Annex 4: Audits

Audit of (Northeast Atlantic mackerel (mac.27.nea))

Date: 8th September, 2021
Auditor: Sólvá Eliasen, Ole Henriksen, Richard Nash

- *Audience to write for: ADG, ACOM, benchmark groups and EG next year.*
- *Aim is to audit (check if correct):*
    - *the stock assessment– concentrate on the input data, settings and output data from the assessment*
    - *the correct use of the assessment output in the forecast, and check if forecast settings are applied correctly*
- *Any deviations from the stock annex should be described sufficiently.*
- *By the conclusion of the working group, all update assessments should be audited successfully.*
- *Store all audits on SharePoint for future reference.*

General

This audit focuses on the advice sheet and the WGWIDE report section on NEA Mackerel. The advice sheet and the stock annex are consistent with the report section. The assessment model performance was good, and a systematic downward revision in the retrospective pattern for F in recent years seems to be improved, although the causality of this change are not discussed and seems unresolved.

For single stock summary sheet advice:

1) **Assessment type:** updated assessment (inter-benchmarked in 2019)
2) **Assessment**: analytical
3) **Forecast**: presented
4) **Assessment model**: A modified state-space Assessment Model (SAM) that is able to incorporate tag/recapture data – both historical steel tags (1980-2006) and recent RFID tags (2014-2020) together with three additional survey indices.
5) **Data issues:** All data are available as described in stock annex and in the report text.
6) **Consistency**: The retrospective bias, where the F has consistently been overestimated and SSB underestimated, has decreased for the 2021 assessment.
7) **Stock status**: SSB is above all reference points (MSY Bt_{rigger}, B_{pa}, and B_{lim}) and F is below $F_{MSY.}$
8) **Management Plan**: There is no management strategy agreed for the stock, therefore ICES based its advice on the MSY approach. No agreement on the share of the stock has been reached for 2021. Despite the acceptance of ICES advice, the total declared quotas in each of the years 2015 to 2020, all exceed the maximum catch advised by ICES.

General comments

The report section is readable and all information is there. Whilst the report is still rather long, the removal of numerous surplus tables was appreciated. The advice sheet is well documented.

Technical comments

The code and input data for the analysis (assessment, and short-term forecast) are all available on SharePoint. An auditor reran the assessment and short-term forecast, however, the documentation in the code was lacking. This must be added so that anyone who is interested in utilising/rerunning/changing the code can do so (a similar comment was also made in the 2020 audit).

To the best of our knowledge, the assessment has been performed correctly according to the stock annex.

Table and figure numbers and references to them in the text have been checked.

Conclusions
The assessment has been performed correctly according to the stock annex.

Audit of Northeast Atlantic Boarfish (Boc.27.6-8)

Date: 02/09/21

Auditor: Afra Egan

General

This is an update assessment with advice provided in 2021 for 2022 and 2023.

For single stock summary sheet advice:

9) **Assessment type: update/SALY**
10) **Assessment**:   trends - Category 3 with biennial advice
11) **Forecast**:   not presented
1) **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, Fmsy, Bmsy and TSB) have been estimated using the exploratory Schaeffer state space surplus production model. The assessment has been run by the WinBUGS14 program.
2) **Data issues:** The stock assessment input data and the r-scripts used in the assessment are all available on SharePoint in the folder "06.Data/boc.27.6-8". There are no issues with the new input data.
3) **Consistency**: This updated assessment is consistent with the assessment carried out in 2020.
4) **Stock status**: ICES cannot assess the stock and exploitation status relative to MSY and PA reference points because the reference points are undefined.
5) **Management Plan:** A management strategy proposed by the Pelagic AC was evaluated and found to be precautionary (ICES, 2015). ICES provides advice for this stock following the standard procedures, which in this case corresponds to the management strategy from the Pelagic AC.

General comments

This was a well-documented, well ordered chapter and is easy to follow and interpret. There are some minor corrections highlighted.

Technical comments

- Minor corrections applied to the numbering of tables.
- IBTS text section 3.6.1 needs figure numbers added
- Add a total column to table 3.1.2.2 to make checking easier
- Table 3.6.4.1 - 2020 - is missing from this table
- Check Irish catch and landings figures: Tables 3.1.2.1, Tables-3.1.2.3-3.1.2.7 and Table 3.2.1.4
- Specify that the figures in Tables 3.1.2.3-3.1.2.7 are landings

Conclusions

The assessment was rerun following the stock annex and all outputs generated were checked against the report and no errors found. The assessment has been performed correctly

Audit of Northeast Atlantic Boarfish (Boc.27.6-8)

Date: 10 september 2021
Auditor: Claus R. Sparrevohn

General

Update advice for the years 2022 and 2023

For single stock summary sheet advice:

6) **Assessment type:** update similar to the assessment in 2019
7) **Assessment**:   Category 3 using the trend of a surplus production model as index of the TSB in the 2 over 3 calculation
8) **Forecast**: NA
9) **Assessment model**: State space surplus production model with catch data, IBTS survey indices, and one acoustic survey.
10) **Data issues:** No issues with data in this year's assessment
11) **Consistency**: Consistent with the 2019 assessment
12) **Stock status**: Reference points are not defined,
13) **Management Plan:** No agreed management plan.

General comments

Procedure is well described in the rapport.

Technical comments
None

Conclusions

The assessment has been performed according to the procedure and is suitable for advice.

Audit of Red Gurnard stock assessment

Date: 14.092021
Auditor: Laurent Dubroca

General

Assessment of this stock is not possible due to the short time-series of the data provided to this group : landings by country and divisions are available from 2006 to 2020, 6 survey abundances index for the species area presented from around 1990 to 2020, with a combined biomass index built on these series.

For single stock summary sheet advice:
1) **Assessment type:** delta-lognormal assessment (from WKWEST)
2) **Assessment**:   trend analyses
3) **Forecast**:   not presented
4) **Assessment model**: surveys indices combined using a delta-lognormal model in an index of biomass to evaluate stock trend
5) **Data issues:** general lack of data
6) **Consistency:** undefined
7) **Stock status**: undefined.
8) **Management Plan**: there is no management plan.

General comments

Well structured and documented section pointing out the lack of data regarding this stock and showing the computation of a biomass index for this stock.

Technical comments

Conclusions

A combined biomass index has been computed correctly. There is no assessment for this stock.

Audit of North Seas Horse mackerel stock (hom.27.3a4bc7d)

Date: 02/09/2021
Auditor: Rosana Ourens

General

General remarks:

- In 2017 the stock was benchmarked and upgraded to category 3. A combined CPUE index is used to evaluate trends in abundance over time. This index is used to estimate the 2-over-3 rule and provide catch advice.

- FMSY proxy is the length based indicator ($L_{mean}/L_{F=M}$) =1. A biomass safeguard is not defined for this stock.

- The 2020 abundance index was not used in the assessment because it was biased (one of the surveys was incomplete).

- Uncertainty cap (downwards) and precautionary buffer were applied this year. It resulted in a catch advice 36% lower than last year.

For single stock summary sheet advice:

Assessment type: SALY Catch advice provided for 2022 and 2023
Assessment: Survey trend-based assessment
Forecast: not presented
Assessment model: NS-IBTS and FR-CGFS survey indices are used in a hurdle model to estimate an average annual CPUE index. This model, selected because the survey data show overdispersion and high proportion of zero values, has two components:

    1) count model (GLM-negative binomial) with year and survey as explanatory factors, including their interaction; and
    2) zero model (GLM-binomial), with year and survey as explanatory factors (without interaction).

The contribution of the two surveys to the combined index is weighted taken into consideration their respective area coverage as well as the mean wing spread (0.76 for NS-IBTS, and 0.24 fir FR-CGFS). Separate models were fitted to the juvenile (<20cm) and adult exploitable (≥20cm) sub-stocks. The index for the adult exploitable sub-stock is used to estimate the 2- over-3 rule.

Additionally, the length-based indicator $L_{mean}/L_{F=M}$ is used to evaluate the status of the stock against a F_{MSY} proxy ($L_{mean}/L_{F=M}$ =1). The length-based indicator is estimated from samples from the commercial catch in 27.7d, the main fishing area.
Data issues: FR-CGFS survey could not complete the stations located in the UK waters because of administrative and pandemic related issues. A sensitivity test was conducted to identify the best approach to deal with this missing data. The test suggested that missing the UK stations from the FR-CGFS or leaving out the FR-CGFS entirely may lead to changes in the abundance index. Therefore, it was decided that no reliable index value for 2020 could be produced. For this reason, the 2-over-3 ratio used in the advice catch was estimated as the 2019 index divided by the mean index value of 2016-2018.

A mistake was also found in the calculation of the length frequency distributions in the 2019 and 2020 assessments, and they were recalculated.

Consistency: The index survey is considered robust, but the hurdle model could not estimate the standard error for the intercept and the parameter θ of the count model for the adult sub-stock model. This issue has happened in the last three assessments, and it might require further exploration in the future. To test the robustness of the model, a zero-inflated model was run with the same setup as the hurdle model and produced very similar outputs.

Although the biomass indicator was estimated for the same time period (2016-2019) as last year given the lack of 2020 survey data, the results are slightly different. This was caused by updates on the data reported in DATRAS, which resulted in a higher biomass estimate for 2016 than in the 2020 assessment.

Stock status

14) The CPUE index for the adult sub-stock declined by 74% in 2017. It has remained low since then, although it slightly increased in 2019.

15) There are some signs of improved recruitment in some years (e.g. 2016, 2018), but the trend of the abundance index for the juvenile sub-stock is fluctuating and, when separated, the two surveys, NS-IBTS and FR-CGFS, do not show the same trend.

16) The fishing pressure has been slightly above F_{MSY} proxy since the beginning of the time series (2016). In 2020 the length-based indicator $L_{mean}/L_{F=M}$ was 0.927.

Management Plan: There is not a management plan for horse mackerel in this area

General comments

The report is well written, well documented, and easy to follow.

Technical comments

• Table 6.4.1 of the draft report has not been updated yet. The stock assessor has been notified.

• The stock annex has been updated since the last benchmark and details how the biomass index and the F_{MSY} proxy are calculated. However, it does not state what the basis for the advice is (2-over-3 rule).

Conclusions

The assessment has been performed correctly

Audit of North Seas Horse mackerel stock (hom.27.3a4bc7d)

Date: September 2nd, 2021
Auditor: Chetyrkin Anatoly

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 in TAC was advised by ICES.

In 2017, the stock was benchmarked and the NS-IBTS and FR-CGFS survey indices where modelled together. The resulting joint index was considered a proper indication of trend in abundance over time and the NSHOM stock was upgraded to category 3.

Due to the COVID pandemic impacting the FR-CGFS, no index value for 2020 was produced. The application of the HCR 3.1 (ICES, 2012) resulted in an index ratio of the 2019 index value (with 2020 is missing) over the mean index value of 2016-2018 of 0.79, meaning that an 20% uncertainty cap was applied to the catch advice.

This stock has a biennial advice for 2022 and 2023 therefore this is an update assessment. The advice sheet was provided in 2021 and report was well written and well documented, however the Stock Annex is rather incomplete and poorly documented.

For single stock summary sheet advice:

1) **Assessment type: SALY** Catch advice provided for 2022 - 2023
2) **Assessment**:   category 3 (survey based method)
3) **Forecast**:   not presented
4) **Assessment model**: Hurdle model and zero-inflated model

Together with the main model was launched a zero-inflated model with the same set-up as the hurdle model. This zero-inflated model was considered to be the second-best model during the benchmark process in 2017 and performed almost equally well as the hurdle model. The fitted values of the zero-inflated model were very similar to that of the hurdle model with warning.

5) **Data issues:**

No data for UK waters due pandemic issues. The problem was solved and part of the catch was calculated with 2019 index divided by the mean index value of 2016-2018

6) **Consistency**: it is consistent with the assessment carried out last year.
    The hurdle model could not estimate some parameters of the count model for the adult sub-stock model. Need to continue research in this direction or look for a new model.

7) **Stock status**: There are signs of improved recruitment in some years, but the trend in the abundance index for juveniles fluctuates and, when split into two surveys, does not show the same trend.
    The $L_{mean}/L_{F=M}$ ratio in 2020 was 0.927, indicating that the fishing mortality is above F_{MSY}.

8) **Management Plan**: There is no management plan for horse mackerel in this area. ICES evaluated a proposed harvest control rule for a multi-annual plan for horse mackerel in the North Sea. None of the options were considered as being in accordance with the precautionary approach.

General comments

The advice sheet and report was well written and well documented.

Technical comments

The stock annex has been updated with new details about FMSY proxy and biomass index calculation. But still not completely filled.

Conclusions

The assessment has been performed correctly. Stock advice for NSHOM is biennial (2022 and 2023).

Audit of Norwegian spring spawning herring (her.27.1-24a514a)

Date: 01.09.2021

Auditor: Are Salthaug, Anna Olafsdottir, Sigurvin Bjarnason

General

The Norwegian springs-pawning herring is carried out using the XSAM model. This audit focuses on input data and assessment.

For single stock summary sheet advice:

17) **Assessment type: update/SALY**
18) **Assessment**: analytical
19) **Forecast**: presented
20) **Assessment model**: XSAM with 3 survey fleets
21) **Data issues:** Input data are available as described in the stock annex. Input data to the assessment were compared between assessment 2020 and 2021, and between the 2021 assessment and the input data tables in the 2021 report. 2021 assessment input data were fetched from the "06.Data" folder on sharepoint and all input data were available: https://community.ices.dk/ExpertGroups/WGWIDE/SitePages/HomePage.aspx?RootFolder=%2FExpertGroups%2FWGWIDE%2F2021%20Meeting%20Docs%2F06%2E%20Data%2Fher%2E27%2E1%2D24a514a&FolderCTID=0x012000FC5A3EF0E554B246B7BDD1920914AB7F&View=%7B1658FCBE%2DAA9C%2D4F82%2DBEC4%2D49E934FCB976%7D

    2020 assessment input data were also fetched from the sharepoint in folder "06.Data – HER – data". Input files were available for catch-at-age, spawning survey, Barents Sea age 1-2years, IESNS survey: https://community.ices.dk/ExpertGroups/WGWIDE/_layouts/15/start.aspx#/2020%20Meeting%20Docs/Forms/AllItems.aspx?RootFolder=%2FExpertGroups%2FWGWIDE%2F2020%20Meeting%20Docs%2F06%2E%20Data%2Fher%2E27%2E1%2D24a514a%2Fdata&FolderCTID=0x01200001CB4C8137392A41ADA4E2F0E296C61D&View=%7B1A2D5296%2D68F0%2D44ED%2DB3E8%2D334756DAC39B%7D

    Data were the same in tables except for 3 instances:

    a) Table 4.4.7.2 in 2021 report does not report values for age 1-2 in year 2008, however there are values in the input data tables both in 2020 and 2021.

    b) Table 4.4.3.1. Catch-at-age numbers. For age 0 in year 1976 the value in the report is wrong compared to the assessment input data. Appears to be a decimal issue.

    c) Table 4.4.4.1. Weight-at-age in the catch. In the assessment input file weight for age 15+ in years 1969-70, 1985-86, 1999, and 2001-2 is listed as zero but in report table values are listed.

22) **Consistency**: This years' assessment is consistent with last years' assessment and the WG accepted the assessment.
23) **Stock status**: The fishing pressure on the stock is above FMSY, FMGT and Fpa (but below Flim). Spawning-stock size is above MSY Btrigger, Bpa, and Blim.
24) **Management Plan**: Agreed by the Coastal States in October 2018: the TAC shall be fixed to a fishing mortality of Fmgt = 0.14, with a constraint of maximum 20% reduction and 25% increase relative to the TAC in the preceding year. If SSB is forecast to be lower than MSY Btrigger in the beginning of the quota year, F decreases linearly from F_{mgt} to F = 0.05 over the biomass range from $B_{trigger}$ to B_{lim}. The long-term management strategy has been evaluated by ICES and found to be consistent with the precautionary approach.

General comments

The input data and assessment are documented as described in the stock annex and the report sections are well ordered.

Technical comments
The stock annex has been updated with the latest survey information. There is an upward revision of the 2016 year class in this years' assessment compared to last year's assessment.

Conclusions
The assessment has been performed correctly

Audit of Western Horse Mackerel data and assessment

Date: 02/09/2021
Auditor: Alessandro Orio, Sondre Hølleland and Gersom Costas

General

Western horse mackerel is assessed as a Category 1 stock. An SS3 model is run to determine the state of the stock in relation to reference points for western horse mackerel.

For single stock summary sheet advice:

25) **Assessment type:** update
26) **Assessment**:   analytical.
27) **Forecast**:   presented
28) **Assessment model**: SS3 model with commercial catches (length and age data) and three survey indices: Triennial egg survey index (1992–2019); IBTS recruitment index; PELA-CUS acoustic biomass.
29) **Data issues:**   No data issues.
30) **Consistency**: The view of the WG was that the assessment should be accepted. The Stock annex needs to be updated for the F and M before spawning used in the forecast (assumed at the beginning of the year in the current forecast) and for the new Fpa value due the changed basis.
31) **Stock status**: Fishing pressure on the stock is at F_{MSY}. Spawning stock size is below MSY $B_{trigger}$ and between B_{pa} and B_{lim}.
32) **Management Plan**: No management plan

General comments

The assessment and forecast have been available for review. Input and output data were correct. A few inconsistencies were found in the advice sheet but these have been already corrected.

Technical comments

Few inconsistencies are present in the stock annex. F and M before spawning in the forecast needs to be updated in the stock annex since in the forecast the spawning time is assumed to happen at the beginning of the year. The section on reference points needs to be updated with the new Fpa due to the change of basis.
A thorough revision of the number of samples used for the different age and length frequency distributions in the assessment is suggested for the next benchmark iteration. There is a need to inspect the potential problems caused by the reweighting of both age length keys and age frequency distribution of the commercial catches using the same parameter. The fishing mortality estimated by the model is weighted by the population numbers but now the unweighted F can be obtained so it would be preferable to switch to that in the future to avoid extra calculations. Forecasts run directly in SS should be also considered during the next benchmark.

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 but it needs to be updated
- 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, no management plan
- 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.

Audit of WHB
Date: 03 September 2021
Auditor: Alexander Pronyuk

General

In this year IBWSS have been conducted. Application of IBWSS indexes for the main age groups is a proven way to fit the cohort programs. The WG used best estimate preliminary catches in 2021 1,242,727 tons. In complex the assessment is satisfactorily provided by the input data.
The WG accepted the update assessment as a basis for advice for 2022.

For single stock summary sheet advice:

1) **Assessment type:** Update assessment. Last interbenchmark protocol was conducted in 2016.
2) **Assessment**: analytical
3) **Forecast**: presented
4) **Assessment model**: SAM, (in addition TISVPA and XSA as optional models for checking purposes; assessments with data from two additional surveys IESNS and IESSNS for checking purposes).
5) **Data issues:** The data for 2020 presented completely in the report. Data for 2021 are preliminary, but applied in the models. Data described in the stock annex, source code for the SAM model and model configuration are available https://www.stockassessment.org.
6) **Consistency**: The view of the WG was this year's assess should be accepted.
7) **Stock status**: SSB is more than Bpa. Fpa < F< Flim. R in 2020-2021 much higher than 2017-2019.
8) **Management Plan**: A long-term management strategy was agreed in 2016. According to the plan catch is set at F_{MSY} when SSB is forecast to be above or equal to $B_{trigger,}$ F is reduced when SSB is less than $B_{trigger}$, and when SSB is less than B_{lim} F = 0.05. TAC constraints of 20% less or 25% more than the TAC of the preceding year apply. The strategy was evaluated by ICES and found to be precautionary. The 20% TAC constrain was not applied when calculating TAC for 2022.

General comments

The report is well documented, contains relevant data and references. Assessment provides a valid basis for advice. The contents of the report correspond to the agenda. Tables of input data (n at age / catch mean weight / survey abundance estimates) agree with data in stockassessment.org. The data have been used as specified in the stock annex. Prediction of overall catch level is done successfully. There is no reason to deviate from the standard procedure for this stock. Reliable recruitment forecast remains to be as the main task. Changing the time-series of geometric mean of a recruitment for the short forecast seems to enough argumented.

Technical comments

Technical comments are provided in the advice sheet and the report text using track changes.
Conclusions
The assessment has been performed correctly according to the stock Annex.