Update on WHM Index Development

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On December 10th 2015 a presentation to the Pelagic AC outlined some of the issues facing the assessment of Western Horse Mackerel. One such issue is the lack of fishery independent information available to the assessment. Currently, the assessment uses an egg count from the triennial mackerel egg survey as an index of stock status. This relative lack of fishery-independent information contributes to high uncertainty in the assessment results and revisions of the stock perception in each of the years a new egg survey result becomes available.

During the initial presentation it was shown that horse mackerel are often encountered during the IBTS, an extensive groundfish survey involving several nations which covers the majority of areas in which horse mackerel are found. Despite the fact that horse mackerel is not aged as part of the groundfish survey protocol, it is possible to identify juveniles (i.e. fish in their first year) from the length-frequency measurements. Two separate approaches were presented as potential candidates for the calculation of an index for juvenile horse mackerel – one using a GLM modelling approach and a second using a more complex spatial model (as used in the development of a juvenile index for mackerel).

A rigorous review of the data and methods initially used has now started with the view to presenting the analysis for consideration during the Inter-benchmark (IBP) data coordination workshop that will take place later this year. This workshop precedes the actual IBP assessment for WHM and should review and finalise the data available for the assessment.

The initial dataset has been expanded to include 2 further surveys, namely the Spanish North Coast and Porcupine surveys. Also, data is now available up to 2015. Current analysis is now based on 5 surveys from 2003 to 2015.

In addition, the analysis is now based on catch rates of juvenile horse mackerel per nautical square mile (previous it was only numbers of juveniles per hour). This extension allows the analysis to include the effects of variable gear parameters (wingspread and towing speed).

In terms of modelling, recent work has concentrated on the GLM approach. A wide number of such models can be considered but the most appropriate model will depend primarily upon the nature of the underlying data and the assumptions made by each model. To this end, a more comprehensive analysis of the available data has been conducted. Two factors that must be taken into consideration are

- Overdispersion – this occurs when the data is very variable. This is a feature of the WHM data. This is typical for a schooling fish where some very large hauls can occur. It is necessary to account for this appropriately within the model.
- Excess zero hauls (zero inflated data) – this is also a feature of this data and, as the name suggests occurs when there are a significant number of zeros in the data i.e. hauls with no

horse mackerel. A zero could be due to the habitat being unsuitable or simply that the fish are not in that particular location (even though it may be suitable) at the time of the sampling event (haul). There are a number of models available that cater for this feature and several have been explored.

To generate an index of abundance it is necessary to divide the survey area into individual strata. Individual surveys within the IBTS have their own sampling schemes to ensure appropriate sampling of the survey area. However, there is no stratification scheme identified for the IBTS as a whole. Ideally, samples from within a single stratum should be considered to come from a homogeneous population. The original presentation outlined a number of potential stratification schemes and additional ones have since been explored. This was done by considering the observed catch rates in relation to haul latitude and depth. One such scheme is shown below. The different coloured points are from the various surveys.
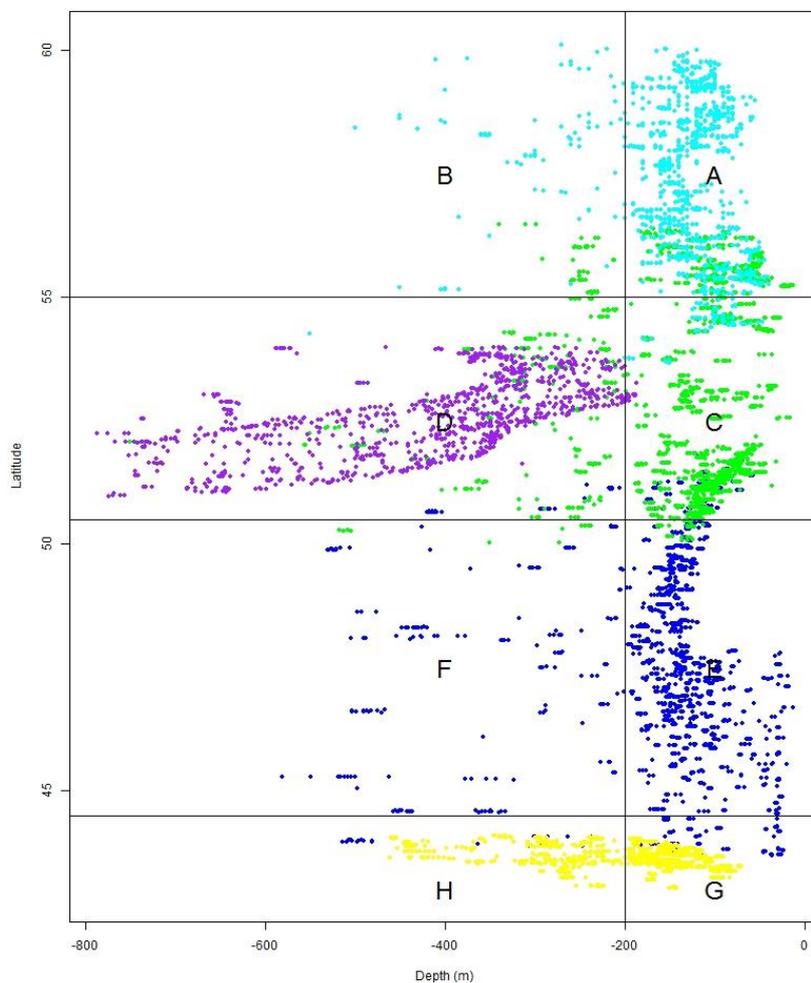
The divisions are based on catch rates versus depth and latitude as shown below. It is clear to see a reduction in catch rate for depths greater than 200m and variations with latitude.
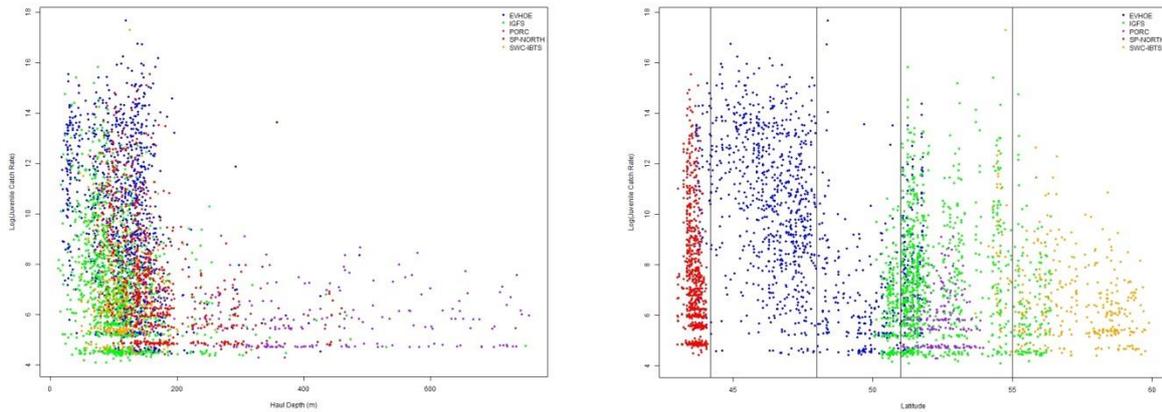
In calculating the index, the importance of individual strata is now weighted according to the stratum area (previously all strata were considered to have equal weighting). One potential index is shown below (the points). The black line represents the recruitment as estimated by the assessment.
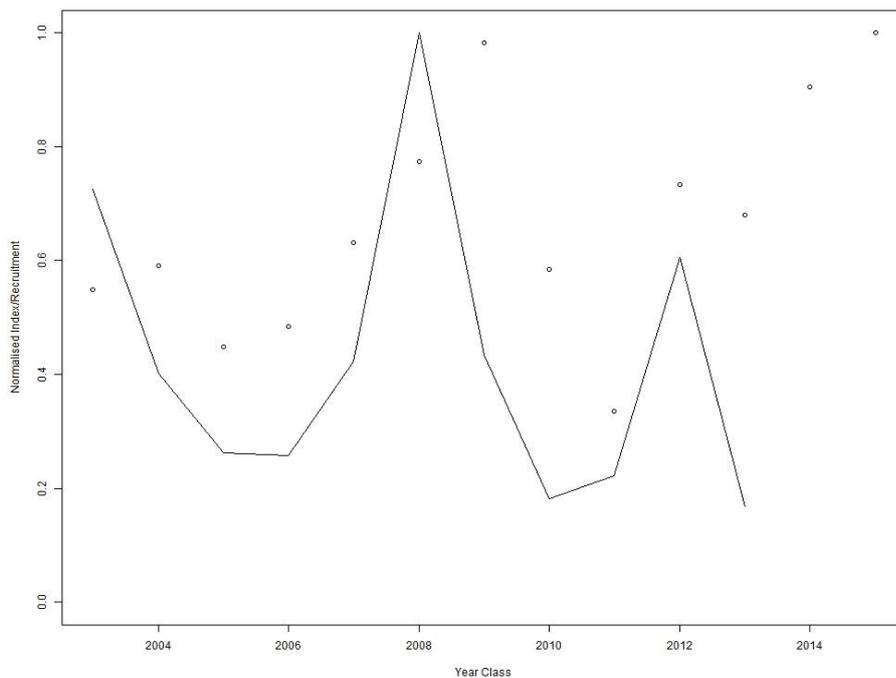
There is general agreement in terms of trends although there appears to be a 1 year lag. One potential advantage of a juvenile index is information on recent recruits which the assessment is unable to provide. This particular index seems to indicate good recent recruitment, which was also noted during the preliminary exercise.

Much work and analysis remains to be completed and is ongoing. Additional data analysis (including the addition of data prior to 2003 and potentially other surveys) is required as is the determination of which particular GLM model is most appropriate. Further exploration with the spatial model is

also required. Any index proposed for inclusion within the assessment will be carefully scrutinised by the ICES WGWIDE working group and also the data workshop.