The following supplement accompanies the article

Characteristics of juvenile survivors reveal spatio-temporal differences in early life stage survival of Baltic cod

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Supplement. Evaluation of the adequacy of applying an age–length relationship established for demersal juveniles caught in 1990–1992 to demersal juveniles caught in 2000

Due to a lack of demersal juvenile samples from the year class 2000, hatch dates of demersal juveniles could not be determined by otolith analysis. Instead, hatch dates were estimated from the length frequency distribution of demersal juveniles caught during the Baltic International Trawl Survey in the fourth quarter (Q4 BITS) of 2000 and an age–length relationship from the literature (Fey & Linkowski 2006). However, this age–length relationship was established for demersal juveniles from the year classes 1990–1992, and demersal juveniles caught in 2000 in the present study may have experienced different growth conditions resulting in different growth trajectories.

In order to evaluate the adequacy of applying the published age–length relationship to estimate ages of demersal juveniles in the present study, length frequency distributions of demersal juveniles from 1990–1992 and from 2000 were compared. Unfortunately, it was not possible to compare length frequency distributions from the Q4 BITS, as this survey has only been conducted since 2000, but length frequency distributions were available from the first quarter BITS (Q1 BITS), which have been conducted since 1991 (ICES 2013). Note that juveniles caught on these first quarter surveys as age-1 fish belong to the year class of the previous year. The BITS surveys cover the entire southern Baltic from ICES Subdivisions (SDs) 21 to 28, i.e. the distribution area of both the western and the eastern Baltic cod stock. In order to compare only juveniles from the eastern Baltic cod stock, area-disintegrated catch per unit effort (CPUE) data per 1 cm length class were obtained from ICES (http://datras.ices.dk/Home/default.aspx) for each individual SD to split the CPUE data into western (SDs 21–24) and eastern (SDs 25–28) Baltic cod. As SD 25 is the main spawning area of the eastern Baltic cod stock and catches of juveniles in the SDs east of SD 25 were generally low and very variable, only data from SD 25 were considered in order to create a length distribution of the Q1 BITS in 2001 (Fig. S1). Based on this distribution, juveniles up to 180 mm length were considered to belong to the year class 2000.

However, as shown in the present study, a considerable part of larvae hatched in SD 25 in the late part of the spawning season in 2000 drifted into SD 24 (cf. Fig. 7 in the main text). This is also reflected in a comparison of CPUE in SD 24 between the year class 2000 and the average for the year classes 1990–2012 (Fig. S2), which clearly shows a peak in the length range 40–120 mm for juveniles from the year class 2000. In connection with Fig. 7 of the main text, it can be assumed that these fish from 40–120 mm

length actually originate from the eastern Baltic stock with main spawning during summer, whereas fish >120 mm belong to the western Baltic stock which mainly spawns in winter to early spring (Hüssy et al. 2012). Therefore, CPUE data from SD 24 and SD 25 were added for the length classes 40–120 mm for the comparison of length frequency distributions. For easier comparison, CPUE data were converted to relative values (%).

The length frequency distributions of juveniles from the year classes 1990–1992 and 2000 were very similar (Fig. S3), indicating that juveniles from both periods experienced similar growth conditions and that the application of the published age–length relationship for juveniles of the year classes 1990–1992 (Fey & Linkowski 2006) provides reasonable age estimates for demersal juveniles of the year class 2000 in the present study.

LITERATURE CITED

Fey DP, Linkowski TB (2006) Predicting juvenile Baltic cod (*Gadus morhua*) age from body and otolith size measurements. ICES J Mar Sci 63:1045–1052

Hüssy K, Hinrichsen HH, Huwer B (2012) Hydrographic influence on the survival potential of western Baltic cod (*Gadus morhua*) eggs. ICES J Mar Sci 69:1736–1743

ICES (International Council for the Exploration of the Sea) (2013) Report of the Baltic Fisheries Assessment Working Group. Copenhagen, 10-17 April 2013. ICES CM 2013/ACOM:10. ICES, Copenhagen

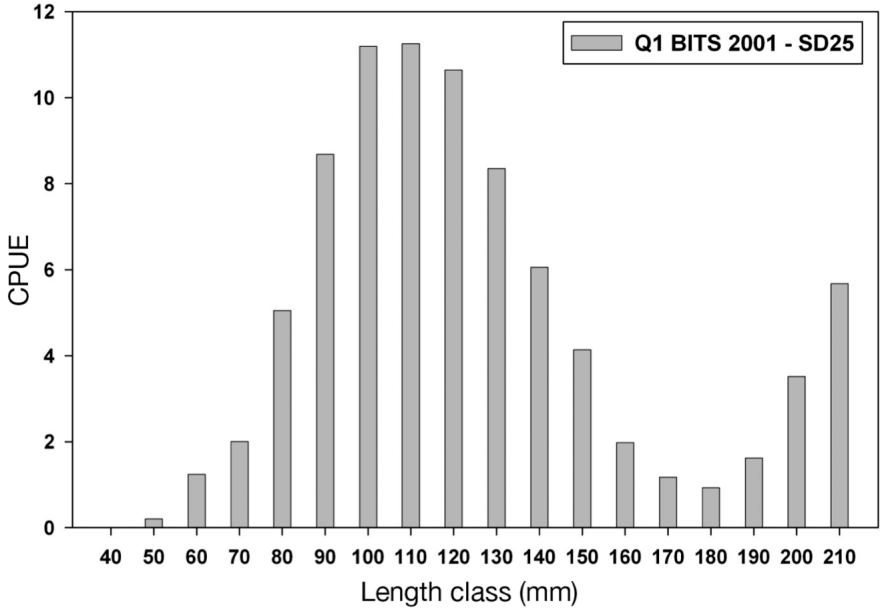

Fig. S1. Catch per unit effort (CPUE) of juvenile eastern Baltic cod *Gadus morhua* caught in ICES Subdivision 25 during the first quarter Baltic International Trawl Survey (Q1 BITS) in 2001. Based on this length distribution, juveniles up to 180 mm length were considered to belong to the year class 2000

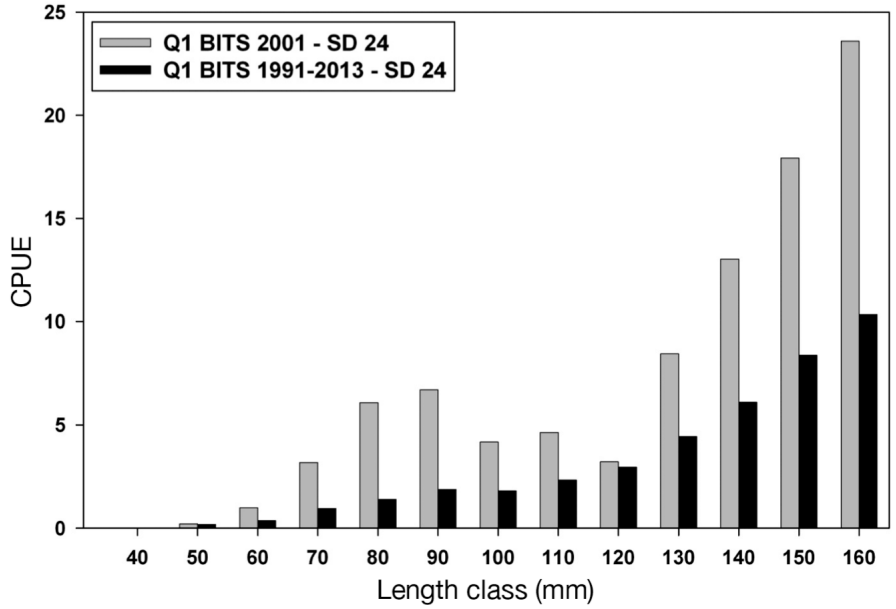

Fig. S2. Catch per unit effort (CPUE) of juvenile Baltic cod *Gadus morhua* caught in ICES Subdivision 24 during the first quarter Baltic International Trawl Surveys (Q1 BITS) in 2001 (grey bars) and average for the period 1991 to 2013 (black bars). The peak in the length range 40–120 mm in 2001 indicates that fish in this length range actually belong to the year class 2000 of the eastern Baltic stock, whereas fish >120 mm belong to the western Baltic stock

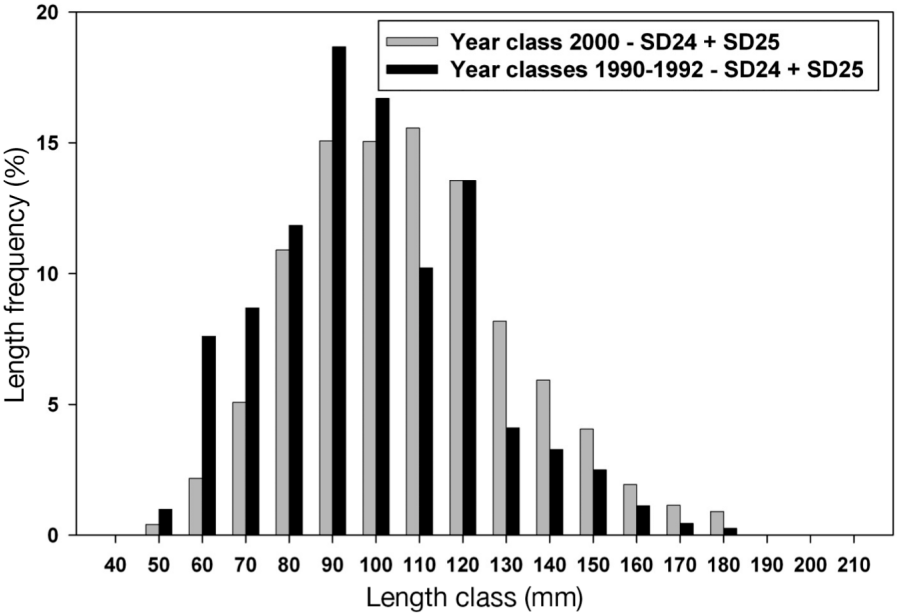

Fig. S3. Length frequency distributions of demersal juvenile *Gadus morhua* from the year classes 1990–1992 and 2000. The similar distributions indicate that juveniles from both periods experienced similar growth conditions and that the application of a published age–length relationship for the year classes 1990–1992 provides a reasonable age estimate for the year class 2000