Package 'datalimited2'

January 20, 2018

Type Package

Title More Stock Assessment Methods for Data-limited Fisheries

Version 0.0.0.9000

Date 2018-01-05

Description Methods for estimating B/BMSY from fisheries catch time series.

URL https://github.com/cfree14/datalimited2

Depends R (>= 3.4.2)

License GPL-3

Encoding UTF-8

LazyData true

Imports plyr, segmented, gbm, dismo, fGarch, R2jags, coda, parallel, foreach, doParallel, gplots

RoxygenNote 6.0.1

R topics documented:

bbmsy2s *Convert saturation to B/BMSY*

Description

Converts saturation (S = B/K) to B/BMSY

Usage

```
bbmsy2s(bbmsy)
```

Arguments

bbmsy	B/BMSY values(s)

Details

S = 1 - depletion = B / K = B/BMSY / 2 B/BMSY = S * 2

Value

Saturation (B/K) value(s)

bsm *Bayesian state-space surplus production model*

Description

Estimates B/BMSY time series and other biological quantities using only a time series of catch and a resilience estimate using the Bayesian surplus produciton model from Froese et al. (2017).

Usage

```
bsm(year, catch, biomass, btype, resilience = NA, r.low = NA, r.hi = NA,
  stb.low = NA, stb.hi = NA, int.yr = NA, intb.low = NA, intb.hi = NA,
  endb.low = NA, endb.hi = NA, q.start = NA, q.end = NA, verbose = T)
```

Arguments

year	A time series of years
catch	A time series of catch
biomass	A time series of biomass or CPUE (type is designated in btype)
btype	Biomass time series type: "None", "biomass", or "CPUE"
resilience	Resilience of the stock: "High", "Medium", "Low", "Very low"
r.low, r.hi	A user-specified prior on the species intrinsic growth rate, r (optional)
stb.low, stb.hi	A user-specified prior on biomass relative to unfished biomass at the beginning of the catch time series (optional)

int.yr	A user-specified year of intermediate biomass (optional)
intb.low, intb.hi	A user-specified prior on biomass relative to unfished biomass in the intermediate year (optional)
endb.low, endb.hi	A user-specified prior on biomass relative to unfished biomass at the end of the catch time series (optional)
q.start, q.end	A user-specified start and end year for estimating the catchability coefficient (optional; default is last 5 years)
verbose	Set to FALSE to suppress printed updates on CMSY/BSM progress (default=TRUE)

Value

A time series of B/BSMY estimates and other stuff

References

Froese R, Demirel N, Coro G, Kleisner KM, Winker H (2017) Estimating fisheries reference points from catch and resilience. Fish and Fisheries 18(3): 506-526. http://onlinelibrary.wiley.com/doi/10.1111/faf.12190/abstract

Examples

```
output <- bsm(year=SOLIRIS$yr, catch=SOLIRIS$ct, biomass=SOLIRIS$bt, btype="CPUE", r.low=0.18, r.hi=1.02)
plot_cmsy2(output)
plot_cmsy2_mgmt(output)
```

---

cmsy2 *cMSY catch-only stock assessment model*

Description

Estimates B/BMSY time series and other biological quantities using only a time series of catch and a resilience estimate using cMSY from Froese et al. (2017).

Usage

```
cmsy2(year, catch, resilience = NA, r.low = NA, r.hi = NA, stb.low = NA,
  stb.hi = NA, int.yr = NA, intb.low = NA, intb.hi = NA,
  endb.low = NA, endb.hi = NA, q.start = NA, q.end = NA, verbose = T)
```

Arguments

year	A time series of years
catch	A time series of catch
resilience	Resilience of the stock: "High", "Medium", "Low", "Very low"
r.low, r.hi	A user-specified prior on the species intrinsic growth rate, r (optional)
stb.low, stb.hi	A user-specified prior on biomass relative to unfished biomass at the beginning of the catch time series (optional)

int.yr	A user-specified year of intermediate biomass (optional)
intb.low, intb.hi	A user-specified prior on biomass relative to unfished biomass in the intermediate year (optional)
endb.low, endb.hi	A user-specified prior on biomass relative to unfished biomass at the end of the catch time series (optional)
q.start, q.end	A user-specified start and end year for estimating the catchability coefficient (optional; default is last 5 years)
verbose	Set to FALSE to suppress printed updates on CMSY/BSM progress (default=TRUE)

Value

A list of length six with the following elements: (1) A dataframe with biological quantity / reference point estimates with 95 (2) A dataframe with B/BMSY and reference point time series with 95 (3) A dataframe with the priors used in the cMSY analysis; (4) A vector with the viable r values; (5) A vector with the viable k values; (6) A vector with the viable saturation values.

References

Froese R, Demirel N, Coro G, Kleisner KM, Winker H (2017) Estimating fisheries reference points from catch and resilience. Fish and Fisheries 18(3): 506-526. http://onlinelibrary.wiley.com/doi/10.1111/faf.12190/abstract

Examples

```
output <- cmsy2(year=SOLIRIS$yr, catch=SOLIRIS$ct, r.low=0.18, r.hi=1.02)
plot_cmsy2(output)
plot_cmsy2_mgmt(output)
```

---

ocom *Optimized catch-only model*

Description

Estimates saturation (B/K) and stock status (B/BMSY) time series and other biological quantities (e.g., r, k, MSY, final year saturation) from a time series of catch and a natural mortality (M) estimate using the optimized catch-only model (OCOM) from Zhou et al. (2017).

Usage

```
ocom(year, catch, m)
```

Arguments

year	A time series of years
catch	A time series of catch
m	Natural mortality (1/yr)

Value

A list with the following elements: (1) time series of B/BMSY estimates; (2) 1000 randomly selected biomass trajectories; (3) 1000 corresponding B/BMSY trajectories; (4) estimates of biological quanties r, k, MSY, S; and (5) the 10,000 draws underpinning these values.

References

Zhou S, Punt AE, Smith ADM, Ye Y, Haddon M, Dichmont CM, Smith DC (2017) An optimised catch-only assessment method for data poor fisheries. ICES Journal of Marine Science: doi:10.1093/icesjms/fsx226. https://doi.org/10.1093/icesjms/fsx226

Examples

```
output <- ocom(year=TIGERFLAT$yr, catch=TIGERFLAT$catch, m=0.27)
plot_ocom(output)
```

`plot_cmsy2` *Plot cMSY and BSM model results*

Description

Plots cMSY and BSM model results following the example of Froese et al. (2016). Produces the following six plots:

- A - Catch time series
- B - Finding viable r-k pairs
- C - Viable r-k pairs
- D - Saturation (B/k) time series
- E - Exploitation rate (F / (r/2)) time series
- F - Surplus production curve

Usage

```
plot_cmsy2(output)
```

Arguments

`output`	Output from the cMSY or BSM stock assessment models (see ?cmsy2 or ?bsm)

Value

Six plots: (1) catch time series; (2) r-k pair search; (3) viable r-k pairs; (4) saturation time series; (5) exploitation rate time series; (6) surplus production curve

References

Froese R, Demirel N, Coro G, Kleisner KM, Winker H (2016) A Simple User Guide for CMSY and BSM (version "q"). 27 October 2016. http://oceanrep.geomar.de/33076/

Examples

```
# Fit cMSY and plot results
output <- cmsy2(year=SOLIRIS$yr, catch=SOLIRIS$ct, r.low=0.18, r.hi=1.02)
plot_cmsy2(output)
plot_cmsy2_mgmt(output)

# Fit BSM and plot results
output <- bsm(year=SOLIRIS$yr, catch=SOLIRIS$ct, biomass=SOLIRIS$bt, btype="CPUE", r.low=0.18, r.hi=1.02)
plot_cmsy2(output)
plot_cmsy2_mgmt(output)
```

---

plot_cmsy2_mgmt *Plot cMSY and BSM model results for management*

Description

Plots cMSY and BSM model results for management following the example of Froese et al. (2016). Produces the following four plots:

- A - Catch time series
- B - B/BMSY time series
- C - F/FMSY time series
- D - Kobe plot

Usage

```
plot_cmsy2_mgmt(output)
```

Arguments

output	Output from the cMSY or BSM stock assessment model (see ?cmsy2 or ?bsm)

Value

Four plots: (1) catch time series; (2) B/BMSY time series; (3) F/FMSY time serie; and (4) Kobe plot

References

Froese R, Demirel N, Coro G, Kleisner KM, Winker H (2016) A Simple User Guide for CMSY and BSM (version "q"). 27 October 2016. http://oceanrep.geomar.de/33076/

Examples

```
# Fit cMSY and plot results
output <- cmsy2(year=SOLIRIS$yr, catch=SOLIRIS$ct, r.low=0.18, r.hi=1.02)
plot_cmsy2(output)
plot_cmsy2_mgmt(output)

# Fit BSM and plot results
output <- bsm(year=SOLIRIS$yr, catch=SOLIRIS$ct, biomass=SOLIRIS$bt, btype="CPUE", r.low=0.18, r.hi=1.02)
plot_cmsy2(output)
plot_cmsy2_mgmt(output)
```

plot_ocom *Plot OCOM results*

Description

Plot OCOM results

Usage

```
plot_ocom(output)
```

Arguments

output	Output from the OCOM model (see ?ocom)

Value

Plots

References

Zhou S, Punt AE, Smith ADM, Ye Y, Haddon M, Dichmont CM, Smith DC (2017) An optimised catch-only assessment method for data poor fisheries. ICES Journal of Marine Science: doi:10.1093/icesjms/fsx226. https://doi.org/10.1093/icesjms/fsx226

Examples

```
output <- ocom(year=YELLSNEMATL$year, catch=YELLSNEMATL$tc, m=0.2)
plot_ocom(output)
```

plot_zbrt *Plot zBRT results*

Description

Plot zBRT results

Usage

```
plot_zbrt(output)
```

Arguments

output	Output from the zBRT model (see ?zbrt)

Value

Plots

Examples

```
output <- zbrt(year=YELLSNEMATL$year, catch=YELLSNEMATL$tc)
plot_zbrt(output)
```

`rorcs` *Refined ORCS approach*

Description

Predicts stock status (i.e., under, fully, or overexploited) using the refined ORCS approach from Free et al. 2017.

Usage

```
rorcs(scores)
```

Arguments

`scores` A numeric vector of length twelve containing scores for the following "Table of Attributes" questions:

- TOA 1 - Status of assessed stocks in fishery
- TOA 3 - Behavior affecting capture (2 or 3 only)
- TOA 5 - Discard rate
- TOA 6 - Targeting intensity
- TOA 7 - M compared to dominant species
- TOA 8 - Occurence in catch
- TOA 9 - Value (US$/lb) - continuous value
- TOA 10 - Recent trends in catch
- TOA 11 - Habitat loss
- TOA 12 - Recent trend in effort
- TOA 13 - Recent trend in abundance index
- TOA 14 - Proportion of population protected

Value

Stock status (i.e., under, fully, or overexploited)

References

Free CM, Jensen OP, Wiedenmann J, Deroba JJ (2017) The refined ORCS approach: a catch-based method for estimating stock status and catch limits for data-poor fish stocks. *Fisheries Research* 193: 60-70. https://doi.org/10.1016/j.fishres.2017.03.017

Examples

```
scores <- c(1, 2, NA, 2, 2, 3, 1.93, 2, 1, 2, 1, 3)
rorcs(scores)
```

s2bbmsy *Convert B/BMSY to saturation*

Description

Converts B/BMSY to saturation (S = B/K).

Usage

```
s2bbmsy(s)
```

Arguments

s	Saturation (B/K) value(s)

Details

S = 1 - depletion = B / K = B/BMSY / 2 B/BMSY = S * 2

Value

B/BMSY values(s)

SOLIRIS *Irish Sea Common sole time series*

Description

A dataset containing the catch and biomass time series for Irish Sea Common sole (Solea solea) from 1970-2014. This stock was used as an example in the cMSY/BSM user manual and is used to validate this package's implementation of cMSY and BSM.

Usage

```
SOLIRIS
```

Format

A data frame with 45 rows (years) and 4 variables:

Stock stock id

yr year

ct catch, in metric tons

ct biomass, in metric tons

Source

Froese R, Demirel N, Coro G, Kleisner KM, Winker H (2017) Estimating fisheries reference points from catch and resilience. Fish and Fisheries 18(3): 506-526. http://onlinelibrary.wiley.com/doi/10.1111/faf.12190/abstract

TIGERFLAT *SE Australia Tiger flathead time series*

Description

A dataset containing the catch time series for SE Australia Tiger flathead (Neoplatycephalus richardsoni) from 1915-2012. This stock was used as an example in the OCOM paper and is used to validate this package's implementation of zBRT and OCOM.

Usage

```
TIGERFLAT
```

Format

A data frame with 98 rows (years) and 3 variables:

Stock stock id

yr year

ct catch, in metric tons

Source

Zhou S, Punt AE, Smith ADM, Ye Y, Haddon M, Dichmont CM, Smith DC (2017) An optimised catch-only assessment method for data poor fisheries. ICES Journal of Marine Science: doi:10.1093/icesjms/fsx226. https://doi.org/10.1093/icesjms/fsx226

YELLSNEMATL *USA SNE/MA Yellowtail flounder time series*

Description

A dataset containing the catch time series for USA SNE/MA Yellowtail flounder (Pleuronectes ferruginea) from 1973-2014.

Usage

```
YELLSNEMATL
```

Format

A data frame with 42 rows (years) and XX variables:

Stock stock id

yr year

ct catch, in metric tons ...

zbrt *Zhou-BRT catch-only stock assessment model*

Description

Estimates saturation (B/K) and stock status (B/BMSY) time series from a time series of catch using the boosted regression tree (BRT) model from Zhou et al. (2017).

Usage

```
zbrt(year, catch)
```

Arguments

year	A time series of years
catch	A time series of catch

Value

A dataframe with a time series of saturation and B/BMSY estimates. S8 and S38 correspond to the saturation estimates from the 8- and 38-predictor models, respectively. S, the best estimate of saturation, is the mean of these two predictions. B/BMSY is this estimate doubled (B/BMSY = S * 2). High and low values correspond to the upper and lower 95

References

Zhou S, Punt AE, Yimin Y, Ellis N, Dichmont CM, Haddon M, Smith DC, Smith ADM (2017) Estimating stock depletion level from patterns of catch history. *Fish and Fisheries*. http://onlinelibrary.wiley.com/doi/10.1111/faf.12201/abstract

Examples

```
output <- zbrt(year=TIGERFLAT$yr, catch=TIGERFLAT$catch)
plot_zbrt(output)
```

Index