Northwest Atlantic Fisheries Organization

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SCIENTIFIC COUNCIL MEETING - MARCH 2018

REPORT OF THE REVIEW OF INPUT DATA FOR 3M COD BENCHMARK ASSESSMENT
March 13, 2018 via WebEx

Report of the Review of Input Data for 3M Cod Benchmark Assessment
13 March 2018 via WebEx

Chair: Brian Healey Rapporteur: Tom Blasdale

1. Opening of the Meeting

This WebEx meeting was organized in order to agree on the input data for the 3M cod benchmark meeting which will take place in Lisbon, 9 to 13 April 2018. The meeting was opened at 11:00 Atlantic Daylight Time on 13 March 2018 by the Chair, Brian Healey who welcomed Scientific Council members from Canada and the European Union (Spain and Portugal) (Appendix II). The chair welcomed Carmen Fernandez and Jim Ianelli who will act as external reviewers for the benchmark process. The third external reviewer, Mike Palmer, was unable to join this WebEx but will receive all the documentation. The Chair extended the appreciation of the Scientific Council to these highly-qualified External Reviewers for their availability. The Chair also noted the participation of the reviewers is beneficial with respect to achieving a successful outcome to the Benchmark, to enhance transparency of process and to ensuring the work of the Council is aligned with best practice.

2. Appointment of Rapporteur

The NAFO Scientific Council Coordinator (Tom Blasdale) was appointed as rapporteur.

3. Input Data Considerations

SCR 18/001 provides details of the Flemish Cap (NAFO Division 3M) cod fishery, the history of assessment and assessment input data. This report summarizes discussions that took place during the data preparation WebEx and decisions that were taken regarding the data to be used in the benchmark assessments. A summary of decision is presented in Annex III.

a) Catch

i) Total Catch

The reduction of the TAC in 1980 produced an immediate decrease in reported catches. The issue of confidence in reported fisheries data was raised in 1986 (NAFO SC Rep., 1986) due to large discrepancies observed between reported catches from member countries and Canadian surveillance estimates. Independent estimates of total annual catches for the period 1988-1994 were made by Vázquez et al. (1995) and substantially differ from total reported catches in the same period. The catches estimated by Vázquez et al. (1995) for this period were found to exceed the official reported statistics by factors ranging from 1.8 – 52.8.

Figure 1 presents the 1959-2016 3M cod catches used by the NAFO Scientific Council for stock assessment and TACs approved by the NAFO Fisheries Commission. For the catch data:

- 1959-1987 come from NAFO Statistical Bulletin.
- 1988-2010 were estimated for Spain and Portugal using observer data and for the other fleets based on the STATLANT 21A data or Canadian Surveillance (if available and differing from reported catch).
- 2011-2012 catches were estimated by the Bayesian VPA model.
- 2013-2015 based on Daily Catch Reports (DCRs). In 2014, for countries that submitted the STATLANT 21A data before June, catches were based on this information. For the rest of the countries, catches were based on the DCRs.

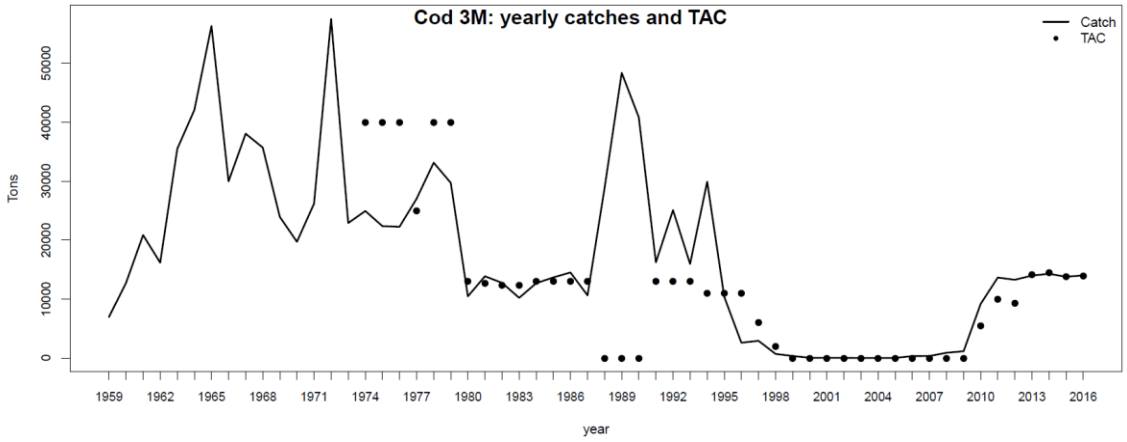

Fig. 1.3 M cod catches estimated by NAFO Scientific Council and TACs in tonnes approved by NAFO Fisheries Commission for the period 1959-2016. Catches for 2011 and 2012 are the median results of the 2017 assessment.

Total catches for the period prior to 1988 come from NAFO Statistical Bulletin: these figures were considered to be highly inaccurate (Vázquez et al., 1995). Because of this, catches before 1988 were not considered in the assessment until 2013. The view that these data are unreliable is also supported by the plot of the ratio between the sum of products of catch at age and weight at age and the total catch weight (Figure 2) which shows large anomalies in many years prior to 1998 which cannot be explained or corrected due to the lack of detailed information. In 2013, assessments were performed using both the post-1988 data and a larger dataset going back to 1972: little difference was observed between these assessments and consequently it was decided to use the post-1972 in subsequent assessments. This was to allow a longer time series of stock-recruit pairs in order to establish $B_{\lim}$. However, SC did not reevaluate the quality of the data during the 2013 assessment when the catch time-series was extended. At that time the only consideration was that the change did not have a large impact on the results and that it allowed to have more data for the stock recruitment relationship. Considering the review of catch data and also the sum of products differences noted above, the Council agreed to return to using 1988 as the first year in the catch time series.

SC decision: *it was agreed that total catch data from 1988 onwards will be used in benchmark assessments. However, at least one run will be performed in the Benchmark using data going back to 1972 in order to determine sensitivity to the additional data, particularly with respect to establishing* B_{lim}.

For the years 2011 and 2012, estimation of catches was not possible and the available values from the STATLANT 21A were not considered to be consistent with the 2010 catch estimates. Catch estimates shown in Figure 1 use values estimated by the Bayesian XSA to fill these missing years. The priors used in the Bayesian assessment were agreed by STACFIS and derived from the 2010 STACFIS catch raised by the ratio of 2011 to 2010 efforts (1.4). The resulting prior median for 2011 was 12836 tons. The 2012 TAC was set slightly lower than that for 2011 and the effort was virtually the same, suggesting no evidence for a change in the catch in 2012 relative to 2011. Therefore, the same figure was taken as prior median for catch in 2012.

SC decision: *Total catches and the catch at age abundance for 2011 and 2012 will be fixed as the prior values (12836 tons for both years) used in the last year approved assessment.*

ii) Catch at age

During the period 2002-2005, neither length nor age distributions in the catch were available. It may be possible to generate replacement CAA values using the mean ratio by age (1998-2008) between the abundances for each of the ages observed in the survey and those observed in the catches (as has been done in the assessment of 3M redfish). However, most of the models that will be used in the benchmark don't necessarily need catch at age data in all years (e.g. the Bayesian models) or are able to reconstruct catch at age statistically (eg SAM) so there will be nothing to be gained from using made up data in these cases. Other models may need full catch at age data but in these cases it may be possible to used values generated statistically in other models.

SC decision: *For the benchmark, it is not necessary to have a complete catch numbers at age matrix at this point. Solutions to problems of missing data in this matrix, where they occur, will be tackled during the process of developing models.*

b) Weight at age

i) Catch weight at age

Figure 2 shows the ratio between the sum of products (SoP) of numbers and weight at age in the commercial catch sampling and the total catch weight. In the years prior to 1988, there are large discrepancies and due to lack of information and low confidence in the catch data, it is not possible to resolve these differences. Discrepancies in more recent years mainly fall within the period 1994 – 2007, when there was limited sampling of the commercial fishery. It was agreed that years in which discrepancies greater than 10% occurred should be reviewed.

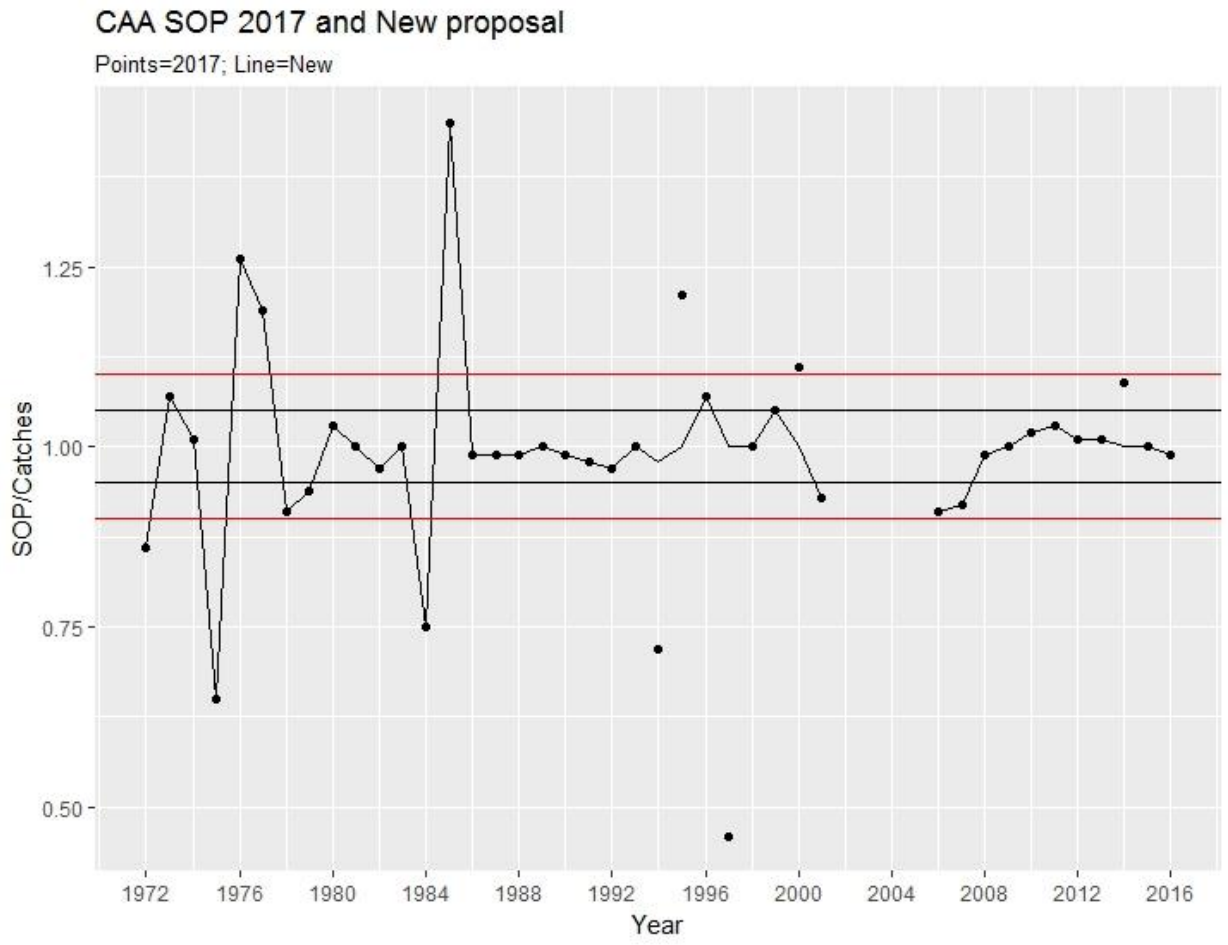

Fig 2. Ratio between the sum of products (SoP) of the commercial numbers and weight at age and the total catch. Line is the new data agreed during the Webex, points are the data used in previous assessments. Red horizontal lines denote +/- 10% difference between these values; black lines denote +/- 5% difference.

For 1994, 1995 and 1997, it is considered likely that the discrepancies arise from inaccurate weight at age data resulting from the low catch sampling levels in those years. Gonzalez-Costas et al (SCR Doc 18-001) suggested using mean weights from survey data, and the SoP/catch ratio resulting from values that were recalculated in this way was very close to one. Alternative suggestions were to rescale the bad values to the total catch weight or to use average weight values from adjacent years to recalculate the bad years.

The discrepancy in 2014 was only 9%. And it was agreed that is not necessary to replace this value. Other discrepancies were discovered to result from computational errors and the discrepancies disappeared when the errors were corrected.

SC decision: *for 1994, 1995 and 1997, interpolation will be applied based on mean weight at age in the catch in the previous and following years. If having applied this correction the discrepancy in the SoP/catch ratio remains >10%, the CAA values will be re-scaled to total catch. For 2014, the value will be maintained. All other corrections will be applied as described in Gonzales-Costas et al. (SCR-Doc 18-001).*

ii) Stock weight at age

Figure 3 shows the ratio between the sum of products (SoP) of survey numbers and stock weight at age and total survey biomass. There were large discrepancies in the Canadian data in almost every year prior to 1988. Since a decision was made to use 1988 as the first year for population modelling, this discrepancy has not been investigated.

SoP catch ratios for the period 1988 to 2005 also show rather large anomalies. These SoP anomalies were found to be due to the fact that the survey abundances and the stock mean weights used in the assessments since 2008 were incorrect due to an error during unit conversion calculations following the survey gear change of 2003-2004.

For the period 2005-2016, all the FC survey input data have been revised and small differences have been found (resulting from a database error). The only substantive revision was for the 2011 survey data, because the *a* and *b* Length-Weight relationship parameters for that year were poorly calculated.

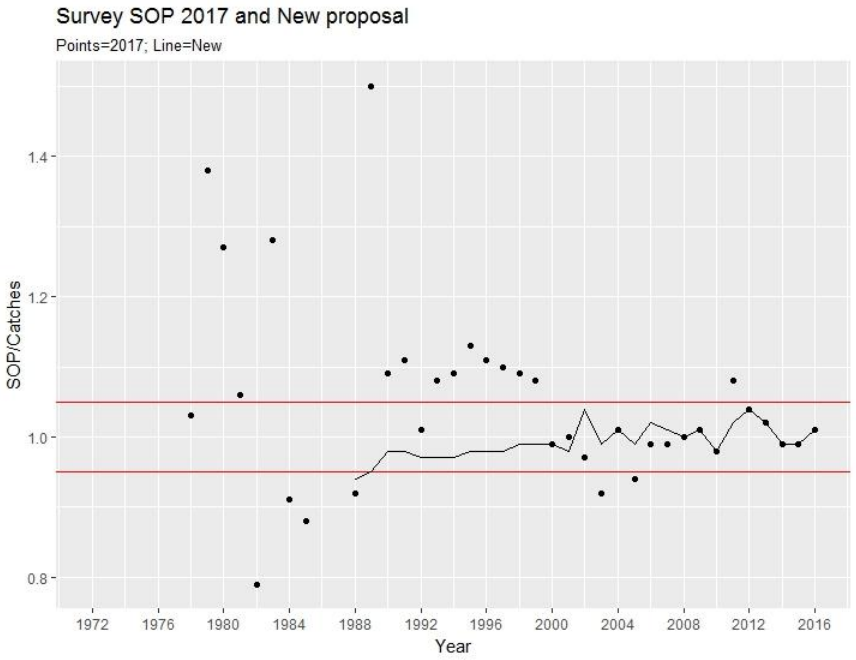

Fig 3. Ratio between the sum of products (SoP) of survey numbers and weight at age and total survey biomass. Points show the values used in past assessments, the solid line shows corrected values. Red horizontal lines denote +/- 5% difference between the SoP and the total biomass.

SC decision: *the corrected values for the stock weight at age and for survey abundance at age in 1988 to 2016 will be used*.

c) Plus Group

The March 2017 3M cod workshop (NAFO, 2017) recommended that the benchmark process considers alternative ways of extending the plus group (via disaggregation of historical data or by using alternative stock assessment models). Currently the plus group is 8+ but in the most recent years the numbers in the 8+ group have increased.

All the input data are available for individual ages up to 16+ for the period 2008-2016 in catch data and 1988-2016 in the survey data. Although it will be possible to use these new disaggregated data up to age 16 in the future, there is insufficient time to complete this work prior to the April 2018 benchmark.

SC decision: *The default approach will be to use the current 8+. The study of an older plus group is considered a secondary problem and will be deferred.*

d) Proportion Mature at age

Previous assessments have used maturity ogives derived from survey data. This is not ideal as the spawning period for this stock is in the spring and surveys take place in July when maturity is more difficult to determine. It should be possible to verify the survey ogives using maturity information collected during the spring in the commercial fleet, however sufficient commercial samples taken during the spring were only available for the years 2012 and 2014. The preliminary results of the comparison between the maturity ogives determined from summer surveys and the spring commercial sampling in these two years (fig 4) show only small differences in L_{50} (around 6 cm in both years). These differences are quite consistent with the observed growth pattern between spring and summer in 3M cod.

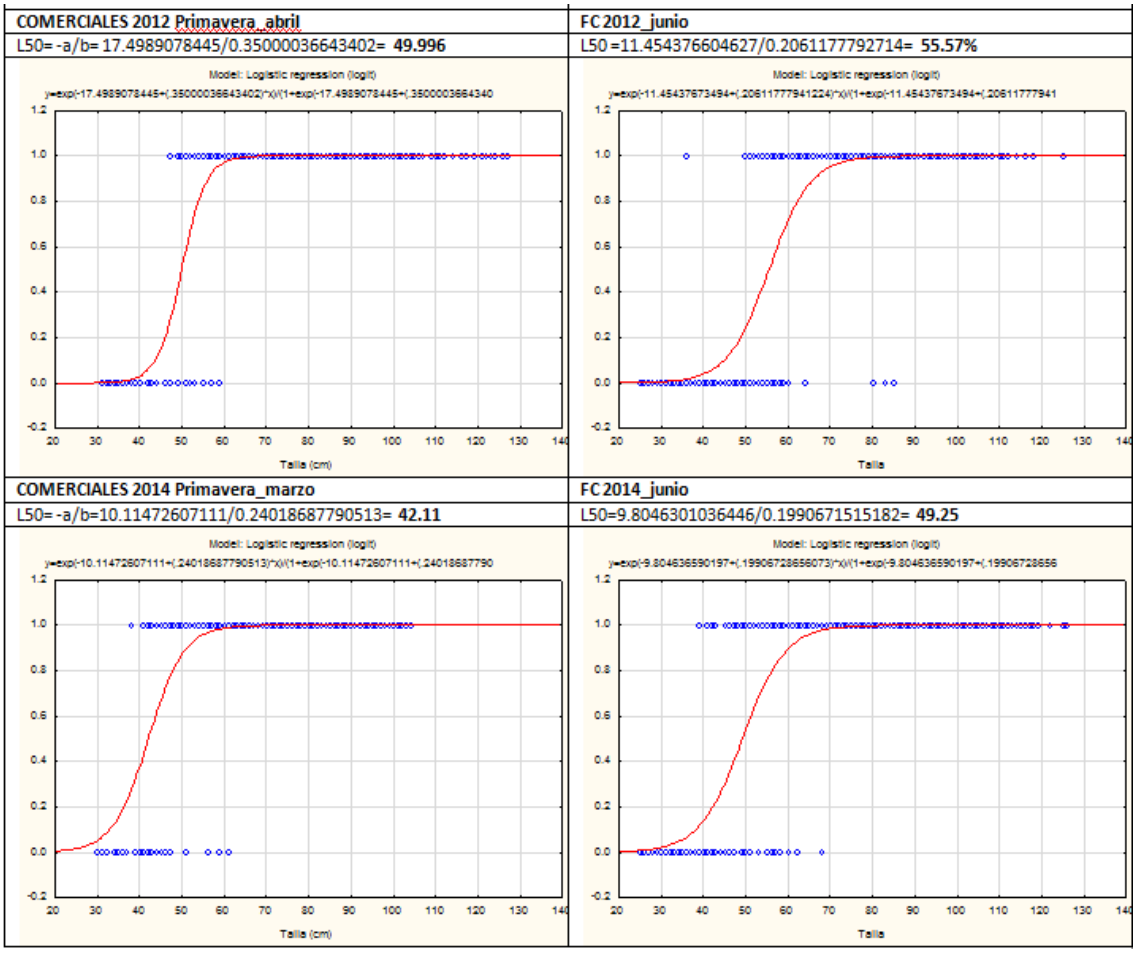

Fig. 4. Survey and spring commercial maturity ogives spring commercial maturity ogives in 2012 and 2014. Plots at left are from commercial sampling, whereas those on the right are from survey samples. The estimated L50 is indicated in the title of each panel.

Further investigation of the method used to calculate the ogives is required (? Are separate curves fitted for every year?). Changes in maturity and weight at age have been significant in recent advice. This should be discussed further during the benchmark meeting and may be the basis of research recommendation.

SC decision: *It was agreed to use the current FC survey maturity ogives during the Benchmark. It was discussed during the meeting that probably it would be necessary to make a research recommendation in the Benchmark to study which would be the best way (by year, by cohort, with correlation, etc.) to estimate the maturity ogives.*

e) Natural Mortality

A number of possible solutions have been considered, including a constant value for all ages and years, a vector of M at age constant for all years, and a matrix with different M values for each age and year (eg. annual values of natural mortality by age and years derived from the GADCAP model). Results indicate that the assumption of constant mortality in all years and ages is not supported.

SC decision. *It is recommended to present three different scenarios for a base case of at least one model that it will be presented in the Benchmark to study the sensibility of the results to the M assumption. The three scenarios are:*

1. *The last approved assessment median M estimated constant for all ages and years: M=0.19.*
2. *The median vector estimated of all size-dependent methods varying by age and constant in time.*
3. *The age/year matrix of M estimated in the updated GADGET model.*

4. Recommendation on data set to use during April 2018 3M cod benchmark

Decisions taken on this meeting are summarized in appendix III and discussed within the relevant text sections.

5. Other Business

No other business

6. Adjournment

The chair thanked the participants for their contributions and acknowledged the extensive background work undertaken by those involved in various 3M cod projects. The meeting was adjourned at 15:00 ADT.

7. References

Ávila de Melo, A.M., F. Saborido-Rey and R. Alpoim, 2009. An XSA based assessment of beaked redfish (S. mentella and S. fasciatus) in NAFO Division 3M based on revised 2005-2008 catches (is a retrospective biased assessment necessarily useless in terms of scientific advice?). NAFO SCR Doc. 09/29 Ser. No N5664, 56pp.

Vázquez A., A. Avila de Melo, E. de Cárdenas and R. Alpoim, 1995. An Assessment of the Cod Stock in NAFO Division 3M. NAFO SCR Doc. 95/73, Serial No. N2590.

NAFO, 2017. NAFO Cod 3M Workshop – Current Assessment and Projection Uncertainties. NAFO SCS Doc. 17/07, Serial No. N6661.

APPENDIX I- Agenda

1. Opening of the meeting
2. Appointment of Rapporteur
3. Input data considerations (SCR (18/xx))
    a. Catch
        i. Total Catch
        ii. Catch at age
    b. Weight at age
        i. Catch weight at age
        ii. Stock weight at age
    c. Proportion Mature at age
    d. Survey Data
        i. Canadian Surveys
        ii. EU/Spanish Surveys
4. Recommendation on data set to use during April 2018 3M cod benchmark
5. Other Business
6. Adjournment

APPENDIX II – List of Participants

CHAIR	
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APPENDIX III – Summary of decisions taken at the meeting

a) Catch

i) Total Catch

It was agreed that total catch data from 1988 onwards will be used in benchmark assessments. However, at least one run will be performed during the benchmark using data going back to 1972 in order to determine sensitivity to the additional data, particularly in establishing B_{lim}.

The Scientific Council agreed that the catches approved for years 2011 and 2012 correspond to the median catch used in the priors for those years in the last approved assessment. . These median catch were derived from the 2010 STACFIS catches raised by the 2011:2010 effort ratio as described above.

ii) Catch at age

For the benchmark, it is not necessary to have a complete catch at age abundance matrix. Solutions to problems of missing data in this matrix, where they occur, will be tackled during the process of developing the models.

b) Weight at age

i) Catch weight at age

For 1994, 1995 and 1997, interpolation will be applied based on mean weight at age in the catch in the previous and following years. If having applied this correction the discrepancy in the SoP/catch ratio remains >10%, the CAA values will be re-scaled to total catch. For 2014, the value will be maintained. All other corrections will be applied as described in Gonzales-Costas et al. (SCR-doc 18-001).

ii) Stock weight at age

The corrected calibrated values for the stock weight at age in 1988 to 2004 will be used.

c) Plus Group

The default approach will be to use the current 8+. The study of an older plus group is considered a secondary problem and will be carried out if there is time.

d) Proportion Mature at age

It was agreed to use the current FC survey maturity ogives during the Benchmark. Further discussion on the ogives estimation method will occur during the benchmark (potentially leading to drafting of a research recommendation).

e) Natural Mortality

It was not agreed what would be the final method to estimate M, but three options were proposed for consideration during the Benchmark.