5.4.3 EU request for advice on a scientific monitoring fishery for herring in ICES divisions 6.a, 7.b, and 7.c

Advice summary

ICES advises that the relevant time frame for fisheries-dependent data collection is August and September in Division 6.a North, late November to mid-January in Division 6.a South, and November in divisions 7.b and 7.c. The appropriate geographic scope of data collection is the active general spawning and pre-spawning areas.

ICES advises that the number of samples to be collected in a monitoring fishery is 46 and that these samples could be obtained through a catch of 4840 tonnes. Under a no-catch scenario, the stock will decline 14%, and it will decline a further 2% via the catches from the monitoring fishery. The catches in the monitoring fishery would be associated with a very low F (approximately 0.02), which is lower than any previously observed value (0.063 in 2005). The proposed monitoring fishery would result in coverage from a range of areas and provide appropriate sampling precision from as wide a set of age classes as possible.

A specific sampling programme is needed to ensure that samples of the appropriate number and geographic/temporal distribution will be collected from this proposed monitoring fishery catch. In addition, given that the estimate of the advised catch for the monitoring fishery is based on average catch per haul (80 tonnes per haul in divisions 6.a South, 7.b, and 7.c and 120 tonnes per haul in division 6.a North), the quota allocation scheme may need to be adjusted to ensure that the number of samples can be collected without exceeding this catch.

Request

As a result of the revised 2015 Benchmark for herring in VIa and VIIb,c, ICES now gives one advice (zero TAC) for the combined area VIa(N) VIa(S), and VIIb,c. ICES still considers two separate stocks exist, but it is not currently possible to segregate them in commercial catches or surveys. ICES advises that a rebuilding plan be developed for these stocks. The ICES HAWG also stated in its March 2015 report that here is a clear need to determine the relative stock sizes.

In its autumn 2015 plenary report, STECF noted that from a stock assessment perspective, it would be beneficial to allow small catches to maintain an uninterrupted time series of fishery-dependent catch data from the stocks in both management areas. The Commission may consider proposing a TAC of sufficient size to enable such ongoing collection of fisheries dependent data, but would like to do this at a level which minimises the impact on the stock. The Commission acknowledges that a small commercial fishery on each of the separate stocks (two separate TACs remain in the Regulation) could facilitate further scientific research, especially to help determine the identity and structure of the two stocks, which is also important to facilitate the development of a rebuilding plan. It is important that such fisheries do not endanger the recovery of the stocks, and that data from such fisheries contribute to the scientific work needed.

ICES is requested to advice on the following points, taking into account and further clarifying the STECF advice (https://stecf.jrc.ec.europa.eu/documents/43805/1281129/2015-11_STECF+PLEN+15-03_JRC98672.pdf) where possible:

- *the relevant timeframe for each stock and its fishery*
- *the approximate geographical area where each fishery should take place*
- *a level of catches that would minimise impact on the stock but would be sufficient to allow collection of fisheries dependent data in the two management areas.*

Elaboration on the advice

Time frame

Experience from sampling in recent fishing seasons shows the main fisheries are temporally discrete, targeting spawning or pre-spawning aggregations.

In Division 6.a North (see Figure 5.4.3.1), the fishery takes place in August and September, mainly in September. This coincides with the peak spawning period of this autumn-spawning stock.

In Division 6.a South (see Figure 5.4.3.1), the fishery takes place from late November to mid-January, but mainly in December. This coincides with the peak spawning of this winter-spawning stock.

There has not been much fishing effort in Division 7.b in recent years. However, the fishery was always in November, coinciding with peak spawning of that autumn-spawning component. In this area, the proposed sampling would need to take place in January, November, and December within a calendar year.

Geographical area

Figure 5.4.3.1 shows known spawning areas for herring in ICES subareas 6 and 7. The black boxes enclose what are considered to be the active spawning areas at present for these stocks, in addition to a pre-spawning aggregation area believed to contain a mixture of stocks. The remaining areas in divisions 6.a North, 6.a South, 7.b, and 7.c are thought to be largely moribund at present. Samples for stock discrimination in these areas could be taken through a small, separate sampling programme. For continuity of the time-series of fishery-dependent catch data, samples should be taken from the pre-spawning aggregations in area 1, where a large proportion of catches has been taken in recent years. Within each box are discrete spawning or pre-spawning aggregation areas, which are active at present and targeted in the present fisheries. These boxes are indicated by numbers 1–6 in Figure 5.4.3.1.

1 Pre-spawning mixed area (47E5 and 48E5)
2 East of Cape Wrath (46E5)
3 West of Cape Wrath (46E4)
4 Butt of Lewis /west of Hebrides (45E2)
5 North Donegal (39E2 and 39E1)
6 West Donegal (38E1)

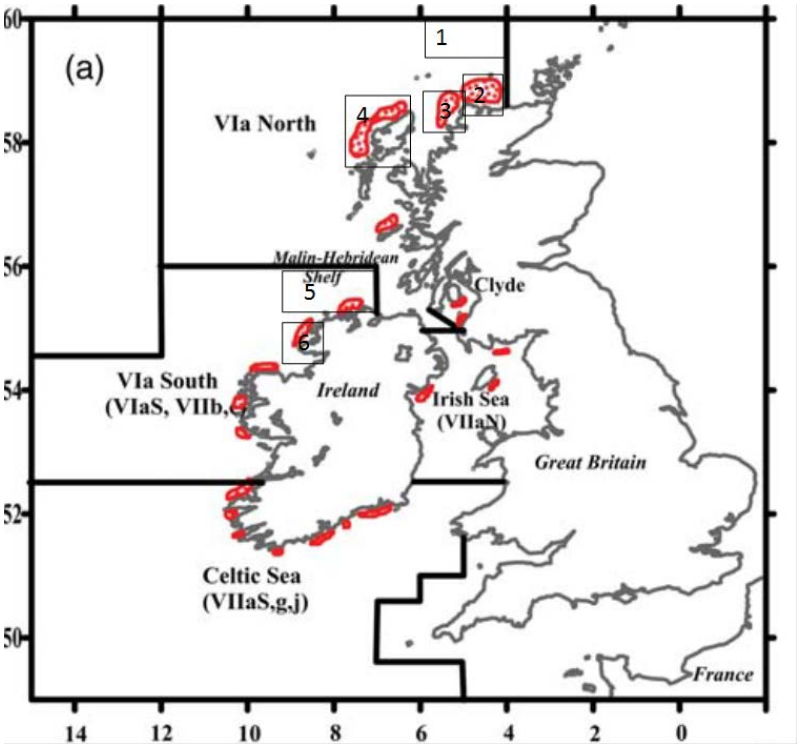

Figure 5.4.3.1 Herring in divisions 6.a, 7.b, and 7.c. Spawning areas for herring in ICES subareas 6 and 7, with currently active spawning areas and pre-spawning aggregation areas for each stock indicated by black rectangles. Redrawn from Geffen *et al.* (2011).

Level of sampling in divisions 6.a South, 7.b, and 7.c

An analysis of the 2009 sampling was conducted. This year was chosen as the fishery was less constrained than it has been in more recent years, the age structure was broader and included both strong and weak year classes, and the number of samples was sufficient to conduct the required analyses.

The analysis was confined to quarter 4 because it is indicative of the winter fishery for which monitoring is required. The Data Collection Framework (DCF) reporting structure defines "precision level 2" as the target for species such as herring. This level of precision equates to 17 samples (Figure 5.4.3.2). Converting each sample to a catch, with an average catch per haul of 80 tonnes (estimated from national logbook data) in Division 6.a South, results in a catch of 1360 tonnes.

Table 5.4.3.1 Herring in divisions 6.a, 7.b, and 7.c. Sampling for divisions 6.a South, 7.b, and 7.c based on DCF precision level 2, assuming one sample per haul and an average haul in the fishery being 80 tonnes.

Basis	CV (%)	No. of samples	Catch (assuming 80 tonnes haul^{-1})	% of lowest observed catch in the time-series (3968 tonnes)
DCF level 2	2.5–12.5	17	1360 t	34%

Level of sampling in Division 6.a North

An analysis of the 2009 sampling was also conducted for Division 6.a North, that year being chosen for the same reasons as previously stated. Taking the observed level of sampling in 2009 would not result in a precision of less than 12.5%, as was achieved for Division 6.a South. Therefore, it is recommended to apply at least the same level of sampling as in 2009, which results in a catch of 3480 tonnes, based on the average haul in the fishery being 120 tonnes (pers. comm. from the Pelagic Freezer Trawler industry representative) and assuming one sample per haul. Figure 5.4.3.3 below shows that the DCF level 2 precision is unattainable.

Table 5.4.3.2 Herring in divisions 6.a, 7.b, and 7.c. Sampling for Division 6.a North based on *status quo* sampling in 2009, assuming one sample per haul and an average haul in the fishery being 120 tonnes.

Basis	CV (%)	No. of samples	Catch (assuming 120 tonnes haul^{-1})	% of lowest observed catch in the time-series (14129 tonnes)
Status quo sampling 2009	14	29	3480 t	25%

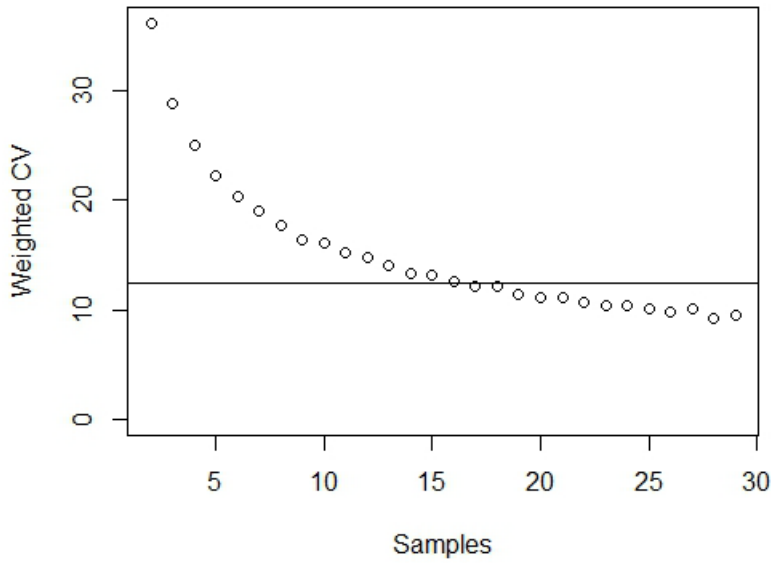

Figure 5.4.3.2 Herring in divisions 6.a, 7.b, and 7.c. Results of bootstrap analysis of divisions 6.a South, 7.b, and 7.c sampling in quarter 4 of 2009 showing the improvement in precision as the number of samples is increased. The horizontal line corresponds to a precision level of 12.5%. The associated minimum number of samples is approximately 17.

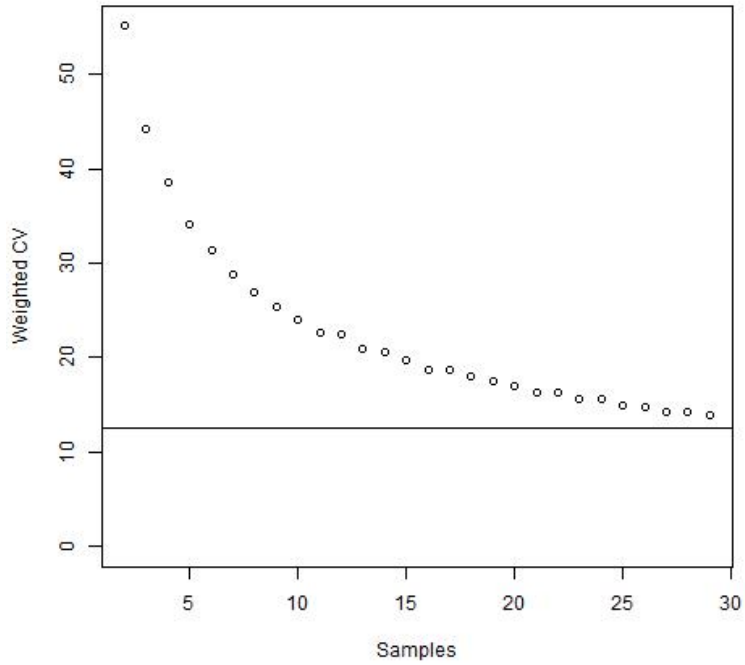

Figure 5.4.3.3 Herring in divisions 6.a, 7.b, and 7.c. Results of bootstrap analysis of Division 6.a North sampling in quarter 4 of 2009, showing the improvement in precision as the number of samples is increased. The horizontal line corresponds to a precision level of 12.5%.

Overall level of sampling

The combined number of samples equals 46 (combination of DCF level 2 and 2009 *status quo* sampling), which results in a catch of 4840 tonnes, based on the average haul in the fishery being 80 tonnes in divisions 6.a South, 7.b, and 7.c (as estimated from national logbook data) and 120 tonnes in Division 6.a North (pers. comm from Pelagic Freezer Trawler industry representative) and assuming one sample per haul.

The impact of 4840 tonnes is compared to other catch values in Table 5.4.3.3. These comparisons are based on the 2015 ICES assessment results and advice for this stock (ICES, 2015). The implied catch of this monitoring fishery would be much lower than the lowest observed catch in divisions 6.a, 7.b, and 7.c of 22 668 tonnes in 1979. A monitoring fishery of 4840 tonnes is projected to result in an overall F on the combined stocks in 2016 of 0.028. This is a 75% reduction in the projected F in 2016 relative to 2015. Under a no-catch scenario, the stock will decline 14%, and it would decline a further 2% with catches from the monitoring fishery.

In recent years (2011–2015), fewer than 46 samples were collected each year despite catches well in excess of 4840 tonnes. This suggests the need for a specific sampling programme to ensure that one sample is taken from each haul in the fishery to achieve the proposed number of samples.

Existing quota allocation keys between and within EU Member States may result in quotas that do not match a realistic haul size, thereby limiting the ability to collect the required number of samples. Effort should be spent such that an equal distribution of samples is taken in each of the six sampling areas.

Table 5.4.3.3 Herring in divisions 6.a, 7.b, and 7.c. Proposed monitoring fishery and other catches, based on the advice given by ICES in 2015 (ICES, 2015).

Level	Catch (tonnes)	CV (%) of age composition	SSB* (tonnes)	F	% of lowest observed catch in the time-series (22668 tonnes)	% change in overall SSB**
Proposed monitoring fishery (46 samples)	4840	12.5 to 14	163940	0.028	21	−16
Observed 2009 number of samples (58 samples)	5800	9 to 14	163399	0.034	26	−16
Zero catch	0	NA	166670	0	0	−14
Lowest previously observed F	9927	NA	160258	0.06	44	−17
Lowest observed catch	22668	NA	153763	0.14	100	−21

* SSB at spawning time (set to September).
** SSB in 2016 relative to SSB in 2015 (at spawning time).

Suggestions

For the purposes of this work, a sample must be taken from a discrete haul in terms of space and time. Catches shared between partner or neighbouring vessels cannot provide separate samples. Samples must be adequate to satisfy standard length, age, and reproductive monitoring purposes by EU Member States for the purposes of supplying data to ICES. Sampling should also ensure that sufficient spawning-specific samples are available for morphometric and genetic analyses as agreed by the Pelagic Advisory Council monitoring scheme 2016 (Pelagic Advisory Council, 2016).

The catches suggested are based on average haul sizes in each area, and assuming one sample per haul. ICES does not consider the mechanism by which the sampling may be allocated within individual countries.

However, managers may have the opportunity to achieve more samples per stock area by means of quota allocation, thereby ensuring that the number of samples can be collected from the specified quota.

Sources and references

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

Geffen, A. J., Nash, R. D. M., and Dickey-Collas, M. 2011. Characterization of herring populations west of the British Isles: an investigation of mixing based on otolith microchemistry. ICES Journal of Marine Science, 68: 1447–1458.

ICES. 2015. Herring (*Clupea harengus*) in divisions VIa and VIIb,c (West of Scotland, West of Ireland). *In* Report of the ICES Advisory Committee, 2015. ICES Advice 2015, Book 5, Section 5.3.19.

Pelagic Advisory Council. 2016. Minutes of the Focus Group meeting on herring in area VIa and VII b,c. 27 January 2016, The Hague, The Netherlands.
http://www.pelagic-ac.org/media/pdf/Minutes%20VIa%20herring%2027%2001%202016.pdf.

Annex 1 – Calculations

Estimates of precision for sampling of herring in divisions 6.a, 7.b, and 7.c were derived from data from 2009 for quarter 4. In total, 29 samples were taken in each area, with an average 202 fish measured and 55 fish aged. The precision (coefficient of variation, CV) was calculated using the group of samples described in Campbell (2016). A bootstrap, with replacement, from the complete sample dataset with a fixed number of samples was performed. An age-length key was constructed using only aged fish from the bootstrapped samples. Each length frequency was passed through the key to generate a proportion-at-age. No raising was carried out such that each sample carried equal weight. The total numbers-at-age was derived and the procedure repeated 1000 times. The CV was calculated weighted by mean numbers-at-age. It is assumed that the samples collected as part of the proposed monitoring programme will be processed in the same way, i.e. a length frequency and a subset of ageing.