CFP Indicators
Testing stability of indicator SSB trend in the Mediterranean

Ernesto Jardim[1]

[1]European Commission, Joint Research Centre, Sustainable resources directorate, Water and Marine Resources unit, 21027 Ispra (VA), Italy
[*]Corresponding author ernesto.jardim@ec.europa.eu

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Contents

1 Background

```
library(lme4)
library(ggplot2)
library(lattice)
library(latticeExtra)
library(reshape2)
library(parallel)
library(influence.ME)
library(xtable)
load("../analysis/RData.med")
options(stringsAsFactors=FALSE, width = 60)
theme_set(theme_bw())
sc <- scale_x_continuous(breaks=2003:2017)
th <- theme(axis.text.x  = element_text(angle=90, vjust=0.5))
nc <- 3
it <- 240
# to control de seed in mclapply
RNGkind("L'Ecuyer-CMRG")
set.seed(1234)
```

2 SSB trend in the Mediterranean

```
idx <- !is.na(sam$SSB)
df0 <- sam[idx,]
df0$Year <- factor(df0$Year)
yrs <- levels(df0$Year)
nd <- data.frame(Year=factor(yrs))
No <- length(unique(df0$stk))

# model
fit <- glmer(SSB ~ factor(Year) + (1|stk), data =  df0, family = Gamma("log"), control=glmerControl(opt

summary(fit)

## Generalized linear mixed model fit by maximum likelihood
##   (Laplace Approximation) [glmerMod]
##  Family: Gamma  ( log )
## Formula: SSB ~ factor(Year) + (1 | stk)
##    Data: df0
## Control: glmerControl(optimizer = "nlminbwrap")
##
##      AIC      BIC   logLik deviance df.resid
##   8662.8   8734.9  -4314.4   8628.8      496
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -1.9615 -0.4753 -0.0727  0.3876  4.0624
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  stk      (Intercept) 0.9008   0.9491
##  Residual             0.1448   0.3806
## Number of obs: 513, groups:  stk, 39
```

```
##
## Fixed effects:
##                   Estimate Std. Error t value Pr(>|z|)
## (Intercept)       8.049529   0.382411  21.049   <2e-16 ***
## factor(Year)2004 -0.045623   0.090294  -0.505   0.6134
## factor(Year)2005  0.002922   0.088150   0.033   0.9736
## factor(Year)2006  0.049569   0.085750   0.578   0.5632
## factor(Year)2007  0.029490   0.083909   0.351   0.7252
## factor(Year)2008 -0.053818   0.083635  -0.643   0.5199
## factor(Year)2009 -0.068571   0.082105  -0.835   0.4036
## factor(Year)2010 -0.085267   0.082312  -1.036   0.3003
## factor(Year)2011 -0.136656   0.082308  -1.660   0.0969 .
## factor(Year)2012 -0.157465   0.082230  -1.915   0.0555 .
## factor(Year)2013 -0.140115   0.082047  -1.708   0.0877 .
## factor(Year)2014 -0.081928   0.081979  -0.999   0.3176
## factor(Year)2015 -0.060442   0.082026  -0.737   0.4612
## factor(Year)2016 -0.039671   0.082027  -0.484   0.6286
## factor(Year)2017 -0.035625   0.081989  -0.435   0.6639
## ---
## Signif. codes:
## 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
xyplot(residuals(fit)~predict(fit))
```

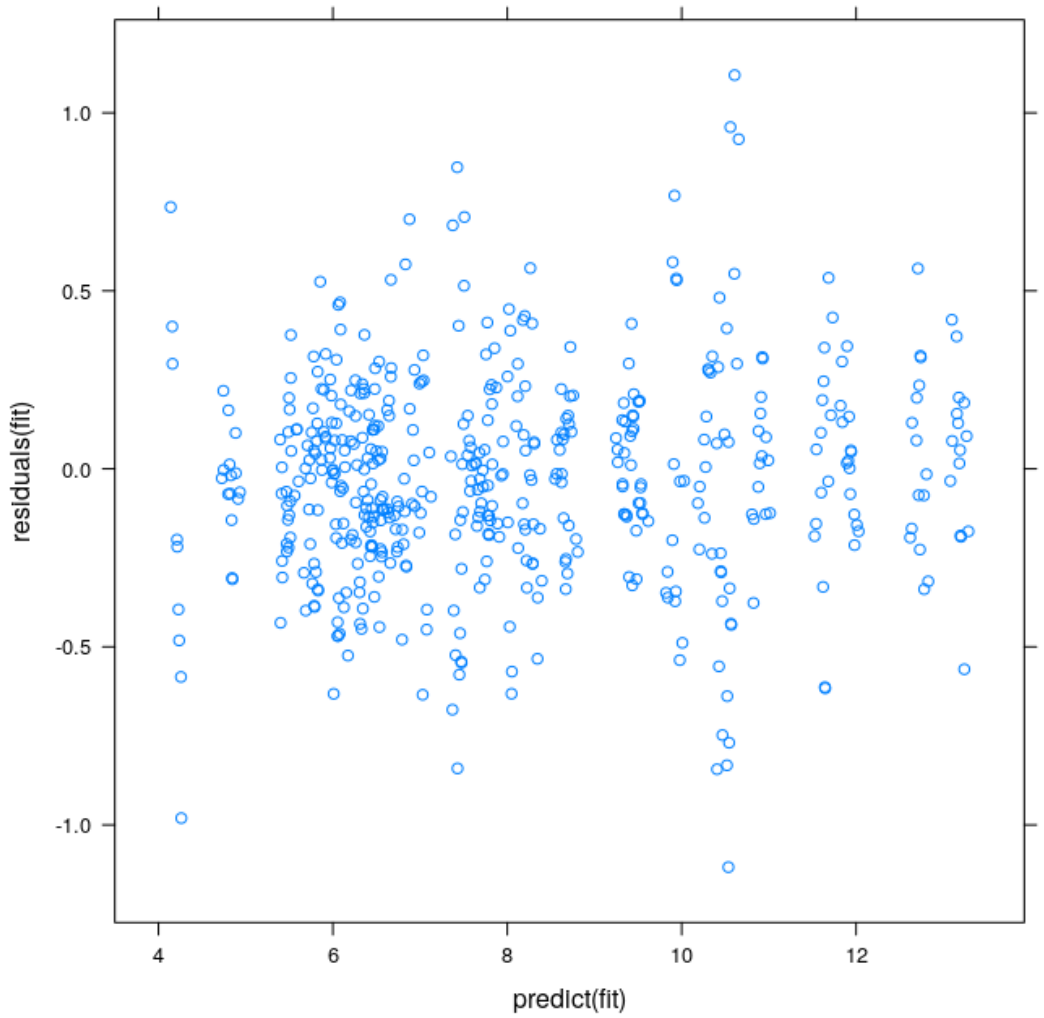


Figure 1: Homogeneity of variance in the GLMM

```
xyplot(residuals(fit)~predict(fit)|df0[,"stk"], main="homogeneity of variance",
    scales=list(x=list(relation="free")))
```

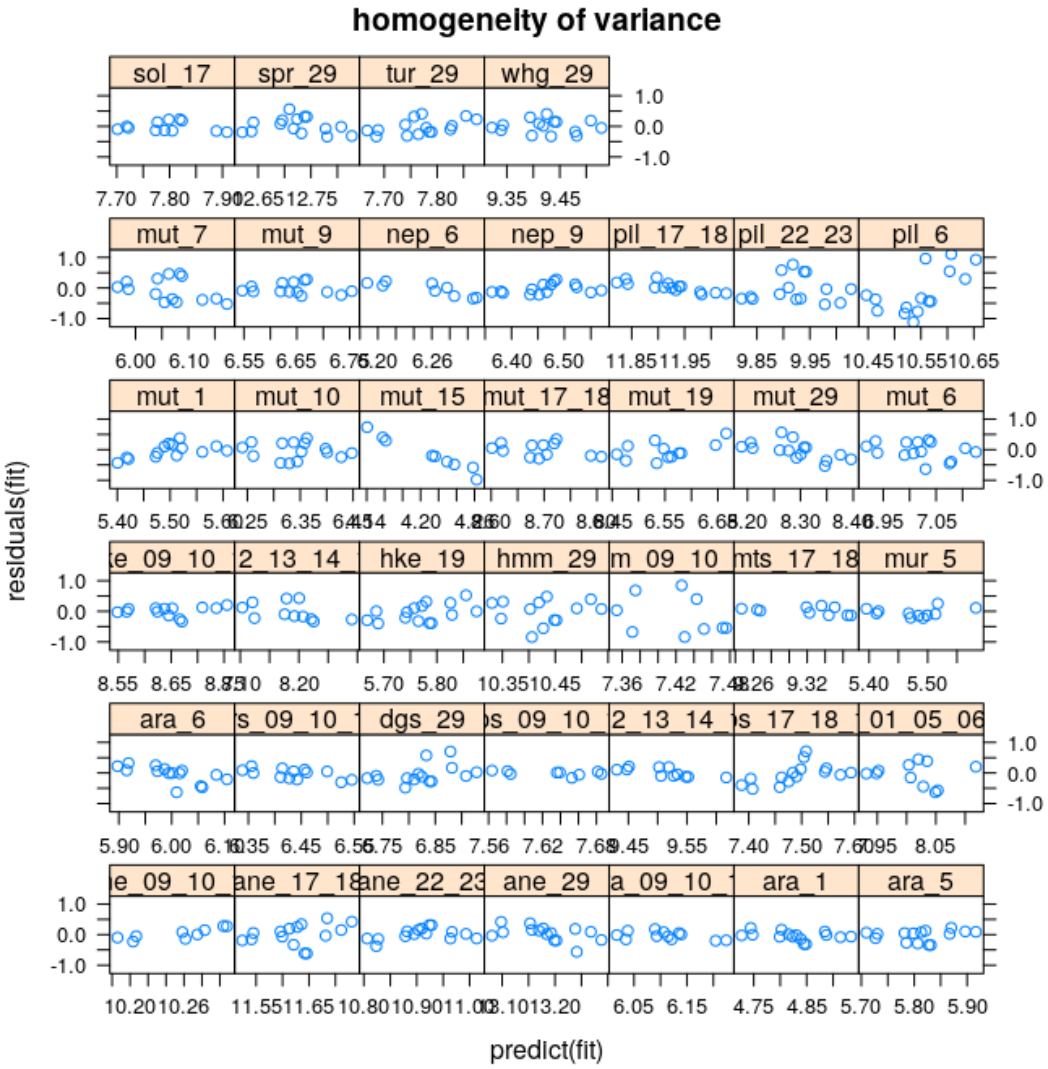


Figure 2: Homogeneity of variance by stock in the GLMM

```
pfun <- function(x, ...){
        panel.qqmathline(x, col="gray50")
        panel.qqmath(x, ...)
}

qqmath(residuals(fit), panel=pfun, pch=19, cex=0.5)
```

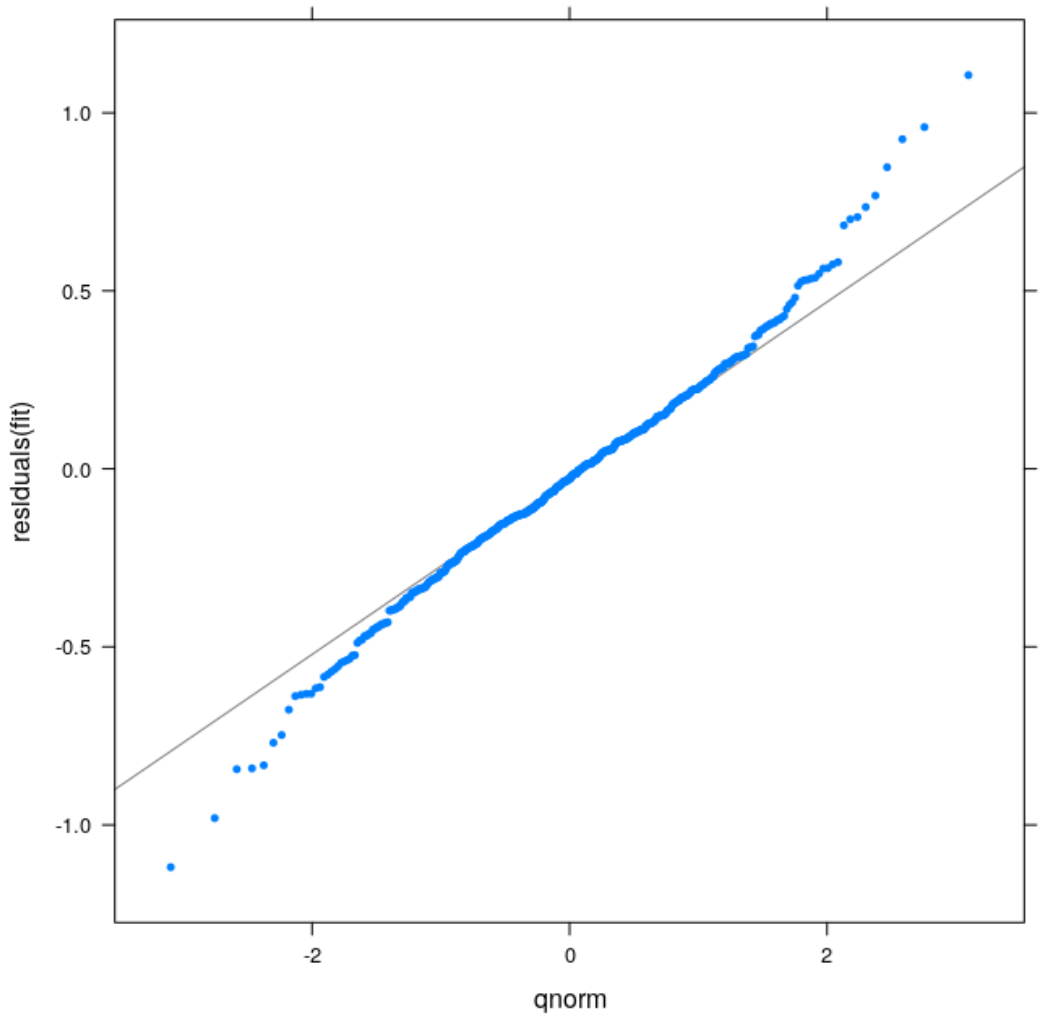


Figure 3: Normality of residuals in the GLMM

```
qqmath(~residuals(fit)|df0[,"stk"], panel=pfun, pch=19, cex=0.5)
```

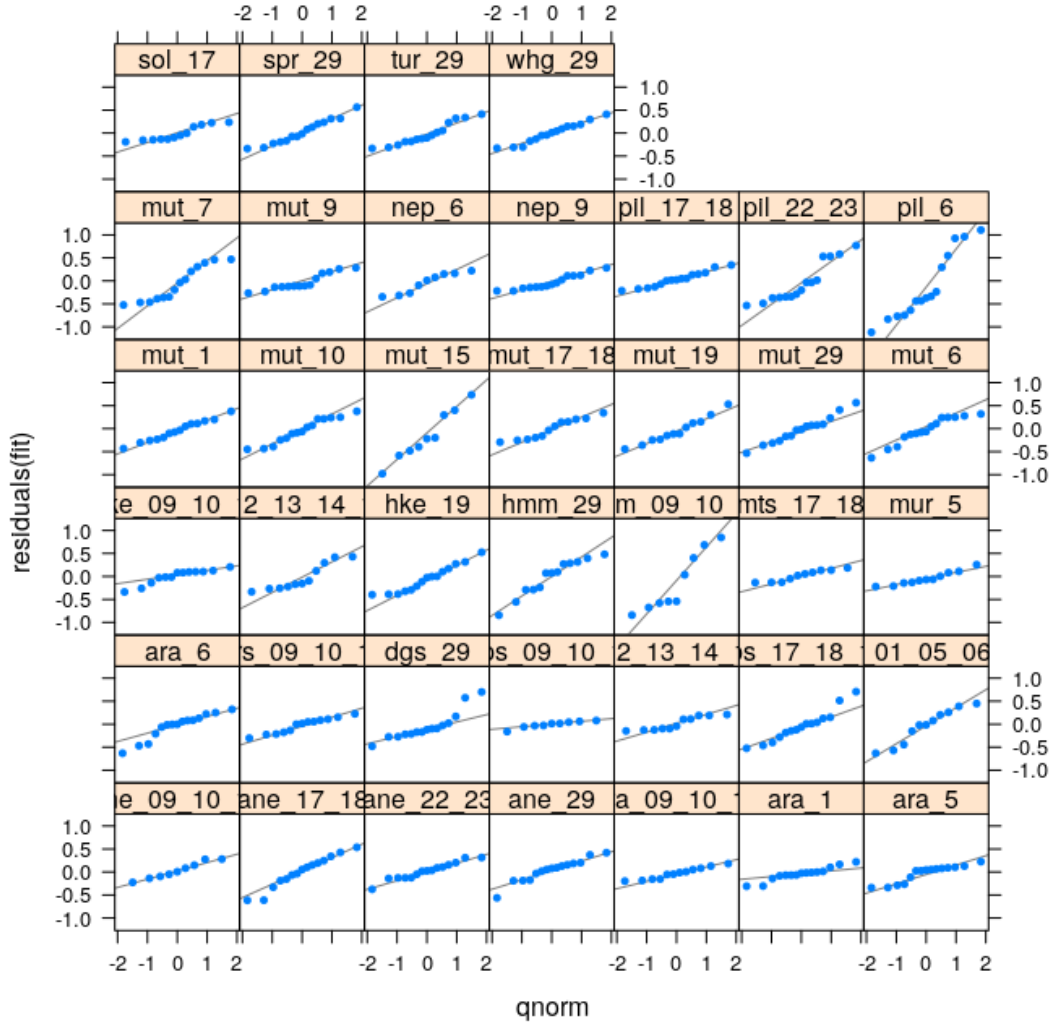


Figure 4: Normality of residuals by stock in the GLMM

```
dotplot(ranef(fit, condVar = TRUE), main=FALSE)

## $stk
```

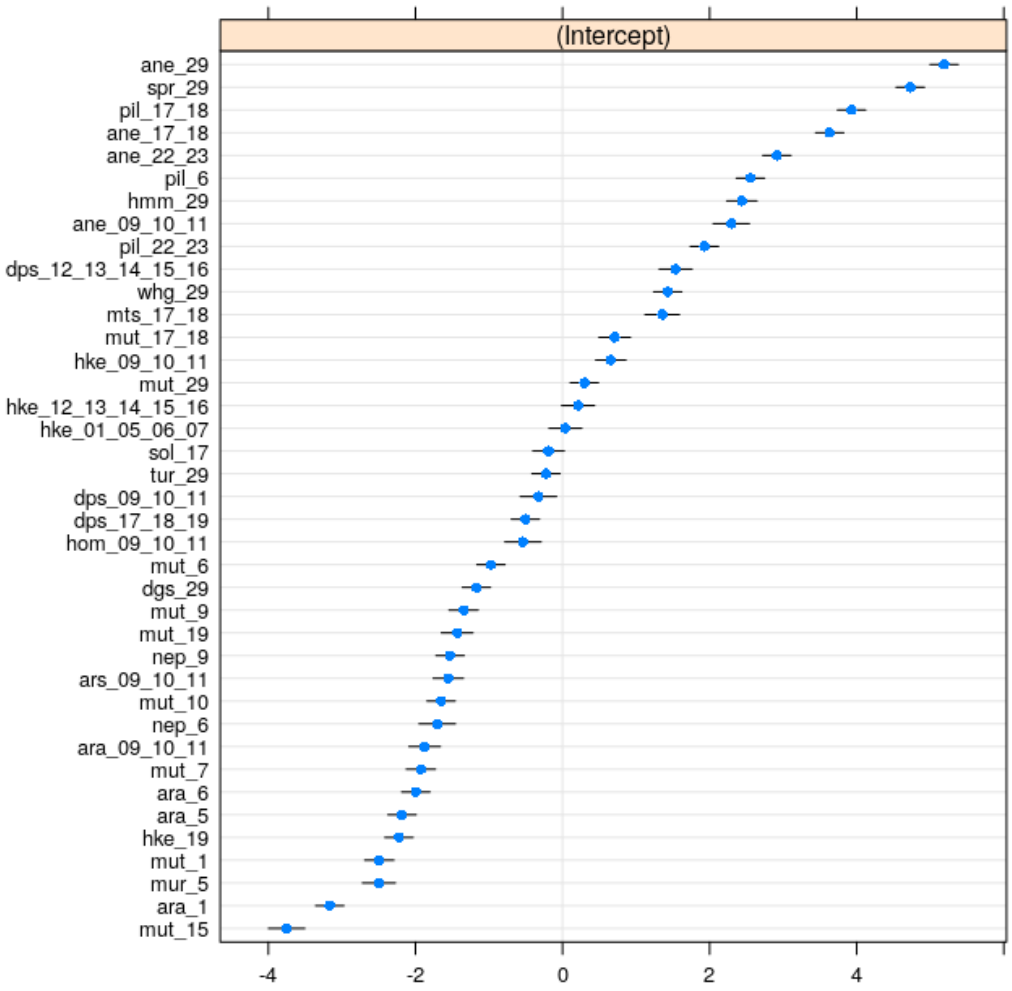


Figure 5: Random effects

```
ifl.stk <- influence.stk(fit, df0, "stk", nc, nd)
dotplot(stk~sd, data=ifl.stk)
```

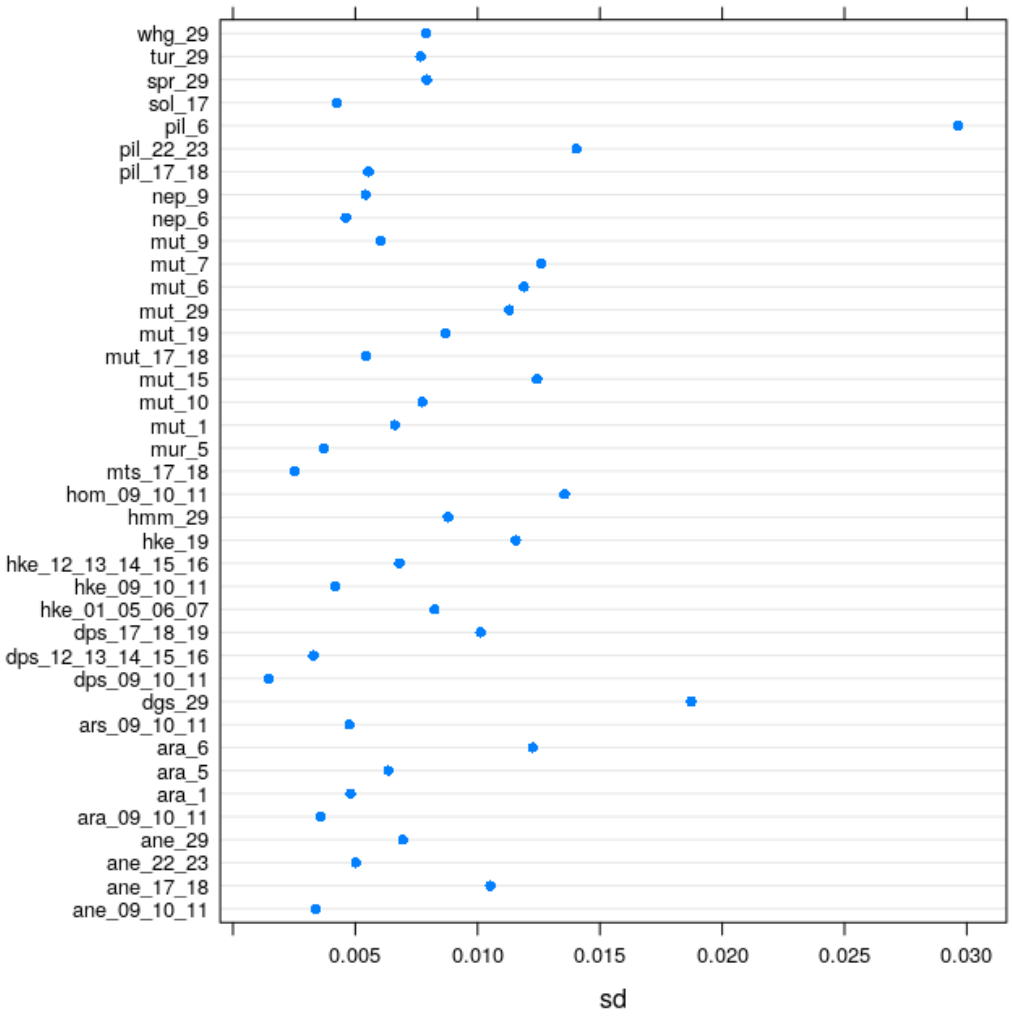
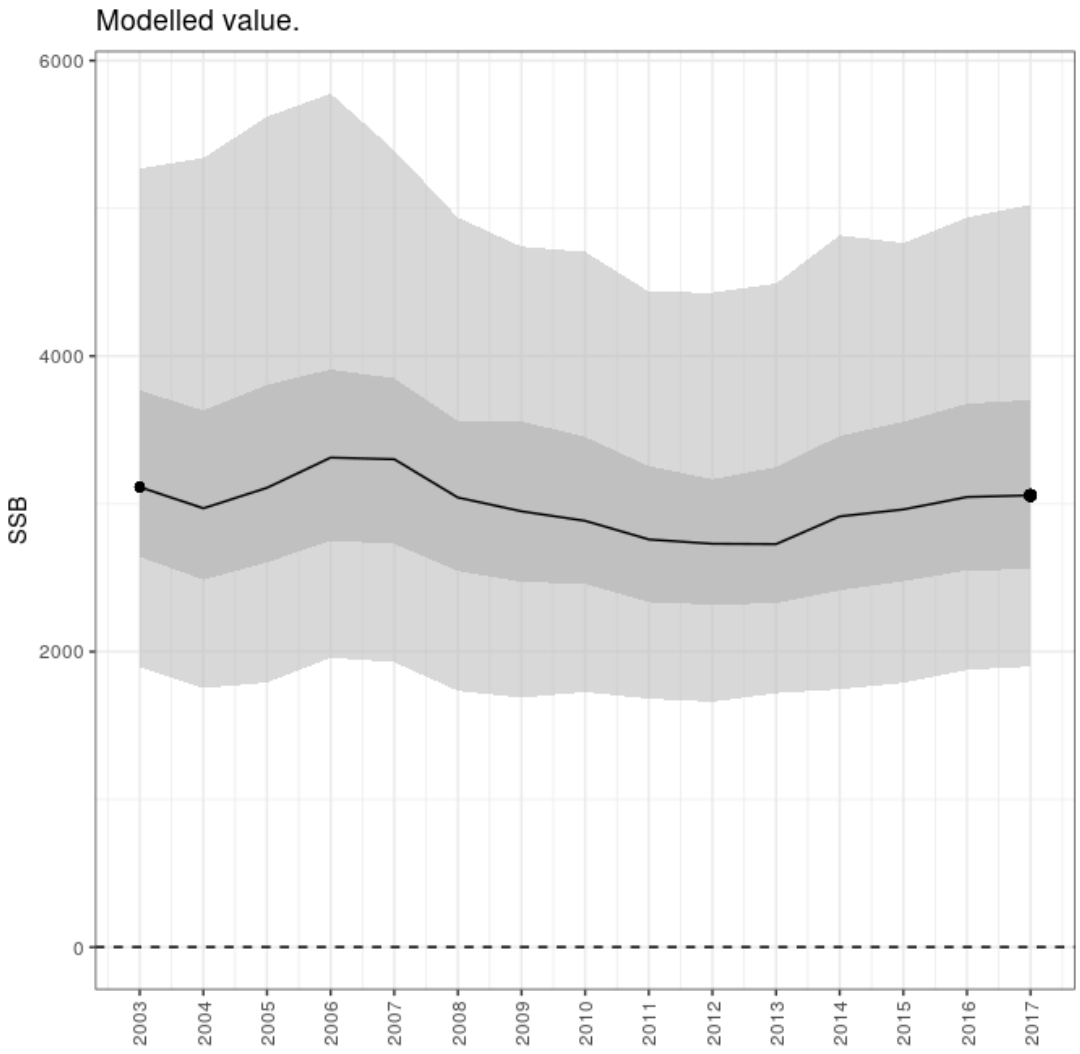


Figure 6: Influence on fixed effect "year" in the GLMM

```
set.seed(1234)
stk <- unique(df0$stk)
bs <- split(1:it, 1:it)
bs <- mclapply(bs, function(x){
        stk <- sample(stk, replace=TRUE)
        df1 <- df0[0,]
        for(i in stk) df1 <- rbind(df1, subset(df0, stk==i))
        fit <- glmer(SSB ~ Year + (1|stk), data = df1, family = Gamma("log"), control=glmerControl(opti
        v0 <- predict(fit, re.form=~0, type="response", newdata=nd)
        if(length(fit@optinfo$conv$lme4)>0) v0[] <- NA
        v0
}, mc.cores=nc)
# remove failed iters
bs <- bs[unlist(lapply(bs, is.numeric))]

ifitm <- do.call("rbind", bs)
ifitq <- apply(ifitm, 2, quantile, c(0.025, 0.25, 0.50, 0.75, 0.975), na.rm=TRUE)
ifitq <- cbind(Year=as.numeric(yrs), as.data.frame(t(ifitq)))
```

```
#png("figNEAI5outmod.png", 600, 400)
ggplot(ifitq, aes(x=Year)) +
  geom_ribbon(aes(ymin = `2.5%`, ymax = `97.5%`), fill="gray", alpha=0.60) +
  geom_ribbon(aes(ymin = `25%`, ymax = `75%`), fill="gray", alpha=0.95) +
  geom_line(aes(y=`50%`)) + expand_limits(y=0) +
  geom_point(aes(x=Year[1], y=`50%`[1])) +
  geom_point(aes(x=Year[length(Year)], y=`50%`[length(`50%`)]), size=2) +
  geom_hline(yintercept = 1, linetype=2) +
  ylab("SSB") + xlab("") +
  theme(legend.position = "none") + sc + th +
    ggtitle("Modelled value.")
```



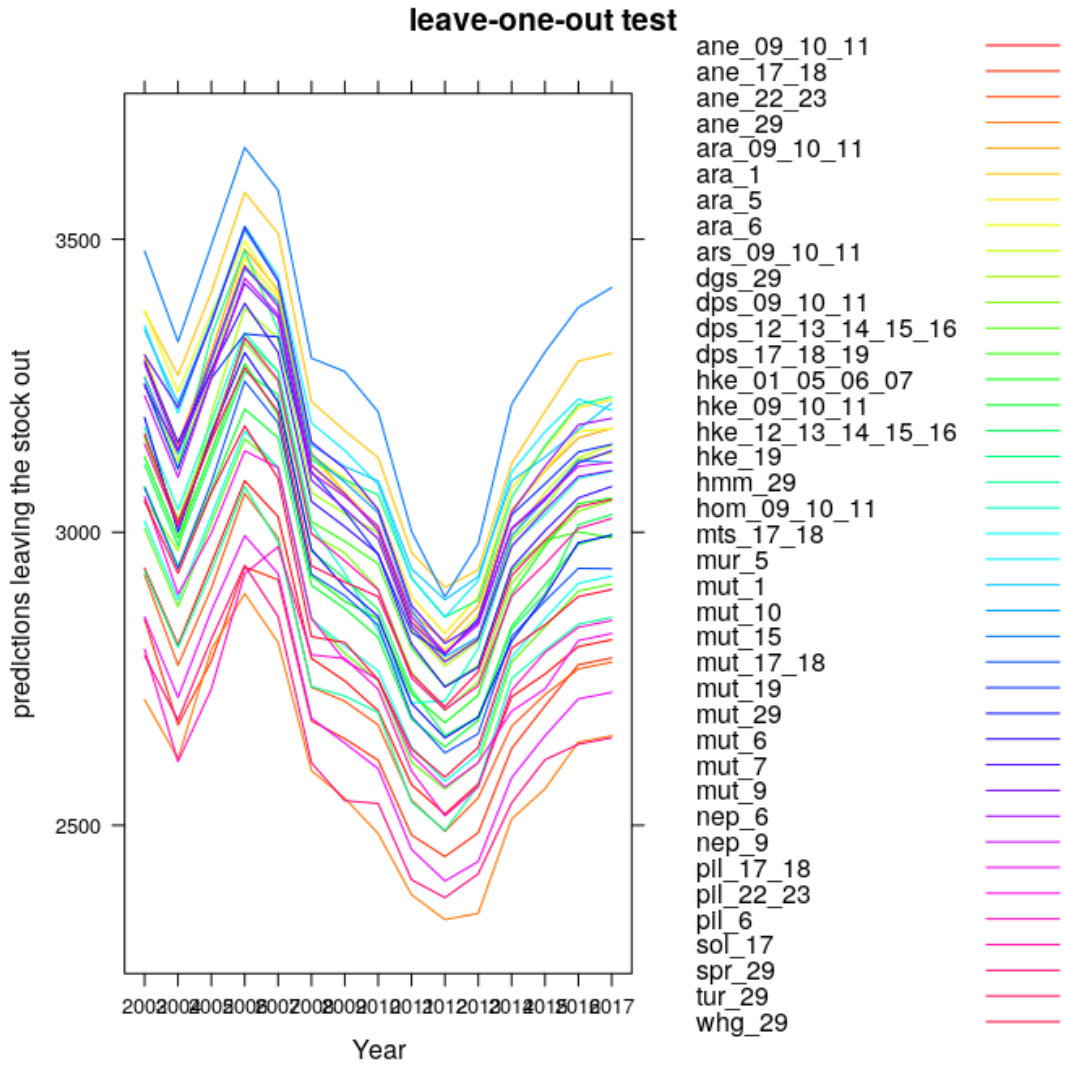

```
#dev.off()
```

```
neafout <- list(fit=fit, bs=bs)
```

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
2.5%	1900.00	1750.00	1790.00	1960.00	1930.00	1730.00	1690.00	1730.00	1680.00	1660.00	1720.00	1750.00	1790.00	18
25%	2640.00	2490.00	2600.00	2750.00	2730.00	2550.00	2470.00	2460.00	2340.00	2320.00	2330.00	2410.00	2480.00	25
50%	3110.00	2970.00	3110.00	3310.00	3300.00	3040.00	2950.00	2890.00	2760.00	2730.00	2730.00	2920.00	2960.00	30
75%	3770.00	3630.00	3810.00	3910.00	3850.00	3560.00	3560.00	3450.00	3260.00	3170.00	3250.00	3460.00	3560.00	36
97.5%	5270.00	5340.00	5620.00	5780.00	5390.00	4940.00	4740.00	4710.00	4440.00	4430.00	4490.00	4820.00	4760.00	49

3 Individual stocks' impact with leave-one-out algorithm

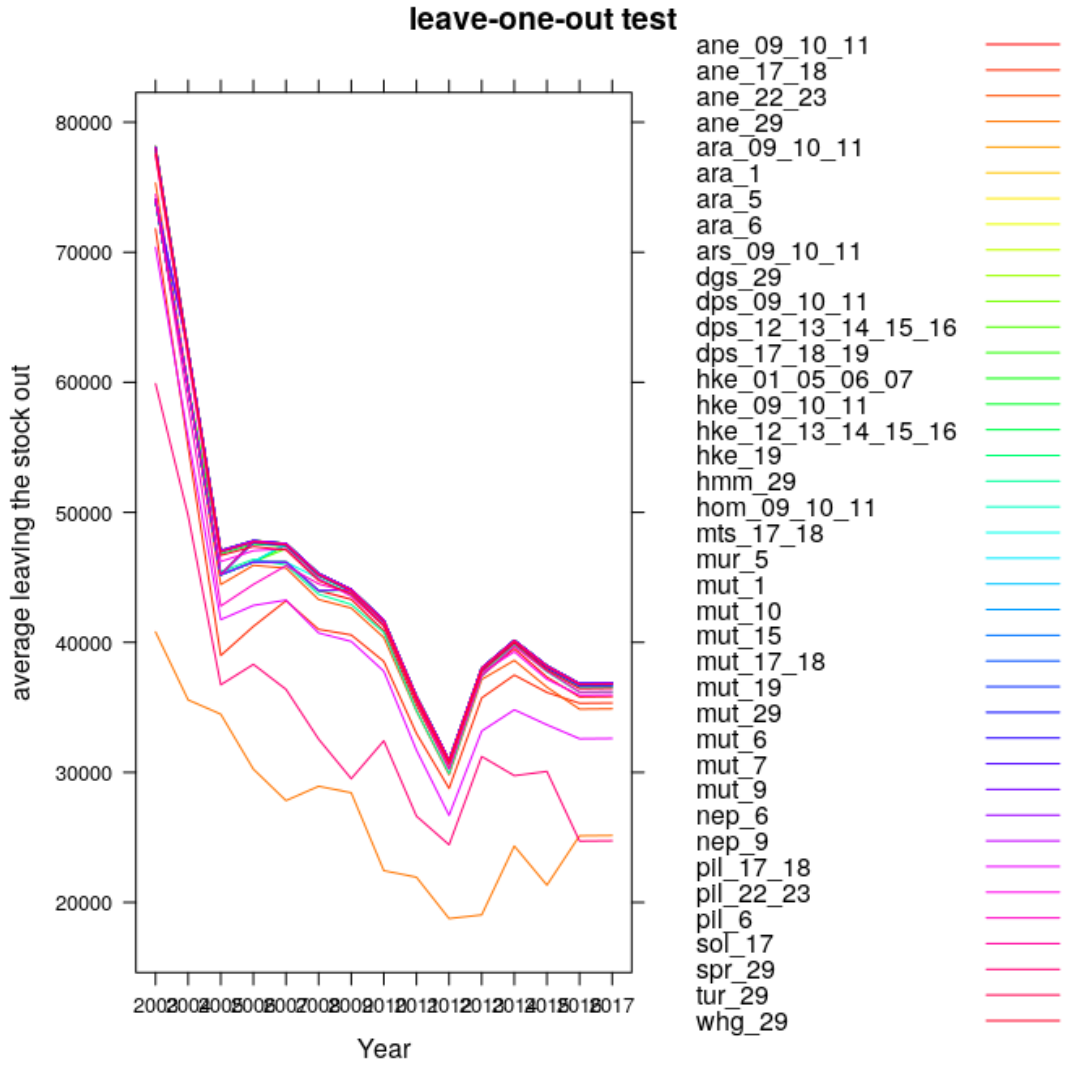
```
stks <- unique(df0$stk)
test <- split(stks, stks)
for(i in stks){
        fit <- glmer(SSB ~ Year + (1|stk), data = df0[df0$stk!=i,],
                family = Gamma("log"), control=glmerControl(optimizer="nlminbwrap"))
        test[[i]] <- data.frame(nd, spp=i,
                pred=predict(fit, re.form=~0, type="response", newdata=nd))
}
test <- do.call("rbind", test)
```



4 Individual stocks' impact on average estimates with leave-one-out algorithm

```
test2 <- split(stks, stks)
for(i in stks){
        test2[[i]] <- data.frame(nd, spp=i,
                avg=tapply(df0[df0$stk!=i,'SSB'], df0[df0$stk!=i,'Year'], mean))
```

```
}
test2 <- do.call("rbind", test2)
```



5 Conclusions

6 References

ICES 2012. ICES Implementation of Advice for Data-limited Stocks in 2012 in its 2012 Advice. ICES CM 2012/ACOM 68. 42 pp.

Jardim E., Scott F., Mosqueira I., Osio C., Vasilakopoulos P., Mannini A., Casey J. (Editors) 2017. Scientific, Technical and Economic Committee for Fisheries (STECF) - Monitoring the performance of the Common Fisheries Policy (STECF-17-XX). EUR XXXX EN; doi:XXXXXXXX

Vasilakopoulos P., Jardim E. 2017. Compilation and quality check of the ICES stock assessment data. EUR XXXX EN; doi:XXXXXXXX