3.3.3.1 **NEAFC request to evaluate and advice on the appropriateness of the plan for a scientific survey for pelagic *Sebastes mentella* in ICES sub-areas I and II**

NEAFC has requested ICES to review the plan for a new international scientific survey for pelagic *Sebastes mentella* in ICES Area I and II:

> *The Contracting Parties agreed to conduct a scientific survey for pelagic Sebastes mentella in ICES Sub-areas I and II during August-September 2008 to measure the horizontal and vertical stock distribution and provide an abundance estimate. The survey will be organized by scientists appointed by the contracting parties and chaired by Norway.*

ICES received the survey plan 2 April 2008. ICES has asked three reviewers to evaluate the plan. The reviewers selected were: Eckhard Bethke (Germany), Ghislain A. Chouinard (Canada), and Pall Reynisson (Iceland). They are all fisheries scientists and highly respected experts in that type of surveys for assessment purposes. They are also independent in the sense that they are not involved with the survey in terms of planning, implementation or results.

Their reviews are annexed.

Two of the reviewers, in general, find the plan appropriate for the purpose of providing information on horizontal and vertical stock distribution and for providing an abundance estimate. One of the reviewers recommends using the same method for the survey in the Norwegian Sea in August 2008 as the one used for years in the Irminger Sea. The reviewers raise issues and give ideas that might lead to improvements in the survey.

Annex 1: Review by Ghislain A.Chouinard

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Providing that the survey can be executed in its entirety, the survey should provide reliable estimates of abundance for redfish in the area down to 500m. While high concentrations of redfish are largely found in the 400 to 500 m range, information indicates that they can also be found in deeper waters. It needs to be recognized that since there appears to be an ontogenetic element to depth distribution in this species of redfish, estimates could be biased as the age composition of the stock changes, particularly if older redfish are found at depths greater than 500 m. The extent of the bias is not known but could be more important in some years.

There are uncertainties about participation from some member countries to the survey. It is recognized in the report that the survey design will need to be amended if some of the parties are not able to participate. One concern is that in the current plan for 5 vessels there seems to be little contingencies in the plan for downtime due to either technical breakdowns or weather conditions. In that respect, it may be useful to start with the inter vessel calibration in the middle of the survey area on the first day and then vessels could conduct their individual transects towards the edges of the survey area. This would ensure that there is inter-calibration conducted and that the center of the survey area is covered. According to Annex 5, this seems to be an area of high density.

The importance of the acoustic calibrations are highlighted and it is suggested that the calibration at the end of the survey be conducted as a matter of course. The technical details of the acoustics equipment and the survey trawl as well as the biological sampling are well described and appropriate.

In order to provide reliable estimates, the length frequency of the insonified fish has to be well described as the mean length is required along with target strength in estimating biomass. Given previously observed differences in the vertical distribution according to length and age in this species, it would be important for the trawl hauls to be standardized and that the trawl haul representatively samples the entire vertical extent of the aggregations represented in the acoustic signal. Given that a quota is attached to the survey, there may be a tendency to deploy the trawl at altitudes where larger or preferred sizes are found which may result in biased estimates. It is recommended that the following elements of a haul be standardized to ensure comparability of estimates between vessels: haul duration, towing speed and haul profile. A double oblique tow from the top of the aggregation to the bottom (500 m) of the aggregation (first half of the haul) and from the bottom to the top (second half of the haul) could ensure that a representative sample is taken. Alternatively, a three-step profile (e.g. equal fishing time at the top, middle and bottom (i. e. 500 m) of an aggregation) haul could be conducted. Using a standardized approach will ensure that comparisons with the multi-sampler cod-end can be made on the same basis between vessels.

In addition to the position and trawl mensuration data, data on altitude of the trawl during each haul should also be collected.

Annex 2: Review by Eckhard Bethke

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At first I want to mention that I never saw an echogram of that area; therefore, reviewing the survey plan is difficult for me even when I have some experiences from comparable surveys in the Irminger Sea.

The task is very critical because we have to measure very small echoes at a great depth just above the noise level at a very low SNR (signal to noise ratio). To increase the SNR long pulses should be used combined with a small bandwidth. However, this concept is working only for environmental or vessel noise, not for reverberation (echoes of unwanted targets). The main question is therefore, which source of noise is limiting the maximum range of the echo sounder. Are we able to cover the needed range by hydro-acoustic means? The experiences from the Irminger Sea surveys show that this is not possible. Therefore we carry out in that area a combined survey. Down to the DSL (deep scattering layer - reverberations covers redfish within this layer) the stock abundance was measured by hydro-acoustic means. The obtained results of this layer were also used to calibrate the trawl (index of catchability). Within and below the DSL (below the DSL redfish echoes are covered by environmental or vessel noise. Reliable measurements are not possible within this range) the stock abundance was measured by trawl catches only. Appendix 5, Figure 2 shows the maximum of s_A – values at a depth of about 350 m. Figure 3, however, shows the maximum of trawl catches at a depth of about 500 m (blue and red dots). Both maxima, however, should be more or less at the same depth. There could be two main reasons for that:

1. There is a DSL: Measurements hampered by reverberation. This means that a trawl – acoustic survey like that in the Irminger Sea has to be carried out. Echo integration within the DSL is not possible.

2. S_v-Threshold: The measured s_A – values are very small and we have a small SNR as well. The application of a S_v-threshold is necessary. Cutting off the noise also some part of echo signal is removed (in the Irminger Sea a threshold of -80 dB was recommended). This effect is a function of depth and influences the results to a large extend (Bethke 2004). However, echo integration could be possible if long pulses in combination with a small bandwidth are used together with a low threshold (<= - 80 dB).

It is necessary to know the situation in the field to decide that. There is no general method; the method has to be tailored always to the conditions in the field. During the Norwegian survey trawl hauls were carried out down to about 500 m. This does not mean that below this depth there is no redfish even if no marks are visible on screen of the sounder (the maximum range for single fish detection of that size). Are there further experiences or knowledge about the trawl depth of the commercial fleet? What do we know already about the maximum depth for redfish occurrences, do we have an overview about that? I guess that a large part of redfish is covered in this area by noise or reverberation like in the Irminger Sea.

To summarize my recommendation: I recommend to use the same method for the survey in the Norwegian Sea in August 2008 like the one used already for years in the Irminger Sea before. The problem seems to be comparable and so the method to solve this problem should be comparable. The differences between the methods are not large. However, using an established method (trawl-acoustic survey) ensures that at the end we may have a more reliable result. Using only echo-integration results could lead to an unknown underestimation of the stock.

Eckhard Bethke had after his submission of the review an email correspondence with some of the scientists involved in the survey. This correspondence is given below.

Eckhard Bethke raised two main questions:

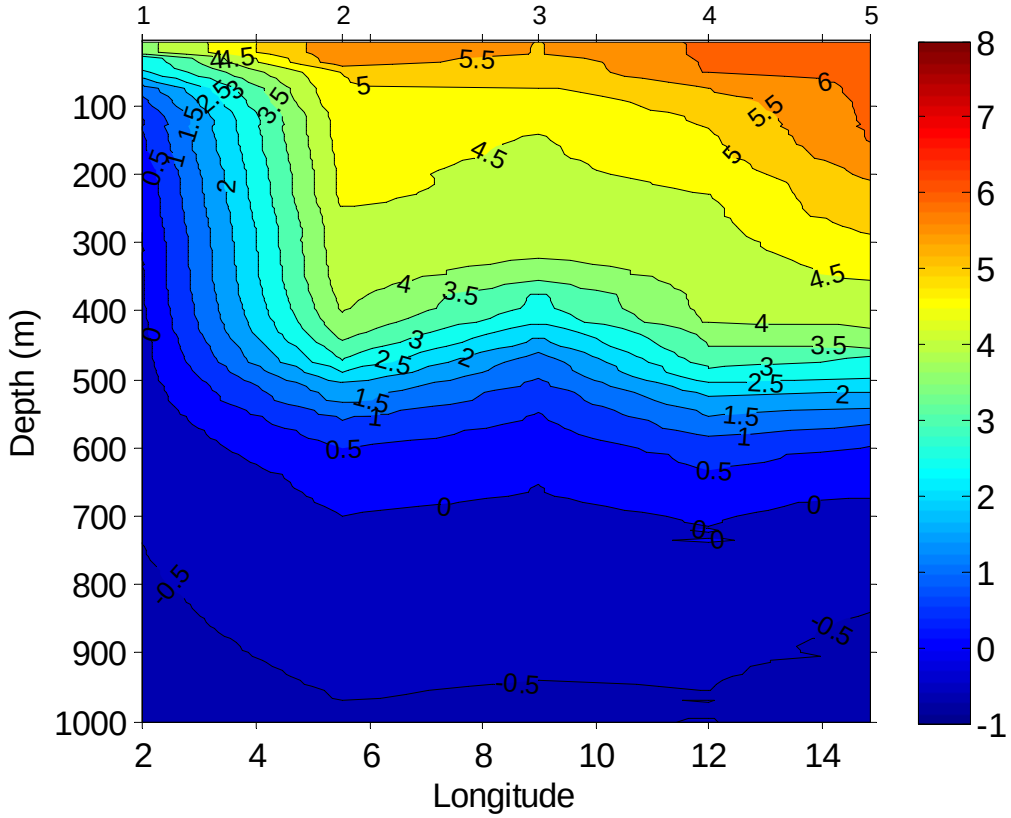
- Did you trawl hauls during that survey down to 1000 m (if possible)?

- Which Sv-threshold was used for echo integration.

Kjell Nedreaas, Kjell (Norway) answered:

We did not trawl down to 1000 m. Some checking of the depth layers below 500-600 m may well be done, but I think the outcome will be poor. It should also preferably be done using the possibility to close the codend in order not to catch redfish in other depths when setting or hauling the trawl. I also have doubts because of temperature (I can provide you with more figures, but here showing one representative example). We did also some deep towed transducer experiments, but in May 2007, showing no fish at these great depths.

The hydrographical conditions (Temperature along 72.16 N, May 2007 (G.O.Sars), see below) suggests that there is probably no redfish below 500 m. Below 500 m it is to cold for redfish (Andrey Pedchenko per. Comm.).



Our standard Sv-threshold was set to -82 dB/m3, but in order to extract the fish then the operator together with the scientist varied this threshold dependent on how 'clean' the registrations were and how dense the plankton was. Mostly we sett he threshold between -72 og -76 dB/m3 before extracting the fish sA-values, and only during the very best conditions we used the integrator value at Sv=-82 dB/m3. Integratorvalues (sA-values) in the Sv interval -76 (-80) to -82 dB/m3 was then allocated to plankton.

Eckhard Bethke concluded:

This does not change my recommendation to carry out a trawl-acoustic survey. We still have the problem of reverberation within the deep scattering layer. The application of a threshold of -72 to -76 dB reduces the sA-values already drastically (Bethke 2004 in the attachment from yesterday). Reliable measurements are not possible.

Annex 3: Review by Pall Reynisson

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Some comments on the Planning of *Sebastes mentella* surveys in the Norvegian Sea August 2008.

The plan seems to be a rather straightforward extension of earlier surveys.

Emphasis on acoustics is quite strong, which is good, and the necessary calibration very much taken into consideration.

I would like to point out that the target strength equation used is different from what has been used in the Irminger Sea since 1992. (ICES C.M. 1992/B:8). But as mentioned in the document there is an ongoing debate on this. One should at least consider very carefully the possibly different conditions and behaviour of the fish in question and relate that to the present survey conditions before deciding on the most appropriate TS.