Package: FLRef (via r-universe)

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Title Reference point computation for advice rules

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Description Blah

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ABItgt *ABItgt() Computes ABI for target F, e.g. ABImsy (Griffith et al. 2023)*

Description

ABItgt() Computes ABI for target F, e.g. ABImsy (Griffith et al. 2023)

Usage

```
ABItgt(stock, ftgt = 0.2, thresh = 0.9, ...)
```

Arguments

stock	object of class FLStock
ftgt	target F at equilibrium, e.g. Fmsy
thresh	quantile ageref treshold, default 0.9

Value

FLQuant

Examples

```
data(ple4)
ABImsy = ABItgt(ple4,ftgt=0.22,thresh=0.9)
plot(ABImsy)+ylim(0,2)+
 geom_hline(yintercept = c(0.8,1),col=c(2,1),linetype=c(2,1))+ylab(expression(ABI[MSY]))
```

ALK *ALK function*

Description

ALK function

Usage

```
ALK(N_a, iALK)
```

Arguments

N_a	numbers at age sample for single event
iALK	from iALK() outout

Value

FLPar of ALK

alk.sample *generates annual ALK sample with length stratified sampling*

Description

generates annual ALK sample with length stratified sampling

Usage

```
alk.sample(lfds, alks, nbin = 20, n.sample = 1)
```

Arguments

lfds	length frequency *FLQuant*
alks	annual ALK proportions at age output form ALKs() *FLPars*
nbin	number of samples per length bin
n.sample	sample size of lfd

Value

FLPars of sampled ALK

ALKs *annual ALK function*

Description

annual ALK function

Usage

```
ALKs(object, iALK)
```

Arguments

object	FLQuant with numbers at age
iALK	from iALK() outout

Value

FLPars of ALK

`applyALK` *applyALK function to length to age*

Description

applyALK function to length to age

Usage

```
applyALK(lfds, alks)
```

Arguments

`alks`	*FLPars* annual ALKs
`lfd`	*FLQuant* with numbers at length

Value

FLQuant for numbers at age

`asem2spm` *asem2spm()*

Description

asem2spm()

Usage

```
asem2spm(
  object,
  quant = c("vb", "ssb"),
  fmsy = NULL,
  rel = FALSE,
  spcurve = FALSE
)
```

Arguments

`object`	An *FLBRP*
`quant`	choose between vb and ssb
`rel`	if TRUE ratios are produced for spcurve
`spcurve`	if TRUE a data.frame is added

Value

prior means for r and m *FLPar*

Examples

```
data(ple4)
sr <- srrTMB(as.FLSR(ple4,model=bevholtSV),spr0=mean(spr0y(ple4)))
brp = FLBRP(ple4,sr)
asem2spm(brp)[1:4]
plotpf(brp)
plotpf(brp,rel=TRUE)
```

---

bioidx.sim *generates FLIndexBiomass with random observation error from an FLStock*

Description

generates FLIndexBiomass with random observation error from an FLStock

Usage

```
bioidx.sim(object, sel = catch.sel(object), sigma = 0.2, q = 0.001)
```

Arguments

object	FLStock
sel	FLQuant with selectivity.pattern
sigma	observation error for log(index)
q	catchability coefficient for scaling

Value

FLIndexBiomass

Examples

```
data(ple4)
sel = newselex(catch.sel(ple4),FLPar(S50=1.5,S95=2.1,Smax=4.5,Dcv=1,Dmin=0.1))
ggplot(sel)+geom_line(aes(age,data))+ylab("Selectivity")+xlab("Age")
object = propagate(ple4,10)
sel = newselex(catch.sel(object),FLPar(S50=2.5,S95=3.2,Smax=3.5,Dcv=0.6,Dmin=0.2))
idx = bioidx.sim(object,sel=sel,q=0.0001)
# Checks
ggplot(idx@sel.pattern)+geom_line(aes(age,data))+ylab("Selectivity")+xlab("Age")
ggplot(idx@index)+geom_line(aes(year,data,col=ac(iter)))+theme(legend.position = "none")+ylab("Index")
```

blag *blag()*

Description

function to assign B[y+1] to B[y]. Warning correlation structure of B[y+1] and F[y] is meaningless

Usage

```
blag(mvn, verbose = TRUE)
```

Arguments

mvn

Value

output list of quant posteriors and mle's

Author(s)

Henning Winker (GFCM)

ca.sim *generates catch.n with lognormal annual and multinomial age composition observation error*

Description

generates catch.n with lognormal annual and multinomial age composition observation error

Usage

```
ca.sim(object, ess = 200, what = c("catch", "landings", "discards")[1])
```

Arguments

object	FLQuant
ess	effective sample size for age composition
what	c("catch", "landings", "discards")
sel	FLQuant with selectivity.pattern e.g. catch.sel()

Value

FLQuant with catch.n samples

Examples

```
data(ple4)
object = propagate(ple4,10)
ca = ca.sim(object,ess=200)
# Checks
ggplot(ca)+geom_line(aes(year,data,col=ac(iter)))+facet_wrap(~age)+
theme(legend.position = "none")+ylab("Index")
```

`computeFbrp` *computeFbrp() Computes biological reference points corresponding to the proxy Fbrp*

Description

computeFbrp() Computes biological reference points corresponding to the proxy Fbrp

Usage

```
computeFbrp(
  stock,
  sr = "missing",
  proxy = NULL,
  x = NULL,
  blim = 0.1,
  type = c("b0", "btgt", "value"),
  btri = "missing",
  bpa = "missing",
  bthresh = "missing",
  verbose = T,
  fmax = 10,
  ...
)
```

Arguments

`stock`	object of class FLStock
`sr`	stock recruitment model of class FLSR
`proxy`	choice of Fmsy proxies (combinations permitted) • "sprx" spawning potential ratio spr/spr0 with basis x • "bx" SSB as fraction xSSB0 • "f0.1" 10 • "fe40" Patterns estimator for Fmsy • "msy" maximum surplus production (not defined for segreg) • numeric user value
`x`	basis in percent for sprx and bx, e.g. 40 for spr40

blim	values < 1 are taken as fraction to B0 and blim > 1 as absolute values unless specified otherwise
type	type of blim input, values < 1 are • "b0" fraction to B0 • "btgt" fraction to Btarget (first occurring in proxy) • "value" absolute value
btri	Btrigger can specified as absolute value
bpa	Bpa can specified as absolute value
bthresh	Bthresh (GFCM) interchangeable use with Bpa
verbose	
fmax	maximum Flim = max(Flim,fmax*Fbrp)

Value

brp object of class FLBRP with computed Fbrp reference points

Examples

```
data(ple4)
srr = srrTMB(as.FLSR(ple4,model=rickerSV),spr0=spr0y(ple4))
brp = computeFbrp(stock=ple4,sr=srr,proxy=c("sprx","f0.1"),blim=0.1,type="b0")
ploteq(brp,obs=TRUE,refpts="msy")
```

---

computeFbrps *computeFbrps() Computes biological reference points corresponding to the proxy Fbrp*

Description

computeFbrps() Computes biological reference points corresponding to the proxy Fbrp

Usage

```
computeFbrps(
  stock,
  sr = "missing",
  proxy = c("sprx", "bx", "all"),
  fmsy = FALSE,
  f0.1 = TRUE,
  fmax = 5,
  verbose = T,
  ...
)
```

Arguments

stock	object of class FLStock
sr	stock recruitment model of class FLSR
fmsy	if TRUE, Fmsy is computed (not suggest for segreg or geomean sr)
f0.1	if TRUE, F0.1 is computed
fmax	maximum Flim = minfmax*Fbrp)
verbose	
proxies	choice of Fmsy proxies • "all" both sprx and bx • "sprx" spawning potential ratio spr/spr0 with basis x • "bx" SSB as fraction xSSB0

Value

brp object of class FLBRP with computed Fbrp reference points

---

Fbrp *Fbrp() Extract Fbrp based reference points from output of computeFbrp*

Description

Fbrp() Extract Fbrp based reference points from output of computeFbrp

Usage

```
Fbrp(brp)
```

Arguments

brp	input of class FLBRP from ComputeFbrp

Value

FLPar object with computed Fbrp reference points

`Fe40` *Fe40() Patterson estimator for Fmsy*

Description

Fe40() Patterson estimator for Fmsy

Usage

```
Fe40(stock, nyears = 3)
```

Arguments

`stock`	input of class FLStock
`nyears`	number of years to average

Value

value

`flr2stars` *flr2stars()*

Description

flr2stars()

Usage

```
flr2stars(object, quantiles = c(0.05, 0.95))
```

Arguments

`object`	of class FLStockR
`quantities`	default is 90CIs as c(0.05,0.95)

Value

STARS list with $timeseris and $refpts

`Fmmy` *Fmmy() Uses opt.bisect to derive the F at Maximum Median Yield from stochastic simulations*

Description

Fmmy() Uses opt.bisect to derive the F at Maximum Median Yield from stochastic simulations

Usage

```
Fmmy(
  brp,
  sigmaR = 0.5,
  rho = 0,
  nyears = 100,
  iters = 250,
  yrs.eval = NULL,
  range = "missing",
  tol = 0.001,
  maxit = 15,
  verbose = TRUE
)
```

Arguments

`brp`	output object from computeFbrp() of class FLBRP
`sigmaR`	lognormal recruitment standard deviation
`rho`	AR1 recruitment autocorrelation coefficient
`nyears`	number of simulation years
`iters`	number simulation iterations
`yrs.eval`	last years to be used evaluation period, default nyears/2
`range`	range of Fbar value to be evaluated
`tol`	tolerance
`maxit`	number of steps
`verbose`	cat comments

Value

list of FLPar, FLStock and FLBRP objects

Examples

```
data(ple4)
bh = srrTMB(as.FLSR(ple4,model=bevholtSV),spr0=spr0y(ple4))
brp = computeFbrp(ple4,bh,proxy=c("bx","msy"),x=35,blim=0.1)
fmmy = Fmmy(brp,sigmaR=0.7,rho=0.3)
getF(fmmy) # FMMY value
plotFsim(fmmy)
brpfmmy = computeFbrp(ple4,bh,proxy=getF(fmmy),blim=0.1)
fsim = Fsim(brpfmmy,sigmaR=0.7,rho=0.3)
plotFsim(fsim)
```

Fp05 *Calculates the Fbar value giving a maximum probability of ssb being below Blim of 5 percent*

Description

Calculates the Fbar value giving a maximum probability of ssb being below Blim of 5 percent

Usage

```
Fp05(
  object,
  iters = "missing",
  range = "missing",
  tol = 0.001,
  maxit = 20,
  verbose = TRUE
)
```

Arguments

object	output from Fsim()
iters	Number of iterations, cannot exceed input object
range	range of Fbar value to be evaluated
verbose	Should progress be shown, TRUE.

Value

list

Examples

```
data(ple4)
bh = srrTMB(as.FLSR(ple4,model=bevholtSV),spr0=spr0y(ple4))
brp = computeFbrp(ple4,bh,proxy="bx",x=35,blim=0.2) # set Blim higher
fsim = Fsim(brp,sigmaR=0.7,rho=0.3,iters=500)
plotFsim(fsim)
fp.05 = Fp05(fsim)
plotFsim(fp.05,panels=c(2,4)) # black line is Fp0.05
getF(fp.05)
```

`Fsim` *Fsim() Simulates stochastic stock dynamics under under constant Fbrp*

Description

Fsim() Simulates stochastic stock dynamics under under constant Fbrp

Usage

```
Fsim(
  brp,
  Ftgt = NULL,
  sigmaR = 0.5,
  rho = 0,
  nyears = 100,
  iters = 250,
  yrs.eval = NULL,
  verbose = TRUE
)
```

Arguments

`brp`	output object from computeFbrp() of class FLBRP
`sigmaR`	lognormal recruitment standard deviation
`rho`	AR1 recruitment autocorrelation coefficient
`nyears`	number of simulation years
`iters`	number simulation iterations
`yrs.eval`	last years to be used evaluation period, default nyears/2
`verbose`	cat comments

Value

list of FLPar, FLStock and FLBRP objects

Examples

```
data(ple4)
hs = srrTMB(as.FLSR(ple4,model=segreg),spr0=spr0y(ple4),lplim=0.05,uplim=0.25)
blim = params(hs)[[2]]
brp = computeFbrp(ple4,hs,proxy=c("sprx","f0.1","msy"),x=40,blim=blim)
ploteq(brp)
fsim = Fsim(brp,sigmaR=0.7,rho=0.3)
plotFsim(fsim)
plotFsim(fsim,panels=2)
```

---

fudc *fudc()*

Description

generates an up-down-constant F-pattern

Usage

```
fudc(
  object,
  fref = 0.2,
  fhi = 2.5,
  flo = 0.8,
  sigmaF = 0.2,
  breaks = c(0.5, 0.75)
)
```

Arguments

object	An *FLStock*
fref	reference denominator for fbar
fhi	factor for high F as fhi = fbar/fref
flo	factor for low F as flo = fbar/fref
sigmaF	variation on fbar
breaks	relative location of directional change

Value

FLQuant

Examples

```
data(ple4)
sr <- srrTMB(as.FLSR(ple4,model=bevholtSV),spr0=mean(spr0y(ple4)))
brp = computeFbrp(ple4,sr,proxy="msy")
fmsy = Fbrp(brp)["Fmsy"]
stki = propagate(ple4,100)
fy = fudc(ple4,fhi=2,flo=0.9,fref=fmsy,sigmaF=0)
fyi = fudc(stki,fhi=2,flo=0.9,fref=fmsy,sigmaF=0.2)
plot(fy,fyi)+ylab("F")
#Forcasting
om <- FLStockR(ffwd(stki,sr,fbar=fyi))
om@refpts = Fbrp(brp)
plotAdvice(window(om,start=1960))
```

---

fwd2stars *Function to summarise forecast results*

Description

Function to summarise forecast results

Usage

```
fwd2stars(object, eval.yrs = NULL, rel = TRUE)
```

Arguments

object	*FLStocks* with list of *FLStockR* objects
eval.yrs	evaluation years of forecast
rel	if TRUE ratios B/Btgt and F/Ftgt are shown

Value

data.frame

---

getF *getF()*

Description

Helper functio to extract F from various FLRef output

Usage

```
getF(x)
```

Arguments

x	output object from computeFbrp() of class FLBRP

`huecol` *huecol*

Description

huecol

Usage

```
huecol(n, alpha = 1)
```

Arguments

n	number of colors
alpha	transluscency

`iALK` *inverse ALK function with lmin added to FLCore::invALK*

Description

inverse ALK function with lmin added to FLCore::invALK

Usage

```
iALK(
  params,
  model = vonbert,
  age,
  cv = 0.1,
  lmin = 5,
  lmax = 1.2,
  bin = 1,
  max = ceiling(linf * lmax),
  reflen = NULL
)
```

Arguments

params	growth parameter, default FLPar(linf,k,t0)
model	growth model, only option currently vonbert
age	age vector
cv	of length-at-age
lmin	minimum length
lmax	maximum upper length specified lmax*linf
bin	length bin size, dafault 1
max	maximum size value
reflen	evokes fixed sd for L_a at sd = cv*reflen
timing	t0 assumed 1st January, default seq(0,11/12,1/12), but can be single event 0.5
unit	default is "cm"

Value

FLPar age-length matrix

---

idx.sim *generates FLIndex with lognormal annual and multinomial age composition observation error*

Description

generates FLIndex with lognormal annual and multinomial age composition observation error

Usage

```
idx.sim(
  object,
  sel = catch.sel(object),
  ages = NULL,
  years = NULL,
  ess = 200,
  sigma = 0.2,
  q = 0.01
)
```

Arguments

object	FLStock
sel	FLQuant with selectivity.pattern
ages	define age range
years	define year range
ess	effective sample size for age composition sample
sigma	annual observation error for log(q)
q	catchability coefficient for scaling

Value

FLIndex

Examples

```
data(ple4)
sel = newselex(catch.sel(ple4),FLPar(S50=1.5,S95=2.1,Smax=4.5,Dcv=1,Dmin=0.1))
ggplot(sel)+geom_line(aes(age,data))+ylab("Selectivity")+xlab("Age")
object = propagate(ple4,10)
idx = idx.sim(object,sel=sel,ess=200,sigma=0.2,q=0.01,years=1994:2017)
# Checks
ggplot(idx@sel.pattern)+geom_line(aes(age,data))+ylab("Selectivity")+xlab("Age")
ggplot(idx@index)+geom_line(aes(year,data,col=ac(iter)))+facet_wrap(~age,scales="free_y")+
theme(legend.position = "none")+ylab("Index")
```

---

jabba2FLStockR *jabba2FLStockR()*

Description

jabba2FLStockR()

Usage

```
jabba2FLStockR(jabba, blim = 0.3, bthr = 0.5, thin = 10, rel = FALSE)
```

Arguments

jabba	fit from JABBA fit_jabba() or jabba$kbtrj
blim	biomass limit reference point as fraction of Bmsy
thin	thinnig rate of retained iters
rel	if TRUE ratios BBmsy and FFmsy are stored
bpa	biomass precautionary reference point as fraction of Bmsy

Value

FLStockR with refpts

jabba2stars *jabba2stars()*

Description

jabba2stars()

Usage

```
jabba2stars(jabba, quantiles = c(0.05, 0.95), blim = 0.3, bthr = 0.5)
```

Arguments

jabba	fit from JABBA fit_jabba() or jabba$kbtrj
quantiles	default is 90CIs as c(0.05,0.95)
blim	biomass limit point as fraction of Bmsy, default 0.3Bmsy (ICES)
bthr	biomass precautionary point as fraction of Bmsy, default 0.5Bmsy (ICES)

Value

STARS list with $timeseris and $refpts

len.sim *function to generate survey (pulse) and continuous LFDs*

Description

function to generate survey (pulse) and continuous LFDs

Usage

```
len.sim(
  N_a,
  params,
  model = vonbert,
  ess = 250,
  timing = seq(0, 11/12, 1/12),
  unit = "cm",
  scale = TRUE,
  reflen = NULL,
  bin = 1,
  cv = 0.1,
  lmin = 5,
  lmax = 1.2
)
```

Arguments

N_a	numbers at age sample
params	growth parameter, default FLPar(linf,k,t0)
model	growth model, only option currently vonbert
ess	effective sample size
timing	t0 assumed 1st January, default seq(0,11/12,1/12), but can be single event 0.5
unit	default is "cm"
scale	if TRUE scaled to N_a input
reflen	evokes fixed sd for L_a at sd = cv*reflen
bin	length bin size, dafault 1
cv	variation in L_a
lmin	minimum length
lmax	maximum upper length specified lmax*linf

Value

FLQuant for length

---

lfd.sim *function to generate survey (pulse) and continuous LFDs*

Description

function to generate survey (pulse) and continuous LFDs

Usage

```
lfd.sim(
  object,
  stock,
  sel = catch.sel(stock),
  params,
  model = vonbert,
  ess = 250,
  timing = seq(0, 11/12, 1/12),
  timeref = 0.5,
  unit = "cm",
  scale = TRUE,
  reflen = NULL,
  bin = 1,
  cv = 0.1,
  lmin = 5,
  lmax = 1.2
)
```

Arguments

object	*FLQuant* numbers at age sample
stock	*FLStock* object
sel	selectivity, default catch.sel(stock)
params	growth parameter, default FLPar(linf,k,t0)
model	growth model, only option currently vonbert
ess	effective sample size
timing	default constinoues seq(0,11/12,1/12), but can be single event 0.5
timeref	reference timing of the sample, default 0.5 (e.g. survey or catch.n)
unit	default is "cm"
scale	if TRUE scaled to N_a input
reflen	evokes fixed sd for L_a at sd = cv*reflen
bin	length bin size, dafault 1
cv	variation in L_a
lmin	minimum length
lmax	maximum upper length specified lmax*linf

Value

FLQuant for length

Mlorenzen *Mlorenzen*

Description

computes Lorenzen M with scaling option

Usage

```
Mlorenzen(object, Mref = "missing", Aref = 2)
```

Arguments

object	weight-at-age of class *FLQuant*
Mref	reference M for scaling
Aref	reference Age for scaling

Value

FLQuant m()

Examples

```
data(ple4)
Ml = Mlorenzen(stock.wt(ple4))
# Scale
Ms = Mlorenzen(stock.wt(ple4),Mref=0.2,Aref=2)
flqs = FLQuants(Lorenzen=Ml,Scaled=Ms)
```

---

newselex *generates flexible 5-paramater selex curves*

Description

generates flexible 5-paramater selex curves

Usage

```
newselex(object, selexpars)
```

Arguments

object	FLQuant from catch.sel() or sel.pattern()
selexpars	Selectivity Parameters selexpars S50, S95, Smax, Dcv, Dmin

- S50: age at 50
- S95: age at 50
- Smax: age at peak of selectivity before descending limb
- Dcv: CV demeterming the steepness of the descending half-normal slope
- Dmin: determines the minimum retention of oldest fishes

Value

FLquant with selectivity pattern

Examples

```
data(ple4)
sel = newselex(catch.sel(ple4),FLPar(S50=2,S95=3,Smax=4.5,Dcv=0.6,Dmin=0.3))
ggplot(sel)+geom_line(aes(age,data))+ylab("Selectivity")+xlab("Age")
# Simulate
harvest(ple4)[] = sel
sr <- srrTMB(as.FLSR(ple4,model=bevholtSV),spr0=mean(spr0y(ple4)))
brp = computeFbrp(ple4,sr,proxy="msy")
fbar(brp) = FLQuant(rep(0.01,70))
stk = as(brp,"FLStock")
units(stk) = standardUnits(stk)
its = 100
stk <- FLStockR(propagate(stk, its))
stk@refpts= Fbrp(brp)
```

```
b0=an(Fbrp(brp)["B0"])
control = FLPar(Feq=0.15,Frate=0.1,Fsigma=0.15,SB0=b0,minyear=2,maxyear=70,its=its)
run <- rffwd(stk, sr=sr,control=control,deviances=ar1rlnorm(0.3, 1:70, its, 0, 0.6))
plotAdvice(run)
```

`opt.bisect` *Bisection approach to optimise x for maximising y*

Description

The plain bisection algorithm (Burden & Douglas, 1985) is employed here to find the value of a given forecast target quantity (e.g. 'fbar') for which a selected value of a performance statistic is obtained over a chosen period.

Usage

```
opt.bisect(
  stock,
  sr,
  deviances = rec(stock) %=% 1,
  metrics,
  statistic,
  years,
  pyears = years,
  tune,
  tol = 0.001,
  maxit = 15,
  log = TRUE,
  verbose = TRUE
)
```

Arguments

`stock`	object class FLStock
`sr`	object class FLSR
`metrics`	FLQuant of FLStock to be defined
`statistic`	
`years`	years to be evaluated
`tune`	range for input x
`tol`	tolerance level
`maxit`	number of optimisation steps
`log`	if TRUE, optimise on log-scale

Author(s)

Credits to Iago Mosqueira

References

Burden, Richard L.; Faires, J. Douglas (1985), "2.1 The Bisection Algorithm", Numerical Analysis (3rd ed.), PWS Publishers, ISBN 0-87150-857-5

Examples

```
data(ple4)
stock <- propagate(stf(ple4, end=2118), 200)
srr <- predictModel(model=rec ~ ifelse(ssb <= b, a * ssb, a * b), params=FLPar(a=1.29, b=1.35e+06))
# GENERATE SRR deviances
devs <- ar1rlnorm(rho=0.4, 2018:2118, iters=200, meanlog=0, sdlog=0.5)
# DEFINE MMY statistic
statistic <- list(MMY=list(~apply(L,1,median), name="MMY",
  desc="ICES Maximum Median Yield"))
# CALL bisect over 100 years, Fmmy calculated over last 50.
fmmy <- opt.bisect(stock, sr=srr, deviances=devs, metrics=list(L=landings),
statistic=statistic, years=2018:2118,
pyears=2069:2118, tune=list(fbar=c(0.01, 0.2)))
# fmmy
mean(fbar(fmmy)[,ac(2069:2118)])
```

---

pgquant *sets plus group on FLQuant*

Description

sets plus group on FLQuant

Usage

```
pgquant(object, pg)
```

Arguments

object	FLQuant
pg	

Value

FLQuant

plotAdvice *plotAdvice Plots stochastic stock dynamics against refpts for constant Fsim()*

Description

plotAdvice Plots stochastic stock dynamics against refpts for constant Fsim()

Usage

```
plotAdvice(
  object,
  rpts = "missing",
  type = NULL,
  plotrefs = TRUE,
  probs = c(0.05, 0.2, 0.5, 0.8, 0.95),
  colour = "dodgerblue",
  ncol = NULL,
  label.size = 2.5
)
```

Arguments

type	age-structured "asm" or surplus production "spm" plotting style
plotrefs	if TRUE reference points are plotted
probs	determine credibility intervals, default 80th, 90th percentiles #' @param ncol number of plot panel columns
colour	color of CIs
label.size	size of refpts labels
stock	FLStock or FLStockR
refpts	as FLPar or Fbrp() if FLStockR is not provided or should be overwritten

Value

ggplot

Examples

```
data(ple4)
srr = srrTMB(as.FLSR(ple4,model=rickerSV),spr0=spr0y(ple4))
brp = computeFbrp(stock=ple4,sr=srr,proxy=c("sprx","f0.1","fe40"),blim=0.1,type="b0")
plotAdvice (ple4,brp)
```

plotAR *plotAR Plots the new proposed ICES advice rule*

Description

plotAR Plots the new proposed ICES advice rule

Usage

```
plotAR(
  pars,
  ftgt = 1,
  btrigger = "missing",
  bpa = "missing",
  bthresh = "missing",
  fpa = "missing",
  fthresh = "missing",
  bclose = 0,
  fmin = 0,
  obs = "missing",
  kobe = TRUE,
  alpha = 1,
  xmax = 1.2,
  ymax = 1.5,
  ylab = "missing",
  xlab = "missing",
  rel = FALSE,
  expand = TRUE,
  labels = TRUE,
  label.cex = 3.5,
  critical = TRUE
)
```

Arguments

pars	FLPar object or computeFbrp() ouput • 1: "Fbrp" # "F.." must first • 2: "Btgt" • 3: "Blim" • 4: "B0"
ftgt	factor to adjust Fmsy or its proxy e.g. 0.8Fmsy
btrigger	biomass trigger below which F is linearly reduced, if > 10 value, else factor*Btgt
bpa	precautionary biomass threshold, if > 10 value, else factor*Blim
fpa	option to input Fpa value
bclose	biomass that invokes fishing closure

fmin	minimum allowable (bycatch) fishing mortality under closure
obs	obtion to show observation with input class 'FLStock'
kobe	add kobe colour-coding
alpha	transparency of shading
xmax	multiplier for upper default xlim
ymax	multiplier for upper default ylim
ylab	option customize ylab
xlab	option customize xlab
rel	option to denote x,y labs as relative B/Btgt and F/Ftgt
expand	option to expand the plot area to border - default TRUE
labels	annotate reference point labels
critical	option to highlight critical zone below blim
labelslabel.cex=3.5	set size of labels

Value

ggplot

Examples

```
data(ple4)
srr = srrTMB(as.FLSR(ple4,model=segreg),spr0=spr0y(ple4))
blim = params(srr)[[2]]
brp = computeFbrp(stock=ple4,sr=srr,proxy="f0.1",blim=blim)
rpt = Fbrp(brp)
plotAR(rpt,btrigger=an(0.8*rpt["Btgt"]))
# Use Bpa as trigger (ICES style)
plotAR(rpt,obs=ple4,bpa=1.4)
# Change kobe to greyscale
plotAR(rpt,obs=ple4,bpa=1.4,kobe=FALSE)
# add fishing closure with minimum unavoidable F and Btrigger
plotAR(rpt,obs=ple4,bpa=1.4,btrigger=0.7,kobe=TRUE,bclose=1,fmin=0.01)
# show a relative
plotAR(rpt,obs=ple4,rel=TRUE,bpa=1.4,btrigger=0.7,kobe=TRUE,bclose=1,fmin=0.02)
```

---

plotbioage *plotbioage() Plots stock N_a, W_a, M_a and Mat_a by year*

Description

plotbioage() Plots stock N_a, W_a, M_a and Mat_a by year

Usage

```
plotbioage(stk, ncol = 2)
```

Arguments

stk	stock object class FLStock
ncol	number of columns in multiplot

Value

ggplot

Examples

```
data(ple4)
plotbioage(ple4)
```

---

plotbioyr *plotbioyr() Plots stock N_a, W_a, M_a and Mat_a across years*

Description

plotbioyr() Plots stock N_a, W_a, M_a and Mat_a across years

Usage

```
plotbioyr(stk, ncol = 2)
```

Arguments

stk	stock object class FLStock
ncol	number of columns in multiplot

Value

ggplot

Examples

```
data(ple4)
plotbioyr(ple4)
```

plotdyn *plotdyn() Plots stock trajectories at age*

Description

plotdyn() Plots stock trajectories at age

Usage

```
plotdyn(stk, ncol = 2)
```

Arguments

stk	stock object class FLStock
ncol	number of columns in multiplot

Value

ggplot

Examples

```
data(ple4)
plotdyn(ple4)
```

ploteq *ploteq() Modification of method plot('FLBRP') to plot equilibrium output of computeFbrp()*

Description

ploteq() Modification of method plot('FLBRP') to plot equilibrium output of computeFbrp()

Usage

```
ploteq(
  brps,
  refpts = "missing",
  obs = FALSE,
  rel = FALSE,
  rpf = TRUE,
  dashed = rpf,
  colours = "missing",
  panels = NULL,
  ncol = 2
)
```

Arguments

brps	output object from computeFbrp of class FLBRP
refpts	Reference points, defaults are computed refpts from computeFbrp() • Fbrp • Blim • B0 • Btri
obs	Should observations be plotted? Defaults to 'FALSE'.
rel	option to denote x,y labs as relative B/Btgt and F/Ftgt
rpf	adds refpts in plots
dashed	plots vertical dashed lines to highlight refpts locations
colours	refpts colours, default is designed for computeFbrp() output
panels	plot panel option 1:4
ncol	number of plot panel columns

Value

ggplot

Examples

```
data(ple4)
srr = srrTMB(as.FLSR(ple4,model=rickerSV),spr0=spr0y(ple4))
brp = computeFbrp(stock=ple4,sr=srr,proxy=c("sprx","f0.1","msy"),blim=0.1,type="b0")
ploteq(brp,obs=TRUE)
ploteq(brp,obs=TRUE,refpts="msy",rel=TRUE)
brp.pa = computeFbrp(stock=ple4,sr=srr,proxy=c("msy","sprx","f0.1"),blim=0.1,bpa=Fbrp(brp)["Blim"]*2,type="b0")
ploteq(brp.pa,obs=TRUE,rel=TRUE)
```

---

plotFsim *plotFsim Plots stochastic stock dynamics against refpts for constant Fsim()*

Description

plotFsim Plots stochastic stock dynamics against refpts for constant Fsim()

Usage

```
plotFsim(
  object,
  worms = TRUE,
  thinning = 10,
  probs = c(0.05, 0.2, 0.5, 0.8, 0.95),
```

```
  plotrefs = TRUE,
  colour = "missing",
  ncol = "missing",
  label.size = 3,
  yrs.eval = NULL,
  panels = "missing"
)
```

Arguments

object	output object from Fsim()
worms	option to show individual iterations
thinning	thinning rate of iterations shows, e.g. 10 shows every 10th
probs	determine credibility intervals, default 80th, 90th percentiles
plotrefs	if TRUE reference points are plotted
colour	color of CIs
ncol	number of plot panel columns
label.size	size of reference points
yrs.eval	last years to be used evaluation period, default half nyears

Value

ggplot

---

plotMajuro *Plots the new proposed ICES advice rule*

Description

Plots the new proposed ICES advice rule

Usage

```
plotMajuro(
  ftgt = 1,
  fthresh = 1.1,
  btgt = 1,
  blim = 0.1,
  btrigger = 0.8 * btgt,
  bthresh = 0.5 * btgt,
  bclose = 0,
  fmin = 0,
  obs = "missing",
  kobe = TRUE,
  alpha = 1,
```

```
  xmax = 1.5,
  ymax = 1.5,
  ylab = "missing",
  xlab = "missing",
  rel = FALSE,
  expand = TRUE,
  labels = TRUE,
  critical = kobe
)
```

Arguments

ftgt	Target F = min(Fbrp,Fp0.5)
btgt	Biomass target corresponding to Fbrp
blim	biomass limit
btrigger	biomass trigger below which F is linearly reduced
bthresh	biomass threshold beyond which biomass is classified sustainable
bclose	biomass that invokes fishing closure
fmin	minimum allowable (bycatch) fishing mortality under closure
obs	obtion to show observation with input class 'FLStock'
kobe	add kobe colour-coding
alpha	transparency of shading
xmax	multiplier for upper default xlim
ymax	multiplier for upper default ylim
ylab	option customize ylab
xlab	option customize xlab
rel	option to denote x,y labs as relative B/Btgt and F/Ftgt
expand	option to expand the plot area to border - default TRUE
labels	annotate reference point labels
critical	option to highlight critical zone below blim

Value

ggplot

Examples

```
plotMajuro()
```

plotpf *plotpf()*

Description

plots production functions

Usage

```
plotpf(object, quant = c("vb", "ssb"), fmsy = NULL, rel = FALSE)
```

Arguments

object	An *FLBRP*
quant	choose between vb and ssb or both
fmsy	default if Fmsy
rel	if TRUE ratios are produced for spcurve

Value

ggplot

Examples

```
data(ple4)
sr <- srrTMB(as.FLSR(ple4,model=bevholtSV),spr0=mean(spr0y(ple4)))
brp = FLBRP(ple4,sr)
asem2spm(brp)[1:4]
plotpf(brp)
plotpf(brp,rel=TRUE)
```

plotspr *plotspr() Plots current vs unfished spawning biomass per recruit at age*

Description

plotspr() Plots current vs unfished spawning biomass per recruit at age

Usage

```
plotspr(stk, nyears = 3)
```

Arguments

stk	stock object class FLStock
nyears	number of current last years, default is 3
ncol	number of columns in multiplot

Value

ggplot

Examples

```
data(ple4)
plotbioage(ple4)
```

---

plotWKREF *plotWKREF Plots the new proposed ICES advice rule*

Description

plotWKREF Plots the new proposed ICES advice rule

Usage

```
plotWKREF(
  ftgt = 1,
  btgt = 1,
  blim = 0.2,
  btrigger = 0.9 * btgt,
  bthresh = 0.8 * btgt,
  bclose = 0,
  fmin = 0,
  obs = "missing",
  kobe = TRUE,
  alpha = 1,
  xmax = 1.3,
  ymax = 1.5,
  ylab = "missing",
  xlab = "missing",
  rel = FALSE,
  expand = TRUE,
  labels = TRUE,
  critical = kobe
)
```

Arguments

ftgt	Target F = min(Fbrp,Fp0.5)
btgt	Biomass target corresponding to Fbrp
blim	biomass limit
btrigger	biomass trigger below which F is linearly reduced
bthresh	biomass threshold beyond which biomass is classified sustainable
bclose	ratio biomass/blim that invokes fishing closure relative to blim
fmin	minimum allowable (bycatch) fishing mortality under closure
obs	obtion to show observation with input class 'FLStock'
kobe	add kobe colour-coding
alpha	transparency of shading
xmax	multiplier for upper default xlim
ymax	multiplier for upper default ylim
ylab	option customize ylab
xlab	option customize xlab
rel	option to denote x,y labs as relative B/Btgt and F/Ftgt
expand	option to expand the plot area to border - default TRUE
labels	annotate reference point labels
critical	option to highlight critical zone below blim

Value

ggplot

Examples

```
plotWKREF()
# Close fishery at Blim and adjust axis labels to relative
plotWKREF(blim=0.2,bclose=0.2,rel=TRUE)
# Close fishery at Blim, but allow fmin (e.g. bycatch)
plotWKREF(blim=0.2,bclose=0.2,fmin=0.1,rel=TRUE)
# Change Btrigger above Btgt
plotWKREF(blim=0.2,bclose=0.2,fmin=0.1,btrigger=0.80,rel=TRUE)
# Plot stock data
data(ple4)
plotWKREF(ftgt=0.25,btgt=8e+05,btrigger = 0.9*8e+05, blim=2e5,bclose=3e5,fmin=0.03,obs=ple4)
```

rc4 *r4sscol*

Description

r4sscol

Usage

```
rc4(n, alpha = 1)
```

Arguments

n	number of colors
alpha	transluscency

Value

vector of color codes

rffwd *rffwd() Project forward an FLStock with evolutionary Fbar*

Description

rffwd() Project forward an FLStock with evolutionary Fbar

Usage

```
rffwd(object, sr, fbar = control, control = fbar, deviances = "missing")
```

Arguments

object	An *FLStock*
sr	A stock-recruit relationship, *FLSR* or *predictModel*.
fbar	Yearly target for average fishing mortality, *FLQuant*.
control	Yearly target for average fishing mortality, *FLPar*.
deviances	Deviances for the strock-recruit relationsip, *FLQuant*.

Value

The projected *FLStock* object.

Examples

```
data(ple4)
sr <- srrTMB(as.FLSR(ple4,model=bevholtSV),spr0=mean(spr0y(ple4)))
brp = computeFbrp(ple4,sr,proxy="msy")
fbar(brp) = FLQuant(rep(0.01,70))
stk = as(brp,"FLStock")
units(stk) = standardUnits(stk)
its = 100
stk <- FLStockR(propagate(stk, its))
stk@refpts= Fbrp(brp)
b0=an(Fbrp(brp)["B0"])
control = FLPar(Feq=0.15,Frate=0.1,Fsigma=0.15,SB0=b0,minyear=2,maxyear=70,its=its)
run <- rffwd(stk, sr=sr,control=control,deviances=ar1rlnorm(0.3, 1:70, its, 0, 0.6))
plotAdvice(run)
```

---

rGclass *Function to characterize Productivity and refpts based on r and Generation*

Description

Function to characterize Productivity and refpts based on r and Generation

Usage

```
rGclass(r = NULL, gt = NULL)
```

Arguments

r	value of the intrinsic rate of population increase
gt	generation time G

Value

list with Productivity category and suggest Fbrps

---

schaefer.sim *schaefer.sim()*

Description

generates a Schafer surplus production model with process and observation error

Usage

```
schaefer.sim(
  k = 10000,
  r = 0.3,
  q = 0.5,
  pe = 0.1,
  oe = 0.2,
  bk = 0.9,
  years = 1980:2022,
  f0 = 0.2,
  fhi = 2.2,
  flo = 0.8,
  sigmaF = 0.15,
  iters = 1,
  blim = 0.3,
  bthr = 0.5,
  rel = FALSE
)
```

Arguments

k	carrying capacity
r	intrinsic rate of population increase
q	catchability coefficient
pe	process error
oe	process error
bk	initial fraction of b/k
years	time horizon
f0	factor for initial year as f0 = f/fmsy
fhi	factor for high F as fhi = f/fmsy
flo	factor for low F as flo = fbar/fmsy
sigmaF	variation on f trajectory
iters	number of iterations
rel	if TRUE metrics B/Bmsy and F/Fmsy are produced

Value

FLQuants

Examples

```
stk = schaefer.sim(iters=100,q=0.5)
plotAdvice(stk)
plot(FLIndex(index=iter(stk@stock,1))) # index
```

sops *scales catch-at-age to total catch with error (optional)*

Description

scales catch-at-age to total catch with error (optional)

Usage

```
sops(object, stock, sigma = 0.1, what = c("catch", "landings", "discards")[1])
```

Arguments

object	FLQuant catch.n, discard.n, landings.n
stock	FLStock
sigma	observation error
what	type c("catch", "landings", "discards")

Value

FLQuant

spict2FLQuant *spict2FLQuant()*

Description

spict2FLQuant()

Usage

```
spict2FLQuant(
  x,
  metric = c("ssb", "fbar", "catch", "stock", "harvest")[1],
  osa = FALSE,
  forecast = F
)
```

Arguments

x	fit from SPICT
osa	add one-step-ahead forecast
forecast	TRUE/FALSE

Value

FLQuant

Author(s)

adopted from Laurie Kell (biodyn)

`spict2FLStockR` *spict2FLStockR()*

Description

spict2FLStockR()

Usage

```
spict2FLStockR(
  res,
  blim = 0.3,
  bthr = 0.5,
  rel = FALSE,
  osa = FALSE,
  forecast = NULL
)
```

Arguments

`res`	fit from SPICT
`blim`	biomass limit reference point as fraction of Bmsy
`bthr`	biomass precautionary reference point as fraction of Bmsy
`rel`	if TRUE ratios BBmsy and FFmsy are stored
`osa`	add one-step-ahead forecast
`forecast`	extract forecast TRUE/FALSE

Value

FLStockR with refpts

spict2stars *spict2stars()*

Description

spict2stars()

Usage

```
spict2stars(spict, blim = 0.3, bthr = 0.5)
```

Arguments

spict	fit from fit.spict()
blim	biomass limit point as fraction of Bmsy, default 0.3Bmsy (ICES)
bthr	biomass precautionary point as fraction of Bmsy, default 0.5Bmsy (ICES)

Value

STARS list with $timeseris and $refpts

ss2FLStockR *ss2FLStockR()*

Description

ss2FLStockR()

Usage

```
ss2FLStockR(mvln, thin = 10, output = NULL)
```

Arguments

mvln	output from ssmvln()
thin	thinnig rate of retained iters
output	expected outputs presented as "mle" or median of "iters"

Value

FLStockR with refpts

ss2stars *ss2stars()*

Description

ss2stars()

Usage

```
ss2stars(mvln, output = c("iters", "mle")[1], quantiles = c(0.025, 0.975))
```

Arguments

mvln	output of ssmvln()
output	choice c("iters","mle")[1]
quantiles	default is 95CIs as c(0.025,0.975)

Value

STARS list with $timeseris and $refpts

ss3col *ss3col*

Description

ss3col

Usage

```
ss3col(n, alpha = 1)
```

Arguments

n	number of colors
alpha	transluscency

Value

vector of color codes

ssmvln *ssmvln()*

Description

function to generate uncertainty for Stock Synthesis

Usage

```
ssmvln(
  ss3rep,
  Fref = NULL,
  years = NULL,
  virgin = FALSE,
  mc = 1000,
  weight = 1,
  run = "MVLN",
  addprj = FALSE,
  ymax = NULL,
  xmax = NULL,
  legendcex = 1,
  verbose = TRUE,
  seed = 123
)
```

Arguments

ss3rep	from r4ss::SS_output
Fref	Choice of Fratio c("MSY","Btgt","SPR","F01"), correponding to F_MSY and F_Btgt
years	single year or vector of years for mvln
virgin	if FALSE (default) the B0 base for Bratio is SSB_unfished
mc	number of monte-carlo simulations
weight	weighting option for model ensembles weight*mc
run	qualifier for model run
addprj	include forecast years
ymax	ylim maximum
xmax	xlim maximum
verbose	Report progress to R GUI?
seed	retains interannual correlation structure like MCMC
out	choice c("iters","mle")
plot	option to show plot
legendcex=1	Allows to adjust legend cex

Value

output list of quant posteriors and mle's

Author(s)

Henning Winker (GFCM)

`stock2ratios` *stock2ratios()*

Description

stock2ratios()

Usage

```
stock2ratios(object)
```

Arguments

`object`	of class *FLStockR*

Value

FLStockR with ratios F/Ftgt and B/Btgt

`stockMedians` *stockMedians*

Description

stockMedians

Usage

```
stockMedians(stock)
```

Arguments

`stock`	class FLStock or FLStockR

Value

medians of all FLstock FlQuants

updsr *updsr()*

Description

updates sr in brp after changing biology

Usage

```
updsr(object, s = 0.7, v = NULL)
```

Arguments

object	An *FLBRP*
s	assumed steepness s
v	input option new SB0

Value

FLBRP

Examples

```
data(ple4)
sr <- srrTMB(as.FLSR(ple4,model=bevholtSV),spr0=mean(spr0y(ple4)))
brp = FLBRP(ple4,sr)
s = sr@SV[[1]]
params(brp)
# change
m(brp) = Mlorenzen(stock.wt(brp),Mref=0.15)
brpupd =updsr(brp,s)
params(brp)
```

updstars *updstars()*

Description

updstars()

Usage

```
updstars(star, newrefpts)
```

Arguments

star	output of star list
newrefpts	manually adjusted reference points

Value

STARS list with $timeseris and $refpts

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