Package 'fishdynr'

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Description Fisheries science related population dynamics models

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URL https://github.com/marchtaylor/fishdynr

R topics documented:

`cohortSim` *Simulation of a cohort*

Description

`cohortSim` simulates a single cohort

Usage

```
cohortSim(params, t_incr = 1)
```

Arguments

`params`	List of parameters to use in function
`t_incr`	Value to use a time increment (in years). Defaults to 1.

Value

A list

Examples

```
data(tilapia)
res <- cohortSim(tilapia, t_incr=.1)
plot(pcap ~ Lt, res, t="l")
plot(Lt ~ t, res, t="l")
plot(Wt ~ t, res, t="l")

plot(Bt ~ t, res, t="l")
lines(SBt ~ t, res, col=2)

plot(Bt ~ Lt, res, t="l")
lines(SBt ~ Lt, res, col=2)

plot(Yt ~ t, res, t="l")

plot(Nt ~ t, res, t="l", log="y")
lines(Nt.noF ~ t, res, col=2, lty=2)
```

`gillnet` *gillnet selection*

Description

`gillnet` describes gillnet selection following Millar and Holst (1997). Possible selectivity distributions include normal (fixed width) and lognormal. [Note: others will be added]

Usage

```
gillnet(Lt, mesh_size, mesh_size1, select_dist, select_p1, select_p2)
```

Arguments

`Lt`	body size
`mesh_size`	mesh size
`mesh_size1`	smallest reference mesh size
`select_dist`	selectivity type (`"normal_fixed", "lognormal"`)
`select_p1`	selectivity function parameter 1 (see Millar and Holst 1997)
`select_p2`	selectivity function parameter 2 (see Millar and Holst 1997)

References

Millar, R. B., & Holst, R. (1997). Estimation of gillnet and hook selectivity using log-linear models. ICES Journal of Marine Science: Journal du Conseil, 54(3), 471-477.

Examples

```
data(tilapia)
tilapia$selectFun="gillnet"
mesh_sizes <- c(60, 80, 100, 120)
op <- par(mar=c(4,4,1,1))
for(i in seq(mesh_sizes)){
  tilapia$mesh_size <- mesh_sizes[i]
  res <- cohortSim(tilapia, t_incr=0.01)
  if(i == 1) plot(pcap ~ Lt, res, t="n")
  lines(pcap ~ Lt, res, col=i)
}
legend("topleft", legend=mesh_sizes,
  col=seq(mesh_sizes), lty=1,
  title="mesh size [mm]", bty="n"
)
par(op)
```

---

growth_soVB — *seasonally oscillating von Bertalanffy growth function*

Description

growth_soVB describes the growth as a function of age (t) using the seasonally oscillating von Bertalanffy growth function (Somers 1988).

Usage

```
growth_soVB(Linf, K, t, t0, ts, C)
```

Arguments

Linf	Infinite length
K	growth constant
t	age
t0	(hypothetical) age at length zero
ts	summer point. Time of year (between 0 and 1) when growth oscillation cycle begins (sine wave term becomes positive)
C	oscillation strength. Varies between 0 and 1.

References

Somers, I. F. (1988). On a seasonally oscillating growth function. Fishbyte, 6(1), 8-11.

Examples

```
t <- seq(0,5,0.1)
L <- growth_soVB(Linf=100, K=0.5, t=t, t0=-0.2, ts=0.5, C=0.75)
plot(t, L, t="l")
```

growth_VB *von Bertalanffy growth function*

Description

growth_VB describes the growth as a function of age (t) using the von Bertalanffy growth function

Usage

```
growth_VB(Linf, K, t, t0)
```

Arguments

Linf	Infinite length
K	growth constant
t	age
t0	(hypothetical) age at length zero

Examples

```
t <- seq(0,5,0.1)
L <- growth_VB(Linf=100, K=0.5, t=t, t0=-0.2)
plot(t, L, t="l")
```

knife_edge *knife-edge selection*

Description

knife_edge describes knife-edge selection where probability of capture 100% after a minimum defined size. Provides a rough estimate of trawl-type selectivity.

Usage

```
knife_edge(Lt, knife_edge_size)
```

Arguments

Lt	body size
knife_edge_size	knife edge size. Minimum size at capture.

Examples

```
data(tilapia)
tilapia$selectFun="knife_edge"
knife_edge_sizes <- c(20, 25, 30, 35)
op <- par(mar=c(4,4,1,1))
for(i in seq(knife_edge_sizes)){
  tilapia$knife_edge_size <- knife_edge_sizes[i]
  res <- cohortSim(tilapia, t_incr=0.01)
  if(i == 1) plot(pcap ~ Lt, res, t="n")
  lines(pcap ~ Lt, res, col=i)
}
legend("topleft", legend=knife_edge_sizes,
  col=seq(knife_edge_sizes), lty=1,
  title="min. size", bty="n"
)
par(op)
```

---

pmat_w — *Probability of maturity logistic function using quartile width*

Description

pmat_w describes the probability of maturity as a function of the size when 50% of the individuals in a population are mature and the width (in size) between 25% and 75% probability of maturity quartiles (after Heino et al. 2002).

Usage

```
pmat_w(Lt, Lmat, wmat)
```

Arguments

Lt	size for probability of maturity calculation
Lmat	size at 50% probability of maturity (i.e. "massive maturity")
wmat	width (in size) between 25% and 75% probability of maturity quartiles

References

Heino M, Dieckmann U, Godo OR (2002) Measuring probabilistic reaction norms for age and size at maturation. Evolution 56: 669-678.

Examples

```
L <- seq(1,20,0.1)
pmat1 <- pmat_w(L, Lmat=10, wmat=5)
pmat2 <- pmat_w(L, Lmat=10, wmat=2)
plot(L, pmat1, t="l", ylab="prob. of maturity")
lines(L, pmat2, lty=2)
legend("bottomright", legend=c("Lmat=10; wmat=5", "Lmat=10; wmat=2"),
 col=1, lty=1:2, bty="n")
```

srrBH *Stock-recruitment relationship (Beverton-Holt type)*

Description

srrBH describes stock-recruitment relationship

Usage

```
srrBH(rmax = 1000, beta = 500, Neggs = 500)
```

Arguments

rmax	maximum recruitment level
beta	parameter describing steepness of relationship. Specifically, beta describes the point where the number of spawned eggs results in half the maximum number of recruits, rmax
Neggs	number of eggs spawned by the adult population

References

Beverton, R. J., Holt, S. J., 1957. On the dynamics of exploited fish populations

Examples

```
Neggs <- seq(0,5e3,,100)
rmax <- 2000
beta <- 500
Nrecr <- srrBH(rmax, beta, Neggs)
plot(Neggs, Nrecr, t="l", ylim=c(0, rmax))
abline(h=rmax, lty=2, col=8)
lines(x=c(0, beta, beta), y=c(rmax/2, rmax/2, 0), lty=2, col=8)
text(x=100, y=rmax*0.95, labels="rmax", col=8)
text(x=beta, y=rmax/2, labels="rmax/2", pos=4, col=8)
text(x=beta, y=0, labels="beta", pos=4, col=8)
```

tilapia *Parameter list for Oreochromis niloticus (Nile tilapia)*

Description

The tilapia data set contains a list of parameters used by other functions in the fishdynr package.

- species. Species name
- growthFun. Name of growth function ("growth_VB" is von Bertalanffy growth function)
- K. Growth constant (for use in von Bertalanffy growth function))
- Linf. Infinite length (for use in von Bertalanffy growth function)
- t0. (hypothetical) time when length equals zero (for use in von Bertalanffy growth function)
- amax. Maximum age

- LWa. Length-weight relationship parameter a (weight~a*length^b)
- LWb. Length-weight relationship parameter b (weight~a*length^b)
- M. Natural mortality
- F. Fishing mortality
- N0. Number of individuals at time 0
- matFun. Name of maturity function ("pmat_w" is a logistic function that includes width, w, of quantiles)
- Lmat. Length at maturity (i.e. where probability of being mature is 50 (for use in "pmat_w" function)
- wmat. Width of length between 25 of transition from immature to mature (for use in "pmat_w" function)
- fec. Number of eggs produced per weight [g] of mature female
- selectFun. Function to use for gear selection. Determines lengths vulnerable to fishing mortality.
- select_p1. Parameter 1 used in "gillnet" selectivity function
- select_p2. Parameter 2 used in "gillnet" selectivity function
- mesh_size. Mesh size [streched length in mm] used in "gillnet" selectivity function
- mesh_size1. Mesh size of smallest reference net used in fitting "gillnet" selectivity function
- select_dist. Distribution type used in "gillnet" selectivity function
- knife_edge_size. Minimum length selected by "knife_edge" selectivity function
- srrFun. Function used for stock-recruitment relationship
- rmax. Maximum recruitment parameter used in "srrBH" stock-recruitment (Beverton-Holt)
- beta. "beta" parameter used in "srrBH" stock-recruitment (Beverton-Holt)

Usage

```
data(tilapia)
```

Format

A list containing parameters used on other `fishdynr` functions

Examples

```
### Ex 1. Plot of single month
data(tilapia)
res <- cohortSim(tilapia, t_incr=0.1)
plot(pcap ~ Lt, res, t="l")
plot(Lt ~ t, res, t="l")
plot(Wt ~ t, res, t="l")
plot(Bt ~ t, res, t="l")
```

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