

# *Management Strategy Evaluation of Biomass Dynamic Management Procedures*

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## *Introduction*

MANAGEMENT STRATEGY EVALUATION (MSE) requires six steps Punt and Donovan (2007); namely i) identification of management objectives; ii) selection of hypotheses for the OM; iii) conditioning the OM based on data and knowledge, and possible weighting and rejection of hypotheses; iv) identifying candidate management strategies; v) running the Management Procedure (MP) as a feedback control in order to simulate the long-term impact of management; and then vi) identifying the MPs that robustly meet management objectives.

In this document we provide an example of conducting an MSE using the `mpb` package.

## *mpb*

```
library(FLCore)
library(mpb)
library(ggplotFL)
```

## *Management objectives*

```
library(FLBRP)
```

## *Operating Model*

```
library(diags)
library(FLife)

# load(om)
# load(eql)
load("/home/laurie/Desktop/flr/mpb/data/om.RData")
load("/home/laurie/Desktop/flr/mpb/data/eql.RData")

om=fwdWindow(om,eql,end=2030)
```

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```
om=propagate(om,100)
```

```
srDev=FLQuant(0,dimnames=list(year=2000:2030))
srDev=rlnorm(100,srDev,0.3)
```

```
om=fwd(om,catch=catch(om)[,ac(2000:2011)],sr=eql,sr.residuals=srDev)
om=fwdWindow(om,eql,end=2040)
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### *Observation Error Model*

```
library(FLBRP)
uDev=FLQuant(0,dimnames=list(year=ac(dims(eql)["minyear"]):ac(dims(eql)["maxyear"])))
uDev=rlnorm(100,uDev,0.3)
```

```
library(popbio)
```

```
refpts=FLBRP::refpts
mp=mpb::FLBRP2biodyn( eql,"biodyn")
```

```
modelParams=mpb::modelParams
```

```
setParams(mp)=ssb.obs(eql)%*%uDev
setControl(mp)=params(mp)
```

### *Management strategies*

```
library(popbio)
mp=FLBRP2biodyn( eql,"biodyn")

modelParams=mpb:::modelParams
setParams(mp)=ssb.obs(eql)%*%uDev
setControl(mp)=params(mp)
```

### *Running*

the Management Procedure (MP) as a feedback control in order to simulate the long-term impact of management;

```
?mseBiodyn
```

### *Identifying the MPs that robustly meet management objectives.*

```
library(kobe)
```

### *References*

Punt, A.E., and G.P. Donovan. 2007. "Developing Management Procedures That Are Robust to Uncertainty: Lessons from the International Whaling Commission." *ICES J. Mar. Sci.* 64 (4): 603–12.