# North Atlantic Albacore MSE

Agreed Validation Steps

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When setting up an MSE it is important to validate the implementation of the various procedures, i.e. the OM, OEM and the MP which has several elements, i.e. the assessment and the harvest control rule.

To do this is important to use the same random deviates across all trials, i.e. combinations of OM scenarios and candidate MPs. As well as then being able to compare like with like (e.g. as in a pairwise t-test) it is possible to check that procedures are correctly implemented, i.e. bounds are implemented as described.

At the Albacore WG a set of validation steps were agreed to be performed before advice will be given, namely

- Use the same random deviates across all scenarios, and check stability of higher and lower percentiles within and across OM/MP scenarios. i.e. run for 1000 iters for selected OM/MP combinations.
- To check SRR run with high F's and the dynamics are working the way they should, i.e contrast in the Spawning stock size and what it gives on recruitment
- Conduct a crosstest, i.e. run OM without feedback generate catch and CPUE fit SA, every 3 years and compare the OM and stock assessment (SA)
- Use OEM in cross test
- For all OM/MP trials run simple F=Ftarget projection, to check dynamics
- Run OM with feedback for an F target of FMSY and compare to F projection
- Run a OM with feedback for an F target of FMSY and an Btreshold of BMSY, compare to above.
- Run a OM with feedback for an F target of FMSY and an Btreshold of BMSY plus TAC bounds of 20, 25 and 30%, compare to above.
- Run scenarios using a factorial design, i.e. main effects, 1st, 2nd, ... order interactions, see if you can predict the performance indicators
- Compare OM and MP reference points
- Check TAC output by MP and Catch taken from OM, iteration by iteration.
- OM conditioning, of historic and future, i.e. calculate the OM production functions and compare trajectories to these.
- Compare OM reference points and statistics such as K, r, ... to MP values
- Check SA, e.g. hitting bounds, convergence
- Compare TAC output from MP compared to Catch from OM

## Summary

### Check SRR and Spawner v F curves

To check the stock recruitment relationships and the spawner and yield cuvres deterministic projections were run with a range of F. If the dynamics are working the way they should then the simulations should converge to the equilibrium cutves. **Figure 1** shows the stock-recruitment curves for 12 scenarios where M and steepness was changed in the Base Case. **Figure 2** shows the corresponding SSB v F curves. These show that the projections converge to the equilibrium values and so the projections and referturence points are consistent. This shows that the future conditioning of the OM is consistent with the historical OM estimates

## Random Deviates

The same random deviates are now used across all scenarios, allowing results to be compared across trials. Projections for $F_{MSY}$ were made for 1000 iters for selected OM/MP combinations **Figure 3**, this allows the stability of higher and lower percentiles within and across OM/MP scenarios to be checked. Once the feedback has been implemented then the variance will change and convergence needs to be rechecked, and the appropraite number of iterations determined.

The number of iterations required can be determined ed by monitoring for what number of iterations, statistics such as expected values, probability of exceeded limits and the standard deviation of the statistics converge. This will be done for the base case, by running for 1000 or more simulations.

## Crosstest

To check the stock assessment e.g. is it hitting bounds or not converging a crosstest was performed. In a crosstest a model is fitted to data and then used to generate data for use when fitting another model. This procedure was used to evaluate the biomass dynamic SA, by running the OM without feedback to generate catch and CPUE then fit the stock SA.

### Perfect Data

In the first instance the CPUE used a single series was catch/effort to see how well the biomass model can fit the age based dynamics. This is important as it helps in setting up the control options and initial conditions in the MP. **Figures 4 and 5** show the results for biomass and F for 12 senarios based on the Base Case and for 3 lengths of time series.

### OEM

The crosstest is repeated using 5 CPUE series with selection patterns condition by OM scenarios, and the same year ranges as used in the 2016 assessment. In the first instance the crosstest is only run for the OM upto 2011 to enable the best control options to be set for the SA. **Figures 6 and 7** show the results for biomass and F for 12 senarios based on the Base Case and for 3 lengths of time series.

## Profiles

There is a problem with convergence, due to the lack of information in the CPUE and and plots like **Figure 8** which show the likelihood profiles by component for an example stock assessement could be used to help set up the assessments.

## OM with feedback

Before running the trials, the MSE was run for a single trial and limited number of iterations for F target of FMSY, a F target of FMSY and a Btreshold of BMSY and an F target of FMSY and a Btreshold of BMSY for TAC bounds of 20, 25 and 30%, and compared to the projection of F=FMSY (**Figure 9**)

This will also allow a comparison of OM and MP reference points and to check that the TAC is being set correctly.

### Factorial Design

These can only be run once the OM, OEM and MP have been validated and agreed.

- Run scenarios using a factorial design, i.e. main effects, 1st, 2nd, ... order interactions, see if you can predict the performance indicators

## Results

**Figure 1**

**Figure 2**

**Figure 3** Estimate of SSB by sample size for projection at $F_{MSY}$

**Figure 4** Crosstest comparision of biomass with MFCL estimates, for single index.

**Figure 5** Crosstest comparision of harvest rate with MFCL estimates, for single index.

**Figure 6** Crosstest comparision of biomass with MFCL estimates.

**Figure 7** Crosstest comparision of harvest rate with MFCL estimates.

**Figure 8** Likelihood profile by CPUE series for example assessment.

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## F=$F_{MSY}$
* For all OM/MP trials run simple F=Ftarget projection, to check dynamics

**Figure 9**

#### OM with feedback

- Run OM with feedback for an F target of FMSY and compare to F projection
- Run a OM with feedback for an F target of FMSY and an Btreshold of BMSY, compare to above.
- Run a OM with feedback for an F target of FMSY and an Btreshold of BMSY plus TAC bounds of 20, 25 and 30%, compare to above.

**Figure 10** Comparison for a single iter

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- Run scenarios using a factorial design, i.e. main effects, 1st, 2nd, ... order interactions, see if you can predict the performance indicators

### Refpts

- Compare OM and MP reference points

### TAC

- Check TAC output by MP and Catch taken from OM, iteration by iteration.

## Conditioning

- OM conditioning, of historic and future, i.e. calculate the OM production functions and compare trajectories to these.

## Refpts

- Compare OM reference points and statistics such as K, r, ... to MP values

**Figure 11** Comparison of reference points

## Check SA

- Check SA, e.g. hitting bounds, convergence

## TAC

- Compare TAC output from MP compared to Catch from OM