

Package: FLfse (via r-universe)

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cod4_stk	<i>North Sea cod</i>
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Description

Cod (*Gadus morhua*) in Subarea 4, Division 7.d, and Subdivision 20 (North Sea, eastern English Channel, Skagerrak). Assessment input data for North Sea cod as used by ICES WGNSSK 2018 and 2019. Includes the stock, the indices and the SAM configuration. See the example(s) below for how to run the assessment.

Usage

- cod4_stk
- cod4_stk_2019
- cod4_stk_2019
- cod4_idx
- cod4_idx_2019
- cod4_conf_sam

Format

- An object of class FLStock of dimension 6 x 56 x 1 x 1 x 1 x 1.
- An object of class FLStock of dimension 6 x 57 x 1 x 1 x 1 x 1.
- An object of class FLStock of dimension 6 x 57 x 1 x 1 x 1 x 1.
- An object of class FLIndices of length 2.
- An object of class FLIndices of length 2.
- An object of class list of length 20.

Source

<https://www.stockassessment.org>

Examples

```
# Replicate the 2018 assessment:
fit <- FLR_SAM(stk = cod4_stk,
               idx = cod4_idx,
               conf = cod4_conf_sam)

# Replicate the 2019 assessment:
fit <- FLR_SAM(stk = cod4_stk_2019,
               idx = cod4_idx_2019,
               conf = cod4_conf_sam)
```

FLR_SAM

Run SAM with FLR objects.

Description

This function runs a SAM assessment using FLR objects as input. Stock and fishery data is extracted from an object of class FLStock, survey indices from FLIndex or FLIndices. Additional model configurations can be passed to SAM.

Usage

```
FLR_SAM(
  stk,
  idx,
  conf = NULL,
  conf_full = FALSE,
  par_ini = NULL,
  DoParallel = FALSE,
  NA_rm = TRUE,
  idx_weight = FALSE,
  ...
)

## S4 method for signature 'FLStock,FLIndices'
FLR_SAM(
  stk,
  idx,
  conf = NULL,
  conf_full = FALSE,
  par_ini = NULL,
  DoParallel = FALSE,
  NA_rm = TRUE,
  idx_weight = FALSE,
  ...
)
```

```
## S4 method for signature 'FLStock,FLIndex'
FLR_SAM(
  stk,
  idx,
  conf = NULL,
  conf_full = FALSE,
  par_ini = NULL,
  DoParallel = FALSE,
  NA_rm = TRUE,
  idx_weight = FALSE,
  ...
)
```

Arguments

<code>stk</code>	Object of class FLStock with stock and fishery data.
<code>idx</code>	Object of class FLIndices or FLIndex object with survey index time series.
<code>conf</code>	Optional configurations passed to SAM. Defaults to NULL. If provided, should be a list.
<code>conf_full</code>	Use provided configuration object in full without ANY checking (see Details for more information).
<code>par_ini</code>	Optional starting parameters for SAM. See details for more information.
<code>DoParallel</code>	Optional, defaults to FALSE. If set to TRUE, will perform iterations of stock in parallel. See Details below for description.
<code>NA_rm</code>	Remove trailing years with NAs, defaults to TRUE.
<code>idx_weight</code>	Use index weights (index variance)? Defaults to FALSE. If required, should be slot of <code>idx</code> .
<code>...</code>	Additional arguments passed to <code>sam.fit()</code> , e.g. <code>newtonsteps</code>

Details

Stock and fishery data is extracted from `stk`, survey indices from `idx`. Stock data used are:

- catch numbers at age (`catch.n` slot from `stk`)
- maturity ogive (`mat` slot from `stk`)
- stock weight at age (`stock.wt` slot from `stk`)
- catch weight at age (`catch.wt` slot from `stk`)
- discards weight at age (`discards.wt` slot from `stk`)
- landings weight at age (`landings.wt` slot from `stk`)
- natural mortality at age (`m` slot from `stk`)
- proportion of fishing mortality before spawning at age (`harvest.spwn` slot from `stk`)
- proportion of natural mortality before spawning at age (`catch.n` slot from `stk`)

- landing fraction at age (calculated as landings numbers at age divided by the catch numbers at age)

Trailing years without data in `stk` are removed, unless turned off by setting `NA_rm = FALSE`.

Survey indices are extracted from `idx`, using the index slot(s). SSB indices can be used. To define an index as SSB index, the first (age) dimension of the index slot of `idx` has to be of length 1 and the name of this dimension can be either missing (NA), non-numeric (e.g. "ssb") or -1.

Additional configurations can be passed as a list to SAM with the `conf` argument. If argument `conf_full` is set to `TRUE`, the configuration is passed straight on to SAM without any checking. If argument `conf_full` is set to `FALSE` (default), then FLR_SAM first generates a default model configuration with `stockassessment`'s `setup.sam.data` and additional configurations available in `conf` replace default configurations. For details about possible configurations and format see `'help("defcon", package = "stockassessment")` and <https://github.com/fishfollower/SAM>.

The function can handle input objects with multiple iterations (iter dimension in `stk` and `idx`). If multiple iterations are provided for `stk` but not for `idx`, `idx` will be inflated, and vice versa. If the assessment fails for some iterations, the error messages are returned for these iterations. If argument `DoParallel` is set to `TRUE`, the individual iterations are processed in parallel. This uses parallel computing provided by the package `DoParallel`. The parallel workers need to be set up and registered before calling the function. See `?DoParallel`.

Argument `par_ini` allows the provision of initial parameter values for SAM and can speed up the model. Either a single set of parameters can be supplied and they are recycled if necessary. Alternatively, a list of initial parameters can be supplied, one for each iteration of the stock/index. If the dimensions of initial values for numbers/fishing mortality at age differ from the data, redundant years are automatically removed and if years are missing, the values from the last provided year are recycled.

The default console output generated by SAM is not printed but saved. It is stored as an attribute of the fit and can be accessed with `attr(fit, "messages")`.

Tagging data can be provided in the usual SAM format and should be stored as an attribute of `attr(catch.n(stk), "recap")`. Additional tagging configurations can be supplied as a list with the attribute `attr(catch.n(stk), "recap_conf")`, e.g. `list(map = list(logitRecapturePhi = factor(c(1, 1))))`, which are then passed on to `sam.fit()`.

Weights for the catch numbers can be supplied as an attribute of `attr(catch.n(stk), "weight")` and should be formatted as `FLQuant` objects.

Value

An object of class `sam` (for single iteration) or `sam_list` (list of `sam` objects for multiple iterations) with the model results.

Warning

This methods requires the `stockassessment` package and all its dependencies to be installed. For details how to obtain `stockassessment`, see <https://github.com/fishfollower/SAM/>.

Examples

```
# fit SAM to North Sea cod
```

```

fit <- FLR_SAM(stk = cod4_stk, idx = cod4_idx)

# use WGNSSK 2017 configuration
fit <- FLR_SAM(stk = cod4_stk, idx = cod4_idx, conf = cod4_conf_sam)

# fit SAM to Irish Sea plaice
fit <- FLR_SAM(stk = ple7a_stk, idx = ple7a_idx, conf = ple7a_conf_sam)

```

FLR_SPiCT

Run SPiCT with FLR objects.

Description

This function extracts the catch from an `FLStock` object and the survey indices/index from a `FLIndices` or `FLIndex` object and runs a SPiCT (Surplus Production in Continuous Time) stock assessment.

Usage

```

FLR_SPiCT(stk, idx, conf = NULL)

## S4 method for signature 'FLStock,FLIndices'
FLR_SPiCT(stk, idx, conf = NULL)

## S4 method for signature 'FLStock,FLIndex'
FLR_SPiCT(stk, idx, conf = NULL)

```

Arguments

<code>stk</code>	Object of class <code>FLStock</code> with catch time series.
<code>idx</code>	Object of class <code>FLIndices</code> or <code>FLIndex</code> object with survey index time series.
<code>conf</code>	Optional configurations passed to SPiCT. Should be a list.

Details

The catch time series is obtained from the catch slot of `stk`.

The survey index/indices are obtained from the index slot(s) of `idx`. If the slot(s) contains an age structure, the sum over all ages is used.

Additional configurations can be passed as a list to SPiCT with the `conf` argument. They are passed directly to SPiCT (`fit.spict`) without checking. Any configurations accepted by (`fit.spict`) can be used.

Value

An object of class `spictcls` with the model results.

Warning

This methods requires the spict package and all its dependencies to be installed. For details how to obtain spict, see <https://github.com/mawp/spict/>.

Examples

```
# fit SPiCT to Irish Sea plaice
fit <- FLR_SPiCT(stk = ple7a_stk, idx = ple7a_idx)
fit

# pass additional configuration, set time step to 1 per year
conf <- list(dteuler = 1)
fit <- FLR_SPiCT(stk = ple7a_stk, idx = ple7a_idx, conf = conf)
fit
```

getpars

Get parameter estimates from SAM model fit.

Description

This function extracts the parameter estimates from a SAM model fit. These are useful e.g. as initial values in subsequent model fits and can improve model convergence/computing time.

Usage

```
getpars(fit)

## S4 method for signature 'sam'
getpars(fit)

## S4 method for signature 'sam_list'
getpars(fit)
```

Arguments

fit A single SAM model fit of class sam or a list of fits of class sam_lst.

Value

A list with the model parameters of the SAM or a list of them in case of several supplied models

Examples

```
### fit SAM to North Sea cod
fit <- FLR_SAM(stk = cod4_stk, idx = cod4_idx, conf = cod4_conf_sam)

### extract parameters
pars <- getpars(fit)

### use them as starting values
fit2 <- FLR_SAM(stk = cod4_stk, idx = cod4_idx, conf = cod4_conf_sam,
                par_ini = pars)
```

had4_stk

North Sea haddock

Description

Haddock (*Melanogrammus aeglefinus*) in Subarea 4, Division 6.a, and Subdivision 20 (North Sea, West of Scotland, Skagerrak). Assessment input data for North Sea haddock as used by ICES WGNSSK 2018. Includes the stock, the indices and the SAM configuration. See the example below for how to run the assessment.

Usage

```
had4_stk

had4_idx

had4_conf_sam
```

Format

An object of class FLStock of dimension 9 x 54 x 1 x 1 x 1 x 1.

An object of class FLIndices of length 2.

An object of class list of length 20.

Source

<https://www.stockassessment.org>

Examples

```
# Replicate the 2018 assessment:
fit <- FLR_SAM(stk = had4_stk,
               idx = had4_idx,
               conf = had4_stk)
```

her4_stk*North Sea herring*

Description

Herring (*Clupea harengus*) in Subarea 4 and divisions 3.a and 7.d, autumn spawners (North Sea, Skagerrak and Kattegat, eastern English Channel). Assessment input data for North Sea herring as used by ICES HAWG 2019. Includes the stock, the indices and the SAM configuration.

Usage`her4_stk``her4_idx``her4_conf_sam`**Format**

An object of class `FLStock` of dimension 9 x 73 x 1 x 1 x 1 x 1.

An object of class `FLIndices` of length 8.

An object of class `list` of length 21.

Details

Please note that the herring SAM assessment requires a different version of the `stockassessment` package. For details, see the readme at <https://github.com/shfischer/FLfse>

Source

https://github.com/ices-eg/wg_HAWG/tree/master/NSAS

Examples

```
# NOTE: the herring SAM assessment requires a different version of
# the stockassessment package
## Not run:
fit <- FLR_SAM(stk = her4_stk,
               idx = her4_idx,
               conf = her4_conf_sam)

## End(Not run)
```

mac.27.nea_stk_2019	<i>Northeast Atlantic mackerel 2019</i>
---------------------	---

Description

Mackerel (*Scomber scombrus*) in subareas 1-8 and 14, and in Division 9.a (the Northeast Atlantic and adjacent waters). Assessment input data for Northeast Atlantic mackerel as used by ICES WGWIDE 2019. Includes the stock, the indices and the SAM configuration. See the example below for how to run the assessment.

Usage

```
mac.27.nea_stk_2019  
  
mac.27.nea_idx_2019  
  
mac.27.nea_conf_2019
```

Format

An object of class FLStock of dimension 13 x 40 x 1 x 1 x 1 x 1.
An object of class FLIndices of length 3.
An object of class list of length 23.

Details

mac.27.nea_stk_2019 includes tagging data, stored as an attribute in attr(catch.n(mac.27.nea_stk_2019), "recap"). An additional tagging configuration is stored in attr(catch.n(mac.27.nea_stk_2019), "recap_conf"). Also, weights for the catch numbers are supplied as an attribute in attr(catch.n(mac.27.nea_stk_2019), "weight"). All additional data is passed on automatically to the SAM assessment.

Source

<https://www.stockassessment.org>

Examples

```
# The 2019 WGWIDE Northeast Atlantic mackerel assessment can be reproduced  
# with:  
fit <- FLR_SAM(stk = mac.27.nea_stk_2019,  
               idx = mac.27.nea_idx_2019,  
               conf = mac.27.nea_conf_2019)
```

ple7a_stk	<i>Irish Sea plaice</i>
-----------	-------------------------

Description

Plaice (*Pleuronectes platessa*) in Division 7.a (Irish Sea). Assessment input data for Irish Sea plaice as used by ICES WGCSE 2017 and 2019. Includes the stock, the indices and the SAM configuration. See the example below for how to run the assessment.

Usage

```
ple7a_stk
ple7a_idx
ple7a_stk_2019
ple7a_idx_2019
ple7a_conf_sam
```

Format

An object of class FLStock of dimension 8 x 36 x 1 x 1 x 1 x 1.
 An object of class FLIndices of length 3.
 An object of class FLStock of dimension 8 x 38 x 1 x 1 x 1 x 1.
 An object of class FLIndices of length 3.
 An object of class list of length 3.

Examples

```
# Replicate the 2019 assessment:
fit <- FLR_SAM(stk = ple7a_stk_2019,
               idx = ple7a_idx_2019,
               conf = ple7a_conf_sam)
```

SAM_uncertainty	<i>Create replicates/iterations of SAM model fit based on variance-covariance matrix</i>
-----------------	--

Description

This function use the uncertainty estimated by SAM to create replicates/iterations of assessment results. The function uses the variance-covariance matrix to quantify uncertainty.

Usage

```

SAM_uncertainty(
  fit,
  n = 1000,
  print_screen = FALSE,
  seed = NULL,
  idx = TRUE,
  idx_cov = TRUE,
  catch_est = TRUE,
  proc_error_est = TRUE
)

## S4 method for signature 'sam'
SAM_uncertainty(
  fit,
  n = 1000,
  print_screen = FALSE,
  seed = NULL,
  idx = TRUE,
  idx_cov = TRUE,
  catch_est = TRUE,
  proc_error_est = TRUE
)

```

Arguments

<code>fit</code>	A SAM model fit object of class <code>sam</code> .
<code>n</code>	Number of replicates
<code>print_screen</code>	If set to <code>TRUE</code> , print output of <code>TMB::sdreport</code> to screen.
<code>seed</code>	Random number seed for reproducibility.
<code>idx</code>	If set to <code>TRUE</code> (default) metrics relating to the indices are returned.
<code>idx_cov</code>	If set to <code>TRUE</code> , return covariance of survey index/indices.
<code>catch_est</code>	If set to <code>TRUE</code> , return catch estimates from SAM.
<code>proc_error_est</code>	If set to <code>TRUE</code> , return (survival) process error level from SAM.

Details

The returned objects are `FLQuants` where the iteration dimension contains the replicates. Each replicate is internally consistent, e.g. the fishing mortality matches the stock numbers of the same replicate.

The following metrics are returned:

- `stock.n` Stock numbers at age for all years, `FLQuant`
- `harvest` Fishing mortalities at age for all years, `FLQuant`

- `catch.n` Estimates of catch numbers at age for all years. This differs from the assessment input values. If the SAM model fit contains catch multipliers, the values returned here are corrected for this. Class `FLQuant`.
- `catch_sd` Standard deviation of the catch numbers at age, time invariant, `FLQuant`
- `survey_catchability` Catchability at age for all years for all survey indices, list of `FLQuants`
- `survey_sd` Standard deviation of all surveys at age, time invariant, list of `FLQuants`,
- `survey_cov` Covariance matrices of survey ages, one for each survey. Return object is a list of lists, the first level corresponds to the replicates, the second level to the surveys. If no covariance between ages is assumed in the SAM model, the diagonal in the covariance matrices is simply the square root of the standard deviation (in `survey_sd`)
- `proc_error` Standard deviation of the stock numbers at age, time invariant, class `FLQuant`. This corresponds to the survival process error assumed/estimated, i.e. quantifies how much the actual stock numbers at age deviate from the deterministic catch equation.

Value

A list of `FLQuants` with the elements: `stock.n`, `harvest`, `catch.n`, `catch_sd`, `survey_catchability`, `survey_sd`, `survey_cov`, `proc_error`.

Examples

```
### fit SAM to North Sea cod
fit <- FLR_SAM(stk = cod4_stk, idx = cod4_idx, conf = cod4_conf_sam)

### create 2 replicates
reps <- SAM_uncertainty(fit, n = 2)
```

SAM2FLStock

Coerce SAM output into FLStock object

Description

This function takes the output from running the SAM stockassessment and converts them into an `FLStock` object.

Usage

```
SAM2FLStock(
  object,
  stk,
  uncertainty = FALSE,
  conf_level = 95,
  stock_only = FALSE,
  catch_estimate = FALSE,
  correct_catch = FALSE,
  mat_est = FALSE,
```

```
stock.wt_est = FALSE,
catch.wt_est = FALSE,
m_est = FALSE,
spinoutyear = FALSE
)

## S4 method for signature 'sam,missing'
SAM2FLStock(
  object,
  stk,
  uncertainty = FALSE,
  conf_level = 95,
  stock_only = FALSE,
  catch_estimate = FALSE,
  correct_catch = FALSE,
  mat_est = FALSE,
  stock.wt_est = FALSE,
  catch.wt_est = FALSE,
  m_est = FALSE,
  spinoutyear = FALSE
)

## S4 method for signature 'sam_list,missing'
SAM2FLStock(
  object,
  stk,
  uncertainty = FALSE,
  conf_level = 95,
  stock_only = FALSE,
  catch_estimate = FALSE,
  correct_catch = FALSE,
  mat_est = FALSE,
  stock.wt_est = FALSE,
  catch.wt_est = FALSE,
  m_est = FALSE,
  spinoutyear = FALSE
)

## S4 method for signature 'sam,FLStock'
SAM2FLStock(
  object,
  stk,
  uncertainty = FALSE,
  conf_level = 95,
  stock_only = FALSE,
  catch_estimate = FALSE,
  correct_catch = FALSE,
  mat_est = FALSE,
```

```

    stock.wt_est = FALSE,
    catch.wt_est = FALSE,
    m_est = FALSE,
    spinoutyear = FALSE
)

## S4 method for signature 'sam_list,FLStock'
SAM2FLStock(
  object,
  stk,
  uncertainty = FALSE,
  conf_level = 95,
  stock_only = FALSE,
  catch_estimate = FALSE,
  correct_catch = FALSE,
  mat_est = FALSE,
  stock.wt_est = FALSE,
  catch.wt_est = FALSE,
  m_est = FALSE,
  spinoutyear = FALSE
)

```

Arguments

object	Object of class <code>sam</code> with the results from a SAM stock assessment run. Alternatively, object of class <code>sam_list</code> , i.e. a list of <code>sam</code> objects.
stk	Optional. Object of class <code>FLStock</code> , to which the assessment results are added.
uncertainty	If set to <code>TRUE</code> , the estimated uncertainty from SAM will be added as attribute.
conf_level	Confidence level used when uncertainty is returned. Defaults to 95 (percent).
stock_only	Logical. If set to <code>TRUE</code> , catch data (numbers, weights) are ignored and only stock data (numbers, SSB, etc.) are returned
catch_estimate	Logical, return the catch estimated by SAM instead of the model input?
correct_catch	Logical, correct catch with catch multiplier estimated by SAM?
mat_est	Logical, return SAM estimates for maturity?
stock.wt_est	Logical, return SAM estimates for stock weights?
catch.wt_est	Logical, return SAM estimates for catch weights?
m_est	Logical, return SAM estimates for natural mortality?
spinoutyear	Logical, return SAM estimates of biological estimates beyond last data year?

Details

SAM2FLStock returns both the input data used for running SAM (e.g. catch) and the model estimates (stock numbers and fishing mortality). By default, the returned catch is the input catch provided to SAM. However, the catch as estimated by SAM can be returned by setting `catch_estimate = TRUE`. Also, estimates of biological data (stock weights, catch weights, natural mortality, maturity) can be returned if requested and available from the model fit. Setting `uncertainty = TRUE`

returns confidence intervals for catch, stock numbers and fishing mortality, saved as attributes in the corresponding slots of the FLStock output.

If an FLStock is provided as stk argument, then this is used as template. If the dimensions (years, iterations) differ between the SAM results and the provided stock template, the returned FLStock is expanded.

The object argument can either be a single SAM model fit or a list of SAM model fits (defined as class sam_list). If a list is provided, the output is an FLStock object where the different iterations correspond to the individual model fits.

The function can handle SAM model fits with multiple fleets. In the returned FLStock, the fleets are combined into a single fleet. Some functionality (e.g. uncertainty bounds) might not work for multiple fleets.

Value

An object of class FLStock.

Examples

```
# fit SAM to North Sea cod
fit <- FLR_SAM(stk = cod4_stk, idx = cod4_idx, conf = cod4_conf_sam)

# coerce the output into FLStock
stk <- SAM2FLStock(fit)

# get catch estimates from model
stk <- SAM2FLStock(fit, catch_estimate = TRUE)

## Not run:
# use multi-fleet SAM model for western Baltic spring-spawning herring and
# load model fit from stockassessment.org
fit <- stockassessment::fitfromweb("WBSS_HAWG_2021")
stk <- SAM2FLStock(fit)

## End(Not run)
```

whg4_stk

North Sea whiting

Description

Whiting (*Merlangius merlangus*) in Subarea 4 and Division 7.d (North Sea and eastern English Channel). Assessment input data for North Sea whiting as used by ICES WGNSSK 2018. Includes the stock, the indices and the SAM configuration. See the example below for how to run the assessment.

Usage`whg4_stk``whg4_idx``whg4_conf_sam`**Format**

An object of class `FLStock` of dimension 9 x 41 x 1 x 1 x 1 x 1.

An object of class `FLIndices` of length 2.

An object of class `list` of length 20.

Source

<https://www.stockassessment.org>

```
#' @examples # Replicate the 2017 assessment: fit <- FLR_SAM(stk = whg4_stk, idx = whg4_idx,  
conf = whg4_conf_sam)
```

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