Evaluation of the survey indices from the autumn/winter surveys of Icelandic summer-spawning herring

by

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Abstract

There has been a suspicion that the age composition in the acoustic surveys of Icelandic summer-spawning herring might be inadequately determined for some years as results of insufficient biological sampling in the survey. The survey indices from the years 1986 to 2010 are therefore validated here by comparing them to the catch composition the same year and determine if the survey indices needs to, and then can, be revisited and recalculated with for example more adequate biological samples originating from the commercial catch. The analyses revealed that all the major discrepancies between the proportion of the age groups in the catch and in the survey could be explained by the nature and location of the fishery and/or different spatial and temporal distribution of the fishery and the acoustic surveys. Thus, there is neither reason nor justification to revisit the acoustic measurements and recalculate the indices with for example different biological samples.

Introduction

As for many other herring stocks, the survey indices from the acoustic measurements are used as tuning series in the analytical assessment of the stock. There has been a suspicion that the age composition in the acoustic surveys might be inadequately determined as results of an occasional insufficient biological sampling in the survey. It can lead to a discrepancy between the observed age composition of the stock as represented by the catch samples and as represented by the acoustic surveys. A likely consequence of such a discrepancy is that the strength of the year classes in the assessment models are determined inaccurately and it can cause unwanted retrospective patterns in the results. The age composition in the survey indices are based on length distributions and age-at-length keys from the surveys themselves. The age-at-length keys are normally not different from the keys that are obtained from the catch samples the same year while the length distribution can be different. It can be normal that the length distribution from a survey and catch samples the same year vary since the survey is assumed to cover the whole distribution area of the stock while the fishery can be concentrated in a single or few subareas. Thus the objective here is to validate the survey indices from the years 1986 to 2010, by comparing it to the catch composition the same year and determine if the survey indices needs to, and then can, be revisited and recalculated with for example more adequate biological samples originating from the commercial catch.

Methods and results

The age distributions from the survey and the catch data were compared and discrepancy between determined, and thereby verified if the age composition in the acoustic surveys might be inadequately determined because the biological sampling in the being insufficient. It involved that for each year the proportion of the different age groups was calculated for the survey data and the catch data and the difference determined as this equation indicates:
The survey and the catch data are the same as used in the analytical assessment of the stock and are provided in the assessment reports (e.g. ICES 2010). The age groups (x) included in the calculations were age 4 to 9 (Fig. 1) and age 5 to 9 (Fig. 2).

Results and Discussions

The data were analyzed both for age groups 4 to 9 (Fig. 1) and age 5 to 9 (Fig. 2). Fig. 1 shows that proportion of age 4 is usually higher in the survey than in the catches. This can most likely be explained by that the fishery is targeting larger herring. There are some exceptions to this, for example in 2006 and 2007 where the fleet had problems in finding large herring and fished instead a large amount of younger herring off the south coast, particularly age 4 in 2006 and age 4 and 5 in 2007 (ICES 2007; 2008). Because the relative difference is largest in the age groups that are entering the fishery, i.e. age 4, the analyses were also limited to age groups 5 to 9 (Fig. 2). The maximum difference between the proportions was less than 0.1 in 14 years out of total 21 years. Further attention was given to years where the maximum difference was >0.1 to determine what caused the differences.

In 1987 and 1988 the differences between the proportions in the catch and surveys was up to 24% (Fig. 2). The reason for this difference is that the fishery took mainly place off the east coast that lies the furthest north where old part of the stock was found (> age 6), while for example age groups 3 to 5 were measured in considerable amount off the southeast coast in 1987 were no fishery took place (MRI 1988). Thus the fishing pattern in these two years was atypical and different from previous years (ICES 1989) and explains the low proportions of age 5, and consequently higher proportions of older ages, in the catch in comparison to the acoustic measurements.

During the years 1991 and 1992, the herring fishing fleet was mainly fishing off the southeast coast of Iceland (ICES 1993; 1994). The proportion of young fish was high in the catches so area closures were frequent, particularly in 1991. It means that the fleet was forced to fish in different areas most likely with the consequences that age composition of the catches was skewed towards older fish relative to the age composition seen from the acoustic surveys, which took place in the same areas during the middle of the fishing seasons. That explains the higher proportion of age groups 5 as seen in the survey (Fig. 2). The 1983 year class (at age 8 in 1991) appeared to show the highest discrepancy of the older age groups, but that can be expected since it was much larger (2-3 times) than the adjoining year classes.

In 1993, there was a completely temporal disharmony between the acoustic measurements undertaken in January and the fishery, which took mainly place in October and November with almost no fishery in January (ICES 1995). It means that the acoustic measurement that was based on 9 biological samples (ICES 2008) can not be recalculated with more samples originating the fishery. Thus, this apparent discrepancy in the age compositions in 1993 as represented by the catch data and the acoustic data (Fig. 2) must be accepted as the best available estimates.

In 2000, the 1994 year class (at age 6; Fig. 2) was in higher proportion in the acoustic measurements than in the catches. Around 70% of the catches that season were taken of the east coast while only 11% of the adult part of the stock was measured there acoustically (ICES 2001). Thus, most of the stock was measured acoustically of the west coast where the 1994 year class was abundant. The stock began to utilize the areas west of Iceland for overwintering from 1995 and on. What initiated these changes has been suggested to be linked to occurrence of the 1993 and the relative big 1994 year classes there, which adopted presumably a new migration pattern (Óskarsson et al. 2009). Thus, considering the fishing
pattern with the most fishery off the east coast and that the relative abundance of the 1994 year class was less off the east coast than off the west coast, this observed discrepancy (Fig. 2) can be expected and can not be rejected.

The discrepancy between the proportions in 2003 is probably related to the fact that the 63% of the catch was taken off the east where only 28% of the stock was located according to the acoustic measurements, beside that the amount of older herring measured was considered small (MRI 2004). Thus this observed discrepancy in 2003 (Fig. 2) seems to be reasonable.

Considering that all the major discrepancies between the proportion of the age groups in the catch and in the survey can be explained by either the nature and location of the fishery or different spatial and temporal distribution of the fishery and the acoustic surveys, there is neither reason nor justification to revisit the acoustic measurements and recalculate the indices with for example different samples.

References
Fig. 1. The difference of proportion of number at age for age groups 4 to 9 of Icelandic summer-spawning herring between the number in commercial catch and number in the survey during 1986 to 2010 where positive residuals represent relative higher proportion in the catch.
Fig. 1. Continues
Fig. 2. The difference of proportion of number at age for age groups 5 to 9 of Icelandic summer-spawning herring between the number in commercial catch and number in the survey during 1986 to 2010 where positive residuals represent relative higher proportion in the catch.
Fig. 2. Continues