DEPLr: Simulation Depletion Model

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Abstract

The **DEPLr** package is an implenentation of the depletion model in R applied to Octopus initially. The package provides tools for running Monte Carlo simulation and projecting stock abundance and biomass in the future to determine TAC for different fleets.

Keywords: Depletion, R, stock assessment, MCMC.

Contents

1. Introduction

aspic is a biomass dynamic model (**??**) originially implemented as a FORTRAN executable. The package provides tools for checking of diagnostics, projections, running Monte Carlo simulation and conducting Management Strategy Evaluation. Since the original FORTRAN code uses proprietry source code it can not be released under an open source licence and so only the FORTRAN execuatable can be provided as part of the package. In consequence the package is not avialable via CRAN but from CRAN instead.

Making **aspic** available as a pakage allows it to be used with other packages for plotting, summarising results and to be simulation tested, e.g. as part of the FLR tools for management strategy evaluation **?**; see (**???????????**)

aspic depends upon the **?** package, which contains most of the methods for

2. Data

aspic uses data on catch and catch per unit effort (CPUE) to estimate model parameters using the simplex algorithm to minimise the residual sum of squares from the fit observed CPUE. The parameters estimated are catchability (q) by fleet and the parameters of the suplus production function.

Data can either be provided as a data.frame or as a test input file.

2.1. R

The best way is to provide input data as a data.frame, with columms for `year,catch,cpue` and `code`; where the later column indicates the type of index (**Table ??**).

```
> library(aspic)
> ### Assessments
> ## 1 file
> aspic=readASPIC(paste(dirAspic,"/",scen=scen[1],".bio",sep=""))
> class(aspic)
> names(aspic)
> aspic=readASPIC(paste(dirAspic,"/",scen=scen[1],".bio",sep=""),data.frame=T)
> class(aspic)
> names(aspic)
> ## many files
> aspics=readASPIC(dirAspic,scen=scen,type="b",data.frame=T)
>
```

2.2. Files

There are six types of files, i.e.

.bio bootstrap estimates of historic biomass and harvest rate
.prj bootstrapped projections with predicted biomass and harvest rates
.det parameter estimates by bootstrap trial
.inp the input file with data, starting guesses, and run settings and for output
.prb as .bio but with projection results

```
> library(FLAdvice)
> ### Assessments
> ## 1 file
> aspic=readASPIC(paste(dirAspic,"/",scen=scen[1],".bio",sep=""))
> class(aspic)
> names(aspic)
> aspic=readASPIC(paste(dirAspic,"/",scen=scen[1],".bio",sep=""),data.frame=T)
> class(aspic)
> names(aspic)
> ## many files
> aspics=readASPIC(dirAspic,scen=scen,type="b",data.frame=T)
>
```

```
> #### Projections
> ## 1 file
> prj=readASPIC(paste(dirAspic,"/","bumcont1bproj500",".prj",sep=""))
> class(prj)
> names(prj)
> prj=readASPIC(paste(dirAspic,"/","bumcont1bproj500",".prj",sep="",data.frame))
> class(prj)
> names(prj)
> ## many
> prjs=readASPIC(dirAspic,scen=expand.grid(scen=c("bumcont1bproj","bumhighpproj"),TAC=seq(0,6000,500)))
> class(prjs)
> names(prjs)
```

2.3. R

There is an example text data set

```
> dirInp=paste(system.file(package="aspic"),"extdata",sep="/")
> asp=aspic(paste(dirInp,"albn.inp",sep="/"))
> asp=fit(asp)
> key=data.frame(
+   name   =c("Troll Composite CPUE","JLL Old","JLL Modern","CT Old","CT Modern"),
+   series=c("I","I","II","I","II"),
+   flag  =c("OT","JA","JA","CT","CT"),
+   gear  =c("TR","LL","LL","LL","LL"))
> dimnames(key)[[1]]=c("Troll Composite CPUE","JLL Old","JLL Modern","CT Old","CT Modern")
> wts=t(array(c(1,1,1,1,1,
+               1,0,0,0,0,
+               0,1,1,0,0,
+               0,0,0,1,1),c(5,4),list(name=key$name,Scenario=1:4)))
```

```
> cpue=subset(diags(asp),!is.na(obs))[,c("year","name","obs")]
> ggplot(aes(year,obs,group=name,col=name),data=cpue)+
+   geom_point()+
+   stat_smooth()+
+   theme_ms(legend.position="bottom")
```

```
> library(gam)
> gm  =gam(log(obs)~lo(year)+name,data=cpue)
> cpue=data.frame(cpue,gam=predict(gm),gamRsdl=residuals(gm))
> scl =coefficients(gm)[3:9]
> names(scl)=substr(names(scl),5,nchar(names(scl)))
> cpue=transform(cpue,scl=scl[as.character(name)])
> cpue[is.na(cpue$scl),"scl"]=0
> cpue=cbind(cpue,key[cpue$name,])[,-2]
> cpue$name=factor(cpue$name, levels=c("Troll Composite CPUE","JLL Old","JLL Modern","CT Old","CT Modern"))
> ggplot(cpue)+ geom_line(aes(year,exp(gam)),col="red")  +
+               geom_smooth(aes(year,obs),se=FALSE)      +
+               geom_point( aes(year,obs,col=name))       +
+               facet_wrap(~name,ncol=1,scale="free_y")  +
+               theme_ms(legend.position="none")         +
+               xlab("Year") + ylab("Index")
```

```
> uMat=ddply(cpue,.(name),transform, obs=stdz(obs))
> uMat=cast(uMat,year~name,value="obs")
> uMat=uMat[apply(uMat,1,function(x) !all(is.na(x))),]
> pM=plotmatrix(uMat[,-1])
> pM$layers[[2]]=NULL
> mns=ddply(subset(pM$data,!(is.na(x) & !is.na(y))),.(xvar,yvar), function(x) mean(x$y,na.rm=T))
> pM+geom_hline(aes(yintercept=V1),data=mns,col="red") +
+    geom_smooth(method="lm",se=F)  +
+    theme(legend.position="bottom")                  +
+    xlab("Index")+ylab("Index")
```

```
> cr=cor(uMat[,-1],use="pairwise.complete.obs")
> dimnames(cr)=list(gsub("_"," ",names(uMat)[-1]),gsub("_"," ",names(uMat)[-1]))
> cr[is.na(cr)]=0
> corrplot(cr,diag=F,order="hclust",addrect=2)  +
+              theme(legend.position="bottom")
```

3. Assessment

```
> asp=fit(asp)
```

```
> plot(asp)
```

4. Diagnostics

5. Reference Points

6. Fitting

7. Plotting

There are various standard plots, i.e. for fitted time series, reference points and diagnostics. Also using ggplot2 a variety of ad-hoc plots can be produced as required and the packages **diags** and **kobe** can be used for diagnostics and providing plots in Kobe II advice framework.

7.1. CPUE

7.2. Diagnostics

Residuals

Likelihood Profiling

8. Uncertainty

8.1. Bootstrapping

9. Management Procedure

9.1. Reference points

9.2. Projections

9.3. Harvest Control Rules

10. Advice

10.1. Kobe Framework

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