

## Annex 6: Audit reports

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### Audit of: had27.1-2 (Haddock in subareas 1 and 2)

Date: 18. May, 2017

Auditor: Asgeir Aglen

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#### General

##### For single stock summary sheet advice:

- 1) **Assessment type:** update
- 2) **Assessment:** analytical
- 3) **Forecast:** presented
- 4) **Assessment model:** SAM; tuned by 3 research vessel surveys. Haddock consumed by cod included in natural mortality, haddock consumption is this year estimated based on the SAM assessment of cod.
- 5) **Data issues:** Missing Russian autumn survey in 2016. Adjustments done for compensating incomplete ecosystem survey in 2016 and winter survey in 2017. Some uncertainty related to catch at age data.
- 6) **Consistency:** Compared to earlier assessments: some downward revision of SSB 2013 and later. Some downward revision of F2008 and later, related to revised estimates of cod predation (upward revision of cod in 2010 and later)
- 7) **Stock status:** SSB well above Blim, Bpa and MSYBtrigger for more than 10 years while, F below reference points since 2008.

**Management Plan:** Various MPs have been in use since 2004. The current HCR for haddock is as follows (see details in Protocol of the 46th Session of the Joint Russian–Norwegian Fisheries Commission, 14 October 2011): TAC for the next year will be set at level corresponding to FMSY. The TAC should not be changed by more than  $\pm 25\%$  compared with the previous year TAC. If the spawning stock falls below Bpa, the procedure for establishing TAC should be based on a fishing mortality that is linearly reduced from FMSY at Bpa to  $F=0$  at SSB equal to zero. At SSB-levels below Bpa in any of the operational years (current year and a year ahead) there should be no limitations on the year-to-year variations in TAC.

- 1) At the 46th Session of the Joint Russian–Norwegian Fisheries Commission in 2016 it was decided to keep the existing HCR for haddock in next five years.

#### General comments

The assessment has been performed correctly.

#### Technical comments

Over the recent years old fish has contributed considerably to the stock and catches. The assessment may further improve by including older ages in the survey tuning series. With current tuning data F is assumed equal for ages 9 and older.

In the report Table 4.8; the column “Biomass eaten” is in thousand tonnes (currently labelled as tonnes)

#### Conclusions

The assessment is recommended as basis for the 2018 advice

## Audit of Cod (*Gadus morhua*) in Subareas I and II (Northeast Arctic)

Date May 6, 2017

Auditor: Ross Tallman, Fisheries and Oceans Canada

### General

The Northeast Arctic cod assessment and draft advice have been approved by the Working Group.

### For single stock summary sheet advice:

- 1) **Assessment type:** update
- 2) **Assessment:** analytical
- 3) **Forecast:** presented
- 4) **Assessment model:** SAM

Four surveys were used for the assessment: (Barents Sea Joint bottom trawl (Feb-Mar, years 1981-2017), Barents Sea+Lofoten Joint acoustic survey (Feb-Mar, years 1985-2017), Russian bottom trawl survey (Oct-Dec, years 1982-2015), Ecosystem survey (Aug-Sep, years 2004-2016)

#### a. SAM Parameter settings

- i. # Min Age (should not be modified unless data are modified accordingly)

3

- ii. # Max Age (should not be modified unless data are modified accordingly)

15

- iii. # Max Age considered a plus group (0=No, 1=Yes)

1

- iv. # Coupling of correlation in observations

(NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA),

( -1, 0, 1, 2, 3, 4, 4, 4, 4, -1, -1, -1),

( -1, 5, 6, 7, 8, 9, 10, 10, 10, -1, -1, -1),

( 11, 12, 13, 14, 14, 14, 14, 14, 14, -1, -1, -1),

( 15, 16, 17, 18, 19, 20, 20, 20, 20, -1, -1, -1)

- v. # Coupling of OBSERVATION VARIANCES

( 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0),

( -1, 1, 1, 1, 1, 1, 1, 1, 1, -1, -1, -1),

( -1, 2, 2, 2, 2, 2, 2, 2, 2, -1, -1, -1),

( 3, 3, 3, 3, 3, 3, 3, 3, 3, -1, -1, -1),

( 4, 4, 4, 4, 4, 4, 4, 4, 4, -1, -1, -1)

vi. # Stock recruitment model code (0=RW, 1=Ricker, 2=BH, ... more in time)

0

vii. # Years in which catch data are to be scaled by an estimated parameter

0

viii. # Define Fbar range

5        10

A comparison with XSA was done.

#### **Model options chosen for XSA**

(used as an additional model for checking of results):

Tapered time weighting applied, power = 3 over 20 years

Catchability independent of stock size for ages > 12

Catchability independent of age for ages > 12

Survivor estimates shrunk towards the mean F of the final 5 years or the 3 oldest ages

S.E. of the mean to which the estimate are shrunk = 1.5

Shrinkage to the population mean (p-shrinkage) not applied

Minimum standard error for population estimates derived from each fleet = 0.3

Prior weighting not applied

**Data issues:** Historically the plus group was age 13+ but with the current presence of abundant year classes close to the age 13 it was decided change to the plus group to age 15+. For age 12 and older some smoothing of data is needed but the procedure for that has not been settled yet.

Biological sampling from the Norwegian fishery and from the Russian trawl fishery has been low. . In 2016 the sampling was low for Norwegian trawl catches in coastal areas in ICES area 2a, thus samples for trawl here were merged with other similar gears when calculating age compositions. Also the split between NEA cod and coastal cod may have been affected by the sampling coverage, and possibly the amount of coastal cod catch is overestimated.

The time series for weight and maturity at age should be revised in 2018 following the revision of the time series for the acoustic estimates in the Norwegian winter survey

There is a concern that catch records have some contradictions in reporting depending on the source. There are discrepancies in catch by area depending on agency reported to (eg. amounts from same area different depending on whether reporting is to ICES or Russian authorities) There is likely a problem with ICES inter-catch.

The 2014 Ecosystem Survey coverage was affected by ice in an area where there had been significant biomass recorded in previous years. It was decided to discard the results from the 2014 Ecosystem survey. Adjustments will be considered next year when there is data from the 2015 survey.

5) **Consistency:** Last year's assessment was accepted.

The assessment, recruitment and forecast models have been applied as specified in the stock annex.

- 6) **Stock status:** The SSB (currently 1,505,000t) has been above Bpa (460,000t) since 2003 and F below or around Fpa since 2003. Recruitment is uncertain but reasonably stable.
- 7) **Man. Plan.:** Biomass reference points: The values adopted by ACFM in 2003 are Blim = 220,000 t, Bpa = 460,000 t. (ICES CM 2003/ACFM:11). Fishing mortality reference points: The values adopted by ACFM in 2003 are Flim = 0.74 and Fpa = 0.40. (ICES CM 2003/ACFM:11). Harvest control rule: At the 31st session of The Joint Norwegian-Russian Fishery Commission (JRNFC) in autumn 2002, the Parties agreed on a new harvest control rule. This rule was applied for the first time when setting quotas for 2004. The rule was somewhat amended at the 33rd session of The Joint Norwegian-Russian Fishery Commission in autumn 2004. The amended rule was evaluated by ICES in 2005 and found to be precautionary.

### **General comments**

This was a well-documented, well ordered and considered section. It was easy to follow and interpret.

### **Technical comments**

No technical comments.

### **Conclusions**

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

## Audit of *Sebastes mentella*

Date: 26.4.2017

Auditor: Arved Staby

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### General

The last assessment for this stock was done in 2014 (three year advice cycle).

The Northeast Arctic Beaked redfish (*Sebastes mentella*) assessment and draft advice have been approved by the Working Group.

### For single stock summary sheet advice:

- 8) **Assessment type: update**
- 9) **Assessment:** analytical
- 10) **Forecast:** presented
- 11) **Assessment model:** Statistical catch-at-age (SCAA) is used to estimate abundance, recruitment and fishing mortality. Schaefer model was not used for validation in 2017.
- 12) **Data issues:** There was no catch at age data available for 2016 (and not enough for an update run in ECA for 2015), and thus catch at age data was simulated for 2016. Other data sets updated with most recent data available. Weight at age was modelled based on catch and survey records, and maturity at age and recruitment was modelled for 2016 using a fixed effects model. Russian autumn survey data for 2016 not available.
- 13) **Consistency:** The last assessment was done three years ago.
- 14) **Stock status:** Spawning-stock biomass (SSB) has steadily increased from 1992 to 2005 and stabilised afterwards at around 890 000 tonnes. After a period of recruitment failure (1996-2003) strong year-classes have started to contribute significantly to the total-stock biomass (TSB). Fishing mortality was at its lowest in 2003 and increased in 2006 with the start of the pelagic fishery in international waters and in 2014 with the opening of the directed fishery in the Norwegian EEZ
- 15) **Management Plan:** There is no management plan for beaked redfish in this area.

### General comments

The section is well written, but would be easier to follow with a more consistent order of tables and figures and the respective referencing to these. Not all tables mentioned in the section are present, and some figures are not referenced in the text.

### Technical comments

Some technical issues are listed below:

Figures:

- Figure 6.x (several figures with that numbering)
- Figure D4: is this time series from 1984 to 2016 or 2017?
- Figure D4 and D5: check consistency in numbering

Tables:

- Table D3 not update because no survey in 2016? Add line to the table so that there is no misunderstanding.
- Table DX numbering
- Table D7 – values for 2016 same as 2015 (due to lack of age data). Mention this in the table text or add foot note
- Table D8 – according to the figure text some numbers should be red (not the case here)

### Conclusions

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

## Audit of Northeast Arctic saithe

Date: 26.04.2017

Auditor: Matthias Bernreuther

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### General

The Northeast Arctic saithe assessment and draft advice have been approved by the Working Group.

### For single stock summary sheet advice:

- 1) **Assessment type:** update
- 2) **Assessment:** analytical
- 3) **Forecast:** presented
- 4) **Assessment model:** SAM – tuning by one acoustic survey (split in two time series)
- 5) **Data issues:** The biological sampling from the fishery may have become critically low after the termination of the original Norwegian port-sampling program in 2009. In 2015 this was in particular the case for samples from trawl in quarter two and three in ICES subarea I and age samples from purse seine fishery south of Lofoten and in quarter two in ICES subarea I. In 2016, the biological sampling has improved, but the low level of sampling may still affect the precision of the catch, weight and maturity at age data.  
Lack of reliable recruitment estimates is a major problem. Prediction of catches will still, to a large extent, be dependent on assumptions of average recruitment in the intermediate year and the forecast period, since fish from age four to seven constitute major parts of the catches.
- 6) **Consistency:** Last year's assessment was accepted. The assessment, recruitment and forecast models have been applied as specified in the stock annex.
- 7) **Stock status:** The SSB has been above  $B_{pa}$  since 1996, declined considerably from 2007 to 2011, then increased again and is presently (2016/2017) estimated to be well above  $B_{pa}$ . The fishing mortality was below  $F_{pa}$  from 1997 to 2009, started to increase in 2005 and was above  $F_{pa}$  from 2010 to 2012, but is presently estimated to be most likely below  $F_{pa}$ . The recruitment has since 2005 been at about the long-term geometric mean level.
- 8) **Management Plan:** Agreed 2011 (first time in 2007):  $F_{MP}=0.32$  and SSB above  $B_{pa}=220\,000$  t. The TAC is based on an average TAC for the coming three years based on  $F_{MP}$ . There is a 15% constrain on TAC change between years. The plan is evaluated by ICES and is found in agreement with the precautionary approach.

### General comments

This was a well documented, well ordered and considered section. It was easy to follow and interpret. All data sets described in the Stock Annex are available.

### Technical comments

Catch at age data was estimated by ECA for the 2017 assessment of NEA saithe. This is the first year that catch at age estimates from ECA are used as input in the SAM assessment. In previous years catch at age was estimated manually, as described in the NEA saithe stock annex.

**Conclusions**

The assessment has been performed correctly and gives a valid basis for advice. Nevertheless, the low level of biological sampling is still a source of uncertainty in the assessment.

## Audit of (Norwegian Coastal Cod)

Date: 31.05.2017

Auditor: Elvar H. Hallfredsson

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### General

The Norwegian coastal cod assessment and draft advice have been approved by the Working Group.

#### For single stock summary sheet advice:

- 16) **Assessment type:** Update
- 17) **Assessment:** Based on survey trends.
- 18) **Forecast:** A trends-based assessment is provided for this stock, which is combined with a trial assessment to form a rebuilding plan.
- 19) **Assessment model:** The models/methods used are the same as specified in the stock annex. A trial updated XSA was run to obtain historic values of  $F(4-7)$ . Calculated survey mortalities ( $Z_s$ ) were regressed with XSA  $F_s$  in the converged part of a trial XSA (1996-2007). This regression was used for converting the 2014 survey mortality to a VPA  $F(4-7)$ . A selection pattern for 2016 was estimated as the average pattern over the years 2011- 2014 in the trial XSA, and  $F_s$  on oldest true age was taken from the trial XSA. The SVPA, which is considered as the final assessment, was run by using the survey based  $F(4-7)$  for 2016 combined with the selection pattern and oldest true  $F_s$  described above. The same procedure was repeated for catch at age data including estimates of recreational catches. This methodology follows the stock annex to the letter.
- 20) **Data issues:** Data used are those prescribed in Stock Annex 02 and are properly updated.

Uncertain estimates of catch at age and limited information about the recreational fishery and the tourist fishery leads to high uncertainty in the catch at age based analysis. The series with recreational and tourist fisheries included may be said to scale the stock size to a more realistic level, but at the same time brings in additional uncertainty. Also, the estimates of commercial catches of coastal cod have been more uncertain in recent years due to the large spawning stock of Northeast Arctic cod mixing with coastal cod during the migration along the coast.

A new time series for commercial catch numbers at age with uncertainty estimates using the ECA-Model, as presented in 2015 benchmark, has not been implemented. Further analysis is required before replacing the traditional catch\_at\_age series with the ECA-results.

The acoustic survey is considered to have a rather large uncertainty. This is because cod contributes to a low fraction of the total observed acoustic values. The cod estimate is thus vulnerable to allocation error.

- 21) **Consistency:** The retrospective SVPA indicates some variability without trend over the last 10 years, both with respect to biomass, recruitment and  $F$ . The recruitment estimate for the final year is highly uncertain in all assessments.
- 22) **Stock status:** This is a trends-based assessment based on survey SSB index and estimates of  $F$  and relative recruitment from an exploratory VPA assessment. The 2016 survey estimate of spawning biomass is above the 2015 survey estimate, but just marginally above the 2001-2015 average. In view of the survey uncertainty there is a



considerable risk that the SSB may still be close to its lowest value. The survey estimate for age 2 is somewhat higher in the three recent years compared to the period 2002–2013. Fishing mortality appears variable without a clear trend since 2000

- 23) **Management Plan:** Until a biologically founded rebuilding target is defined, the stock complex will only be regarded as restored when the survey index of spawning stock in two successive years is observed to be above 60 000 tonnes (1995–1998 average). This rebuilding plan was put into operation in 2011. The plan specifies the following plan for reducing the fishing mortality in every year when the latest survey shows a reduced SSB-index: Plan was evaluated by ICES and is found in agreement with the precautionary approach.

Action year	1	2	3	4	5	6	7
Reduction relative to F2009	15%	30%	45%	60%	75%	90%	100%

The spawning-stock biomass (SSB) index in the 2010 survey was below the index in the 2009 survey. Step 1 was thus initiated in 2011. This means that the regulation in 2011 was aimed at a 15% reduction of F relative to F2009. The 2011 survey gave a higher SSB index than in 2010, allowing the regulation for step 1 to continue in 2012. The 2012 survey resulted in a lower SSB index compared to 2011; accordingly step 2 was set in motion in 2013, with regulations aiming for an F at least 30% below F2009. The 2013 and 2014 surveys showed an increased the SSB index, allowing for the existing regulations to be continued in 2014 and 2015 (still step 2). 2015. The 2015 survey showed a decline, and the regulations in 2016 should aim for 45% reduced F. The 45% also applies for 2017, since the latest survey gave a higher ssb-estimate then the previous.

### General comments

This was a well documented, well ordered and considered section. It was easy to follow and interpret.

### Technical comments

The methods are technically correct but it is not clear if alternatives have been considered in the assessment. However, this this is assumed to be addressed when appropriate benchmark is undertaken.

### Conclusions

The assessment has been performed correctly

This audit finds the assessment to be clear and has followed expected practices fully. The results can be taken as reliable. However, the lack of updated information about recreational and tourist fishing, and unceartein discrimination between coastal cod and NEA cod at commen fishing grounds, contributes to uncertainty in the assessment of this stock.

## Audit of Greenland halibut in subareas 1 and 2

Date: 31.06.2017

Auditor: Sam Subbey

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### General

The Greenland halibut assessment and draft advice have been approved by the Working Group.

#### For single stock summary sheet advice:

- 1) **Assessment type:** update
- 2) **Assessment:** analytical
- 3) **Forecast:** presented
- 4) **Assessment model:** GADGET length based model
- 5) **Data issues:** No specific issues

**Consistency:** New assessment method with a length based GADGET (ICES, 2015 and Howell *et al.*, 2015) model was benchmarked in 2015 (IPHALI 2015) and accepted by ACOM the same year. The GADGET model output showed an increasing trend in biomass from 1992 until recent years, when the trend has flattened and is slightly downward the last year.

**Stock status:** A long-term average  $F_{MSY}$  is not appropriate for this stock given the recent extended run of poor recruitment. Bpa is the only reference point used for this stock, and the stock status (i.e. above Bpa) is set entirely within the gadget model. Using the Bpa from the benchmark as reference, the stock is assessed to be above Bpa, and projected to remain so over the 5 year forecast, on condition that the advice is followed.

**Management Plan:** There is no agreed Management Plan for this stock. The 38<sup>th</sup> JRNFC's Session in 2009 decided to cancel the ban against targeted Greenland halibut fishery and established the TAC at 15 000 t for next three years (2010-2012). The 40<sup>th</sup> JRNFC Session in 2011 decided to increase the TAC for 2012 up to 18 000 t, and at the 42<sup>nd</sup> JRNFC Session in 2012 the TAC for 2013 was increased to 19 000 t. The 43<sup>rd</sup> and 44<sup>th</sup> session kept the same TAC for 2014 and 2015. For 2016 and 2017 TAC was set to 22 and 24 thousand t, respectively.

### General comments

A well written and document.

### Technical comments

The Gadget model needs further developing, and there is also a need for better investigation of reference points, and the development of a HCR.

### Conclusions

Given that the 5 projection comes close to Bpa, exceeding the catch advice could pose a risk to the stock status.