MEETING REPORT

Focus Group 3 horse mackerel stocks

Date: 3 April 2023

Time: 10:00 – 13:00 hrs CEST

Location: Online (Zoom) with simultaneous interpretation in SP-FR-ENG

1. Opening of the meeting

Jérôme Jourdain, Chair of the Focus Group, opened the meeting. He asked the Secretariat to go over the housekeeping arrangements for this online meeting with simultaneous interpretation. A tour de table followed.

2. Adoption of the agenda and meeting rationale

The Chair explained the rationale for holding this meeting, which for the first time covered all three horse mackerel stocks (Western, Southern and North Sea).

During the October 2022 PelAC meeting, the PelAC urgently called the Commission for the organisation of a benchmark meeting that treats the three horse mackerel stocks together. The Chair expressed gratitude for the Commission's attendance at today's meeting. He understood the benchmark was high on the Commission agenda, which he appreciated, as a commitment to send a joint request to ICES in this sense was also included in the Written record of annual fisheries consultations between the EU and UK for 2023. He underlined the urgency of organising this benchmark as soon as possible this year.

The PelAC agreed to hold a Focus Group meeting to which key involved scientist in the different stocks are invited, to give the PelAC an overview of the current state of play in relation to the science and assessments of these stocks. His impression from the MIACO meeting was ICES' perceived reluctance to move forward with the benchmark meeting this year. For this reason, the agenda of today's meeting focusses on the science aspects only, in the hopes to expedite the benchmark meeting as a matter of priority. He stressed this meeting would not cover separate discussions such as on management strategies or the work to align the horse mackerel TACs with ICES advice areas, which would be discussed with the SWWAC at a later stage, as this would require a significant amount of technical work as well. The topic of the benchmark would be today's primary focus.

The Chair gave particular thanks to Sean O'Donoghue and the Secretariat for their assistance in developing the agenda of the day's meeting during the Chairs absence. He explained the first portion of the meeting would be dedicated to the scientific state of play of the assessments of all three stocks, followed by an update on the genetics stock-ID work carried out for horse mackerel to date. Following these presentations, the meeting will zoom into the specific issues per stock, to take stock of what would need to be addressed at the next benchmark meeting and to determine how the PelAC can help advance this process.

Finally, he concluded that under AOB, time permitting, an exchange of views would be held on the different approaches taken by Member States for the implementation of the Western horse mackerel bycatch quota.

The agenda was adopted without amends.

3. State of play 3 horse mackerel stocks

The chairman invited the three involved scientists to present the state of play on the different horse mackerel stocks.

- ### Presentation Western horse mackerel by Andrew Campbell

Andrew Campbell, from the Marine Institute in Ireland, took the floor to give an overview of the current state of play with regard to Western horse mackerel. He explained that Western horse mackerel was an important fishery in Ireland. While he was a long-standing member of WGWIDE, he noted he was not the stock assessor for this stock, as this responsibility falls onto Cefas in the UK.

He showed a plot that depicted the distribution of the three horse mackerel stocks in European waters, noting the Western stock has the largest geographic spread. The stock distribution is inferred from fishery activity as well as egg and larvae observations. Following the HOMSIR project in 2003, ICES division 8c was moved from the Southern to the Western stock. Ongoing genetic studies will further investigate the stock boundaries – in particular mixed areas that require further investigation and were important to recognize moving forward:

- 7d, e (Western & North Sea)
- 9aN (Western & Southern)
- 4a, 3a (Western & North Sea)

Catches in 4a,3a are assigned to either Northern and Western stocks depending on the quarter they are caught in the year.

Campbell went over the assessment history. The first analytical assessment developed for Western horse mackerel was the SAD assessment model in 2008. This was developed specifically for this stock because of its characteristics and the data available, which was limited. The triennial egg survey provides estimates for egg production, and the catch-at-age information is the richest data source available. Another important driver for the development of this particular model were the recruitment characteristics for this stock. In 1982 there was a particularly strong year class that was so dominant it was considered abnormal.

In 2017, the first scheduled benchmark took place which replaced the SAD model with a stock-synthesis model. This type of model, which is used more in USA than in Europe, is an integrated analysis model, which offers a lot of flexibility in terms of information you can put in, so it allowed for greater use of fishery independent information. The SAD model was more limited in that sense. The new model was implemented after the 2017 benchmark, and it included an egg production index (with the two earliest surveys discounted due to poor survey coverage) and a recruitment index calculated from a number of IBTS (groundfish) surveys covering quite a large portion of the total area for this stock. It also included information from an acoustic survey in division 8c as well as length and age sampling data. As a result of the benchmark, the reference points were re-estimated. They were revisited in 2019 when it was considered the 2017 estimated reference points were no longer appropriate. Campbell underlined the estimation of reference points was still an important ongoing issue for this stock. How the model uses the data was very complex with a complex set of inputs, which in his view were one of the issues to address in the assessment.

In 2022 an update assessment was carried out. He depicted graphs from ICES advice for catches, SSB and recruitment. At the start of the time series, the increase in catches was wholly driven by the excessive recruitment peak of 1982. It was 20 times larger than average high recruitment peaks and it has not been repeated since. Nothing of the sort has been seen in the last 40 years in this fishery. As this year class was fished out, the level of catch declined. A recruitment peak in 2001 was still just one third of the 1982 peak. In the plot, it can be seen that recent recruitment is stable and relatively low. Recent assessments show the stock size reached an all-time low in 2017 and is slow to recover. It is now below B_{lim} and forecast to remain so in the current year, which is why the stock is now under a 0 TAC advice.

The expert working group looks at the performance of the assessment every year. Benchmarking comes around when the working group determines the data and the fit need to be relooked at. He showed three plots depicting how the assessment performs with the recruitment index fit, the total annual egg production fit and the 8c survey acoustic biomass fit. In the early years, there was a good fit of these data with the model but in more recent years the fit has deteriorated, which is not showing up in the catches and the recruitment. This is perhaps related to the uncertainty in the assessment and requires further investigation. There is a general downward trend in the egg survey results with an exceptionally low egg count in 2019. The most recent survey was conducted in 2022 but the assessment is not configured to use in-year data. In terms of the acoustic information, the fit has never been good and this definitely requires attention. Overall, this is a consistent observation with the other data sources.

Campbell added that separate to the poor model fit, the biggest 'red flag' in the assessment was the poor retrospective performance, and unfortunately it takes time for this to become apparent. In the last 5 assessments, the SSB time series required revision and every year it went down. The increase in SSB is also becoming less pronounced every year, so recovery looks slower each year. This year there was no going around it, the stock is located below Blim. The retrospective bias is a 'huge issue that requires attention'.

In conclusion, the stock has been in a general decline for several years with no indications of significant recruitment. The recruitment peak in 1982 was extraordinary and there are no assumptions for a repeat. Since the 2017 benchmark, the performance of assessment has deteriorated, with a consistent and worsening retrospective pattern, indicative of model misspecification. The model has a poor fit to some of the data sources (recent commercial catch composition, PELGAS (8c) acoustic survey index and length composition). The model is complex and the data re-weighting scheme has given the working group issues in the last few years and requires investigation. The reference points also require revision. Since the last benchmark, new data and methods are available that can be further explored (acoustic, groundfish surveys, index standardisation techniques, genetics studies and alternative stock assessment models).

The Chair thanked Campbell for his presentation and opened the floor for quick questions from the participants.

Sean O'Donoghue asked why ICES choose to give advice given that the Mohn's rho values were outside the acceptable bounds.

Campbell replied that this was followed through relative reference but unfortunately it hadn't provided route out of the current situation. There was room for interpretation of the Mohn's rho values but this has not been carried out yet and it would not be possible to look at this in detail before the next WGWIDE.

Claus Reedtz-Sparrevohn added that considering the direction of the retrospective bias even if looked at it would still not change the 0 TAC advice, the stock is at a lower point this year. He noted the argument had been put forward but as far as he understood it did not change the outcome.

- Presentation Southern horse mackerel by Gersom Costas

Gersom Costas explained that the expert working group WGHANSA covered the assessment of the Southern horse mackerel stock. Both he and Hugo Mendes were the stock assessors of this stock.

The basis for the assessment is an ICES category-1 (data-rich). The assessment uses the AMISH model, which is an age-based assessment model, a tailored model that works similar to the AMACK model used in the USA. As data input, the model uses catch in numbers-at-age since 1982; selectivity pattern by age (blocks selectivity for catch & survey index), tuning indices (the only biomass index from the IBTS survey in Spain/Portugal); mean weight-at-age in the catch and stock. Discard quantities are considered negligible.

According to the latest advice, the stock is on the increase. The SSB has been increasing significantly since 2014 and recruitment has increased in 2012, 2017 and 2019. He noted that the problem is that both the SSB and recruitment have wide confidence intervals, which means the model produces high uncertainty in the threshold. The fishing mortality (F) is related to SSB and shows a decreasing trend in the last years and is well below Fmsy. The total catches have been relatively stable in the recent years, without important 'jumps'.

He explained the fishery operates with six fleets, defined by the gear type (bottom trawl, purse-seine and artisanal) and country (Portugal and Spain). The Portuguese artisanal fleet is the least important for the catches of horse mackerel. In the catches by gear temporal series show significant increase in the use of bottom trawl in 2013 and purse seine in 2012. In terms of selectivity pattern, bottom trawlers target ages 1-3 and purse seiner the younger fish (ages 0-2). When looking at the catches-by-year in the Spanish fleet, there is a significant increase in the catches by purse seiners since 2013 and an important decrease in bottom trawl catches in 2011 and 2017.

According to Costas this increase in purse seine catches (targeting younger fish) since 2012-2013 was related to the 'sardine crisis' around this time, where the fleet targeting sardine switched to horse mackerel due to lack of sardines.

The abundance-at-age survey index is derived from the combined Portuguese and Spanish IBTS surveys and excludes ages 0 because they are 'really noisy'. Estimates of the current index are considered very noisy as well. In the years 2012, 2019, 2020 the survey index could not be estimated because no survey took place.

Until 2009, division 8c was included in the TAC but since 2010 the TAC area consisted of division 9a only. In recent years, the difference between advice TACs and observed catches has been markedly different.

According to Costas, the problem in this assessment is the high confidence interval for F and recruitment, leading to a high uncertainty of the stock status. Possible reasons for this uncertainty could be that the changes in the relative contribution to the catch from bottom trawl and purse-seine fleets have led to changes in the age composition of catches. The current assessment model does not appear to be sensitive enough to the changing pattern of selectivity that have occurred in recent years. In addition, the current survey tuning index is noisy and could not be estimated for 2012, 2019 and 2020.

The Chair thanked Costas for this presentation and remarked on the interesting points highlighted with regard to the observed catches. He asked is similar links could be made to observations of sardine and anchovy biomass in division 8.

Costas replied that the division was due to high uncertainty in the SSB and recruitment, the coefficient of variation was around 30%, which was quite high.

The Chair remarked on the changes in the activity of the trawlers and purse seiners related to changes in the fishery and added that further north an increase in the number of catches of smaller fish and smaller sardines was noticed. He thought these couldn't be harvested because there is no market for them, especially in the canning industry. Perhaps the lack of market streams may explain why the catches are not reflecting the level of biomass seen.

Luis Vicente pointed out that increases in purse seine activities were in fact related to the 'sardine issue', but clarified that a double effect this could be seen. Some years there are more horse mackerel catches because there is a lack of sardines to catch, but in other years there is a temporary stop of the fleet due to EU funding issues, and the opposite effect is seen. He asked how the model could account for years where there is no fleet activity at all. He specified the interplay is not as simple as 'no sardines, so more horse mackerel', in some cases there are no sardines and even less horse mackerel. Separately Vicente referred to the artisanal fisheries, usually representing fixed gears but he noted another type of artisanal fishery existed, where nets are thrown into the sea from the beach and the catch is pulled back. This fishery targets very small sizes and he asked is this type of fishery could have any effect on the assessment. In the South the opposite of what the Chair had mentioned was true, small sizes have high market value.

With regard to nets set out from the beach, Costas replied that catches must be quantified in weight and numbers. This kind of gear does not generate weight in significant quantities, so it would have very little impact on the selectivity pattern. Since the last sardine crisis, the change in selectivity pattern was very quick, and the assessment model was not sensitive enough to realise this quick change, due to the wide confidence interval.

- Presentation North Sea horse mackerel by Claus Reedtz-Sparrevohn

Claus Reedtz-Sparrevohn took the floor to present the state of play on the North Sea horse mackerel stock. He explained that contrary to the other two horse mackerel stocks, the NS stock is data-limited so there is no full analytical assessment for this stock. ICES issues two-year advice for this stock.

For NS horse mackerel, there is no sampling procedure in place, so it is not possible to have an age-based assessment. The catches are around 10.000 tonnes and while relatively stable they have fluctuated a bit from year to year. From the catches an abundance index is calculated.

He showed a plot of the abundance index that gives a length-based indication that the stock is fished at Fmsy, though the link appears smaller when looking at the catches. The length-based indication can be used as an indicator that you are fishing above Fmsy but this type of analysis comes with quite some uncertainty.

Reedtz-Sparrevohn moved on to explain that fishing horse mackerel in the North Sea can be quite tricky: it's not just where the fish are caught but also what time of the year they are caught. In areas 4b,c and 7d, horse mackerel caught belong to the NS stock independent of the quarter of the year they are fished. In areas 4a and 3a, the quarter of the year the horse mackerel are fished, determines whether they belong to either the North Sea or the Channel stock: fish caught in Q1 and Q2 are North Sea horse mackerel, if they are fished in Q3 and Q4 they are counted as Western horse mackerel. These discrepancies are important to take into account moving forward.

Reedtz-Sparrevohn showed some bycatch data from the small-meshed fishery of NS sandeel, NS sprat and Norway pout fishery, and in 2022 this accounted for 0% in both fisheries, so it is not a big bycatch fishery. In 2022, 177 kg was bycaught in the sprat fishery. Recent development in the fishery shows the proportions of the fishery, where most of the fishery takes place in area 7d. In the last 3-4 years, an increase in horse mackerel was noticeable in area 4a in Q1 and Q2 as well.

In summary, the lack of analytical assessment as well as the inconsistency in the catch areas and catches throughout the year would be worth looking into in a benchmark. The bycatches in demersal

fisheries would also be worth examining more closely to determine if these horse mackerel bycatches constitute a significant part or not.

The Chair thanked Reedtz-Sparrevohn for this presentation and concluded the NS horse mackerel stock illustrates the opportunities that combining the three stocks in one benchmark could bring.

4. State of play horse mackerel genetics research

The Chair invited Ed Farrell to provide an update on ongoing genetic stock-ID projects concerning horse mackerel. Ed Farrell took the floor and indicated that the results he was presenting were only preliminary at this stage, since a 'huge batch of data' was still being analysed at this time which he expected would generate promising results for this discussion.

He depicted a map showing the delineation of the horse mackerel stocks, which showed the separation of the stocks in the English Channel (areas 7e and 7d) and a delineation between the Western and the Southern stocks. He explained there was a long history of stock-ID work on horse mackerel since the HOMSIR project in 2003, where different attempts were made to try and distinguish between the stocks with varying levels of success. The outcome of HOMSIR project is where the current stock delineation for horse mackerel is based on. Farrell has been working on horse mackerel genetics since 2015, when there was still confusion over the population structure and limited genetic power available to split the populations accurately.

This changed when a new approach was introduced that was first used in herring: to sequence the entire genome. Instead of looking at random, small bits of genetic material, the whole genome is sequenced through which even very small differences can be detected. This can help reveal the population structure. An assignment model is built with information from genetic markers, which can be used to assign samples from batches back to their populations of origin.

Farrell flagged that a paper on this work was recently accepted and was due to be published soon: *The genomic basis and environmental correlates of local adaptation in the Atlantic horse mackerel (Trachurus trachurus)*. He would circulate once it comes out (**action 1**).

The study revealed a high-level population structure of Western, Southern and North Sea. Also some North African samples were included.

The main conclusions of the paper were:

- The North Sea population is completely distinct from all other horse mackerel populations
- All Western samples cluster together

The confusion starts with the population structure within the Southern Stock area (9a). Part of the fish found in that area grouped together with the Western stock and the rest were from a more southerly population. So the Southern area contains fish that come from two different populations. The caveat is that the samples taken were all juveniles and not spawning baseline samples.

The ongoing stock-ID project uses informative markers from a large panel of markers from across the entire genome, to screen many samples. These informative markers can then be used in the assignment model for assigning mixed commercial and survey catches back to their population of origin.

Farrell noted that high powered genetic approaches enable the identification of markers across the entire genome to get a complete picture of the population structure. The horse mackerel genome consists of 801 million base pairs. Only a small fraction of the genome has 'SNP's' that are variable. Over the entire genome a very tiny percentage provides informative information, so the only way to handle finding very small differences is through entire genome sequencing. All the informative markers are put into a 'SNP chip' to speed up the genotyping process, similar to what was done for

herring. A 'SNP chip' allows for the upscaling of analyses to screening thousands of samples in a very short time. The panel of markers was applied to a large panel of samples, where 2304 individuals were genotyped. The samples analysed were spawning baseline samples (so fish caught in spawning condition) from each potential population as well as potential mixed samples from 4a, 7d, 7e.

Farrell showed plots of ongoing analyses, clearly showing the distinction of NS samples from all others. The North African samples were also separate from all others. The samples from the Western and Southern samples, all juvenile fish, are more clustered indicating connectivity between the Western and Southern areas. Further ongoing analysis needs to be completed to come up with a definitive population structure between the Southern and Western stock.

Looking more closely at what southern samples contain: there is spread of samples and a temporal spread is shown as well. 2016 samples consisted mainly of juveniles. The length distribution in 2017 was very similar. The 2017 samples taken from northern Portuguese waters clustered with the Western baseline samples. Samples of stage 3 baseline samples were collected in 2019 in Portuguese waters and all aligned with Western baseline samples; so there is a definite structure and mixing ongoing between the Southern and Western areas. A lot more samples are needed to get a full picture of what is happening, and at this stage this cannot be taken any further. It is certain though that there are at least two populations in the Southern assessment area, which are unlikely to be contained within that area.

NS and Western populations can be split and after running the analysis it's possible to pick up which markers are driving the analysis, and how the assignment can be refined to improve the assignment model. The model gives a measure that has been developed against which samples can be tested, giving a measure of self-assignment success rate, which is greater than 90%. Refining this is currently being worked on.

To test the assignment model samples of known origin were assigned (known-unknown samples). Western known-unknown samples showed a perfect assignment, and known-unknown samples from the southern North Sea revealed some mixing that needs to be looked into further. But the assignment model is considered robust enough to move forward on an exploratory basis. Unknown samples from Norwegian waters, mainly bycatch, consisting of a mixture of maturity stages caught in all quarters, were assigned with the assignment model, and nearly all assigned perfectly to the Western stock. Therefore, the assumption fish in area 4a caught in Q1 and Q2 are considered NS horse mackerel is not supported by this data. Farrell underlined the relatively small number of samples, but based on this data the current assumption of stock delineation is incorrect.

7d samples were assigned and revealed a big mix of North Sea and Western fish. In some samples there was a dominance of NS fish but in others a dominance of western fish. The 7d area is clearly a mixing zone, to work out the levels of mixing a more sampling is needed to cover the entire year, in order to check for temporal differences. Survey and commercial catches in this area need to be genetically assigned. In the analysis of the 7e samples the majority assigned to the Western stock with a few indications of NS fish in there, the level of mixing is not yet fully understood but the tools are in place to analyse this further.

In summary, results show that Southern stock juvenile fish come from at least 2 populations: the Western population and a population with more Southern characteristics, for which there is no baseline yet. A new baseline is needed to better understand the split. There is a need for more baseline samples from Southern area from across entire spawning season. Survey and catch data needs to be analysed to inform sampling of 'mixed' aggregations.

It is very easy to distinguish the North Sea population from the Western population. The preliminary assignment model has over 90% self-assignment success rate and further refinement is currently ongoing.

Samples from 4a assign to Western regardless of quarter, and samples from 7d indicate a mix of Western and North Sea horse mackerel. A seasonal aspect may influence the mixing proportions. Samples from 7e are predominantly Western.

There is a need for additional baseline samples from North Sea in particular, and to develop a sampling plan in the commercial catches for areas 7d and 7e.

The Chair thanked Ed Farrell for this presentation which he remarked was 'quite technical' but nevertheless reveals a lot of interesting insights. In particular, the results of 4a and 7d samples were in his view examples of how genetics can be used to inform stock assessments in the future.

5. Identification of issues

The Chair provided a brief recap of the presentations on the different stocks held so far. For the NS stock, the assessment is quite uncertain. Ed Farrell has shown that the assumptions of horse mackerel in 4a were not justified based on the genetic data collected. There is a mix of Western and NS stock in are 7d. Therefore, the catches may in fact include a significant number of Western horse mackerel, and the SSB might be lower than currently estimated. The NS horse mackerel is a category 3 stock and the recent advice was for 8 969 tonnes in 2022 and 2023.

The Western stock is a category 1 stock but the retrospective performance appears to worsen, deteriorating the validity of the model. The stock is currently under a 0 TAC advice with biomass under the Blim threshold. The stock has been decreasing for a number of years and the PelAC has developed a recovery plan for this stock, which in any case would require an update based on the benchmark, but hopefully this would take place as soon as possible.

The PelAC already held a Focus Group meeting on the Southern stock end of 2021, where it decided to withhold any further recommendations on this stock until the benchmark for this stock takes place and clarity arises on the various data and assessment issues.

He gave the floor to Andrew Campbell to go over the issues in the assessment and the data for Western horse mackerel.

Western horse mackerel

Campbell recalled that he had already covered many details about data inputs that feed into the stock-synthesis model: catch data, egg survey, data from IBTS surveys and acoustics surveys. Benchmark protocols require a full review of the available data.

To give a full picture, the assessment working group had compiled the following list of issues regarding data to be addressed in a potential benchmark:

In terms of fishery dependent data (coming from the fishery), there are a number of issues and potential improvements to look at. Some issues are more 'procedural' in the sense that 'they make life difficult for the stock-assessor'. In these cases, it is not the data that needs fixing but a process that needs improving to make it less 'error-prone' for the assessor.

- He highlighted the length composition of national catches. These are currently being delivered to the stock coordinator in several different formats, which complicates the processing and compilation for use by stock assessment. Campbell said the data should be uploaded to the ICES InterCatch portal, a facility where data can be uploaded and centralised. The provision of this data needs tightening up.

- Another issue related to aging information. Some historic age samples are not uploaded to InterCatch, so they are not available for the stock coordinator and assessor, procedures for

this must be put in place. There are issues with Dutch sampling from freezer-trawlers that are not Dutch but UK flagged. The samples are assigned to flag-state and thus not picked up in the assessment, but this is incorrect. This was being worked on and should be added to the age base information for the benchmark. Then there is an issue with regard to aging error: any scientific process has some degree of uncertainty associated with it, but aging in horse mackerel in particular can be difficult to process. There is an error when aging data is being compiled. This was not the most pressing issue at this time, but worth mentioning nonetheless.

- The information on discards is incomplete, there are only estimates available on some fleets or some countries. The length compositions for several countries are available from 2018 (not included in previous benchmark) but is not being used in the current assessment. This should be high on the priority list for the benchmark. There is also the question of where genetic information can be assigned.

- Finally, it needs to be decided what to do with historic catch information, assignment protocols that are currently in place (e.g. 4a,7d,9a) and to what extent these can be overturned moving forward.

In terms of fishery independent information (survey data), the following issues were identified:

Egg surveys (MEGS)

- The mackerel and horse mackerel egg survey (MEGS) takes place every three years since 1992. This is a large expert group covering both the mackerel and horse mackerel species, but the primary focus in on mackerel. The past few years resulted in changes to the survey design: mackerel has been spawning earlier in the year so the timing of the survey has shifted in order to capture that. As a result of this, it needs to be considered how well the current survey design is capturing the spawning season for horse mackerel. In the earlier periods very little horse mackerel spawning is being picked up and it needs to be double checked if the full spawning is being captured properly, through a review of the historic coverage with respect to horse mackerel.

- The egg survey is currently being used to derive an index for stock productivity. The count of eggs requires a better understanding of fecundity sampling data in order to use the data to derive an index for SSB.

Acoustic surveys

- Currently, the only acoustic data being used in the assessment comes from the PELACUS survey which takes place in division 8c, which is a very small proportion of the overall distribution of the stock. Information from that survey is used to derive abundance and length composition estimates.

- Another spring/summer survey PELGAS run by the French in areas 8a b, and WESPAS in areas 6 and 7. This information is used to derive horse mackerel abundance-at-length and -age. The PELGAS survey needs to be revisited to get age-based or length-based information which is more representative of the geographic distribution.

- Autumn surveys need to be explored. This is potentially a rich source of information that should be examined and analysed.

Groundfish surveys

The groundfish surveys are currently used to derive a recruitment index but it does not cover area 8c. Further investigation should be done to extend the survey to include 8c. Resulting data should be made readily available from DATRAS.

Other models (such as VAST models) could be looked at to establish spatial correlations.

Stock/species data

- Recent stock-ID genetic studies need to be reviewed to establish a firmer base on the stock distribution.

- The current assumption with regard to natural mortality is that it is age/time invariant. Alternatives to this assumption could be considered.

- Growth model can be further examined

- The fecundity parameters need revisiting: sampling programmes are currently ongoing at the PFA, and MEGS is looking into recent new scientific findings as regards fecundity. This is something the benchmark should take stock of and take into consideration.

In terms of issues regarding the assessment method for Western horse mackerel, the following points were identified by the expert working group:

- The SS model is very flexible, but it can quickly get complicated making it increasingly difficult to track what is going on. The model was first implemented in 2017 and is well due for another examination, with a view to the poor fit of commercial catches. The model is currently based on a single fleet, area and sex model with mixed length/ages. The expansion to additional fleets and the incorporation of fishery independent information needs to be looked at. It is unclear how the model uses mixed length/age-based information, it depends on the type of information available. The aging information from recent years is quite good, but certainly requires examination.

- Finally, the poor retrospective patterns, the deterioration in fit of the assessment to the data in most recent years and the fact that the assessment doesn't utilise the most recent information are a strong cause for review.

Andrew Campbell proposed the following action plan as suggested by the expert working group to address the issues related to horse mackerel in preparation of the benchmark:

- To investigate data compilation/configuration (i.e. explore use of multiple fleets/areas; expand to ICES division 8; separate age/length composition)
- To include all available age information (Dutch samples from foreign vessels)
- To include discard length composition information (from 2018 onwards)
- To establish a data re-weighting procedure (SS option)
- To investigate the inclusion/estimation of fecundity parameters

- To investigate alternative natural mortality assumptions (e.g. age dependent)
- To implement in most recent version of Stock Synthesis (provides additional features)
- To implement STF within SS (currently FLR)
- To explore alternative assessment models (e.g. SAM)
- the reference points require revision

Niels Hintzen queried to what extent working group members had been assigned to tackle these different points.

Campbell replied that for the time being nobody had been assigned to these different tasks. He regretted that the relevant stock assessor was based in the UK and as such, could not take part in this forum.

Hintzen underlined the importance of assigning people to carry out the work and argued this needed to be pushed forward in the ICES community. Campbell added that the timing of the benchmark would be an important driver for this, as institutes need to take this work into account in their annual planning.

Claus Reedtz-Sparrevohn wondered whether any of the category 3/data-limited approaches had been considered for Western horse mackerel as a potential outcome of the benchmark? Could it be a possible outcome that due to the large retrospective bias a full analytical assessment is no longer possible? He asked Campbell for his opinion on the usefulness of a category 3 assessment.

Campbell replied that it could be a potential outcome of the benchmark given what is known about how the assessment performs, but he hadn't examined this possibility closely. It all comes down to the question of resources, and how much can be achieved through this exercise. In large part that will drive the potential for improvement, and if that's not possible it could naturally be possible to consider lower categories, but he had not looked at this.

Ilaria Vielmini thanked the scientists for this comprehensive overview. She provided a brief update from DG MARE, and explained that in the written records between UK and EU from 2023, both parties had agreed and committed to ask ICES for an inter-benchmark for Western horse mackerel to take place in 2023. The matter was being addressed by the EU and the UK under the framework of the SCF. A first draft TOR for ICES has been shared in the 4th Working Group meeting which took place on 8 March. The draft is still under discussion and needs to be finalised asap for submission to ICES as a joint EU-UK request. She underlined that it would be very helpful to receive input from this Focus Group meeting so that it can be tabled for discussion with the UK and the SCF before the TOR is finalised.

The Chair thanked Vielmini for this update. He noted the question raised by Hintzen was essential to determine a timeframe for the work as outlined in the action plan. This needed to be addressed urgently in order to ensure the Commission has all the necessary information for its ongoing discussions with the UK.

Sean O'Donoghue agreed it was important to get clarity in terms of who is assigned to deliver on the different points presented by Campbell. Separately, he wasn't surprised that huge difficulties were being experienced with the Western horse mackerel assessment. The assessment is currently not taking into account stock-ID genetics information, and he would be surprised if this wouldn't have an important bearing on the assessment. To him, one thing became clear from the presentations: genetic information needs to be taken onboard and dealing with the three stocks in isolation 'would be a major mistake'. A joint benchmark for the three stocks is essential. He asked Campbell whether there were any other models that would be worth exploring.

Niels Hintzen favoured taking a 'pragmatic approach', and to use the assessment model that works best. The stock-synthesis model was complex and all the different settings may not be fully

understood, but it comes down to making assumptions in the assessment model. In his view both the SS and the SAM models were equally viable options. The SS model was a category 2 assessment, so choosing that model would mean downgrading the assessment. But finding the time to appropriately set up the model will be the time-limiting factor, and it may not lead to the desired outcome.

Andrew Campbell fully concurred with the remarks made by Hintzen, it all comes down to resources. Running models is a time-consuming process and takes a lot of effort. With an SS, SAM or SpiCT model, it's the setup that is key, with the right configuration and assumptions. Resources are needed to do this properly. It is important to know who will do the job, before going into anything else. He stressed this needed to be a joint effort, and the scientists present today can all contribute but more people are needed to do the job.

With regard to constraints on resources and availability, Ed Farrell shared that he had encountered similar issues in his genetics work, where capacity at the institutes was lacking to take on the work. Ultimately, a relationship was developed with commercial providers that were outsourced to get some of the work done. He wondered whether any kind of system could be thought of where part of the model development work could be contracted out on a commercial basis. He asked if this was something ICES could accept.

Campbell replied this would be 'unusual, but not unheard of'. It's the timescale around that work that puts a strain on the process, and the time to review it.

Ed Farrell added a point that might be worth considering: at a benchmark some areas may be addressed and stock-ID may be a longer process. Developing a long-term plan around improvement of the assessment. It is surprising that in the 40-year history of dealing with this fishery, there still isn't a good index for horse mackerel. It could be worthwhile to start from scratch to deal with what is available and develop a long-term plan for improvement.

Campbell was in favour of longer-term strategic approaches, and putting the research in place to support this.

The Chair concluded that from a Focus Group point of view, it is important to focus on the short-term strategy first to prepare for the 2023 benchmark. He hoped this would align as much as possible with what we would like to see as a long-term strategy.

He invited Gersom Costas to present the issues around the Southern horse mackerel data and assessment.

Southern horse mackerel

Gersom Costas reiterated that the high confidence intervals for the Southern horse mackerel SSB, fishing mortality and recruitment lead to the high uncertainty in the stock status.

He highlighted possible reasons for this included:

- Changes in the relative contribution to the catch from bottom trawl and purse-seine fleets have led to changes in the age composition of catches. The current assessment model does not appear to be sensitive enough to the changing pattern of selectivity that have occurred in recent years.

- The current survey tuning index is noisy and could not be estimated for 2012, 2019 and 2020.

Regarding the assessment model, the challenge is to try to implement the new selectivity option in the model to allow more time varying aspects in the fishery pattern. But because the model is tailored, it means we are dependent on the person who developed it. This person has been contacted but there hasn't been enough time to address the varying aspects in fishing patterns.

One suggestion would be to explore a different model with more flexibility. The opposite is true then Western horse mackerel: where the SS model used is quite flexible, the AMISH model used in the Southern stock is not sensitive enough to account for time varying aspects in the pattern of selectivity.

The last benchmark in 2019 tried to look at improving the tuning index, but this wasn't successful. A new benchmark would need to improve the current IBTS survey index and explore additional indices such as the horse mackerel egg survey index (DEPM), and the fleet CPUE indices. The problem with the egg survey index are the fecundity parameters. Last year it was difficult to collect spawning female samples of the Western stock. More support was offered by sample collection from the PFA, but the collection of spawning females was still a problem. The fecundity parameters need improvement to derive an SSB index. The use of fleet CPUE indices was a work in progress in the Portuguese fleet. If another additional index is obtained, it needs to be forwarded to the person that made the model in order to include the index as data input.

Luis Vicente wondered if there was a problem with the model that required changes. Even with the uncertainty, the biomass level is still growing suggesting that the model was working. 'Obviously there is always a need for more certainty' but he felt that in general the model was providing management solutions leading to positive results. He asked if there was a real need to adapt the model significantly.

Gersom Costas replied that the current survey index was quite noisy. As more indices are added, it depends on their weighting whether or how the output of the model improves. The IBTS survey did not take place in 2019 and 2020 so there was no survey index or those years. This year it could be seen that the 2019-2020 recruitment further increased the uncertainty. The plots and the advice sheet show that the assessment is becoming increasingly uncertain. Recruitment has a large confidence interval, which can further increase the uncertainty in other stock parameters such as SSB or fishing mortality.

Farrell asked what was limiting the Southern horse mackerel catches from an industry point of view. He noted catches had been decreasing since 2016, while the advice was 'through the roof'. He asked if there was no desire to catch more, or simply no ability to catch more? If not, this could potentially indicate the model is not fully working.

Costas replied that in the last year there was a decrease in catches by purse seiners, horse mackerel was not available for purse seiners. A regulation between Portuguese stakeholders for the Portuguese fleet also have had an influence on this. The Spanish industry had relayed to Costas that they hadn't found a lot of horse mackerel, but it should be noted the Spanish fleet only fishes in the North representing on 25% of the Coast.

As regards the Portuguese fleet and the purse seiners, Luis Vicente added this was very much dependent on the year and the variations had very little to do with eh stock status. Some years when sardine catches are low, purse seiners would catch more horse mackerel. From a trawler point of view, his members indicate they do not experience a difficulty to catch horse mackerel but if other species with a higher commercial value (such as squid) are more abundant, the catches are shifted to that species. This immediately impacts the horse mackerel catches because the fleet is not large. The same was true for purse seiners. In years with more anchovy, effort is moved away from horse mackerel. Therefore, in his view, the lack of catches was due to the availability of 'better choices' rather than the ability of finding the stock.

Sean O'Donoghue came back to the general question: it is important that all three stocks are assessed together. He asked the scientists to clarify whether they were looking at combining the stocks together or looking at them separately. There seemed to be a difference between WGHANSA and WGWIDE in their approaches for considering the issues in the assessment. He asked the scientists for their views on benchmarking the three stocks together.

The Chair agreed this was the crux of the matter and asked if it was possible to combine the stocks.

As far as Campbell was aware, at present the Benchmark Oversight Group (BOG) was proposing a benchmark meeting that would cover all three stocks, but the timing for it was 'later than you would like'. Niels Hintzen, as a former member of the BOG until recently, confirmed the BOG was proposing a benchmark covering all three stocks which would take place early 2024. A data compilation meeting was planned to take place end of 2023.

The Chair thanked Hintzen and Campbell for sharing these insights.

Maria José Rico, Chair of the Pelagic Working Group of the SWWAC, said the presentations had been very detailed and scientific, and while not a scientist herself, she thought she was able to follow most of them. Her take on the discussions so far was that regardless of the assessment, it seemed to go 'hand in hand with uncertainty'. On behalf of the sector of fishermen affected, any correct management model or system would require solid scientific evaluations, but the information is limited. Between the SWWAC and the PelAC, the sectors are different. In areas 8c and 9, the Spanish fleet is not only composed of trawlers but also small-scale purse seiners, as well as artisanal fishing vessels. Last year, a joint discussion on horse mackerel took place as well. While there was a lot of uncertainty, it was important to have solid information and to bear in mind the differences between the different fleet that target the species. It all comes down to getting better data.

Ed Farrell added a final point in relation to the upcoming benchmark, where likely there would be a focus on configuration of the existing models and the delineation of stock boundaries had a long way to go yet. But as a first step, he suggested to compile the data from all the stocks together to try and get a full picture of the biology of this species first, before going any further. Length, age, and maturity data needs to be analysed, at a fine temporal and spatial scale, across the entire distribution area together, in order to understand the biology as a first step.

The Chair fully concurred with Farrell's proposal, putting all the existing information together could be good starting point for the direction of this discussion.

6. Listing of action items

The Chair showed a slide with suggestions submitted by Farrell on how to move forward, which were:

- Compile data across the three stocks together

- Do not split by stock or ICES Division

- Need clear picture of biology without 'stock' bias

With regard to catch + IBTS + acoustic surveys, create an overview of:

- Catch sampling

- Distribution by month and by rectangle across 3 stock areas

- Length, age and maturity by month and rectangle

With regard to the egg surveys, suggestions are to:

- Compare spatial coverage with maturity data from above

- Identify the gaps

- Determine if MEGS is a valid index

As a primary action item of this Focus Group meeting, the Chair proposed that the Secretariat would develop a detailed meeting report covering the different elements presented today, and that also includes the different suggestions for next steps ahead of the upcoming benchmark.

This report can serve as recommendation for the Commission to further their discussion with the UK and ICES on the TOR for the benchmark meeting. He proposed to have a draft report ready by the PelAC April meeting for approval.

Andrew Campbell remarked it would be very challenging and ambitious to gather all the information to create the overviews proposed by Farrell in this timeframe. Compiling distributions by month and rectangles requires asking for this information to each data submitter. The ability to do so also depends on the country. Compiling the data to this level would be a very big exercise.

Niels Hintzen agreed with Campbell on the workload involved. It would heavily depend on the response by the different MS on the data call. A middle ground could be length data by month and rectangle. Collecting working data should give enough to split the units. This could be a way to achieve the results quicker.

Another suggestion for a recommendation was made, which was to recommend the set up a stock-ID task force within ICES to ensure the genetic information gets through the system. O'Donoghue recalled that the PelAC has been at the forefront of genetics for many years and needs to underline the urgency of taking this information onboard, as well as underlining the importance of dealing with the three stocks in one benchmark.

It was agreed to prepare a detailed meeting report and to list the different suggestions to the PelAC WGII meeting on 19 April (**action 2**).

7. Any Other Business

The discussion on the implementation of the horse mackerel bycatch quota was moved to the upcoming PelAC Working Group II meeting planned for the 19 April, due to time constraints.

The Chairman closed the meeting at 13:20 and thanked the scientists and participants for their contributions.

8. Action items

Action No.	Action	Responsible party
1	Circulate published paper on horse mackerel genome sequencing once published	Ed Farrell; Secretariat
2	Prepare detailed meeting report (which include suggestions for follow-up work as well as a recommendation for the setup of an ICES taskforce on genetic stock-ID work and to ensure a benchmark deals with all the three horse mackerel stocks combined), and present suggestions for next steps at PelAC April meeting.	Secretariat, Chair

9. Meeting participants

Name	Organisation
Jerome Jourdain (Chair)	UAPF
Anne-Marie Kats	PelAC
Sean O'Donoghue	Killybegs Fishermen Organisation
Ed Farrell	Killybegs Fishermen Organisation
Niels Hintzen	Pelagic Freezer-Trawler Association
Tim Heddema	Pelagic Freezer-Trawler Association
José Beltran	Organization of Fishery Producers of the port of Burela - Lugo (OPP-7 BURELA)
Maria Jose Rico Fernandez	CCSUD
Luis Vicente	ADAPI
Catarina Abril	Sciaena
Ilaria Vielmini	DG MARE
Chloé Pocheau	CCSUD
Andrew Campbell	Marine Institute
Claus Reedtz-Sparrevohn	Danish Pelagic Producers Organisation
Gersom Costas	Centro Oceanográfico de Vigo, Instituto Español de Oceanografía