

## Annex 5: Audit Reports

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### Audit of North Sea horse mackerel (WGWIDE 2018)

*Date: 11.09.2018*

*Auditor: Leif Nøttestad*

#### General

In 2012 the North Sea horse mackerel (NSHM) was classified as a category 5 stock, based on the ICES approach to data-limited stocks (DLS). Since then, a progressive reduction of TAC was advised by ICES, from 25500 tonnes in 2013-2014 to 15200 tonnes in 2015-2016.

In 2017 this stock was benchmarked and the North Sea International Bottom Trawl Survey (NS-IBTS) and Channel Ground Fish Survey (CGFS) abundance indices were modeled together. The resulting joint index was considered a proper indication of trend in abundance over time and the NSHM stock was upgraded to category 3. Stock advice for NSHM is biannual. In 2017 the advice for years 2018 and 2019 was provided. The joint abundance survey index indicated a continuation in the increasing trend observed since 2013. Nevertheless, the joint survey index for 2017 has shown a sudden change and steep decline, due to the drop of the CGFS survey index, WGWIDE decided to continue with the current advice of 17517 tonnes for 2019.

The data used as input to the NSHM assessment is as provided to the stock assessor by the stock and survey coordinators. The assessment and forecast appear to have been run in accordance with the stock annex.

#### For single stock summary sheet advice:

Short description of the assessment: extremely useful for reference of ACOM.

- **Assessment type: update** (benchmarked early 2017)
- **Assessment:** analytical category 3 (survey based method)
- **Forecast:** not presented
- **Assessment model:** JAXass model. Separable VPA type model
- **Data issues:** Data available as described in stock annex. Considerable uncertainties may be present in both survey indices, as well as in catch and bycatch statistics within and between years. Marked decline in the exploitable biomass index, mostly due to the decrease in the CGFS index. Signals of lower recruitment in the English Channel in 2017 compared to 2016. Steps may need to be taken next year for NSHM, if this steep decline continues, to ensure that the stock is kept in a healthy state and fished sustainably.
- **Consistency:** This year's assessment has been conducted in a manner consistent with last year (benchmark) and stock annex.
- **Stock status:** F/F<sub>msy</sub> slightly above 1
- **Management Plan:** No

#### General comments

The assessment is well documented and structured. It is quite easy to follow. Applying CPUE from the fishery is not optimal as input data for stock abundance and may involve uncertainties not possible to properly identify and quantify.

**Technical comments**

The assessment is done according to decisions taken during benchmark in 2017 and according to the stock annex.

**Conclusions**

The updated assessment has been performed correctly. Stock advice for NSHM is bi-annual. Given the steep decline in the index documented in 2017 compared to 2016 during the second year of an advice, care should be taken when establishing biannual advice for NSHM in the future.

## Audit of Boarfish

Date: 2018.09.13

Auditor: Sólva Káradóttir Eliassen (input data and assessment)

### For single stock summary sheet advice:

- Assessment type: update
- **Assessment:** trends – Category 3 stock
- **Forecast:** not presented
- **Assessment model:** Bayesian Schaefer state space surplus production model fitted using catch data, 6 delta-lognormal estimated IBTS survey indices, and 1 acoustic survey estimate. Key parameters ( $r$ ,  $K$ ,  $F_{msy}$ ,  $B_{msy}$  and  $TSB$ ) have been estimated using the exploratory Schaeffer state space surplus production model. The assessment has been run by the WinBUGS14 program.
- **Data issues:** Input data (i.e. yearly total biomass derived from acoustics, annual total catches and survey data) are available on Sharepoint as described in the Stock Annex. Catch and acoustic biomasses are also available in the WGWIDE report and in stock annex. There are inconsistencies between assessment input in landings/discards/catch data (catch.data.xlsx) and landings/discards/catch data in table 3.1.2.1. However, this does not affect the assessment, since the total catches are correct. This issue will be clarified in next year's report. The survey data are only available in the data folder, and thus it is not possible to double check whether these are consistent.
- **Stock status:**  $\langle B_{msy} \rangle = 1.63e5 < TSB.50 = 2.5e5$  and  $\langle F_{msy} \rangle = 0.18$ .  $F$  for 2018 has not yet been estimated, but it was 0.056 in 2017.
- Management Plan:

### General comments

In general, the assessment model is well described.

### Conclusions

The assessment has been performed correctly

### Checklist for audit process

#### General aspects

- Has the EG answered those TORs relevant to providing advice?
  - Yes
- Is the assessment according to the stock annex description?
  - Yes
- If a management plan is used as the basis of the advice, has been agreed to by the relevant parties and has the plan been evaluated by ICES to be precautionary?
- Have the data been used as specified in the stock annex?

- Has the assessment, recruitment and forecast model been applied as specified in the stock annex?
- Is there any **major** reason to deviate from the standard procedure for this stock?
- Does the update assessment give a valid basis for advice? If not, suggested what other basis should be sought for the advice?

## Audit of Red gurnard

*Date: 07.09.2018*

*Auditor: Konstantina Dimitrakopoulou*

### General

Survey data available in DATRAS was reported for this stock for the IBTS-Q1 survey in the North Sea, the WCGFS Scottish West Coast Groundfish Survey, the IGFS Irish Groundfish Survey, the French EVHOE-WIBTS-Q4 in the Celtic Sea and Bay of Biscay and CGFS-Q4 in Division 7d. Survey abundance information was provided separately for SP-PORC and SP-NSGFS, the Spanish Porcupine and Northern Spanish groundfish surveys.

The landings data are not species-specific in the fisheries and there are currently no technical measures specifically for managing the fishery. There is need for regular sampling of red gurnard in commercial landings and discarding to provide series of length or age compositions to conduct analytical assessment.

### For single stock summary sheet advice:

- Assessment type: update
- **Assessment:** not presented
- Assessment model: NA
- **Data issues:** landings data are not species-specific, lack of biological sampling in commercial landings and discarding
- Consistency: NA
- Stock status: Uncertain
- Management Plan: NA

### General comments

This is a well-documented section.

### Technical comments

None

### Conclusions

The assessment has been performed correctly.

## Audit of Blue whiting (*Micromesistius poutassou*) in subareas 27.1–9, 12, and 14 (Northeast Atlantic)

Date: September 6, 2018

Auditor: Anna H. Olafsdottir

### General

Assessment model, recruitment estimates, and forecast model were executed according to stock annex description. The updated assessment gives a valid basis for advice.

### For single stock summary sheet advice:

- **Assessment type:** update. Benchmark in 2012 (WKPELA 2012) and adaptation of model at an inter benchmark in 2016 (IBPBLW 2016).
- **Assessment:** age-based analytical assessment that uses catches both in the model and the forecast.
- **Forecast:** presented.
- **Assessment model:** SAM with length and age composition of commercial catch and as tuning series an age segregated tuning index from scientific acoustic survey of the spawning stock in March on main spawning grounds on the shelf west of Ireland.
- **Data issues:** input data for the assessment, as described in the stock annex, are available online at <https://www.stockassessment.org/index.php> in folder "BW\_2018". The mean weight at age from the Faroese catch-at-age data from 2016 were brought up for discussion at this years assessment. Exploratory runs indicated some discrepancy when included in the assessment. It was decided to await for updated age-readings at next year's assessment, before any changes will be made to the input data.
- **Consistency:** assessment results for SSB and F show a decline in SSB and increase in F compared to last year assessment.
- **Stock status:**  $SSB > B_{trigger}$  and  $F_{MSY} < F < F_{pa}$ . Trend in recruitment low for the last two years.
- **Management Plan:** Long-term management strategy agreed in 2016. The main elements of the plan is catch set at  $F_{MSY}$  when  $SSB \text{ forecast} \geq B_{trigger}$ , reduced F when  $B_{trigger} > SSB > B_{lim}$ , and set  $F = 0.05$  when  $SSB < B_{lim}$ . There are 20% reductions and 25% increase contain on annual deviation in TAC. Plan is evaluated by ICES and regarded consistent with the precautionary approach.

### General comments

This was a well documented, well ordered, short and to the point section. It was easy to follow and interpret. There were minor discrepancies between subchapters number and numbering of figures and tables.

### Technical comments

- Consider supplying the results of the forecast and annual catch scenarios online with the assessment.
- There are minor errors in text on the advice sheet: 1) in section "Basis of the assessment" length frequency of catch data is listed as input data. Also,

weight-at-age in the catch is missing from the input data list; 2) in section “Indicators” list of surveys used to evaluate recruitment for age-1 and age-2 is wrong. According to presentation at WGWIDE and the stock annex, the IESSNS and EVHOV are not used to evaluate recruitment.

- There are minor issues with numbering of figures and tables in the report text. Numbering of figures and tables is not coordinated with subchapter numbering in report text. This applies to all figures and tables from report subchapter 2.4.1 and onward. Labelling of some figures and tables is not in chronological order in the report text. For example, in report text reference to Table 2.3.1.2.5 before Table 2.3.1. This occurs at several occasions of figures and tables in the report. Tables 2.3.1.4, 2.3.2.1.3, 2.4.2.4, and 2.4.2.6 are not referred to in report. Figure 2.3.1.5. is not referred to report.
- Minor discrepancies between report text and data reported in tables: 1) in sub-chapter 2.4.1.1: sampling intensity in report text missing a few areas; 2) in sub-chapter 2.4.2 report text has preliminary catches for Q1 and Q2 in 2018 as 1351802 ton compared to 1330754 in Table 2.3.2.1.
- Minor mistakes in Tables and Figures: 1) in Table 2.8.2.2.1: when  $F=0$ , catch in 2019 is listed as 4 ton; 2) Figure 2.9.1 is labelled as displaying the period from 2010 to 2018, however it appears to display assessments from 2013 to 2018.

## Conclusions

The assessment has been performed correctly

## Blue whiting.

*Date: 2 September 2018*

*Auditor: Nikolay Timoshenko*

### General

WG suggests that the catches in 2018 should be no more than 1712870 tonnes. The assessment is based on knowledge of the level and structure of the catch in the first half of year. Proportion of the annual catch-at-age taken in the first semester of 2015-2017 was used for raising the preliminary first half year of 2018 catch data. Such predicts have not so far been accompanied by notable deviations and seem acceptable to be applied in the cohort programs. BWSSS provides the basis of fitting which from two youngest age groups are excluding. Comparison with the results of other surveys convinces that as data accumulates, it will be possible to return to this question. In general, the assessment is satisfactorily provided by the input data.

### For single stock summary sheet advice:

The evaluation methodology was described in the previous reports of WGWIDE.

- Assessment type: update/SALY
- **Assessment:** analytical
- **Forecast:** presented
- **Assessment model:** SAM, TISVPA, XSA +1 survey
- **Data issues:** The data for 2017 presented completely in the annex. Data for 2018 in part were as the results of the assumptions.
- **Consistency:** The view of the WG was that last years assess should have been accepted.
- **Stock status:** B is clearly more than Bpa.  $F < F_{pa}$ . R seems to be low last years.

### General comments

Report is well documented, contains relevant explanations and references. Assessment provides a valid basis for advice. The contents of the report correspond to the agenda. The data been used as specified in the stock annex. There is no reason to deviate from the standard procedure for this stock. Reliable recruitment forecast remains to be as the main task.

### Technical comments

The three models applied show similar dynamics in biomass and recruitment. The SSB values are estimated to be increasing in 2011-2018. That growth potential is corresponding by the presence of strength generations of 2013-2015. Later, the growth of biomass has ceased to prevail over its decline in accordance with the conclusion of WG last year. Dynamics of  $F$  is also the same in all models until 2017. In 2018, SAM and TISWPA show a decrease in  $F$  in the age range 3-7 while XSA records a slight increase. However, if the range is extended to the ages of 1-8, XSA also shows a decrease. Such differences are due to the difference in the selection pattern.

### Conclusions

The assessment has been performed correctly. The dynamics of the blue whiting stock has been described by the fishing mortality exceeding  $F_{msy}$  for a long time. The biomass



remains noticeably higher than the corresponding reference points. That means that the chosen strategy facilitated the retention of the SSB in precautionary boundaries. The detected decline in biomass will require a more careful attitude to the recommendations of the group in respect of following the  $F_{MSY}$  rule.

## Audit of (Stock name)

*Date: 02-09-2018*

*Auditor: Claus Reedtz Sparrevohn*

### General

This audit is written for the use during the ADG. There has been no deviation from the stock annex and the assessment are much in line with the previous 2018 assessment.

This assessment only prompted few discussions during the meeting. That the 2019 advice was smaller than the 2018 advice was a bit surprising giving that the IBWSS index was historical high. However, the EG agreed that this could fully be explained by 1) the higher TAC (+325 002 tons) and 2) the small incoming year classes (2015 and 2016). It should be noted by the ADG, that in the advice it is stated that the recruitment in both 2016 and 2017 was low, although in the report it is only stated that the 2017 is low (section 2.1). The size of the 2016 recruitment (2015 yearclass) can be discussed.

As part of the audit the numbers presented in the advice has been check with the numbers that appear in the report. Some small discrepancy:

- Total 2017 catches is 1558061 kt in the rapport and 1555069 in table 12 in the advice sheet.

### For single stock summary sheet advice:

Short description of the assessment: extremely useful for reference of ACOM.

- Assessment type: update
- **Assessment:** analytical
- **Forecast:** presented
- Assessment model: *SAM*
- **Data issues:** One survey (IBWSS) used. Catch data for 2018 estimated by raising the quarter 1 and 2 catches.
- **Consistency:** This year assessment is basically in line with last year assessment
- **Stock status:** Above MSY B<sub>trigger</sub>
- **Management Plan:** Agreed in 2017. In the management plan a stability clause (-20% / +25 TAC constraint) is set out. The plan is evaluated by ICES assuming that catches will equal the advised management plan TAC. This is not the case for 2018, where the total catch is assumed to equal the sum of national quotas, which is 23.4% higher, than the advice when applying the Management Plan. Therefore, the EG was in agreement that the -20% should be calculated from the latest ICES advice and not the TAC. This lead to a decrease on -17.6% and hence the TAC constraint was not considered relevant.

### General comments

The assessment was performed correctly and did not prompt much discussion at the meeting.

**Technical comments**

None

**Conclusions**

The assessment has been performed correctly

**Checklist for audit process**

## General aspects

- Has the EG answered those TORs relevant to providing advice?
  - Yes
- Is the assessment according to the stock annex description?
  - Yes
- If a management plan is used as the basis of the advice, has been agreed to by the relevant parties and has the plan been evaluated by ICES to be precautionary?
  - Yes
- Have the data been used as specified in the stock annex?
  - Yes
- Has the assessment, recruitment and forecast model been applied as specified in the stock annex?
  - Yes
- Is there any **major** reason to deviate from the standard procedure for this stock?
  - No
- Does the update assessment give a valid basis for advice? If not, suggested what other basis should be sought for the advice?
  - Yes

## Striped red mullet.

*Date: 6 September 2018*

*Auditor: Anatoly Chetyrkin*

### General

For single stock summary sheet advice:

- **Assessment type:** no assessment due to lack of age structured analytical input data
- **Assessment:** Not presented
- **Forecast:** Not presented
- **Assessment model:** None
- **Data issues:** General lack of data, both sampling and time-series.
- **Consistency:** NA
- **Stock status:** undefined.
- **Management Plan:** undefined.

### General comments

This is a well documented section, but the lack of information and data omit any usable conclusion and advice on this species.

### Technical comments

The total number in the table 10.1 for 2006,2008,2011,2013,2014 and 2017 \*\* years does not coincide with the sum of the columns by 1. This is certainly a rounding problem in the calculation. For 2017\* there is an error in total value calculation.

The total number in the table 10.2 for 2007,2010-2014,2016 and 2017 \*\* years does not coincide with the sum of the columns by 1. This is certainly a rounding problem in the calculation. For 2008 the total value is calculated incorrectly.

There is no reference to Table 10.2 in the text.

### Conclusions

The assessment has been performed correctly when a few corrections have been made in the tables.

## Audit of Striped red mullet

*Date: 07/09/2018*

*Auditor: Patrícia Gonçalves*

### General

Age structured analytical model is not possible due to short time-series of available data.

### For single stock summary sheet advice:

- **Assessment type: update/SALY** There is no assessment, due to a short time-series of age data available.
- **Assessment:** limited data available to evaluate stock trends.
- **Assessment model:** no assessment.
- **Data issues:**
- **Consistency:**
- **Stock status:** undefined.
- **Management Plan:** there is no management plan.

### General comments

The section is well structured.

### Technical comments

The 2006 total landings are different in Table 10.1 and Table 10.2.

Table 10.2 is not mentioned on the text.

The cited references: Jones, 1972; Russel, 1976; are not included on the references list.

## Assessment type: update Western horse mackerel (hom.27.2a4a5b6a7a-ce-k8) – data audit

*Date: 8 September 2018*

*Auditor: Martin Pastoors*

### General

The Western horse mackerel assessment has been carried out using Stock Synthesis 3.30. This audit only focusses on the data that is being used for the assessment.

When auditing the input and output data to this assessment, it was noticed that the tracking of the data throughout the assessment process is quite challenging. Input datafiles are prepared specifically in the format required by Stock Synthesis, however the link between the basic input data and the input file for the assessment needs to be better documented and explained. Ideally, the input data should be available in standard readable formats so that other assessment models than Stock Synthesis could also be deployed.

The assessment itself is consistent with the assessment carried out in 2017, although the retrospective upward revision of biomass and downward revision of fishing mortality has again occurred this year.

### Summary

- Assessment type: update/SALY
- **Assessment:** analytical
- **Forecast:** presented
- **Assessment model:** Stock Synthesis 3.30
- **Data issues:** The main issue with the data for this assessment is the difficult in tracking the different sources of input data and how they lead to the Stock Synthesis input file. It is recommended to provide a detailed step-by-step documentation how the data is being worked up. In the current situation it is not feasible to completely check derivation of the input data to the stock assessment from the raw data files.
- **Consistency:** The view of the WG was that the assessment should be accepted. However, there was a major discussion on the applicability of the biomass reference points which were estimated at the benchmark in 2017. Due to the retrospective revisions after the benchmark, the stock size over a period of around 15 years has been estimated to be higher than in the previous assessments. Because the  $B_{lim}$  was set as the  $B_{loss}$  of the benchmark assessment in 2017 which also happened to be the last data point in the time series, the applicability of the biomass reference points was seriously questioned. An interbenchmark has been proposed to address this issue.
- **Stock status:**  $B$  is between  $B_{lim}$  and  $B_{trigger}$ .  $F$  is well below  $F_{MSY}$ .

### General comments

The report is well documented and contains relevant explanations and references in line with the reports of previous years. The assessment has been used as the basis for the advice although concerns have been raised in the WG about the applicability of the biomass reference points or on the question whether the assessment should be used as an absolute or relative indication of development of the stock. Given that this was an

update assessment, in the end the stock annex was followed which resulted in the advice that is in the draft advice document. The data been used as specified in the stock annex although, as mentioned above, the documentation of the input data is difficult to track. Reliable stock indicators remain an important challenge for the assessment, since there is only the egg survey (every three years), a recruitment index and a biomass and length-frequency index from the southern part of the distribution area.

### Technical comments

Only one model (Stock Synthesis) has been applied to this stock as specified in the stock annex. Previously the stock was assessed with the SAD model, but the development of that model has been terminated. Stock Synthesis requires two input files: a control file and a data file. The control file contains the settings to be used in the model and also the values of the assumed variables like natural mortality ( $M=0.15$  for all ages and years).

The data file contains a specification of the datasources that are being used and the actual data series. Data series that are not used in the model but instead are calculated (e.g. maturity, weight, fecundity) are not included in the data file even though that data may be available in the underlying data sources.

SSB is around the lowest of the time series but recruitment appears to have been a bit higher over the past few years. Fishing mortality is estimate around 0.06 in the most recent year which is substantially lower than the  $F_{MSY}$ . The retrospective revisions of the stock estimates have been a feature of the western horse mackerel assessment for many years already. Unfortunately, the Stock Synthesis model does not seem to have remedied that situation.

### Conclusions

The assessment has been performed according to the specifications in the stock annex. Concerns have been raised about whether the assessment is capable of measuring the absolute level of biomass and fishing mortality of this stock. The biomass is now estimated to be close to  $MSY B_{trigger}$  by the virtue of the retrospective revisions of the assessment relative to the fixed reference points. An interbenchmark has been proposed to address this issue. The interbenchmark could also explore the potential application of a second assessment model as a confirmation of the trends observed in Stock Synthesis.

The documentation and transparency of the input data for the assessment needs to be improved.

## Audit of mac.27.nea

*Date: 3<sup>rd</sup> September 2018*

*Auditor: Andrew Campbell*

### General

The WG accepted the update assessment as a basis for advice for 2019 but is concerned with some aspects of the data and assessment model. The assessment is particularly sensitive to the inclusion of an additional year of RFID tagging data. However, the group could find no compelling argument to exclude this data from this update assessment. A need for improved understanding of model behavior the development of additional model metrics to investigate the weighting given to individual datasets prompted the group to propose ToRs for an interbenchmark exercise.

The fishery independent datasets currently indicate a declining stock, which, combined with high catches assumed for 2018 lead to a predicted SSB below MSY Btrigger (2.57Mt) in 2018.

There are possible issues with over parameterization of the assessment model with some strong correlations between parameters are noted.

The data used as input to the assessment is as provided to the stock assessor by the stock and survey coordinators. The mechanism for the delivery of this data requires formalization for auditing and quality checking purposes. The assessment and forecast appear to have been run in accordance with the stock annex.

### For single stock summary sheet advice:

- **Assessment type:** update (benchmarked early 2017)
- **Assessment:** analytical, category 1
- **Forecast:** presented
- **Assessment model:** SAM, modified to utilise tag/recapture dataset. FLR forecast.
- **Data issues:**

No recruitment index is available for 2016 and 2017. This necessitates a departure from the procedure outlined in the stock annex for estimating the recruitment estimates required for the short term forecast, whereby the terminal assessment year recruitment estimate is replaced.

There were minor updates to the historical RFID tagging dataset although changes to recapture rates were generally < 1%.

Some other issues were clarified by the stock assessor during the audit and did not necessitate any changes to the assessment.

- **Consistency:** This year's assessment has been conducted in a manner consistent with last year and the stock annex. Outputs indicate revisions to absolute SSB and F over the last 10 years of the order of 10%.
- **Stock status:** SSB is forecast to fall below MSY Btrigger (2.57Mt) in 2018 if the intermediate year catch (approx. twice the advice) is realised. Intermediate year catch assumptions in previous years have proved accurate. Maintain-



ing the current catches (approx. 1Mt) into 2020 would result in the SSB falling below  $B_{lim}$  in 2020. Fishing mortality has been increasing since 2011 and exceeds  $F_{pa}$  (0.35) in 2017.

- **Management Plan:** ICES advised on a proposed management plan from EU, Norway and Faroe Islands in September 2017 (and also revised the fishing mortality reference points). A suite of target fishing mortality and biomass trigger points were evaluated for a hockey-stick type HCR. The requesting parties agreed on a LTMP with a target  $F$  of 0.21 and a trigger point of 2.57Mt (coinciding with the MSY reference points). However, since not all fishing parties are in agreement, ICES advice is based on the MSY approach.

### General comments

The draft report text that was available at the time of this audit is well structured and clear. The assessment code is relatively clear and concise. However, a number of assessment model parameter settings are not explicitly detailed in the code (likely because they assume default values). An explicit line of code/comment would aid auditing.

Inclusion of code for tabulating the assessment output would be beneficial for auditing purposes.

The STF code was slightly more complex. IBTS index time series is hard-coded in script and ideally should be input from the same file as used for the assessment script.

### Technical comments

The IESSNS catchability parameter couplings (-1/-1/-1/3/4/4/4/4/4/4/4/-1) do not match those in the stock annex (-1/-1/-1/2/3/4/5/6/7/8/9/9/-1) or the draft report but they are consistent with the 2017 assessment.

The stock annex includes a clear explanation with regard to the calculation of the recruitment estimate in the terminal assessment year. However, for both this and last year it has not been possible to follow the procedure and an alternative has been used. This should be described in the stock annex along with an exact specification of the years to be used when calculating the geometric mean for the recruitments in the period of the short term forecast.

### Conclusions

The assessment has been performed correctly.

### Checklist for audit process

#### General aspects

- Has the EG answered those TORs relevant to providing advice?
- Is the assessment according to the stock annex description?
- If a management plan is used as the basis of the advice, has been agreed to by the relevant parties and has the plan been evaluated by ICES to be precautionary?
- Have the data been used as specified in the stock annex?
- Has the assessment, recruitment and forecast model been applied as specified in the stock annex?

- Is there any **major** reason to deviate from the standard procedure for this stock?
  - Does the update assessment give a valid basis for advice? If not, suggested what other basis should be sought for the advice?
- 1 ) /SALY There is no assessment, due to a short time-series of age data available.
  - 2 ) **Assessment:** limited data available to evaluate stock trends.
  - 3 ) **Assessment model:** no assessment.
  - 4 ) Data issues:
  - 5 ) Consistency:
  - 6 ) **Stock status:** undefined.
  - 7 ) **Management Plan:** there is no management plan.

### General comments

The section is well structured.

### Technical comments

The 2006 total landings are different in Table 10.1 and Table 10.2.

Table 10.2 is not mentioned on the text.

The cited references: Jones, 1972; Russel, 1976; are not included on the references list.

## Audit of Mackerel (WGWIDE 2018)

Date: 7. September 2018

Auditor: Jan Arge Jacobsen

### General

The stock assessment for NEA mackerel in 2016 has been done according to the stock annex. The stock is estimated to be below  $MSY B_{trigger}$  in 2018, for the first time since 2007, and the advice is thus based on the MSY approach:  $F_{MSY} * SSB(2019) / MSY B_{trigger}$

### For single stock summary sheet advice:

Short description of the assessment:

- Assessment type: update
- **Assessment:** analytical
- **Forecast:** presented
- **Assessment model:** State-space model (SAM) fitted to catch-at-age data for ages 0 to 12 (+ group) (1980-2017, strongly down-weighted for 1980-1999) and three surveys: 1) Mackerel Egg survey (triennial, 1992-2016); 2) Recruitment index from IBTS Q1 and Q4 surveys (1998-2015); and 3) abundance estimates, ages 6 to 11, from IESSNS survey (2007 and 2010-2018). The model also incorporates tagging-recapture data from the Norwegian tagging program (1980-2005) and the new RFID tagging series (2011 and onwards).
- **Data issues:** New survey input data for the assessment, as described in the stock annex, were available for the IESSNS, tagging-recapture data from the Norwegian tagging program and egg survey series. However, no data was available for the IBTS recruitment index from the North Sea for the second year in a row. With the addition of 2017 catch-at-age, weights-at-age in the catch and in the stock, maturity ogive and proportions of natural and fishing mortality occurring before spawning.
- **Consistency:** Last year's assessment was accepted
- **Stock status:**  $B < B_{MSY B_{trigger}}$  and  $B_{lim} < B < B_{pa}$ ,  $F > F_{MSY}$  and  $F_{pa} < F < F_{lim}$ , R has been high since early 2000s but the 2015 and 2016 year-classes are estimated to be below average.
- **Management Plan:** There is no agreement on an overarching management plan for mackerel. ICES have based their advice on the MSY approach. However EU, NO and FO agreed in 2014 on an *ad hoc* management plan for the years 2015-2018. The *ad hoc* Management Plan was evaluated by ICES in 2017 after the benchmark, and was adjusted accordingly for the updated reference points by the three parties for the 2018 advice (refer to Table 8.2.4.1 in the WG report).

### General comments

The sections were well ordered, however not all were finished by the time of the audit. This did not affect the main conclusions. Analyses were well described and the results presented clearly. The conclusions regarding advice are appropriate, given the divergent survey trends, increased reliance on catch data and associated change in perception of stock status. The short time series of some of the survey caused instability in the model, as the "leave out" runs clearly demonstrated. The perception of the stock

changed proportionally much by on removal of single input series. The model might be over parameterized.

### Technical comments

Due to missing IBTS recruitment index the setting for the SAM run were not entirely in accordance with stock annex (benchmark 2017). The outdated time series from WGWIDE 2016 was used in the assessment and it was therefore conducted without an index value for the 2016 and 2017 year classes (see Sec. 8.6.2 for details).

There might be some issues with the use of the tagging data (RFID) in the SAM model. In Section 8.6.4 a discussion of possible effects/biases were discussed that might have large influences on the model runs, e.g. if the recapture rates in different areas/seasons vary due according to incomplete mixing of tagged fish, or due to mortality happening between seasons (for instance between quarter 1 and quarter 4 catches). These potential biases are not taken into account in SAM assessment model today. Also the high tagging mortality for the RFID tags that the model estimates were considered problematic in the assessment. Alternative use of tag data in the assessment was discussed in this section. An ICES workshop on tagging data was suggested.

The realisation of the process error in the model was also inspected (Section 8.7.5). While process error is assumed to be independent and identically distributed, there is clear evidence of correlations in the realisation of the process error in the mackerel assessment, which appears to be correlated both across age-classes and temporarily. The temporal autocorrelation can also be visualised if the process error is expressed in term of biomass (deviations in abundances-at-age multiplied by weight at age and summed over all age classes, Figure 8.7.5.4 in the WG report). For the years since 2010 the cumulated process error remains positive, with the magnitude reaching a third of the volume of the catches for 2009. The reason for this misbehaviour of the model could not be identified.

### Conclusions

The update assessment has been performed correctly and gives a valid basis for advice.

The WG recommends an interbenchmark as soon as possible (2019) to deal with data/model issues.