Extended Survivors Analysis

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Introduction

Shepherd (1999) Kell et al. (2007) LT Kell, Pastoors, et al. (2005) LT Kell, Pilling, et al. (2005)

```
library(FLCore)
library(FLXSA)

data(ple4)
data(ple4.indices)

is(ple4)
getSlots(is(ple4))

is(ple4.indices)
getSlots(is(ple4.indices[[1]]))
```

Plotting

Plots are important for examining objects, exploring data, summarising results, checking outputs, and diagnosing problems. FLXSA uses the `ggplot2` and `ggplotFL` packages.

```
library(ggplotFL)

plot(ple4)


plot(ple4.indices[["SNS"]]@index)+
       geom_point()+
       geom_smooth(se=FALSE)
```

```
Warning: Removed 5 rows containing non-finite
values (stat_smooth).
```

```
Warning: Removed 5 rows containing missing values
(geom_point).
```

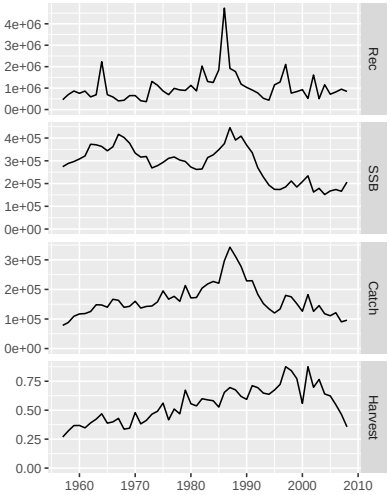

Figure 1: Time series

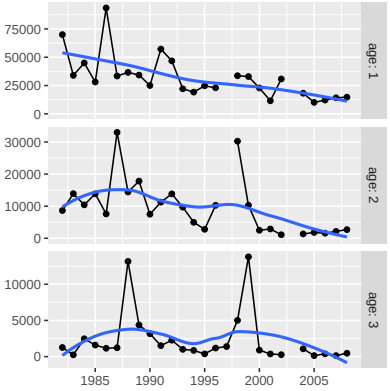

Figure 2: CPUE Time series

FLXSA Class

Fitting

```
ctl     =FLXSA.control()
ple4.xsa=FLXSA(ple4,ple4.indices)
ple4    =ple4+ple4.xsa
```

Figure 1. XSA fits.

Figure 2. XSA plots, weights for terminal year Ns for each CPUE observation and shrinkage

Diagnostics

```
library(diags)

dgs=diags(ple4.xsa)
```

Figure 3. XSA diagnostics, residuals against fitted value.

Figure 4. XSA diagnostics, residuals against year.

Figure 5. XSA diagnostics, Calibration regression plots for age 4.

Figure 6. XSA diagnostics, AR plots of lagged residuals

Figure 7. XSA diagnostics, QQ plots to check for normality

Uncertainty

```
xsa =FLXSA(ple4,ple4.indices)
ple4=FLXSA:::rand(100,ple4,xsa)
```

Parameters

Retrospectives

Figure 8. Retrospective XSA time series estimates.

Crossvalidation

Kell, Kimoto, and Kitakado (2016)

Reference Points

```
library(FLBRP)
```

Figure 9. Stock Recruitment Relationship

Projection

Figure 10. Equilibrium Analysis with reference points.
Figure 11. Equilibrium Analysis with observations.
Figure 12. Kobe Phase Plot.

Harvest Control Rules

Advice

```
library(kobe)
```

MSE

Tables

Table 1a. XSA Control options from continuity run.
Table 2a. XSA diagnostics from continuity run.

References

Kell, L.T., I. Mosqueira, P. Grosjean, J.M. Fromentin, D. Garcia, R. Hillary, E. Jardim, et al. 2007. "FLR: An Open-Source Framework for the Evaluation and Development of Management Strategies." *ICES J. Mar. Sci.* 64 (4): 640.

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Shepherd, JG. 1999. "Extended Survivors Analysis: An Improved Method for the Analysis of Catch-at-Age Data and Abundance Indices." *ICES J. Mar. Sci.* 56 (5). Oxford University Press: 584–91.