

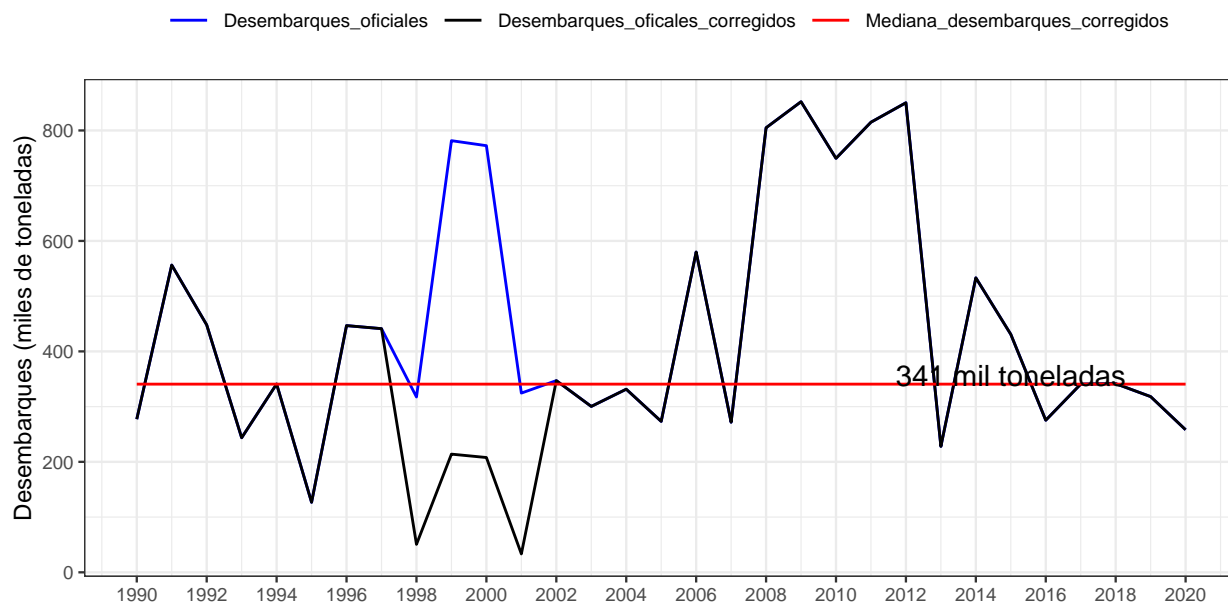
salidas_InformeFinal

Antecedentes

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



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

```

      "Desembarque_artesanal",
      "Desembarque_industrial")

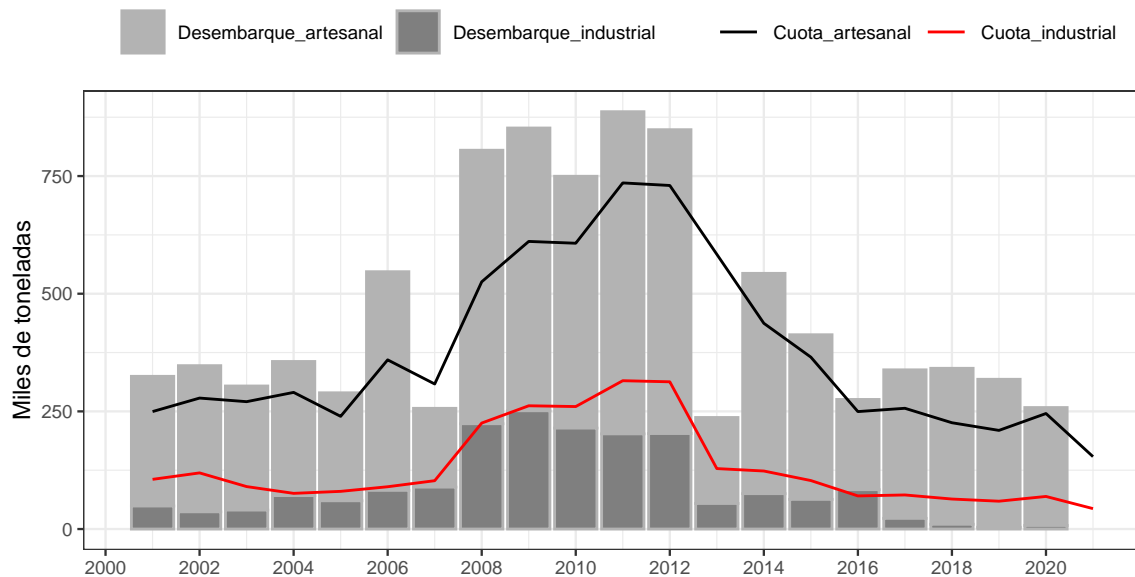
dataDesem3 <- data.frame(ant$year_cuota,ant$cuot_art,ant$cuot_ind)
colnames(dataDesem3) <- c("Years",
      "Cuota_artesanal",
      "Cuota_industrial")

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

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

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")

```

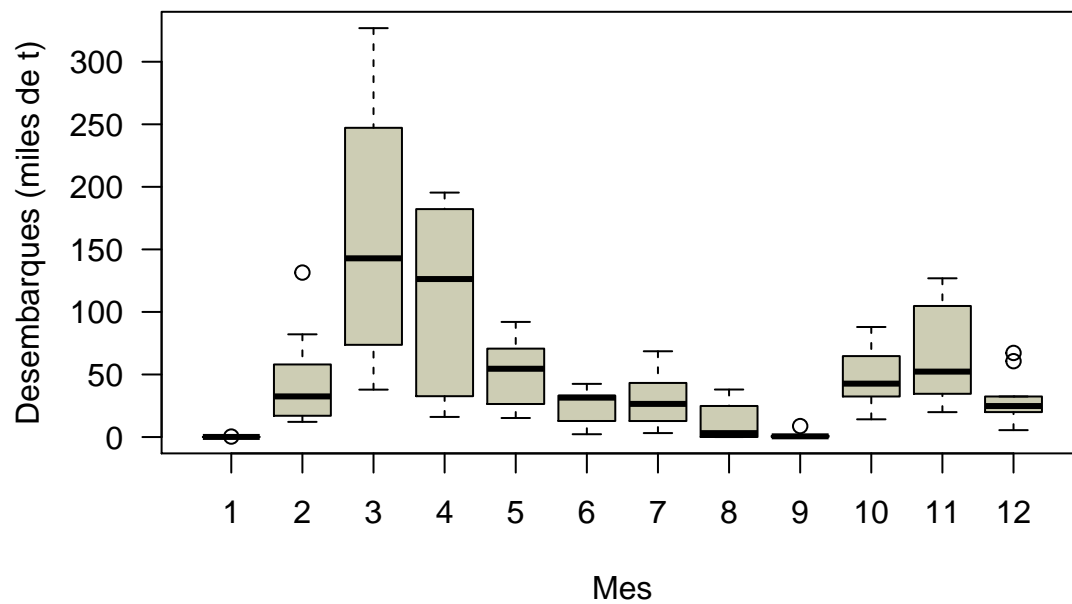


```

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_sernapesca[,2:13])))

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

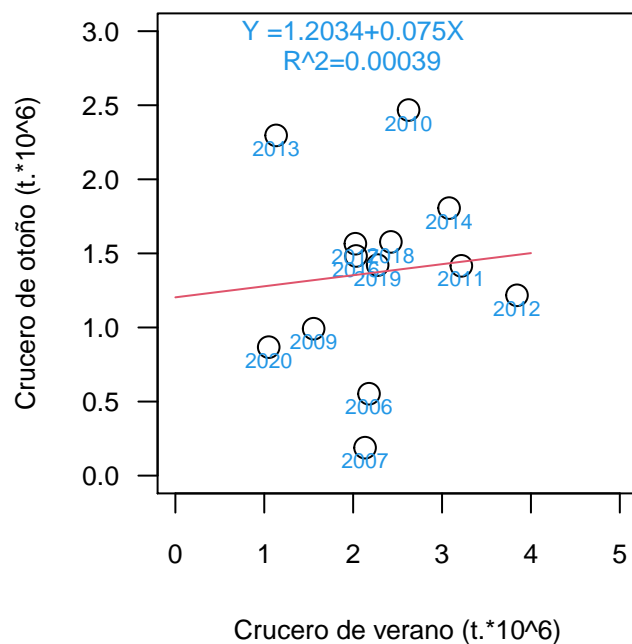
```



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

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

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

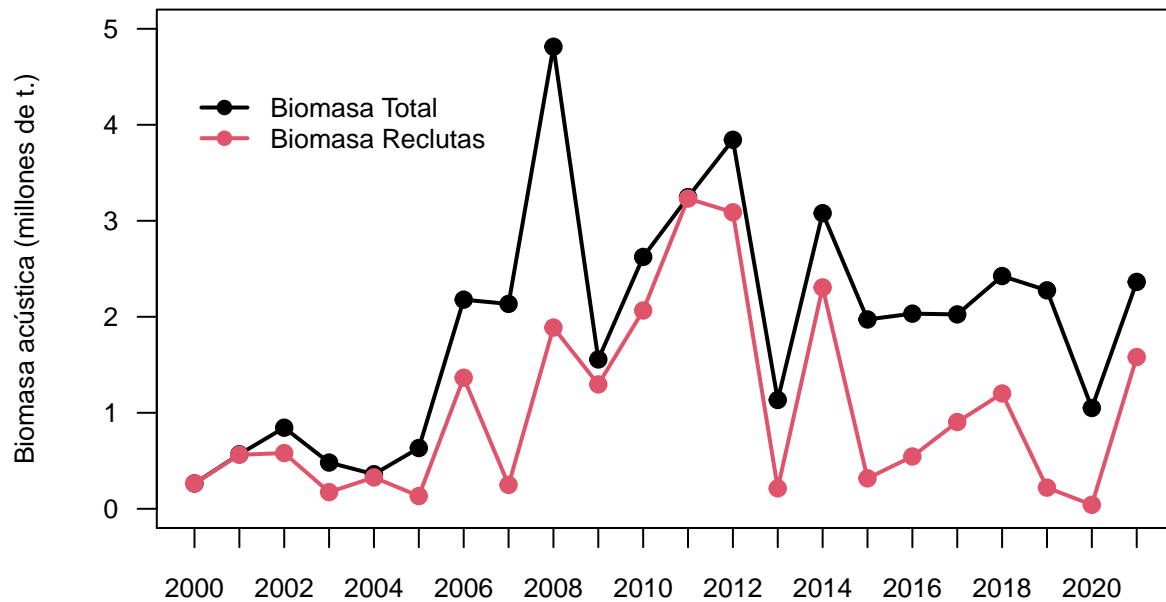


```

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

par(mar=c(2,4,1,1)+0.5)
plot(anorecl,BTreclas/1000000,ylim=c(0,5),xaxp=c(2000,2021,21),las=1,ylab="Biomasa acústica (millones de toneladas)",
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)

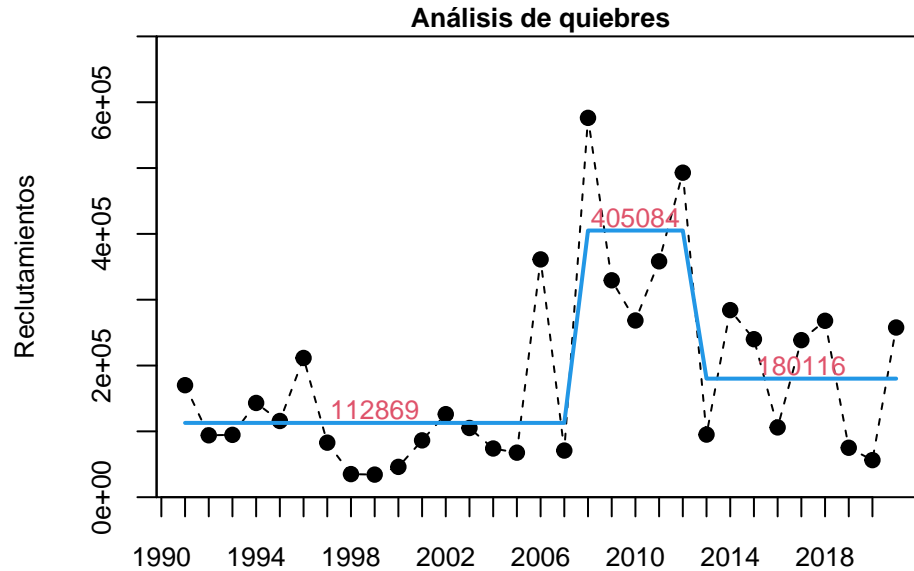
```



Metodología

```
library(strucchange)
years<-rep2$years
nyears<-length(years)
bp.nile <- breakpoints(rep2$Reclutas ~ 1)
fm0 <- lm(rep2$Reclutas ~ 1)
fm1 <- lm(rep2$Reclutas ~ breakfactor(bp.nile, breaks = 2))
quiebres3<-fitted(fm1)

par(mfrow=c(1,1),mar=c(2,4,1,1))
plot(years,rep2$Reclutas,type="l",lty=2,pch=19,ylim=c(0,700000),
      xaxp=c(1990,2020,30),yaxs="i",xlab="",ylab="Reclutamientos",main="Análisis de quiebres",cex.main=0)
points(years,rep2$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
```



```

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

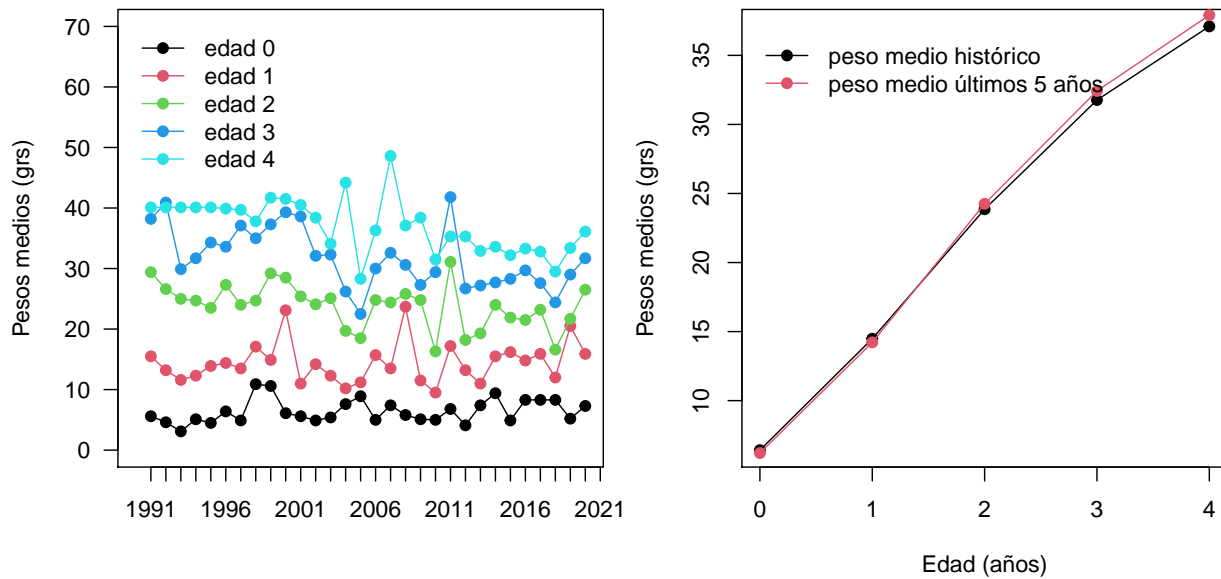
#Proporcion observada
WmedF <-dat1$Wmed
WiniF <-dat1$Wini

#Proporciones
Wm  <-c(WmedF); Wm[Wm==0] <-NA
Wi  <-c(WiniF); Wi[Wi==0] <-NA

x1 <-c(years1[1],years1[nyears1]+1,nyears1+1/2)
#Proporci?n de edad
par(mar=c(4,4,2,1),mfrow=c(1,2))
# pesos medios
plot(years1,WmedF[,1],type="n",las=1,ylim=c(0,70),xlim=c(1990,years1[nyears1]),ylab="Pesos medios (grs)")
for(i in 1:5){
  lines(years1,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[nyears1-5:nyears1,]),col=2,type="o",pch=19)
legend(0,37,c("peso medio hist?rico","peso medio ?ltimos 5 a?os"),pch=19,lwd=1,col=c(1,2),bty="n")

```



Resultados

```
setwd(dir.1)
years <- rep2$years
nyears <- dat2$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<-rep2$years[rep2$desembarqueobs>0]
yreclas <-rep2$years[rep2$reclasobs>0]
ypelaces <-rep2$years[rep2$pelacesobs>0]
ycompflota <-rep2$years[rowSums(rep2$pf_obs)>0]
ycompreclas <-rep2$years[rowSums(rep2$pobs_RECLAS)>0]
ycomppelaces <-rep2$years[rowSums(rep2$pobs_PELACES)>0]
ypesomedio <-rep2$years[rowSums(dat2$Wmed)>0]
ypesoinicial <-rep2$years[rowSums(dat2$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)

ejeje<-c("Desembarques","Biom_Cru_verano","Biom_Cru_otoño","CompEdad Flota","CompEdad C.verano","CompEdad C.otoño")
```

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

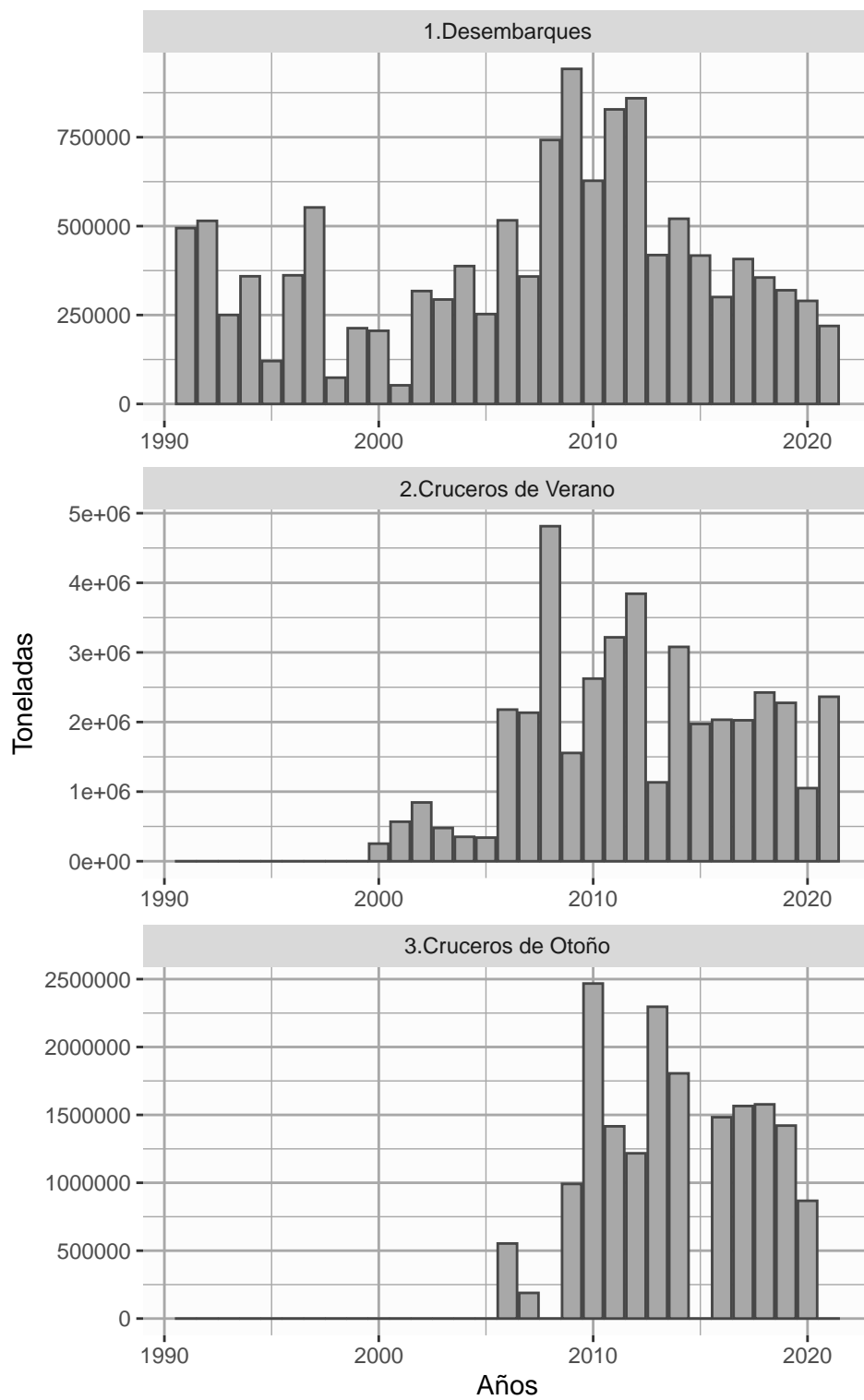
box()
```



```
des_obs <- data.frame(rep2$desembarqueobs)
bc_obs <- data.frame(rep2$reclasobs)
bp_obs <- data.frame(rep2$pelacesobs)
yearc <- rep2$years
nyearc <-length(yearc)

obsC <- as.data.frame(bc_obs) %>% mutate(year=yearc) %>% melt(id.vars='year') %>% mutate(type='2.Cruce')
obsP <- as.data.frame(bp_obs) %>% mutate(year=yearc) %>% melt(id.vars='year') %>% mutate(type='3.Cruce')
obsD <- as.data.frame(des_obs) %>% mutate(year=yearc) %>% melt(id.vars='year') %>% mutate(type='1.Desembarques')
Bcru <-rbind(obsC,obsP,obsD)

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

```
years <- rep2$years
nyears <- length(years)
age <- seq(0,4,1)
nage <- length(age)
WmedF <- dat2$Wmed
```

```

WiniF <- dat2$Wini
pobsF <- rep2$pf_obs

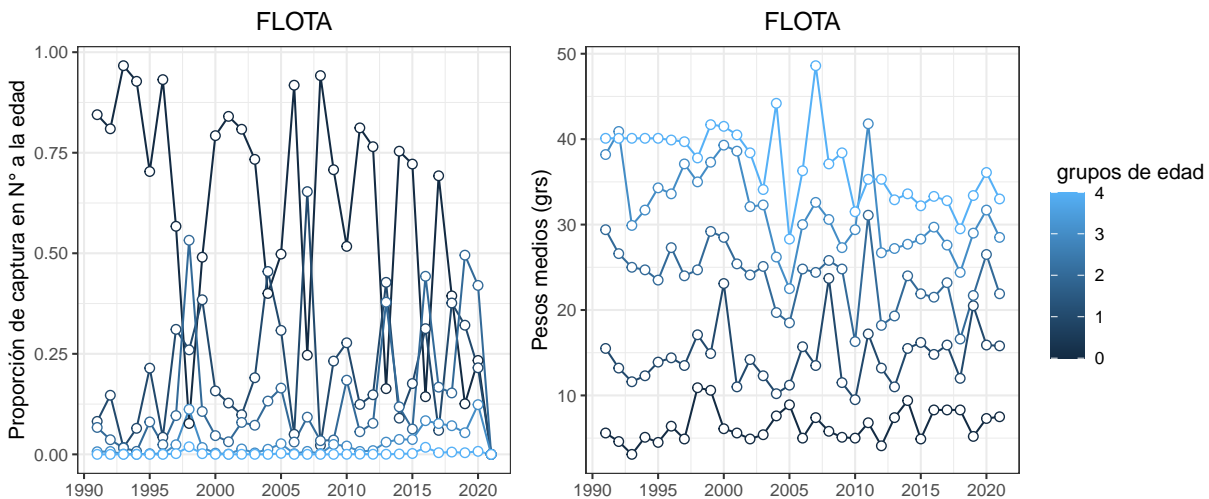
WmedF <- as.data.frame(WmedF) %>% mutate(years=years) %>% melt(id.vars='years') %>% mutate(
pobsF <- as.data.frame(pobsF) %>% mutate(years=years) %>% melt(id.vars='years') %>% mutate(

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

```



```

pobsF <- rep2$pf_obs
pF <- c(pobsF); pF[pF==0] <-NA
WmedF <- dat2$Wmed
Wm <- c(WmedF); Wm[Wm==0] <-NA

years <- rep2$years
nyears <- dat2$nanos

```

```

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

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

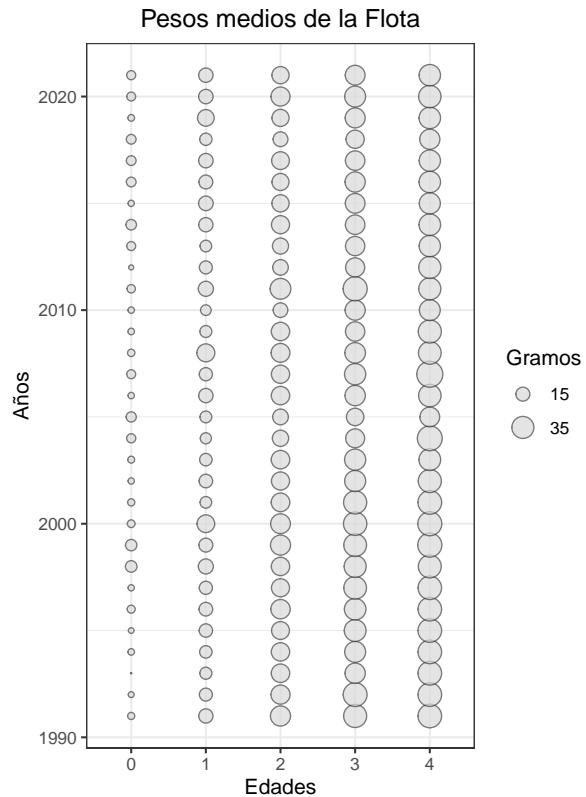
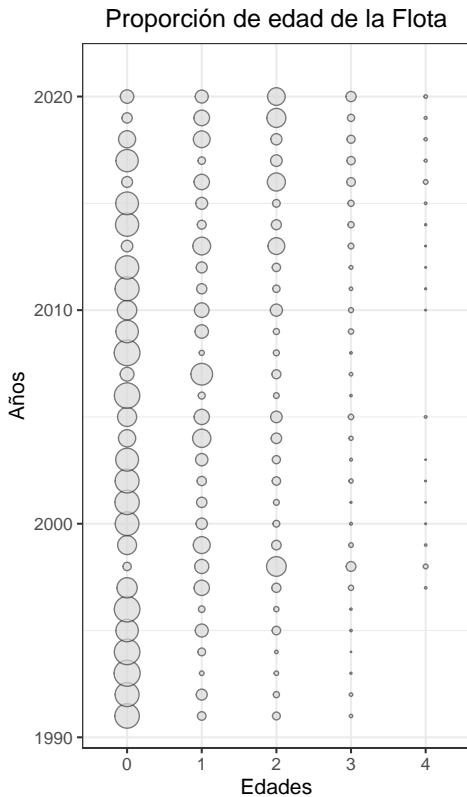
datosProp=data.frame(x=edad,y=anos,tamano=pF)
datosWmed=data.frame(x=edad,y=anos,tamano=Wm )

g1 <- ggplot (datosProp,aes(x,y)) +
  geom_point(aes(size=tamano),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=tamano),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

```



```
years <- rep2$years
nyears <- dat2$nanos
age <- seq(0,4,1)
nage <- length(age)
pobsR <- rep2$pobs_RECLAS
pobsP <- rep2$pobs_PELACES
```

```
pobsR <- as.data.frame(pobsR) %>% mutate(years=years) %>% melt(id.vars='years') %>%
```

```
mutate(
```

```
pobsP <- as.data.frame(pobsP) %>% mutate(years=years) %>% melt(id.vars='years') %>%
```

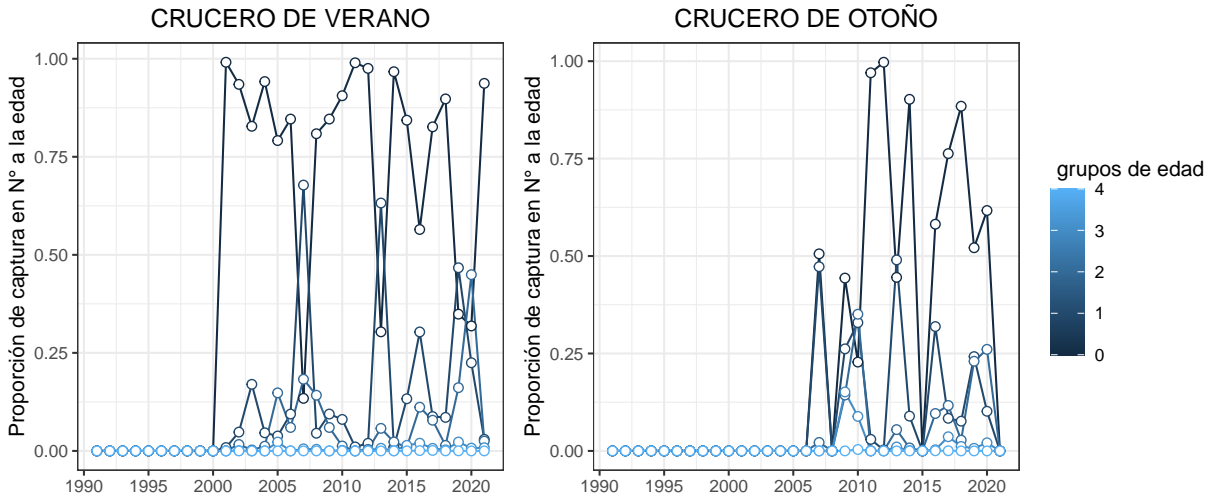
```
mutate(
```

```
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



```
pobsR <- rep2$pobs_RECLAS
pR <- c(pobsR); pR[pR==0] <-NA
pobsP <- rep2$pobs_PELACES
pP <- c(pobsP); pP[pP==0] <-NA

years <- rep2$years
nyears <- dat2$nanos
age <- seq(0,4,1)
nage <- length(age)

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

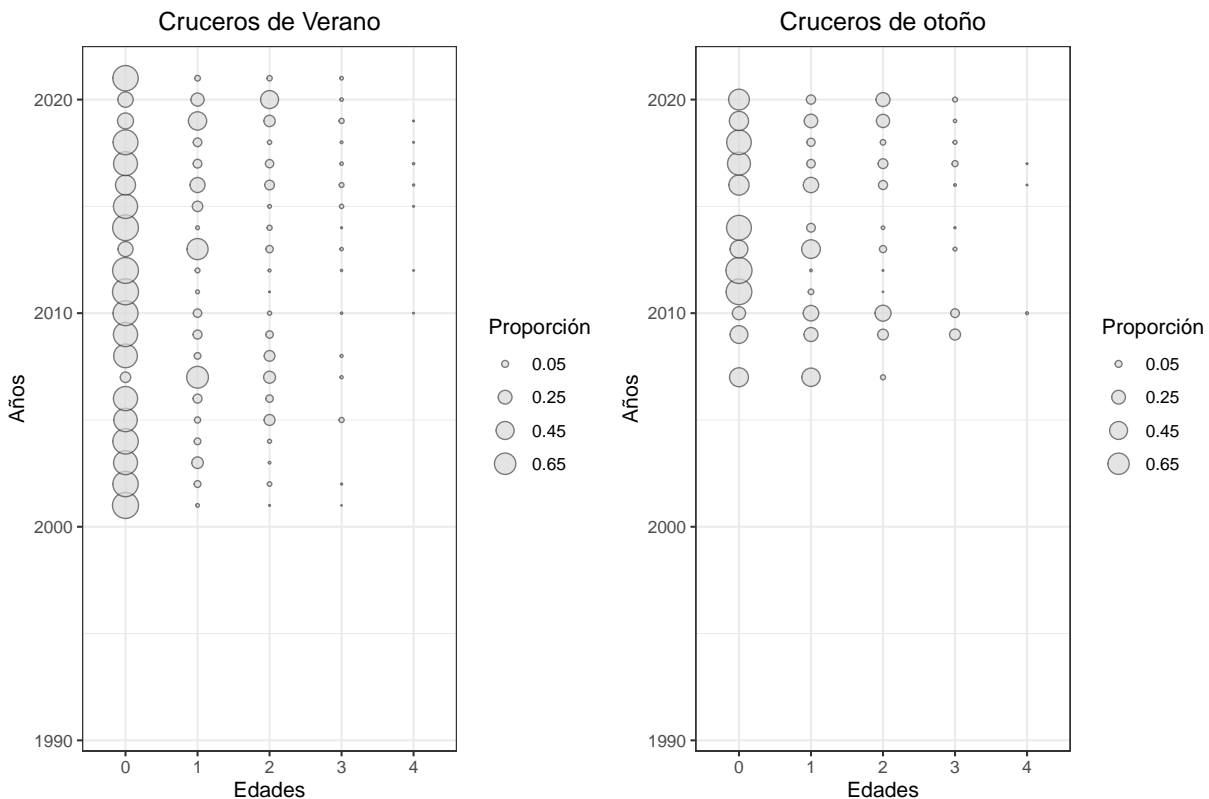
datosPropR=data.frame(x=edad,y=anos,tamano=pR)
datosPropP=data.frame(x=edad,y=anos,tamano=pP )

g1 <- ggplot (datosPropR,aes(x,y)) +
  geom_point(aes(size=tamano),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=tamano),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



```
yrs <- rep2$years
nyrs <- length(yrs)
lasty <- yrs[nyrs]
cvBcV <-0.30
cvBc0 <-0.30
cvdes <-0.01

ind_obs <- cbind(c(rep2$reclasobs),c(rep2$pelacesobs), c(rep2$desembarqueobs)); ind_obs[ind_obs==0,] <- NA
colnames(ind_obs) <- c('Crucero_verano', 'Crucero_otoño', 'Desembarques')
ind <- data.frame(ind_obs) %>% mutate(Asesoría='observado') %>% mutate(yrs= yrs) %>% melt(id_vars='Asesoría', variable_name='Edades', value_name='Proporción')

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')

sept <- data.frame(ind_sept) %>% mutate (Asesoría='septiembre_2020') %>% mutate (yrs= yrs) %>% melt(id_vars='Asesoría', variable_name='Edades', value_name='Proporción')

marzo <- data.frame(ind_marzo) %>% mutate (Asesoría='marzo_2021') %>% mutate (yrs= yrs) %>% melt(id_vars='Asesoría', variable_name='Edades', value_name='Proporción')
```

```

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

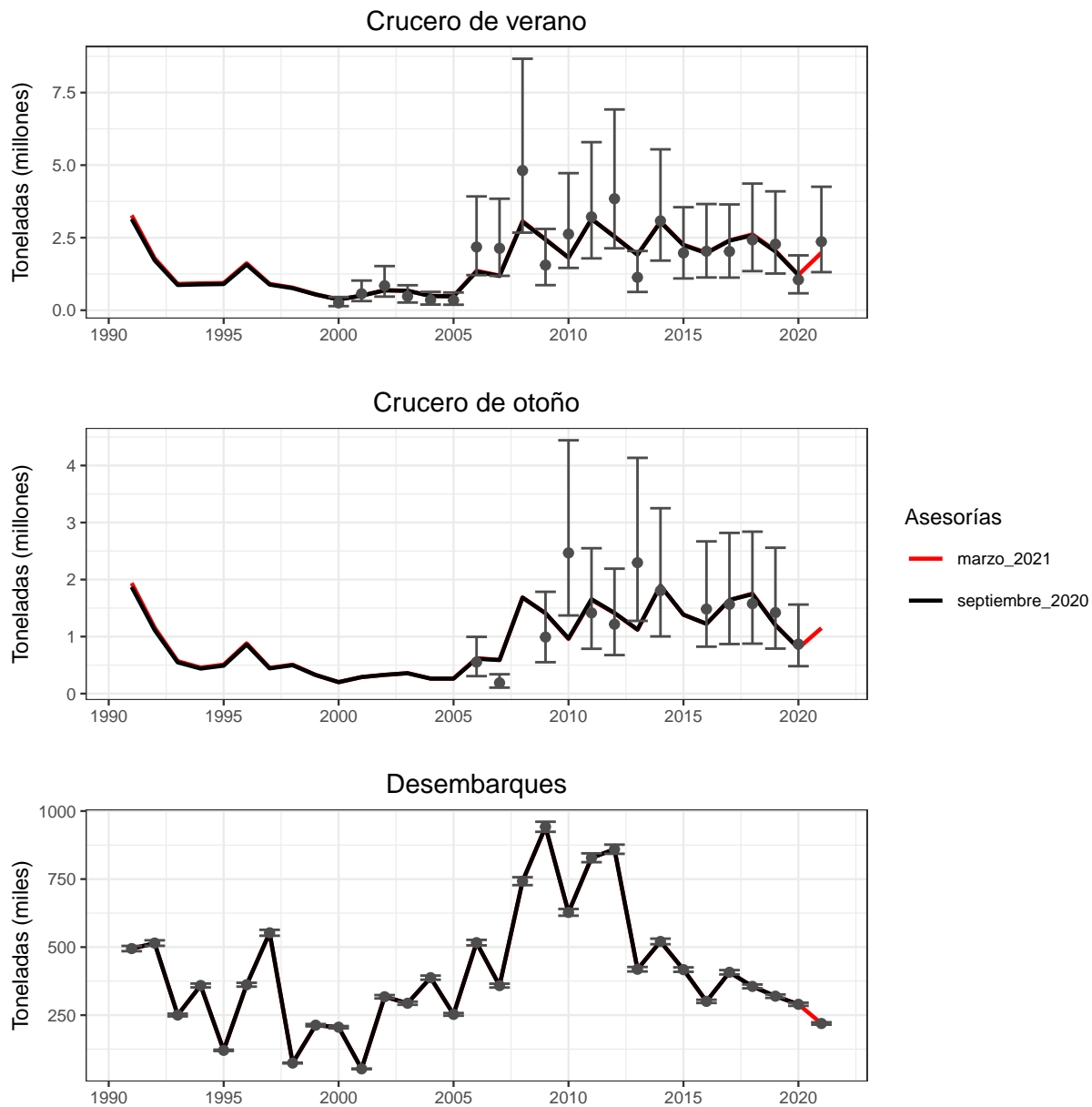
BcV <- ggplot(base1 %>% filter(Asesoria!='observado', variable=='Crucero_verano'),
  aes(yrs,value/1000000)) +
  geom_line(aes(colour=Asesoria), size=0.8) +
  scale_colour_manual(values=c('red','black')) +
  geom_point(data = base1 %>% filter(Asesoria=='observado', variable=='Crucero_verano'),
  aes(yrs,value/1000000), shape = 19, colour = 'gray30') +
  geom_errorbar(data = base1 %>% filter(Asesoria=='observado', variable=='Crucero_verano'),
  aes(ymin = value*exp(-1.96*cvBc0)*10^-6, ymax = value*exp(1.96*cvBc0)*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('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('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")

```



I. INDICES DE ABUNDANCIA

#

```

years <- dat2$Ind[,1]
nyears <- dat2$nanos
age <- seq(0,4,1)
nage <- dat2$nedades
Amax <- dat2$nedades
Age <- seq(0,4,1)
#Observado
obsR <- rep2$reclasobs ; obsR[obsR<=1] <-NA
obsP <- rep2$pelacesobs ; obsP[obsP<=1] <-NA
obsM <- rep2$mphobs ; obsM[obsM<=1] <-NA
obsD <- rep2$desembarqueobs
#predicho #stdpredicho

```



```

predR <- rep2$reclaspred
predP <- rep2$pelacespred
predM <- rep2$mphpred
predD <- rep2$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)

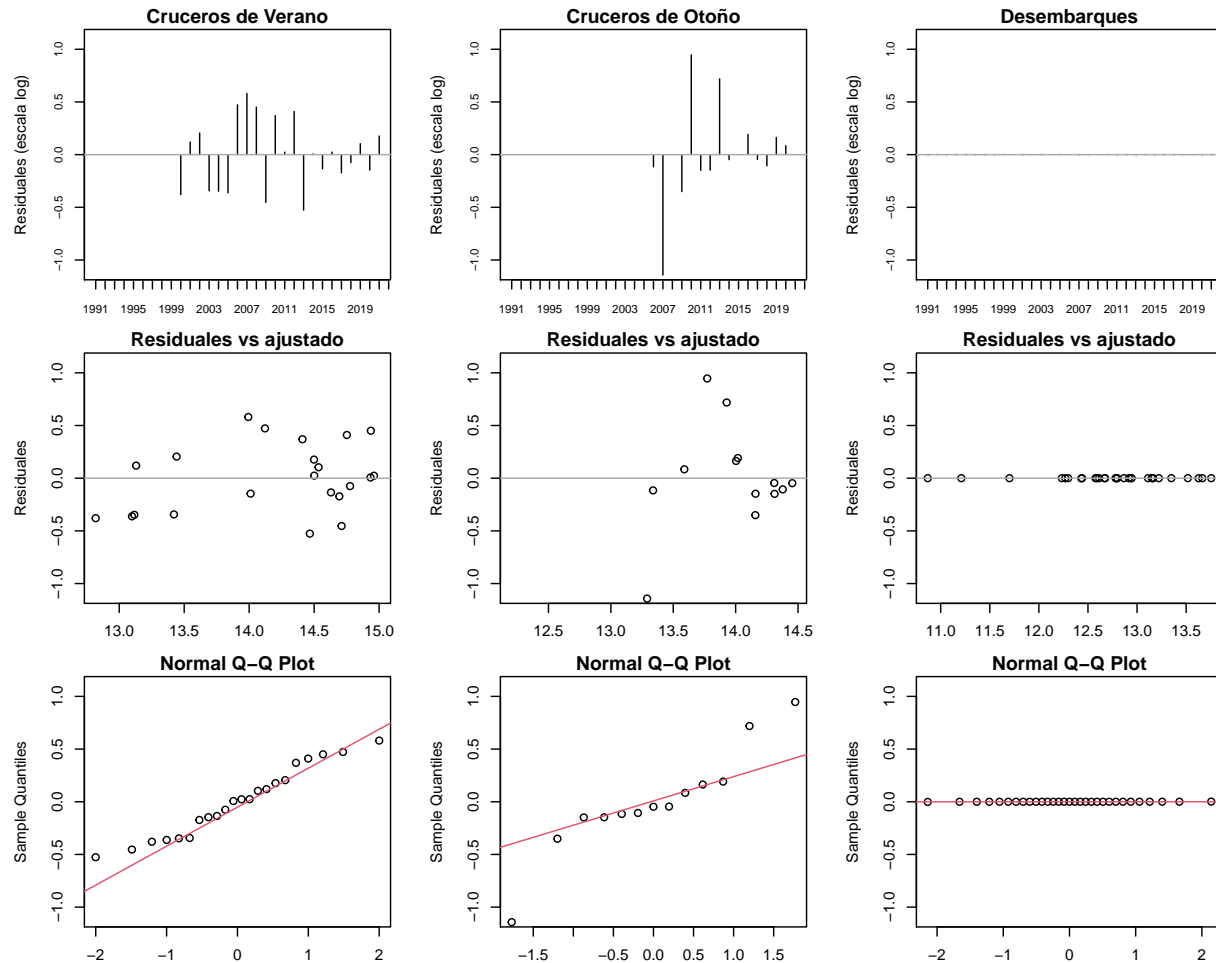
par(mfcol=c(3,3),mar=c(2,4,1,1)+0.5)

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

```



```

years <- dat2$Ind[,1]
nyears <- length(years)
age <- seq(0,4,1)
nage<-length(age)

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

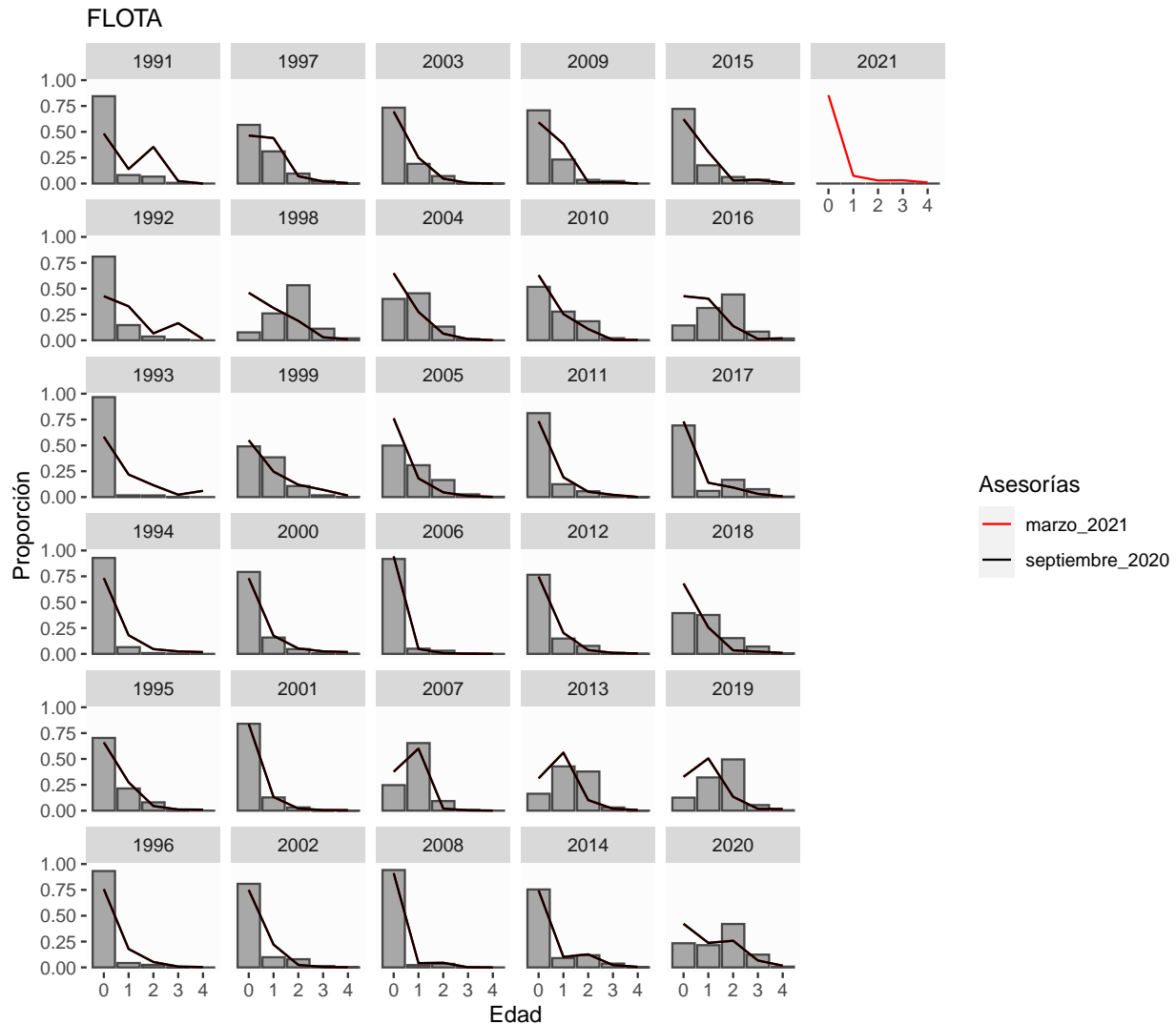
mat <- rbind(obs,pred_sep,pred_marzo)

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('red','black'),name="Asesorías") +
theme(panel.background = element_rect(fill = "gray99")) + theme(panel.grid=element_line(color=
ggtitle("FLOTA") + theme(plot.title = element_text(size = 12))
```

fig1



```
years <- dat2$Ind[,1]
nyears <- length(years)
age <-seq(0,4,1)
nage<-length(age)

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

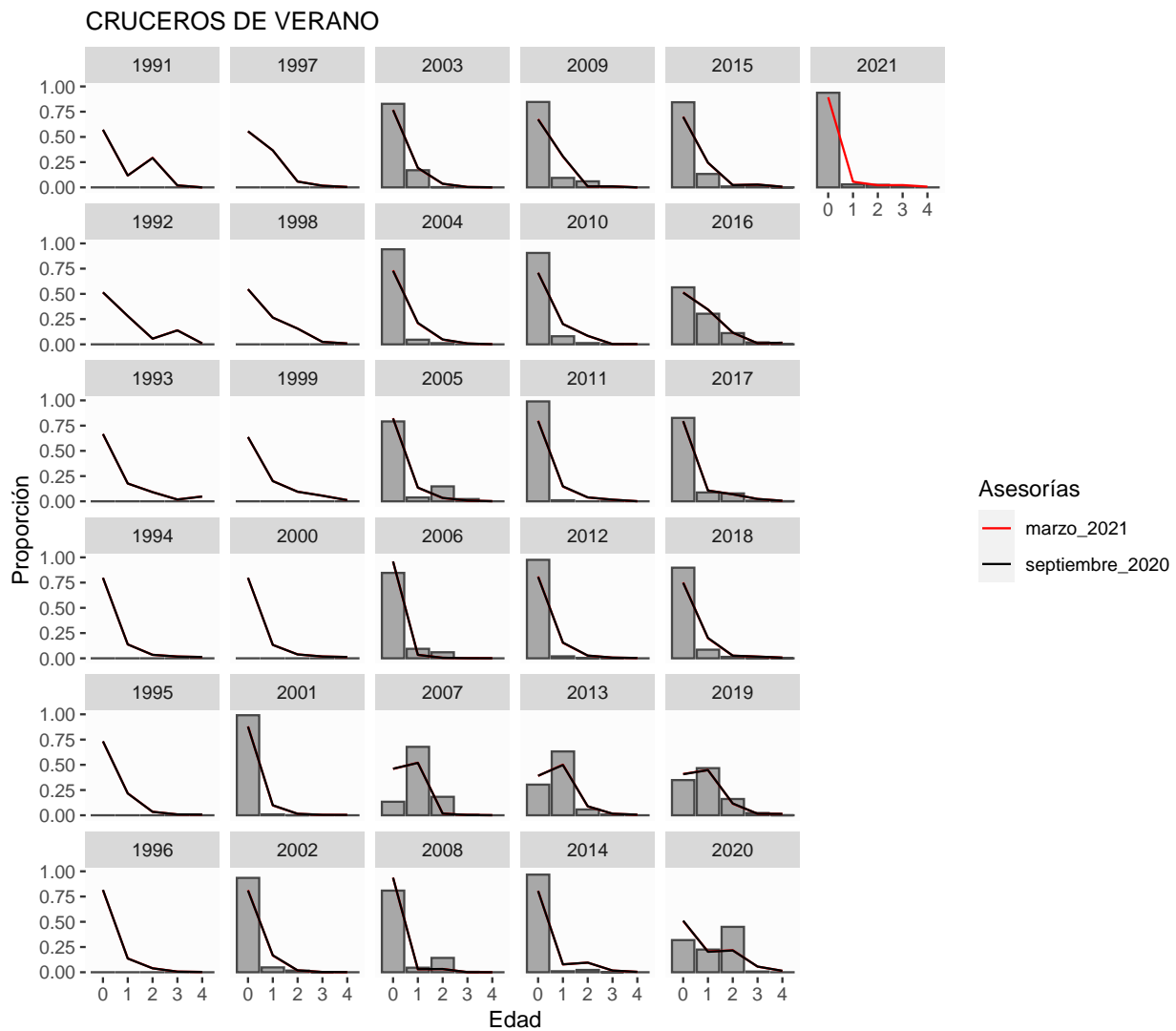
pred_marzo <- as.data.frame(etcf2_pre) %>% mutate(year=years) %>% melt(id.vars='year') %>%
  mutate(edad = rep(age, each=nyears)) %>% mutate(type='marzo_2021')

mat <- rbind(obs,pred_sep,pred_marzo)

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('red','black'),name="Asesorías") +
  theme(panel.background = element_rect(fill ="gray99")) + theme(panel.grid=element_line(color=
  ggtitle("CRUCEROS DE VERANO") + theme(plot.title = element_text(size = 12))

fig1

```



```

years <- dat2$Ind[,1]
nyears <- length(years)
age <- seq(0,4,1)

```

```

nage<-length(age)

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

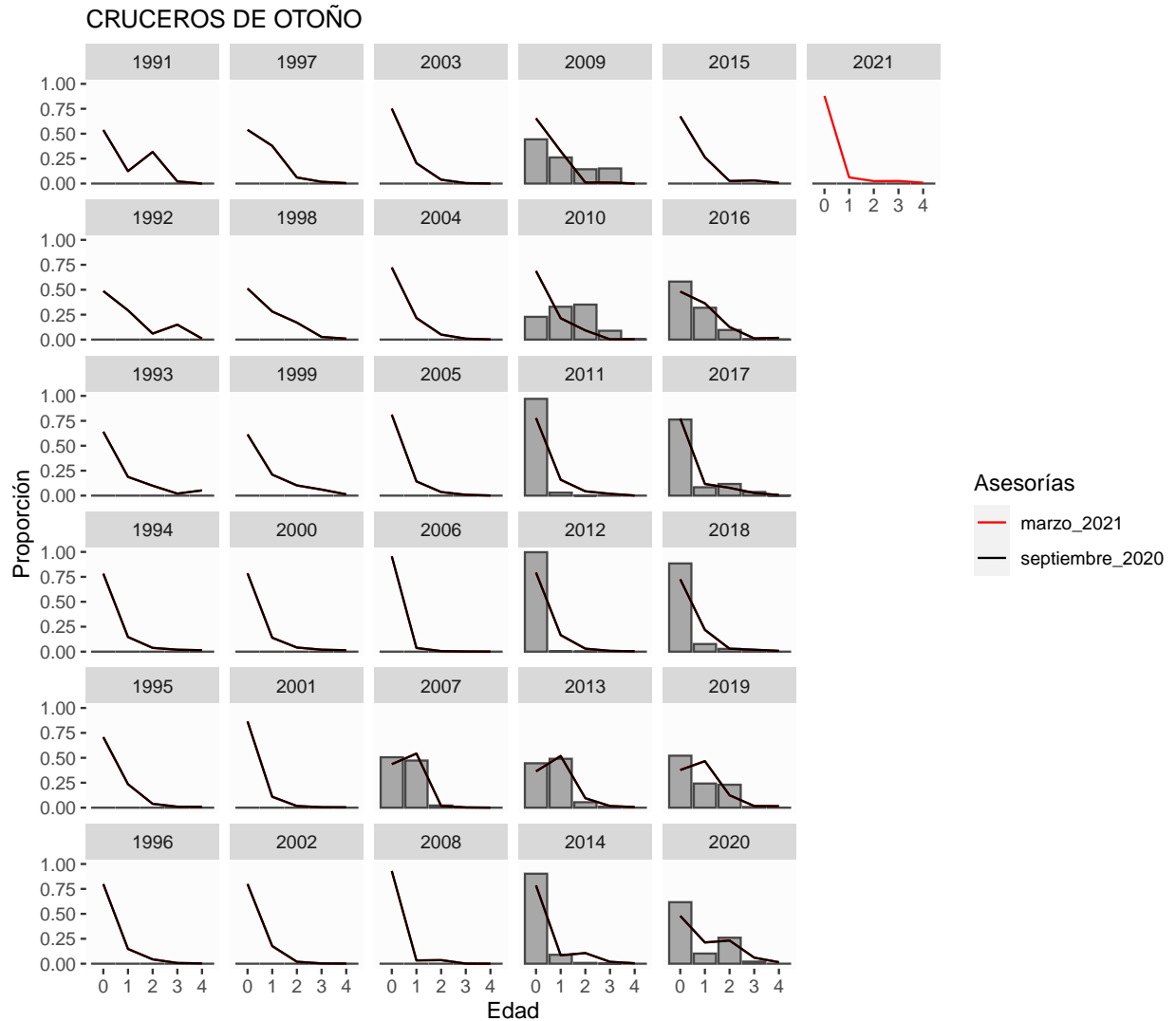
pred_marzo <- as.data.frame(etcf2_pre) %>% mutate(year=years) %>% melt(id.vars='year') %>%
  mutate(edad = rep(age, each=nyears)) %>% mutate(type='marzo_2021')

mat <- rbind(obs,pred_sep,pred_marzo)

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('red','black'),name="Asesorías") +
  theme(panel.background = element_rect(fill ="gray99")) + theme(panel.grid=element_line(color=
  ggtitle("CRUCEROS DE OTOÑO") + theme(plot.title = element_text(size = 12))

fig1

```



```

ppredF<-rep2$pf_pred
ppredR<-rep2$ppred_RECLAS
ppredP<-rep2$ppred_PELACES

#DESEMBARQUES
anos<-dat2$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])

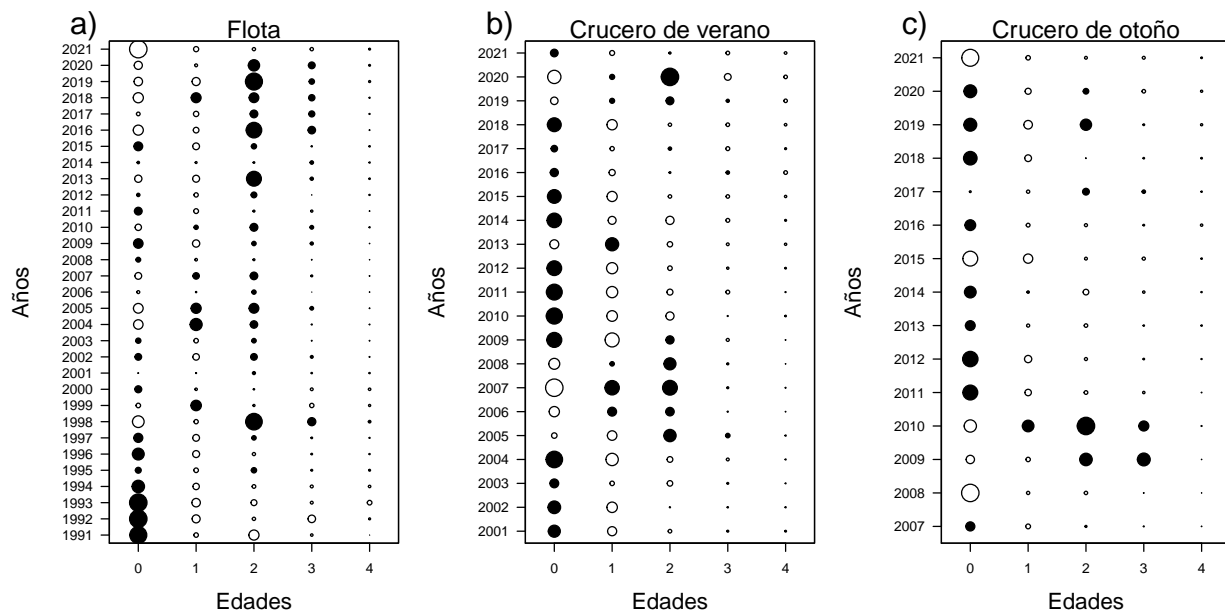
```

```

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()

```



```

years<-rep2$years
nyears<-length(years)

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

VarPob<- data.frame(x=years, 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))

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="")

#=====#
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)
#=====#
years  <- rep_mar21$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))
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))

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))

year_retros <- c("2021_marzo","2020_sept","2020_julio","2020_marzo","2019_sept")
nretros <-5

#Retrospectivo tradicional
Rt <- ggplot(Rtcomp) +
  geom_ribbon(data=VarPob,aes(ymin=lowerRt2, ymax=upperRt2, 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)+
  labs(x = '', y = 'Reclutamientos ',colour='Asesorías') +
  scale_x_continuous(breaks = seq(from = 1990, to = 2021, by = 5)) +
  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")

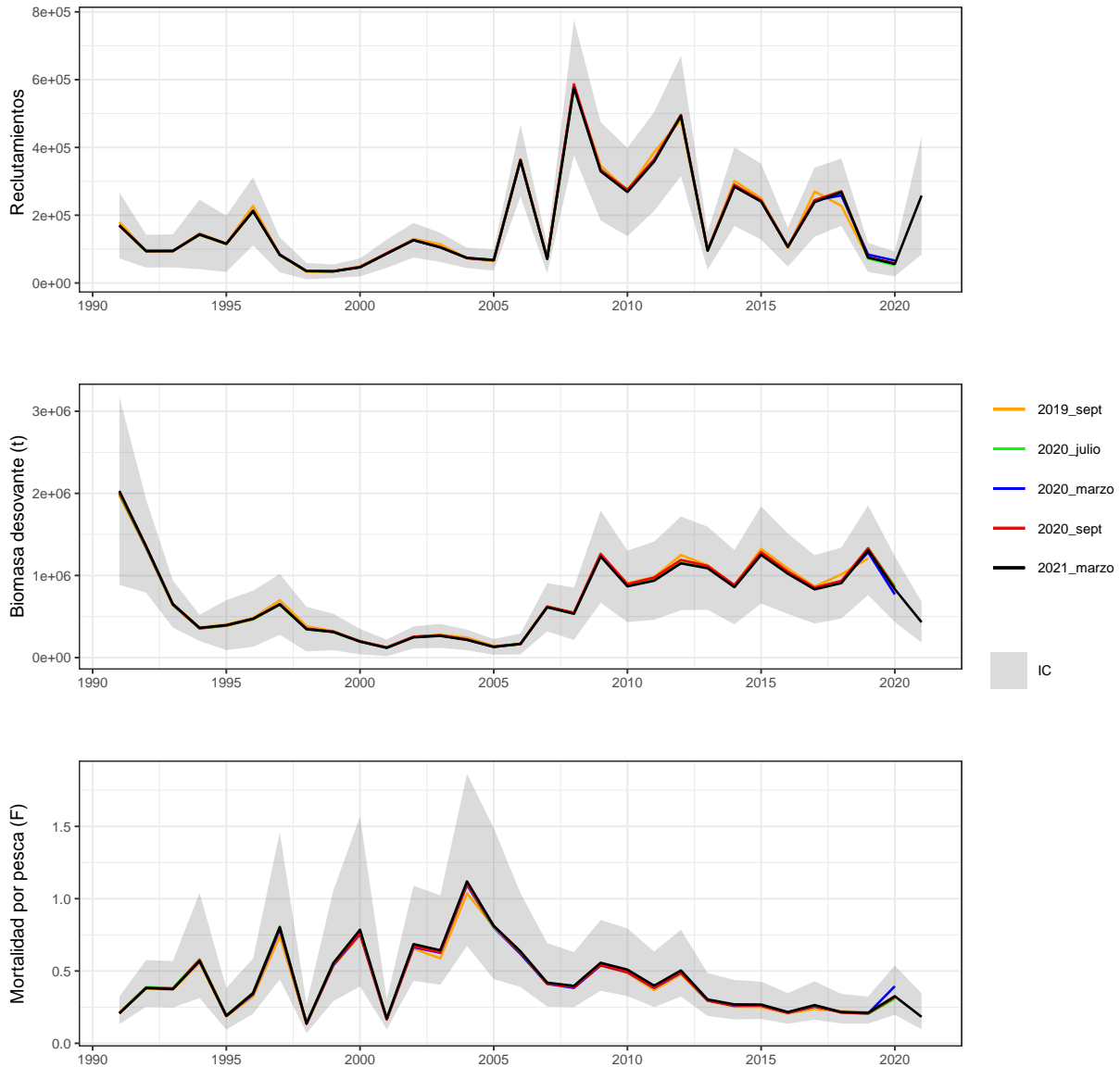
BD <- ggplot(SSBtcomp) +
  geom_ribbon(data=VarPob,aes(ymin=lowerBD2, ymax=upperBD2, x=x, fill = "IC"), alpha = 0.2)+
  geom_line(aes(y=SSBt_sept19, x=x, colour = year_retros[nretros]), size=0.5)+
  geom_line(aes(y=SSBt_mar20, x=x, colour = year_retros[nretros-1]), size=0.5)+
  geom_line(aes(y=SSBt_jul20, 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)+
  labs(x = '', y = 'Biomasa desovante (t)',colour='Asesorías') +
  scale_x_continuous(breaks = seq(from = 1990, to = 2021, by = 5)) +
  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))

Ft <- ggplot(Ftcomp) +
  geom_ribbon(data=VarPob,aes(ymin=lowerFt2, ymax=upperFt2, 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)+
  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("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



```
dir<-paste(dir.0,"/Retrospectivo_marz",sep="")
setwd(dir)
admb<-"MAE0321"

years<-rep2$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 = (Rt2 -1.96*Rt2std), upper = (Rt2+1.96*Rt2std))
BD_retro<- data.frame(x=years, y1=retroBD[,2],y2=retroBD[,3],y3=retroBD[,4],y4=retroBD[,5],y5=retroBD[,6],
  lower = (BD2 -1.96*BD2std), upper = (BD2+1.96*BD2std))
Ft_retro<- data.frame(x=years, y1=retroF[,2],y2=retroF[,3],y3=retroF[,4],y4=retroF[,5],y5=retroF[,6],
  lower = exp(Ft2-1.96*Ft2std), upper = exp(Ft2+1.96*Ft2std))

#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],y6=rel.diff.r[,6])
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],y6=rel.diff.ssb[,6])
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],y6=rel.diff.f[,6])

#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"))+

```

```

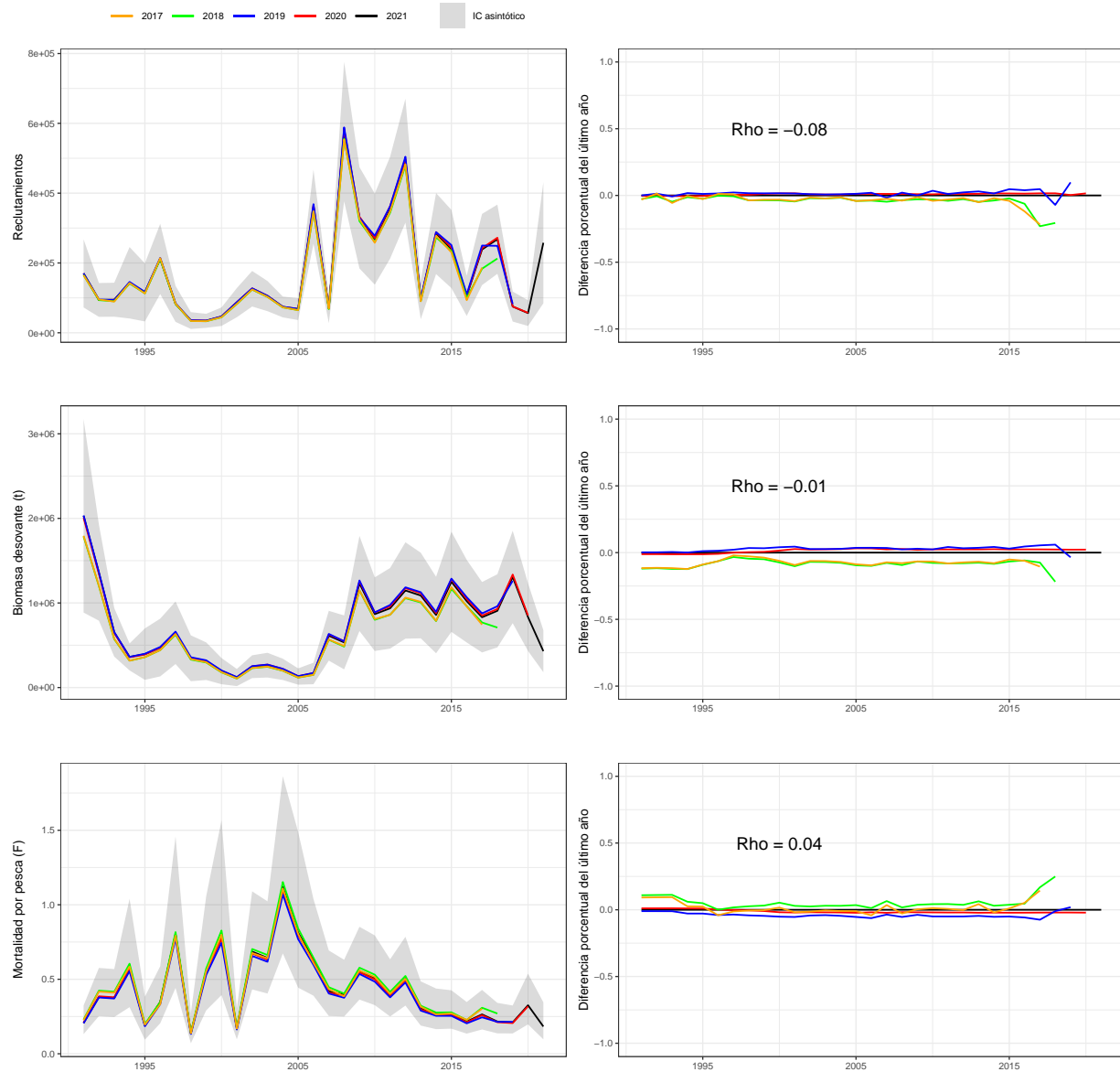
theme_bw(base_size=8) +
  ggtitle('')+
  theme(plot.title = element_text(hjust = 0.5),legend.position="none")

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

```



```

dir<-paste(dir.0,"/Verosimilitud_marz",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,"/MAE0321s",i,".rep",sep=""))
  logRo[i]  <- report$log_Ro
  likeval[i,]<- report$likeval}

like    <- data.frame(round(likeval,3),Total=apply(likeval,1,sum))

```

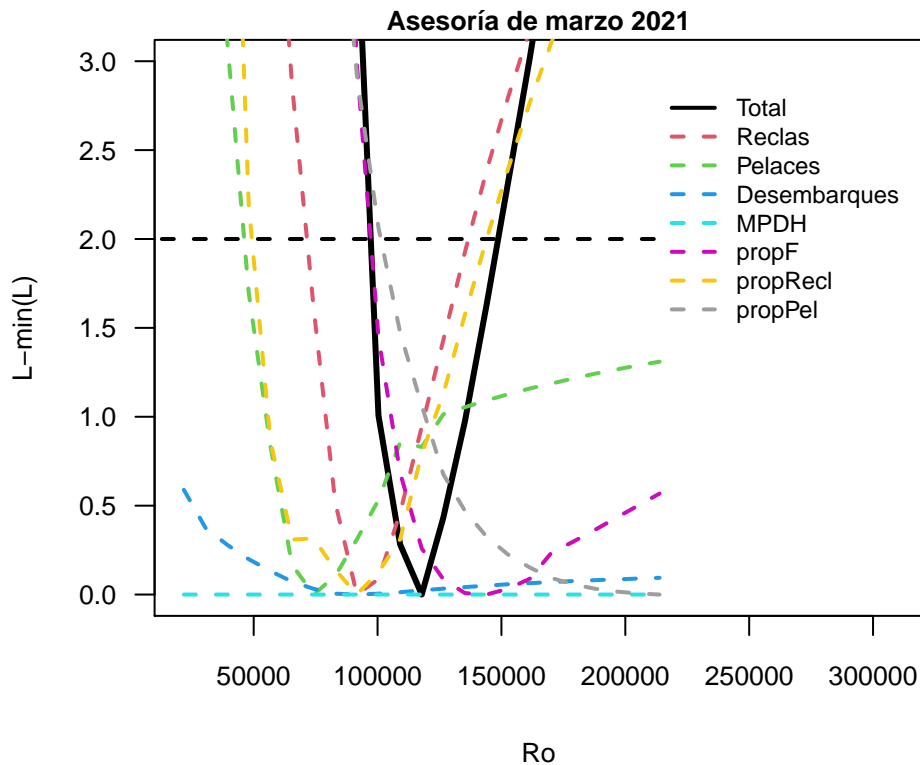
```

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)

```

```

years1<-rep2$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)

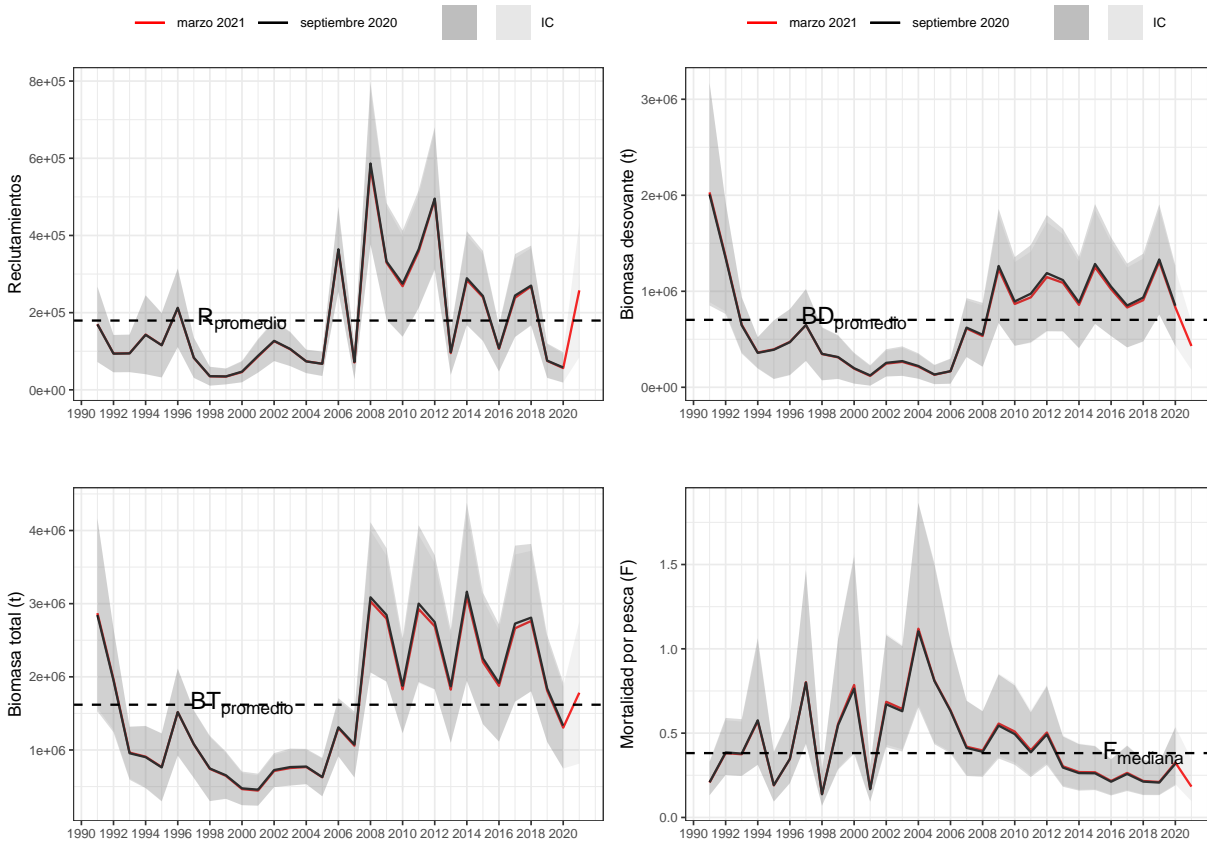
```

```

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))

```



```
years<-c("1990/91", "1991/92", "1992/93", "1993/94", "1994/95", "1995/96", "1996/97", "1997/98", "1998/99", "1999/00", "2000/01", "2001/02", "2002/03", "2003/04", "2004/05", "2005/06", "2006/07", "2007/08", "2008/09", "2009/10", "2010/11", "2011/12", "2012/13", "2013/14", "2014/15", "2015/16", "2016/17", "2017/18", "2018/19", "2019/20", "2020/21")
```

```
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
```

```
VarPobl1<- cbind('Año'=yearsb,
                  "$BD_{sept}"=c(BD1),
                  "$BD_{marzo}"=c(BD2),
```

```

"$BT_{sept}$"=c(BT1),
"$BT_{marzo}$"=c(BT2),
"$R_{sept}$"=c(Rt1),
"$R_{marzo}$"=c(Rt2),
"$F_{sept}$"=c(round(exp(Ft1),3)),
"$F_{marzo}$"=c(round(exp(Ft2),3)))
kable(VarPobl1)

```

Año	BD_{sept}	BD_{marzo}	BT_{sept}	BT_{marzo}	R_{sept}	R_{marzo}	F_{sept}	F_{marzo}
1990/91	2008700	2030000	2844200	2870400	169670	170120	0.209	0.207
1991/92	1344500	1358500	1949500	1966700	93768	94041	0.386	0.382
1992/93	645250	652550	955290	964360	94409	94707	0.379	0.375
1993/94	358150	362070	902180	909000	142470	143180	0.576	0.57
1994/95	390940	395090	761620	767170	115500	115760	0.192	0.19
1995/96	469770	473120	1518000	1517100	212650	211490	0.347	0.347
1996/97	648700	647450	1080200	1077600	83311	82828	0.8	0.803
1997/98	348370	346010	746840	741130	35378	35062	0.137	0.138
1998/99	314830	311640	653870	646260	34847	34292	0.547	0.555
1999/00	198580	194090	475590	465230	47251	46073	0.764	0.786
2000/01	123590	118470	457800	444970	88252	86319	0.167	0.172
2001/02	254560	246340	725490	713020	126940	126130	0.671	0.686
2002/03	272510	264590	766550	753550	105990	105110	0.63	0.643
2003/04	221470	215090	773620	767100	73689	73955	1.104	1.12
2004/05	132870	130190	629360	626840	67496	67638	0.809	0.813
2005/06	167690	166450	1310300	1299600	364340	361230	0.631	0.636
2006/07	621470	612730	1074400	1058400	72290	70839	0.412	0.419
2007/08	546580	533910	3087000	3029800	586530	576230	0.389	0.397
2008/09	1263800	1230300	2846100	2794700	332590	329460	0.545	0.557
2009/10	894040	867720	1877000	1828600	275020	268470	0.494	0.509
2010/11	974810	936800	3000800	2926400	364240	358290	0.386	0.398
2011/12	1189500	1147700	2747600	2690600	495590	492960	0.493	0.504
2012/13	1116600	1088100	1869900	1824500	97434	95115	0.296	0.303
2013/14	883910	857790	3164100	3096700	289240	284180	0.263	0.269
2014/15	1284500	1250400	2252000	2202700	243240	240020	0.262	0.268
2015/16	1047700	1021300	1916400	1876300	107500	106000	0.212	0.217
2016/17	851980	831090	2728000	2663200	244410	238570	0.258	0.264
2017/18	934650	907150	2809100	2763000	270150	267990	0.213	0.216
2018/19	1331300	1307200	1841000	1811000	75649	75099	0.207	0.21
2019/20	849310	832960	1333000	1305400	58067	56309	0.319	0.326
2020/21	NA	430060	NA	1782600	NA	257750	NA	0.183

```

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

```

```

# Reclutamientos asesoría marzo 2021
Rprom_1991_2007<-mean(Rt2[1:17])
Rprom_2008_2012<-mean(Rt2[18:22])
Rprom_2013_2021<-mean(Rt2[23:31])
Rprom_2013_2020<-mean(Rt2[23:30])
Rprom_historico<-mean(Rt2)

```

```

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-(Rt2[31]/Rprom_1991_2007)
Rlast_2008_2012<-1-(Rt2[31]/Rprom_2008_2012)
Rlast_2013_2021<-1-(Rt2[31]/Rprom_2013_2021)
Rlast_2013_2020<-1-(Rt2[31]/Rprom_2013_2020)
Rlast_historico<-1-(Rt2[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(BT2[1:17])
BTprom_2008_2012<-mean(BT2[18:22])
BTprom_2013_2021<-mean(BT2[23:31])
BTprom_2013_2020<-mean(BT2[23:30])
BTprom_historico<-mean(BT2)

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-(BT2[31]/BTprom_1991_2007)
BTlast_2008_2012<-1-(BT2[31]/BTprom_2008_2012)
BTlast_2013_2021<-1-(BT2[31]/BTprom_2013_2021)
BTlast_2013_2020<-1-(BT2[31]/BTprom_2013_2020)
BTlast_historico<-1-(BT2[31]/BTprom_historico)

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

# Biomasa desovante (BD) asesoría marzo 2021

BDprom_1991_2007<-mean(BD2[1:17])
BDprom_2008_2012<-mean(BD2[18:22])
BDprom_2013_2021<-mean(BD2[23:31])
BDprom_2013_2020<-mean(BD2[23:30])
BDprom_historico<-mean(BD2)

```

```

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-(BD2[31]/BDprom_1991_2007)
BDlast_2008_2012<-1-(BD2[31]/BDprom_2008_2012)
BDlast_2013_2021<-1-(BD2[31]/BDprom_2013_2021)
BDlast_2013_2020<-1-(BD2[31]/BDprom_2013_2020)
BDlast_historico<-1-(BD2[31]/BDprom_historico)

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

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

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

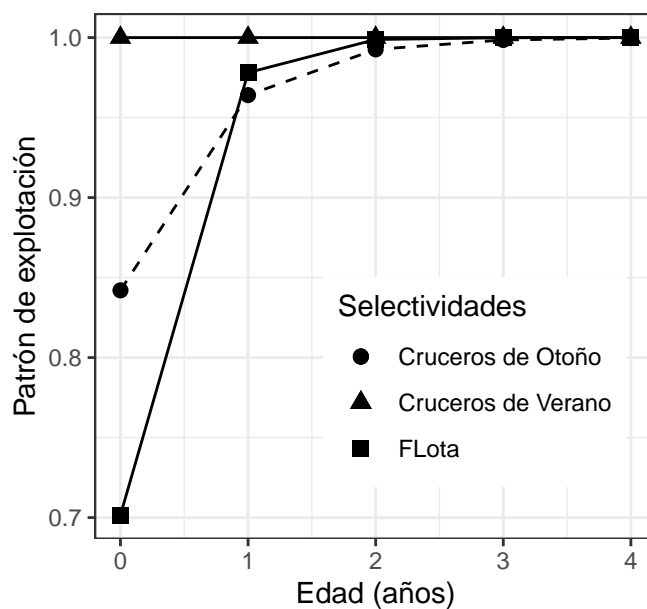
```

```

sel_Flota<-rep2$Sel_flota[1,]
sel_CruV <-rep2$Sel_reclas[1,]
sel_Cru0 <-rep2$Sel_pelaces[1,]

g1 <- ggplot () +
  #líneas
  geom_line(aes(x=age,y=sel_Flota))+
  geom_line(aes(x=age,y=sel_CruV))+
  geom_line(aes(x=age,y=sel_Cru0),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_Cru0,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

```



```
#PBR año biológico
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)

#PBR año biológico
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)

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

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

Tabla3.1<-rbind( "BDpromedio"=c(round(Bmed1/10^3,0),
                                round(Bmed2/10^3,0)),
                "Fmh"=c(round(Fmedian1,2),
                        round(Fmedian2,2)),
                "%BDPR_Fmh"=c(pSPR_Fmh1*100,
                             pSPR_Fmh2*100),
                "%BDPR_F~RMS~"=c(60,
                                60),
                "%BD_Fmh"=c(pB_Fmh1*100,
                            pB_Fmh2*100),
                "%BD_F~RMS~"=c(55,
                              55),
                "BD0"=c(round(Bo1/10^3,0),

```

```

        round(Bo2/10^3,0)),
        "BD55%"=c(round(BRMS1/10^3,0),
        round(BRMS2/10^3,0)),
        "BD27.5%"=c(round(BLIM1/10^3,0),
        round(BLIM2/10^3,0)))

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

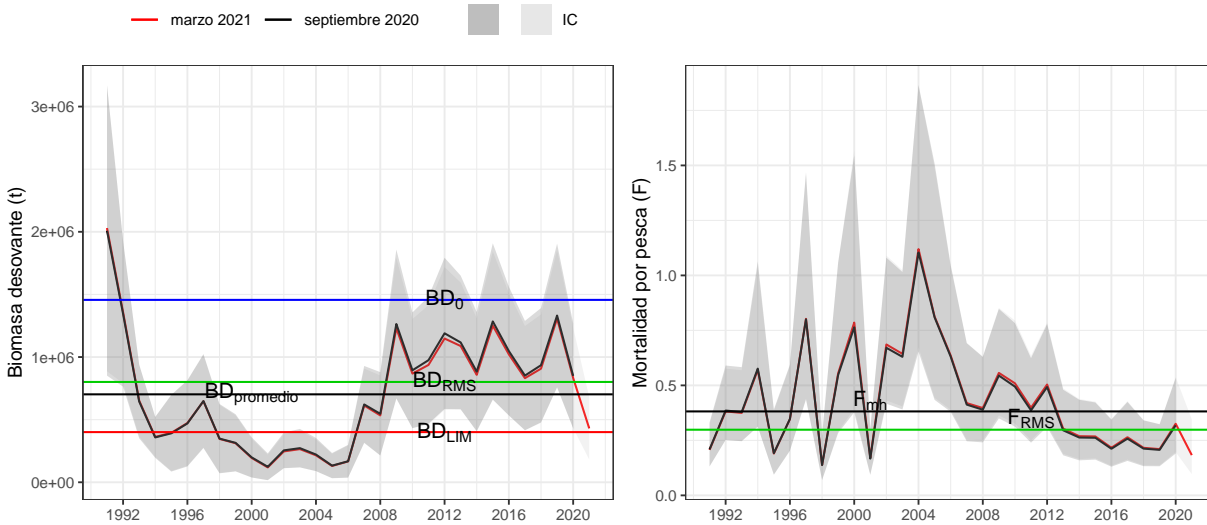
write.csv(Tabla3.1, file="Tabla21_PBRsporasesoria.csv")

BD <- ggplot() +
  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=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(BRMS2,BLIM2,Bo2,Bmed2),colour=c('green3','red','blue','black'))+
  annotate("text", x=c(rep(2012,3),2000), y=c(BRMS2,BLIM2,Bo2,Bmed2),
        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('red',"black"))+
  scale_fill_manual("",values=c("grey30",'gray75'))+
  theme_bw(base_size=10) +
  ggtitle('')+
  theme(plot.title = element_text(hjust = 0.5),legend.position="top")

Ft <- ggplot() +
  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=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(FRMS2,median(VarPobMar$Ft2)),colour=c('green3','black')) +
  annotate("text", x=c(2011,2001), y=c(FRMS2,median(exp(ln_Fyr2)))+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('red',"black"))+
  scale_fill_manual("",values=c("grey30",'gray75'))+
  theme_bw(base_size=10) +
  ggtitle('')+
  theme(plot.title = element_text(hjust = 0.5),legend.position="none")

BD + Ft

```

```

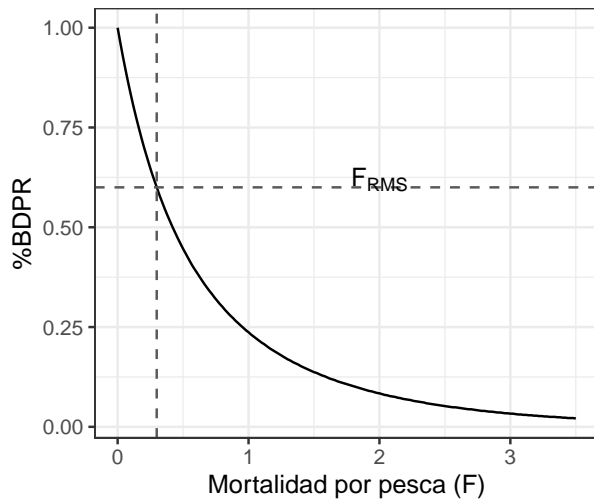
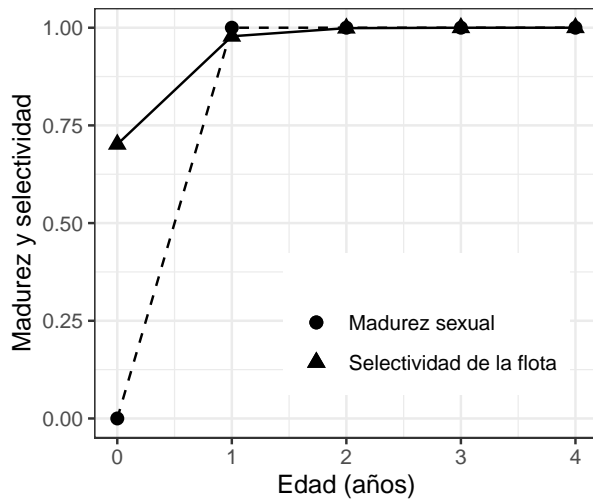
sel_Flota <- rep2$Sel_flota[1,]
madurez  <- dat2$madurezsexual
Fspr     <- SPRcurv2[,1]
BDspr    <- SPRcurv2[,4]

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(1,0.5))

g2 <- ggplot () +
  geom_line(aes(x=Fspr,y=BDspr))+
  geom_hline(yintercept = 0.6,colour=c('gray35'),linetype="dashed") +
  geom_vline(xintercept = FRMS2,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(1,0.5))

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 sobreexplotación*
#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)

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

BD_BDrms <- ggplot() +
  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=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('red',"black"))+
  scale_fill_manual("",values=c("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=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=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('red',"black"))+
  scale_fill_manual("",values=c("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_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(xbm,ybm), size=0.3,color="red")+

```

```

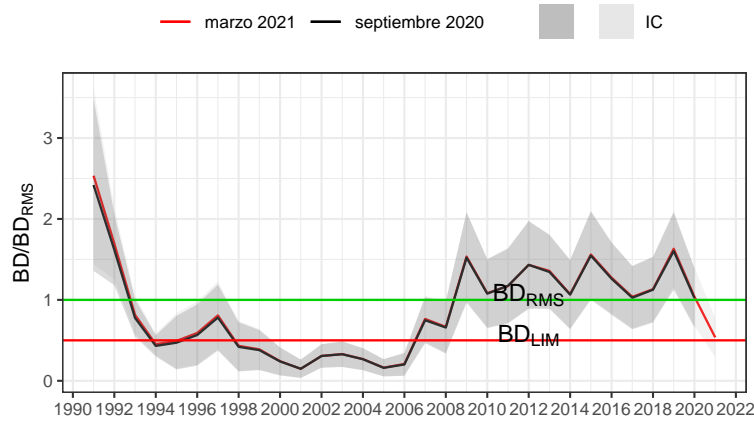
geom_line(aes(xbs,ybs), size=0.3,color="black")+
annotate("text", x=c(1,1), y=c(3.4,3.2), colour = c("red","black"), size = 2.5,
        label=c(paste("IC95%_marzo2021= [",round(icbm[1],3),"-",round(icbm[2],3),"]",sep=" "),
                paste("IC95%_sept2020 = [",round(icbs[1],3),"-",round(icbs[2],3),"]",sep=" "))) +
labs(x = expression("BD"[last]*"/BD"[RMS]), y = 'Densidad de probabilidad',tag="b") +
scale_colour_manual("",values=c('red',"black"))+
scale_fill_manual("",values=c("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_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(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), y=c(2.5,2.35), colour = c("red","black"), size = 2.5,
        label=c(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")

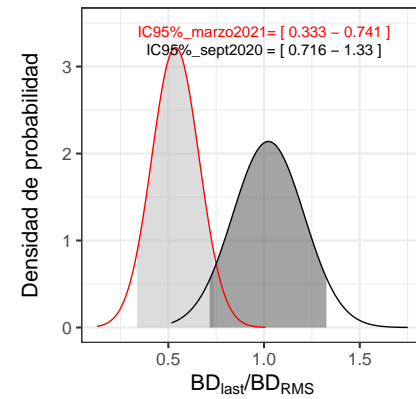
{(BD_BDrms / F_Frms) | (fig_desnb/fig_desnf)} + plot_layout(ncol=2,widths=c(2,1))

```

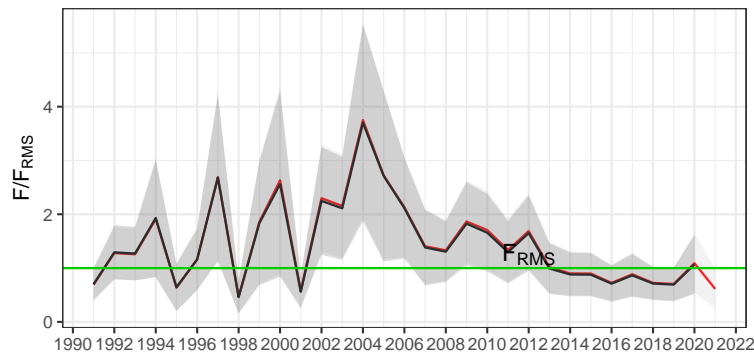
a)



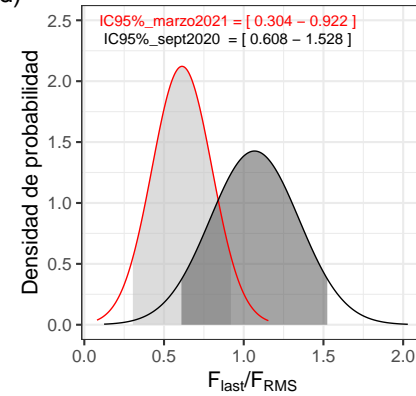
b)



c)



d)



```

years<-c("1990/91","1991/92","1992/93","1993/94","1994/95","1995/96","1996/97","1997/98","1998/99","1999/00","2000/01","2001/02")
VarPobl2<- cbind('Años'=years,
  "$F/F_{RMS}_{sept}"=c(round(exp(Ft1)/FRMS1,3)),
  "$F/F_{RMS}_{marzo}"=c(round(exp(Ft2)/FRMS2,3)),
  "$BD/BD_{RMS}_{sept}"=c(round(BD1/BRMS1,3)),
  "$BD/BD_{RMS}_{marzo}"=c(round(BD2/BRMS2,3)))
kable(VarPobl2, align = 'c')

```

Años	$F/F_{RMS_{sept}}$	$F/F_{RMS_{marzo}}$	$BD/BD_{RMS_{sept}}$	$BD/BD_{RMS_{marzo}}$
1990/91	0.7	0.693	2.419	2.534
1991/92	1.293	1.279	1.619	1.696
1992/93	1.27	1.256	0.777	0.815
1993/94	1.931	1.911	0.431	0.452
1994/95	0.643	0.637	0.471	0.493
1995/96	1.164	1.161	0.566	0.591
1996/97	2.682	2.689	0.781	0.808
1997/98	0.461	0.464	0.42	0.432
1998/99	1.835	1.859	0.379	0.389
1999/00	2.561	2.632	0.239	0.242
2000/01	0.56	0.576	0.149	0.148
2001/02	2.249	2.299	0.307	0.308

Años	$F/F_{RMS_{sept}}$	$F/F_{RMS_{marzo}}$	$BD/BD_{RMS_{sept}}$	$BD/BD_{RMS_{marzo}}$
2002/03	2.111	2.155	0.328	0.33
2003/04	3.701	3.751	0.267	0.269
2004/05	2.713	2.724	0.16	0.163
2005/06	2.116	2.131	0.202	0.208
2006/07	1.383	1.405	0.748	0.765
2007/08	1.305	1.331	0.658	0.667
2008/09	1.825	1.865	1.522	1.536
2009/10	1.657	1.707	1.077	1.083
2010/11	1.295	1.335	1.174	1.17
2011/12	1.651	1.688	1.433	1.433
2012/13	0.991	1.016	1.345	1.358
2013/14	0.881	0.901	1.065	1.071
2014/15	0.878	0.898	1.547	1.561
2015/16	0.71	0.726	1.262	1.275
2016/17	0.865	0.886	1.026	1.038
2017/18	0.713	0.725	1.126	1.133
2018/19	0.693	0.705	1.603	1.632
2019/20	1.068	1.091	1.023	1.04
2020/21	NA	0.613	NA	0.537

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

years<-c("1990/91","1991/92","1992/93","1993/94","1994/95","1995/96","1996/97","1997/98","1998/99","1999/00","2000/01","2001/02","2002/03","2003/04","2004/05","2005/06","2006/07")

VarPobl2b<- cbind('Años'=years,
  "$Y/BT_{sept}$"=c(round(rep1$desembarquepred/BT1,3)),
  "$Y/BT_{marzo}$"=c(round(rep2$desembarquepred/BT2,3)),
  "$C/N_{sept}$"=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)))
kable(VarPobl2b, align = 'c')
```

Años	Y/BT_{sept}	Y/BT_{marzo}	C/N_{sept}	C/N_{marzo}
1990/91	0.174	0.172	0.102	0.101
1991/92	0.264	0.261	0.179	0.178
1992/93	0.262	0.26	0.169	0.167
1993/94	0.398	0.395	0.232	0.23
1994/95	0.158	0.157	0.088	0.088
1995/96	0.238	0.238	0.148	0.149
1996/97	0.512	0.513	0.323	0.324
1997/98	0.099	0.1	0.069	0.069
1998/99	0.326	0.33	0.233	0.236
1999/00	0.432	0.442	0.291	0.298
2000/01	0.115	0.118	0.074	0.076
2001/02	0.438	0.445	0.261	0.266
2002/03	0.383	0.39	0.252	0.256
2003/04	0.501	0.505	0.39	0.394
2004/05	0.401	0.403	0.302	0.304
2005/06	0.394	0.397	0.237	0.239
2006/07	0.334	0.339	0.193	0.196

Años	Y/BT_{sept}	Y/BT_{marzo}	C/N_{sept}	C/N_{marzo}
2007/08	0.24	0.245	0.158	0.161
2008/09	0.331	0.337	0.229	0.234
2009/10	0.334	0.343	0.209	0.215
2010/11	0.276	0.283	0.164	0.169
2011/12	0.313	0.319	0.202	0.206
2012/13	0.224	0.229	0.147	0.15
2013/14	0.165	0.168	0.116	0.119
2014/15	0.185	0.189	0.119	0.122
2015/16	0.157	0.16	0.104	0.107
2016/17	0.149	0.153	0.114	0.117
2017/18	0.127	0.129	0.097	0.098
2018/19	0.174	0.176	0.105	0.107
2019/20	0.217	0.222	0.152	0.155
2020/21	NA	0.123	NA	0.08

```

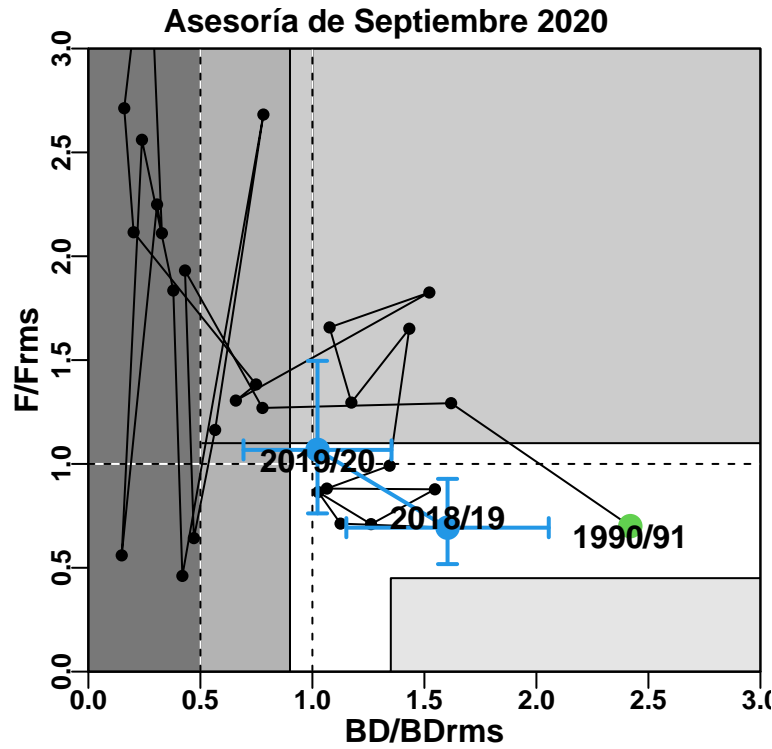
#setwd(dir.basedatos)
write.csv(VarPobl2b, file="Tabla_23_tasasExplotacion.csv")
#setwd(dir.1)

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),

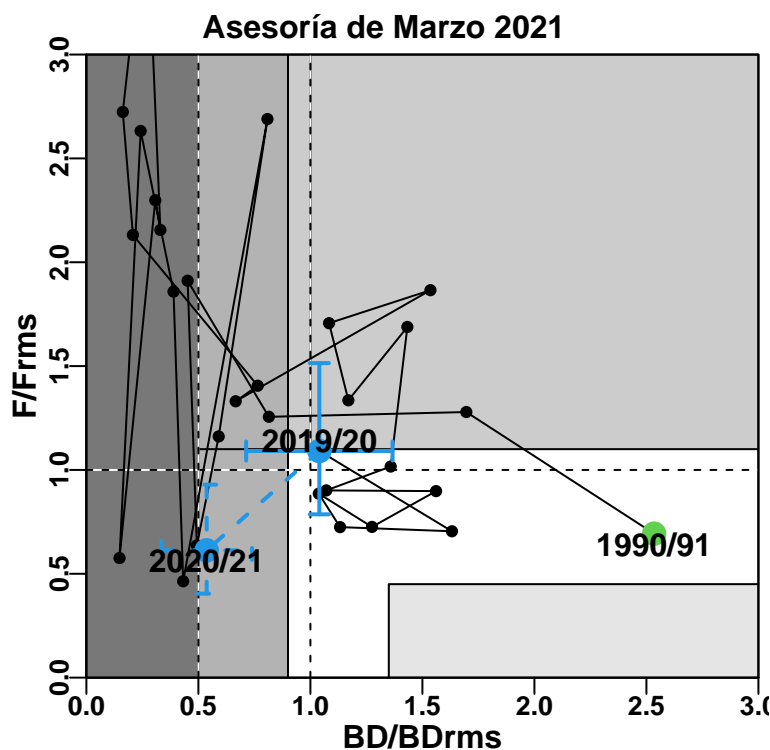
```

```
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),
```



```

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

```

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