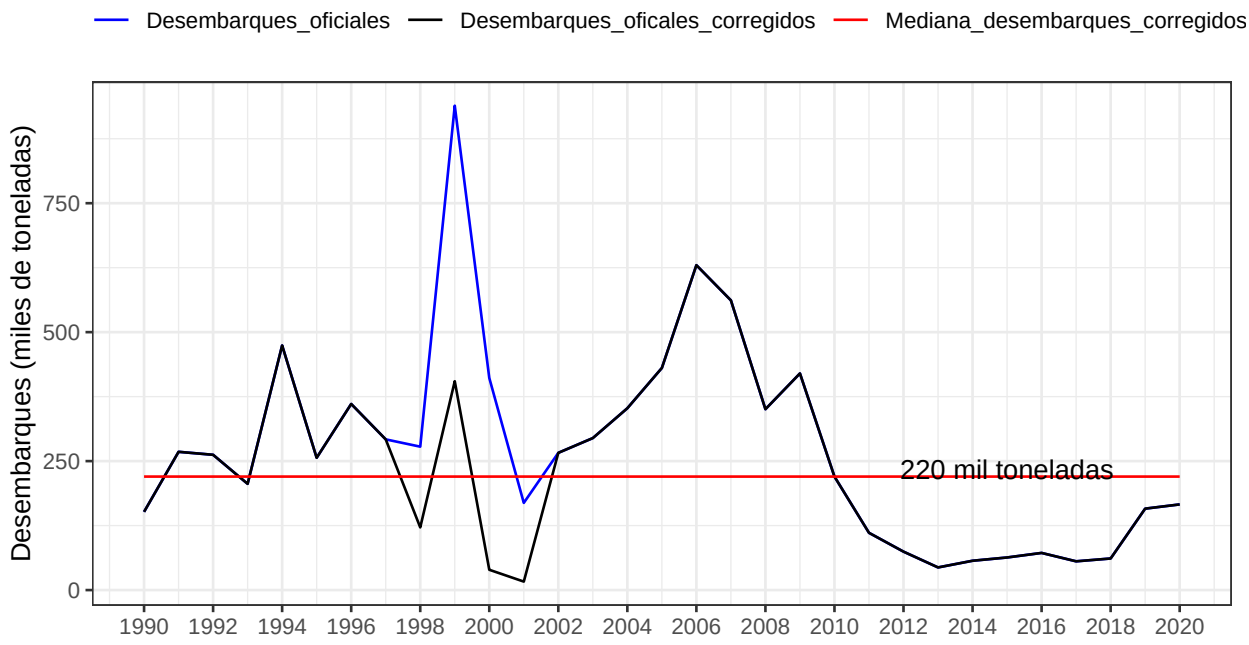
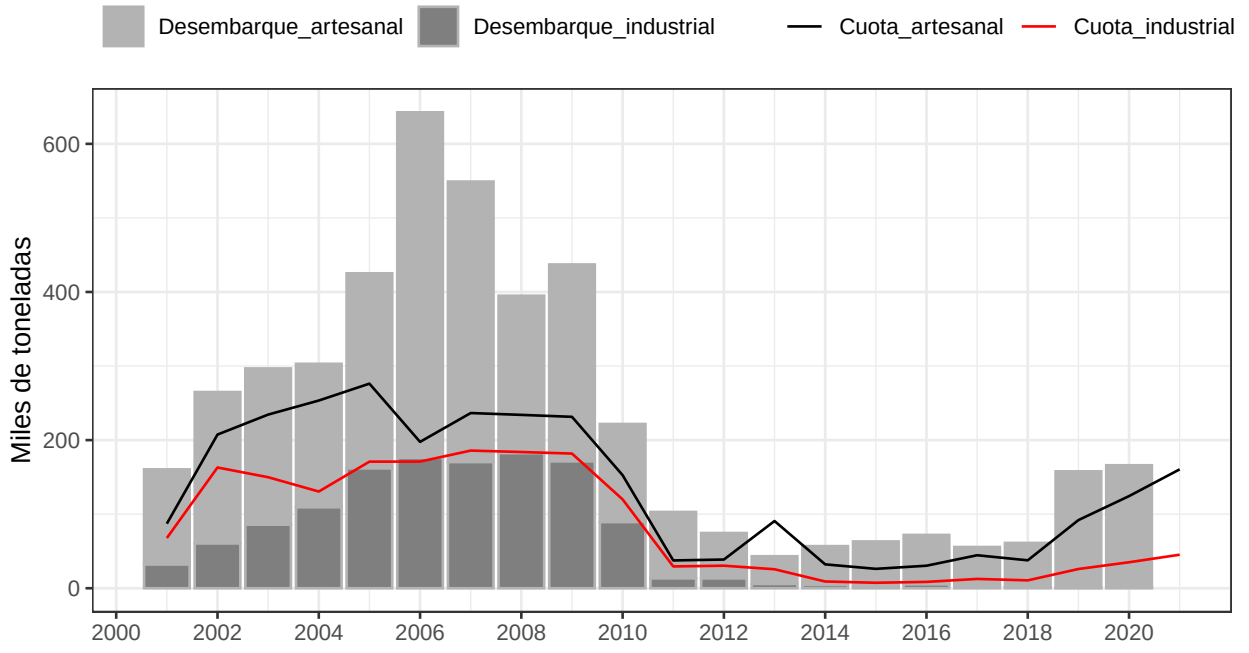
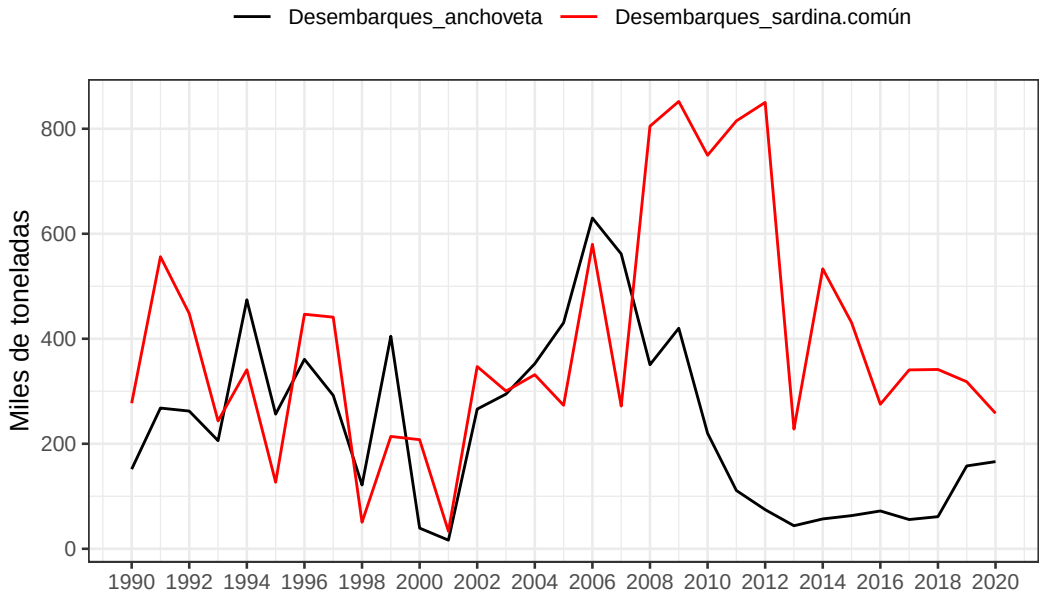
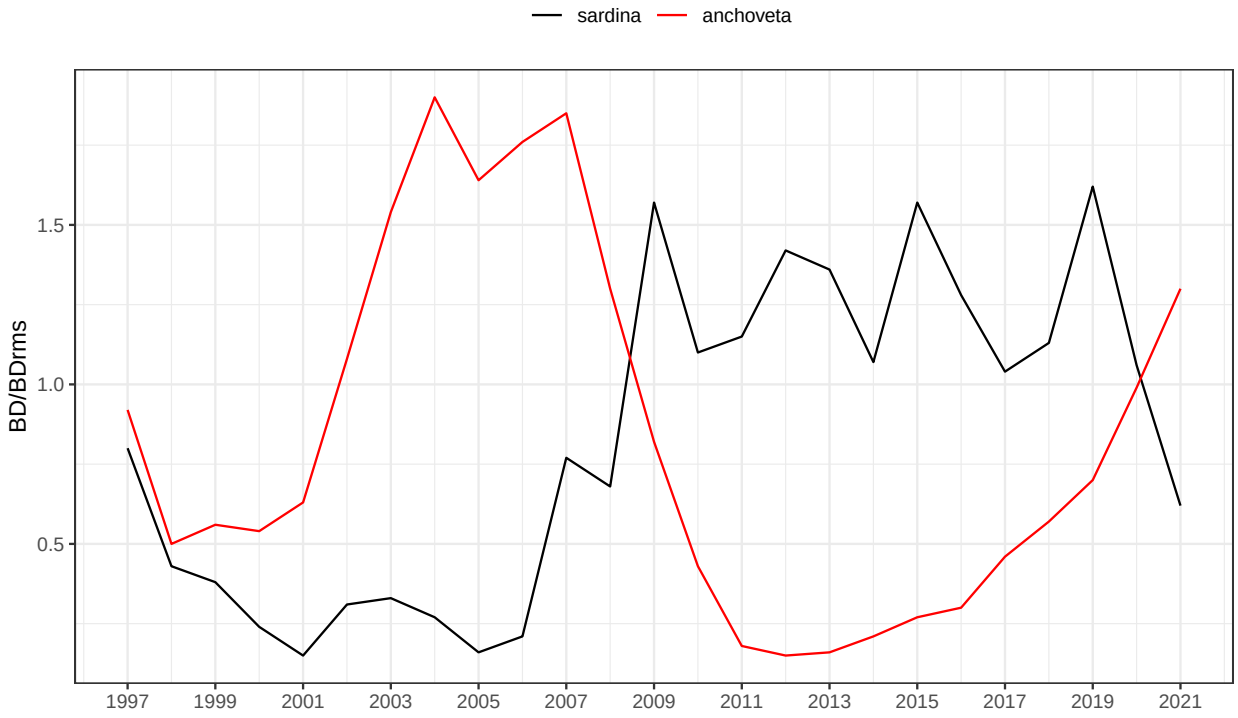
# Figura y Tablas Primer Informe Anchoveta Centro-sur Septiembre 2021

## ANTECEDENTES

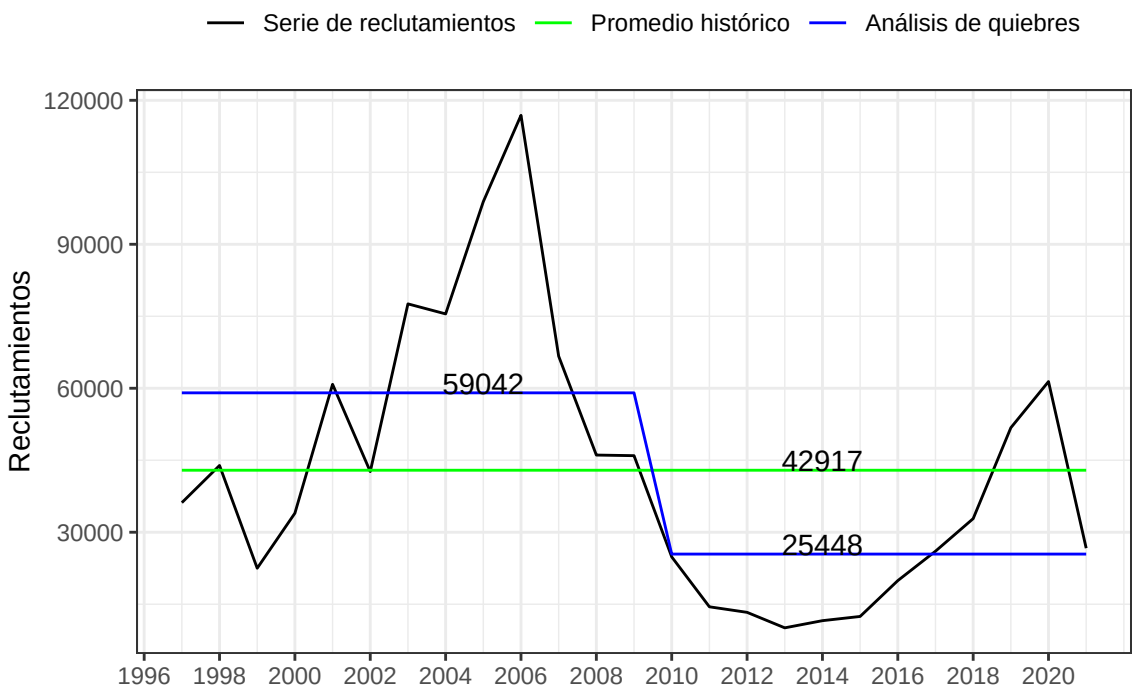


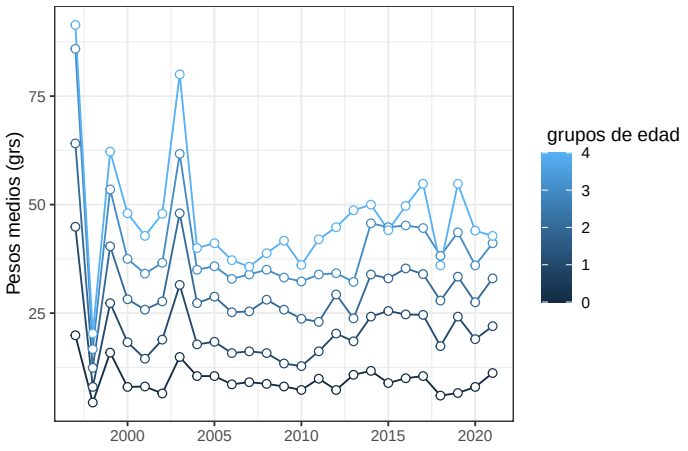



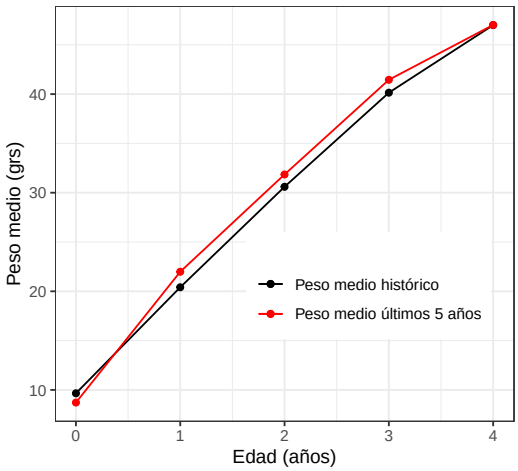

Desembarques_anchoveta
Desembarques_sardina.común
Miles de toneladas
0
200
400
600
800
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020


sardina
anchoveta
BD/BDrms
0.5
1.0
1.5
1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017 2019 2021

# METODOLOGÍA



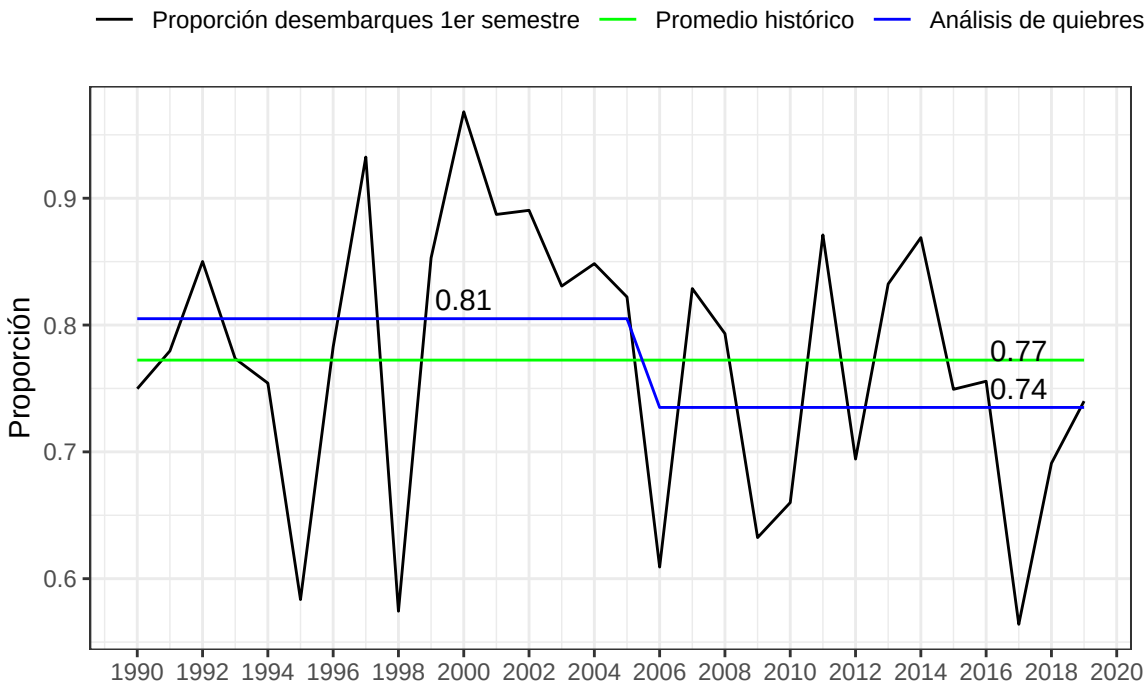
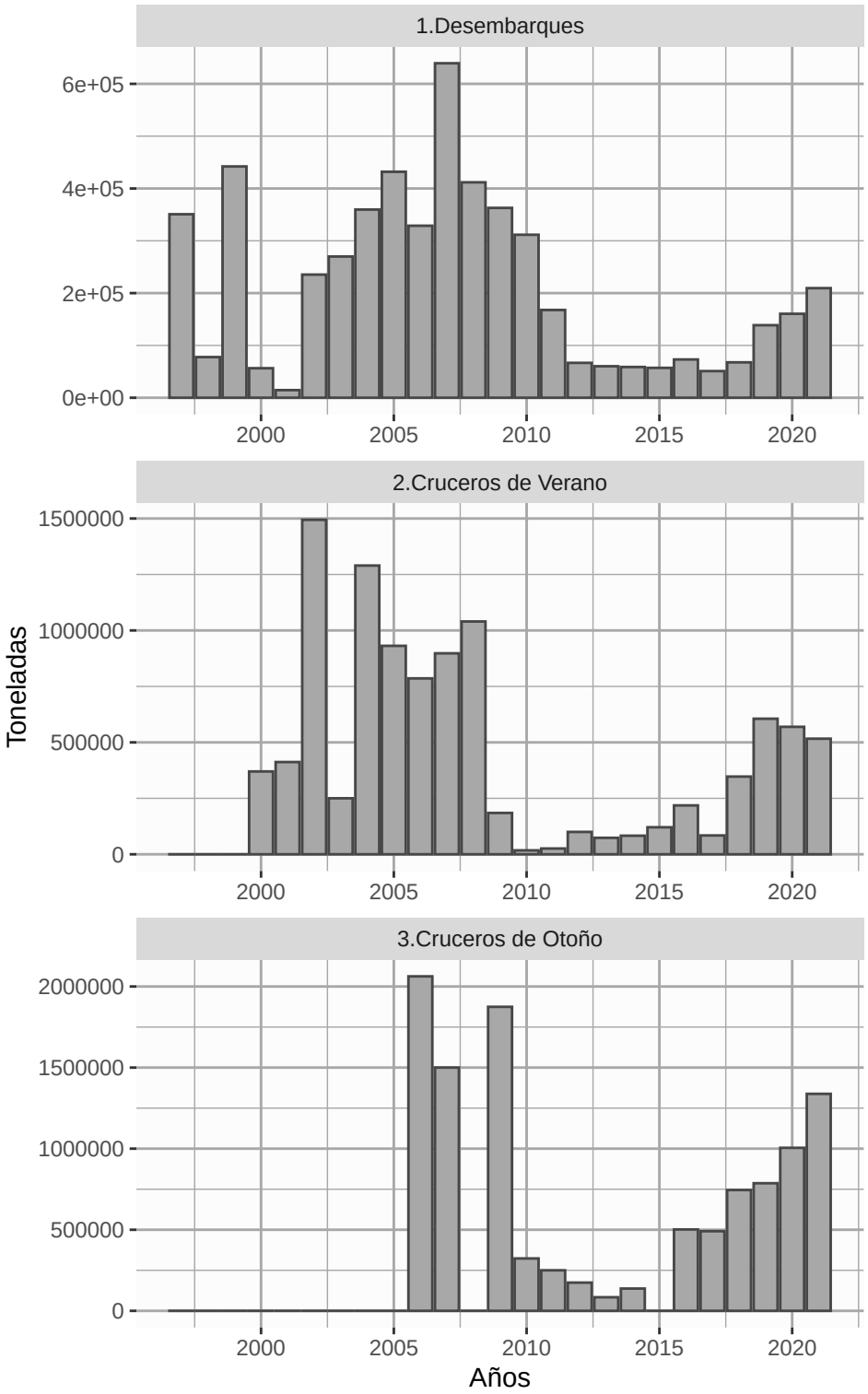


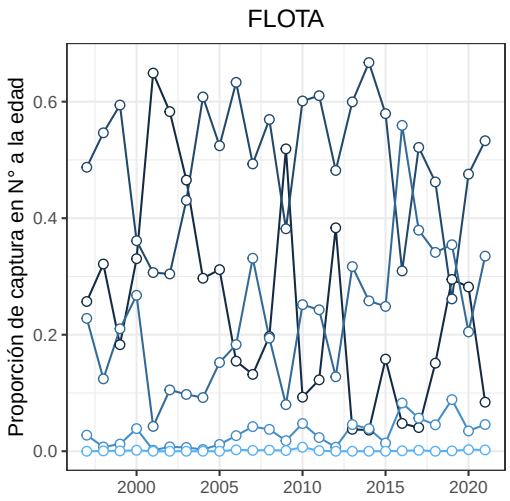


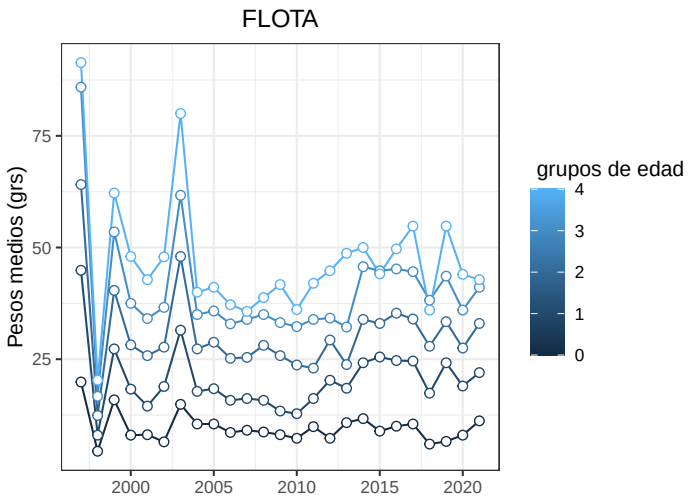
**Tabla 16.**
Desembarques en toneladas, porcentaje de descarte supuesto, captura descartada (toneladas) y captura total (toneladas) estimadas en año biológico para anchoveta de las Regiones de Valparaíso a Los Lagos.

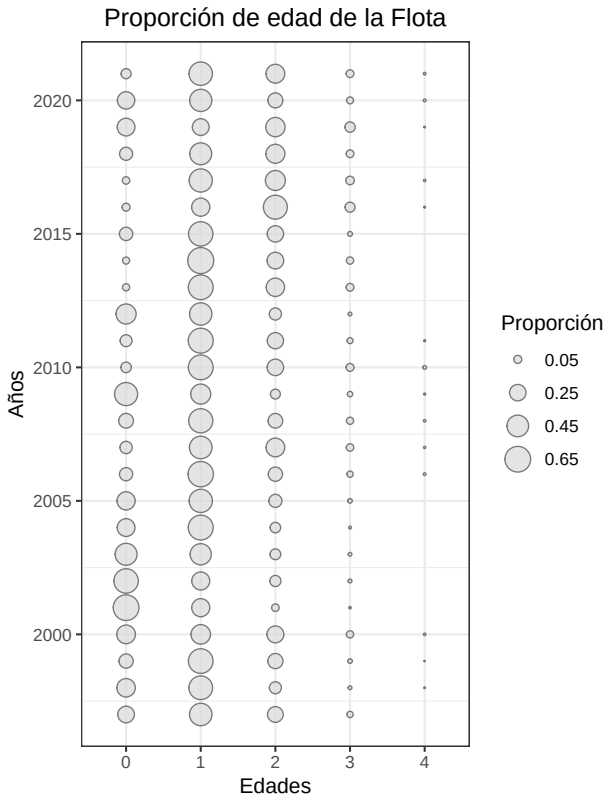
| Año.biológico | Desembarques.t. | Porcentaje.descarte | Captura.descartada.t. | Captura.total.t. |
|---|---|---|---|---|
| 1996-97 | 350755 | 0% | 0 | 350755 |

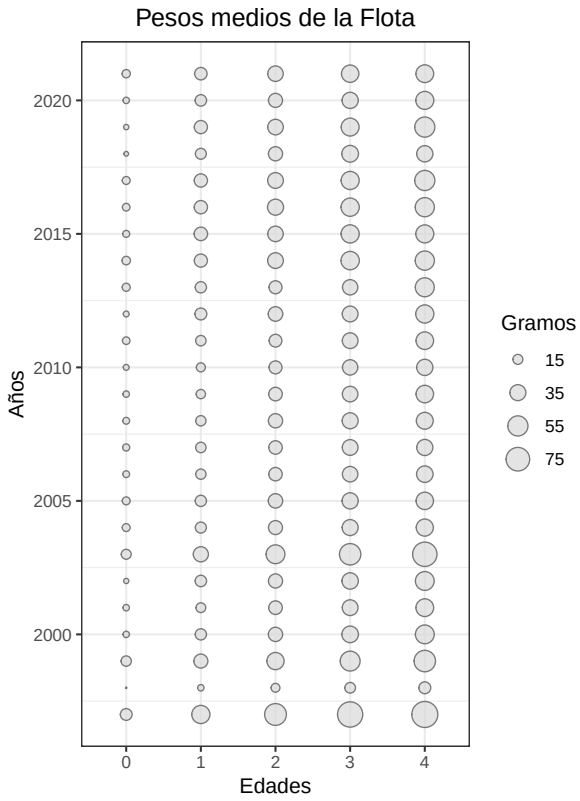
| Año.biológico | Desembarques.t. | Porcentaje.descarte | Captura.descartada.t. | Captura.total.t. |
|---|---|---|---|---|
| 1997-98 | 77701 | 0% | 0 | 77701 |
| 1998-99 | 442110 | 0% | 0 | 442110 |
| 1999-00 | 56441 | 0% | 0 | 56441 |
| 2000-01 | 13986 | 4% | 559 | 14545 |
| 2001-02 | 226307 | 4% | 9052 | 235359 |
| 2002-03 | 259572 | 4% | 10383 | 269955 |
| 2003-04 | 345847 | 4% | 13834 | 359681 |
| 2004-05 | 415290 | 4% | 16612 | 431902 |
| 2005-06 | 316159 | 4% | 12646 | 328805 |
| 2006-07 | 614773 | 4% | 24591 | 639364 |
| 2007-08 | 395911 | 4% | 15836 | 411747 |
| 2008-09 | 348914 | 4% | 13957 | 362871 |
| 2009-10 | 299548 | 4% | 11982 | 311530 |
| 2010-11 | 161306 | 4% | 6452 | 167758 |
| 2011-12 | 64116 | 4% | 2565 | 66681 |
| 2012-13 | 57910 | 4% | 2316 | 60226 |
| 2013-14 | 56524 | 4% | 2261 | 58785 |
| 2014-15 | 54919 | 4% | 2197 | 57116 |
| 2015-16 | 70367 | 4% | 2815 | 73181 |
| 2016-17 | 49016 | 4% | 1961 | 50977 |
| 2017-18 | 66757 | 1,4% | 935 | 67692 |
| 2018-19 | 135804 | 2,1% | 2852 | 138656 |
| 2019-20 | 157646 | 1,8% | 2838 | 160484 |
| 2020-21 | 205398 | 2% | 4108 | 209506 |

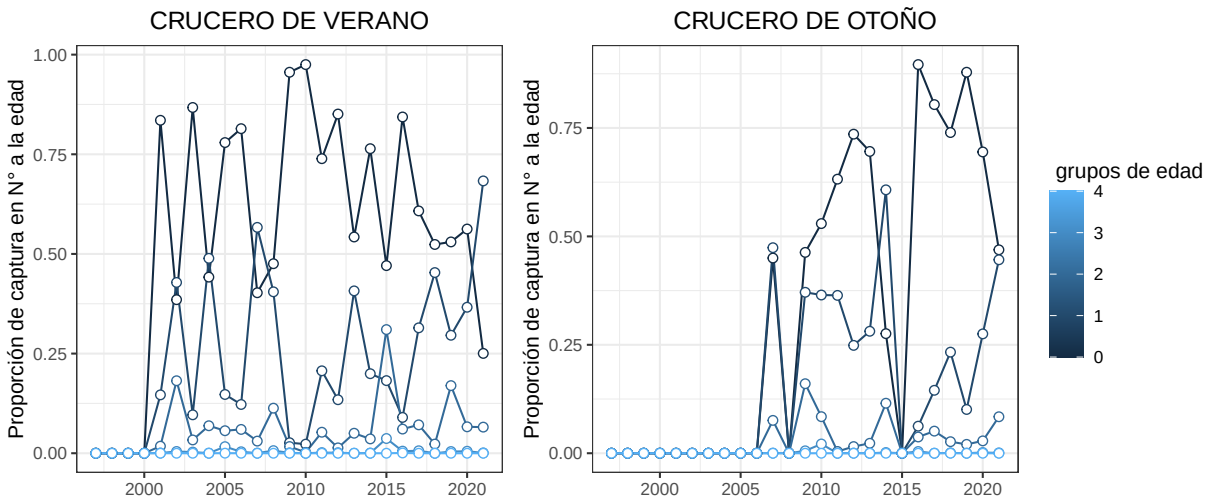

1.Desembarques
6e+05
4e+05
2e+05
0e+00
2.Cruceros de Verano
1500000
1000000
500000
0
3.Cruceros de Otoño
2000000
1500000
1000000
500000
0
2000
2005
2010
2015
2020
Toneladas
Años

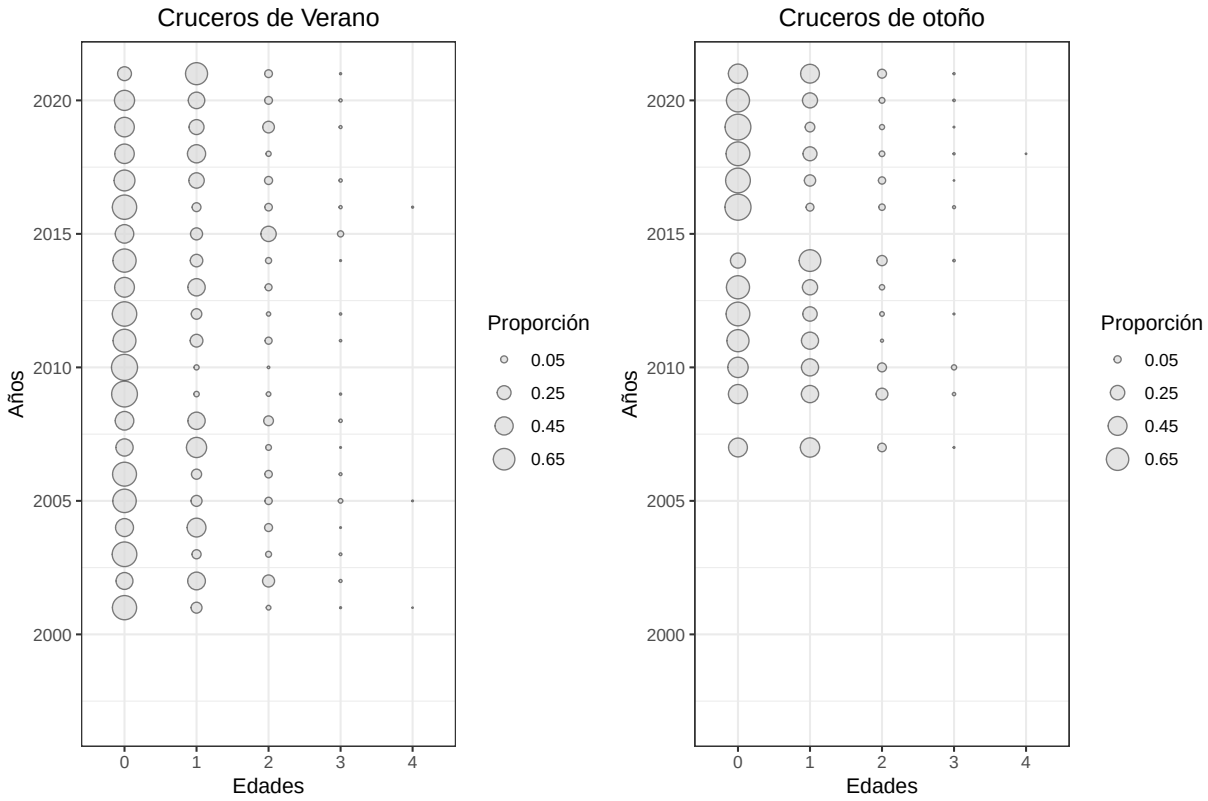

FLOTA
Proporción de captura en N° a la edad
0.0
0.2
0.4
0.6
2000
2005
2010
2015
2020

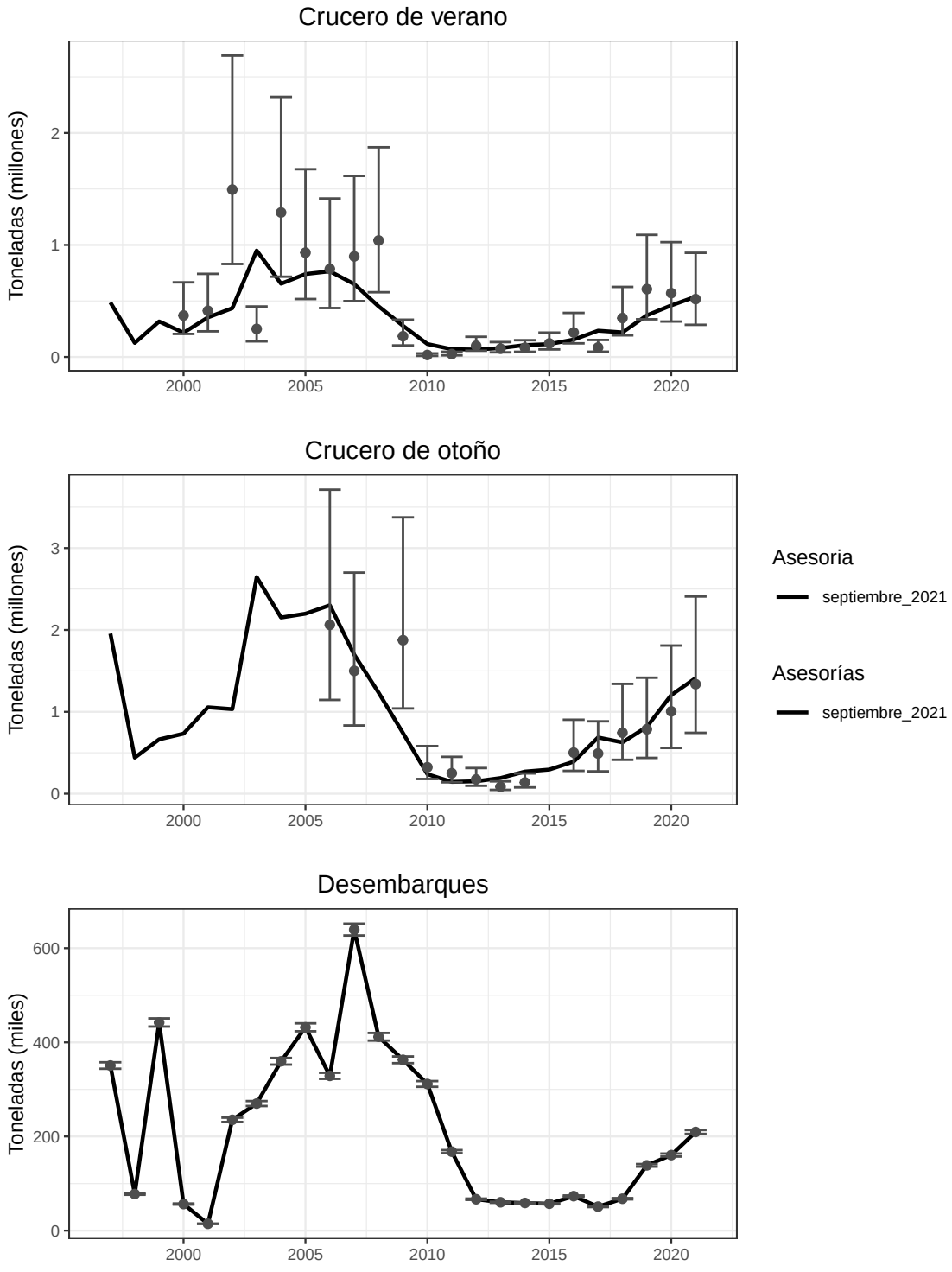

FLOTA
Pesos medios (grs)
25
50
75
2000
2005
2010
2015
2020
grupos de edad
0
1
2
3
4

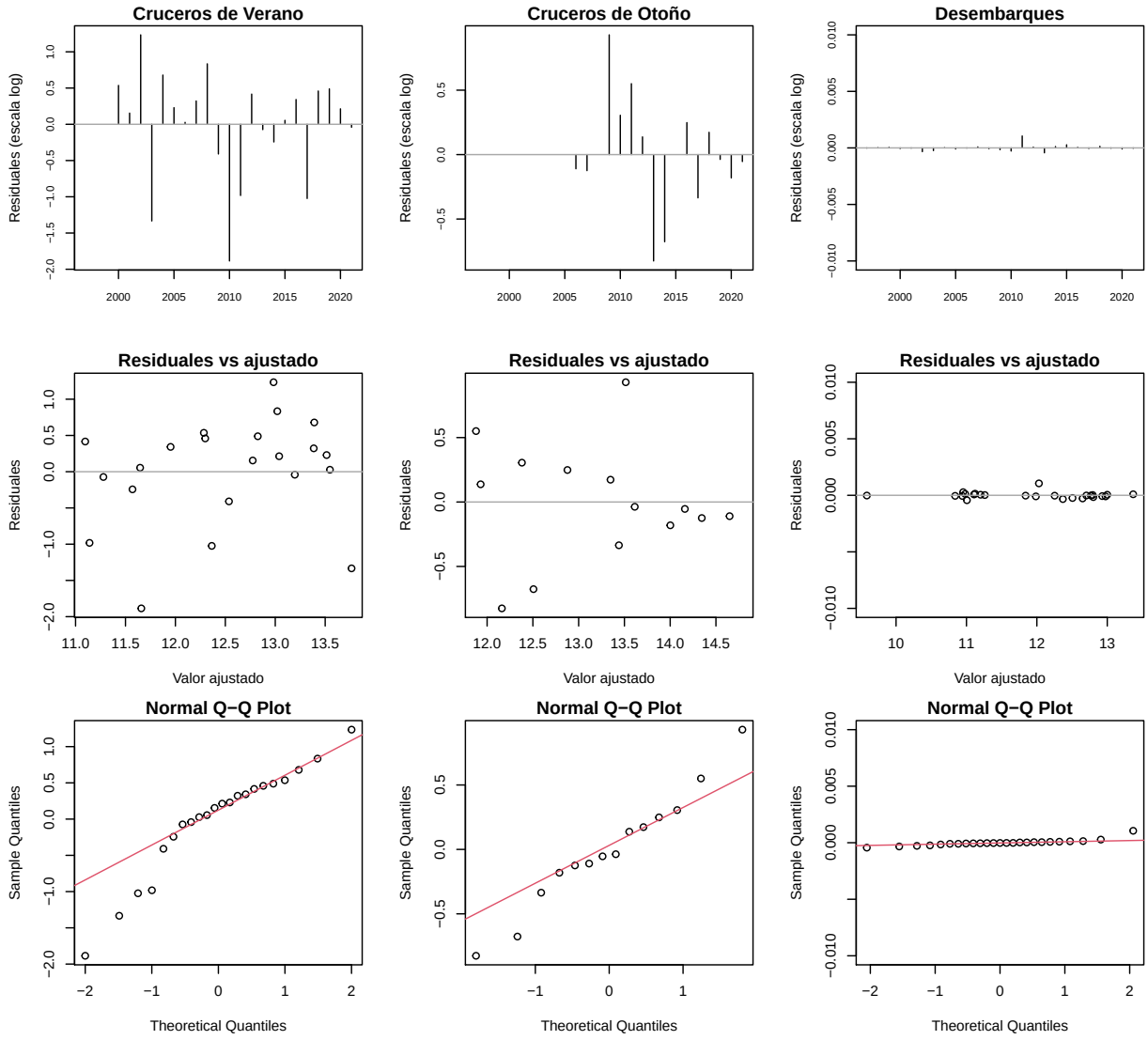

Proporción de edad de la Flota
Años
2000
2005
2010
2015
2020
0
1
2
3
4
Edades
Proporción
0.05
0.25
0.45
0.65

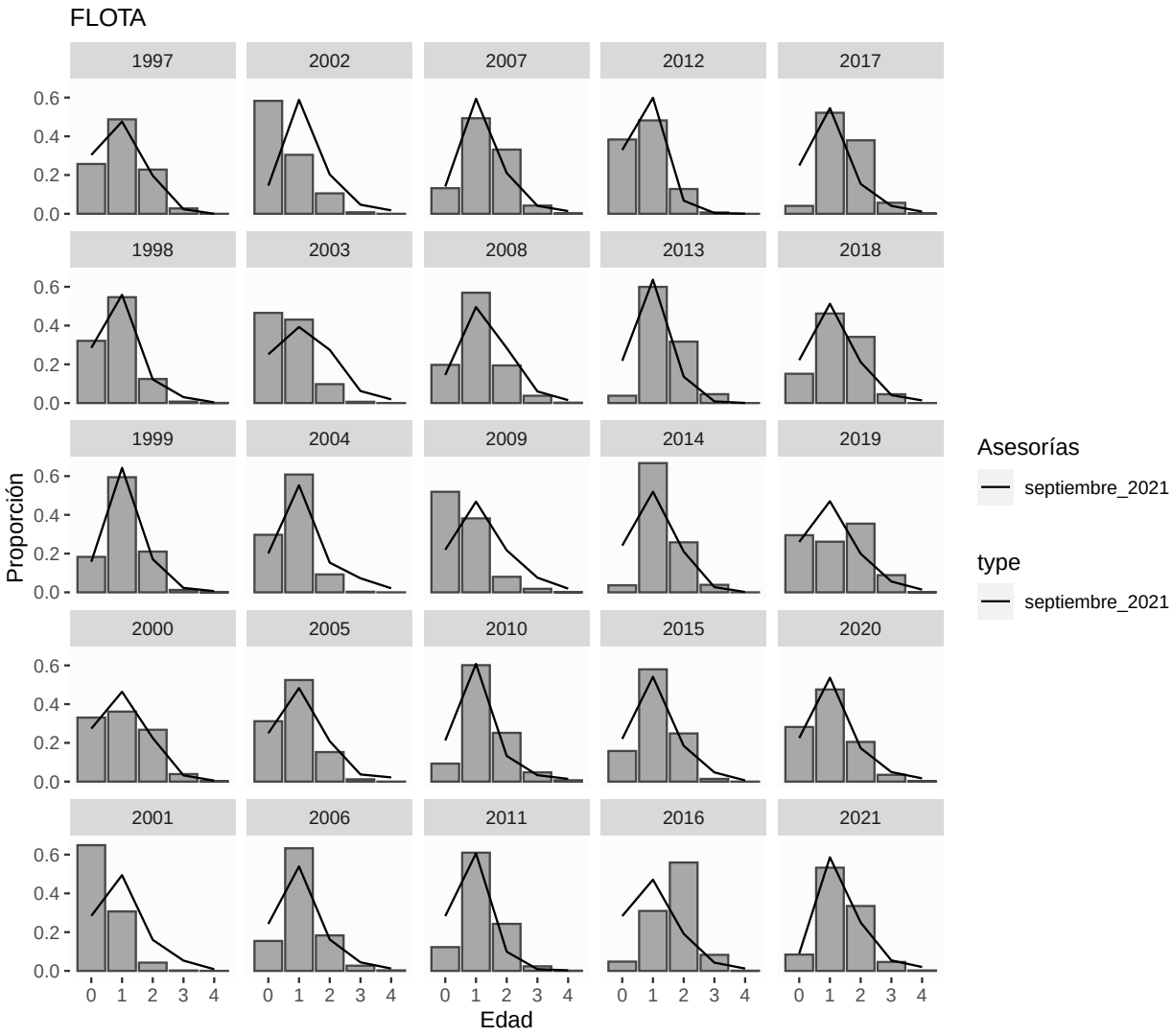

Pesos medios de la Flota
Años
2000
2005
2010
2015
2020
0
1
2
3
4
Edades
Gramos
15
35
55
75

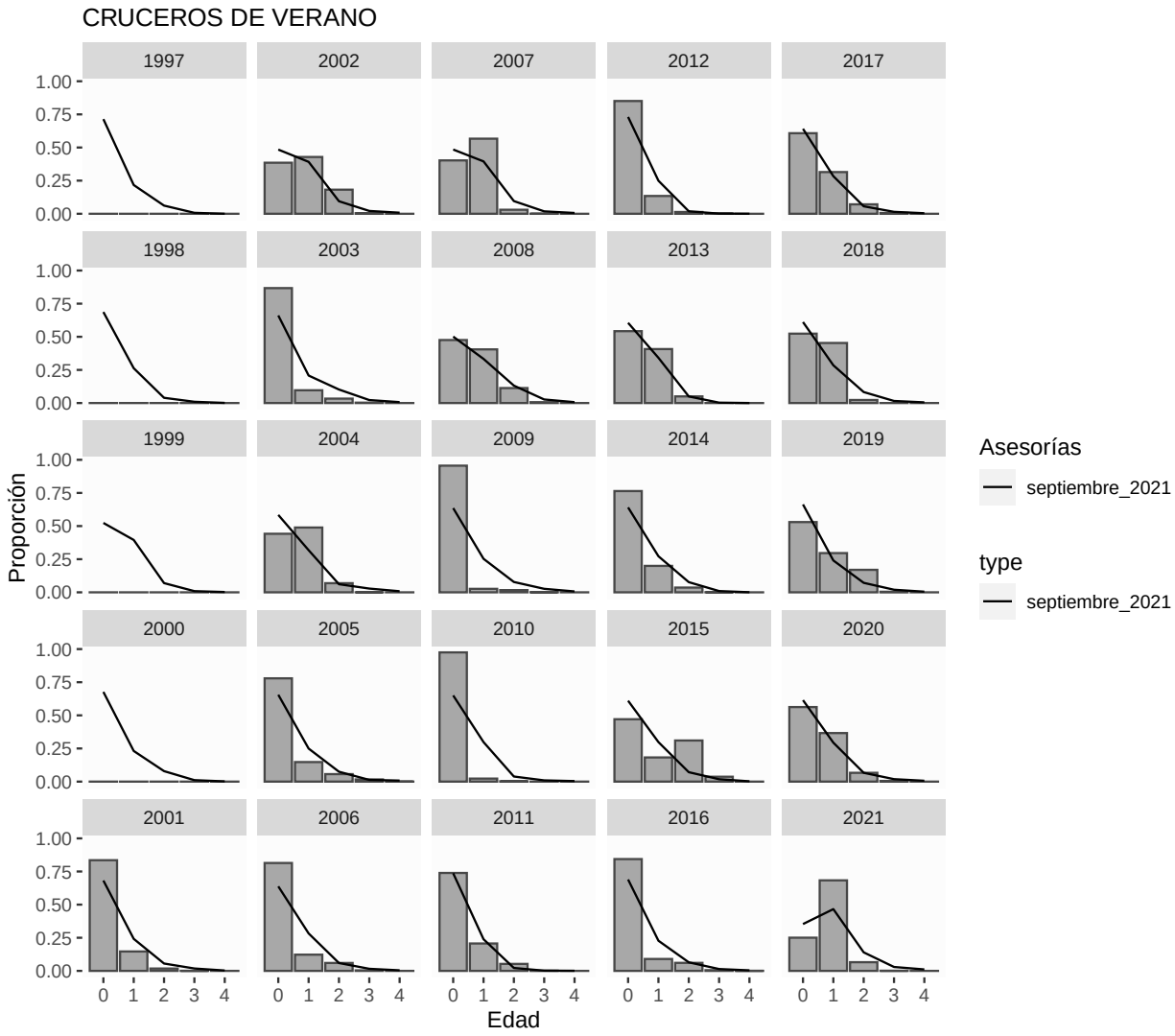

CRUCERO DE VERANO
CRUCERO DE OTOÑO
Proporción de captura en N° a la edad
1.00
0.75
0.50
0.25
0.00
2000
2005
2010
2015
2020
grupos de edad
4
3
2
1
0

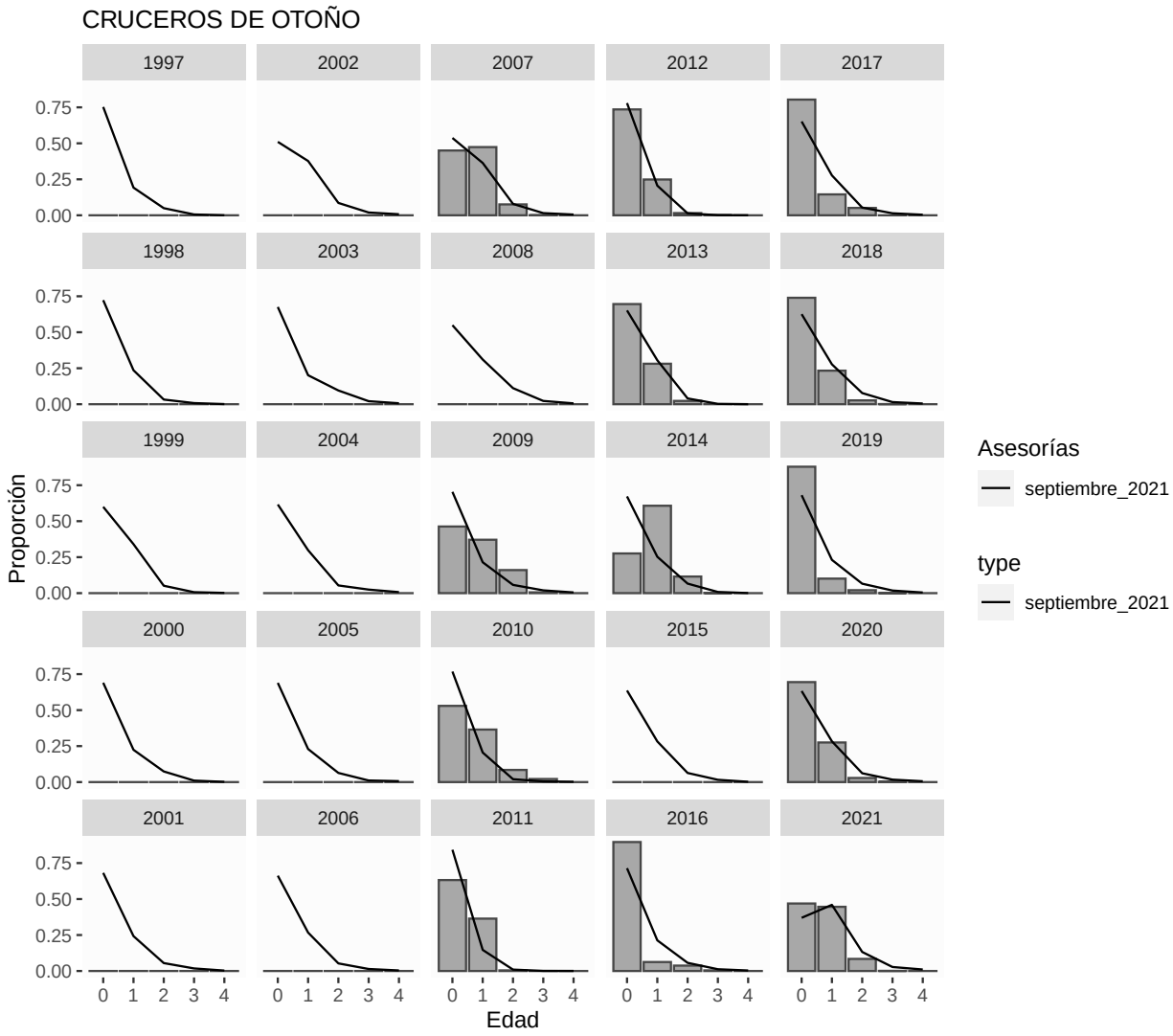

Cruceros de Verano
Cruceros de otoño
Años
2020
2015
2010
2005
2000
0
1
2
3
4
Edades
Proporción
0.05
0.25
0.45
0.65

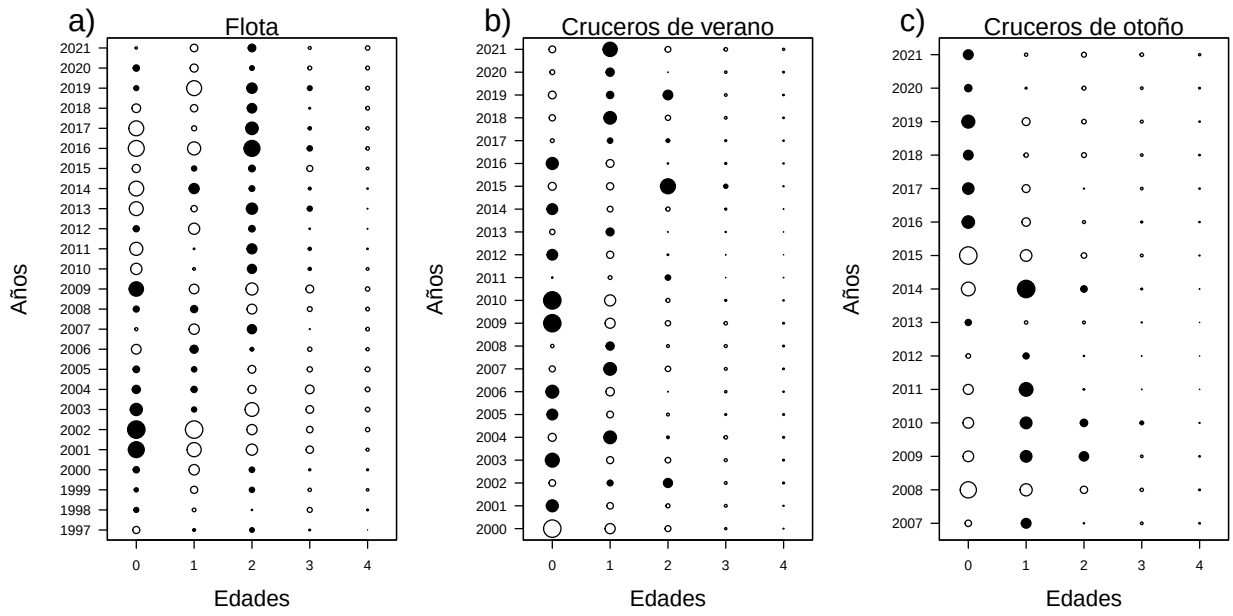

Crucero de verano
Toneladas (millones)
0
1
2
2000
2005
2010
2015
2020
Crucero de otoño
Toneladas (millones)
0
1
2
3
2000
2005
2010
2015
2020
Asesoria
septiembre_2021
Asesorías
septiembre_2021
Desembarques
Toneladas (miles)
0
200
400
600
2000
2005
2010
2015
2020


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


FLOTA
1997
2002
2007
2012
2017
1998
2003
2008
2013
2018
1999
2004
2009
2014
2019
2000
2005
2010
2015
2020
2001
2006
2011
2016
2021
Proporción
0.0
0.2
0.4
0.6
0 1 2 3 4
Edad
Asesorías
septiembre_2021
type
septiembre_2021

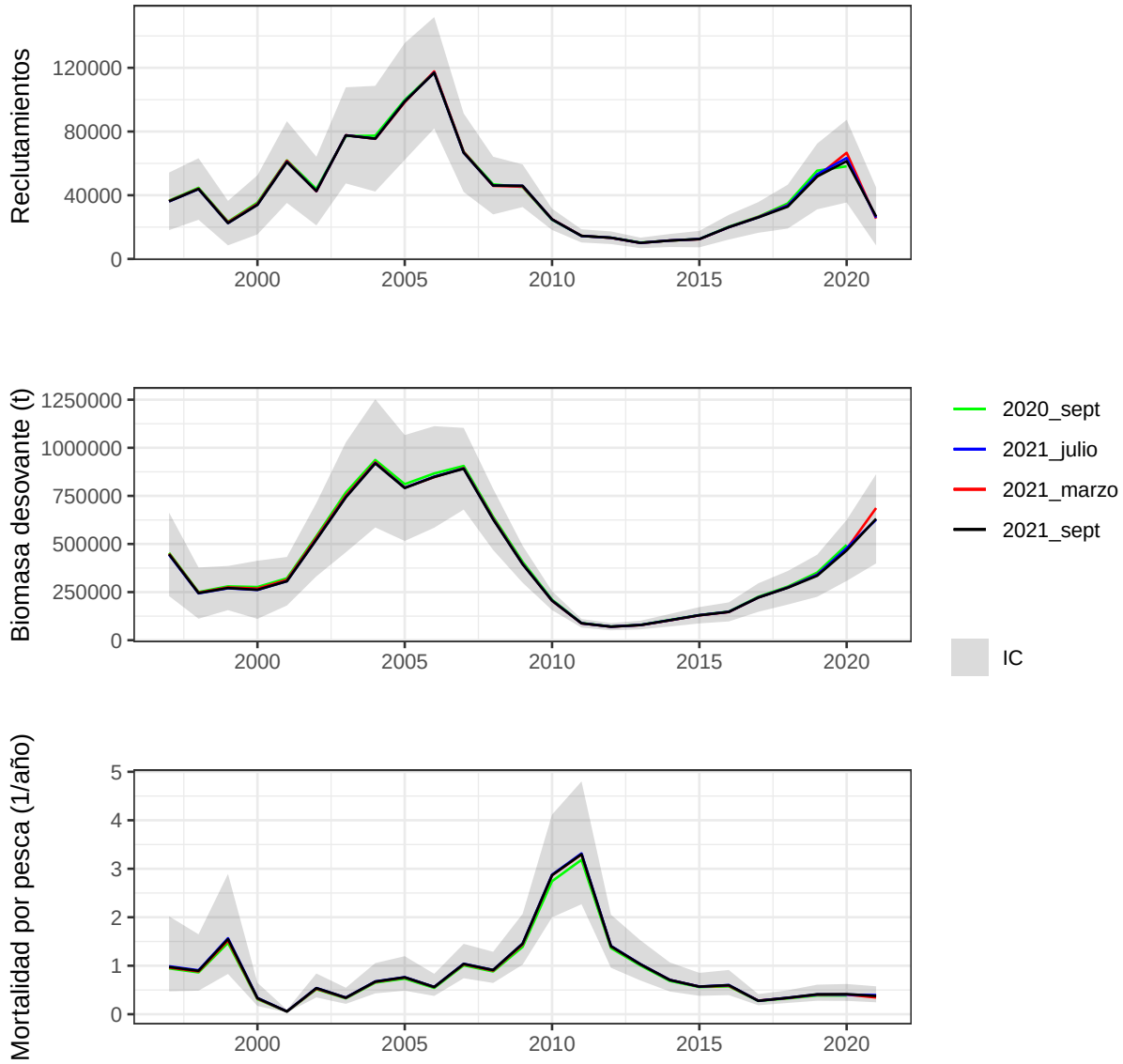

CRUCEROS DE VERANO
1997
2002
2007
2012
2017
1998
2003
2008
2013
2018
1999
2004
2009
2014
2019
2000
2005
2010
2015
2020
2001
2006
2011
2016
2021
1.00
0.75
0.50
0.25
0.00
Proporción
0 1 2 3 4
Edad
Asesorías
septiembre_2021
type
septiembre_2021

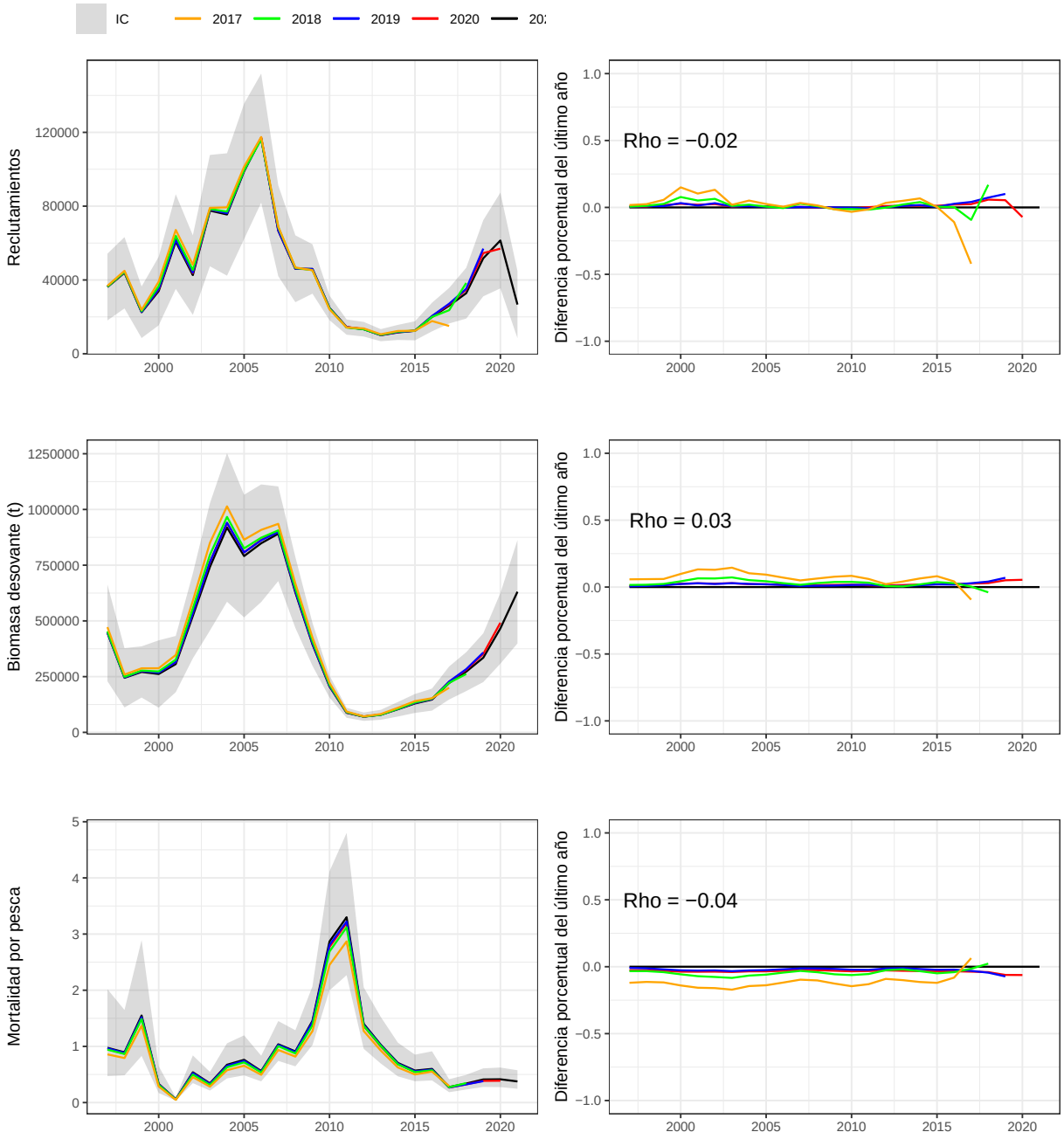

CRUCEROS DE OTOÑO
1997
2002
2007
2012
2017
1998
2003
2008
2013
2018
1999
2004
2009
2014
2019
2000
2005
2010
2015
2020
2001
2006
2011
2016
2021
Proporción
0.00
0.25
0.50
0.75
0 1 2 3 4
Edad
Asesorías
septiembre_2021
type
septiembre_2021

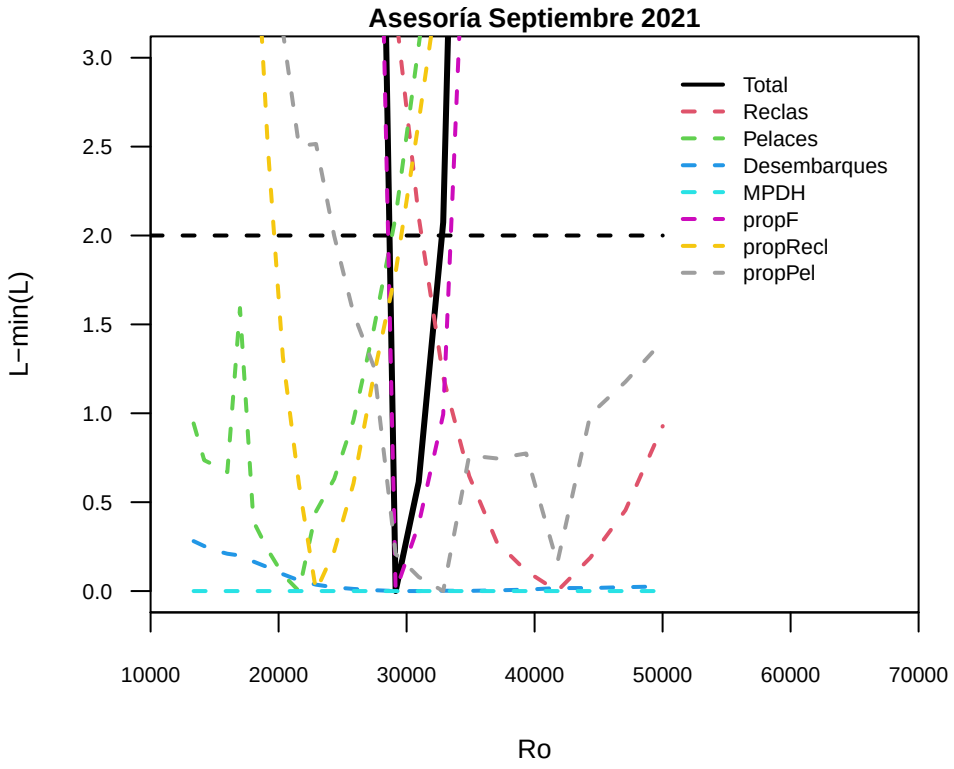



```
sept20 <-paste(dir.1,"/MAE0920b.rep",sep="")
mar21  <-paste(dir.1,"/MAE0321b.rep",sep="")
jul21  <-paste(dir.1,"/MAE0721b.rep",sep="")
sept21 <-paste(dir.1,"/MAE0921b.rep",sep="")
#================================================================================#
rep_sept20 <- reptoRlist(sept20)
rep_mar21  <- reptoRlist(mar21)
rep_jul21  <- reptoRlist(jul21)
rep_sept21  <- reptoRlist(sept21)
#================================================================================#
years  <- rep_sept21$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_sept20=c(rep_sept20$Reclutas,NA),
                          Rt_mar21=c(rep_mar21$Reclutas),
                          Rt_jul21=c(rep_jul21$Reclutas),
                          Rt_sept21=c(rep_sept21$Reclutas))

 SSBtcomp <- data.frame(x=years,
                          SSBt_sept20=c(rep_sept20$SSB,NA),
                          SSBt_mar21=c(rep_mar21$SSB),
                          SSBt_jul21=c(rep_jul21$SSB),
                          SSBt_sept21=c(rep_sept21$SSB))

 Ftcomp <- data.frame(x=years,
                          Ft_sept20=c(rep_sept20$Ftot,NA),
                          Ft_mar21=c(rep_mar21$Ftot),
                          Ft_jul21=c(rep_jul21$Ftot),
                          Ft_sept21=c(rep_sept21$Ftot))
```

```r
year_retros <- c('2021_sept',"2021_julio","2021_marzo","2020_sept")
nretros <-4


#Retrospectivo tradicional
Rt <- ggplot(Rtcomp) +
    geom_ribbon(data=VarPob,aes(ymin=lowerRt1, ymax=upperRt1, x=x, fill = "IC"), alpha = 0.2)+
    geom_line(aes(y=Rt_sept20, x=x, colour = year_retros[nretros]), size=0.5)+
    geom_line(aes(y=Rt_mar21, x=x, colour = year_retros[nretros-1]), size=0.5)+
    geom_line(aes(y=Rt_jul21, x=x, colour = year_retros[nretros-2]), size=0.5)+
    geom_line(aes(y=Rt_sept21, x=x, colour = year_retros[nretros-3]), 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("green","blue","red","black"))+
    scale_fill_manual("",values=c("grey30"))+
    theme_bw(base_size=11) +
     ggtitle('')+
     theme(plot.title = element_text(hjust = 0.5),legend.position="none")

BD <- ggplot(SSBtcomp) +
     geom_ribbon(data=VarPob,aes(ymin=lowerBD1, ymax=upperBD1, x=x, fill = "IC"), alpha = 0.2)+
    geom_line(aes(y=SSBt_sept20, x=x, colour = year_retros[nretros]), size=0.5)+
    geom_line(aes(y=SSBt_mar21, x=x, colour = year_retros[nretros-1]), size=0.5)+
    geom_line(aes(y=SSBt_jul21, x=x, colour = year_retros[nretros-2]), size=0.5)+
    geom_line(aes(y=SSBt_sept21, x=x, colour = year_retros[nretros-3]), 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("green","blue","red","black"))+
    scale_fill_manual("",values=c("grey30"))+
    theme_bw(base_size=11) +
     ggtitle('')+
     theme(plot.title = element_text(hjust = 0.5))

Ft <- ggplot(Ftcomp) +
    geom_ribbon(data=VarPob,aes(ymin=lowerFt1, ymax=upperFt1, x=x, fill = "IC"), alpha = 0.2)+
    geom_line(aes(y=Ft_sept20, x=x, colour = year_retros[nretros]), size=0.5)+
    geom_line(aes(y=Ft_mar21, x=x, colour = year_retros[nretros-1]), size=0.5)+
    geom_line(aes(y=Ft_jul21, x=x, colour = year_retros[nretros-2]), size=0.5)+
    geom_line(aes(y=Ft_sept21, x=x, colour = year_retros[nretros-3]), size=0.5)+
    labs(x = '', y = 'Mortalidad por pesca (1/año)',colour='Asesorías')  +
    scale_x_continuous(breaks = seq(from = 1990, to = 2021, by = 5)) +
    scale_colour_manual("",values=c("green","blue","red","black"))+
    scale_fill_manual("",values=c("grey30"))+
    theme_bw(base_size=11) +
    ggtitle('')+
    theme(plot.title = element_text(hjust = 0.5),legend.position="none")

Rt/BD/Ft
```


Reclutamientos
120000
80000
40000
0
2000
2005
2010
2015
2020
Biomasa desovante (t)
1250000
1000000
750000
500000
250000
0
2000
2005
2010
2015
2020
2020_sept
2021_julio
2021_marzo
2021_sept
IC
Mortalidad por pesca (1/año)
5
4
3
2
1
0
2000
2005
2010
2015
2020


IC
2017
2018
2019
2020
20
Reclutamientos
Diferencia porcentual del último año
Rho = −0.02
Biomasa desovante (t)
Rho = 0.03
Mortalidad por pesca
Rho = −0.04


Asesoría Septiembre 2021
L−min(L)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
10000
20000
30000
40000
50000
60000
70000
Ro
Total
Reclas
Pelaces
Desembarques
MPDH
propF
propRecl
propPel

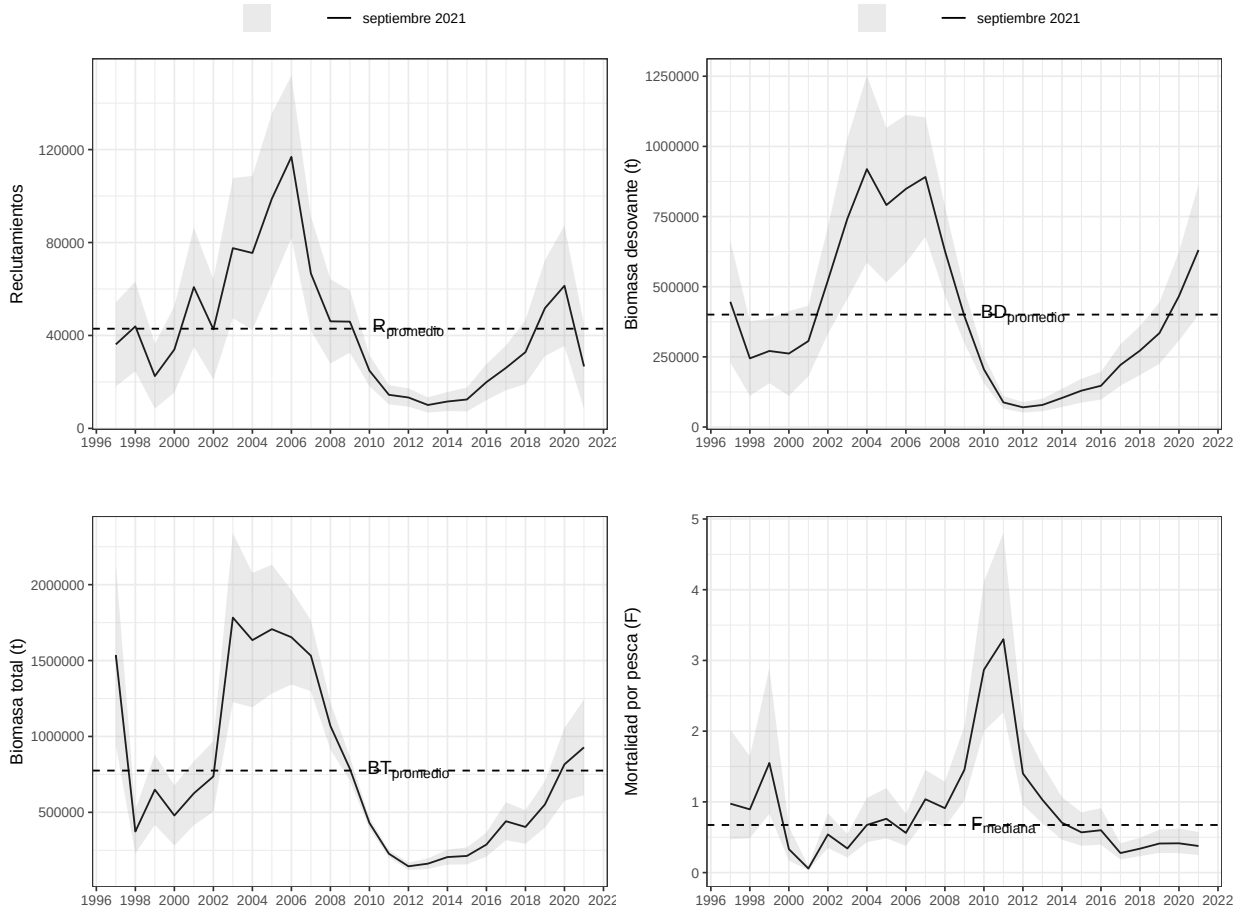
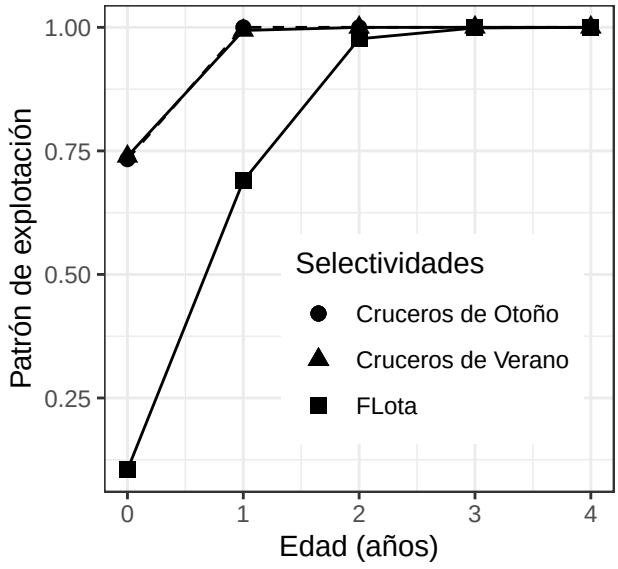

septiembre 2021
Reclutamientos
$R_{promedio}$
septiembre 2021
Biomasa desovante (t)
$BD_{promedio}$
Biomasa total (t)
$BT_{promedio}$
Mortalidad por pesca (F)
$F_{mediana}$

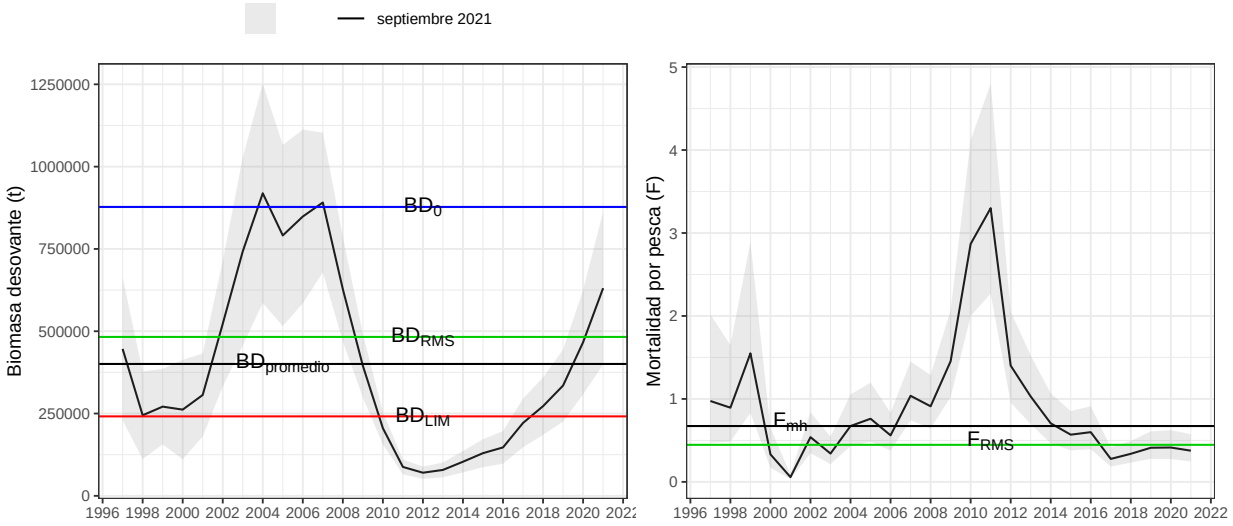
**Tabla 17.**
Variables poblacionales estimadas en la evaluación de anchoveta de las Regiones de Valparaíso a Los Lagos.

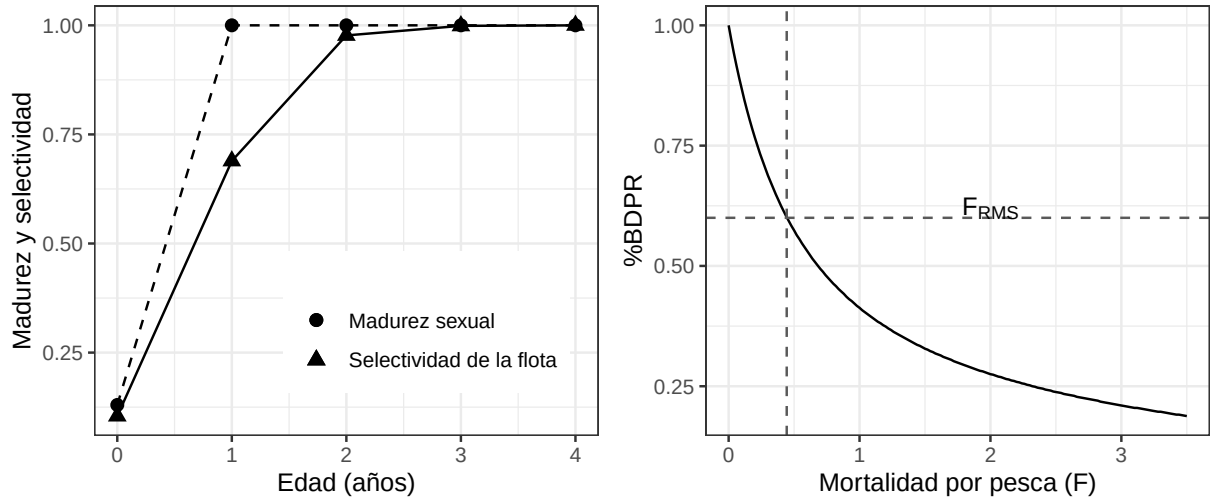
| Año | $BD_{sept}$ | $BD_{marzo}$ | $BD_{julio}$ | $BT_{sept}$ | $BT_{marzo}$ | $BT_{julio}$ | $R_{sept}$ | $R_{marzo}$ | $R_{julio}$ | $F_{sept}$ | $F_{marzo}$ | $F_{julio}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1996/97 | 446310 | 449330 | 443792 | 1536600 | 1544300 | 1532630 | 36162 | 36327 | 36114.4 | 0.975 | 0.963 | 0.989 |
| 1997/98 | 244750 | 246830 | 243421 | 373710 | 376310 | 372225 | 43906 | 44137 | 43856.4 | 0.894 | 0.882 | 0.906 |
| 1998/99 | 270970 | 274410 | 269947 | 649390 | 659290 | 648361 | 22502 | 22999 | 22500 | 1.55 | 1.52 | 1.567 |
| 1999/00 | 261880 | 268420 | 261093 | 479180 | 489730 | 478819 | 33972 | 34607 | 34069.8 | 0.332 | 0.322 | 0.335 |
| 2000/01 | 306350 | 313470 | 306495 | 625390 | 637170 | 626269 | 60820 | 61647 | 60974.3 | 0.057 | 0.056 | 0.058 |
| 2001/02 | 522520 | 532230 | 523559 | 736610 | 746790 | 737871 | 42634 | 42404 | 42662.7 | 0.539 | 0.527 | 0.54 |
| 2002/03 | 742540 | 751530 | 744117 | 1783000 | 1794500 | 1785330 | 77583 | 77704 | 77626.6 | 0.342 | 0.336 | 0.342 |
| 2003/04 | 919090 | 925060 | 920598 | 1634700 | 1640700 | 1637000 | 75495 | 75394 | 75552.8 | 0.673 | 0.666 | 0.676 |
| 2004/05 | 790960 | 792710 | 792302 | 1706900 | 1704800 | 1709420 | 98882 | 98343 | 98996.8 | 0.761 | 0.756 | 0.764 |
| 2005/06 | 848470 | 847350 | 850165 | 1653700 | 1657200 | 1656100 | 116880 | 117750 | 116943 | 0.561 | 0.559 | 0.563 |
| 2006/07 | 891020 | 894650 | 892636 | 1531900 | 1539100 | 1533900 | 66686 | 67258 | 66686.5 | 1.038 | 1.03 | 1.041 |
| 2007/08 | 627730 | 633110 | 629190 | 1069600 | 1074100 | 1071210 | 46078 | 45869 | 46064.3 | 0.911 | 0.899 | 0.912 |
| 2008/09 | 395000 | 397670 | 395986 | 786840 | 786660 | 787690 | 45950 | 45408 | 45877.1 | 1.455 | 1.436 | 1.457 |
| 2009/10 | 205460 | 204780 | 205889 | 430210 | 429780 | 430634 | 24867 | 24924 | 24814 | 2.868 | 2.865 | 2.878 |
| 2010/11 | 87765 | 87492 | 87969.4 | 227340 | 227210 | 227531 | 14463 | 14507 | 14434.1 | 3.3 | 3.295 | 3.317 |
| 2011/12 | 70217 | 70070 | 70405.9 | 144490 | 144100 | 144770 | 13306 | 13250 | 13317.2 | 1.401 | 1.398 | 1.408 |
| 2012/13 | 78720 | 78341 | 78958.5 | 161880 | 161480 | 162233 | 10078 | 10083 | 10087.5 | 1.029 | 1.03 | 1.033 |
| 2013/14 | 103590 | 103220 | 103902 | 205310 | 204780 | 205737 | 11574 | 11559 | 11582.8 | 0.706 | 0.706 | 0.708 |
| 2014/15 | 129640 | 129170 | 129992 | 212760 | 211870 | 213265 | 12448 | 12369 | 12468.5 | 0.569 | 0.569 | 0.57 |
| 2015/16 | 147040 | 146480 | 147467 | 287730 | 286960 | 288424 | 19921 | 19948 | 19956 | 0.599 | 0.587 | 0.601 |
| 2016/17 | 221370 | 221930 | 222044 | 441450 | 444140 | 442739 | 26048 | 26318 | 26122 | 0.277 | 0.281 | 0.278 |
| 2017/18 | 272390 | 274050 | 273533 | 403680 | 407650 | 406733 | 32831 | 33685 | 33513.8 | 0.339 | 0.334 | 0.338 |
| 2018/19 | 334890 | 340830 | 339853 | 552200 | 558780 | 561985 | 51775 | 51784 | 53182.2 | 0.411 | 0.402 | 0.407 |
| 2019/20 | 466470 | 473920 | 479011 | 816150 | 835630 | 838744 | 61395 | 66653 | 63379.1 | 0.414 | 0.405 | 0.404 |
| 2020/21 | 630820 | 686790 | 626493 | 928130 | 918000 | 923891 | 26675 | 25359 | 25914.4 | 0.376 | 0.345 | 0.395 |

```
##                       difRt      difBT      difBD    Rprom    BTprom   BDprom
## Rlast_2002_2008   0.6460552  0.3609580  0.1532309 75364.86 1452377.1 744972.9
## Rlast_2009_2017  -0.4502888 -2.3215381 -3.3134892 18392.89  279427.8 146243.6
## Rlast_historico   0.3784549 -0.1973492 -0.5745367 42917.24  775154.0 400638.5
```

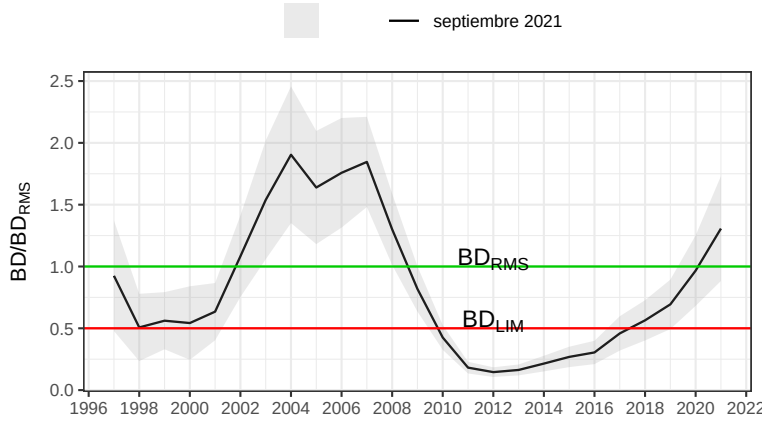


| | Septiembre | Marzo | Julio |
|---|---|---|---|
| BDpromedio | 401.00 | 406.00 | 402.00 |
| Fmh | 0.67 | 0.67 | 0.68 |
| %BDPR_Fmh | 50.40 | 50.40 | 50.40 |
| %BDPR_$F_{RMS}$ | 60.00 | 60.00 | 60.00 |
| %BD_Fmh | 45.40 | 45.40 | 45.40 |
| %BD_$F_{RMS}$ | 55.00 | 55.00 | 55.00 |
| BDo | 878.00 | 886.00 | 879.00 |
| BD55% | 483.00 | 487.00 | 484.00 |
| BD27.5% | 241.00 | 244.00 | 242.00 |

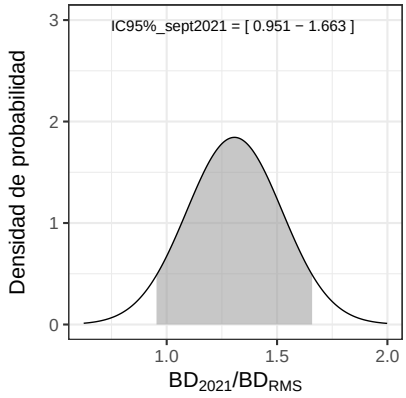


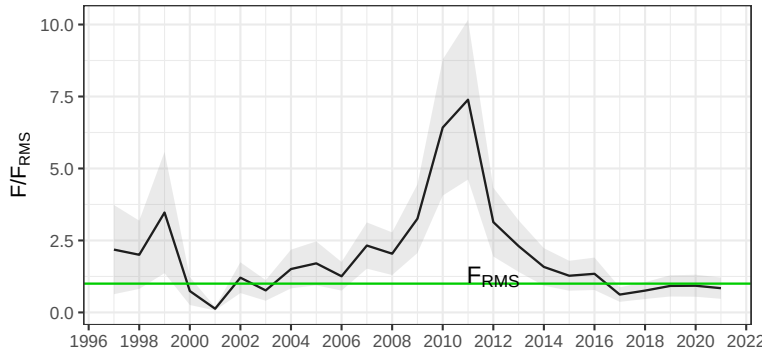
a)


septiembre 2021
BD/BD$_{RMS}$
BD$_{RMS}$
BD$_{LIM}$
2.5
2.0
1.5
1.0
0.5
0.0
1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020 2022

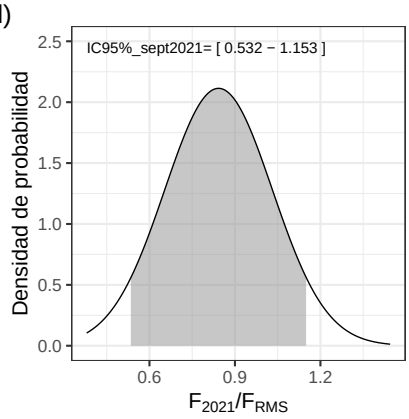
b)


IC95%_sept2021 = [ 0.951 − 1.663 ]
Densidad de probabilidad
3
2
1
0
1.0
1.5
2.0
BD$_{2021}$/BD$_{RMS}$

c)

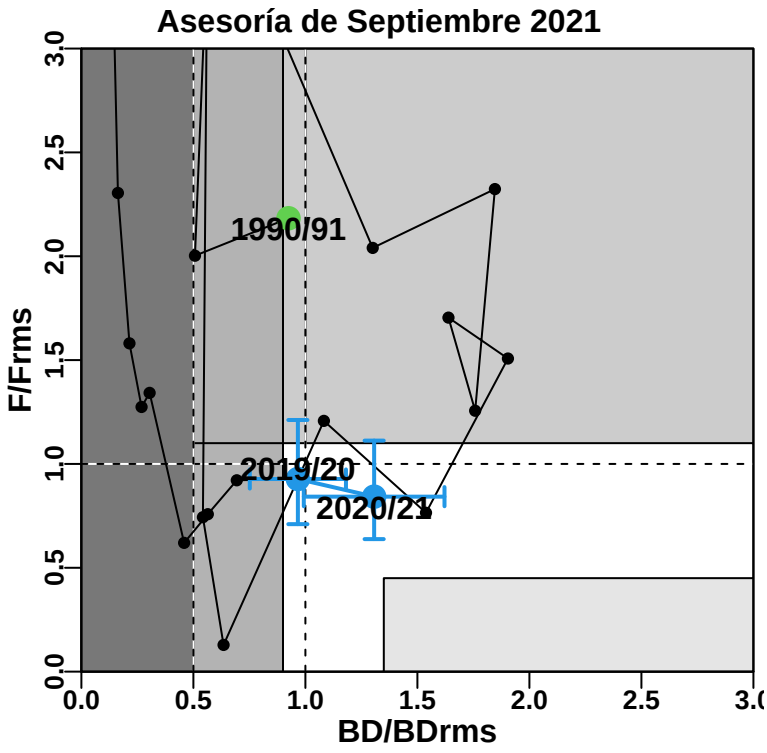

F/F$_{RMS}$
F$_{RMS}$
10.0
7.5
5.0
2.5
0.0
1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020 2022

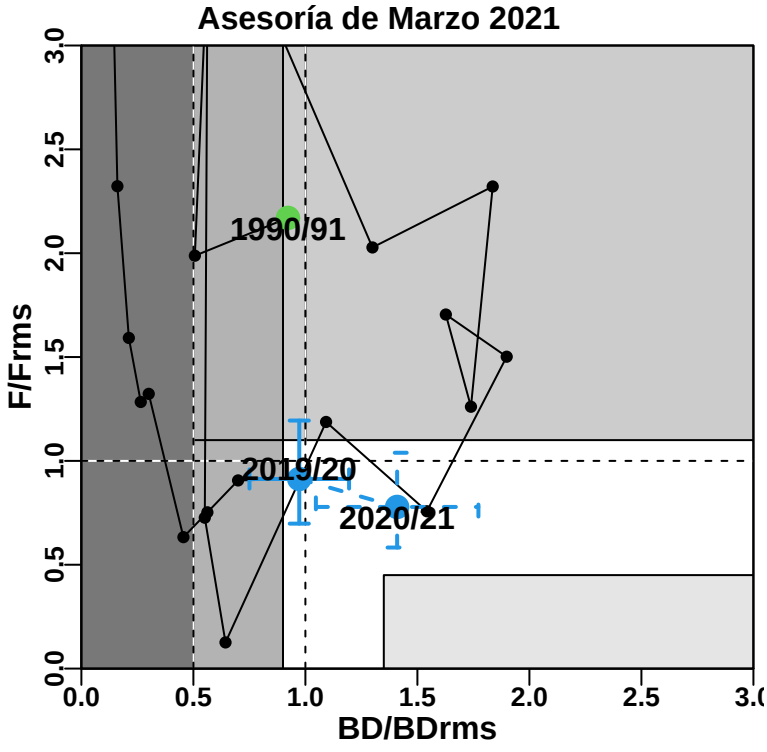
d)


IC95%_sept2021= [ 0.532 − 1.153 ]
Densidad de probabilidad
2.5
2.0
1.5
1.0
0.5
0.0
0.6
0.9
1.2
F$_{2021}$/F$_{RMS}$

| Años | $F/F_{RMS_{sept}}$ | $F/F_{RMS_{marzo}}$ | $F/F_{RMS_{julio}}$ | $BD/BD_{RMS_{sept}}$ | $BD/BD_{RMS_{marzo}}$ | $BD/BD_{RMS_{julio}}$ |
|---|---|---|---|---|---|---|
| 1996/97 | 2.183 | 2.17 | 2.203 | 0.925 | 0.922 | 0.918 |
| 1997/98 | 2.003 | 1.988 | 2.019 | 0.507 | 0.507 | 0.503 |
| 1998/99 | 3.47 | 3.426 | 3.492 | 0.561 | 0.563 | 0.558 |
| 1999/00 | 0.743 | 0.726 | 0.747 | 0.543 | 0.551 | 0.54 |
| 2000/01 | 0.129 | 0.126 | 0.129 | 0.635 | 0.643 | 0.634 |
| 2001/02 | 1.207 | 1.187 | 1.204 | 1.083 | 1.092 | 1.083 |
| 2002/03 | 0.765 | 0.758 | 0.763 | 1.538 | 1.542 | 1.539 |
| 2003/04 | 1.507 | 1.502 | 1.506 | 1.904 | 1.899 | 1.904 |
| 2004/05 | 1.704 | 1.705 | 1.703 | 1.639 | 1.627 | 1.639 |
| 2005/06 | 1.256 | 1.261 | 1.255 | 1.758 | 1.739 | 1.758 |
| 2006/07 | 2.323 | 2.321 | 2.319 | 1.846 | 1.836 | 1.846 |
| 2007/08 | 2.04 | 2.028 | 2.033 | 1.3 | 1.299 | 1.301 |
| 2008/09 | 3.257 | 3.238 | 3.246 | 0.818 | 0.816 | 0.819 |
| 2009/10 | 6.422 | 6.458 | 6.412 | 0.426 | 0.42 | 0.426 |
| 2010/11 | 7.388 | 7.429 | 7.39 | 0.182 | 0.18 | 0.182 |
| 2011/12 | 3.138 | 3.152 | 3.136 | 0.145 | 0.144 | 0.146 |
| 2012/13 | 2.305 | 2.322 | 2.302 | 0.163 | 0.161 | 0.163 |
| 2013/14 | 1.581 | 1.592 | 1.577 | 0.215 | 0.212 | 0.215 |
| 2014/15 | 1.274 | 1.284 | 1.271 | 0.269 | 0.265 | 0.269 |
| 2015/16 | 1.342 | 1.323 | 1.339 | 0.305 | 0.301 | 0.305 |
| 2016/17 | 0.62 | 0.633 | 0.619 | 0.459 | 0.455 | 0.459 |
| 2017/18 | 0.758 | 0.752 | 0.754 | 0.564 | 0.562 | 0.566 |
| 2018/19 | 0.921 | 0.906 | 0.906 | 0.694 | 0.7 | 0.703 |
| 2019/20 | 0.927 | 0.913 | 0.901 | 0.966 | 0.973 | 0.991 |
| 2020/21 | 0.842 | 0.778 | 0.88 | 1.307 | 1.41 | 1.296 |

| Años | $Y/BT_{sept}$ | $Y/BT_{marzo}$ | $Y/BT_{julio}$ | $C/N_{sept}$ | $C/N_{marzo}$ | $C/N_{julio}$ |
|---|---|---|---|---|---|---|
| 1996/97 | 0.228 | 0.227 | 0.229 | 0.164 | 0.163 | 0.164 |
| 1997/98 | 0.208 | 0.206 | 0.209 | 0.156 | 0.155 | 0.156 |
| 1998/99 | 0.681 | 0.671 | 0.682 | 0.326 | 0.322 | 0.327 |
| 1999/00 | 0.118 | 0.115 | 0.118 | 0.064 | 0.063 | 0.064 |
| 2000/01 | 0.023 | 0.023 | 0.023 | 0.011 | 0.011 | 0.011 |
| 2001/02 | 0.32 | 0.315 | 0.319 | 0.14 | 0.139 | 0.14 |
| 2002/03 | 0.151 | 0.15 | 0.151 | 0.07 | 0.07 | 0.07 |
| 2003/04 | 0.22 | 0.219 | 0.22 | 0.147 | 0.147 | 0.147 |
| 2004/05 | 0.253 | 0.253 | 0.253 | 0.147 | 0.148 | 0.147 |
| 2005/06 | 0.199 | 0.198 | 0.199 | 0.113 | 0.112 | 0.112 |
| 2006/07 | 0.417 | 0.415 | 0.417 | 0.251 | 0.25 | 0.25 |
| 2007/08 | 0.385 | 0.383 | 0.384 | 0.225 | 0.225 | 0.224 |
| 2008/09 | 0.461 | 0.461 | 0.461 | 0.274 | 0.275 | 0.273 |
| 2009/10 | 0.724 | 0.725 | 0.724 | 0.447 | 0.447 | 0.446 |
| 2010/11 | 0.737 | 0.738 | 0.737 | 0.436 | 0.436 | 0.435 |
| 2011/12 | 0.461 | 0.463 | 0.461 | 0.211 | 0.212 | 0.211 |
| 2012/13 | 0.372 | 0.373 | 0.371 | 0.203 | 0.203 | 0.202 |
| 2013/14 | 0.286 | 0.287 | 0.286 | 0.14 | 0.14 | 0.139 |
| 2014/15 | 0.268 | 0.27 | 0.268 | 0.12 | 0.121 | 0.12 |
| 2015/16 | 0.254 | 0.25 | 0.254 | 0.11 | 0.108 | 0.109 |
| 2016/17 | 0.115 | 0.117 | 0.115 | 0.057 | 0.058 | 0.057 |
| 2017/18 | 0.168 | 0.165 | 0.166 | 0.074 | 0.073 | 0.073 |
| 2018/19 | 0.251 | 0.248 | 0.247 | 0.081 | 0.081 | 0.08 |
| 2019/20 | 0.197 | 0.192 | 0.191 | 0.089 | 0.085 | 0.086 |
| 2020/21 | 0.226 | 0.218 | 0.227 | 0.123 | 0.117 | 0.13 |


Asesoría de Septiembre 2021
F/Frms
BD/BDrms
1990/91
2019/20
2020/21
0.0
0.5
1.0
1.5
2.0
2.5
3.0


Asesoría de Marzo 2021
F/Frms
BD/BDrms
1990/91
2019/20
2020/21
0.0
0.5
1.0
1.5
2.0
2.5
3.0

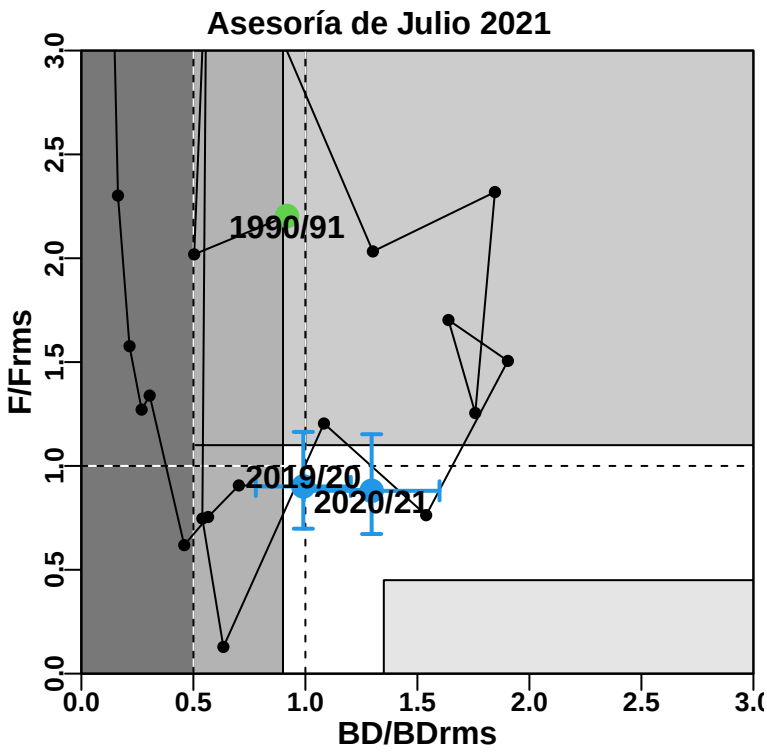
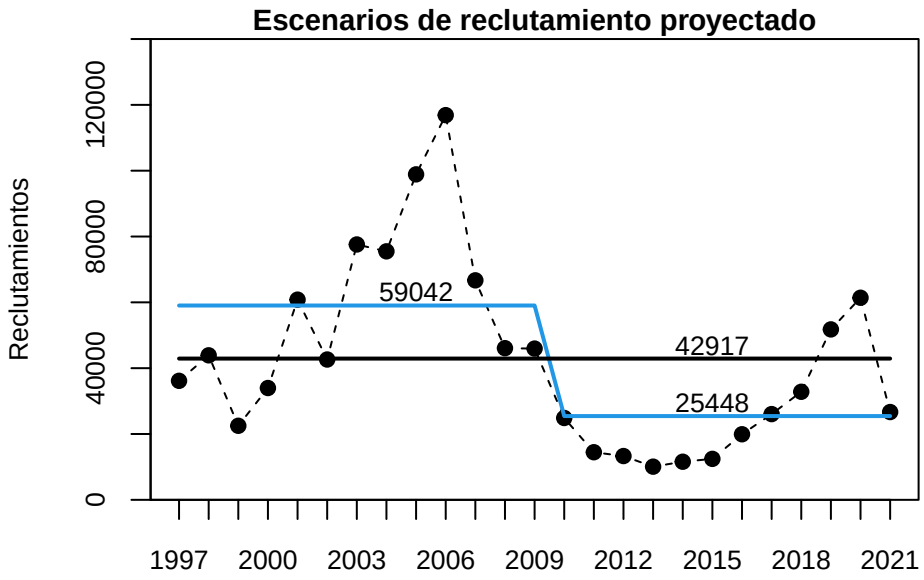

Asesoría de Julio 2021
F/Frms
BD/BDrms
1990/91
2019/20
2020/21
0.0
0.5
1.0
1.5
2.0
2.5
3.0

**Tabla 21.**
Puntos Biológicos de referencia (PBRs) y probabilidades de estar bajo $BD_{RMS}$ y sobre $F_{RMS}$ y en sobreexplotación, colapsado o sobrepesca.

| | Septiembre 2021 | Marzo 2021 | Julio 2021 |
|---|---|---|---|
| Año biológico | 2020/21 | 2020/21 | 2020/21 |
| $F_{RMS}$ | 0.45 | 0.44 | 0.45 |
| $BD_{RMS}$ | 483 | 487 | 484 |
| $BD_{LIM}$ | 241 | 244 | 242 |
| $p(BD_{last} < BD_{RMS})$ | 0.08 | 0.05 | 0.08 |
| $p(F_{last} > F_{RMS})$ | 0.2 | 0.11 | 0.27 |
| $p(sobre - explotación)$ | 0.03 | 0.02 | 0.03 |
| $p(agotado/colapsado)$ | 0 | 0 | 0 |
| $p(sobrepesca)$ | 0.09 | 0.04 | 0.13 |

**CBA inicial (Asesoría de septiembre)**



| | 1997-2009 | Histórico | 2010-2020 |
|---|---|---|---|
| mean | 209420 | 197520 | 182380 |
| std | 39403 | 39414 | 39521 |
| 10% | 158923 | 147009 | 131732 |
| 20% | 176258 | 164348 | 149118 |
| 30% | 188757 | 176851 | 161655 |
| 40% | 199437 | 187535 | 172367 |
| 50% | 209420 | 197520 | 182380 |

| | 1997-2009 | Histórico | 2010-2020 |
|---|---|---|---|
| 10% | 0.24 | 0.26 | 0.28 |
| 20% | 0.16 | 0.17 | 0.18 |
| 30% | 0.10 | 0.10 | 0.11 |
| 40% | 0.05 | 0.05 | 0.05 |
| 50% | 0.00 | 0.00 | 0.00 |

| | 1997-2009 | Histórico | 2010-2020 |
|---|---|---|---|
| 10% | 155745 | 144069 | 129097 |
| 20% | 172732 | 161061 | 146136 |
| 30% | 184982 | 173314 | 158422 |
| 40% | 195449 | 183784 | 168920 |
| 50% | 205232 | 193570 | 178732 |

## Primera Revisión de CBA (Asesoría de marzo)

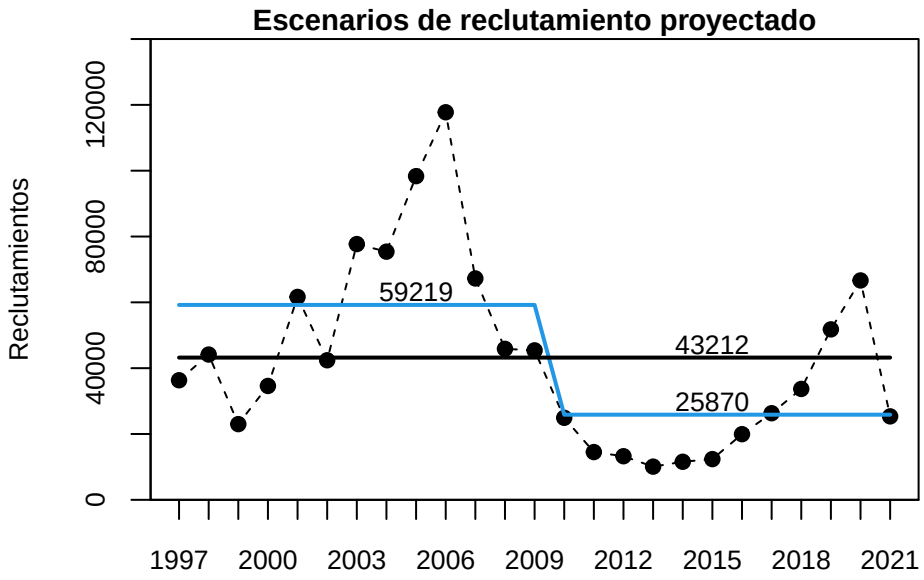


**Tabla 25.**
Primera revisión de CBA 2021 de anchoveta centro-sur bajo $Fcte = F_{RMS}$ con sus respectivos percentiles de probabilidad entre 10% y 50% y tres escenarios de reclutamiento.

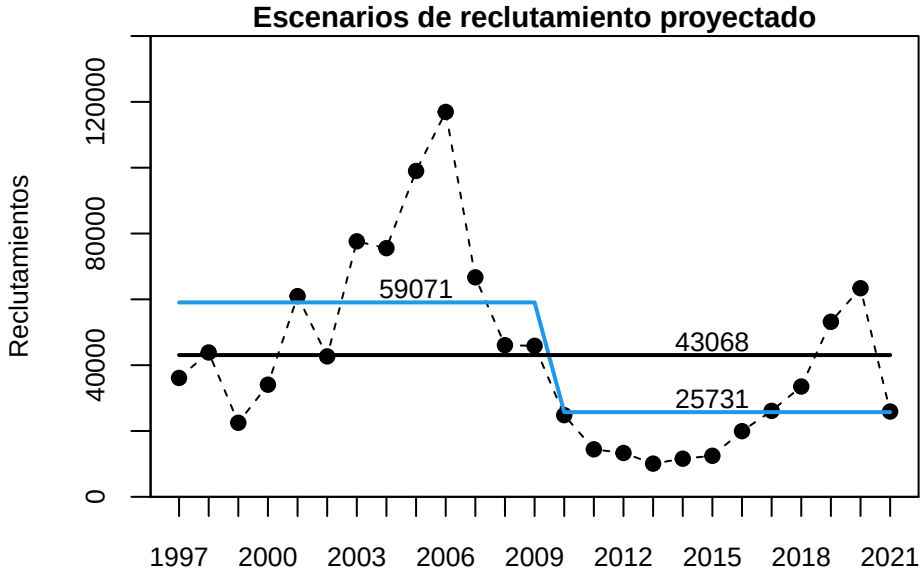
| | 1997-2009 | Histórico | 2010-2021 |
|---|---|---|---|
| mean | 205360 | 204260 | 202860 |
| std | 15645 | 15671 | 15709 |
| 10% | 185310 | 184177 | 182728 |
| 20% | 192193 | 191071 | 189639 |
| 30% | 197156 | 196042 | 194622 |
| 40% | 201396 | 200290 | 198880 |
| 50% | 205360 | 204260 | 202860 |

| | 1997-2009 | Histórico | 2010-2021 |
|---|---|---|---|
| 10% | 0.10 | 0.10 | 0.10 |
| 20% | 0.06 | 0.06 | 0.07 |
| 30% | 0.04 | 0.04 | 0.04 |
| 40% | 0.02 | 0.02 | 0.02 |
| 50% | 0.00 | 0.00 | 0.00 |

| | 1997-2009 | Histórico | 2010-2021 |
|---|---|---|---|
| 10% | 181604 | 180493 | 179074 |
| 20% | 188349 | 187250 | 185846 |
| 30% | 193213 | 192121 | 190730 |
| 40% | 197368 | 196284 | 194903 |
| 50% | 201253 | 200175 | 198803 |

| | 1997-2009 | Histórico | 2010-2021 |
|---|---|---|---|
| 10% | 17 | 25 | 39 |
| 20% | 9 | 16 | 27 |
| 30% | 4 | 11 | 20 |
| 40% | 1 | 7 | 15 |
| 50% | -2 | 3 | 11 |

## Segunda Revisión de CBA (Asesoría de marzo 2021)




| | 1997-2009 | Histórico | 2010-2021 |
|---|---|---|---|
| mean | 207760 | 206640 | 205210 |
| std | 13322 | 13328 | 13342 |
| 10% | 190687 | 189559 | 188112 |
| 20% | 196548 | 195423 | 193981 |
| 30% | 200774 | 199651 | 198213 |
| 40% | 204385 | 203263 | 201830 |
| 50% | 207760 | 206640 | 205210 |

| | 1997-2009 | Histórico | 2010-2021 |
|---|---|---|---|
| 10% | 0.08 | 0.08 | 0.08 |
| 20% | 0.05 | 0.05 | 0.05 |
| 30% | 0.03 | 0.03 | 0.03 |
| 40% | 0.02 | 0.02 | 0.02 |
| 50% | 0.00 | 0.00 | 0.00 |

| | 1997-2009 | Histórico | 2010-2021 |
|---|---|---|---|
| 10% | 186873 | 185768 | 184349 |
| 20% | 192617 | 191514 | 190101 |
| 30% | 196758 | 195658 | 194249 |
| 40% | 200297 | 199198 | 197793 |
| 50% | 203605 | 202507 | 201106 |

| | 1997-2009 | Histórico | 2010-2021 |
|---|---|---|---|
| 10% | 20 | 29 | 43 |
| 20% | 12 | 19 | 30 |
| 30% | 6 | 13 | 23 |
| 40% | 2 | 8 | 17 |

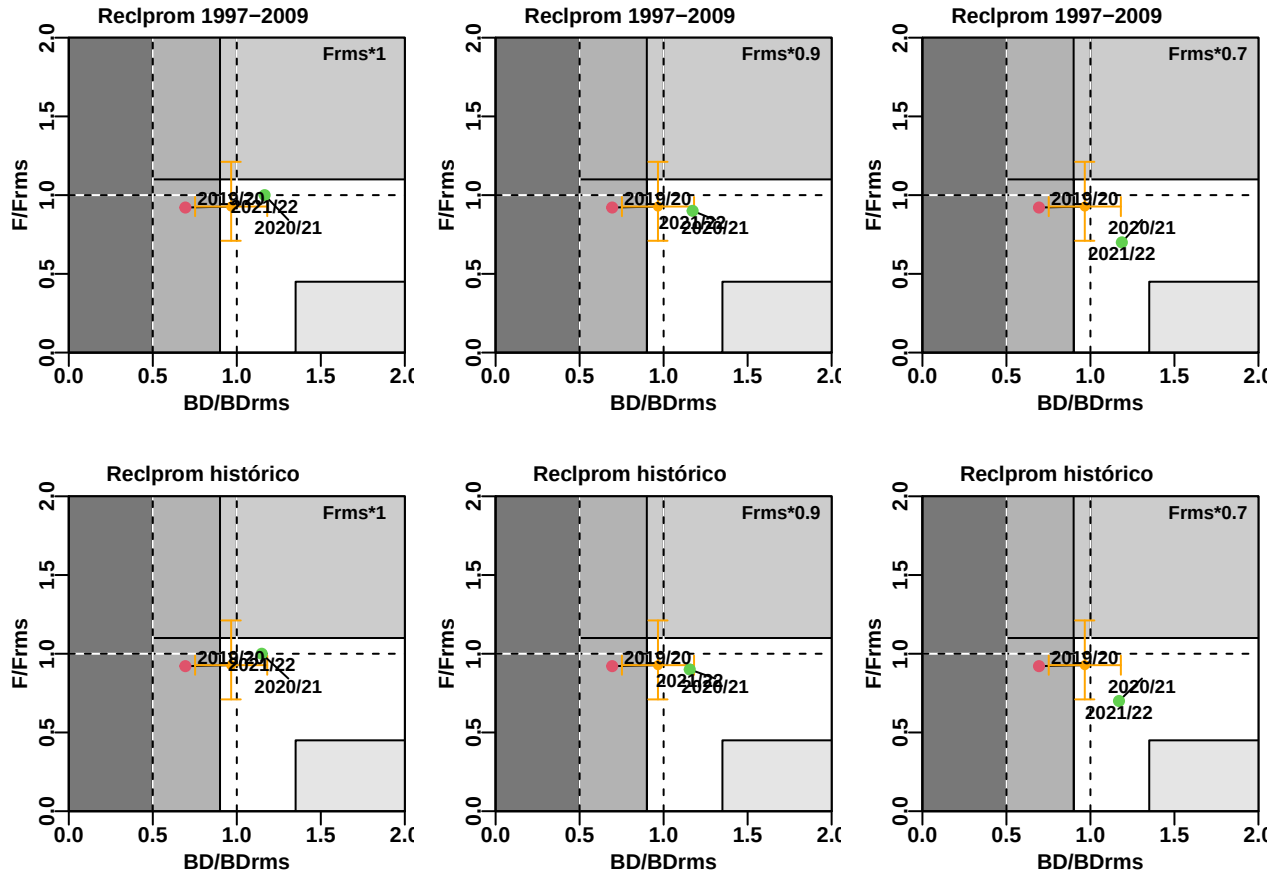
| | 1997-2009 | Histórico | 2010-2021 |
|---|---|---|---|
| 50% | -1 | 5 | 13 |

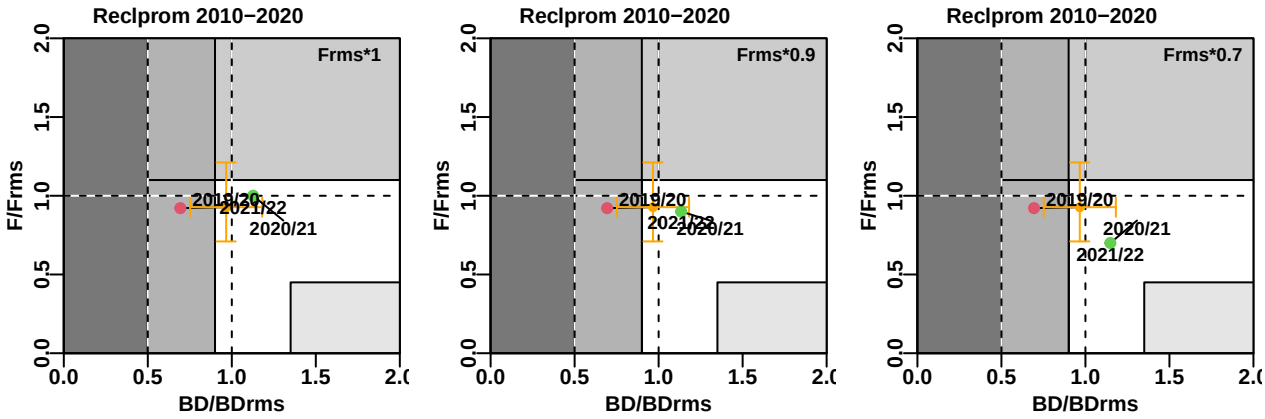
## Proyección Estatus 2021 - Asesoría septiembre

| | 1997-2009[$F_{RMS}$*1] | [$F_{RMS}$*0.9] | [$F_{RMS}$*0.7] |
|---|---|---|---|
| p(sobre-explotación)_2019/20 | 0.32 | 0.32 | 0.32 |
| p(colapso)_2019/20 | 0.00 | 0.00 | 0.00 |
| p(sobre-explotación)_2020/21 | 0.03 | 0.03 | 0.03 |
| p(colapso)_2020/21 | 0.00 | 0.00 | 0.00 |
| p(sobre-explotación)_2021/22 | 0.11 | 0.11 | 0.10 |
| p(colapso)_2021/22 | 0.00 | 0.00 | 0.00 |

| | histórico[$F_{RMS}$*1] | [$F_{RMS}$*0.9] | [$F_{RMS}$*0.7] |
|---|---|---|---|
| p(sobre-explotación)_2019/20 | 0.32 | 0.32 | 0.32 |
| p(colapso)_2019/20 | 0.00 | 0.00 | 0.00 |
| p(sobre-explotación)_2020/21 | 0.03 | 0.03 | 0.03 |
| p(colapso)_2020/21 | 0.00 | 0.00 | 0.00 |
| p(sobre-explotación)_2021/22 | 0.13 | 0.12 | 0.11 |
| p(colapso)_2021/22 | 0.00 | 0.00 | 0.00 |

| | 2010 - 2020[$F_{RMS}$*1] | [$F_{RMS}$*0.9] | [$F_{RMS}$*0.7] |
|---|---|---|---|
| p(sobre-explotación)_2019/20 | 0.32 | 0.32 | 0.32 |
| p(colapso)_2019/20 | 0.00 | 0.00 | 0.00 |
| p(sobre-explotación)_2020/21 | 0.03 | 0.03 | 0.03 |
| p(colapso)_2020/21 | 0.00 | 0.00 | 0.00 |
| p(sobre-explotación)_2021/22 | 0.15 | 0.15 | 0.13 |
| p(colapso)_2021/22 | 0.00 | 0.00 | 0.00 |



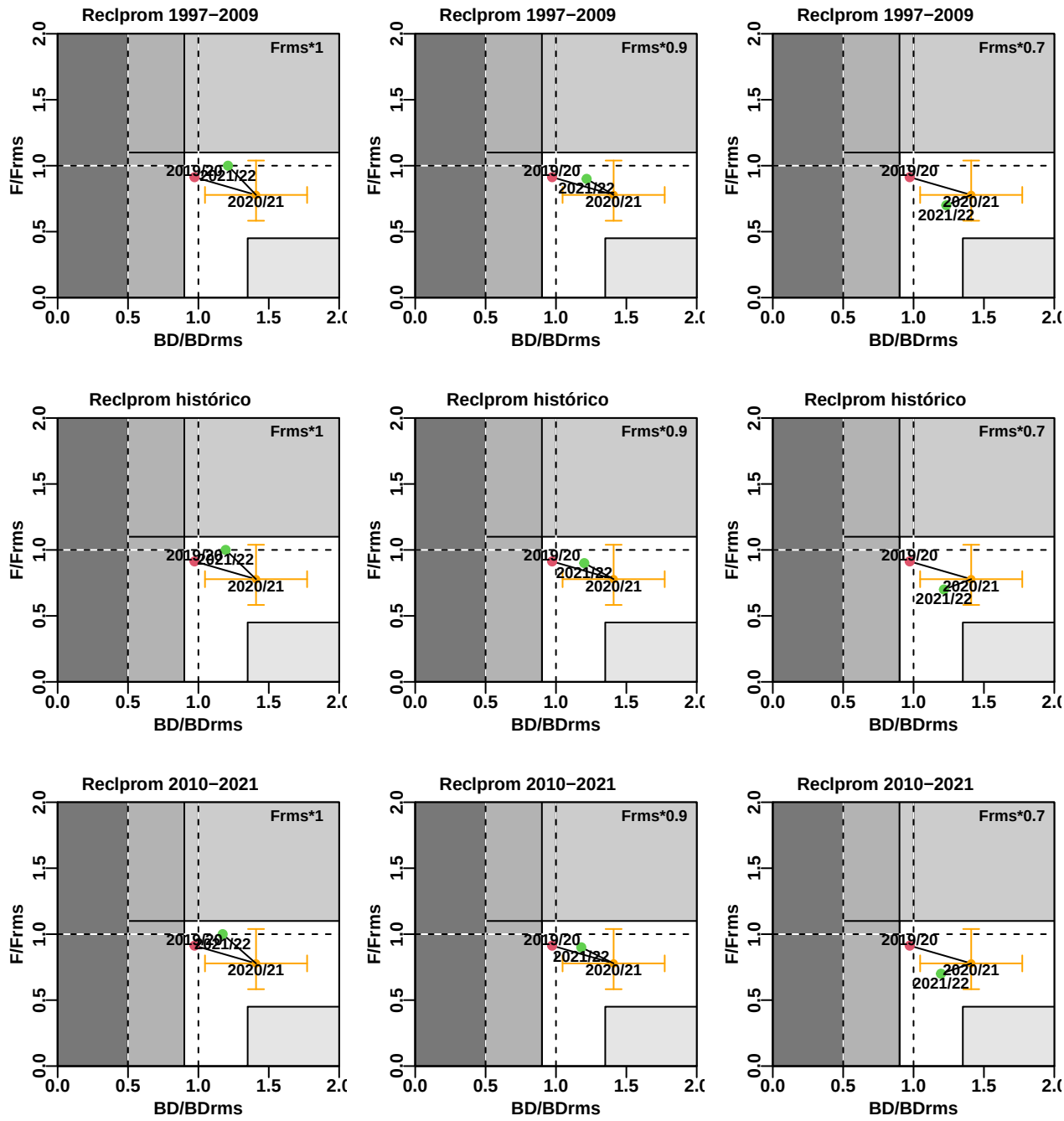



## Proyección Estatus 2022 - Asesoría marzo 2021

| | 1997-2009[$F_{RMS}$*1] | [$F_{RMS}$*0.9] | [$F_{RMS}$*0.7] |
|---|---|---|---|
| p(BD<0,9$BD_{RMS}$)_2020/21 | 0.02 | 0.02 | 0.02 |
| p(BD<0,5$BD_{RMS}$)_2020/21 | 0.00 | 0.00 | 0.00 |
| p(BD<0,9$BD_{RMS}$)_2021/22 | 0.11 | 0.11 | 0.10 |
| p(BD<0,5$BD_{RMS}$)_2021/22 | 0.00 | 0.00 | 0.00 |

| | histórico[$F_{RMS}$*1] | [$F_{RMS}$*0.9] | [$F_{RMS}$*0.7] |
|---|---|---|---|
| p(BD<0,9$BD_{RMS}$)_2020/21 | 0.02 | 0.02 | 0.02 |
| p(BD<0,5$BD_{RMS}$)_2020/21 | 0.00 | 0.00 | 0.00 |
| p(BD<0,9$BD_{RMS}$)_2021/22 | 0.12 | 0.12 | 0.11 |
| p(BD<0,5$BD_{RMS}$)_2021/22 | 0.00 | 0.00 | 0.00 |

| | 2010 - 2021[$F_{RMS}$*1] | [$F_{RMS}$*0.9] | [$F_{RMS}$*0.7] |
|---|---|---|---|
| p(BD<0,9$BD_{RMS}$)_2020/21 | 0.02 | 0.02 | 0.02 |
| p(BD<0,5$BD_{RMS}$)_2020/21 | 0.00 | 0.00 | 0.00 |
| p(BD<0,9$BD_{RMS}$)_2021/22 | 0.14 | 0.14 | 0.13 |
| p(BD<0,5$BD_{RMS}$)_2021/22 | 0.00 | 0.00 | 0.00 |

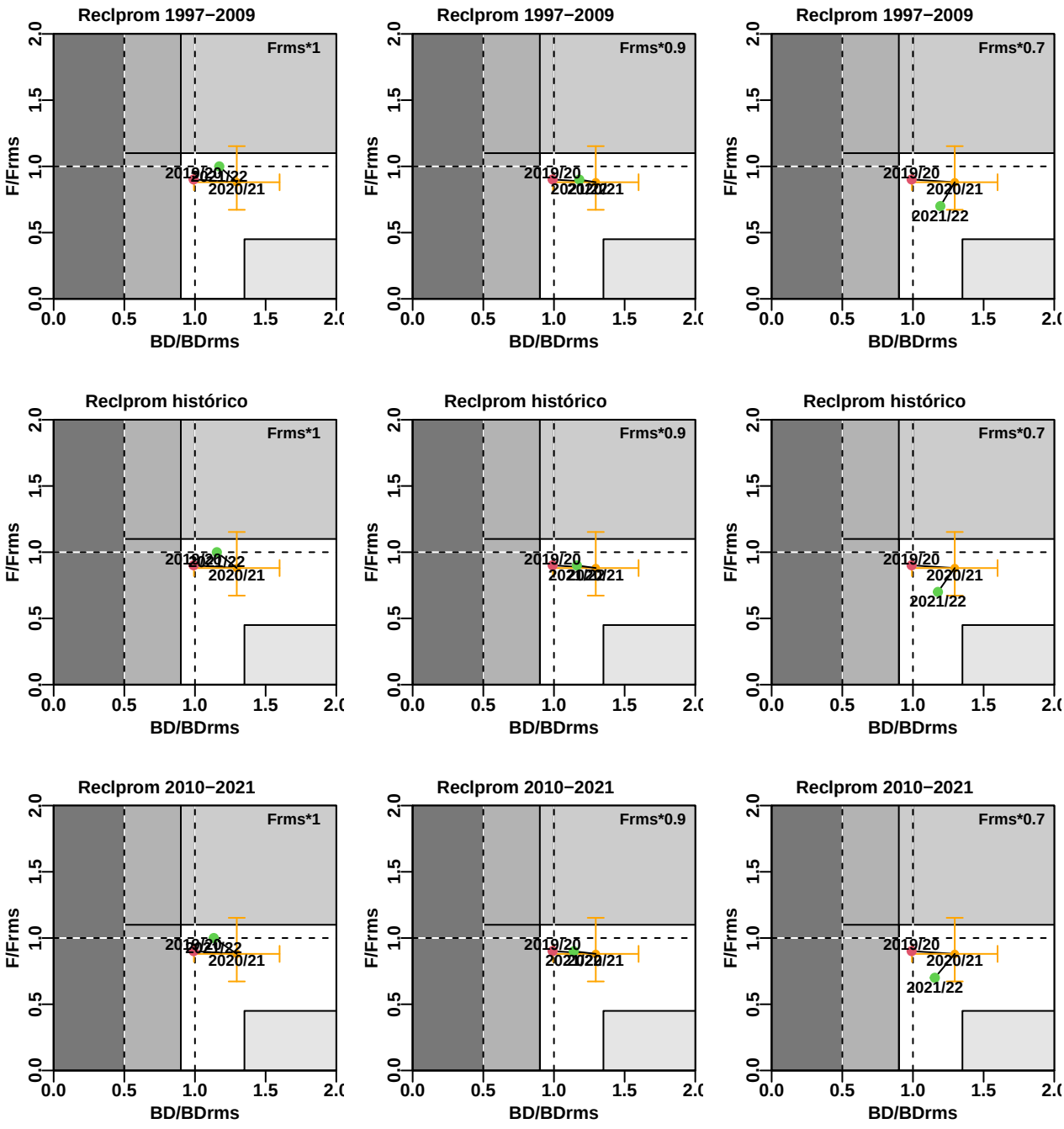



## Proyección Estatus 2022 - Asesoría julio 2021

| | 1997-2009[$F_{RMS}$*1] | [$F_{RMS}$*0.9] | [$F_{RMS}$*0.7] |
|---|---|---|---|
| p(BD<0,9$BD_{RMS}$)_2020/21 | 0.03 | 0.03 | 0.03 |
| p(BD<0,5$BD_{RMS}$)_2020/21 | 0.00 | 0.00 | 0.00 |
| p(BD<0,9$BD_{RMS}$)_2021/22 | 0.11 | 0.10 | 0.09 |
| p(BD<0,5$BD_{RMS}$)_2021/22 | 0.00 | 0.00 | 0.00 |

| | histórico[$F_{RMS}$*1] | [$F_{RMS}$*0.9] | [$F_{RMS}$*0.7] |
|---|---|---|---|
| p(BD<0,9$BD_{RMS}$)_2020/21 | 0.03 | 0.03 | 0.03 |
| p(BD<0,5$BD_{RMS}$)_2020/21 | 0.00 | 0.00 | 0.00 |
| p(BD<0,9$BD_{RMS}$)_2021/22 | 0.12 | 0.12 | 0.11 |
| p(BD<0,5$BD_{RMS}$)_2021/22 | 0.00 | 0.00 | 0.00 |

| | 2010 - 2021[$F_{RMS}$*1] | [$F_{RMS}$*0.9] | [$F_{RMS}$*0.7] |
|---|---|---|---|
| p(BD<0,9$BD_{RMS}$)_2020/21 | 0.03 | 0.03 | 0.03 |
| p(BD<0,5$BD_{RMS}$)_2020/21 | 0.00 | 0.00 | 0.00 |
| p(BD<0,9$BD_{RMS}$)_2021/22 | 0.15 | 0.14 | 0.13 |
| p(BD<0,5$BD_{RMS}$)_2021/22 | 0.00 | 0.00 | 0.00 |


Reclprom 1997−2009
Frms*1
Reclprom 1997−2009
Frms*0.9
Reclprom 1997−2009
Frms*0.7
Reclprom histórico
Frms*1
Reclprom histórico
Frms*0.9
Reclprom histórico
Frms*0.7
Reclprom 2010−2021
Frms*1
Reclprom 2010−2021
Frms*0.9
Reclprom 2010−2021
Frms*0.7
F/Frms
BD/BDrms
2019/20
2020/21
2021/22