Annex 7: Special Request - Evaluation of a sentinel TAC for Celtic Sea Herring

This annex was added to the report in October 2019.

Evaluation report of the proposal for a monitoring TAC for the Celtic Sea Herring

Background

The 2019 assessment of Celtic Sea herring estimated that the stock has decreased significantly since 2011 and has been below B_{lim} since 2017 (ICES, 2019). ICES advised that there should be no catch on this stock in 2020. Given this context, ICES is requested to

→ provide advice on the minimum level of catches (tonnage) required in a sentinel TAC, which would provide sufficient data for ICES in order to continue providing scientific advice on the state of this stock.

Ireland is the main participant in the Celtic Sea herring fishery and has 86% of the TAC. The Irish Celtic Sea herring fleet is composed of two components; The "Sentinel fleet" defined as the fleet of vessels <17 m LOA that operate in ICES Division 7.aS and receives an allocation of the Irish quota. In this document "sentinel TAC" was replaced by "monitoring TAC" to avoid any confusion with the Irish sentinel fleet.

Methodology

The procedure adopted aims to determine the number of individual samples required to meet an acceptable level of precision within the resulting catch-at-age matrix (Campbell, 2016). To determine an appropriate level of precision Irish sampling data from 2013–2017 was examined. Ireland is the only country sampling Celtic Sea herring.

Sampling precision was calculated using a bootstrap technique:

1. Set N = total number of available age samples
2. Randomly sample with replacement the complete dataset. Quality is considered equivalent across samples and equivalent weight is attributed to all the samples
3. An ALK is constructed using the age data from the bootstrapped samples,
4. Numbers–at–age are generated by passing the whole dataset through the ALK
5. Steps 2–4 are repeated 1000 times
6. Calculate a weighted CV from the 1000 iterations
7. Set N = N-1 and repeat steps 2–6, continuing until N = 2

As background, the DCF reporting structure defines the level of precision for ageing as follows

Level	CV (%)
0	20+
1	12.5-20
2	2.5-12.5
3	0-2.5

A precision level of 2 is the target for group 1 and group 2 species for landings data, from a stock such as Celtic Sea herring (Commission Decision 2010/93/EU).

Data

Length frequency data from Irish port sampling is plotted in Figure 1. In 2013 smaller fish were sampled in 7.g but a similar mode can be seen in both areas. Lengths sampled were similar in both areas in 2015 and 2016. In 2014, two modes can be seen in 7.aS from the sentinel fleet that did not appear in the main fleet. In 2017, two clear modes are evident in the main fleet operating in 7.g. This is less defined in 7.aS.

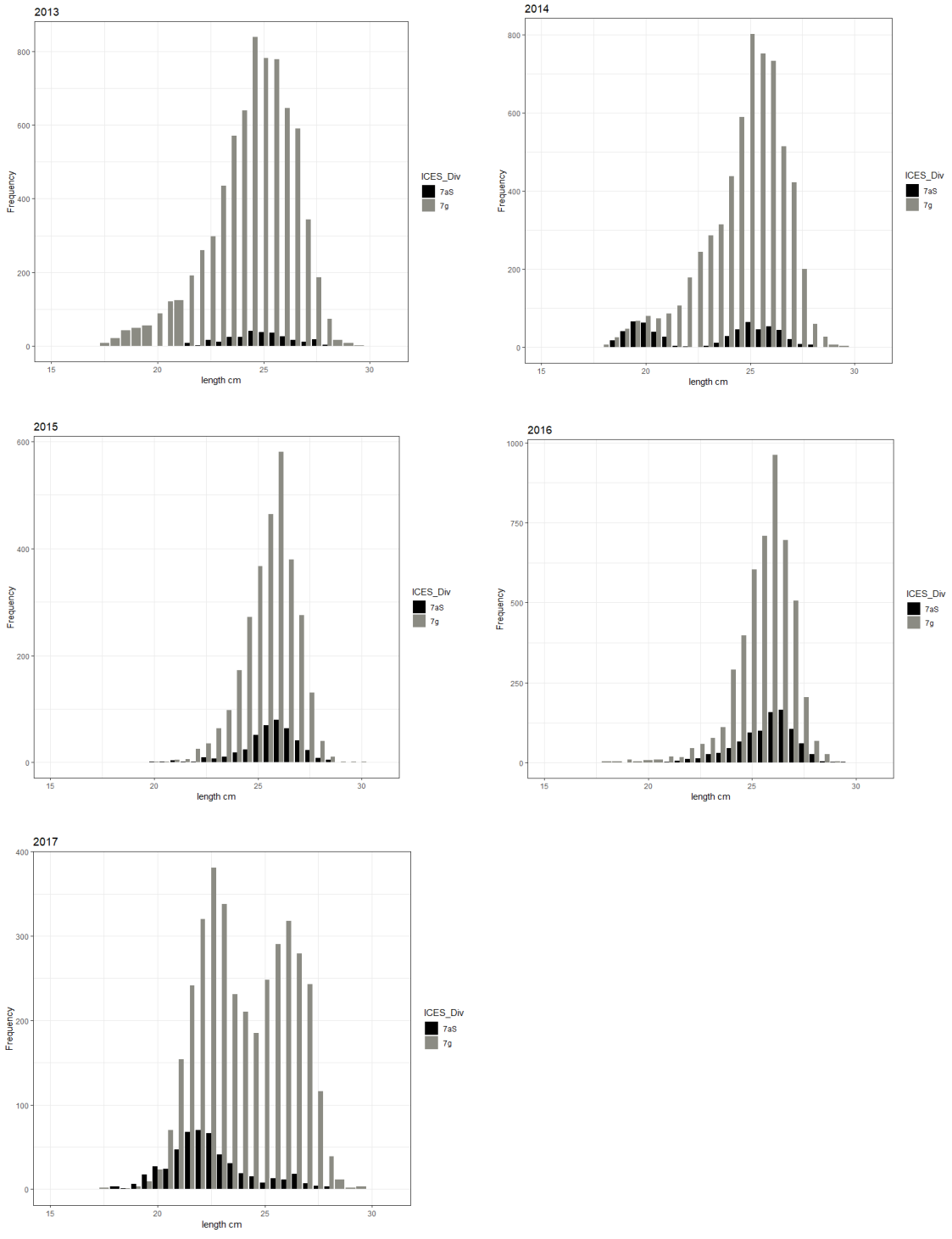

Figure 1: Length frequency of samples collected from landings of the main fleet 7.g (grey) and the sentinel fleet 7.aS (black) 2013–2017.

Results

Sampling precision

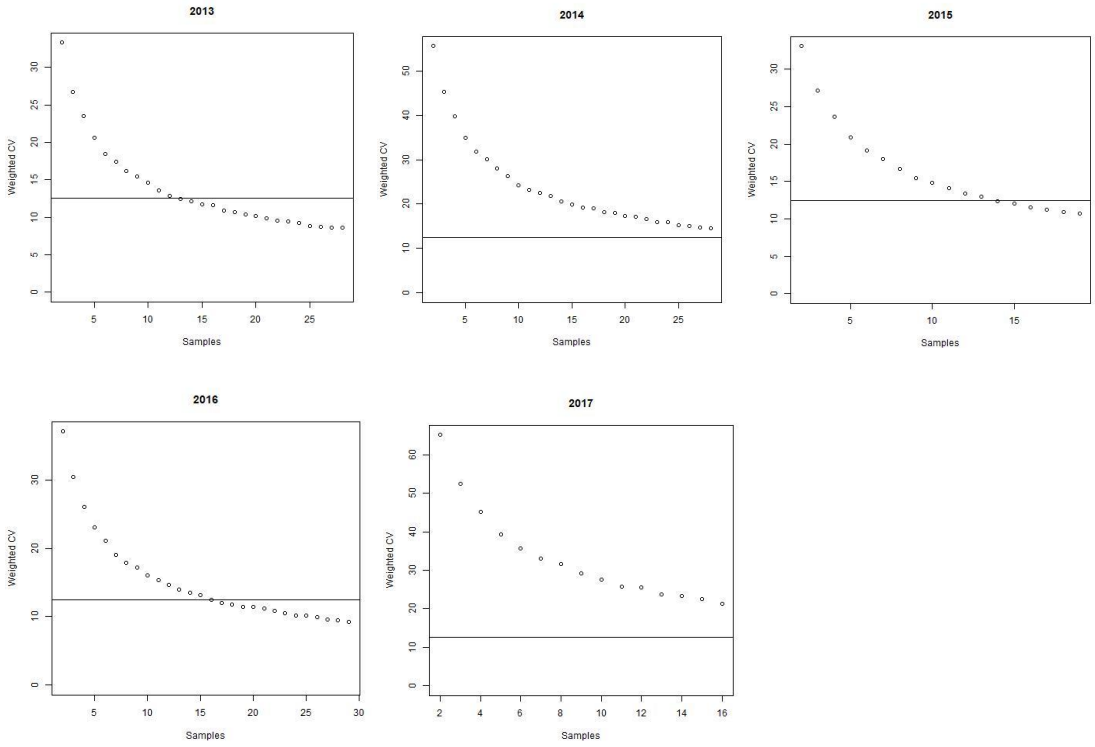

Figure 2: Weighted CV vs number of samples collected per year from 2013 to 2017

The number of samples required to reach a sampling precision <12.5% ranged from 14 to 17 samples in 2013, 2015 and 2016. The threshold was not reached for samples collected in 2014 and 2017 although 28 and 16 samples were aged respectively (Table 1).

Table 1: Number of samples collected per year and number of samples required to reach a sampling precision <12.5%

Year	N samples	N of samples required
2013	28	14
2014	28	NA
2015	19	15
2016	29	17
2017	16	NA

Estimation of the Monitoring TAC

To estimate the level of catches which would provide a sufficient number of samples, the average haul size from each fleet, provided by the Irish Industry (Celtic Sea Herring Management Advisory committee) was used.

- Main fleet: Average size of a haul is 65 t.
- Sentinel fleet: Average size of a haul is 6 t.

An analysis of the 2013–2017 Irish sampling data was conducted. 2016 was chosen as the reference year because the fishery was not constrained by quota, the age structure included both strong and weak year classes, and there was good distribution of samples in both 7.aS and 7.g. The analysis was confined to quarter 4 because it is indicative of the winter fishery for which monitoring is required. In total, 29 samples were taken in 7.g and 7.aS combined, with an average of 186 fish measured and 50 fish aged per sample.

Based on sampling data in 2016, it is possible to attain a precision of 12.5% with 17 samples. The highest level of sampling should be in the main fishery (13 samples) where the majority of the quota is. The sentinel fishery should provide 4 samples. These proportions are based on the sampling levels that have been attained from this fishery in the past.

Table 2: Sampling of the main fishery

Basis	CV%	No of samples	Catch assuming 65 t hauls
DCF Level 2	2.5–12.5	13	845 t

Table 3: Sampling of the sentinel fishery

Basis	CV%	No of samples	Catch assuming 6 t hauls
DCF Level 2	2.5–12.5	4	24 t

Total proposed monitoring TAC = 869 t

The Celtic Sea Herring TAC is shared between Germany, France, UK, the Netherlands and Ireland (Council Regulation (EU) 2019/124). The percentages are given in Table 4 with the greatest proportion of the TAC allocated to Ireland.

Table 4: Percentage of Celtic Sea Herring TAC by country and the proposed monitoring TAC.

Country	Percentage	TAC (t)
Germany	1.1%	10
France	6.2%	54
UK	0.1%	1
Ireland	86.4%	751
Netherlands	6.2%	54
Total		869

Evaluation of the impact of the proposed monitoring TAC on the recovery of the stock

To evaluate the impact of the monitoring TAC on the recovery of the stock, a shortcut Management Strategy Evaluation was run using SimpSim which is a version of EqSim, the ICES software to calculate reference points that works at non–equilibrium. SimpSim was used in the evaluation of the blue whiting management strategies (ICES, 2016).

Operating Model (OM)

The Operating Model (OM) was based on the 2019 assessment (ICES, 2019). The stock–recruitment relationship is a segmented regression model with a breakpoint at B_{lim} (34 000 t). The 2019 catch was assumed to be 5320 t which is the same figure used by HAWG for the short term forecast (see Section 6 of this report).

Implementation Model

Three scenarios were considered in the implementation model.

1. No Catch.
2. The proposed monitoring TAC (869 t).
3. The Irish proportion of the proposed monitoring TAC (751 t).

Performance statistics

The second and third scenarios described above were compared to the zero catch scenario to highlight the impact of the proposed monitoring TAC on the recovery of the stock. The year of recovery was defined as the year when the risk to B_{lim} falls below 5%. For each scenario, the realised F, the year of recovery and the risk to B_{lim} in 2023 and 2024 were tabulated (Table 5).

Table 5: Performance statistics (range of F over the years 2021–2026 derived from the Management Strategy Evaluation simulating 3 scenarios, i.e. no catch, proposed monitoring TAC fully caught, Irish portion of the proposed monitoring TAC only.

Scenario	Range of Realised F	Recovery Year	Risk to B_{lim} in 2023	Risk to B_{lim} in 2024
No catch	0	2023	3.5%	1.2%
Total TAC = 869 t	0.04–0.01	2024	5.1%	2.8%
Irish quota = 751 t	0.03–0.01	2023	4.7%	2.6%

Conclusions

Based on sampling data in 2016, it is possible to attain a precision level of 12.5% in the Celtic Sea herring fishery with approximately 17 samples and these could be obtained with a monitoring TAC of 869 t.

The length composition of catches from the main fleet and the sentinel fleet exhibited differences in some years. It is recommended to keep sampling both fleets to ensure any differences in length compositions are monitored.

The simulations show that with no fishing in 2020 recovery is expected in 2023. The proposed monitoring TAC of 869 t will delay this recovery by one year until 2024. If only the Irish portion of the TAC (751 t) is taken the recovery year remains at 2023.

References

Campbell, A. 2016. Sampling Precision in the 6.a, 7.b, and 7.c Herring Fishery. ICES CM 2016/ACOM:51. 16 pp.

ICES. 2016. Report of the Workshop on Blue Whiting (Micromesistius poutassou) Long Term Management Strategy Evaluation (WKBWMS), 30 August 2016, ICES HQ, Copenhagen, Denmark. ICES CM 2016/ACOM:53. 104 pp.

Review on the Evaluation report of the proposal for monitoring TAC for the Celtic Sea Herring.

Reviewer 1

ICES is requested advice on the minimum level of catches (tonnage) required in a sentinel TAC, which would provide sufficient data for ICES in order to continue providing scientific advice on the state of the stock. The expert report proposes a monitoring TAC of 869 t (845 t from the main fishery and 24 t from the sentinel fishery) based on sampling precision of <12.5% and 2016 as reference year as the basis of the calculations.

The analysis conducted is appropriate for determining the number of samples required to reach a sampling precision of <12.5% (following also Campbell, 2016). This level of precision for ageing is taken from the Commission Decision 2010/93/EU section B.B 2.4. Please see the document for comments in the text.

The major concern for this stock, as I see it, is to keep the mortality of the stock at a minimum level. The proposed monitoring TAC of 869 t will delay this recovery of the stock by one year until 2024 according to the shortcut Management Strategy evaluation that was run. So the proposed numbers for the sampling do not seem to be the best option. Instead of catching this much, would it not be a possibility to use the fishery independent acoustic samples?

Response: The short–cut MSE was run with 3 different scenarios, (i) no catch, (ii) full uptake of the monitoring TAC, (iii) only the Irish quota. In case (ii) the risk to B_{lim} in 2023 is 5.1% and falls to 2.8% in 2024. The risk in 2023 is only marginally higher than 5%. As other countries have quota but do not have a targeted fishery on this stock, their quota might not be fished. In this case, the risk to B_{lim} would fall below 5% in 2023 and the recovery year would be the same as in the no catch scenario. With the proposed monitoring TAC of 869 t (80% lower than the lowest TAC for that stock), the fishing mortality would be 0.04 in 2020 (30% lower than the lowest fishing mortality in the time series).

Below, I list some of the issues that I think needs more clarification and thorough elaboration from the experts:

1. Using the Acoustic survey - There is a fishery independent acoustic survey that is also used in the assessment in years 2002–2018 (excluding years 2004 and 2017). Is it not possible to use the acoustic survey results to assess the state of the stock by using the existing correlation between the acoustic survey results and the correlated SSB found in the assessment? If possible, it would be enough in the rebuilding phase of the stock to only perform the acoustic survey and from that draw inferences about the SSB development. I would like the experts to elaborate if this is feasible or not.
2. In addition, the acoustic survey provides data on the size and length distribution of the fish. For instance, the acoustic survey in 2018 October provided 9788 t and 213 491 individuals which were provided from 15 trawl hauls. 529 herring were aged and 1668 length measured and 807 length-weights recorded. Can the experts give reasons why the age/length information obtained from the acoustic survey is not sufficient to obtain the required information on the state of the stock?

Response: (1) and (2): The Celtic Sea Herring assessment is a full analytical category 1 assessment. Two data series are used in the age–disaggregated model, the catch–at–age matrix (fishery dependent) and the survey index (fishery independent) to tune the model. Using only the survey data in the assessment will increase the uncertainty on the SSB estimation. The survey is carried out over a three week period in October. The survey follows a parallel transect design standard across all acoustic surveys and in a pre-defined survey area for this stock. Sampling levels vary

on the acoustic survey and rely on the survey encountering herring marks along the survey track. When the stock is low estimates from acoustic surveys in general are uncertain. For instance, in 2018 the CV for the survey was 50% and could not be calculated on the 2017 survey due to the fact that only one biological sample was collected. The survey does not guarantee adequate biological or acoustic sampling at low stock sizes. Sufficient information on age structure may not be available to the assessment if the acoustic survey is the only data source. The monitoring fishery would cover a period 6 weeks and would provide a better sampling coverage of the fishing grounds.

3. When the estimation for the monitoring TAC is made the experts indicate that the average haul size is 65 t for the main fleet. Is it possible to shorten the trawl time of the hauls thereby reducing the tonnage obtained in the catch? Can the experts show evidence why a reduced haul time/size is not sufficient to meet the requirements of precision for a representative age/length distribution.

Response (3): Herring is a pelagic schooling fish. Fish density in aggregations could be high. As opposed to demersal fishing, reducing the time of trawling does not necessarily reduce the catch. We are reducing the risk of not collecting enough samples by using average haul sizes provided by fishermen (65 t in the main fleet). The monitoring TAC would help to maintain a commercial catch–at–age matrix consistent with fleet behaviour in years when commercial TAC is available.

4. It looks as the sentinel fleet is catching the same size distribution as the main fleet, why not only use the data from the sentinel fleet? Can the experts provide arguments for not using only the sentinel fleet?

Response (4): In the CSH fishery, the sentinel fleet (vessels <17 m LOA) is confined to 7.aS and fishes primarily inshore in two ICES rectangles. The main fleet (larger vessels) fishes primarily in 7.g and cover a much larger area than the sentinel fleet. In Figure 1 of the report, length frequencies from 2013 to 2017 are presented. In 2013, 2014 and 2017, differences in catch composition appear. The 7.g component of the stock would not be sampled if only the sentinel fleet participates the fishery.

5. Are all the hauls going to be sampled or what is meaning of "the sampling level of 2016"? For example, is it every third haul or every third trip etc.? Maybe it is possible to reduce the total catch by increasing the intensity of the sampling. Can the experts elaborate on this?

Response (5): In this fishery, like in the 6.a, 7.b–c herring fishery, vessels that prosecute the fishery will be requested to take a 25 kg sample of unsorted catch at every haul directly from the net and arrange to deliver the samples to the Marine Institute. Upon availability, the vessel will be requested to carry an observer on board who will take and process the sample.

Reviewer 2

This is a review of the report supporting the ICES response for a special request from the European Commission asking for advice on the minimum level of catches (tonnage) required in a monitoring TAC, which would provide sufficient data for ICES in order to continue providing scientific advice on the state of Herring in Division 7.a South of 52°30'N, 7.g-h and 7.j-k.

The ICES response to this request provides a monitoring TAC, defined as the product of the number of samples that allows achieving a sampling precision <12.5% and the average haul tonnage. It also provides a short-cut MSE to evaluate the impact of the proposed monitoring TAC on the recovery of the stock compared to a zero catch situation.

Reviewer's Comments

The methodology conducted by Gras and Egan is appropriate to answer this request. They followed the approach described in Campbell (2016) to calculate sampling precision and monitoring TAC, and then an MSE was implemented. However, for the first part, the methodology differs in a technical issue that is of particular significance, and it is about the choice of the year selected as a baseline for the analysis.

While in Campbell (2016), the analysis just starts defining the baseline year, in the evaluation report, the analysis starts calculating the sampling precision for the yearly data available from 2013 to 2017, and after that, 2016 is decided as the baseline year. This sampling precision analysis developed for some years in the report provides important information related to other years different to 2016 and it is never used again in the posterior results.

This additional analysis shows that for the year 2014 there was almost the same number of samples as for the year 2016 but the desired sampling precision was not achieved. This also indicates that the sampling precision not only depends on the number of samples available. Thus, it is necessary to understand what the particular circumstances are that prevent the desired precision level from being obtained when there is a high number of samples available. This understanding should determine also additional constraints on the recommended monitoring TAC. In case it is not possible to diagnose the reasons for not achieving the sampling precision with almost the same aged samples available, I suggest to calculate the number of samples required for all the years analysed, even if that number is higher than the samples available, then, choose the two highest numbers of samples required to calculate the monitoring TAC and decide among them using the MSE short-cut approach.

In summary, the report should take into account the possibility of a monitoring TAC providing 17 samples but with similar sampling properties as the one in 2014.

On the other hand, it is assumed that it is necessary to have enough samples with a <12.5% sampling precision level to provide scientific advice using an analytical assessment but that was not the case in years 2014 and 2017. Therefore, it would be helpful in terms of consistency if ICES could suggest to the HAWG to check the precision level of aged samples before the assessment and to analyse the consequences on the advice of not having the required precision level.

Some minor issues are also included as comments in the main document.

Response of the authors

The year 2016 was chosen using the same criteria as Campbell (2016), i.e. the catch was not limited by the quota. For transparency purposes, other years were also presented.

The difference in 2014 is the appearance of a cohort <20 cm that was not observed in 2013, 2015 and 2016 in catch samples. That small cohort in 2014 might be at the origin of a higher value in precision level. In 2014, although the number of samples went up to 28, the threshold of 12.5% was not reached. When two distinct modes are present in the length frequency data, a very high

level of sampling would be required to reach the sampling precision level of 12.5%. Increasing the number of samples to ensure the precision threshold is reached in any circumstances would imply increasing the level of catches and delay further the recovery of the stock. Collecting 17 samples would ensure that the precision level of 12.5% would be reached in non-exceptional circumstances and would ensure a low impact on the recovery of the stock as shown in the MSE.