

# VPA & XSA in FLR

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```
# This document is based on:
# Stock Assessment Using Tuned VPA. Rob Scott & Clara Ulrich (December 2010) and
# Virtual Population analysis using eXtended Survivor Analysis.
#Dorleta Garcia & Alessandro MANNINI (March 2017)

# Removing previous objects and clean environment
rm(list=ls())

# Use underneath code to open FLR installation window
# utils::install.packages(repos="http://flr-project.org/R")

#### Load libraries ####
library(FLCore)

## Loading required package: MASS
## Loading required package: lattice
## FLCore (Version 2.6.3, packaged: 2017-07-05 12:26:15 UTC)
library(FLAssess)

## Loading required package: FLaSh
library(FLXSA)
library(ggplotFL)

## Loading required package: ggplot2
##
## Attaching package: 'ggplot2'
## The following object is masked from 'package:FLCore':
##
##      %+%
## Warning: replacing previous import 'ggplot2::%+%' by 'FLCore::%+%' when
## loading 'ggplotFL'

#### Load data ####
load("HKE_09_10_11_stk.RData")
HKE=stk
load("HKE_09_10_11_idx.RData")
HKE.idx=flq.idx

#####
#### Explore data structure ####
#####

#### Exploring commercial data ####
str(HKE)
```

```

## Formal class 'FLStock' [package "FLCore"] with 20 slots
## ..@ catch      :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## .. .. ..@ .Data: num [1, 1:9, 1, 1, 1, 1] 4657 3830 3405 3664 3384 ...
## .. .. ..- attr(*, "dimnames")=List of 6
## .. .. ..$ age   : chr "all"
## .. .. ..$ year  : chr [1:9] "2006" "2007" "2008" "2009" ...
## .. .. ..$ unit  : chr "unique"
## .. .. ..$ season: chr "all"
## .. .. ..$ area  : chr "unique"
## .. .. ..$ iter  : chr "1"
## .. .. ..@ units: chr "NA"
## ..@ catch.n     :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## .. .. ..@ .Data: num [1:7, 1:9, 1, 1, 1, 1] 82424 14603 2299 299 103 ...
## .. .. ..- attr(*, "dimnames")=List of 6
## .. .. ..$ age   : chr [1:7] "0" "1" "2" "3" ...
## .. .. ..$ year  : chr [1:9] "2006" "2007" "2008" "2009" ...
## .. .. ..$ unit  : chr "unique"
## .. .. ..$ season: chr "all"
## .. .. ..$ area  : chr "unique"
## .. .. ..$ iter  : chr "1"
## .. .. ..@ units: chr "NA"
## ..@ catch.wt    :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## .. .. ..@ .Data: num [1:7, 1:9, 1, 1, 1, 1] 0.0098 0.1385 0.5228 1.1716 1.9158 ...
## .. .. ..- attr(*, "dimnames")=List of 6
## .. .. ..$ age   : chr [1:7] "0" "1" "2" "3" ...
## .. .. ..$ year  : chr [1:9] "2006" "2007" "2008" "2009" ...
## .. .. ..$ unit  : chr "unique"
## .. .. ..$ season: chr "all"
## .. .. ..$ area  : chr "unique"
## .. .. ..$ iter  : chr "1"
## .. .. ..@ units: chr "NA"
## ..@ discards    :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## .. .. ..@ .Data: num [1, 1:9, 1, 1, 1, 1] NA NA NA NA NA NA NA NA NA
## .. .. ..- attr(*, "dimnames")=List of 6
## .. .. ..$ age   : chr "all"
## .. .. ..$ year  : chr [1:9] "2006" "2007" "2008" "2009" ...
## .. .. ..$ unit  : chr "unique"
## .. .. ..$ season: chr "all"
## .. .. ..$ area  : chr "unique"
## .. .. ..$ iter  : chr "1"
## .. .. ..@ units: chr "NA"
## ..@ discards.n  :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## .. .. ..@ .Data: num [1:7, 1:9, 1, 1, 1, 1] 0 0 0 0 0 0 0 0 0 0 ...
## .. .. ..- attr(*, "dimnames")=List of 6
## .. .. ..$ age   : chr [1:7] "0" "1" "2" "3" ...
## .. .. ..$ year  : chr [1:9] "2006" "2007" "2008" "2009" ...
## .. .. ..$ unit  : chr "unique"
## .. .. ..$ season: chr "all"
## .. .. ..$ area  : chr "unique"
## .. .. ..$ iter  : chr "1"
## .. .. ..@ units: chr "NA"
## ..@ discards.wt :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## .. .. ..@ .Data: num [1:7, 1:9, 1, 1, 1, 1] NaN NaN NaN NaN NaN NaN NaN NaN NaN ...
## .. .. ..- attr(*, "dimnames")=List of 6

```

```

## ..$ age : chr [1:7] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ landings :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1, 1:9, 1, 1, 1, 1] 4657 3830 3405 3664 3384 ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr "all"
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ landings.n :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:7, 1:9, 1, 1, 1, 1] 82424 14603 2299 299 103 ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:7] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ landings.wt :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:7, 1:9, 1, 1, 1, 1] 0.0098 0.1385 0.5228 1.1716 1.9158 ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:7] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ stock :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1, 1:9, 1, 1, 1, 1] NA NA NA NA NA NA NA NA NA
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr "all"
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ stock.n :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:7, 1:9, 1, 1, 1, 1] NA NA NA NA NA NA NA NA NA ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:7] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"

```

```

## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ stock.wt :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:7, 1:9, 1, 1, 1, 1] 0.0098 0.1385 0.5228 1.1716 1.9158 ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:7] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ m :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:7, 1:9, 1, 1, 1, 1] 1.166 0.573 0.434 0.369 0.331 ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:7] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ mat :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:7, 1:9, 1, 1, 1, 1] 0 0.224 0.89 1 1 ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:7] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ harvest :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:7, 1:9, 1, 1, 1, 1] NA NA NA NA NA NA NA NA NA ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:7] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "f"
## ..@ harvest.spwn:Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:7, 1:9, 1, 1, 1, 1] 0 0 0 0 0 0 0 0 0 ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:7] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ m.spwn :Formal class 'FLQuant' [package "FLCore"] with 2 slots

```

```
## .. ..@ .Data: num [1:7, 1:9, 1, 1, 1, 1] 0 0 0 0 0 0 0 0 0 0 ...
## .. ..- attr(*, "dimnames")=List of 6
## .. ..$ age : chr [1:7] "0" "1" "2" "3" ...
## .. ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## .. ..$ unit : chr "unique"
## .. ..$ season: chr "all"
## .. ..$ area : chr "unique"
## .. ..$ iter : chr "1"
## .. ..@ units: chr "NA"
## ..@ name : chr "Index File; HKE GSA 10\t"
## ..@ desc : chr "Imported from a VPA file. ( HKE10.IND ). Wed Jul 12 09:23:47 2017"
## ..@ range : Named num [1:7] 0 6 NA 2006 2014 ...
## .. ..- attr(*, "names")= chr [1:7] "min" "max" "plusgroup" "minyear" ...
```

```
landings(HKE)[] #landings
```

```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age  2006   2007   2008   2009   2010   2011   2012   2013   2014
##   all 4656.5 3829.7 3405.5 3664.3 3384.1 3757.4 2640.7 2895.4 3074.7
##
## units:  NA
```

```
units(landings(HKE))<-"t"
```

```
catch.n(HKE)[] #catch number by age
```

```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006      2007      2008      2009      2010      2011
##   0 8.2424e+04 6.2020e+04 6.5121e+04 9.1660e+04 4.2494e+04 6.6748e+04
##   1 1.4603e+04 1.3976e+04 1.2123e+04 1.2360e+04 1.2523e+04 1.2820e+04
##   2 2.2993e+03 1.3141e+03 8.7033e+02 8.1216e+02 1.4515e+03 1.2039e+03
##   3 2.9858e+02 2.0899e+02 2.5103e+02 1.7153e+02 2.2510e+02 2.8533e+02
##   4 1.0297e+02 5.4785e+01 8.0515e+01 8.5904e+01 6.8254e+01 1.0077e+02
##   5 2.9440e+01 1.2424e+01 3.7507e+01 2.5232e+01 3.6735e+01 3.7943e+01
##   6 1.0011e-03 2.6453e+00 7.7576e+00 9.2521e+00 1.1873e+01 8.3724e+00
##      year
## age 2012      2013      2014
##   0 2.9969e+04 2.6054e+04 4.2564e+04
##   1 1.0271e+04 1.2899e+04 1.0589e+04
##   2 8.8035e+02 7.4427e+02 1.3310e+03
##   3 2.0918e+02 1.3405e+02 1.8698e+02
##   4 5.3596e+01 5.3242e+01 3.9646e+01
##   5 1.4063e+01 1.1699e+01 2.4068e+01
##   6 2.0197e+00 3.8645e+00 1.9806e+01
##
## units:  NA
```

```
units(catch.n(HKE)) <- "10^3"
```

```
catch.wt(HKE)[] #catch weight by age
```

```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006      2007      2008      2009      2010      2011      2012
##   0 0.0097962 0.0111972 0.0099485 0.0107332 0.0100794 0.0090594 0.0122723
##   1 0.1385243 0.1465506 0.1437444 0.1460090 0.1336534 0.1469369 0.1404243
##   2 0.5227660 0.5264274 0.5163683 0.5108274 0.5129791 0.5053598 0.5024037
##   3 1.1715577 1.1825167 1.1354463 1.1593580 1.1450351 1.1673509 1.1375630
##   4 1.9157514 1.8273481 1.8831095 1.8759900 1.9165670 1.9015151 1.9288463
##   5 2.6205658 2.8217072 2.6853483 2.6349913 2.7660951 2.6874283 2.7865475
##   6 3.0005651 4.9239695 3.6367794 3.7139220 3.9833698 4.0459298 3.8248526
##   year
## age 2013      2014
##   0 0.0112717 0.0091963
##   1 0.1468980 0.1544967
##   2 0.5469402 0.4646127
##   3 1.1530822 1.1471284
##   4 1.8358521 1.8486048
##   5 2.6033860 2.6832733
##   6 4.3827720 3.8651729
##
## units: NA
```

```
units(catch.wt(stk)) <- "kg"
```

```
stock.n(HKE)[] #stock number by age
```

```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
##   0 NA   NA   NA   NA   NA   NA   NA   NA   NA
##   1 NA   NA   NA   NA   NA   NA   NA   NA   NA
##   2 NA   NA   NA   NA   NA   NA   NA   NA   NA
##   3 NA   NA   NA   NA   NA   NA   NA   NA   NA
##   4 NA   NA   NA   NA   NA   NA   NA   NA   NA
##   5 NA   NA   NA   NA   NA   NA   NA   NA   NA
##   6 NA   NA   NA   NA   NA   NA   NA   NA   NA
##
## units: NA
```

```
units(stock.n(stk)) <- "10^3"
```

```
stock.wt(HKE)#stock weight by age
```

```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006      2007      2008      2009      2010      2011      2012
##   0 0.0097962 0.0111972 0.0099485 0.0107332 0.0100794 0.0090594 0.0122723
##   1 0.1385243 0.1465506 0.1437444 0.1460090 0.1336534 0.1469369 0.1404243
##   2 0.5227660 0.5264274 0.5163683 0.5108274 0.5129791 0.5053598 0.5024037
```

```
## 3 1.1715577 1.1825167 1.1354463 1.1593580 1.1450351 1.1673509 1.1375630
## 4 1.9157514 1.8273481 1.8831095 1.8759900 1.9165670 1.9015151 1.9288463
## 5 2.6205658 2.8217072 2.6853483 2.6349913 2.7660951 2.6874283 2.7865475
## 6 3.0005651 4.9239695 3.6367794 3.7139220 3.9833698 4.0459298 3.8248526
##   year
## age 2013      2014
## 0 0.0112717 0.0091963
## 1 0.1468980 0.1544967
## 2 0.5469402 0.4646127
## 3 1.1530822 1.1471284
## 4 1.8358521 1.8486048
## 5 2.6033860 2.6832733
## 6 4.3827720 3.8651729
##
## units: NA
```

```
units(stock.wt(HKE))<-"kg"
```

```
mat(HKE)[] #maturity by age
```

```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006      2007      2008      2009      2010      2011      2012      2013
## 0 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
## 1 0.22389 0.22937 0.23087 0.22959 0.21997 0.23263 0.22140 0.22809
## 2 0.89022 0.88628 0.88310 0.88439 0.88006 0.88317 0.87961 0.88248
## 3 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
## 4 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
## 5 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
## 6 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
##   year
## age 2014
## 0 0.00000
## 1 0.22457
## 2 0.87454
## 3 1.00000
## 4 1.00000
## 5 1.00000
## 6 1.00000
##
## units: NA
```

```
m(HKE) #natural mortality by age
```

```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006      2007      2008      2009      2010      2011      2012      2013
## 0 1.16598 1.17944 1.17946 1.18589 1.16715 1.18240 1.17651 1.17923
## 1 0.57300 0.58483 0.58097 0.58199 0.57010 0.58148 0.57175 0.58332
## 2 0.43358 0.42889 0.42585 0.42665 0.42300 0.42596 0.42216 0.42493
## 3 0.36924 0.36101 0.36227 0.36534 0.36893 0.35964 0.36056 0.36332
```

```
## 4 0.33085 0.32538 0.32989 0.33276 0.33468 0.32642 0.32832 0.33127
## 5 0.32130 0.31785 0.31030 0.31912 0.31088 0.30655 0.31254 0.33417
## 6 0.29999 0.29584 0.29537 0.29791 0.29535 0.29706 0.29560 0.29862
##   year
## age 2014
## 0 1.18751
## 1 0.57941
## 2 0.41521
## 3 0.35960
## 4 0.32681
## 5 0.30738
## 6 0.29966
##
## units: NA
```

```
harvest(HKE)[] #fishing mortality by age - Not filled in yet
```

```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## 0 NA    NA    NA    NA    NA    NA    NA    NA    NA
## 1 NA    NA    NA    NA    NA    NA    NA    NA    NA
## 2 NA    NA    NA    NA    NA    NA    NA    NA    NA
## 3 NA    NA    NA    NA    NA    NA    NA    NA    NA
## 4 NA    NA    NA    NA    NA    NA    NA    NA    NA
## 5 NA    NA    NA    NA    NA    NA    NA    NA    NA
## 6 NA    NA    NA    NA    NA    NA    NA    NA    NA
##
## units: f
```

```
units(harvest(HKE))<-"f"
```

```
range(HKE)[c("minfbar","maxfbar")]
```

```
## minfbar maxfbar
##      0      6
```

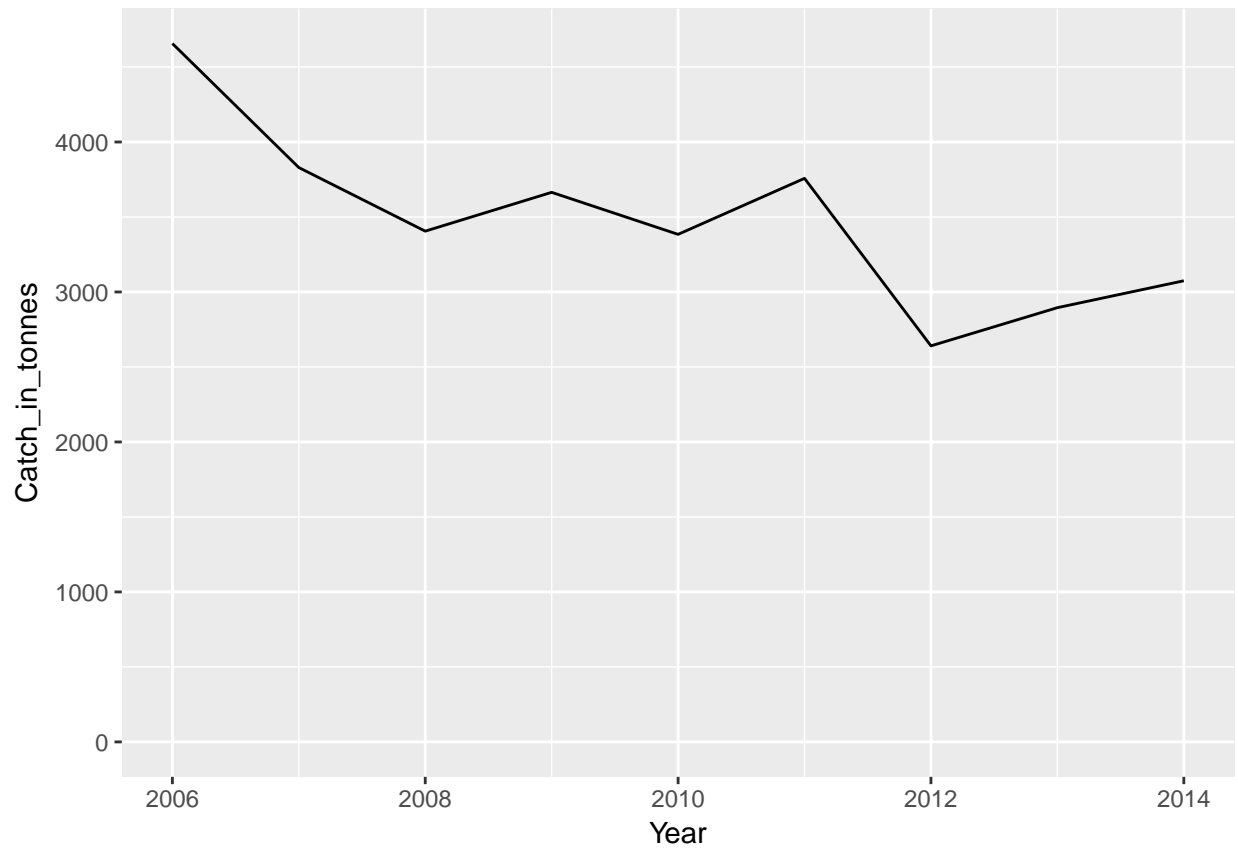
```
fbar(HKE)[] # Not filled in yet
```

```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## all NA    NA    NA    NA    NA    NA    NA    NA    NA
##
## units: f
```

```
#####
### Exploring data loaded ##
#####
```

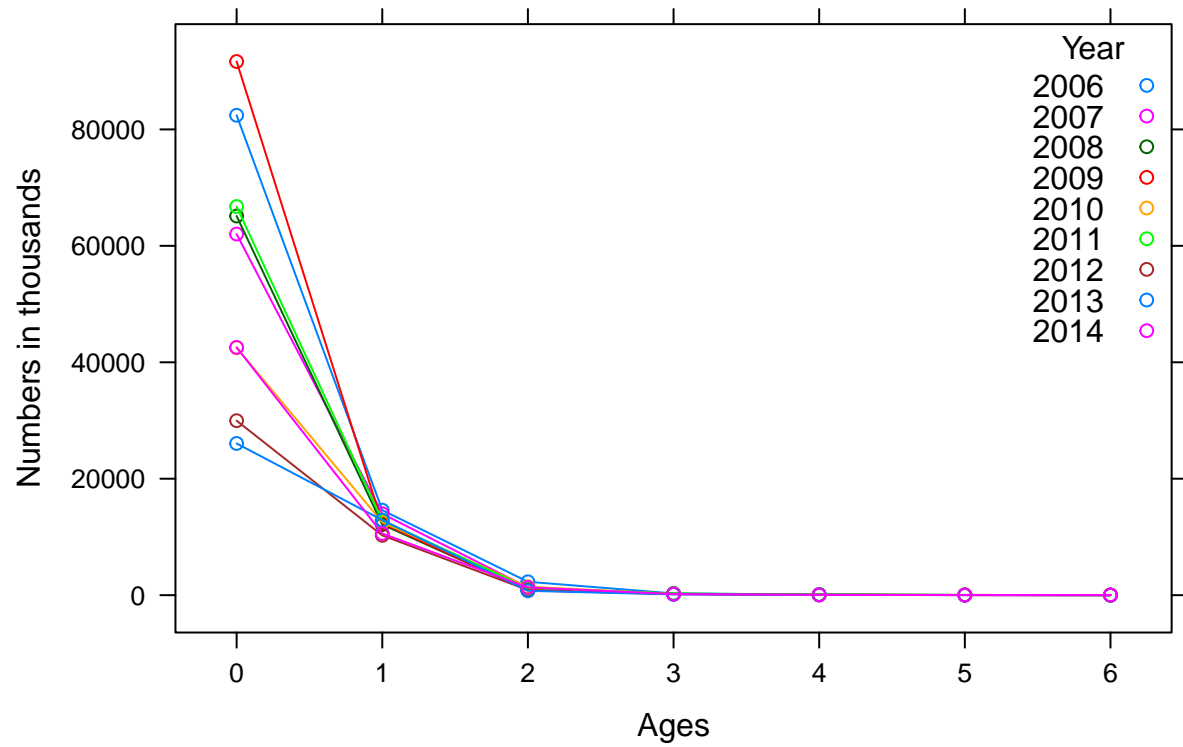
```
plot(catch(HKE),xlab="Year",ylab="Catch_in_tonnes")
```





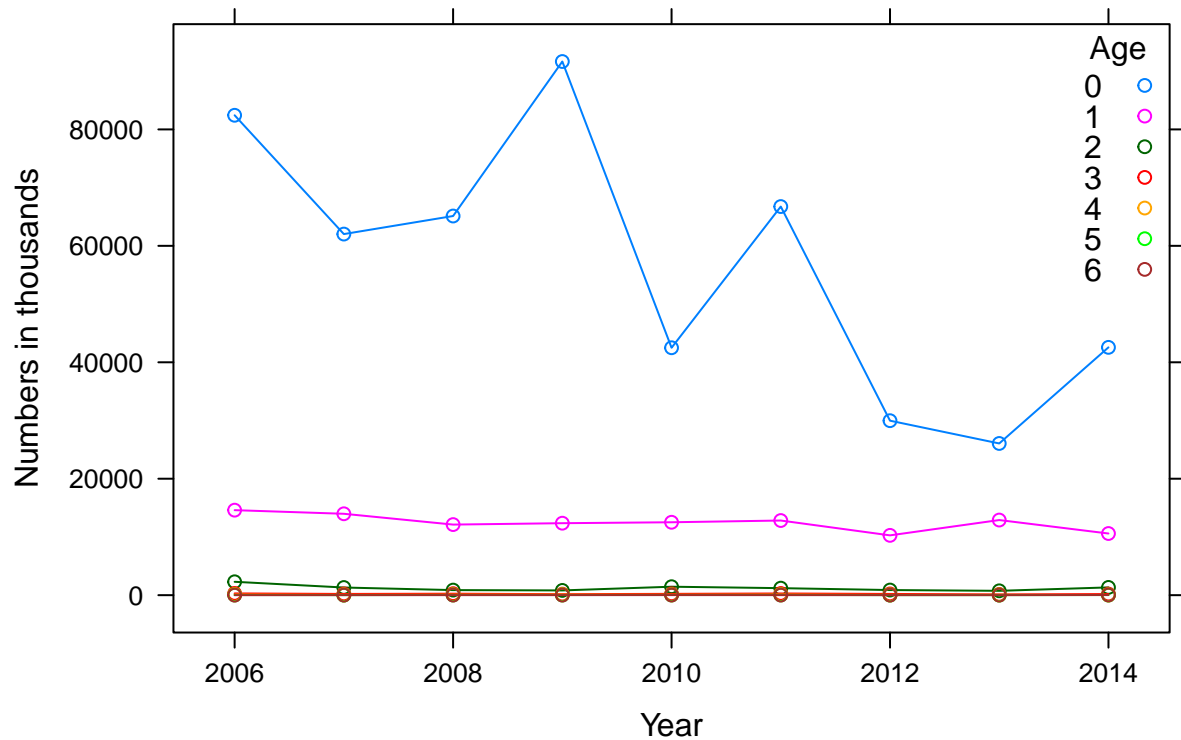
```
catture=as.data.frame(catch.n(HKE))
xyplot(data~age,type=c('l','p'),groups=year,data=catture, xlab="Ages",
       ylab="Numbers in thousands",main="Catches_HKE_GSA9-11",
       auto.key=list(corner=c(1,1), columns=1,
                     title="Year", cex.title=1))
```

## Catches\_HKE\_GSA9-11



```
xyplot(data~year,type=c('l','p'),groups=age,data=catture, xlab="Year",
       ylab="Numbers in thousands",main="Catches_HKE_GSA9-11",
       auto.key=list(corner=c(1,1), columns=1,
                     title="Age", cex.title=1))
```

## Catches\_HKE\_GSA9-11



```
# Set fbar in the stock
```

```
range(HKE)["minfbar"] <- 0
range(HKE)["maxfbar"] <- 3
```

```
# Set the plus group in the stock
```

```
HKE <- setPlusGroup(HKE, 6)
```

```
# Set the plus group in the index (if needed!)
```

```
# HKE.idx[[1]] <- FLIndex(index=setPlusGroup(index(HKE.idx[[1]]), 5))
```

```
# range(HKE.idx[[1]], c("startf", "endf")) <- c(0.66, 0.75)
```

```
#### Exploring survey index ####
```

```
str(HKE.idx)
```

```
## Formal class 'FLIndices' [package "FLCore"] with 4 slots
```

```
## ..@ .Data:List of 4
```

```
## .. ..$ :Formal class 'FLIndex' [package "FLCore"] with 12 slots
```

```
## .. .. ..@ type : chr "numbers"
```

```
## .. .. ..@ distribution: chr(0)
```

```
## .. .. ..@ index :Formal class 'FLQuant' [package "FLCore"] with 2 slots
```

```
## .. .. .. ..@ .Data: num [1:7, 1:9, 1, 1, 1, 1] 1250.42 99.67 2.32 0.49 0.01 ...
```

```
## .. .. .. ..- attr(*, "dimnames")=List of 6
```

```
## .. .. .. ..$ age : chr [1:7] "0" "1" "2" "3" ...
```

```
## .. .. .. ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
```

```

## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ index.var :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:7, 1:9, 1, 1, 1, 1] NA NA NA NA NA NA NA NA NA NA ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:7] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ catch.n :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:7, 1:9, 1, 1, 1, 1] 1250.42 99.67 2.32 0.49 0.01 ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:7] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ catch.wt :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:7, 1:9, 1, 1, 1, 1] NA NA NA NA NA NA NA NA NA NA ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:7] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ effort :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1, 1:9, 1, 1, 1, 1] 1 1 1 1 1 1 1 1 1
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr "all"
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ sel.pattern :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:7, 1:9, 1, 1, 1, 1] NA NA NA NA NA NA NA NA NA NA ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:7] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"

```

```

## ..@ units: chr "NA"
## ..@ index.q :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:7, 1:9, 1, 1, 1, 1] NA NA NA NA NA NA NA NA NA NA ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:7] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ name : chr "MEDITS_SA10"
## ..@ desc : chr "\"Tuning;\"\\thke\\tin\\tGSA\\t10\\t\\t . Imported from VPA file."
## ..@ range : Named num [1:7] 0 6 6 2006 2014 ...
## ..- attr(*, "names")= chr [1:7] "min" "max" "plusgroup" "minyear" ...
## ..$ :Formal class 'FLIndex' [package "FLCore"] with 12 slots
## ..@ type : chr "numbers"
## ..@ distribution: chr(0)
## ..@ index :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:5, 1:9, 1, 1, 1, 1] 0.01278 0.00574 0.00233 0.00058 0.0001 ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:5] "2" "3" "4" "5" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ index.var :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:5, 1:9, 1, 1, 1, 1] NA NA NA NA NA NA NA NA NA NA ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:5] "2" "3" "4" "5" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ catch.n :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:5, 1:9, 1, 1, 1, 1] 0.01278 0.00574 0.00233 0.00058 0.0001 ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:5] "2" "3" "4" "5" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ catch.wt :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:5, 1:9, 1, 1, 1, 1] NA NA NA NA NA NA NA NA NA NA ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:5] "2" "3" "4" "5" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"

```

```

## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ effort :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1, 1:9, 1, 1, 1, 1] 1 1 1 1 1 1 1
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr "all"
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ sel.pattern :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:5, 1:9, 1, 1, 1, 1] NA NA NA NA NA NA NA NA NA NA ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:5] "2" "3" "4" "5" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ index.q :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:5, 1:9, 1, 1, 1, 1] NA NA NA NA NA NA NA NA NA NA ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:5] "2" "3" "4" "5" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ name : chr "CPUE_LLS_SA10"
## ..@ desc : chr "\"Tuning;\"\\thke\\tin\\tGSA\\t10\\t\\t . Imported from VPA file."
## ..@ range : Named num [1:7] 2 6 6 2006 2014 ...
## ..- attr(*, "names")= chr [1:7] "min" "max" "plusgroup" "minyear" ...
## ..$ :Formal class 'FLIndex' [package "FLCore"] with 12 slots
## ..@ type : chr "numbers"
## ..@ distribution: chr(0)
## ..@ index :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:5, 1:9, 1, 1, 1, 1] 1686.571 58.583 2.502 0.26 0.182 ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:5] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ index.var :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:5, 1:9, 1, 1, 1, 1] NA NA NA NA NA NA NA NA NA NA ...
## ..- attr(*, "dimnames")=List of 6

```

```

## ..$ age : chr [1:5] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ catch.n :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:5, 1:9, 1, 1, 1, 1] 1686.571 58.583 2.502 0.26 0.182 ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:5] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ catch.wt :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:5, 1:9, 1, 1, 1, 1] NA NA NA NA NA NA NA NA NA NA ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:5] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ effort :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1, 1:9, 1, 1, 1, 1] 1 1 1 1 1 1 1 1 1
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr "all"
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ sel.pattern :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:5, 1:9, 1, 1, 1, 1] NA NA NA NA NA NA NA NA NA NA ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:5] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ index.q :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:5, 1:9, 1, 1, 1, 1] NA NA NA NA NA NA NA NA NA NA ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:5] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"

```

```

## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ name : chr "MEDITS_SA9"
## ..@ desc : chr "\"Tuning; HKE in GSA 9\"\\t\\t\\t\\t\\t\\t . Imported from VPA file."
## ..@ range : Named num [1:7] 0 4 4 2006 2014 ...
## ..- attr(*, "names")= chr [1:7] "min" "max" "plusgroup" "minyear" ...
## ..$ :Formal class 'FLIndex' [package "FLCore"] with 12 slots
## ..@ type : chr "numbers"
## ..@ distribution: chr(0)
## ..@ index :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:6, 1:9, 1, 1, 1, 1] 670.54 2937.1 318.85 9.71 8.32 ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:6] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ index.var :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:6, 1:9, 1, 1, 1, 1] NA NA NA NA NA NA NA NA NA NA ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:6] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ catch.n :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:6, 1:9, 1, 1, 1, 1] 670.54 2937.1 318.85 9.71 8.32 ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:6] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ catch.wt :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:6, 1:9, 1, 1, 1, 1] NA NA NA NA NA NA NA NA NA NA ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:6] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ effort :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1, 1:9, 1, 1, 1, 1] 1 1 1 1 1 1 1 1 1
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr "all"

```



```
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ sel.pattern :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:6, 1:9, 1, 1, 1, 1] NA NA NA NA NA NA NA NA NA NA ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:6] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ index.q :Formal class 'FLQuant' [package "FLCore"] with 2 slots
## ..@ .Data: num [1:6, 1:9, 1, 1, 1, 1] NA NA NA NA NA NA NA NA NA NA ...
## ..- attr(*, "dimnames")=List of 6
## ..$ age : chr [1:6] "0" "1" "2" "3" ...
## ..$ year : chr [1:9] "2006" "2007" "2008" "2009" ...
## ..$ unit : chr "unique"
## ..$ season: chr "all"
## ..$ area : chr "unique"
## ..$ iter : chr "1"
## ..@ units: chr "NA"
## ..@ name : chr "MEDITS_SA11"
## ..@ desc : chr "\"Tuning; HKE in GSA 11\\\"\\t\\t\\t\\t\\t\\t\\t . Imported from VPA file."
## ..@ range : Named num [1:7] 0 5 5 2006 2014 ...
## ..- attr(*, "names")= chr [1:7] "min" "max" "plusgroup" "minyear" ...
## ..@ names: chr [1:4] "Med_SA10" "LLS_SA10" "Med_SA9" "Med_SA11"
## ..@ desc : chr(0)
## ..@ lock : logi FALSE
```

```
index(HKE.idx[[1]])
```

```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006    2007    2008    2009    2010    2011    2012    2013
## 0 1250.42 1907.19 1544.78 1890.43 813.51 639.35 907.40 1252.29
## 1  99.67  51.52  92.69  78.11 131.46  67.18  56.44  67.21
## 2   2.32   0.95   2.97   0.38   1.46   2.45   2.37   4.37
## 3   0.49   0.97   1.52   0.32   0.30   1.20   0.29   0.29
## 4   0.01   0.14   0.01   0.01   0.17   0.01   0.01   0.01
## 5   0.01   0.14   0.01   0.32   0.15   0.01   0.16   0.22
## 6   0.01   0.01   0.40   0.01   0.24   0.01   0.01   0.01
##   year
## age 2014
## 0 610.50
## 1  64.50
## 2   4.00
## 3   0.20
## 4   0.30
```

```
## 5 0.01
## 6 0.01
##
## units: NA
```

```
index(HKE.idx[[2]])
```

```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006 2007 2008 2009 2010 2011 2012 2013
## 2 0.01278 0.00445 0.00380 0.01084 0.02713 0.00739 0.01070 0.02498
## 3 0.00574 0.01201 0.00268 0.00422 0.00311 0.00728 0.00800 0.01286
## 4 0.00233 0.00305 0.00165 0.00264 0.00095 0.00329 0.00123 0.00489
## 5 0.00058 0.00103 0.00087 0.00049 0.00127 0.00049 0.00043 0.00110
## 6 0.00010 0.00017 0.00024 0.00057 0.00081 0.00043 0.00011 0.00110
## year
## age 2014
## 2 0.00328
## 3 0.00711
## 4 0.00209
## 5 0.00182
## 6 0.00182
##
## units: NA
```

```
index(HKE.idx[[3]])
```

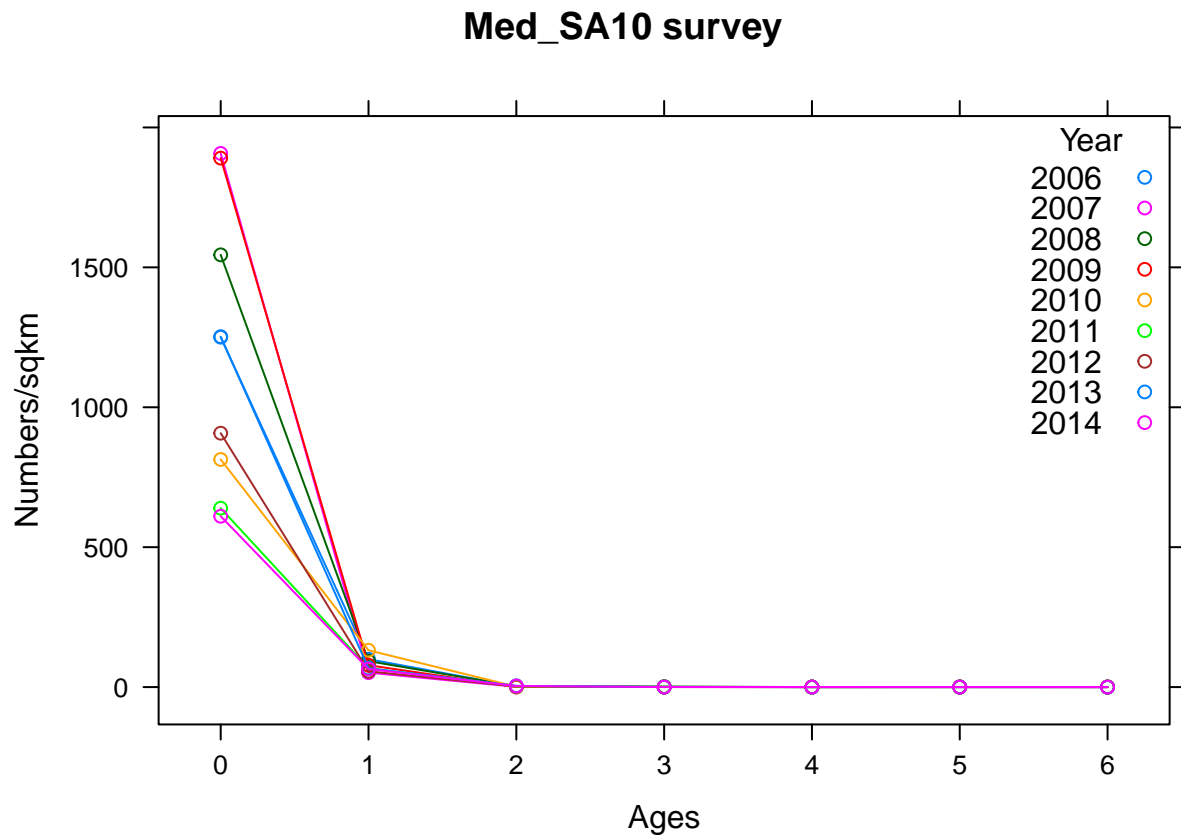
```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006 2007 2008 2009 2010 2011 2012
## 0 1686.571 2514.259 5871.627 6573.900 2469.127 769.899 1464.350
## 1 58.583 38.880 57.216 52.838 37.298 29.391 21.931
## 2 2.502 2.240 1.241 1.085 2.573 1.290 0.991
## 3 0.260 1.537 0.320 0.457 0.100 0.329 0.484
## 4 0.182 0.098 0.446 0.076 0.078 0.100 0.312
## year
## age 2013 2014
## 0 1743.236 1564.170
## 1 35.288 27.137
## 2 1.001 1.901
## 3 0.102 0.218
## 4 0.327 0.294
##
## units: NA
```

```
index(HKE.idx[[4]])
```

```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006 2007 2008 2009 2010 2011
```

```
## 0 670.54118 41.52112 15.62535 169.89754 425.29091 131.21140
## 1 2937.09865 894.58545 1789.55082 1096.90804 5498.63206 1448.02851
## 2 318.85030 52.05745 331.40367 41.01887 325.50351 108.27250
## 3 9.70508 9.41459 86.14269 2.35216 11.09259 10.65544
## 4 8.32349 1.20577 4.99132 1.03735 0.20931 2.58515
## 5 0.25517 0.58951 0.10542 0.10302 0.20931 0.10000
## year
## age 2012 2013 2014
## 0 177.07300 3.55349 33.66270
## 1 932.28655 1588.46822 531.75387
## 2 44.39525 125.83856 48.62221
## 3 2.41746 9.89288 4.95696
## 4 0.54934 0.92149 0.70563
## 5 0.32986 0.41369 0.22548
##
## units: NA
```

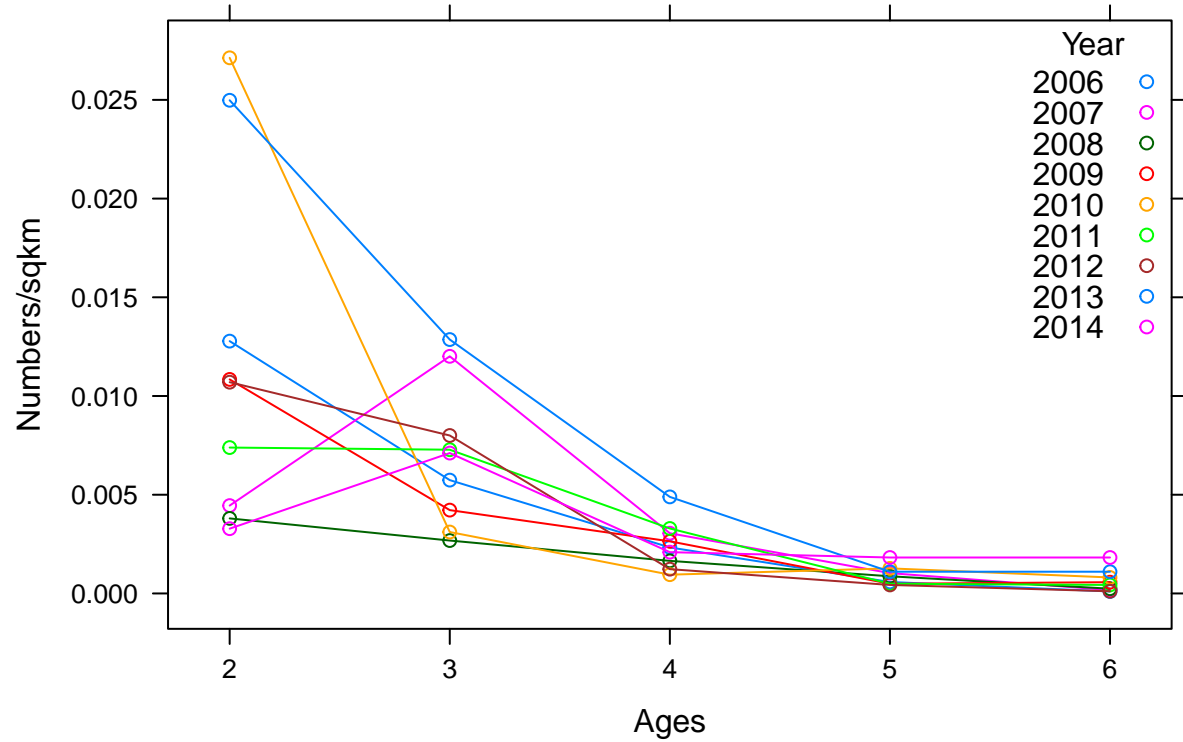
```
Med_SA10=as.data.frame(catch.n(HKE.idx[[1]]))
xyplot(data=age,type=c('l','p'),groups=year,data=Med_SA10, xlab="Ages",
       ylab="Numbers/sqkm",main="Med_SA10 survey",
       auto.key=list(corner=c(1,1), columns=1,
                     title="Year", cex.title=1))
```



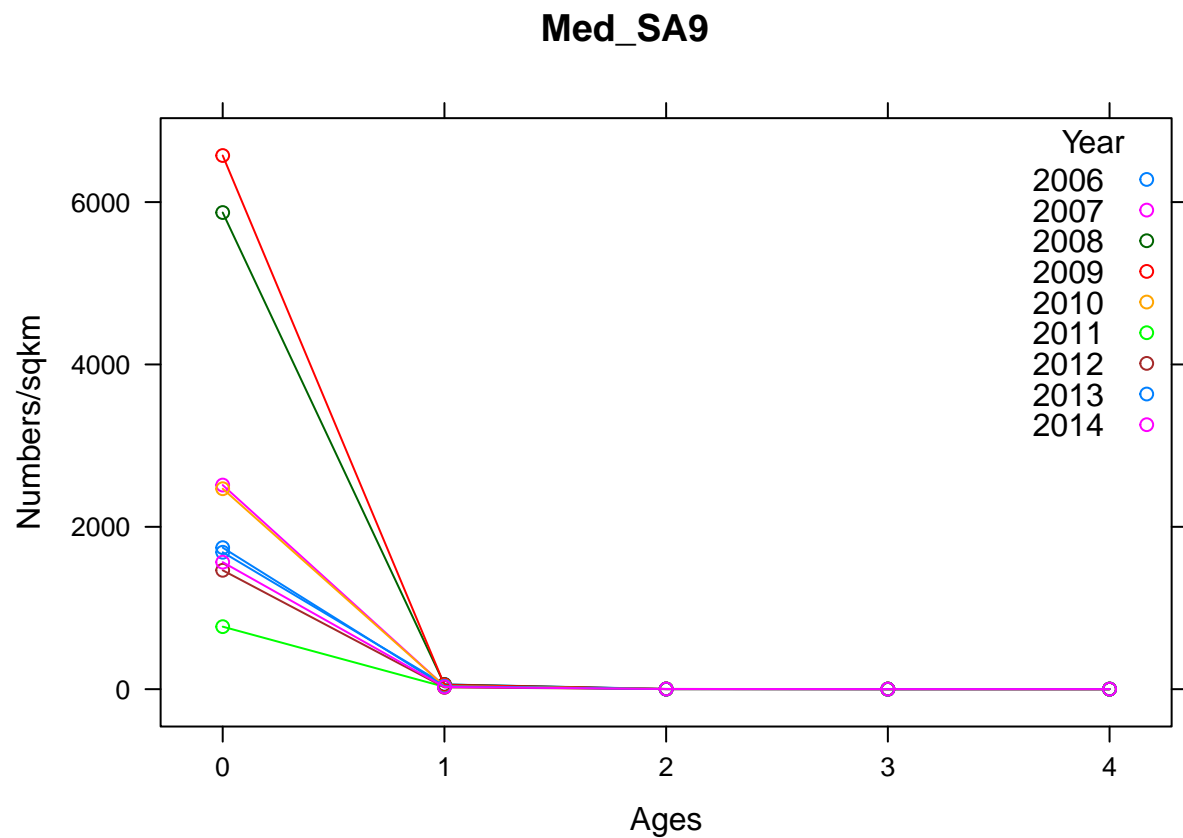
```
LLS_SA10=as.data.frame(catch.n(HKE.idx[[2]]))
xyplot(data=age,type=c('l','p'),groups=year,data=LLS_SA10, xlab="Ages",
       ylab="Numbers/sqkm",main="LLS_SA10",
       auto.key=list(corner=c(1,1), columns=1,
```

```
title="Year", cex.title=1))
```

## LLS\_SA10

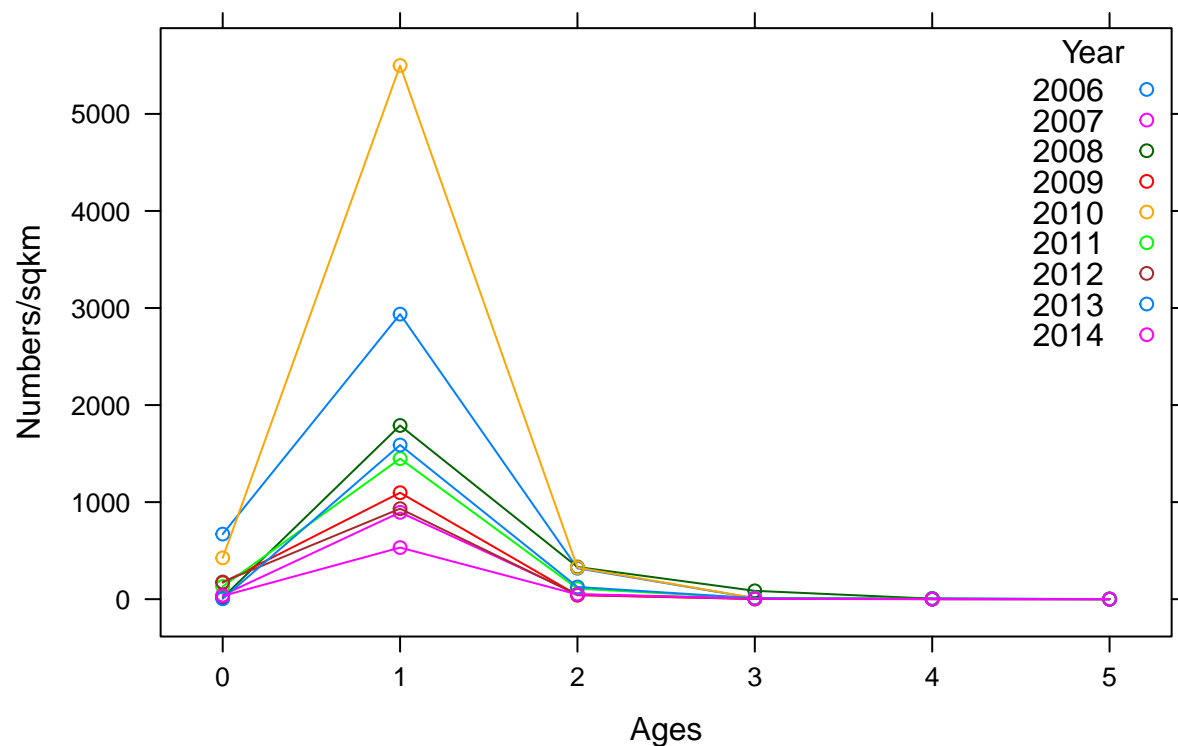


```
Med_SA9=as.data.frame(catch.n(HKE.idx[[3]]))
xyplot(data~age,type=c('l','p'),groups=year,data=Med_SA9, xlab="Ages",
       ylab="Numbers/sqkm",main="Med_SA9",
       auto.key=list(corner=c(1,1), columns=1,
                     title="Year", cex.title=1))
```



```
Med_SA11=as.data.frame(catch.n(HKE.idx[[4]]))
xyplot(data~age,type=c('l','p'),groups=year,data=Med_SA11, xlab="Ages",
       ylab="Numbers/sqkm",main="Med_SA11",
       auto.key=list(corner=c(1,1), columns=1,
                     title="Year", cex.title=1))
```

## Med\_SA11

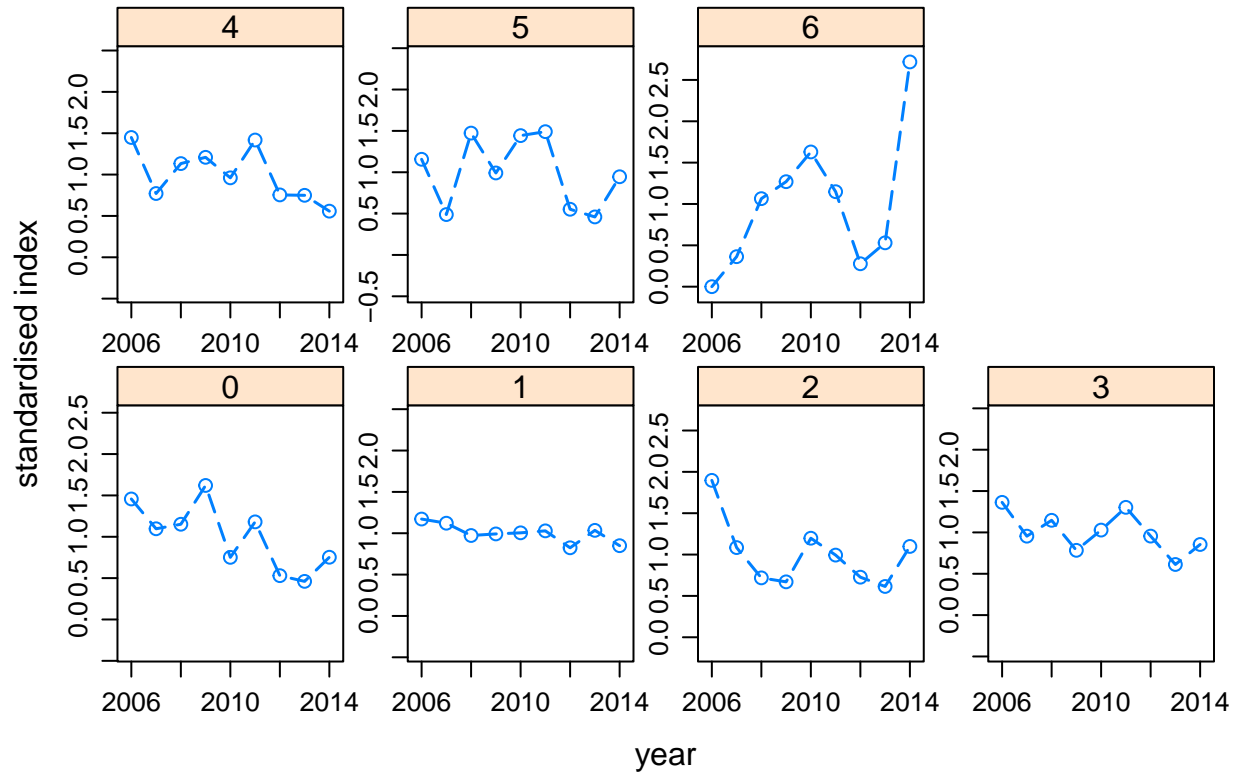


```
#####
### Cohorts consistence ###
#####

my.stock <- HKE
catchn.fli <- FLIndex(FLQuant(NA, dimnames=list(year = dimnames(catch.n(HKE))$year,
                                                age = dimnames(catch.n(HKE))$age)))

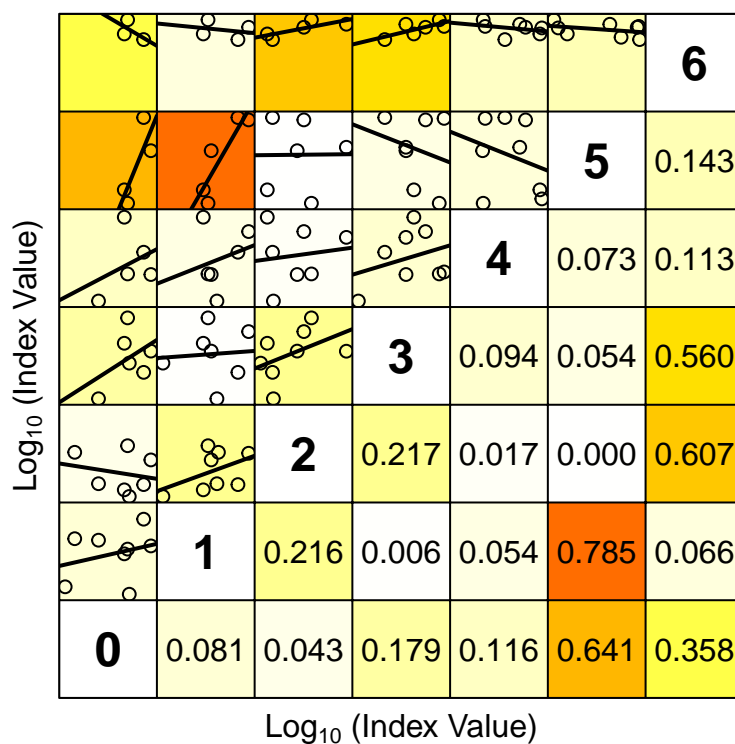
index(catchn.fli) <- catch.n(my.stock)
plot(catchn.fli, type="ts", main="abundance in the catch by age")
```

## abundance in the catch by age



```
plot(catchn.fli, type="internal", main="Cohorts consistence in the catch")
```

## Cohorts consistence in the catch



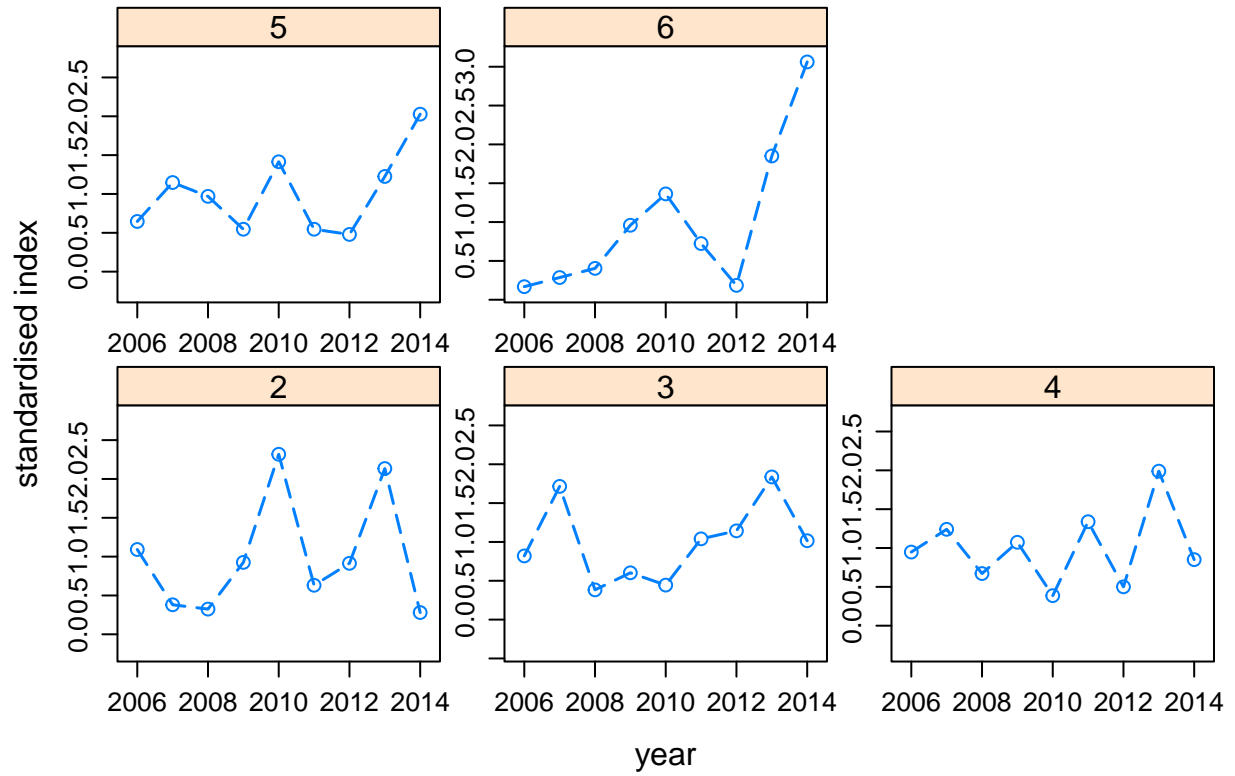
Lower right panels show the Coefficient of Determination ( $r^2$ )

```
# plot(HKE.idx[[1]], type="ts",main="abundance in the MDTS GSA10 survey by age")
# plot(HKE.idx[[1]], type="internal",main="Cohorts consistence in the MDTS10 survey")
#survey #1 MEDITS 10
```

```
#if you have more than one index
plot(HKE.idx[[2]], type="ts",main="abundance in the LLS GSA10 survey by age")
```

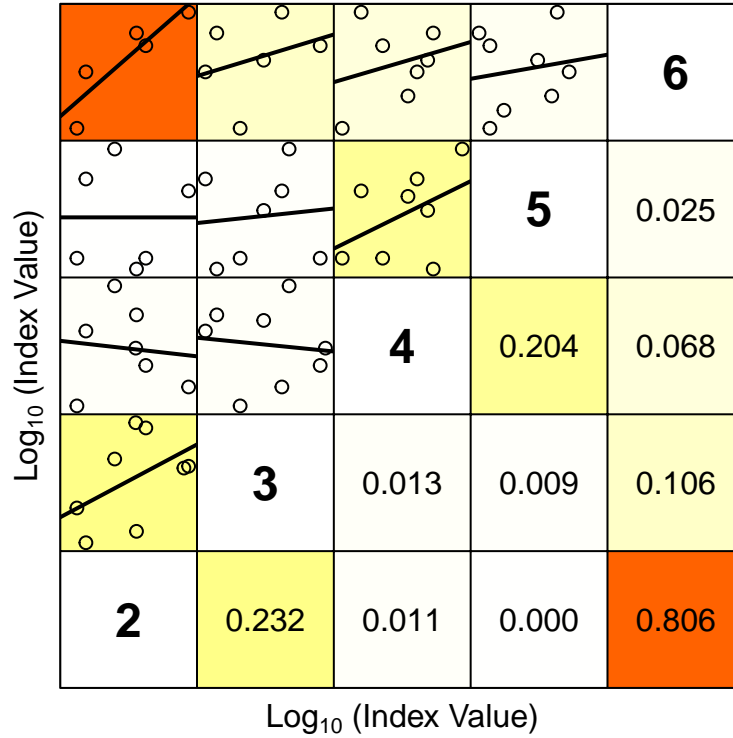


## abundance in the LLS GSA10 survey by age



```
plot(HKE.idx[[2]], type="internal", main="Cohorts consistence in the LLS10 cpue")
```

## Cohorts consistence in the LLS10 cpue



Lower right panels show the Coefficient of Determination ( $r^2$ )

```
#cpue #2 LLS 10
```

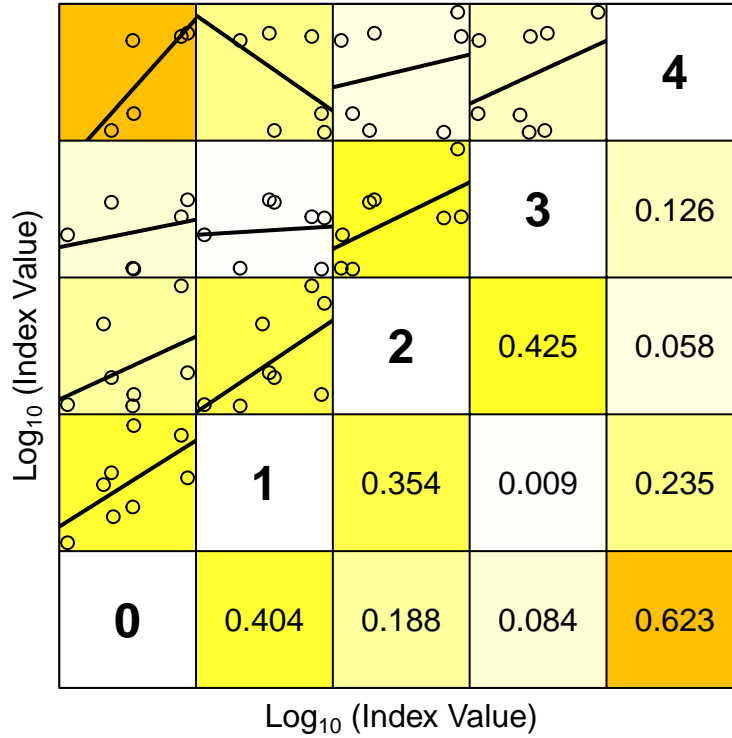
```
plot(HKE.idx[[3]], type="ts", main="abundance in the MDTs GSA9 survey by age")
```

### abundance in the MDTs GSA9 survey by age



```
plot(HKE.idx[[3]], type="internal",main="Cohorts consistence in the MDTs9 survey")
```

## Cohorts consistence in the MDTs9 survey

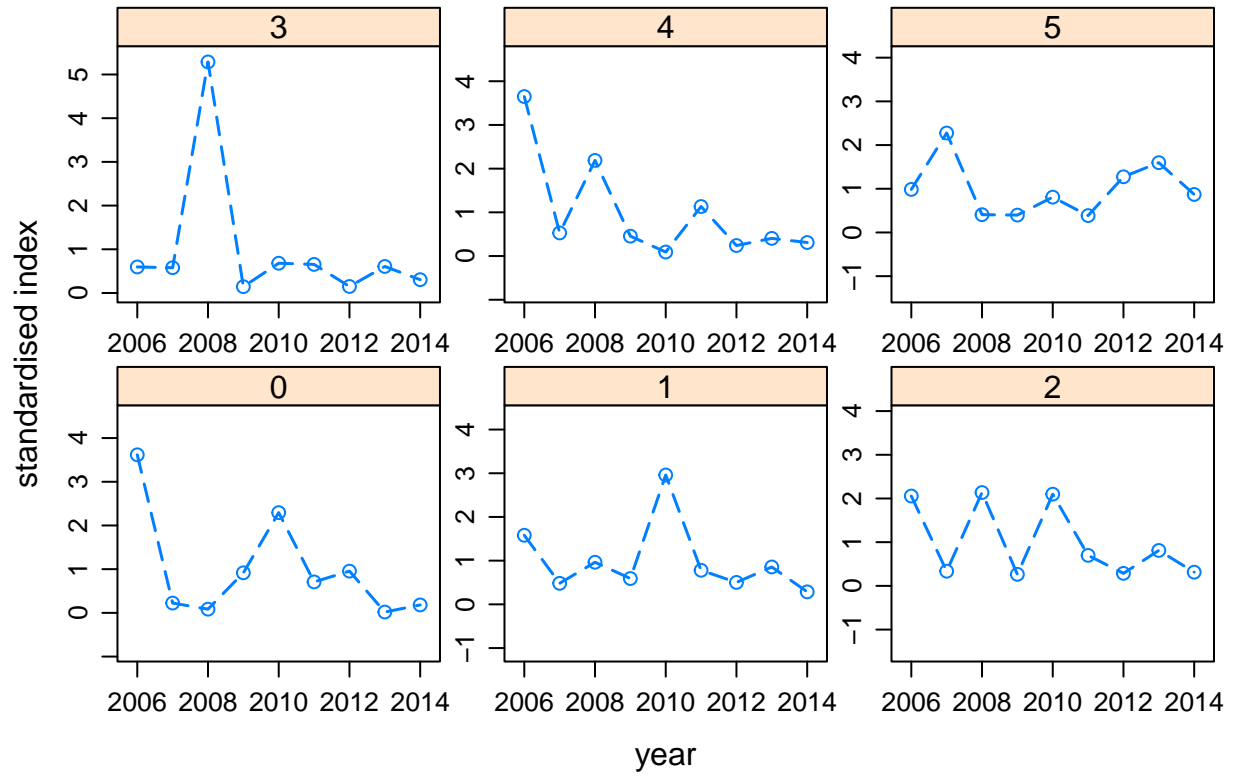


Lower right panels show the Coefficient of Determination ( $r^2$ )

```
#survey #3 MEDITS 9
```

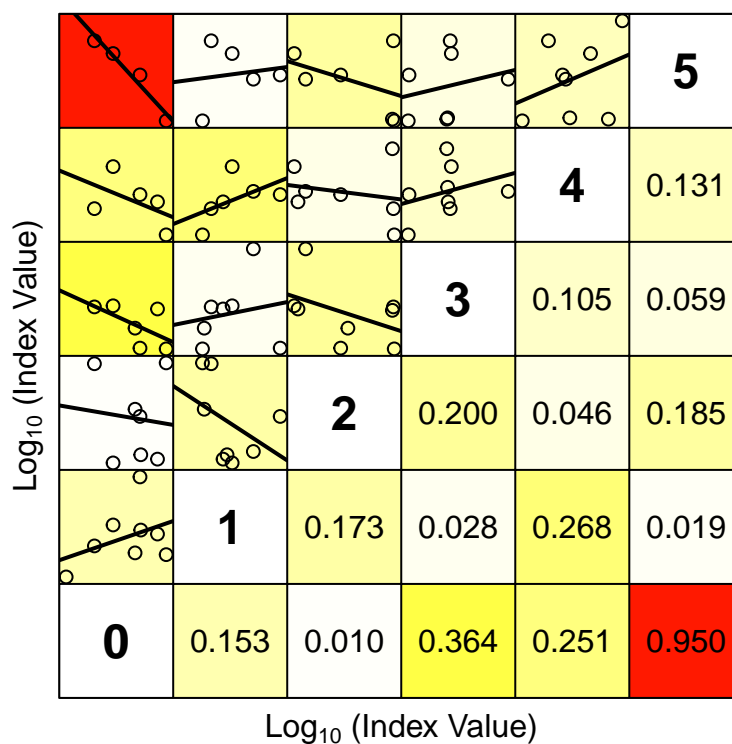
```
plot(HKE.idx[[4]], type="ts", main="abundance in the MDTs GSA11 survey by age")
```

### abundance in the MDTs GSA11 survey by age



```
plot(HKE.idx[[4]], type="internal", main="Cohorts consistence in the MDTs11 survey")
```

## Cohorts consistence in the MDTs11 survey



Lower right panels show the Coefficient of Determination ( $r^2$ )

*#survey #3 MEDITS 11*

```
#####
##### VPA #####
#####
```

```
#####
#### Setting F in terminal age and year####
#####
```

```
# The VPA method estimates population numbers and fishing mortalities
# at age by back-calculating values down each cohort. To do this, the
# method requires initial values of harvest for the terminal age and
# terminal year in the FLStock object. These terminal values must be
# specified by the user prior to running the VPA.
# We can use this information to manually specify the terminal values
# in the harvest slot. In this instance we will set these values to 0.5
```

```
#### AGE ####
harvest(HKE)[ac(range(HKE)[ "max" ])]
```

```
## An object of class "FLQuant"
```

```

## , , unit = unique, season = all, area = unique
##
##   year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
##    6 NA    NA    NA    NA    NA    NA    NA    NA    NA
##
## units:  f
harvest(HKE)[ac(range(HKE)["max"]), ] <- 0.5
harvest(HKE)[ac(range(HKE)["max"])]

## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
##    6 0.5  0.5  0.5  0.5  0.5  0.5  0.5  0.5  0.5
##
## units:  f
#### YEAR ####
harvest(HKE)[, ac(range(HKE)["maxyear"])]

## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2014
##    0 NA
##    1 NA
##    2 NA
##    3 NA
##    4 NA
##    5 NA
##    6 0.5
##
## units:  f
harvest(HKE)[, ac(range(HKE)["maxyear"])] <- 0.5
harvest(HKE)[, ac(range(HKE)["maxyear"])]

## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2014
##    0 0.5
##    1 0.5
##    2 0.5
##    3 0.5
##    4 0.5
##    5 0.5
##    6 0.5
##
## units:  f

```

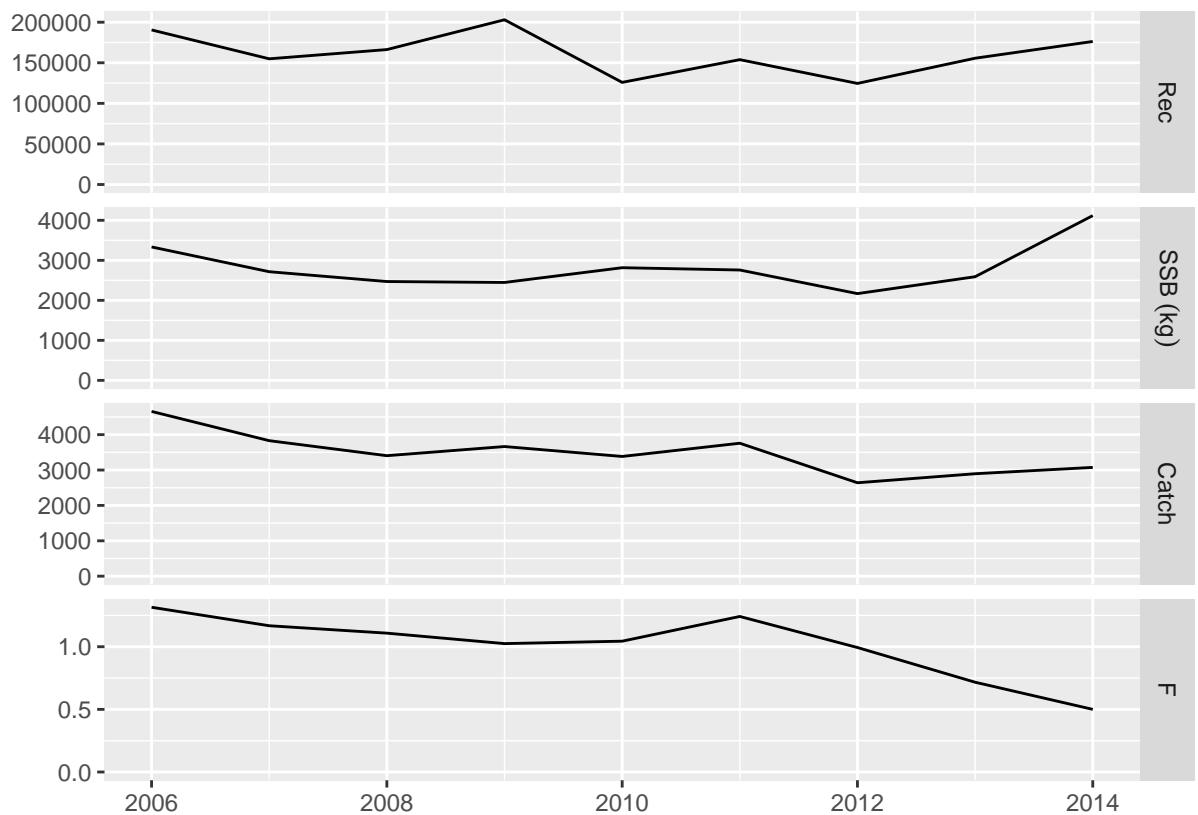
```
#####
#### Run VPA ####
#####

HKE.vpa <- VPA(HKE, fratio = 1, fit.plusgroup = T)

# fratio: A numeric value giving the ratio of the fishing mortality in the
# oldest to that of the next oldest age.
# An F ratio can only be specified when fit.plusgroup is TRUE. Default value is "missing".
# fit.plusgroup: A boolean value specifying whether, or not, the oldest age represents
# a plusgroup. The default value is TRUE.

#### Adding results to the stock object ####
HKE.new <- HKE + HKE.vpa

#### Plot main results ####
plot(HKE.new)
```



```
## Have a look in stock number and harvest##
harvest(HKE.new) # Fishing mortality by age

## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006  2007  2008  2009  2010  2011  2012  2013
```



```
## 0 1.09051 0.97614 0.94496 1.17815 0.76205 1.10409 0.49528 0.32362
## 1 1.65124 1.89788 1.73736 1.45930 1.61477 1.89711 1.62183 1.16767
## 2 1.55402 1.05871 0.96866 0.79719 1.09255 1.08813 1.13116 0.71551
## 3 0.96429 0.73753 0.78216 0.66533 0.70766 0.87720 0.72591 0.66029
## 4 1.37279 0.55844 0.89834 0.85579 0.76280 1.04704 0.47353 0.48958
## 5 1.60846 0.69485 1.18323 0.99464 1.54685 1.93484 0.44805 0.20507
## 6 1.60846 0.69485 1.18323 0.99464 1.54685 1.93484 0.44805 0.20507
## year
## age 2014
## 0 0.50000
## 1 0.50000
## 2 0.50000
## 3 0.50000
## 4 0.50000
## 5 0.50000
## 6 0.50000
##
## units: f
```

```
HKE.new@harvest[c("5", "6")]
```

```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006 2007 2008 2009 2010 2011 2012 2013
## 5 1.60846 0.69485 1.18323 0.99464 1.54685 1.93484 0.44805 0.20507
## 6 1.60846 0.69485 1.18323 0.99464 1.54685 1.93484 0.44805 0.20507
## year
## age 2014
## 5 0.50000
## 6 0.50000
##
## units: f
```

```
z(HKE.new)["0", "2006"] # Total mortality estimates
```

```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006
## 0 2.2565
##
## units: NC
```

```
stock.n(HKE.new) # Stock number by age
```

```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006 2007 2008 2009 2010 2011
## 0 1.9050e+05 1.5490e+05 1.6627e+05 2.0301e+05 1.2586e+05 1.5387e+05
## 1 2.2056e+04 1.9949e+04 1.7943e+04 1.9870e+04 1.9091e+04 1.8283e+04
## 2 3.4078e+03 2.3853e+03 1.6661e+03 1.7663e+03 2.5804e+03 2.1476e+03
```

```

## 3 5.6067e+02 4.6695e+02 5.3888e+02 4.1311e+02 5.1946e+02 5.6687e+02
## 4 1.5622e+02 1.4776e+02 1.5566e+02 1.7158e+02 1.4738e+02 1.7701e+02
## 5 4.1319e+01 2.8436e+01 6.1055e+01 4.5579e+01 5.2274e+01 4.9183e+01
## 6 1.3946e-03 5.9990e+00 1.2556e+01 1.6574e+01 1.6803e+01 1.0819e+01
##   year
## age 2012      2013      2014
## 0 1.2456e+05 1.5562e+05 1.7626e+05
## 1 1.5636e+04 2.3407e+04 3.4624e+04
## 2 1.5333e+03 1.7437e+03 4.0635e+03
## 3 4.7250e+02 3.2435e+02 5.5742e+02
## 4 1.6456e+02 1.5942e+02 1.1654e+02
## 5 4.4823e+01 7.3806e+01 7.0155e+01
## 6 6.3898e+00 2.3988e+01 5.7539e+01
##
## units: NA
#####
#### Checking the nb of surviving from age t to age t+1 ####
#####

# The numbers surviving from age(a) to age(a+1) are found by multiplying by
# the exponential of the total mortality for that age: Nb_survivors=N(a+1)=N(a)*exp-Z(a)

as.numeric(HKE.new@stock.n["0","2006"])*exp(-(as.numeric(z(HKE.new)["0","2006"])))

## [1] 19948.76

stock.n(HKE.new)["1","2007"]

## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2007
## 1 19949
##
## units: NA

as.numeric(HKE.new@stock.n["2","2008"])*exp(-(as.numeric(z(HKE.new)["2","2008"])))

## [1] 413.1051

stock.n(HKE.new)["3","2009"]

## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2009
## 3 413.11
##
## units: NA

as.numeric(HKE.new@stock.n["5","2008"])*exp(-(as.numeric(z(HKE.new)["5","2008"])))

## [1] 13.71158

```

```
stock.n(HKE.new)["6","2009"]# plugroup effects (sum of Nb belonging to different ages)
```

```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2009
##    6 16.574
##
## units:  NA
```

```
## Have a look in stock number and fishing mortality in a time range e.g. 2010:2014 ##
stock.n(HKE.new)[, ac(2010:range(HKE)["maxyear"])]
```

```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2010      2011      2012      2013      2014
##    0 1.2586e+05 1.5387e+05 1.2456e+05 1.5562e+05 1.7626e+05
##    1 1.9091e+04 1.8283e+04 1.5636e+04 2.3407e+04 3.4624e+04
##    2 2.5804e+03 2.1476e+03 1.5333e+03 1.7437e+03 4.0635e+03
##    3 5.1946e+02 5.6687e+02 4.7250e+02 3.2435e+02 5.5742e+02
##    4 1.4738e+02 1.7701e+02 1.6456e+02 1.5942e+02 1.1654e+02
##    5 5.2274e+01 4.9183e+01 4.4823e+01 7.3806e+01 7.0155e+01
##    6 1.6803e+01 1.0819e+01 6.3898e+00 2.3988e+01 5.7539e+01
##
## units:  NA
```

```
harvest(HKE.new)[, ac(2010:range(HKE)["maxyear"])]
```

```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2010      2011      2012      2013      2014
##    0 0.76205 1.10409 0.49528 0.32362 0.50000
##    1 1.61477 1.89711 1.62183 1.16767 0.50000
##    2 1.09255 1.08813 1.13116 0.71551 0.50000
##    3 0.70766 0.87720 0.72591 0.66029 0.50000
##    4 0.76280 1.04704 0.47353 0.48958 0.50000
##    5 1.54685 1.93484 0.44805 0.20507 0.50000
##    6 1.54685 1.93484 0.44805 0.20507 0.50000
##
## units:  f
```

```
#####
##### EXERCISE 1 #####
#### Run VPA with different Fterminal and compare results ####
#####

#####
##### Exercise 2 #####
#### Run VPA with different fratio and compare results ####
#####
```

```

#####
#### Tuning VPA ####
#####

# As noted above the VPA method requires user defined terminal estimates
# of fishing mortality. This dependency limits the usefulness of
# the method since it is often the most recent, terminal, estimates that
# are of most concern to fishery managers.

# Additional catch at age and effort information, derived either from a sub component
# of the fishery or from a fishery independent source such as a research survey,
# can be used to 'tune' the assessment, as described above, and thereby
# obtain better estimates of fishing mortality and stock numbers in
# the most recent years. Several so-called ad hoc techniques for tuning
# a VPA have been developed. Extended Survival Analysis (XSA) is one of the most common.

#####
#### FLXSA ####
#####

# XSA is a more sophisticated method that uses information on individual
# cohort sizes to estimate survivors at each age in the terminal population.
# Although the modelling approach is more involved the method
# requires the same input of catch numbers at age and indices of catch
# per unit effort and it retains at its core the basic VPA method. The
# details of the XSA method are too complex to show here, or to code
# individually as we have for the Laurec-Shepherd approach. Instead
# the FLXSA method has been developed as an additional package to
# FLAssess.

# FLXSA(stock, indices, control, desc, diag.flag=TRUE)

# stock= An object of class FLStock.

# indices= An object of class FLIndices that contains one or more indices of catch at age
# and effort.

# control= An object of class FLXSA.control that specifies the model parameters.

# desc= An optional character string holding a short description of the data and model

# diag.flag= Boolean. If true the method will return the full diagnostics for the analysis. If
# false, only the estimated stock numbers and harvest values will be returned.
# Defalut setting is True.

#####
#### The FLXSA control object ####
#####

# The FLXSA.control object contains all of the user defined model
# settings for running an XSA analysis. It can be created in several

```

```
# different ways.
# The simplest method is to accept all of the default settings by calling the FLXSA.control function
# without any extra arguments:
```

```
FLXSA.control()
```

```
## tol      1e-09
## maxit     30
## min.nse   0.3
## fse       0.5
## rage      0
## qage      10
## shk.n     TRUE
## shk.f     TRUE
## shk.yrs   5
## shk.ages  5
## window    100
## tsrange   20
## tspower   3
## vpa       FALSE
```

```
FLXSA.control(x=NULL, tol=1e-09, maxit=30, min.nse=0.3, fse=0.5,
              # rage=0, qage=10, shk.n=TRUE, shk.f=TRUE, shk.yrs=5, shk.ages=5,
              # window=100, tsrange=20, tspower=3, vpa=FALSE)
```

```
# x= An object of class FLXSA. If specified the control object
# is initialised with the same settings as the XSA analysis stored in the object.
```

```
# tol= The convergence tolerance. The model is considered to have converged once the
# sum of the absolute differences in terminal F values between two successive
# iterations is less than the specified value.
```

```
# maxit= The maximum number of iterations that the model can run
```

```
# min.nse= The minimum standard error to be used for inverse variance weighting of the
# survivors estimates.
```

```
#
```

```
# fse= User defined standard error when shrinking the mean F
```

```
#
```

```
# rage= The oldest age for which the two parameter model is used for determining
# catchability at age
```

```
#
```

```
# qage= The age after which catchability is no longer estimated. Catchability at older
# ages will be set to the value of catchability at this age.
```

```
#
```

```
# shk.n Boolean. If TRUE apply shrinkage to the population mean. Applies to the
# recruiting ages only.
```

```
#
```

```
# shk.f= Boolean. If TRUE apply shrinkage to the mean F.
```

```
#
```

```
# shk.yrs= The number of years to be used for shrinkage to the mean F.
```

```
#
```

```
# shk.ages= The ages over which shrinkage to the mean F should be applied.
```

```
#
```

```

# window= The specific year range for which the model should be run.
#
# tsrange= The number of years to be used in the time series weighting.
#
# tspower= The power to be used in the time series taper weighting.
#
# vpa= Boolean. If TRUE, use VPA to calculate historical values of F and population
# abundance. If FALSE, use cohort approximation.

```

```

# Alternatively the default settings can be over-written by specifying
# values at the point of creation or by overwriting them afterwards.

```

```

FLXSA.control <- FLXSA.control(maxit = 50, qage = 8)
FLXSA.control=FLXSA.control()
slot(FLXSA.control, "qage") <- as.integer(8)
slot(FLXSA.control, "maxit") <- as.integer(50)
FLXSA.control

```

```

## tol      1e-09
## maxit    50
## min.nse  0.3
## fse      0.5
## rage     0
## qage     8
## shk.n    TRUE
## shk.f    TRUE
## shk.yrs  5
## shk.ages 5
## window   100
## tsrange  20
## tspower  3
## vpa      FALSE

```

```

#####
##### FLXSA Control used as best run in the HKE_9-11 official assessment EWG15-11 #####
#####

```

```

# FLXSA.control(x=NULL, tol=1e-09, maxit=30, min.nse=0.3, fse=2,
#               rage=0, qage=5, shk.n=TRUE, shk.f=TRUE, shk.yrs=3, shk.ages=2,
#               window=100, tsrange=20, tspower=3, vpa=FALSE)

```

```

FLXSA.control=FLXSA.control()
FLXSA.control

```

```

## tol      1e-09
## maxit    30
## min.nse  0.3
## fse      0.5
## rage     0
## qage     10
## shk.n    TRUE
## shk.f    TRUE
## shk.yrs  5

```

```
## shk.ages          5
## window            100
## tsrange           20
## tspower            3
## vpa                FALSE

slot(FLXSA.control, "rage") <- as.integer(0)
slot(FLXSA.control, "qage") <- as.integer(5)
slot(FLXSA.control, "shk.ages") <- as.integer(2)
slot(FLXSA.control, "shk.yrs") <- as.integer(3)
slot(FLXSA.control, "fse") <- 2
slot(FLXSA.control, "maxit") <- as.integer(30)
FLXSA.control
```

```
## tol              1e-09
## maxit             30
## min.nse           0.3
## fse               2
## rage              0
## qage              5
## shk.n             TRUE
## shk.f             TRUE
## shk.yrs           3
## shk.ages          2
## window            100
## tsrange           20
## tspower            3
## vpa                FALSE
```

*# This is because the default type numeric cannot be used in this slot. Such  
# coercion is not necessary when using the FLXSA.control() function as this check is performed  
# internally by the function.*

*# Once the control object has been created, the XSA analysis can be run as a  
# simple one-line command. The FLXSA function returns an object of class FLXSA  
# which extends the FLAssess class. The FLXSA object  
# contains all of the information in the FLAssess class plus additional information  
# specific to the XSA assessment method, such as the survivors estimates and their internal  
# and external standard errors. The control object used for the assessment is also  
# stored in the returned FLXSA object to provide a record of  
# what settings were used for that particular run. All of the settings in the  
# returned control object will remain the same except for the maxit slot that  
# contains the maximum number of iterations for the analysis.  
# This value will be overwritten with the actual number of iterations taken to reach  
# convergence, if indeed the model had converged before the maximum number initially specified.*

```
#####
##### Run XSA #####
#####
```

```
#### TUNING using all indices ####
HKE.xsa <- FLXSA(HKE, HKE.idx, FLXSA.control)
HKE.new_xsa <- HKE + HKE.xsa
```

```
#### TUNING by index only for comparison ####
"MDTS_GSA10"
```

```
## [1] "MDTS_GSA10"
```

```
HKE.xsa.t1 <- FLXSA(HKE, HKE.idx[[1]],
                    FLXSA.control)
HKE.xsa_idx1 <- HKE + HKE.xsa.t1
```

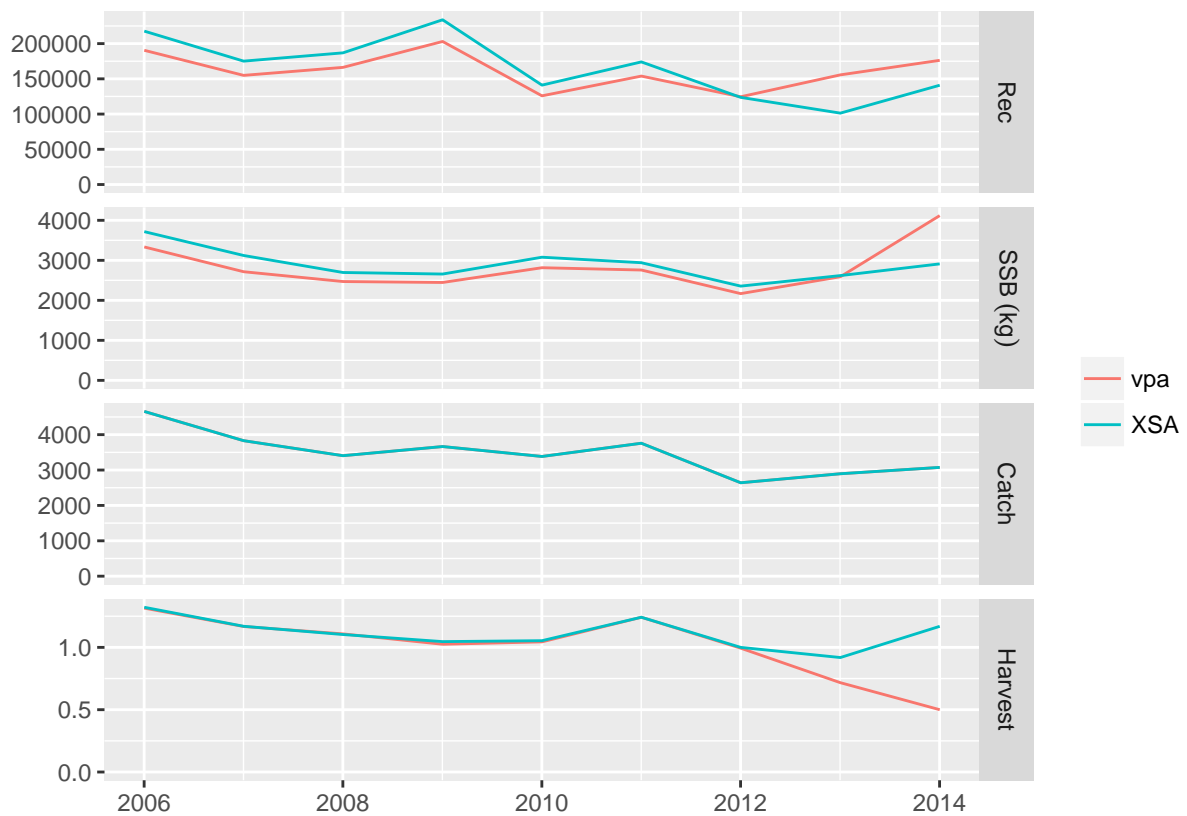
```
"LLS_GSA10"
```

```
## [1] "LLS_GSA10"
```

```
HKE.xsa.t2 <- FLXSA(HKE, HKE.idx[[2]],
                    FLXSA.control)
HKE.xsa_idx2 <- HKE + HKE.xsa.t2
```

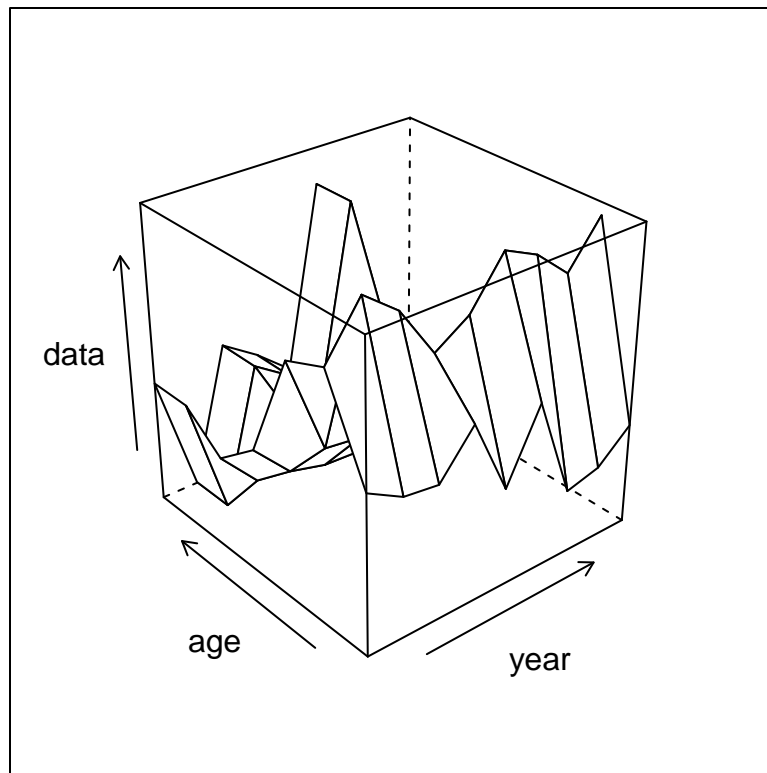
```
#### Plotting main results ####
```

```
plot(FLStocks(vpa=HKE.new, XSA = HKE.new_xsa))
```

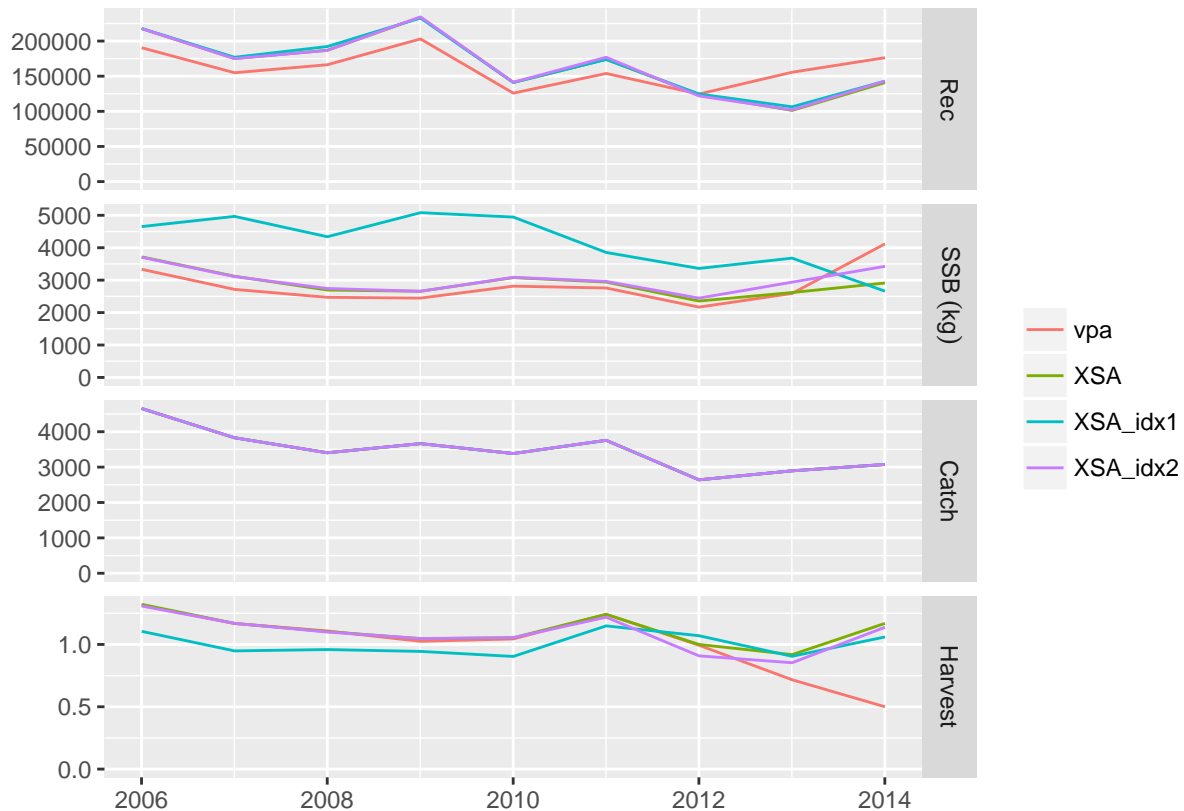


```
wireframe(data~year+age, data=harvest(HKE.new_xsa))
```





```
#### Plotting main results adding the two run with using only one index ####  
plot(FLStocks(vpa=HKE.new,XSA = HKE.new_xsa,XSA_idx1 = HKE.xsa_idx1,XSA_idx2 = HKE.xsa_idx2))
```



```
# Appart from the model diagnostics, the FLXSA method returns two important results,
# namely the estimated values of fishing mortality and population numbers at age.
# These are returned as FLQuants and are stored in the harvest and stock.n slots,
# respectively, of the FLXSA object. These estimated values can be
# very easily read back into an FLStock object using the + operator.
# Once the results have been read back into a FLStock object we can look at some of the key
# information such as SSB, recruitment and mean fishing mortality values.
# But before concentrating too much on the results of the assessment
# it is advisable to first investigate some of the model diagnostics.
```

```
#####
#### Diagnostics ####
#####
```

```
# There are many diagnostic checks that one might be interested in conducting to examine
# the model fit. The first might be to see if the model has reached convergence within
# the specified number of iterations.
```

```
slot(slot(HKE.xsa, "control"), "maxit")
```

```
## [1] 30
```

```
# Additionally one can check for discrepancies between the internal and
# external standard errors of the survivors estimates
# Very often plots of the catchability residuals are made to inspect for any obvious trends
# or departures from the assumption of constant catchability over time.
```

```

# There are several ways to access diagnostic information about your fitted XSA model.
# The easiest is perhaps to use the diagnostics function, which will replicate the
# diagnostic output produced by the original VPA suite (developed in the early 1990's).
# Note that this function merely outputs the results to the screen
# and no object is created by the method. The function was created to allow the user to cut
# and paste the information from the console to a report.
# The output can be quite long, particularly if the assessment
# comprises a large number of ages and many tuning indices.
# The standard output can be divided roughly into
# eight sections each providing different information about the model and the fit.
# These sections comprise the model dimensions; parameter settings
# regression weights; the estimated fishing mortalities and population
# numbers for the last 10 years; the aggregated survivors estimates;
# the log catchability residuals for each of the tuning indices and finally
# the individual survivors estimates for each year-class represented in the terminal year.
# In order to make this document more readable we will print out only a few sections of
# the diagnostic output at a time (this feature is not yet distributed with FLXSA).
# We can do this by passing a vector of TRUE and FALSE values to the sections argument of
# the diagnostics method. By default all sections are set to
# TRUE so that all of the information is output to the screen.
# In order to reduce the quantity of output further
# we will run a new XSA for a reduced number of ages and with only one tuning index and
# will start by outputting only the dimension information and the parameter settings
# from our diagnostics.

```

```

HKE.xsa2 <- FLXSA(trim(HKE, age = 1:4), HKE.idx[[3]],
                  FLXSA.control)
diagnostics(HKE.xsa2)

```

```

## FLR XSA Diagnostics 2017-07-12 16:15:02
##
## CPUE data from indices
##
## Catch data for 9 years 2006 to 2014. Ages 1 to 4.
##
##      fleet first age last age first year last year alpha beta
## 1 MEDITS_SA9      1      3      2006      2014 <NA> <NA>
##
##
## Time series weights :
##
##      Tapered time weighting applied
##      Power = 3 over 20 years
##
## Catchability analysis :
##
##      Catchability independent of size for all ages
##
##      Catchability independent of age for ages > 3
##
## Terminal population estimation :

```

```

##
##      Survivor estimates shrunk towards the mean F
##      of the final   3 years or the   2 oldest ages.
##
##      S.E. of the mean to which the estimates are shrunk =   2
##
##      Minimum standard error for population
##      estimates derived from each fleet =   0.3
##
##      prior weighting not applied
##
## Regression weights
##      year
## age   2006   2007   2008   2009   2010   2011   2012   2013   2014
##   all 0.82 0.877 0.921 0.954 0.976 0.99 0.997   1   1
##
##
## Fishing mortalities
##      year
## age 2006   2007   2008   2009   2010   2011   2012   2013   2014
##   1 1.738 1.931 1.969 1.527 1.653 2.065 1.876 1.608 2.033
##   2 0.969 1.190 0.938 1.150 1.204 1.103 1.518 1.076 1.137
##   3 1.514 0.250 1.046 0.608 2.213 1.134 0.731 1.627 1.269
##   4 1.514 0.250 1.046 0.608 2.213 1.134 0.731 1.627 1.269
##
##
## XSA population number (Thousand)
##      age
## year      1      2      3      4
##   2006 23599 4602  460 151
##   2007 21898 2341 1131 293
##   2008 18839 1769  464 143
##   2009 21120 1471  452 221
##   2010 20595 2562  304  86
##   2011 19637 2229  504 171
##   2012 16144 1392  483 120
##   2013 21590 1397  200  75
##   2014 16279 2412  311  63
##
##
## Estimated population abundance at 1st Jan 2015
##      age
## year      1      2      3      4
##   2015 1 1193 509 60
##
##
## Fleet:  MEDITS_SA9
##
## Log catchability residuals.
##
##      year
## age 2006   2007   2008   2009   2010   2011   2012   2013   2014
##   1 0.228 -0.006 0.547 0.137 -0.130 -0.113 -0.308 -0.249 -0.022
##   2 -0.388 0.284 -0.153 0.003 0.336 -0.263 0.147 -0.063 0.057

```

```

## 3 -0.035 0.213 -0.069 0.097 -0.230 -0.081 0.148 -0.084 0.055
##
##
## Mean log catchability and standard error of ages with catchability
## independent of year class strength and constant w.r.t. time
##
##          1          2          3
## Mean_Logq -5.0800 -6.4307 -6.5092
## S.E_Logq 0.2125 0.2125 0.2125
##
##
## Terminal year survivor and F summaries:
##
## ,Age 1 Year class =2013
##
## source
##          scaledWts survivors yrcls
## MEDITS_SA9 0.853      1169 2013
## fshk      0.147      1344 2013
##
## ,Age 2 Year class =2012
##
## source
##          scaledWts survivors yrcls
## MEDITS_SA9 0.934      541 2012
## fshk      0.066      424 2012
##
## ,Age 3 Year class =2011
##
## source
##          scaledWts survivors yrcls
## MEDITS_SA9 0.926      65 2011
## fshk      0.074      38 2011
diagnostics(HKE.xsa2, sections = c(T, rep(F,
7)))

## FLR XSA Diagnostics 2017-07-12 16:15:02
##
## CPUE data from indices
##
## Catch data for 9 years 2006 to 2014. Ages 1 to 4.
##
##          fleet first age last age first year last year alpha beta
## 1 MEDITS_SA9          1          3      2006      2014 <NA> <NA>
diagnostics(HKE.xsa2, sections = c(T, T, rep(F,
6)))

## FLR XSA Diagnostics 2017-07-12 16:15:02
##
## CPUE data from indices
##
## Catch data for 9 years 2006 to 2014. Ages 1 to 4.
##
##          fleet first age last age first year last year alpha beta

```

```

## 1 MEDITS_SA9          1          3          2006          2014 <NA> <NA>
##
##
## Time series weights :
##
## Tapered time weighting applied
## Power = 3 over 20 years
##
## Catchability analysis :
##
## Catchability independent of size for all ages
##
## Catchability independent of age for ages > 3
##
## Terminal population estimation :
##
## Survivor estimates shrunk towards the mean F
## of the final 3 years or the 2 oldest ages.
##
## S.E. of the mean to which the estimates are shrunk = 2
##
## Minimum standard error for population
## estimates derived from each fleet = 0.3
##
## prior weighting not applied
diagnostics(HKE.xsa2, sections = c(T, T, T,rep(F,
5)))

## FLR XSA Diagnostics 2017-07-12 16:15:02
##
## CPUE data from indices
##
## Catch data for 9 years 2006 to 2014. Ages 1 to 4.
##
## fleet first age last age first year last year alpha beta
## 1 MEDITS_SA9          1          3          2006          2014 <NA> <NA>
##
##
## Time series weights :
##
## Tapered time weighting applied
## Power = 3 over 20 years
##
## Catchability analysis :
##
## Catchability independent of size for all ages
##
## Catchability independent of age for ages > 3
##
## Terminal population estimation :
##
## Survivor estimates shrunk towards the mean F
## of the final 3 years or the 2 oldest ages.
##

```

```

##      S.E. of the mean to which the estimates are shrunk =    2
##
##      Minimum standard error for population
##      estimates derived from each fleet =    0.3
##
##      prior weighting not applied
##
## Regression weights
##      year
## age   2006  2007  2008  2009  2010  2011  2012  2013  2014
## all  0.82  0.877  0.921  0.954  0.976  0.99  0.997    1    1

# Next we can output the regression weights and the fishing mortalities
# and population numbers for the last 10 years and also the aggregated survivors estimates.

diagnostics(HKE.xsa2, sections = c(F, F, T, T,
                                   T, T, F, F))

## Regression weights
##      year
## age   2006  2007  2008  2009  2010  2011  2012  2013  2014
## all  0.82  0.877  0.921  0.954  0.976  0.99  0.997    1    1
##
##
##      Fishing mortalities
##      year
## age   2006  2007  2008  2009  2010  2011  2012  2013  2014
## 1  1.738  1.931  1.969  1.527  1.653  2.065  1.876  1.608  2.033
## 2  0.969  1.190  0.938  1.150  1.204  1.103  1.518  1.076  1.137
## 3  1.514  0.250  1.046  0.608  2.213  1.134  0.731  1.627  1.269
## 4  1.514  0.250  1.046  0.608  2.213  1.134  0.731  1.627  1.269
##
##
##      XSA population number (Thousand)
##      age
## year      1      2      3      4
## 2006 23599 4602  460 151
## 2007 21898 2341 1131 293
## 2008 18839 1769  464 143
## 2009 21120 1471  452 221
## 2010 20595 2562  304  86
## 2011 19637 2229  504 171
## 2012 16144 1392  483 120
## 2013 21590 1397  200  75
## 2014 16279 2412  311  63
##
##
##      Estimated population abundance at 1st Jan 2015
##      age
## year      1      2      3      4
## 2015 1 1193 509 60

# And finally we can output the catchability residuals and the individual survivors estimates.
# Note that very little thought went into the parameter settings for this particular model

```

```

# fit so please don't interrogate the output presented here too closely.
# Also note that we do not normally expect the diagnostics output to be
# broken up as we have here. We present it in this way purely to make it more
# presentable in this document.
# By default all sections are set to TRUE so
# it is very likely that you won't need to give this argument at all
# when calling the diagnostics method.

```

```

diagnostics(HKE.xsa2, sections = c(F, F, F, F,
                                   F, F, T, T))

```

```

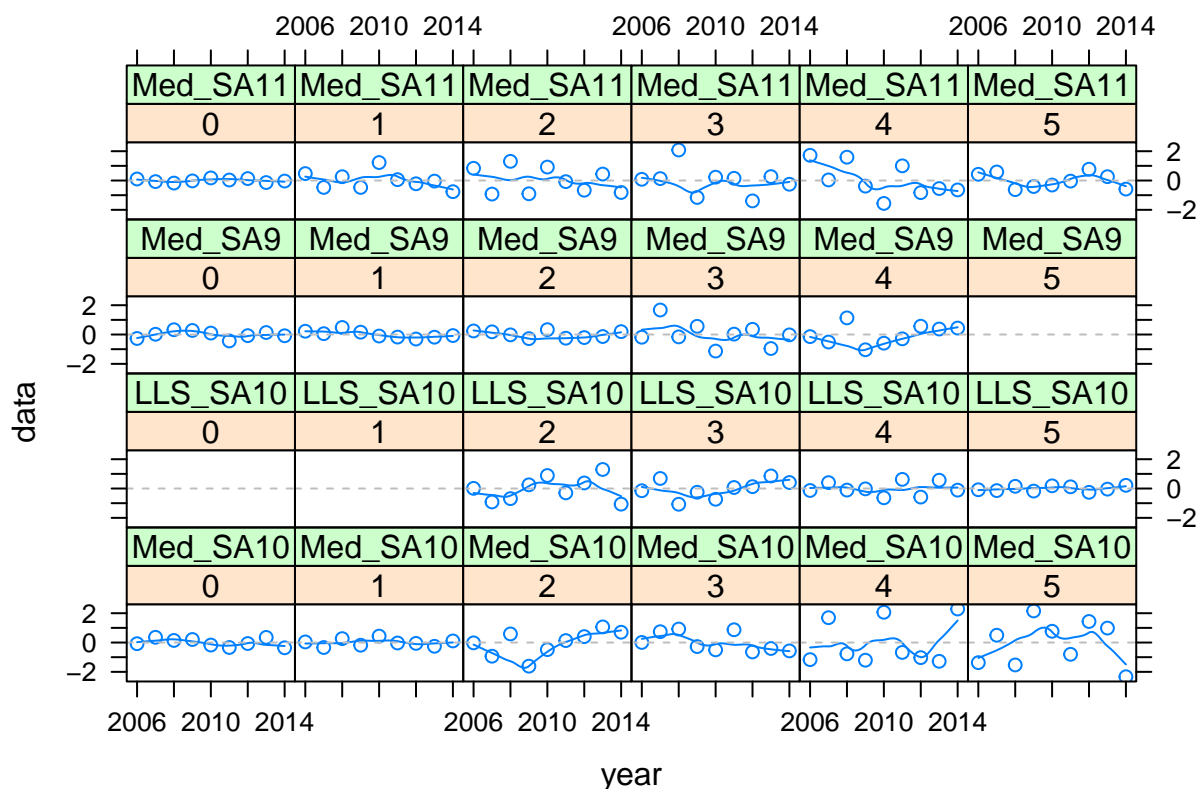
##
##
## Fleet: MEDITS_SA9
##
## Log catchability residuals.
##
##   year
## age  2006   2007   2008   2009   2010   2011   2012   2013   2014
##  1  0.228 -0.006  0.547  0.137 -0.130 -0.113 -0.308 -0.249 -0.022
##  2 -0.388  0.284 -0.153  0.003  0.336 -0.263  0.147 -0.063  0.057
##  3 -0.035  0.213 -0.069  0.097 -0.230 -0.081  0.148 -0.084  0.055
##
##
## Mean log catchability and standard error of ages with catchability
## independent of year class strength and constant w.r.t. time
##
##           1           2           3
## Mean_Logq -5.0800 -6.4307 -6.5092
## S.E_Logq   0.2125  0.2125  0.2125
##
##
## Terminal year survivor and F summaries:
##
## ,Age 1 Year class =2013
##
## source
##           scaledWts survivors yrcls
## MEDITS_SA9      0.853      1169  2013
## fshk            0.147      1344  2013
##
## ,Age 2 Year class =2012
##
## source
##           scaledWts survivors yrcls
## MEDITS_SA9      0.934       541  2012
## fshk            0.066       424  2012
##
## ,Age 3 Year class =2011
##
## source
##           scaledWts survivors yrcls
## MEDITS_SA9      0.926        65  2011
## fshk            0.074        38  2011

```



```
# Very often the quickest and simplest way to determine the fit of the model is through
# visual inspection of the various diagnostic outputs.
# Here we provide examples of how to extract the relevant information from the
# return FLXSA object and to plot it using a variety of lattice functions available to R.
# We start by plotting the log catchability residuals at age from each of the three tuning series.
# The data are stored as an FLQuants object in the index.res slot of the FLXSA object
# First we need to assign names to each of the FLQuant objects so we know which fleet
# they represent
```

```
names(HKE.xsa@index.res) <- names(HKE.idx)
pfun <- function(x, y, ...) {
  panel.xyplot(x, y, ...)
  panel.loess(x, y, ...)
  panel.abline(h = 0, col = "grey", lty = 2)
}
plot(xyplot(data ~ year | ac(age) + qname, data = index.res(HKE.xsa),
  panel = pfun))
```



```
#### RESIDUALS BUBBLE PLOTS ####
index.res(HKE.xsa)
```

```
## $ Med_SA10
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
```

```

##      year
## age 2006      2007      2008      2009      2010      2011
##   0 -0.0786042  0.3585839  0.1428852  0.2062029 -0.1719172 -0.3368008
##   1  0.0409260 -0.3384312  0.2668435 -0.1817533  0.4382134 -0.0318903
##   2 -0.0220488 -0.9326331  0.5862352 -1.6125942 -0.4823015  0.1339421
##   3  0.0066446  0.7403522  0.9195224 -0.2758507 -0.4992837  0.8708034
##   4 -1.1658383  1.6943759 -0.7719857 -1.2052175  2.0657747 -0.6733219
##   5 -1.3728329  0.4971117 -1.5283475  2.1577986  0.7682405 -0.8023418
##      year
## age 2012      2013      2014
##   0 -0.0685557  0.3499253 -0.3584791
##   1 -0.0591758 -0.2548402  0.1082698
##   2  0.4045334  1.0661950  0.7030935
##   3 -0.6401291 -0.4056010 -0.5694707
##   4 -1.0304936 -1.2796440  2.2876044
##   5  1.4358571  0.9851988 -2.3325625
##
## units:  NA
##
## $ LLS_SA10
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006      2007      2008      2009      2010      2011      2012
##   2  0.011508 -0.916729 -0.688703  0.252759  0.888401 -0.295883  0.380638
##   3 -0.150509  0.687067 -1.072158 -0.253788 -0.732769  0.070667  0.128616
##   4 -0.134080  0.402741 -0.106581 -0.022158 -0.631852  0.624309 -0.582606
##   5 -0.084209 -0.141082  0.152603 -0.172923  0.184603  0.117880 -0.259128
##      year
## age 2013      2014
##   2  1.299742 -1.065428
##   3  0.858351  0.409817
##   4  0.565907 -0.109900
##   5 -0.041099  0.219663
##
## units:  NA
##
## $ Med_SA9
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006      2007      2008      2009      2010      2011      2012
##   0 -0.268787  0.018134  0.325221  0.279359  0.098093 -0.438872 -0.075563
##   1  0.223678  0.057849  0.481414  0.160707 -0.102372 -0.173529 -0.307140
##   2  0.243397  0.184874 -0.023015 -0.280454  0.332047 -0.250687 -0.209212
##   3 -0.183940  1.671389 -0.161473  0.558618 -1.128687  0.028245  0.355461
##   4 -0.143008 -0.512058  1.134751 -1.039584 -0.591317 -0.293461  0.565816
##      year
## age 2013      2014
##   0  0.137456 -0.084920
##   1 -0.182381 -0.070653
##   2 -0.137954  0.197523

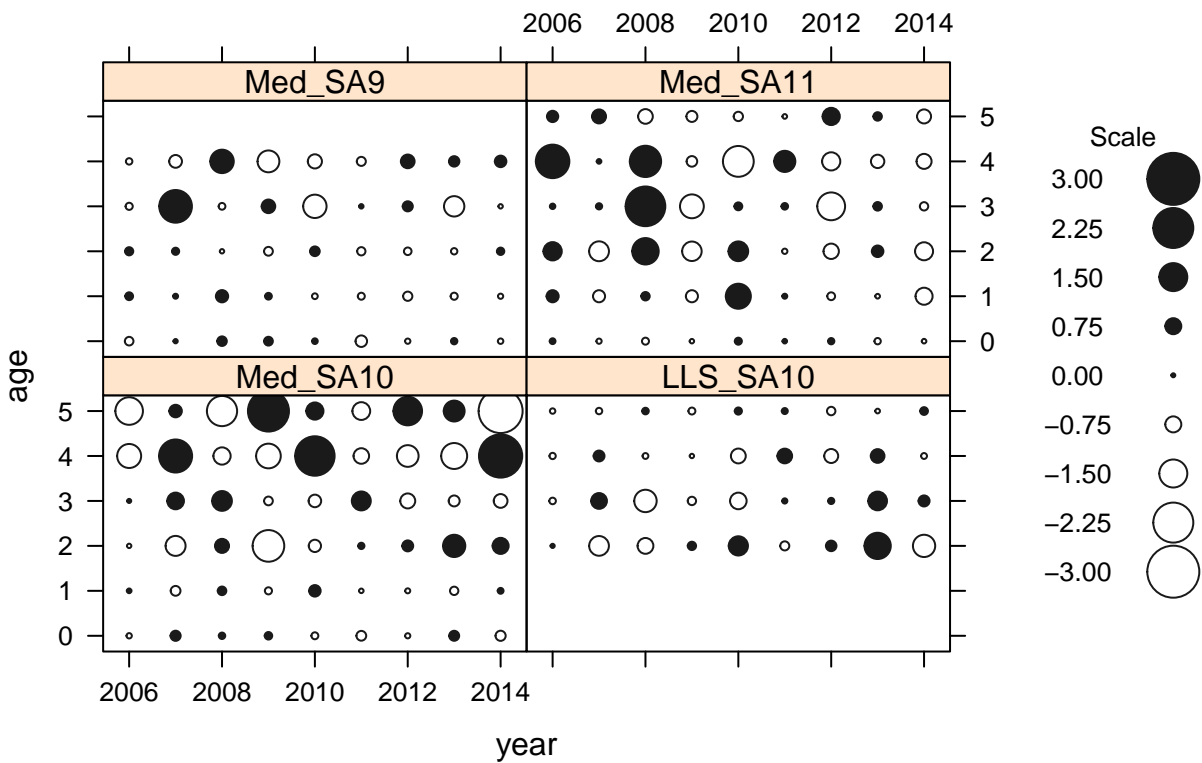
```

```

## 3 -0.954207 -0.025444
## 4 0.375471 0.440852
##
## units: NA
##
## $ Med_SA11
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006      2007      2008      2009      2010      2011      2012
## 0 0.104475 -0.072362 -0.175374 -0.027692 0.177405 0.034022 0.133225
## 1 0.473793 -0.470889 0.259682 -0.470892 1.226325 0.059123 -0.222019
## 2 0.835365 -0.924917 1.308742 -0.903665 0.916684 -0.076341 -0.662702
## 3 0.083015 0.131049 2.081199 -1.155745 0.227407 0.153245 -1.388919
## 4 1.721707 0.039732 1.591774 -0.384003 -1.562322 1.000792 -0.826581
## 5 0.424738 0.581370 -0.622022 -0.408840 -0.309899 -0.040126 0.771042
## year
## age 2013      2014
## 0 -0.138003 -0.035995
## 1 -0.040017 -0.759989
## 2 0.440383 -0.816440
## 3 0.267623 -0.254159
## 4 -0.546612 -0.641746
## 5 0.261910 -0.583388
##
## units: NA
bubbles(age ~ year|qname, data = index.res(HKE.xsa)
, main = "Proportion at age by year Sh0.5")

```

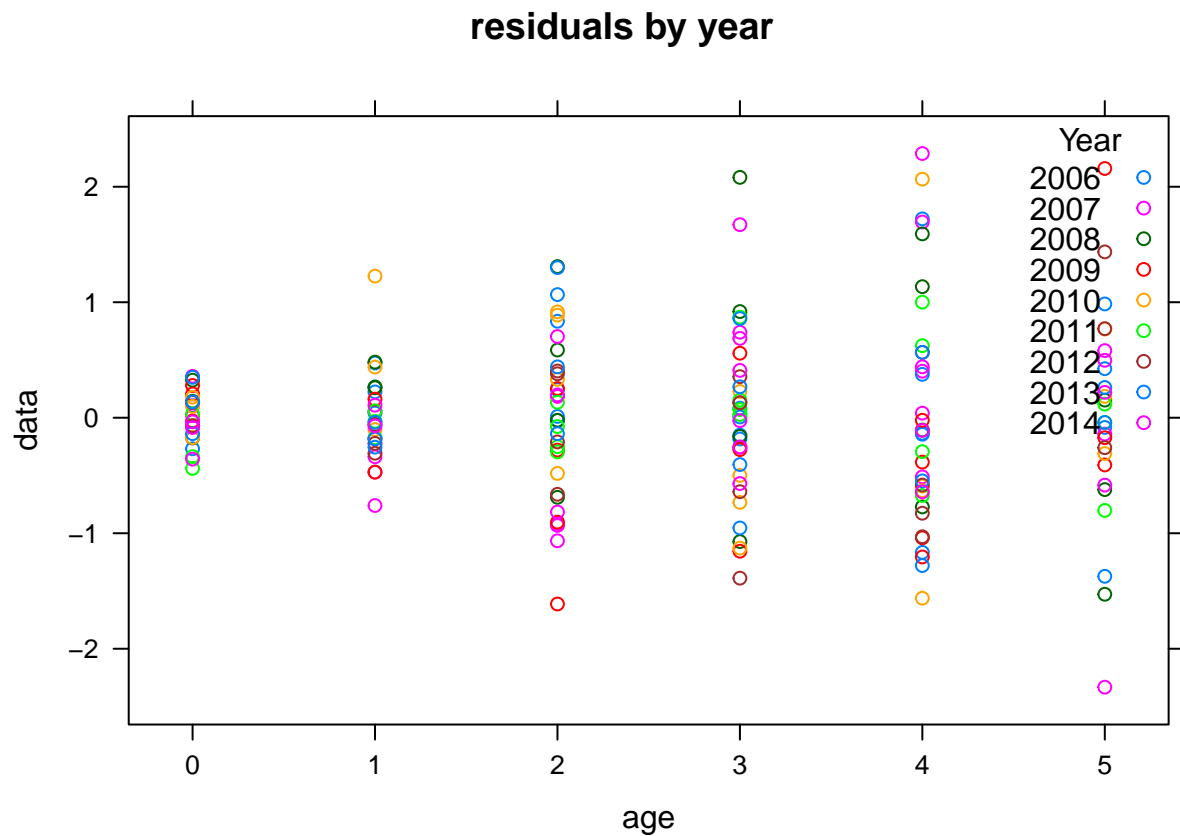
## Proportion at age by year Sh0.5



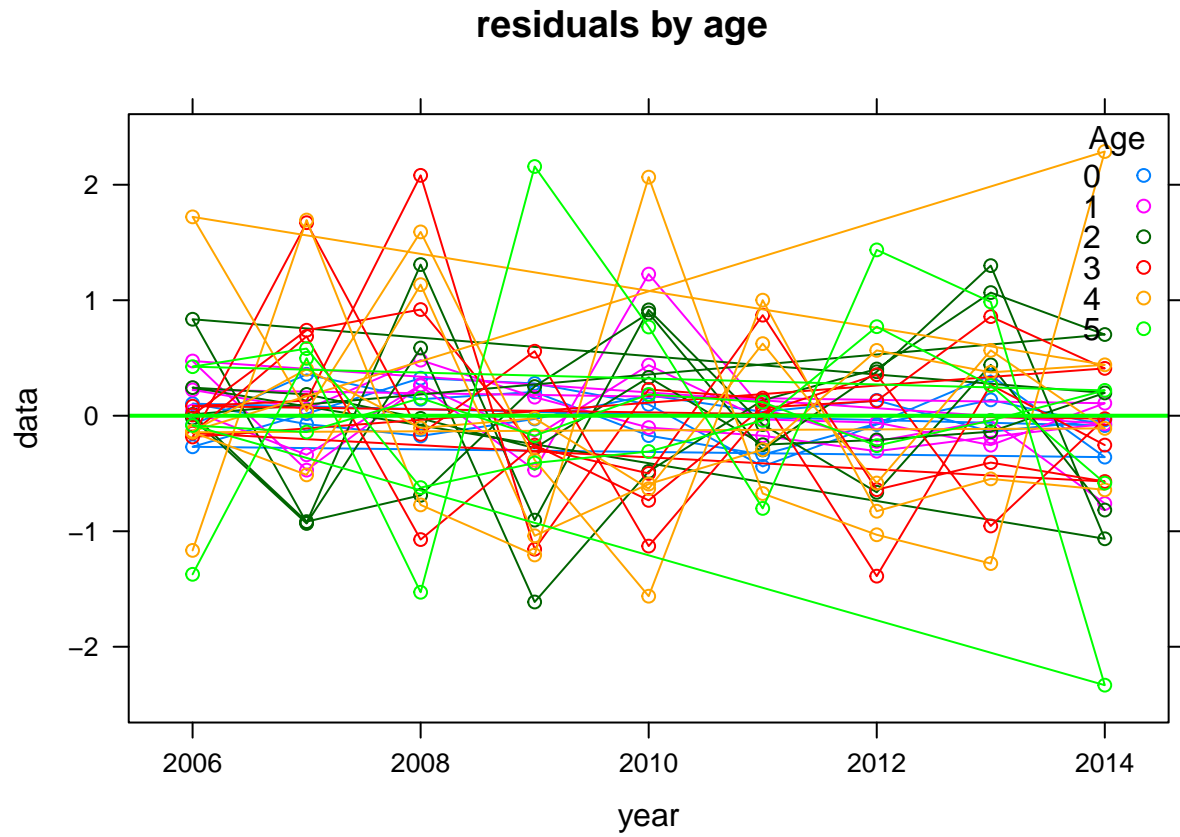
#####

```
res_fin=as.data.frame(index.res(HKE.xsa))

xyplot(data~age,type="p",groups=year,data=res_fin,main="residuals by year",
        auto.key=list(corner=c(1,1), columns=1,
                      title="Year", cex.title=1))
```



```
xyplot(data~year,type=c('l','p'),groups=age,data=res_fin,main="residuals by age",
  auto.key=list(corner=c(1,1), columns=1,title="Age", cex.title=1),
  panel=function(...) {
    panel.xyplot(...)
    panel.abline(h=0,col="green",lwd=2)
  })
```



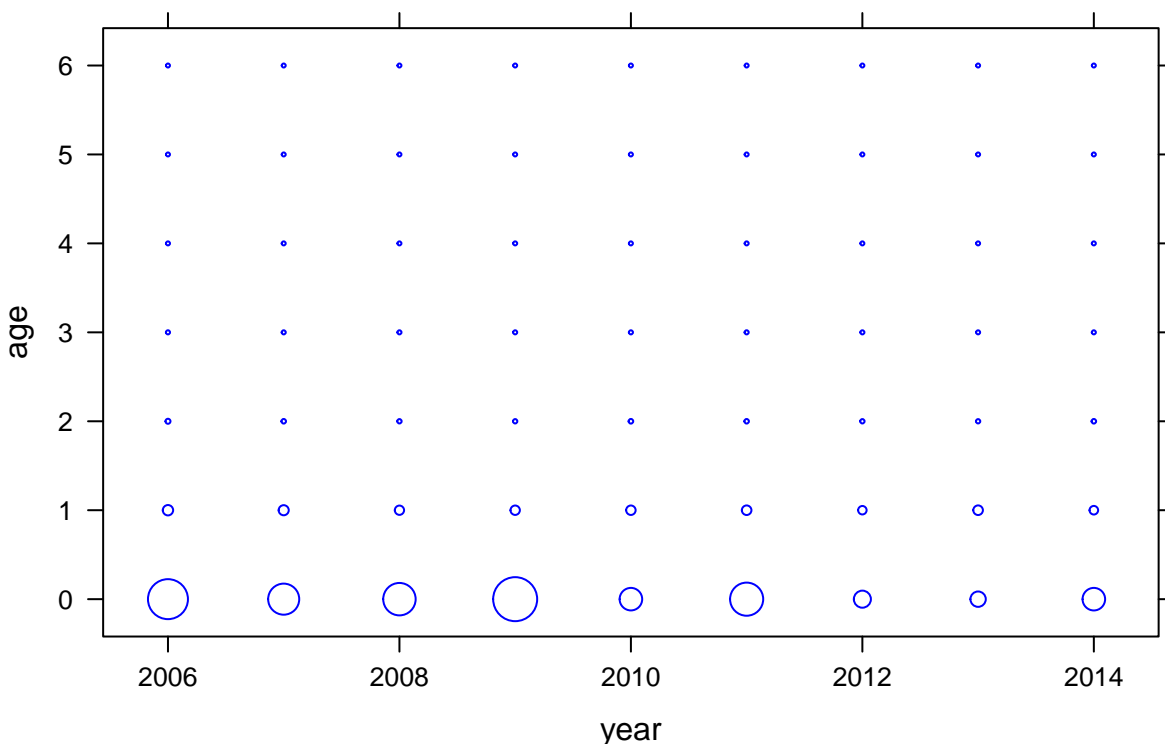
```
bubbles(age ~ year, data = index(HKE.idx[[1]]), main = "Proportion at age by year in the survey")
```

### Proportion at age by year in the survey



```
bubbles(age ~ year, data = catch.n(HKE.new_xsa), main = "Proportion at age by year in the catch")
```

## Proportion at age by year in the catch



*# A simple comparison of the terminal survivors estimates can be obtained  
 # from the information stored in the diagnostics slot of the FLXSA object.  
 # In the following example we first extract the information relevant  
 # to the survivors estimates in the final year and store it as a temporary object.  
 # The weights values contained in this data set are the raw fleet based weights that  
 # have been calculated from the standard errors of the fleet based survivors estimates at each age  
 # in the cohort. To aid visualisation and to see the relative contribution  
 # of each fleets estimate to the final estimated value of survivors  
 # we re-scale the weights to a maximum value of 1 and plot both the fleet  
 # based survivors estimates from each fleet and their scaled weight. The results  
 # show relatively consistent estimates of survivors from all fleets across most ages.  
 # The scaled weights show the some series to have the greatest influence on the terminal estimates  
 # at the younger ages whilst others have greater influence at older ages and that throughout  
 # all ages F shrinkage recieves very little weighting.*

```
# kk <- slot(HKE.xsa,"diagnostics")[is.element(slot(HKE.xsa,"diagnostics")$year, 2014), ]
# kk <- cbind(kk, w.scaled = kk$w/rep(tapply(kk$w, kk$yrcls, sum),c(table(kk$yrcls))))
# nplot <- barchart(ac(yrcls) ~ nhat, groups = source, data = kk,
#                   col = grey(c(0.1, 0.6, 0.3, 0.8, 1)), main = "N Estimates",
#                   ylab = "Year Class", key = list(x = 0.6, y = 0.2,
#                   text = list(legend = rev(c("BTS-Isis", "BTS-Tridens", "fshk", "SNS", "pi"))),
#                   rectangles = list(col = grey(rev(c(0.1, 0.6, 0.3, 0.8, 1))))))
# wplot <- barchart(ac(yrcls) ~ w.scaled, groups = source, data = kk,
#                   col = grey(c(0.1, 0.6, 0.3, 0.8, 1)), main = "Scaled Weights",
#                   ylab = "", xlab = "Relative Weight")
# print(nplot, position = c(0, 0, 0.5, 1), more = TRUE)
```



```

# print(wplot, position = c(0.5, 0, 1, 1))

#####
### Sensitivity analysis ###
#####

# The simplified calling format of FLXSA makes it very easy to run multiple analyses to
# investigate model sensitivity to parameter settings.
# A wide variety of such investigations are possible.
# In this simple example we will look at the effect that different F shrinkage standard errors
# have on the terminal estimates of fishing mortality.
# We start by creating a vector of F shrinkage values to be used in the analyses and by creating an
# FLQuant with sufficient dimensions to store the results.
# To do this we use the propagate function to
# extend an FLQuant in the 6th dimension by the number of runs that we are going to perform.
# The estimates of fishing mortality for each XSA run are stored in the FLQuant using
# the 6th dimension to hold each iteration.
# The results show little sensitivity to increasing F shrinkage values.

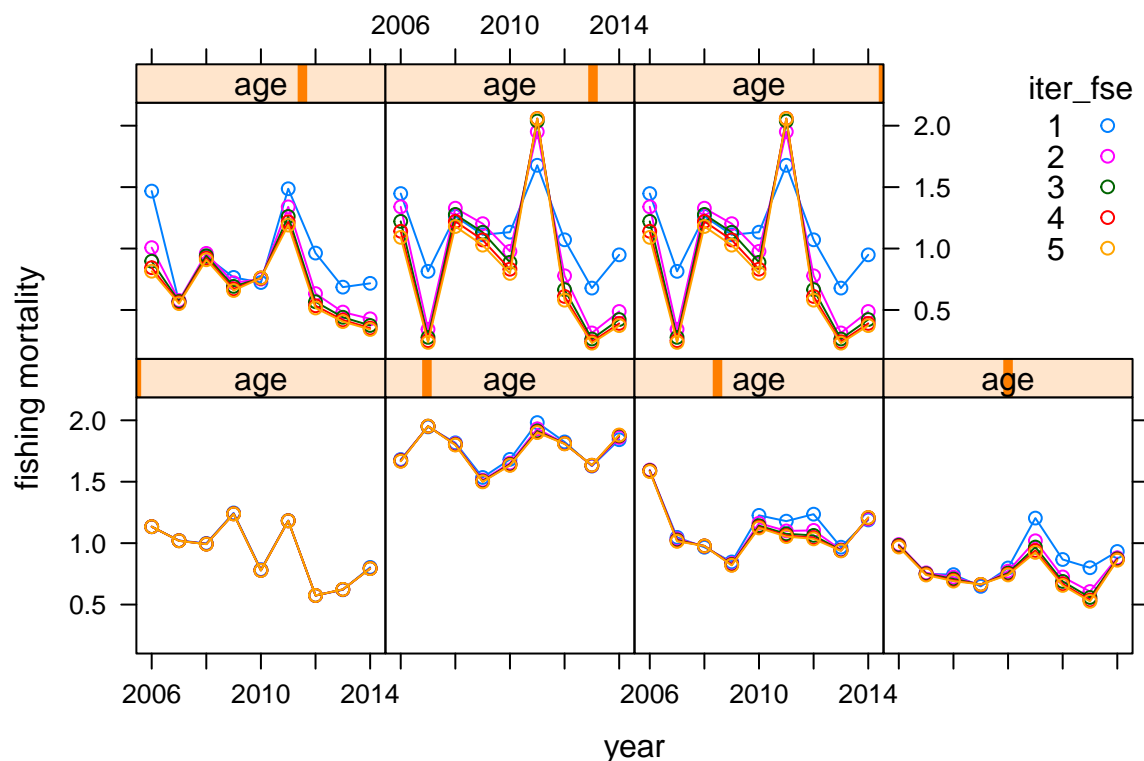
#### Looping XSA with different fse values and store harvest
fsevals <- seq(0.5, 2.5, by = 0.5)
res <- propagate(harvest(HKE), length(fsevals))
for (i in 1:length(fsevals)) {
  xsa.control <- FLXSA.control(fse = fsevals[i])
  iter(res, i) <- harvest(FLXSA(HKE, HKE.idx,
                               xsa.control))
}
# plot(xyplot(data ~ year | age, groups = iter,
#             data = res, type = "l", col = "black", xlim = c(2006:2014)))

res_df=as.data.frame(res)

xyplot(data~year|age,groups=iter,data=res_df, xlab="year", ylab="fishing mortality",
       main="Sensitivity by different fse values",type=c('l','p'),
       auto.key=list(corner=c(1,1), columns=1,
                     title="iter_fse", cex.title=1))

```

## Sensitivity by different fse values



```
#### Looping XSA with different fse values
```

```
fsevals <- seq(0.5, 3, by = 0.5)
```

```
XSA_f <- list()
```

```
for (i in 1:length(fsevals)) {
```

```
  xsa.control <- FLXSA.control(fse = fsevals[i])
```

```
  XSA <- FLXSA(HKE, HKE.idx, xsa.control)
```

```
XSA_f[i]=HKE+ XSA
```

```
}
```

```
## Warning in `[<-`(`*tmp*`, i, value = <S4 object of class
## structure("FLStock", package = "FLCore")>): implicit list embedding of S4
## objects is deprecated
```

```
## Warning in `[<-`(`*tmp*`, i, value = <S4 object of class
## structure("FLStock", package = "FLCore")>): implicit list embedding of S4
## objects is deprecated
```

```
## Warning in `[<-`(`*tmp*`, i, value = <S4 object of class
## structure("FLStock", package = "FLCore")>): implicit list embedding of S4
## objects is deprecated
```

```
## Warning in `[<-`(`*tmp*`, i, value = <S4 object of class
## structure("FLStock", package = "FLCore")>): implicit list embedding of S4
## objects is deprecated
```

```
## Warning in `[<-`(`*tmp*`, i, value = <S4 object of class
## structure("FLStock", package = "FLCore")>): implicit list embedding of S4
```

```

## objects is deprecated

## Warning in `[<-`(`*tmp*`, i, value = <S4 object of class
## structure("FLStock", package = "FLCore")>): implicit list embedding of S4
## objects is deprecated
XSA_f

## [[1]]
## An object of class "FLStock"
## Slot "catch":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age  2006   2007   2008   2009   2010   2011   2012   2013   2014
##    all 4656.5 3829.7 3405.5 3664.3 3384.1 3757.4 2640.7 2895.4 3074.7
##
## units:  NA
##
## Slot "catch.n":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006      2007      2008      2009      2010      2011
##    0 8.2424e+04 6.2020e+04 6.5121e+04 9.1660e+04 4.2494e+04 6.6748e+04
##    1 1.4603e+04 1.3976e+04 1.2123e+04 1.2360e+04 1.2523e+04 1.2820e+04
##    2 2.2993e+03 1.3141e+03 8.7033e+02 8.1216e+02 1.4515e+03 1.2039e+03
##    3 2.9858e+02 2.0899e+02 2.5103e+02 1.7153e+02 2.2510e+02 2.8533e+02
##    4 1.0297e+02 5.4785e+01 8.0515e+01 8.5904e+01 6.8254e+01 1.0077e+02
##    5 2.9440e+01 1.2424e+01 3.7507e+01 2.5232e+01 3.6735e+01 3.7943e+01
##    6 1.0011e-03 2.6453e+00 7.7576e+00 9.2521e+00 1.1873e+01 8.3724e+00
##      year
## age 2012      2013      2014
##    0 2.9969e+04 2.6054e+04 4.2564e+04
##    1 1.0271e+04 1.2899e+04 1.0589e+04
##    2 8.8035e+02 7.4427e+02 1.3310e+03
##    3 2.0918e+02 1.3405e+02 1.8698e+02
##    4 5.3596e+01 5.3242e+01 3.9646e+01
##    5 1.4063e+01 1.1699e+01 2.4068e+01
##    6 2.0197e+00 3.8645e+00 1.9806e+01
##
## units:  10^3
##
## Slot "catch.wt":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006      2007      2008      2009      2010      2011      2012
##    0 0.0097962 0.0111972 0.0099485 0.0107332 0.0100794 0.0090594 0.0122723
##    1 0.1385243 0.1465506 0.1437444 0.1460090 0.1336534 0.1469369 0.1404243
##    2 0.5227660 0.5264274 0.5163683 0.5108274 0.5129791 0.5053598 0.5024037
##    3 1.1715577 1.1825167 1.1354463 1.1593580 1.1450351 1.1673509 1.1375630

```

```

## 4 1.9157514 1.8273481 1.8831095 1.8759900 1.9165670 1.9015151 1.9288463
## 5 2.6205658 2.8217072 2.6853483 2.6349913 2.7660951 2.6874283 2.7865475
## 6 3.0005651 4.9239695 3.6367794 3.7139220 3.9833698 4.0459298 3.8248526
##   year
## age 2013      2014
## 0 0.0112717 0.0091963
## 1 0.1468980 0.1544967
## 2 0.5469402 0.4646127
## 3 1.1530822 1.1471284
## 4 1.8358521 1.8486048
## 5 2.6033860 2.6832733
## 6 4.3827720 3.8651729
##
## units: NA
##
## Slot "discards":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## all NA   NA   NA   NA   NA   NA   NA   NA   NA
##
## units: NA
##
## Slot "discards.n":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## 0 0     0     0     0     0     0     0     0     0
## 1 0     0     0     0     0     0     0     0     0
## 2 0     0     0     0     0     0     0     0     0
## 3 0     0     0     0     0     0     0     0     0
## 4 0     0     0     0     0     0     0     0     0
## 5 0     0     0     0     0     0     0     0     0
## 6 0     0     0     0     0     0     0     0     0
##
## units: NA
##
## Slot "discards.wt":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## 0 NA   NA   NA   NA   NA   NA   NA   NA   NA
## 1 NA   NA   NA   NA   NA   NA   NA   NA   NA
## 2 NA   NA   NA   NA   NA   NA   NA   NA   NA
## 3 NA   NA   NA   NA   NA   NA   NA   NA   NA
## 4 NA   NA   NA   NA   NA   NA   NA   NA   NA
## 5 NA   NA   NA   NA   NA   NA   NA   NA   NA
## 6 0     0     0     0     0     0     0     0     0

```

```

##
## units:  NA
##
## Slot "landings":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age  2006   2007   2008   2009   2010   2011   2012   2013   2014
##   all 4656.5 3829.7 3405.5 3664.3 3384.1 3757.4 2640.7 2895.4 3074.7
##
## units:  t
##
## Slot "landings.n":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006      2007      2008      2009      2010      2011
##   0 8.2424e+04 6.2020e+04 6.5121e+04 9.1660e+04 4.2494e+04 6.6748e+04
##   1 1.4603e+04 1.3976e+04 1.2123e+04 1.2360e+04 1.2523e+04 1.2820e+04
##   2 2.2993e+03 1.3141e+03 8.7033e+02 8.1216e+02 1.4515e+03 1.2039e+03
##   3 2.9858e+02 2.0899e+02 2.5103e+02 1.7153e+02 2.2510e+02 2.8533e+02
##   4 1.0297e+02 5.4785e+01 8.0515e+01 8.5904e+01 6.8254e+01 1.0077e+02
##   5 2.9440e+01 1.2424e+01 3.7507e+01 2.5232e+01 3.6735e+01 3.7943e+01
##   6 1.0011e-03 2.6453e+00 7.7576e+00 9.2521e+00 1.1873e+01 8.3724e+00
##      year
## age 2012      2013      2014
##   0 2.9969e+04 2.6054e+04 4.2564e+04
##   1 1.0271e+04 1.2899e+04 1.0589e+04
##   2 8.8035e+02 7.4427e+02 1.3310e+03
##   3 2.0918e+02 1.3405e+02 1.8698e+02
##   4 5.3596e+01 5.3242e+01 3.9646e+01
##   5 1.4063e+01 1.1699e+01 2.4068e+01
##   6 2.0197e+00 3.8645e+00 1.9806e+01
##
## units:  NA
##
## Slot "landings.wt":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006      2007      2008      2009      2010      2011      2012
##   0 0.0097962 0.0111972 0.0099485 0.0107332 0.0100794 0.0090594 0.0122723
##   1 0.1385243 0.1465506 0.1437444 0.1460090 0.1336534 0.1469369 0.1404243
##   2 0.5227660 0.5264274 0.5163683 0.5108274 0.5129791 0.5053598 0.5024037
##   3 1.1715577 1.1825167 1.1354463 1.1593580 1.1450351 1.1673509 1.1375630
##   4 1.9157514 1.8273481 1.8831095 1.8759900 1.9165670 1.9015151 1.9288463
##   5 2.6205658 2.8217072 2.6853483 2.6349913 2.7660951 2.6874283 2.7865475
##   6 3.0005651 4.9239695 3.6367794 3.7139220 3.9833698 4.0459298 3.8248526
##      year
## age 2013      2014
##   0 0.0112717 0.0091963

```

```

## 1 0.1468980 0.1544967
## 2 0.5469402 0.4646127
## 3 1.1530822 1.1471284
## 4 1.8358521 1.8486048
## 5 2.6033860 2.6832733
## 6 4.3827720 3.8651729
##
## units: NA
##
## Slot "stock":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## all NA   NA   NA   NA   NA   NA   NA   NA   NA
##
## units: NA
##
## Slot "stock.n":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006      2007      2008      2009      2010      2011
## 0 2.1774e+05 1.7481e+05 1.8600e+05 2.3281e+05 1.4006e+05 1.7373e+05
## 1 2.3897e+04 2.1842e+04 1.9355e+04 2.1077e+04 2.0457e+04 1.9888e+04
## 2 3.5881e+03 2.5089e+03 1.7377e+03 1.7597e+03 2.5382e+03 2.1512e+03
## 3 5.7474e+02 4.7457e+02 5.7345e+02 4.3171e+02 4.9240e+02 4.8790e+02
## 4 1.5789e+02 1.4905e+02 1.5629e+02 1.8973e+02 1.5669e+02 1.5330e+02
## 5 4.5198e+01 2.6142e+01 6.1091e+01 4.4102e+01 6.3290e+01 5.4388e+01
## 6 1.4748e-03 5.4265e+00 1.2195e+01 1.5648e+01 1.9802e+01 1.1481e+01
##      year
## age 2012      2013      2014
## 0 1.2366e+05 1.0165e+05 1.3962e+05
## 1 1.6301e+04 2.1489e+04 1.6812e+04
## 2 1.5326e+03 1.4850e+03 2.3556e+03
## 3 4.3210e+02 2.9197e+02 3.6913e+02
## 4 1.0215e+02 1.2662e+02 9.1244e+01
## 5 2.5010e+01 2.8077e+01 4.5802e+01
## 6 3.4817e+00 9.0616e+00 3.6663e+01
##
## units: NA
##
## Slot "stock.wt":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006      2007      2008      2009      2010      2011      2012
## 0 0.0097962 0.0111972 0.0099485 0.0107332 0.0100794 0.0090594 0.0122723
## 1 0.1385243 0.1465506 0.1437444 0.1460090 0.1336534 0.1469369 0.1404243
## 2 0.5227660 0.5264274 0.5163683 0.5108274 0.5129791 0.5053598 0.5024037
## 3 1.1715577 1.1825167 1.1354463 1.1593580 1.1450351 1.1673509 1.1375630

```

```

## 4 1.9157514 1.8273481 1.8831095 1.8759900 1.9165670 1.9015151 1.9288463
## 5 2.6205658 2.8217072 2.6853483 2.6349913 2.7660951 2.6874283 2.7865475
## 6 3.0005651 4.9239695 3.6367794 3.7139220 3.9833698 4.0459298 3.8248526
##   year
## age 2013      2014
## 0 0.0112717 0.0091963
## 1 0.1468980 0.1544967
## 2 0.5469402 0.4646127
## 3 1.1530822 1.1471284
## 4 1.8358521 1.8486048
## 5 2.6033860 2.6832733
## 6 4.3827720 3.8651729
##
## units: kg
##
## Slot "m":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006      2007      2008      2009      2010      2011      2012      2013
## 0 1.16598 1.17944 1.17946 1.18589 1.16715 1.18240 1.17651 1.17923
## 1 0.57300 0.58483 0.58097 0.58199 0.57010 0.58148 0.57175 0.58332
## 2 0.43358 0.42889 0.42585 0.42665 0.42300 0.42596 0.42216 0.42493
## 3 0.36924 0.36101 0.36227 0.36534 0.36893 0.35964 0.36056 0.36332
## 4 0.33085 0.32538 0.32989 0.33276 0.33468 0.32642 0.32832 0.33127
## 5 0.32130 0.31785 0.31030 0.31912 0.31088 0.30655 0.31254 0.33417
## 6 0.29999 0.29584 0.29537 0.29791 0.29535 0.29706 0.29560 0.29862
##   year
## age 2014
## 0 1.18751
## 1 0.57941
## 2 0.41521
## 3 0.35960
## 4 0.32681
## 5 0.30738
## 6 0.29966
##
## units: NA
##
## Slot "mat":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006      2007      2008      2009      2010      2011      2012      2013
## 0 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
## 1 0.22389 0.22937 0.23087 0.22959 0.21997 0.23263 0.22140 0.22809
## 2 0.89022 0.88628 0.88310 0.88439 0.88006 0.88317 0.87961 0.88248
## 3 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
## 4 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
## 5 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
## 6 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
##   year

```

```

## age 2014
## 0 0.00000
## 1 0.22457
## 2 0.87454
## 3 1.00000
## 4 1.00000
## 5 1.00000
## 6 1.00000
##
## units: NA
##
## Slot "harvest":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006 2007 2008 2009 2010 2011 2012 2013
## 0 1.13352 1.02127 0.99810 1.24600 0.78485 1.18389 0.57347 0.62026
## 1 1.68091 1.94640 1.81685 1.53477 1.68221 1.98166 1.82404 1.62742
## 2 1.58938 1.04706 0.96675 0.84696 1.22610 1.17917 1.23588 0.96710
## 3 0.98040 0.74969 0.74378 0.64812 0.79797 1.20405 0.86687 0.79981
## 4 1.46751 0.56652 0.93533 0.76513 0.72346 1.48666 0.96313 0.68562
## 5 1.44760 0.81445 1.26230 1.11202 1.13333 1.67766 1.07119 0.67814
## 6 1.44760 0.81445 1.26230 1.11202 1.13333 1.67766 1.07119 0.67814
## year
## age 2014
## 0 0.80299
## 1 1.84189
## 2 1.18881
## 3 0.93217
## 4 0.71671
## 5 0.94876
## 6 0.94876
##
## units: f
##
## Slot "harvest.spwn":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## 0 0 0 0 0 0 0 0 0
## 1 0 0 0 0 0 0 0 0 0
## 2 0 0 0 0 0 0 0 0 0
## 3 0 0 0 0 0 0 0 0 0
## 4 0 0 0 0 0 0 0 0 0
## 5 0 0 0 0 0 0 0 0 0
## 6 0 0 0 0 0 0 0 0 0
##
## units: NA
##
## Slot "m.spwn":
## An object of class "FLQuant"

```



```

## , , unit = unique, season = all, area = unique
##
##   year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
##   0 0    0    0    0    0    0    0    0    0
##   1 0    0    0    0    0    0    0    0    0
##   2 0    0    0    0    0    0    0    0    0
##   3 0    0    0    0    0    0    0    0    0
##   4 0    0    0    0    0    0    0    0    0
##   5 0    0    0    0    0    0    0    0    0
##   6 0    0    0    0    0    0    0    0    0
##
## units: NA
##
## Slot "name":
## [1] "Index File; HKE GSA 10\t"
##
## Slot "desc":
## [1] "Imported from a VPA file. ( HKE10.IND ).  Wed Jul 12 09:23:47 2017 + FLAssess: "
##
## Slot "range":
##      min      max plusgroup  minyear  maxyear  minfbar  maxfbar
##      0        6        6      2006      2014        0        3
##
## [[2]]
## An object of class "FLStock"
## Slot "catch":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## all 4656.5 3829.7 3405.5 3664.3 3384.1 3757.4 2640.7 2895.4 3074.7
##
## units: NA
##
## Slot "catch.n":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006      2007      2008      2009      2010      2011
##   0 8.2424e+04 6.2020e+04 6.5121e+04 9.1660e+04 4.2494e+04 6.6748e+04
##   1 1.4603e+04 1.3976e+04 1.2123e+04 1.2360e+04 1.2523e+04 1.2820e+04
##   2 2.2993e+03 1.3141e+03 8.7033e+02 8.1216e+02 1.4515e+03 1.2039e+03
##   3 2.9858e+02 2.0899e+02 2.5103e+02 1.7153e+02 2.2510e+02 2.8533e+02
##   4 1.0297e+02 5.4785e+01 8.0515e+01 8.5904e+01 6.8254e+01 1.0077e+02
##   5 2.9440e+01 1.2424e+01 3.7507e+01 2.5232e+01 3.6735e+01 3.7943e+01
##   6 1.0011e-03 2.6453e+00 7.7576e+00 9.2521e+00 1.1873e+01 8.3724e+00
##   year
## age 2012      2013      2014
##   0 2.9969e+04 2.6054e+04 4.2564e+04
##   1 1.0271e+04 1.2899e+04 1.0589e+04

```

```

## 2 8.8035e+02 7.4427e+02 1.3310e+03
## 3 2.0918e+02 1.3405e+02 1.8698e+02
## 4 5.3596e+01 5.3242e+01 3.9646e+01
## 5 1.4063e+01 1.1699e+01 2.4068e+01
## 6 2.0197e+00 3.8645e+00 1.9806e+01
##
## units: 10^3
##
## Slot "catch.wt":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006      2007      2008      2009      2010      2011      2012
## 0 0.0097962 0.0111972 0.0099485 0.0107332 0.0100794 0.0090594 0.0122723
## 1 0.1385243 0.1465506 0.1437444 0.1460090 0.1336534 0.1469369 0.1404243
## 2 0.5227660 0.5264274 0.5163683 0.5108274 0.5129791 0.5053598 0.5024037
## 3 1.1715577 1.1825167 1.1354463 1.1593580 1.1450351 1.1673509 1.1375630
## 4 1.9157514 1.8273481 1.8831095 1.8759900 1.9165670 1.9015151 1.9288463
## 5 2.6205658 2.8217072 2.6853483 2.6349913 2.7660951 2.6874283 2.7865475
## 6 3.0005651 4.9239695 3.6367794 3.7139220 3.9833698 4.0459298 3.8248526
##      year
## age 2013      2014
## 0 0.0112717 0.0091963
## 1 0.1468980 0.1544967
## 2 0.5469402 0.4646127
## 3 1.1530822 1.1471284
## 4 1.8358521 1.8486048
## 5 2.6033860 2.6832733
## 6 4.3827720 3.8651729
##
## units: NA
##
## Slot "discards":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## all NA   NA   NA   NA   NA   NA   NA   NA   NA
##
## units: NA
##
## Slot "discards.n":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## 0 0      0      0      0      0      0      0      0      0
## 1 0      0      0      0      0      0      0      0      0
## 2 0      0      0      0      0      0      0      0      0
## 3 0      0      0      0      0      0      0      0      0
## 4 0      0      0      0      0      0      0      0      0

```

```

##      5 0      0      0      0      0      0      0      0      0
##      6 0      0      0      0      0      0      0      0      0
##
## units:  NA
##
## Slot "discards.wt":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
##    0 NA   NA   NA   NA   NA   NA   NA   NA   NA
##    1 NA   NA   NA   NA   NA   NA   NA   NA   NA
##    2 NA   NA   NA   NA   NA   NA   NA   NA   NA
##    3 NA   NA   NA   NA   NA   NA   NA   NA   NA
##    4 NA   NA   NA   NA   NA   NA   NA   NA   NA
##    5 NA   NA   NA   NA   NA   NA   NA   NA   NA
##    6 0     0     0     0     0     0     0     0     0
##
## units:  NA
##
## Slot "landings":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## all 4656.5 3829.7 3405.5 3664.3 3384.1 3757.4 2640.7 2895.4 3074.7
##
## units:  t
##
## Slot "landings.n":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006      2007      2008      2009      2010      2011
##    0 8.2424e+04 6.2020e+04 6.5121e+04 9.1660e+04 4.2494e+04 6.6748e+04
##    1 1.4603e+04 1.3976e+04 1.2123e+04 1.2360e+04 1.2523e+04 1.2820e+04
##    2 2.2993e+03 1.3141e+03 8.7033e+02 8.1216e+02 1.4515e+03 1.2039e+03
##    3 2.9858e+02 2.0899e+02 2.5103e+02 1.7153e+02 2.2510e+02 2.8533e+02
##    4 1.0297e+02 5.4785e+01 8.0515e+01 8.5904e+01 6.8254e+01 1.0077e+02
##    5 2.9440e+01 1.2424e+01 3.7507e+01 2.5232e+01 3.6735e+01 3.7943e+01
##    6 1.0011e-03 2.6453e+00 7.7576e+00 9.2521e+00 1.1873e+01 8.3724e+00
##      year
## age 2012      2013      2014
##    0 2.9969e+04 2.6054e+04 4.2564e+04
##    1 1.0271e+04 1.2899e+04 1.0589e+04
##    2 8.8035e+02 7.4427e+02 1.3310e+03
##    3 2.0918e+02 1.3405e+02 1.8698e+02
##    4 5.3596e+01 5.3242e+01 3.9646e+01
##    5 1.4063e+01 1.1699e+01 2.4068e+01
##    6 2.0197e+00 3.8645e+00 1.9806e+01
##

```

```

## units: NA
##
## Slot "landings.wt":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006      2007      2008      2009      2010      2011      2012
##   0 0.0097962 0.0111972 0.0099485 0.0107332 0.0100794 0.0090594 0.0122723
##   1 0.1385243 0.1465506 0.1437444 0.1460090 0.1336534 0.1469369 0.1404243
##   2 0.5227660 0.5264274 0.5163683 0.5108274 0.5129791 0.5053598 0.5024037
##   3 1.1715577 1.1825167 1.1354463 1.1593580 1.1450351 1.1673509 1.1375630
##   4 1.9157514 1.8273481 1.8831095 1.8759900 1.9165670 1.9015151 1.9288463
##   5 2.6205658 2.8217072 2.6853483 2.6349913 2.7660951 2.6874283 2.7865475
##   6 3.0005651 4.9239695 3.6367794 3.7139220 3.9833698 4.0459298 3.8248526
##      year
## age 2013      2014
##   0 0.0112717 0.0091963
##   1 0.1468980 0.1544967
##   2 0.5469402 0.4646127
##   3 1.1530822 1.1471284
##   4 1.8358521 1.8486048
##   5 2.6033860 2.6832733
##   6 4.3827720 3.8651729
##
## units: NA
##
## Slot "stock":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age  2006 2007 2008 2009 2010 2011 2012 2013 2014
## all NA   NA   NA   NA   NA   NA   NA   NA   NA
##
## units: NA
##
## Slot "stock.n":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006      2007      2008      2009      2010      2011
##   0 2.1769e+05 1.7490e+05 1.8642e+05 2.3329e+05 1.4060e+05 1.7385e+05
##   1 2.3928e+04 2.1826e+04 1.9385e+04 2.1204e+04 2.0603e+04 2.0056e+04
##   2 3.5826e+03 2.5259e+03 1.7290e+03 1.7762e+03 2.6091e+03 2.2335e+03
##   3 5.7173e+02 4.7099e+02 5.8452e+02 4.2600e+02 5.0319e+02 5.3438e+02
##   4 1.9137e+02 1.4696e+02 1.5379e+02 1.9744e+02 1.5274e+02 1.6076e+02
##   5 4.6837e+01 5.0194e+01 5.9586e+01 4.2305e+01 6.8816e+01 5.1557e+01
##   6 1.5322e-03 1.0547e+01 1.1876e+01 1.4977e+01 2.1612e+01 1.0820e+01
##      year
## age 2012      2013      2014
##   0 1.2361e+05 1.0147e+05 1.4050e+05
##   1 1.6336e+04 2.1475e+04 1.6754e+04

```

```

## 2 1.6265e+03 1.5050e+03 2.3479e+03
## 3 4.8583e+02 3.5355e+02 3.8217e+02
## 4 1.3459e+02 1.6409e+02 1.3406e+02
## 5 3.0397e+01 5.1439e+01 7.2704e+01
## 6 4.2621e+00 1.6767e+01 5.8862e+01
##
## units: NA
##
## Slot "stock.wt":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006      2007      2008      2009      2010      2011      2012
## 0 0.0097962 0.0111972 0.0099485 0.0107332 0.0100794 0.0090594 0.0122723
## 1 0.1385243 0.1465506 0.1437444 0.1460090 0.1336534 0.1469369 0.1404243
## 2 0.5227660 0.5264274 0.5163683 0.5108274 0.5129791 0.5053598 0.5024037
## 3 1.1715577 1.1825167 1.1354463 1.1593580 1.1450351 1.1673509 1.1375630
## 4 1.9157514 1.8273481 1.8831095 1.8759900 1.9165670 1.9015151 1.9288463
## 5 2.6205658 2.8217072 2.6853483 2.6349913 2.7660951 2.6874283 2.7865475
## 6 3.0005651 4.9239695 3.6367794 3.7139220 3.9833698 4.0459298 3.8248526
## year
## age 2013      2014
## 0 0.0112717 0.0091963
## 1 0.1468980 0.1544967
## 2 0.5469402 0.4646127
## 3 1.1530822 1.1471284
## 4 1.8358521 1.8486048
## 5 2.6033860 2.6832733
## 6 4.3827720 3.8651729
##
## units: kg
##
## Slot "m":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006      2007      2008      2009      2010      2011      2012      2013
## 0 1.16598 1.17944 1.17946 1.18589 1.16715 1.18240 1.17651 1.17923
## 1 0.57300 0.58483 0.58097 0.58199 0.57010 0.58148 0.57175 0.58332
## 2 0.43358 0.42889 0.42585 0.42665 0.42300 0.42596 0.42216 0.42493
## 3 0.36924 0.36101 0.36227 0.36534 0.36893 0.35964 0.36056 0.36332
## 4 0.33085 0.32538 0.32989 0.33276 0.33468 0.32642 0.32832 0.33127
## 5 0.32130 0.31785 0.31030 0.31912 0.31088 0.30655 0.31254 0.33417
## 6 0.29999 0.29584 0.29537 0.29791 0.29535 0.29706 0.29560 0.29862
## year
## age 2014
## 0 1.18751
## 1 0.57941
## 2 0.41521
## 3 0.35960
## 4 0.32681
## 5 0.30738

```

```

## 6 0.29966
##
## units: NA
##
## Slot "mat":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006 2007 2008 2009 2010 2011 2012 2013
## 0 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
## 1 0.22389 0.22937 0.23087 0.22959 0.21997 0.23263 0.22140 0.22809
## 2 0.89022 0.88628 0.88310 0.88439 0.88006 0.88317 0.87961 0.88248
## 3 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
## 4 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
## 5 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
## 6 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
## year
## age 2014
## 0 0.00000
## 1 0.22457
## 2 0.87454
## 3 1.00000
## 4 1.00000
## 5 1.00000
## 6 1.00000
##
## units: NA
##
## Slot "harvest":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006 2007 2008 2009 2010 2011 2012 2013
## 0 1.13400 1.02030 0.99431 1.24096 0.78029 1.18239 0.57375 0.62184
## 1 1.67541 1.95072 1.80902 1.51320 1.65177 1.93060 1.81287 1.63005
## 2 1.59542 1.03469 0.97501 0.83463 1.16267 1.09949 1.10400 0.94573
## 3 0.98922 0.75822 0.72308 0.66039 0.77210 1.01925 0.72487 0.60641
## 4 1.00749 0.57738 0.96080 0.72124 0.75135 1.33916 0.63350 0.48275
## 5 1.33977 0.34271 1.32842 1.20265 0.97707 1.95082 0.77848 0.31306
## 6 1.33977 0.34271 1.32842 1.20265 0.97707 1.95082 0.77848 0.31306
## year
## age 2014
## 0 0.79532
## 1 1.86020
## 2 1.19631
## 3 0.88095
## 4 0.42807
## 5 0.48782
## 6 0.48782
##
## units: f
##

```

```

## Slot "harvest.spwn":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
##  0 0    0    0    0    0    0    0    0    0
##  1 0    0    0    0    0    0    0    0    0
##  2 0    0    0    0    0    0    0    0    0
##  3 0    0    0    0    0    0    0    0    0
##  4 0    0    0    0    0    0    0    0    0
##  5 0    0    0    0    0    0    0    0    0
##  6 0    0    0    0    0    0    0    0    0
##
## units:  NA
##
## Slot "m.spwn":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
##  0 0    0    0    0    0    0    0    0    0
##  1 0    0    0    0    0    0    0    0    0
##  2 0    0    0    0    0    0    0    0    0
##  3 0    0    0    0    0    0    0    0    0
##  4 0    0    0    0    0    0    0    0    0
##  5 0    0    0    0    0    0    0    0    0
##  6 0    0    0    0    0    0    0    0    0
##
## units:  NA
##
## Slot "name":
## [1] "Index File; HKE GSA 10\t"
##
## Slot "desc":
## [1] "Imported from a VPA file. ( HKE10.IND ).  Wed Jul 12 09:23:47 2017 + FLAssess: "
##
## Slot "range":
##      min      max plusgroup  minyear  maxyear  minfbar  maxfbar
##      0        6          6    2006     2014      0        3
##
## [[3]]
## An object of class "FLStock"
## Slot "catch":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
##  all 4656.5 3829.7 3405.5 3664.3 3384.1 3757.4 2640.7 2895.4 3074.7
##
## units:  NA

```

```

##
## Slot "catch.n":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006      2007      2008      2009      2010      2011
##   0 8.2424e+04 6.2020e+04 6.5121e+04 9.1660e+04 4.2494e+04 6.6748e+04
##   1 1.4603e+04 1.3976e+04 1.2123e+04 1.2360e+04 1.2523e+04 1.2820e+04
##   2 2.2993e+03 1.3141e+03 8.7033e+02 8.1216e+02 1.4515e+03 1.2039e+03
##   3 2.9858e+02 2.0899e+02 2.5103e+02 1.7153e+02 2.2510e+02 2.8533e+02
##   4 1.0297e+02 5.4785e+01 8.0515e+01 8.5904e+01 6.8254e+01 1.0077e+02
##   5 2.9440e+01 1.2424e+01 3.7507e+01 2.5232e+01 3.6735e+01 3.7943e+01
##   6 1.0011e-03 2.6453e+00 7.7576e+00 9.2521e+00 1.1873e+01 8.3724e+00
##   year
## age 2012      2013      2014
##   0 2.9969e+04 2.6054e+04 4.2564e+04
##   1 1.0271e+04 1.2899e+04 1.0589e+04
##   2 8.8035e+02 7.4427e+02 1.3310e+03
##   3 2.0918e+02 1.3405e+02 1.8698e+02
##   4 5.3596e+01 5.3242e+01 3.9646e+01
##   5 1.4063e+01 1.1699e+01 2.4068e+01
##   6 2.0197e+00 3.8645e+00 1.9806e+01
##
## units: 10^3
##
## Slot "catch.wt":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006      2007      2008      2009      2010      2011      2012
##   0 0.0097962 0.0111972 0.0099485 0.0107332 0.0100794 0.0090594 0.0122723
##   1 0.1385243 0.1465506 0.1437444 0.1460090 0.1336534 0.1469369 0.1404243
##   2 0.5227660 0.5264274 0.5163683 0.5108274 0.5129791 0.5053598 0.5024037
##   3 1.1715577 1.1825167 1.1354463 1.1593580 1.1450351 1.1673509 1.1375630
##   4 1.9157514 1.8273481 1.8831095 1.8759900 1.9165670 1.9015151 1.9288463
##   5 2.6205658 2.8217072 2.6853483 2.6349913 2.7660951 2.6874283 2.7865475
##   6 3.0005651 4.9239695 3.6367794 3.7139220 3.9833698 4.0459298 3.8248526
##   year
## age 2013      2014
##   0 0.0112717 0.0091963
##   1 0.1468980 0.1544967
##   2 0.5469402 0.4646127
##   3 1.1530822 1.1471284
##   4 1.8358521 1.8486048
##   5 2.6033860 2.6832733
##   6 4.3827720 3.8651729
##
## units: NA
##
## Slot "discards":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique

```



```

##
##      year
## age  2006 2007 2008 2009 2010 2011 2012 2013 2014
##   all NA   NA   NA   NA   NA   NA   NA   NA   NA
##
## units:  NA
##
## Slot "discards.n":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
##   0 0    0    0    0    0    0    0    0    0
##   1 0    0    0    0    0    0    0    0    0
##   2 0    0    0    0    0    0    0    0    0
##   3 0    0    0    0    0    0    0    0    0
##   4 0    0    0    0    0    0    0    0    0
##   5 0    0    0    0    0    0    0    0    0
##   6 0    0    0    0    0    0    0    0    0
##
## units:  NA
##
## Slot "discards.wt":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
##   0 NA   NA   NA   NA   NA   NA   NA   NA   NA
##   1 NA   NA   NA   NA   NA   NA   NA   NA   NA
##   2 NA   NA   NA   NA   NA   NA   NA   NA   NA
##   3 NA   NA   NA   NA   NA   NA   NA   NA   NA
##   4 NA   NA   NA   NA   NA   NA   NA   NA   NA
##   5 NA   NA   NA   NA   NA   NA   NA   NA   NA
##   6 0    0    0    0    0    0    0    0    0
##
## units:  NA
##
## Slot "landings":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age  2006   2007   2008   2009   2010   2011   2012   2013   2014
##   all 4656.5 3829.7 3405.5 3664.3 3384.1 3757.4 2640.7 2895.4 3074.7
##
## units:  t
##
## Slot "landings.n":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year

```

```

## age 2006      2007      2008      2009      2010      2011
## 0 8.2424e+04 6.2020e+04 6.5121e+04 9.1660e+04 4.2494e+04 6.6748e+04
## 1 1.4603e+04 1.3976e+04 1.2123e+04 1.2360e+04 1.2523e+04 1.2820e+04
## 2 2.2993e+03 1.3141e+03 8.7033e+02 8.1216e+02 1.4515e+03 1.2039e+03
## 3 2.9858e+02 2.0899e+02 2.5103e+02 1.7153e+02 2.2510e+02 2.8533e+02
## 4 1.0297e+02 5.4785e+01 8.0515e+01 8.5904e+01 6.8254e+01 1.0077e+02
## 5 2.9440e+01 1.2424e+01 3.7507e+01 2.5232e+01 3.6735e+01 3.7943e+01
## 6 1.0011e-03 2.6453e+00 7.7576e+00 9.2521e+00 1.1873e+01 8.3724e+00
## year
## age 2012      2013      2014
## 0 2.9969e+04 2.6054e+04 4.2564e+04
## 1 1.0271e+04 1.2899e+04 1.0589e+04
## 2 8.8035e+02 7.4427e+02 1.3310e+03
## 3 2.0918e+02 1.3405e+02 1.8698e+02
## 4 5.3596e+01 5.3242e+01 3.9646e+01
## 5 1.4063e+01 1.1699e+01 2.4068e+01
## 6 2.0197e+00 3.8645e+00 1.9806e+01
##
## units: NA
##
## Slot "landings.wt":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006      2007      2008      2009      2010      2011      2012
## 0 0.0097962 0.0111972 0.0099485 0.0107332 0.0100794 0.0090594 0.0122723
## 1 0.1385243 0.1465506 0.1437444 0.1460090 0.1336534 0.1469369 0.1404243
## 2 0.5227660 0.5264274 0.5163683 0.5108274 0.5129791 0.5053598 0.5024037
## 3 1.1715577 1.1825167 1.1354463 1.1593580 1.1450351 1.1673509 1.1375630
## 4 1.9157514 1.8273481 1.8831095 1.8759900 1.9165670 1.9015151 1.9288463
## 5 2.6205658 2.8217072 2.6853483 2.6349913 2.7660951 2.6874283 2.7865475
## 6 3.0005651 4.9239695 3.6367794 3.7139220 3.9833698 4.0459298 3.8248526
## year
## age 2013      2014
## 0 0.0112717 0.0091963
## 1 0.1468980 0.1544967
## 2 0.5469402 0.4646127
## 3 1.1530822 1.1471284
## 4 1.8358521 1.8486048
## 5 2.6033860 2.6832733
## 6 4.3827720 3.8651729
##
## units: NA
##
## Slot "stock":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## all NA NA NA NA NA NA NA NA NA
##
## units: NA

```

```

##
## Slot "stock.n":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006      2007      2008      2009      2010      2011
##   0 2.1768e+05 1.7496e+05 1.8656e+05 2.3344e+05 1.4080e+05 1.7387e+05
##   1 2.3950e+04 2.1822e+04 1.9404e+04 2.1249e+04 2.0650e+04 2.0117e+04
##   2 3.5868e+03 2.5386e+03 1.7269e+03 1.7868e+03 2.6341e+03 2.2603e+03
##   3 5.7400e+02 4.7371e+02 5.9275e+02 4.2459e+02 5.1008e+02 5.5071e+02
##   4 2.0522e+02 1.4854e+02 1.5569e+02 2.0317e+02 1.5176e+02 1.6553e+02
##   5 4.9030e+01 6.0143e+01 6.0722e+01 4.3669e+01 7.2922e+01 5.0855e+01
##   6 1.6085e-03 1.2659e+01 1.2117e+01 1.5486e+01 2.2951e+01 1.0654e+01
##   year
## age 2012      2013      2014
##   0 1.2356e+05 1.0134e+05 1.4068e+05
##   1 1.6343e+04 2.1458e+04 1.6717e+04
##   2 1.6608e+03 1.5086e+03 2.3386e+03
##   3 5.0335e+02 3.7604e+02 3.8453e+02
##   4 1.4599e+02 1.7631e+02 1.4970e+02
##   5 3.3834e+01 5.9648e+01 8.1476e+01
##   6 4.7574e+00 1.9469e+01 6.6073e+01
##
## units: NA
##
## Slot "stock.wt":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006      2007      2008      2009      2010      2011      2012
##   0 0.0097962 0.0111972 0.0099485 0.0107332 0.0100794 0.0090594 0.0122723
##   1 0.1385243 0.1465506 0.1437444 0.1460090 0.1336534 0.1469369 0.1404243
##   2 0.5227660 0.5264274 0.5163683 0.5108274 0.5129791 0.5053598 0.5024037
##   3 1.1715577 1.1825167 1.1354463 1.1593580 1.1450351 1.1673509 1.1375630
##   4 1.9157514 1.8273481 1.8831095 1.8759900 1.9165670 1.9015151 1.9288463
##   5 2.6205658 2.8217072 2.6853483 2.6349913 2.7660951 2.6874283 2.7865475
##   6 3.0005651 4.9239695 3.6367794 3.7139220 3.9833698 4.0459298 3.8248526
##   year
## age 2013      2014
##   0 0.0112717 0.0091963
##   1 0.1468980 0.1544967
##   2 0.5469402 0.4646127
##   3 1.1530822 1.1471284
##   4 1.8358521 1.8486048
##   5 2.6033860 2.6832733
##   6 4.3827720 3.8651729
##
## units: kg
##
## Slot "m":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique

```

```

##
##   year
## age 2006    2007    2008    2009    2010    2011    2012    2013
##   0 1.16598 1.17944 1.17946 1.18589 1.16715 1.18240 1.17651 1.17923
##   1 0.57300 0.58483 0.58097 0.58199 0.57010 0.58148 0.57175 0.58332
##   2 0.43358 0.42889 0.42585 0.42665 0.42300 0.42596 0.42216 0.42493
##   3 0.36924 0.36101 0.36227 0.36534 0.36893 0.35964 0.36056 0.36332
##   4 0.33085 0.32538 0.32989 0.33276 0.33468 0.32642 0.32832 0.33127
##   5 0.32130 0.31785 0.31030 0.31912 0.31088 0.30655 0.31254 0.33417
##   6 0.29999 0.29584 0.29537 0.29791 0.29535 0.29706 0.29560 0.29862
##   year
## age 2014
##   0 1.18751
##   1 0.57941
##   2 0.41521
##   3 0.35960
##   4 0.32681
##   5 0.30738
##   6 0.29966
##
## units: NA
##
## Slot "mat":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006    2007    2008    2009    2010    2011    2012    2013
##   0 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
##   1 0.22389 0.22937 0.23087 0.22959 0.21997 0.23263 0.22140 0.22809
##   2 0.89022 0.88628 0.88310 0.88439 0.88006 0.88317 0.87961 0.88248
##   3 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
##   4 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
##   5 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
##   6 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
##   year
## age 2014
##   0 0.00000
##   1 0.22457
##   2 0.87454
##   3 1.00000
##   4 1.00000
##   5 1.00000
##   6 1.00000
##
## units: NA
##
## Slot "harvest":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006    2007    2008    2009    2010    2011    2012    2013
##   0 1.13412 1.01968 0.99299 1.23933 0.77863 1.18212 0.57409 0.62288

```

```

## 1 1.67136 1.95180 1.80407 1.50580 1.64213 1.91278 1.81087 1.63326
## 2 1.59083 1.02570 0.97708 0.82695 1.14207 1.07600 1.06319 0.94197
## 3 0.98255 0.75173 0.70847 0.66352 0.75650 0.96805 0.68849 0.55773
## 4 0.89653 0.56914 0.94133 0.69188 0.75862 1.26125 0.56674 0.44065
## 5 1.22106 0.27728 1.27781 1.13242 0.88791 2.03788 0.66545 0.26370
## 6 1.22106 0.27728 1.27781 1.13242 0.88791 2.03788 0.66545 0.26370
## year
## age 2014
## 0 0.79377
## 1 1.87250
## 2 1.20561
## 3 0.87233
## 4 0.37374
## 5 0.42232
## 6 0.42232
##
## units: f
##
## Slot "harvest.spwn":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## 0 0 0 0 0 0 0 0 0
## 1 0 0 0 0 0 0 0 0 0
## 2 0 0 0 0 0 0 0 0 0
## 3 0 0 0 0 0 0 0 0 0
## 4 0 0 0 0 0 0 0 0 0
## 5 0 0 0 0 0 0 0 0 0
## 6 0 0 0 0 0 0 0 0 0
##
## units: NA
##
## Slot "m.spwn":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## 0 0 0 0 0 0 0 0 0
## 1 0 0 0 0 0 0 0 0 0
## 2 0 0 0 0 0 0 0 0 0
## 3 0 0 0 0 0 0 0 0 0
## 4 0 0 0 0 0 0 0 0 0
## 5 0 0 0 0 0 0 0 0 0
## 6 0 0 0 0 0 0 0 0 0
##
## units: NA
##
## Slot "name":
## [1] "Index File; HKE GSA 10\t"
##
## Slot "desc":

```

```

## [1] "Imported from a VPA file. ( HKE10.IND ).  Wed Jul 12 09:23:47 2017 + FLAssess: "
##
## Slot "range":
##      min      max plusgroup  minyear  maxyear  minfbar  maxfbar
##      0        6          6    2006    2014        0        3
##
##
## [[4]]
## An object of class "FLStock"
## Slot "catch":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age  2006  2007  2008  2009  2010  2011  2012  2013  2014
##   all 4656.5 3829.7 3405.5 3664.3 3384.1 3757.4 2640.7 2895.4 3074.7
##
## units:  NA
##
## Slot "catch.n":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006      2007      2008      2009      2010      2011
##   0 8.2424e+04 6.2020e+04 6.5121e+04 9.1660e+04 4.2494e+04 6.6748e+04
##   1 1.4603e+04 1.3976e+04 1.2123e+04 1.2360e+04 1.2523e+04 1.2820e+04
##   2 2.2993e+03 1.3141e+03 8.7033e+02 8.1216e+02 1.4515e+03 1.2039e+03
##   3 2.9858e+02 2.0899e+02 2.5103e+02 1.7153e+02 2.2510e+02 2.8533e+02
##   4 1.0297e+02 5.4785e+01 8.0515e+01 8.5904e+01 6.8254e+01 1.0077e+02
##   5 2.9440e+01 1.2424e+01 3.7507e+01 2.5232e+01 3.6735e+01 3.7943e+01
##   6 1.0011e-03 2.6453e+00 7.7576e+00 9.2521e+00 1.1873e+01 8.3724e+00
##      year
## age 2012      2013      2014
##   0 2.9969e+04 2.6054e+04 4.2564e+04
##   1 1.0271e+04 1.2899e+04 1.0589e+04
##   2 8.8035e+02 7.4427e+02 1.3310e+03
##   3 2.0918e+02 1.3405e+02 1.8698e+02
##   4 5.3596e+01 5.3242e+01 3.9646e+01
##   5 1.4063e+01 1.1699e+01 2.4068e+01
##   6 2.0197e+00 3.8645e+00 1.9806e+01
##
## units:  10^3
##
## Slot "catch.wt":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006      2007      2008      2009      2010      2011      2012
##   0 0.0097962 0.0111972 0.0099485 0.0107332 0.0100794 0.0090594 0.0122723
##   1 0.1385243 0.1465506 0.1437444 0.1460090 0.1336534 0.1469369 0.1404243
##   2 0.5227660 0.5264274 0.5163683 0.5108274 0.5129791 0.5053598 0.5024037
##   3 1.1715577 1.1825167 1.1354463 1.1593580 1.1450351 1.1673509 1.1375630

```

```

## 4 1.9157514 1.8273481 1.8831095 1.8759900 1.9165670 1.9015151 1.9288463
## 5 2.6205658 2.8217072 2.6853483 2.6349913 2.7660951 2.6874283 2.7865475
## 6 3.0005651 4.9239695 3.6367794 3.7139220 3.9833698 4.0459298 3.8248526
##   year
## age 2013      2014
## 0 0.0112717 0.0091963
## 1 0.1468980 0.1544967
## 2 0.5469402 0.4646127
## 3 1.1530822 1.1471284
## 4 1.8358521 1.8486048
## 5 2.6033860 2.6832733
## 6 4.3827720 3.8651729
##
## units: NA
##
## Slot "discards":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## all NA   NA   NA   NA   NA   NA   NA   NA   NA
##
## units: NA
##
## Slot "discards.n":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## 0 0     0     0     0     0     0     0     0     0
## 1 0     0     0     0     0     0     0     0     0
## 2 0     0     0     0     0     0     0     0     0
## 3 0     0     0     0     0     0     0     0     0
## 4 0     0     0     0     0     0     0     0     0
## 5 0     0     0     0     0     0     0     0     0
## 6 0     0     0     0     0     0     0     0     0
##
## units: NA
##
## Slot "discards.wt":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## 0 NA   NA   NA   NA   NA   NA   NA   NA   NA
## 1 NA   NA   NA   NA   NA   NA   NA   NA   NA
## 2 NA   NA   NA   NA   NA   NA   NA   NA   NA
## 3 NA   NA   NA   NA   NA   NA   NA   NA   NA
## 4 NA   NA   NA   NA   NA   NA   NA   NA   NA
## 5 NA   NA   NA   NA   NA   NA   NA   NA   NA
## 6 0     0     0     0     0     0     0     0     0

```

```

##
## units:  NA
##
## Slot "landings":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age  2006   2007   2008   2009   2010   2011   2012   2013   2014
##   all 4656.5 3829.7 3405.5 3664.3 3384.1 3757.4 2640.7 2895.4 3074.7
##
## units:  t
##
## Slot "landings.n":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006      2007      2008      2009      2010      2011
##   0 8.2424e+04 6.2020e+04 6.5121e+04 9.1660e+04 4.2494e+04 6.6748e+04
##   1 1.4603e+04 1.3976e+04 1.2123e+04 1.2360e+04 1.2523e+04 1.2820e+04
##   2 2.2993e+03 1.3141e+03 8.7033e+02 8.1216e+02 1.4515e+03 1.2039e+03
##   3 2.9858e+02 2.0899e+02 2.5103e+02 1.7153e+02 2.2510e+02 2.8533e+02
##   4 1.0297e+02 5.4785e+01 8.0515e+01 8.5904e+01 6.8254e+01 1.0077e+02
##   5 2.9440e+01 1.2424e+01 3.7507e+01 2.5232e+01 3.6735e+01 3.7943e+01
##   6 1.0011e-03 2.6453e+00 7.7576e+00 9.2521e+00 1.1873e+01 8.3724e+00
##      year
## age 2012      2013      2014
##   0 2.9969e+04 2.6054e+04 4.2564e+04
##   1 1.0271e+04 1.2899e+04 1.0589e+04
##   2 8.8035e+02 7.4427e+02 1.3310e+03
##   3 2.0918e+02 1.3405e+02 1.8698e+02
##   4 5.3596e+01 5.3242e+01 3.9646e+01
##   5 1.4063e+01 1.1699e+01 2.4068e+01
##   6 2.0197e+00 3.8645e+00 1.9806e+01
##
## units:  NA
##
## Slot "landings.wt":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006      2007      2008      2009      2010      2011      2012
##   0 0.0097962 0.0111972 0.0099485 0.0107332 0.0100794 0.0090594 0.0122723
##   1 0.1385243 0.1465506 0.1437444 0.1460090 0.1336534 0.1469369 0.1404243
##   2 0.5227660 0.5264274 0.5163683 0.5108274 0.5129791 0.5053598 0.5024037
##   3 1.1715577 1.1825167 1.1354463 1.1593580 1.1450351 1.1673509 1.1375630
##   4 1.9157514 1.8273481 1.8831095 1.8759900 1.9165670 1.9015151 1.9288463
##   5 2.6205658 2.8217072 2.6853483 2.6349913 2.7660951 2.6874283 2.7865475
##   6 3.0005651 4.9239695 3.6367794 3.7139220 3.9833698 4.0459298 3.8248526
##      year
## age 2013      2014
##   0 0.0112717 0.0091963

```



```

## 1 0.1468980 0.1544967
## 2 0.5469402 0.4646127
## 3 1.1530822 1.1471284
## 4 1.8358521 1.8486048
## 5 2.6033860 2.6832733
## 6 4.3827720 3.8651729
##
## units: NA
##
## Slot "stock":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## all NA   NA   NA   NA   NA   NA   NA   NA   NA
##
## units: NA
##
## Slot "stock.n":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006      2007      2008      2009      2010      2011
## 0 2.1768e+05 1.7500e+05 1.8665e+05 2.3354e+05 1.4089e+05 1.7389e+05
## 1 2.3967e+04 2.1821e+04 1.9416e+04 2.1275e+04 2.0679e+04 2.0146e+04
## 2 3.5910e+03 2.5480e+03 1.7264e+03 1.7934e+03 2.6485e+03 2.2766e+03
## 3 5.7680e+02 4.7646e+02 5.9888e+02 4.2427e+02 5.1442e+02 5.6018e+02
## 4 2.1310e+02 1.5048e+02 1.5760e+02 2.0744e+02 1.5153e+02 1.6852e+02
## 5 5.0809e+01 6.5801e+01 6.2122e+01 4.5045e+01 7.5984e+01 5.0695e+01
## 6 1.6702e-03 1.3860e+01 1.2413e+01 1.5999e+01 2.3948e+01 1.0616e+01
##      year
## age 2012      2013      2014
## 0 1.2354e+05 1.0129e+05 1.4076e+05
## 1 1.6348e+04 2.1454e+04 1.6700e+04
## 2 1.6773e+03 1.5114e+03 2.3359e+03
## 3 5.1398e+02 3.8686e+02 3.8637e+02
## 4 1.5259e+02 1.8372e+02 1.5723e+02
## 5 3.5996e+01 6.4405e+01 8.6797e+01
## 6 5.0685e+00 2.1035e+01 7.0444e+01
##
## units: NA
##
## Slot "stock.wt":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006      2007      2008      2009      2010      2011      2012
## 0 0.0097962 0.0111972 0.0099485 0.0107332 0.0100794 0.0090594 0.0122723
## 1 0.1385243 0.1465506 0.1437444 0.1460090 0.1336534 0.1469369 0.1404243
## 2 0.5227660 0.5264274 0.5163683 0.5108274 0.5129791 0.5053598 0.5024037
## 3 1.1715577 1.1825167 1.1354463 1.1593580 1.1450351 1.1673509 1.1375630

```

```

## 4 1.9157514 1.8273481 1.8831095 1.8759900 1.9165670 1.9015151 1.9288463
## 5 2.6205658 2.8217072 2.6853483 2.6349913 2.7660951 2.6874283 2.7865475
## 6 3.0005651 4.9239695 3.6367794 3.7139220 3.9833698 4.0459298 3.8248526
## year
## age 2013      2014
## 0 0.0112717 0.0091963
## 1 0.1468980 0.1544967
## 2 0.5469402 0.4646127
## 3 1.1530822 1.1471284
## 4 1.8358521 1.8486048
## 5 2.6033860 2.6832733
## 6 4.3827720 3.8651729
##
## units: kg
##
## Slot "m":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006      2007      2008      2009      2010      2011      2012      2013
## 0 1.16598 1.17944 1.17946 1.18589 1.16715 1.18240 1.17651 1.17923
## 1 0.57300 0.58483 0.58097 0.58199 0.57010 0.58148 0.57175 0.58332
## 2 0.43358 0.42889 0.42585 0.42665 0.42300 0.42596 0.42216 0.42493
## 3 0.36924 0.36101 0.36227 0.36534 0.36893 0.35964 0.36056 0.36332
## 4 0.33085 0.32538 0.32989 0.33276 0.33468 0.32642 0.32832 0.33127
## 5 0.32130 0.31785 0.31030 0.31912 0.31088 0.30655 0.31254 0.33417
## 6 0.29999 0.29584 0.29537 0.29791 0.29535 0.29706 0.29560 0.29862
## year
## age 2014
## 0 1.18751
## 1 0.57941
## 2 0.41521
## 3 0.35960
## 4 0.32681
## 5 0.30738
## 6 0.29966
##
## units: NA
##
## Slot "mat":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006      2007      2008      2009      2010      2011      2012      2013
## 0 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
## 1 0.22389 0.22937 0.23087 0.22959 0.21997 0.23263 0.22140 0.22809
## 2 0.89022 0.88628 0.88310 0.88439 0.88006 0.88317 0.87961 0.88248
## 3 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
## 4 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
## 5 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
## 6 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
## year

```

```

## age 2014
## 0 0.00000
## 1 0.22457
## 2 0.87454
## 3 1.00000
## 4 1.00000
## 5 1.00000
## 6 1.00000
##
## units: NA
##
## Slot "harvest":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006 2007 2008 2009 2010 2011 2012 2013
## 0 1.13415 1.01928 0.99222 1.23834 0.77784 1.18191 0.57419 0.62334
## 1 1.66835 1.95204 1.80097 1.50154 1.63635 1.90435 1.80930 1.63418
## 2 1.58623 1.01911 0.97755 0.82220 1.13050 1.06228 1.04471 0.93906
## 3 0.97446 0.74529 0.69796 0.66423 0.74702 0.94084 0.66821 0.53706
## 4 0.84428 0.55931 0.92253 0.67155 0.76029 1.21724 0.53426 0.41856
## 5 1.14067 0.25017 1.22111 1.07017 0.83187 2.05910 0.61022 0.24166
## 6 1.14067 0.25017 1.22111 1.07017 0.83187 2.05910 0.61022 0.24166
## year
## age 2014
## 0 0.79312
## 1 1.87788
## 2 1.20828
## 3 0.86571
## 4 0.35229
## 5 0.39061
## 6 0.39061
##
## units: f
##
## Slot "harvest.spwn":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## 0 0 0 0 0 0 0 0 0
## 1 0 0 0 0 0 0 0 0 0
## 2 0 0 0 0 0 0 0 0 0
## 3 0 0 0 0 0 0 0 0 0
## 4 0 0 0 0 0 0 0 0 0
## 5 0 0 0 0 0 0 0 0 0
## 6 0 0 0 0 0 0 0 0 0
##
## units: NA
##
## Slot "m.spwn":
## An object of class "FLQuant"

```

```

## , , unit = unique, season = all, area = unique
##
##   year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
##   0 0    0    0    0    0    0    0    0    0
##   1 0    0    0    0    0    0    0    0    0
##   2 0    0    0    0    0    0    0    0    0
##   3 0    0    0    0    0    0    0    0    0
##   4 0    0    0    0    0    0    0    0    0
##   5 0    0    0    0    0    0    0    0    0
##   6 0    0    0    0    0    0    0    0    0
##
## units: NA
##
## Slot "name":
## [1] "Index File; HKE GSA 10\t"
##
## Slot "desc":
## [1] "Imported from a VPA file. ( HKE10.IND ).  Wed Jul 12 09:23:47 2017 + FLAssess: "
##
## Slot "range":
##      min      max plusgroup  minyear  maxyear  minfbar  maxfbar
##      0        6        6      2006      2014        0        3
##
##
## [[5]]
## An object of class "FLStock"
## Slot "catch":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## all 4656.5 3829.7 3405.5 3664.3 3384.1 3757.4 2640.7 2895.4 3074.7
##
## units: NA
##
## Slot "catch.n":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006      2007      2008      2009      2010      2011
##   0 8.2424e+04 6.2020e+04 6.5121e+04 9.1660e+04 4.2494e+04 6.6748e+04
##   1 1.4603e+04 1.3976e+04 1.2123e+04 1.2360e+04 1.2523e+04 1.2820e+04
##   2 2.2993e+03 1.3141e+03 8.7033e+02 8.1216e+02 1.4515e+03 1.2039e+03
##   3 2.9858e+02 2.0899e+02 2.5103e+02 1.7153e+02 2.2510e+02 2.8533e+02
##   4 1.0297e+02 5.4785e+01 8.0515e+01 8.5904e+01 6.8254e+01 1.0077e+02
##   5 2.9440e+01 1.2424e+01 3.7507e+01 2.5232e+01 3.6735e+01 3.7943e+01
##   6 1.0011e-03 2.6453e+00 7.7576e+00 9.2521e+00 1.1873e+01 8.3724e+00
##   year
## age 2012      2013      2014
##   0 2.9969e+04 2.6054e+04 4.2564e+04
##   1 1.0271e+04 1.2899e+04 1.0589e+04

```

```

## 2 8.8035e+02 7.4427e+02 1.3310e+03
## 3 2.0918e+02 1.3405e+02 1.8698e+02
## 4 5.3596e+01 5.3242e+01 3.9646e+01
## 5 1.4063e+01 1.1699e+01 2.4068e+01
## 6 2.0197e+00 3.8645e+00 1.9806e+01
##
## units: 10^3
##
## Slot "catch.wt":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006      2007      2008      2009      2010      2011      2012
## 0 0.0097962 0.0111972 0.0099485 0.0107332 0.0100794 0.0090594 0.0122723
## 1 0.1385243 0.1465506 0.1437444 0.1460090 0.1336534 0.1469369 0.1404243
## 2 0.5227660 0.5264274 0.5163683 0.5108274 0.5129791 0.5053598 0.5024037
## 3 1.1715577 1.1825167 1.1354463 1.1593580 1.1450351 1.1673509 1.1375630
## 4 1.9157514 1.8273481 1.8831095 1.8759900 1.9165670 1.9015151 1.9288463
## 5 2.6205658 2.8217072 2.6853483 2.6349913 2.7660951 2.6874283 2.7865475
## 6 3.0005651 4.9239695 3.6367794 3.7139220 3.9833698 4.0459298 3.8248526
##      year
## age 2013      2014
## 0 0.0112717 0.0091963
## 1 0.1468980 0.1544967
## 2 0.5469402 0.4646127
## 3 1.1530822 1.1471284
## 4 1.8358521 1.8486048
## 5 2.6033860 2.6832733
## 6 4.3827720 3.8651729
##
## units: NA
##
## Slot "discards":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## all NA  NA  NA  NA  NA  NA  NA  NA  NA
##
## units: NA
##
## Slot "discards.n":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## 0 0 0 0 0 0 0 0 0
## 1 0 0 0 0 0 0 0 0 0
## 2 0 0 0 0 0 0 0 0 0
## 3 0 0 0 0 0 0 0 0 0
## 4 0 0 0 0 0 0 0 0 0

```

```

##      5 0      0      0      0      0      0      0      0      0
##      6 0      0      0      0      0      0      0      0      0
##
## units:  NA
##
## Slot "discards.wt":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
##    0 NA   NA   NA   NA   NA   NA   NA   NA   NA
##    1 NA   NA   NA   NA   NA   NA   NA   NA   NA
##    2 NA   NA   NA   NA   NA   NA   NA   NA   NA
##    3 NA   NA   NA   NA   NA   NA   NA   NA   NA
##    4 NA   NA   NA   NA   NA   NA   NA   NA   NA
##    5 NA   NA   NA   NA   NA   NA   NA   NA   NA
##    6 0     0     0     0     0     0     0     0     0
##
## units:  NA
##
## Slot "landings":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## all 4656.5 3829.7 3405.5 3664.3 3384.1 3757.4 2640.7 2895.4 3074.7
##
## units:  t
##
## Slot "landings.n":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006      2007      2008      2009      2010      2011
##    0 8.2424e+04 6.2020e+04 6.5121e+04 9.1660e+04 4.2494e+04 6.6748e+04
##    1 1.4603e+04 1.3976e+04 1.2123e+04 1.2360e+04 1.2523e+04 1.2820e+04
##    2 2.2993e+03 1.3141e+03 8.7033e+02 8.1216e+02 1.4515e+03 1.2039e+03
##    3 2.9858e+02 2.0899e+02 2.5103e+02 1.7153e+02 2.2510e+02 2.8533e+02
##    4 1.0297e+02 5.4785e+01 8.0515e+01 8.5904e+01 6.8254e+01 1.0077e+02
##    5 2.9440e+01 1.2424e+01 3.7507e+01 2.5232e+01 3.6735e+01 3.7943e+01
##    6 1.0011e-03 2.6453e+00 7.7576e+00 9.2521e+00 1.1873e+01 8.3724e+00
##      year
## age 2012      2013      2014
##    0 2.9969e+04 2.6054e+04 4.2564e+04
##    1 1.0271e+04 1.2899e+04 1.0589e+04
##    2 8.8035e+02 7.4427e+02 1.3310e+03
##    3 2.0918e+02 1.3405e+02 1.8698e+02
##    4 5.3596e+01 5.3242e+01 3.9646e+01
##    5 1.4063e+01 1.1699e+01 2.4068e+01
##    6 2.0197e+00 3.8645e+00 1.9806e+01
##

```

```

## units: NA
##
## Slot "landings.wt":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006      2007      2008      2009      2010      2011      2012
##   0 0.0097962 0.0111972 0.0099485 0.0107332 0.0100794 0.0090594 0.0122723
##   1 0.1385243 0.1465506 0.1437444 0.1460090 0.1336534 0.1469369 0.1404243
##   2 0.5227660 0.5264274 0.5163683 0.5108274 0.5129791 0.5053598 0.5024037
##   3 1.1715577 1.1825167 1.1354463 1.1593580 1.1450351 1.1673509 1.1375630
##   4 1.9157514 1.8273481 1.8831095 1.8759900 1.9165670 1.9015151 1.9288463
##   5 2.6205658 2.8217072 2.6853483 2.6349913 2.7660951 2.6874283 2.7865475
##   6 3.0005651 4.9239695 3.6367794 3.7139220 3.9833698 4.0459298 3.8248526
##      year
## age 2013      2014
##   0 0.0112717 0.0091963
##   1 0.1468980 0.1544967
##   2 0.5469402 0.4646127
##   3 1.1530822 1.1471284
##   4 1.8358521 1.8486048
##   5 2.6033860 2.6832733
##   6 4.3827720 3.8651729
##
## units: NA
##
## Slot "stock":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age  2006 2007 2008 2009 2010 2011 2012 2013 2014
## all NA   NA   NA   NA   NA   NA   NA   NA   NA
##
## units: NA
##
## Slot "stock.n":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006      2007      2008      2009      2010      2011
##   0 2.1768e+05 1.7503e+05 1.8670e+05 2.3360e+05 1.4095e+05 1.7390e+05
##   1 2.3978e+04 2.1821e+04 1.9423e+04 2.1291e+04 2.0697e+04 2.0163e+04
##   2 3.5942e+03 2.5545e+03 1.7264e+03 1.7977e+03 2.6575e+03 2.2870e+03
##   3 5.7906e+02 4.7855e+02 6.0311e+02 4.2430e+02 5.1717e+02 5.6607e+02
##   4 2.1793e+02 1.5204e+02 1.5906e+02 2.1038e+02 1.5155e+02 1.7043e+02
##   5 5.2058e+01 6.9270e+01 6.3250e+01 4.6094e+01 7.8093e+01 5.0710e+01
##   6 1.7133e-03 1.4596e+01 1.2651e+01 1.6389e+01 2.4634e+01 1.0619e+01
##      year
## age 2012      2013      2014
##   0 1.2354e+05 1.0127e+05 1.4080e+05
##   1 1.6352e+04 2.1453e+04 1.6693e+04

```

```

## 2 1.6866e+03 1.5135e+03 2.3354e+03
## 3 5.2083e+02 3.9295e+02 3.8776e+02
## 4 1.5671e+02 1.8850e+02 1.6146e+02
## 5 3.7371e+01 6.7369e+01 9.0229e+01
## 6 5.2661e+00 2.2010e+01 7.3262e+01
##
## units: NA
##
## Slot "stock.wt":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006      2007      2008      2009      2010      2011      2012
## 0 0.0097962 0.0111972 0.0099485 0.0107332 0.0100794 0.0090594 0.0122723
## 1 0.1385243 0.1465506 0.1437444 0.1460090 0.1336534 0.1469369 0.1404243
## 2 0.5227660 0.5264274 0.5163683 0.5108274 0.5129791 0.5053598 0.5024037
## 3 1.1715577 1.1825167 1.1354463 1.1593580 1.1450351 1.1673509 1.1375630
## 4 1.9157514 1.8273481 1.8831095 1.8759900 1.9165670 1.9015151 1.9288463
## 5 2.6205658 2.8217072 2.6853483 2.6349913 2.7660951 2.6874283 2.7865475
## 6 3.0005651 4.9239695 3.6367794 3.7139220 3.9833698 4.0459298 3.8248526
## year
## age 2013      2014
## 0 0.0112717 0.0091963
## 1 0.1468980 0.1544967
## 2 0.5469402 0.4646127
## 3 1.1530822 1.1471284
## 4 1.8358521 1.8486048
## 5 2.6033860 2.6832733
## 6 4.3827720 3.8651729
##
## units: kg
##
## Slot "m":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006      2007      2008      2009      2010      2011      2012      2013
## 0 1.16598 1.17944 1.17946 1.18589 1.16715 1.18240 1.17651 1.17923
## 1 0.57300 0.58483 0.58097 0.58199 0.57010 0.58148 0.57175 0.58332
## 2 0.43358 0.42889 0.42585 0.42665 0.42300 0.42596 0.42216 0.42493
## 3 0.36924 0.36101 0.36227 0.36534 0.36893 0.35964 0.36056 0.36332
## 4 0.33085 0.32538 0.32989 0.33276 0.33468 0.32642 0.32832 0.33127
## 5 0.32130 0.31785 0.31030 0.31912 0.31088 0.30655 0.31254 0.33417
## 6 0.29999 0.29584 0.29537 0.29791 0.29535 0.29706 0.29560 0.29862
## year
## age 2014
## 0 1.18751
## 1 0.57941
## 2 0.41521
## 3 0.35960
## 4 0.32681
## 5 0.30738

```



```

## 6 0.29966
##
## units: NA
##
## Slot "mat":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006 2007 2008 2009 2010 2011 2012 2013
## 0 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
## 1 0.22389 0.22937 0.23087 0.22959 0.21997 0.23263 0.22140 0.22809
## 2 0.89022 0.88628 0.88310 0.88439 0.88006 0.88317 0.87961 0.88248
## 3 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
## 4 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
## 5 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
## 6 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
## year
## age 2014
## 0 0.00000
## 1 0.22457
## 2 0.87454
## 3 1.00000
## 4 1.00000
## 5 1.00000
## 6 1.00000
##
## units: NA
##
## Slot "harvest":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006 2007 2008 2009 2010 2011 2012 2013
## 0 1.13415 1.01904 0.99175 1.23770 0.77739 1.18175 0.57421 0.62355
## 1 1.66629 1.95202 1.79901 1.49891 1.63265 1.89966 1.80813 1.63436
## 2 1.58274 1.01462 0.97751 0.81921 1.12342 1.05363 1.03462 0.93688
## 3 0.96804 0.74046 0.69091 0.66416 0.74112 0.92470 0.65578 0.52611
## 4 0.81532 0.55165 0.90873 0.65826 0.76014 1.19100 0.51589 0.40547
## 5 1.09088 0.23604 1.17937 1.02751 0.79743 2.05711 0.57976 0.22971
## 6 1.09088 0.23604 1.17937 1.02751 0.79743 2.05711 0.57976 0.22971
## year
## age 2014
## 0 0.79276
## 1 1.88043
## 2 1.20880
## 3 0.86080
## 4 0.34128
## 5 0.37260
## 6 0.37260
##
## units: f
##

```

```

## Slot "harvest.spwn":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
##   0 0    0    0    0    0    0    0    0    0
##   1 0    0    0    0    0    0    0    0    0
##   2 0    0    0    0    0    0    0    0    0
##   3 0    0    0    0    0    0    0    0    0
##   4 0    0    0    0    0    0    0    0    0
##   5 0    0    0    0    0    0    0    0    0
##   6 0    0    0    0    0    0    0    0    0
##
## units:  NA
##
## Slot "m.spwn":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
##   0 0    0    0    0    0    0    0    0    0
##   1 0    0    0    0    0    0    0    0    0
##   2 0    0    0    0    0    0    0    0    0
##   3 0    0    0    0    0    0    0    0    0
##   4 0    0    0    0    0    0    0    0    0
##   5 0    0    0    0    0    0    0    0    0
##   6 0    0    0    0    0    0    0    0    0
##
## units:  NA
##
## Slot "name":
## [1] "Index File; HKE GSA 10\t"
##
## Slot "desc":
## [1] "Imported from a VPA file. ( HKE10.IND ).  Wed Jul 12 09:23:47 2017 + FLAssess: "
##
## Slot "range":
##      min      max plusgroup  minyear  maxyear  minfbar  maxfbar
##      0        6          6    2006     2014      0        3
##
## [[6]]
## An object of class "FLStock"
## Slot "catch":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
##   all 4656.5 3829.7 3405.5 3664.3 3384.1 3757.4 2640.7 2895.4 3074.7
##
## units:  NA

```

```

##
## Slot "catch.n":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006      2007      2008      2009      2010      2011
##   0 8.2424e+04 6.2020e+04 6.5121e+04 9.1660e+04 4.2494e+04 6.6748e+04
##   1 1.4603e+04 1.3976e+04 1.2123e+04 1.2360e+04 1.2523e+04 1.2820e+04
##   2 2.2993e+03 1.3141e+03 8.7033e+02 8.1216e+02 1.4515e+03 1.2039e+03
##   3 2.9858e+02 2.0899e+02 2.5103e+02 1.7153e+02 2.2510e+02 2.8533e+02
##   4 1.0297e+02 5.4785e+01 8.0515e+01 8.5904e+01 6.8254e+01 1.0077e+02
##   5 2.9440e+01 1.2424e+01 3.7507e+01 2.5232e+01 3.6735e+01 3.7943e+01
##   6 1.0011e-03 2.6453e+00 7.7576e+00 9.2521e+00 1.1873e+01 8.3724e+00
##   year
## age 2012      2013      2014
##   0 2.9969e+04 2.6054e+04 4.2564e+04
##   1 1.0271e+04 1.2899e+04 1.0589e+04
##   2 8.8035e+02 7.4427e+02 1.3310e+03
##   3 2.0918e+02 1.3405e+02 1.8698e+02
##   4 5.3596e+01 5.3242e+01 3.9646e+01
##   5 1.4063e+01 1.1699e+01 2.4068e+01
##   6 2.0197e+00 3.8645e+00 1.9806e+01
##
## units: 10^3
##
## Slot "catch.wt":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006      2007      2008      2009      2010      2011      2012
##   0 0.0097962 0.0111972 0.0099485 0.0107332 0.0100794 0.0090594 0.0122723
##   1 0.1385243 0.1465506 0.1437444 0.1460090 0.1336534 0.1469369 0.1404243
##   2 0.5227660 0.5264274 0.5163683 0.5108274 0.5129791 0.5053598 0.5024037
##   3 1.1715577 1.1825167 1.1354463 1.1593580 1.1450351 1.1673509 1.1375630
##   4 1.9157514 1.8273481 1.8831095 1.8759900 1.9165670 1.9015151 1.9288463
##   5 2.6205658 2.8217072 2.6853483 2.6349913 2.7660951 2.6874283 2.7865475
##   6 3.0005651 4.9239695 3.6367794 3.7139220 3.9833698 4.0459298 3.8248526
##   year
## age 2013      2014
##   0 0.0112717 0.0091963
##   1 0.1468980 0.1544967
##   2 0.5469402 0.4646127
##   3 1.1530822 1.1471284
##   4 1.8358521 1.8486048
##   5 2.6033860 2.6832733
##   6 4.3827720 3.8651729
##
## units: NA
##
## Slot "discards":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique

```

```

##
##      year
## age  2006 2007 2008 2009 2010 2011 2012 2013 2014
##   all NA   NA   NA   NA   NA   NA   NA   NA   NA
##
## units:  NA
##
## Slot "discards.n":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
##   0 0    0    0    0    0    0    0    0    0
##   1 0    0    0    0    0    0    0    0    0
##   2 0    0    0    0    0    0    0    0    0
##   3 0    0    0    0    0    0    0    0    0
##   4 0    0    0    0    0    0    0    0    0
##   5 0    0    0    0    0    0    0    0    0
##   6 0    0    0    0    0    0    0    0    0
##
## units:  NA
##
## Slot "discards.wt":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
##   0 NA   NA   NA   NA   NA   NA   NA   NA   NA
##   1 NA   NA   NA   NA   NA   NA   NA   NA   NA
##   2 NA   NA   NA   NA   NA   NA   NA   NA   NA
##   3 NA   NA   NA   NA   NA   NA   NA   NA   NA
##   4 NA   NA   NA   NA   NA   NA   NA   NA   NA
##   5 NA   NA   NA   NA   NA   NA   NA   NA   NA
##   6 0    0    0    0    0    0    0    0    0
##
## units:  NA
##
## Slot "landings":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age  2006   2007   2008   2009   2010   2011   2012   2013   2014
##   all 4656.5 3829.7 3405.5 3664.3 3384.1 3757.4 2640.7 2895.4 3074.7
##
## units:  t
##
## Slot "landings.n":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year

```

```

## age 2006      2007      2008      2009      2010      2011
## 0 8.2424e+04 6.2020e+04 6.5121e+04 9.1660e+04 4.2494e+04 6.6748e+04
## 1 1.4603e+04 1.3976e+04 1.2123e+04 1.2360e+04 1.2523e+04 1.2820e+04
## 2 2.2993e+03 1.3141e+03 8.7033e+02 8.1216e+02 1.4515e+03 1.2039e+03
## 3 2.9858e+02 2.0899e+02 2.5103e+02 1.7153e+02 2.2510e+02 2.8533e+02
## 4 1.0297e+02 5.4785e+01 8.0515e+01 8.5904e+01 6.8254e+01 1.0077e+02
## 5 2.9440e+01 1.2424e+01 3.7507e+01 2.5232e+01 3.6735e+01 3.7943e+01
## 6 1.0011e-03 2.6453e+00 7.7576e+00 9.2521e+00 1.1873e+01 8.3724e+00
## year
## age 2012      2013      2014
## 0 2.9969e+04 2.6054e+04 4.2564e+04
## 1 1.0271e+04 1.2899e+04 1.0589e+04
## 2 8.8035e+02 7.4427e+02 1.3310e+03
## 3 2.0918e+02 1.3405e+02 1.8698e+02
## 4 5.3596e+01 5.3242e+01 3.9646e+01
## 5 1.4063e+01 1.1699e+01 2.4068e+01
## 6 2.0197e+00 3.8645e+00 1.9806e+01
##
## units: NA
##
## Slot "landings.wt":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006      2007      2008      2009      2010      2011      2012
## 0 0.0097962 0.0111972 0.0099485 0.0107332 0.0100794 0.0090594 0.0122723
## 1 0.1385243 0.1465506 0.1437444 0.1460090 0.1336534 0.1469369 0.1404243
## 2 0.5227660 0.5264274 0.5163683 0.5108274 0.5129791 0.5053598 0.5024037
## 3 1.1715577 1.1825167 1.1354463 1.1593580 1.1450351 1.1673509 1.1375630
## 4 1.9157514 1.8273481 1.8831095 1.8759900 1.9165670 1.9015151 1.9288463
## 5 2.6205658 2.8217072 2.6853483 2.6349913 2.7660951 2.6874283 2.7865475
## 6 3.0005651 4.9239695 3.6367794 3.7139220 3.9833698 4.0459298 3.8248526
## year
## age 2013      2014
## 0 0.0112717 0.0091963
## 1 0.1468980 0.1544967
## 2 0.5469402 0.4646127
## 3 1.1530822 1.1471284
## 4 1.8358521 1.8486048
## 5 2.6033860 2.6832733
## 6 4.3827720 3.8651729
##
## units: NA
##
## Slot "stock":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## all NA NA NA NA NA NA NA NA NA
##
## units: NA

```

```

##
## Slot "stock.n":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006      2007      2008      2009      2010      2011
##   0 2.1768e+05 1.7504e+05 1.8673e+05 2.3364e+05 1.4098e+05 1.7391e+05
##   1 2.3986e+04 2.1822e+04 1.9428e+04 2.1302e+04 2.0710e+04 2.0173e+04
##   2 3.5965e+03 2.5589e+03 1.7266e+03 1.8004e+03 2.6634e+03 2.2940e+03
##   3 5.8070e+02 4.8004e+02 6.0598e+02 4.2442e+02 5.1897e+02 5.6990e+02
##   4 2.2104e+02 1.5317e+02 1.6010e+02 2.1238e+02 1.5163e+02 1.7168e+02
##   5 5.2912e+01 7.1501e+01 6.4069e+01 4.6839e+01 7.9525e+01 5.0768e+01
##   6 1.7428e-03 1.5069e+01 1.2823e+01 1.6665e+01 2.5099e+01 1.0633e+01
##   year
## age 2012      2013      2014
##   0 1.2354e+05 1.0125e+05 1.4082e+05
##   1 1.6354e+04 2.1453e+04 1.6689e+04
##   2 1.6923e+03 1.5150e+03 2.3354e+03
##   3 5.2536e+02 3.9668e+02 3.8875e+02
##   4 1.5938e+02 1.9165e+02 1.6406e+02
##   5 3.8271e+01 6.9292e+01 9.2493e+01
##   6 5.3954e+00 2.2643e+01 7.5122e+01
##
## units:  NA
##
## Slot "stock.wt":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006      2007      2008      2009      2010      2011      2012
##   0 0.0097962 0.0111972 0.0099485 0.0107332 0.0100794 0.0090594 0.0122723
##   1 0.1385243 0.1465506 0.1437444 0.1460090 0.1336534 0.1469369 0.1404243
##   2 0.5227660 0.5264274 0.5163683 0.5108274 0.5129791 0.5053598 0.5024037
##   3 1.1715577 1.1825167 1.1354463 1.1593580 1.1450351 1.1673509 1.1375630
##   4 1.9157514 1.8273481 1.8831095 1.8759900 1.9165670 1.9015151 1.9288463
##   5 2.6205658 2.8217072 2.6853483 2.6349913 2.7660951 2.6874283 2.7865475
##   6 3.0005651 4.9239695 3.6367794 3.7139220 3.9833698 4.0459298 3.8248526
##   year
## age 2013      2014
##   0 0.0112717 0.0091963
##   1 0.1468980 0.1544967
##   2 0.5469402 0.4646127
##   3 1.1530822 1.1471284
##   4 1.8358521 1.8486048
##   5 2.6033860 2.6832733
##   6 4.3827720 3.8651729
##
## units:  kg
##
## Slot "m":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique

```

```

##
##   year
## age 2006    2007    2008    2009    2010    2011    2012    2013
##   0 1.16598 1.17944 1.17946 1.18589 1.16715 1.18240 1.17651 1.17923
##   1 0.57300 0.58483 0.58097 0.58199 0.57010 0.58148 0.57175 0.58332
##   2 0.43358 0.42889 0.42585 0.42665 0.42300 0.42596 0.42216 0.42493
##   3 0.36924 0.36101 0.36227 0.36534 0.36893 0.35964 0.36056 0.36332
##   4 0.33085 0.32538 0.32989 0.33276 0.33468 0.32642 0.32832 0.33127
##   5 0.32130 0.31785 0.31030 0.31912 0.31088 0.30655 0.31254 0.33417
##   6 0.29999 0.29584 0.29537 0.29791 0.29535 0.29706 0.29560 0.29862
##   year
## age 2014
##   0 1.18751
##   1 0.57941
##   2 0.41521
##   3 0.35960
##   4 0.32681
##   5 0.30738
##   6 0.29966
##
## units: NA
##
## Slot "mat":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006    2007    2008    2009    2010    2011    2012    2013
##   0 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
##   1 0.22389 0.22937 0.23087 0.22959 0.21997 0.23263 0.22140 0.22809
##   2 0.89022 0.88628 0.88310 0.88439 0.88006 0.88317 0.87961 0.88248
##   3 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
##   4 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
##   5 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
##   6 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
##   year
## age 2014
##   0 0.00000
##   1 0.22457
##   2 0.87454
##   3 1.00000
##   4 1.00000
##   5 1.00000
##   6 1.00000
##
## units: NA
##
## Slot "harvest":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##   year
## age 2006    2007    2008    2009    2010    2011    2012    2013
##   0 1.13414 1.01887 0.99144 1.23728 0.77712 1.18164 0.57421 0.62366

```

```

## 1 1.66489 1.95193 1.79773 1.49720 1.63021 1.89679 1.80730 1.63434
## 2 1.58028 1.01160 0.97734 0.81727 1.11888 1.04800 1.02854 0.93533
## 3 0.96344 0.73707 0.68621 0.66390 0.73731 0.91454 0.64783 0.51962
## 4 0.79776 0.54621 0.89918 0.64953 0.75952 1.17450 0.50464 0.39727
## 5 1.05945 0.22776 1.15099 0.99936 0.77570 2.04930 0.56146 0.22256
## 6 1.05945 0.22776 1.15099 0.99936 0.77570 2.04930 0.56146 0.22256
## year
## age 2014
## 0 0.79254
## 1 1.88179
## 2 1.20874
## 3 0.85735
## 4 0.33486
## 5 0.36160
## 6 0.36160
##
## units: f
##
## Slot "harvest.spwn":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## 0 0 0 0 0 0 0 0 0
## 1 0 0 0 0 0 0 0 0 0
## 2 0 0 0 0 0 0 0 0 0
## 3 0 0 0 0 0 0 0 0 0
## 4 0 0 0 0 0 0 0 0 0
## 5 0 0 0 0 0 0 0 0 0
## 6 0 0 0 0 0 0 0 0 0
##
## units: NA
##
## Slot "m.spwn":
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006 2007 2008 2009 2010 2011 2012 2013 2014
## 0 0 0 0 0 0 0 0 0
## 1 0 0 0 0 0 0 0 0 0
## 2 0 0 0 0 0 0 0 0 0
## 3 0 0 0 0 0 0 0 0 0
## 4 0 0 0 0 0 0 0 0 0
## 5 0 0 0 0 0 0 0 0 0
## 6 0 0 0 0 0 0 0 0 0
##
## units: NA
##
## Slot "name":
## [1] "Index File; HKE GSA 10\t"
##
## Slot "desc":

```



```
## [1] "Imported from a VPA file. ( HKE10.IND ).  Wed Jul 12 09:23:47 2017 + FLAssess: "
##
## Slot "range":
##      min      max plusgroup  minyear  maxyear  minfbar  maxfbar
##      0       6       6      2006    2014       0       3
plot(FLStocks(XSA_f))

## Warning in .local(x, ...): Duplicated names in object, changed to
## differentiate

## Warning in grid.Call(L_stringMetric, as.graphicsAnnot(x$label)): font
## metrics unknown for character 0x9

## Warning in grid.Call(L_stringMetric, as.graphicsAnnot(x$label)): font width
## unknown for character 0x9

## Warning in grid.Call(L_stringMetric, as.graphicsAnnot(x$label)): font
## metrics unknown for character 0x9

## Warning in grid.Call(L_stringMetric, as.graphicsAnnot(x$label)): font width
## unknown for character 0x9

## Warning in grid.Call(L_stringMetric, as.graphicsAnnot(x$label)): font
## metrics unknown for character 0x9

## Warning in grid.Call(L_stringMetric, as.graphicsAnnot(x$label)): font width
## unknown for character 0x9

## Warning in grid.Call(L_stringMetric, as.graphicsAnnot(x$label)): font
## metrics unknown for character 0x9

## Warning in grid.Call(L_stringMetric, as.graphicsAnnot(x$label)): font width
## unknown for character 0x9

## Warning in grid.Call(L_stringMetric, as.graphicsAnnot(x$label)): font
## metrics unknown for character 0x9

## Warning in grid.Call(L_stringMetric, as.graphicsAnnot(x$label)): font width
## unknown for character 0x9

## Warning in grid.Call(L_stringMetric, as.graphicsAnnot(x$label)): font
## metrics unknown for character 0x9

## Warning in grid.Call(L_stringMetric, as.graphicsAnnot(x$label)): font width
## unknown for character 0x9

## Warning in grid.Call(L_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## font width unknown for character 0x9

## Warning in grid.Call(L_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## font width unknown for character 0x9

## Warning in grid.Call(L_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## font width unknown for character 0x9

## Warning in grid.Call(L_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## font width unknown for character 0x9

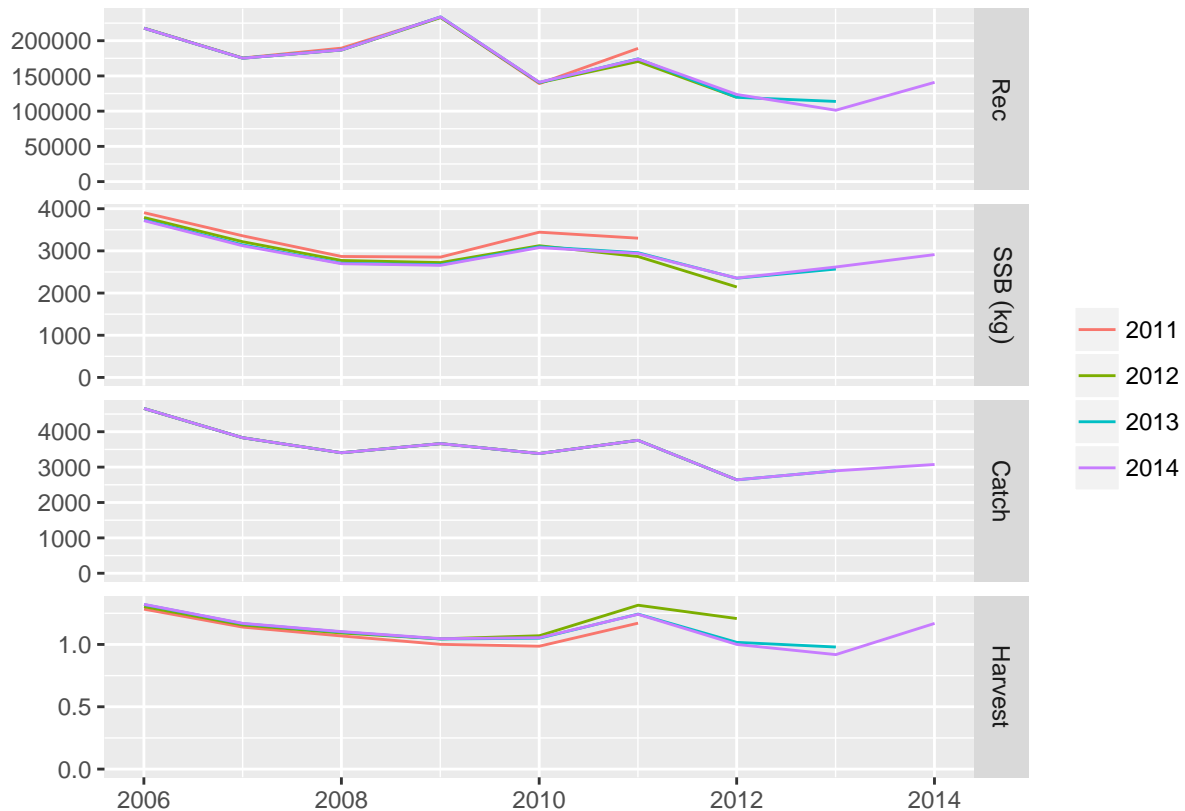
## Warning in grid.Call(L_textBounds, as.graphicsAnnot(x$label), x$x, x$y, :
## font width unknown for character 0x9
```

[illegible]



*# An important diagnostic check is to see how the estimated values vary as the time series  
# of the input data changes.  
# We can make use of existing R functions to apply the same assessment model to successively  
# truncated the time series of input data. In this example we are using window to truncate  
# the FLStock object to the specified year range, the + operator to pass the results of the XSA  
# into the FLStock object and the tapply function to perform this action over the year range 2011:2014.  
# Note that the resulting object, called stk.retro, is of class FLStocks  
# i.e. a list of FLStock objects, each one having a separate year range*

```
## Retrospective analysis ##
retro.years <- 2011:2014# retro years range
stk.retro <- tapply(retro.years,1:length(retro.years),function(x)
  return(window(HKE.new_xsa,end=x)+FLXSA(window(HKE.new_xsa,end=x),HKE.idx, FLXSA.control)))
stk.retro<- FLStocks(stk.retro)
# stk.retro@names=c("2013","2014","2015")
stk.retro@names=ac(unique(retro.years))
plot(stk.retro)
```



```
#####
##### EXERCISE 3 #####
#### Run XSA with different Fcontrol settings and compare results ####
#####
```

```
#####
##### EXERCISE 4 #####
#### Run XSA with different Fcontrol settings and based on
# diagnostics choose the best model ####
#####
```

```
##### FINAL OUTPUTS #####
(TOTAL_BIOMASS=quantSums(stock.n(HKE.new_xsa)*stock.wt(HKE.new_xsa)))
```

```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age  2006   2007   2008   2009   2010   2011   2012   2013   2014
## all 8640.2 7702.7 6810.1 7675.3 6829.9 6931.5 5767.7 6296.2 6345.7
##
## units: kg
```

```
(TOTAL_CATCH=quantSums(catch.n(HKE.new_xsa)*catch.wt(HKE.new_xsa)))
```

```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age  2006   2007   2008   2009   2010   2011   2012   2013   2014
##   all 4656.5 3829.7 3405.5 3664.3 3384.1 3757.4 2640.7 2895.4 3074.7
##
## units: 1000
```

```
(SSB=ssb(HKE.new_xsa))
```

```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age  2006   2007   2008   2009   2010   2011   2012   2013   2014
##   all 3716.8 3121.0 2695.7 2657.3 3077.7 2940.6 2355.4 2618.3 2911.4
##
## units: kg
```

```
(RECRUITS=rec(HKE.new_xsa))
```

```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006   2007   2008   2009   2010   2011   2012   2013   2014
##    0 217732 175119 186877 233825 141055 174001 123684 101295 140914
##
## units: NA
```

```
(FISHING_MORTALITY=fbar(HKE.new_xsa))
```

```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age  2006   2007   2008   2009   2010   2011   2012   2013
##   all 1.32180 1.16916 1.10318 1.04618 1.05383 1.24175 0.99996 0.91843
##      year
## age  2014
##   all 1.16887
##
## units: f
```

```
(FISHING_MORTALITY_AGE=harvest(HKE.new_xsa))
```

```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age 2006   2007   2008   2009   2010   2011   2012   2013
##    0 1.13364 1.01811 0.99012 1.23532 0.77651 1.18041 0.57331 0.62331
##    1 1.65744 1.94750 1.79173 1.48998 1.61893 1.89038 1.79834 1.62589
##    2 1.56415 0.99569 0.96884 0.80824 1.09994 1.02250 1.01510 0.91896
```

```
## 3 0.93196 0.71535 0.66204 0.65120 0.71992 0.87371 0.61309 0.50556
## 4 0.73898 0.51045 0.84087 0.60648 0.73036 1.10319 0.46175 0.36294
## 5 0.91471 0.20154 0.98511 0.84756 0.67732 1.73793 0.48911 0.19650
## 6 0.91471 0.20154 0.98511 0.84756 0.67732 1.73793 0.48911 0.19650
## year
## age 2014
## 0 0.79176
## 1 1.87754
## 2 1.18447
## 3 0.82170
## 4 0.32126
## 5 0.31774
## 6 0.31774
##
## units: f
```

```
(TOTAL_MORTALITY=z(HKE.new_xsa))
```

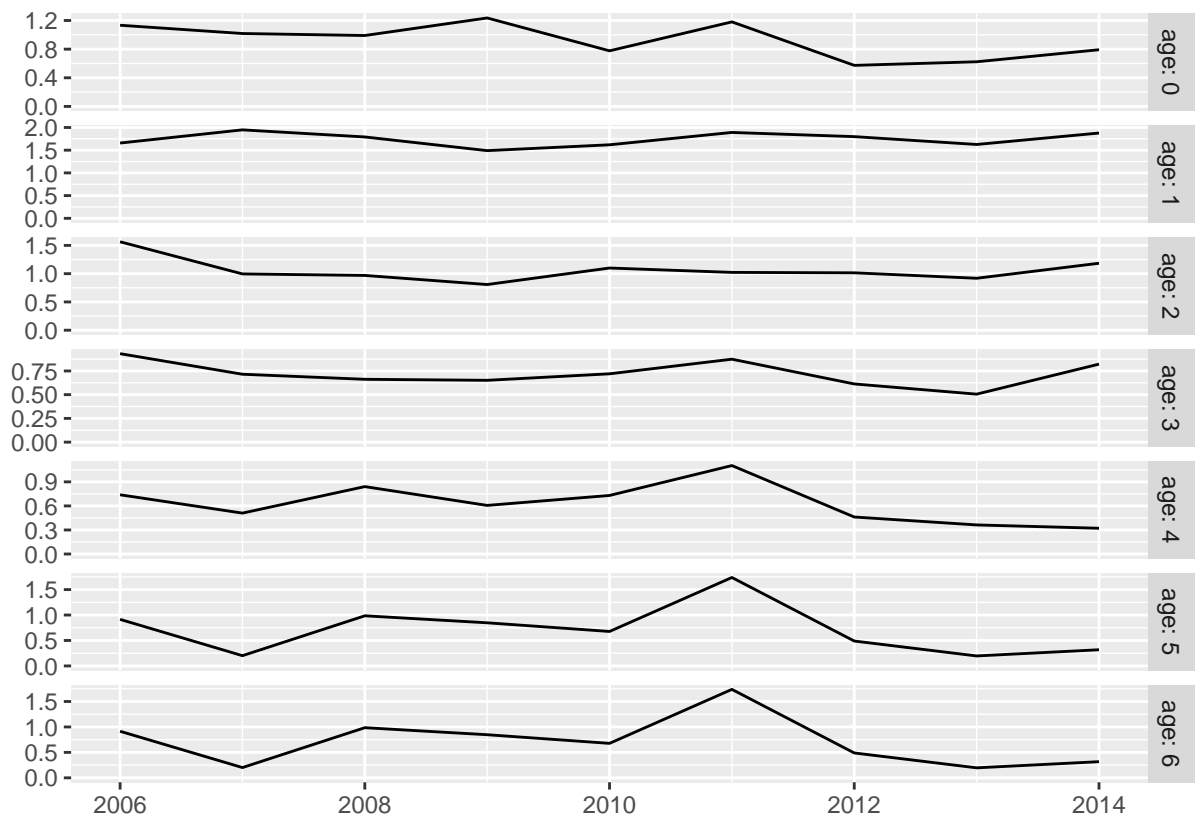
```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006 2007 2008 2009 2010 2011 2012 2013
## 0 2.29962 2.19755 2.16958 2.42121 1.94365 2.36281 1.74981 1.80254
## 1 2.23044 2.53233 2.37270 2.07196 2.18903 2.47186 2.37009 2.20921
## 2 1.99773 1.42457 1.39469 1.23490 1.52295 1.44845 1.43726 1.34389
## 3 1.30121 1.07636 1.02431 1.01653 1.08885 1.23335 0.97366 0.86888
## 4 1.06983 0.83583 1.17077 0.93925 1.06504 1.42961 0.79007 0.69422
## 5 1.23601 0.51939 1.29541 1.16668 0.98820 2.04449 0.80165 0.53067
## 6 1.21470 0.49738 1.28048 1.14546 0.97267 2.03499 0.78472 0.49512
## year
## age 2014
## 0 1.97927
## 1 2.45695
## 2 1.59968
## 3 1.18130
## 4 0.64806
## 5 0.62512
## 6 0.61740
##
## units: NC
```

```
(STOCK_NB=stock.n(HKE.new_xsa))
```

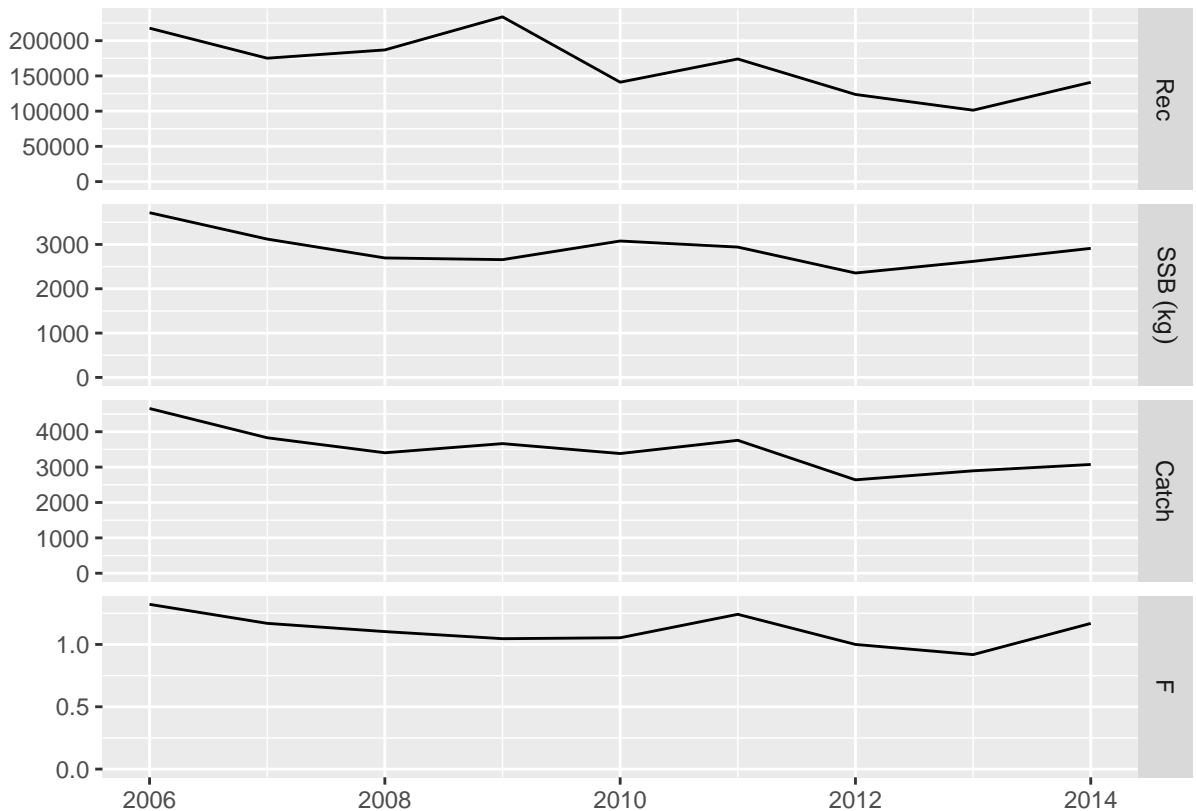
```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
## year
## age 2006 2007 2008 2009 2010 2011
## 0 2.1773e+05 1.7512e+05 1.8688e+05 2.3382e+05 1.4105e+05 1.7400e+05
## 1 2.4028e+04 2.1838e+04 1.9451e+04 2.1346e+04 2.0767e+04 2.0196e+04
## 2 3.6117e+03 2.5826e+03 1.7355e+03 1.8134e+03 2.6883e+03 2.3264e+03
## 3 5.9239e+02 4.8991e+02 6.2139e+02 4.3025e+02 5.2746e+02 5.8623e+02
## 4 2.3257e+02 1.6125e+02 1.6698e+02 2.2311e+02 1.5569e+02 1.7754e+02
## 5 5.7678e+01 7.9788e+01 6.9905e+01 5.1784e+01 8.7218e+01 5.3667e+01
```

```
##      6 1.9067e-03 1.6827e+01 1.4047e+01 1.8495e+01 2.7594e+01 1.1314e+01
##      year
## age 2012      2013      2014
##  0 1.2368e+05 1.0130e+05 1.4091e+05
##  1 1.6383e+04 2.1497e+04 1.6701e+04
##  2 1.7051e+03 1.5314e+03 2.3601e+03
##  3 5.4656e+02 4.0510e+02 3.9943e+02
##  4 1.7078e+02 2.0643e+02 1.6991e+02
##  5 4.2504e+01 7.7501e+01 1.0311e+02
##  6 6.0033e+00 2.5344e+01 8.3835e+01
##
## units:  NA
```

```
plot(harvest(HKE.new_xsa))
```



```
plot(HKE.new_xsa)
```



```
###Final comparison Fcurr(f_bar) against reference point (f0.1)
```

```
#f0.1=c(refpts(yprec)["f0.1","harvest"]) # if FBRP has been already used
#fmax=c(refpts(yprec)["fmax","harvest"]) # if FBRP has been already used
```

```
f0.1=0.25 # as an example
fmax=0.35 # as an example
fbar(HKE.new_xsa)/f0.1
```

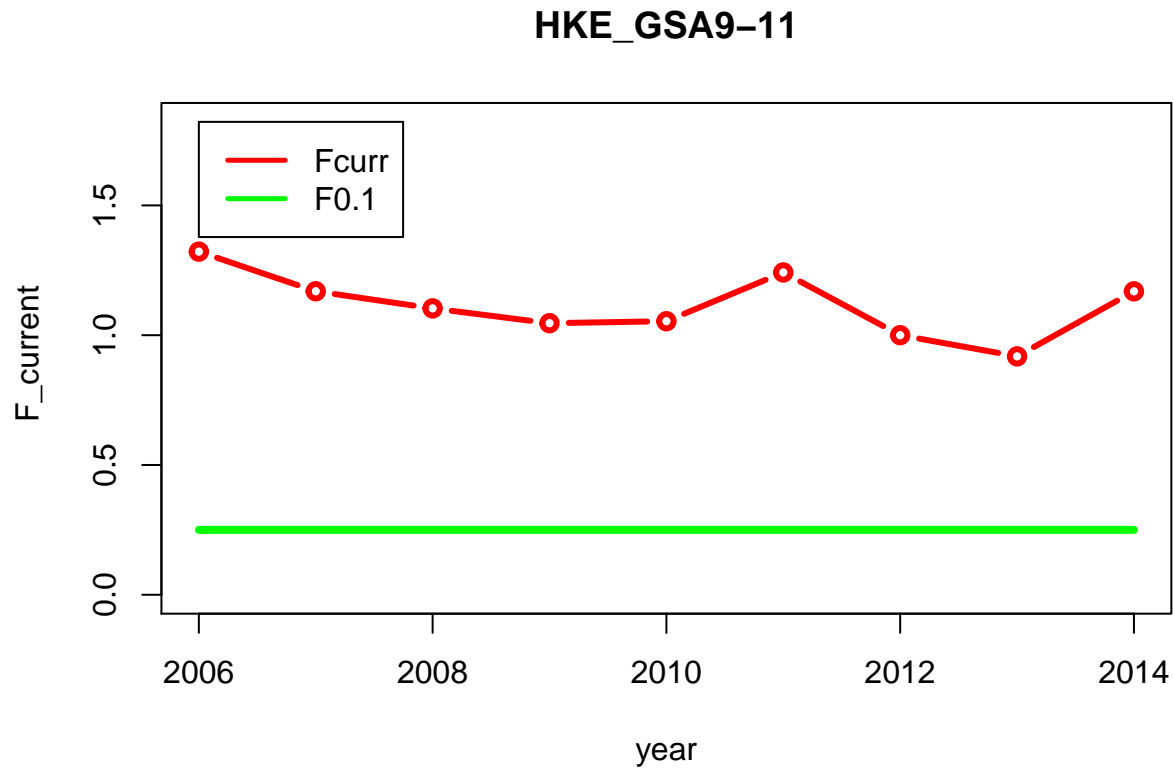
```
## An object of class "FLQuant"
## , , unit = unique, season = all, area = unique
##
##      year
## age  2006  2007  2008  2009  2010  2011  2012  2013  2014
## all  5.2872 4.6766 4.4127 4.1847 4.2153 4.9670 3.9998 3.6737 4.6755
##
## units:  f
```

```
F_bar=as.data.frame(fbar(HKE.new_xsa))
F_bar=cbind(F_bar,f0.1,fmax)

plot(F_bar$year,F_bar$data,type="b",col="red",main = "HKE_GSA9-11",
      ylim=c(0,max(F_bar$data)+0.5),ylab=" F_current",xlab="year",lwd=3)
lines(F_bar$year,F_bar$f0.1,col="green",lwd=4)
legend(min(F_bar$year),max(F_bar$data)+0.5, # places a legend at the appropriate place
       c("Fcurr","F0.1"), # puts text in the legend
       lty=c(1,1), # gives the legend appropriate symbols (lines
```



```
lwd=c(2.5,2.5),col=c("red","green")) # gives the legend lines the correct color and width
```



```
#####
##### EXERCISE 5 #####
#### Run XSA with different Fbar settings and compare results ####
#####

#####
##### EXERCISE 6 #####
#### Run XSA with different natural mortality values (vector or costant)
# and compare results #####
#####

# to save the stock object:
HKE_final=HKE.new_xsa
HKE_indices_final=HKE.idx
save(HKE.new_xsa, file="HKEFbar0_3.Rdata")
## change the file name output on the basis of your stock
save(HKE.idx, file="HKEFbar0_3_idx.Rdata")#
save.image(file="Ple4Fbar1_6.RData")
```

##### END OF THE SCRIPT #####