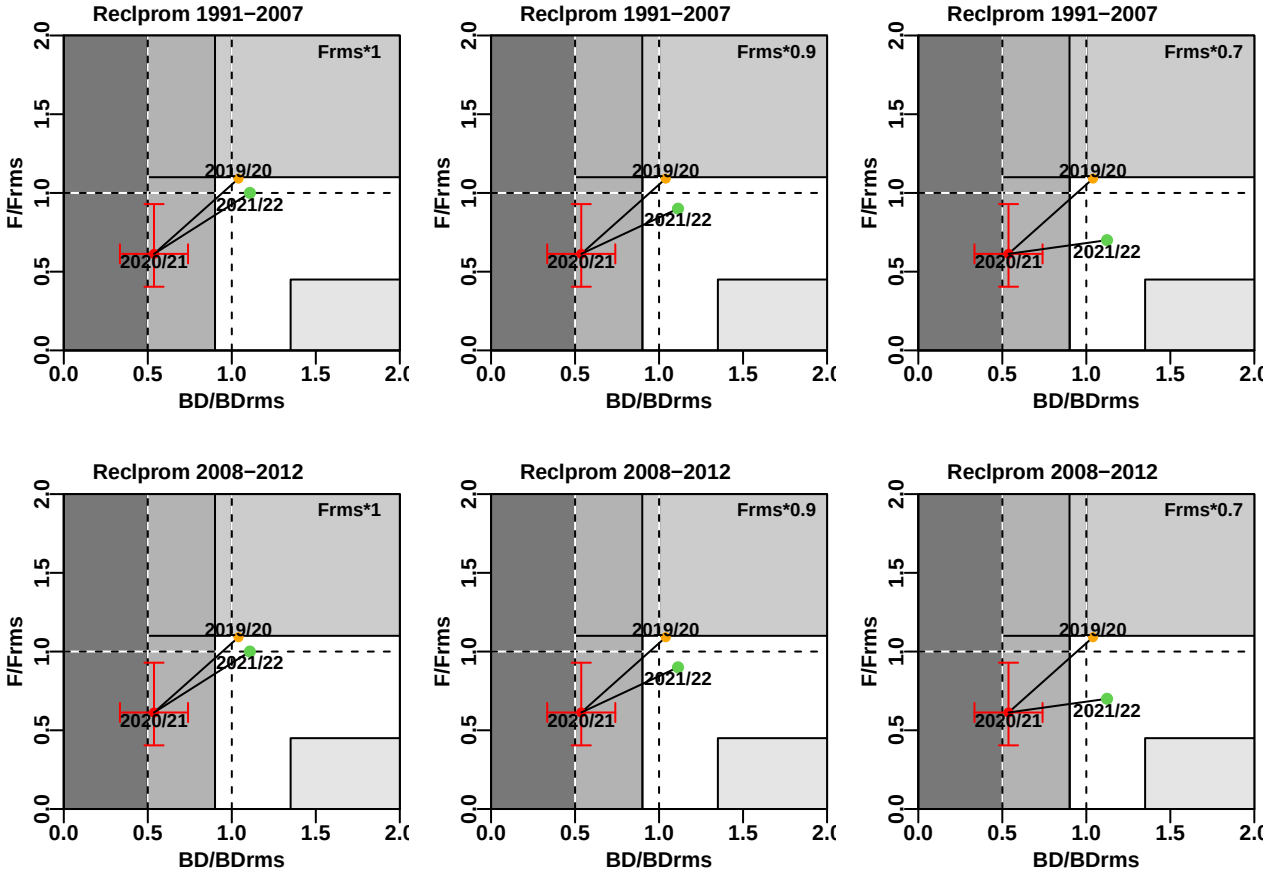


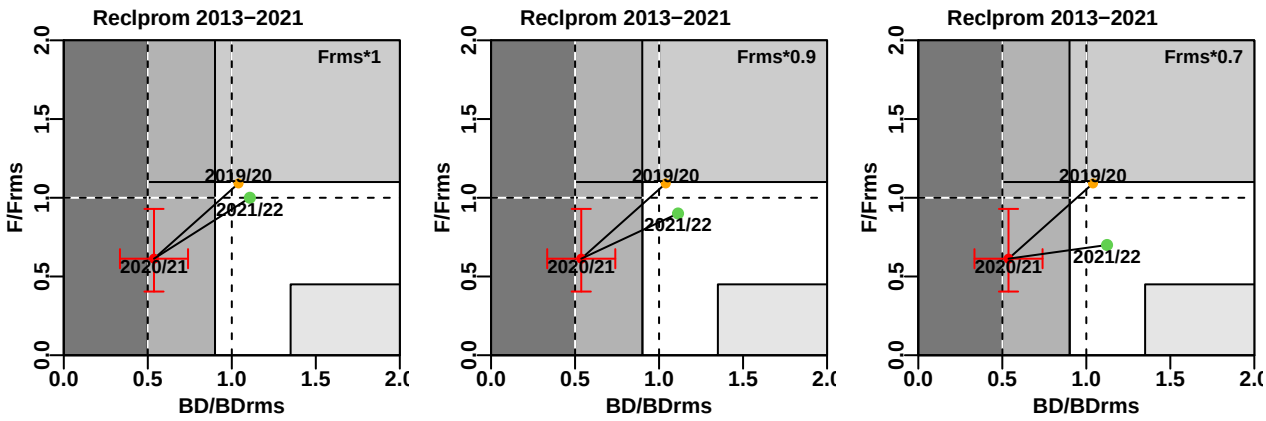

Reclprom 2008−2012
Frms*1
Reclprom 2008−2012
Frms*0.9
Reclprom 2008−2012
Frms*0.7
Reclprom 2013−2020
Frms*1
Reclprom 2013−2020
Frms*0.9
Reclprom 2013−2020
Frms*0.7
F/Frms
BD/BDrms
2020/21
2019/20
2018/19
0.0
0.5
1.0
1.5
2.0

	1991-2007[F_{RMS}*1]	[F_{RMS}*0.9]	[F_{RMS}*0.7]
p(BD<0,9BD_{RMS})_2020/21	1.00	1.00	1.00
p(BD<0,5BD_{RMS})_2020/21	0.38	0.38	0.38
p(BD<0,9BD_{RMS})_2021/22	0.27	0.26	0.26
p(BD<0,5BD_{RMS})_2021/22	0.04	0.03	0.03

	2008-2012[F_{RMS}*1]	[F_{RMS}*0.9]	[F_{RMS}*0.7]
p(BD<0,9BD_{RMS})_2020/21	1.00	1.00	1.00
p(BD<0,5BD_{RMS})_2020/21	0.38	0.38	0.38
p(BD<0,9BD_{RMS})_2021/22	0.27	0.26	0.26
p(BD<0,5BD_{RMS})_2021/22	0.04	0.03	0.03

	2013-2021[F_{RMS}*1]	[F_{RMS}*0.9]	[F_{RMS}*0.7]
p(BD<0,9BD_{RMS})_2020/21	1.00	1.00	1.00
p(BD<0,5BD_{RMS})_2020/21	0.38	0.38	0.38
p(BD<0,9BD_{RMS})_2021/22	0.27	0.26	0.26
p(BD<0,5BD_{RMS})_2021/22	0.04	0.03	0.03

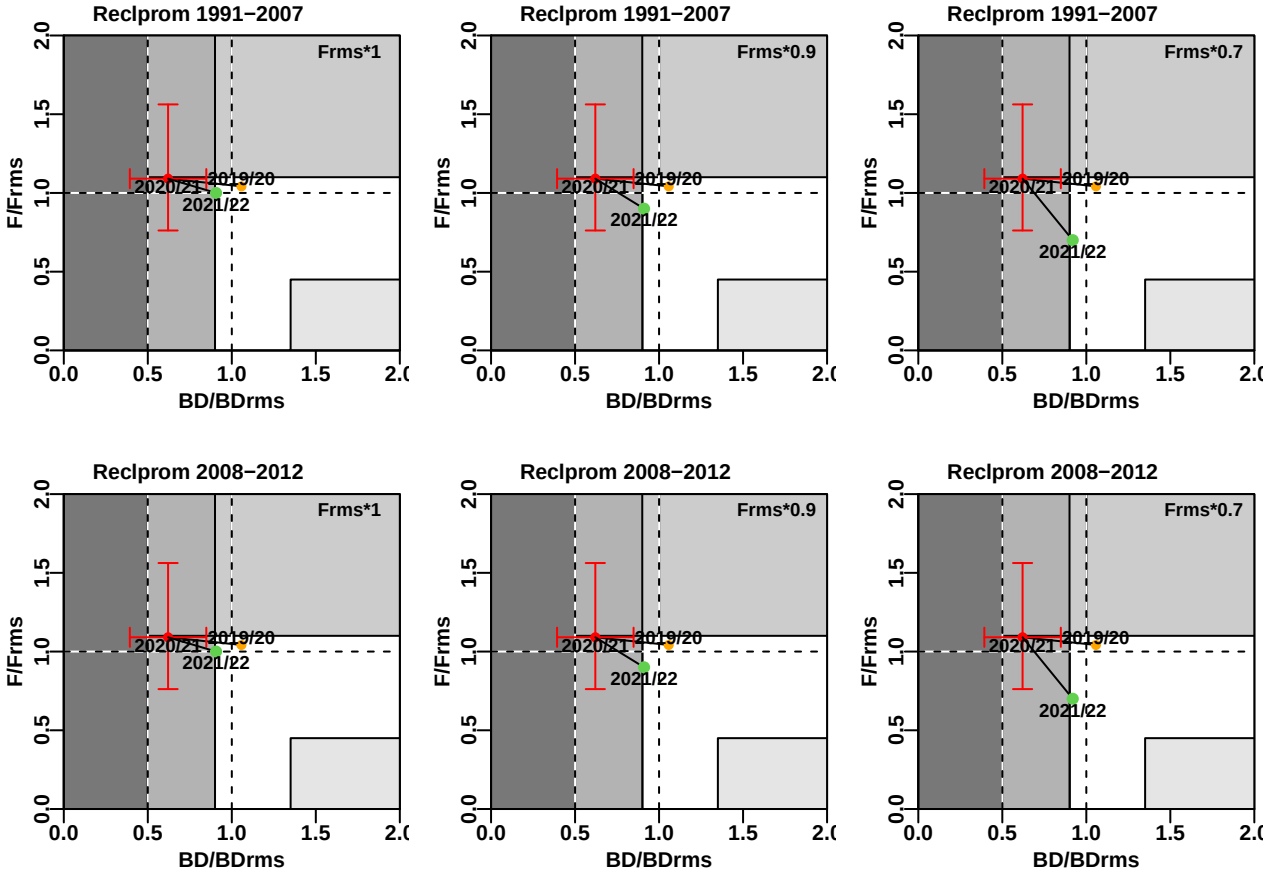


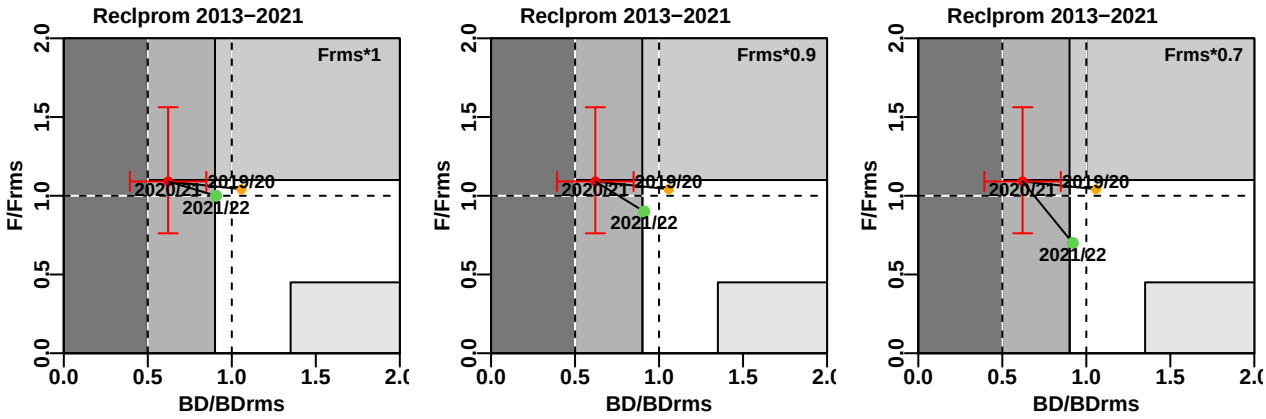

Reclprom 2013−2021
Frms*1
2019/20
2021/22
2020/21
F/Frms
BD/BDrms
0.0
0.5
1.0
1.5
2.0
Reclprom 2013−2021
Frms*0.9
2019/20
2021/22
2020/21
F/Frms
BD/BDrms
Reclprom 2013−2021
Frms*0.7
2019/20
2021/22
2020/21
F/Frms
BD/BDrms

	1991-2007[F_{RMS}*1]	[F_{RMS}*0.9]	[F_{RMS}*0.7]
p(BD<0,9BD_{RMS})_2020/21	0.98	0.98	0.98
p(BD<0,5BD_{RMS})_2020/21	0.19	0.19	0.19
p(BD<0,9BD_{RMS})_2021/22	0.49	0.48	0.47
p(BD<0,5BD_{RMS})_2021/22	0.04	0.03	0.03

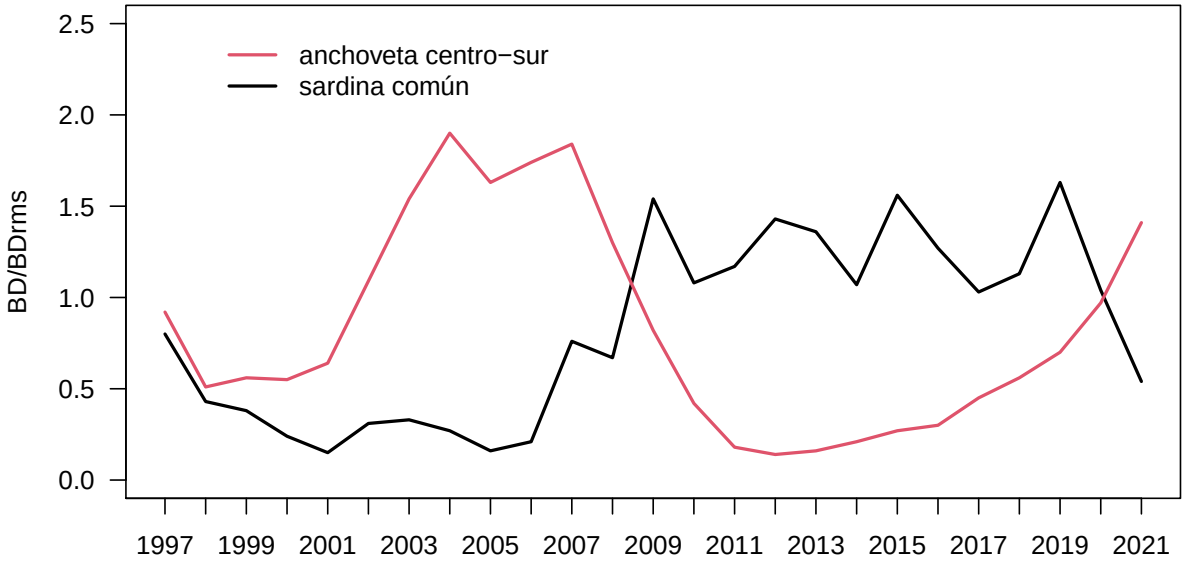
	2008-2012[F_{RMS}*1]	[F_{RMS}*0.9]	[F_{RMS}*0.7]
p(BD<0,9BD_{RMS})_2020/21	0.98	0.98	0.98
p(BD<0,5BD_{RMS})_2020/21	0.19	0.19	0.19
p(BD<0,9BD_{RMS})_2021/22	0.49	0.48	0.47
p(BD<0,5BD_{RMS})_2021/22	0.04	0.03	0.03

	2013-2021[F_{RMS}*1]	[F_{RMS}*0.9]	[F_{RMS}*0.7]
p(BD<0,9BD_{RMS})_2020/21	0.98	0.98	0.98
p(BD<0,5BD_{RMS})_2020/21	0.19	0.19	0.19
p(BD<0,9BD_{RMS})_2021/22	0.49	0.48	0.47
p(BD<0,5BD_{RMS})_2021/22	0.04	0.03	0.03




Reclprom 2013−2021
Frms*1
2020/21
2019/20
2021/22
F/Frms
BD/BDrms
0.0
0.5
1.0
1.5
2.0
Reclprom 2013−2021
Frms*0.9
2020/21
2019/20
2021/22
F/Frms
BD/BDrms
Reclprom 2013−2021
Frms*0.7
2020/21
2019/20
2021/22
F/Frms
BD/BDrms

5. DISCUSIÓN


anchoveta centro−sur
sardina común
BD/BDrms
2.5
2.0
1.5
1.0
0.5
0.0
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021