

APPENDIX B: Estimation of surface area biomass of 3 pelagic species

Biomass

Spawning stock biomass (SSB) numbers were extracted from the ICES database for NSS Herring (*Clupea harengus*, data = 10.17895/ices.data.7360), Mackerel (*Scomber scombrus*, data = DOI: 10.17895/ices.data.7362) and Blue Whiting (*Micromesistius poutassou*, data = DOI: **10.17895/ices.data.7361**). **The average value of SSB in the period 2000-2019 were used.**

Area

ICES manage different stocks by assigning to which subareas and divisions it belongs and these areas were used to determine the area of its horizontal distribution. Herring is assigned to subareas 1, 2, 5 and divisions 4.a and 14.a, Mackerel in subareas 1-8 and 14 and division 9.a, while Blue whiting is assigned to subareas 1-9, 12, and 14. However, the northernmost subareas stretches all the way up to 84.75 °N and subarea 1 (Barents Sea) all the way to 68.5°E. For all species it was determined that any area north of 80°N were not to be included and an eastern limit were set at 25°E for Herring and Mackerel and at 35°E for Blue whiting. Finally, for Mackerel and Blue whiting, the whole of subarea 3 is said to be included, but this includes the Baltic Sea. It was therefore decided that only division 3.a of subarea 3 were to be included. Figure 1 shows the included areas for the three species with superimposed ICES statistical rectangles (ICES, 1977) and all included ICES divisions. Note the northern and eastern cut off explained above.

The ICES statistical rectangles (https://gis.ices.dk/shapefiles/ICES_rectangles.zip) all have had the surface area calculated, as well as the percentage of landmass within each rectangle. The surface area occupied by each species were calculated by summing all statistical rectangles (with landmass area removed) within the assigned subareas and divisions.

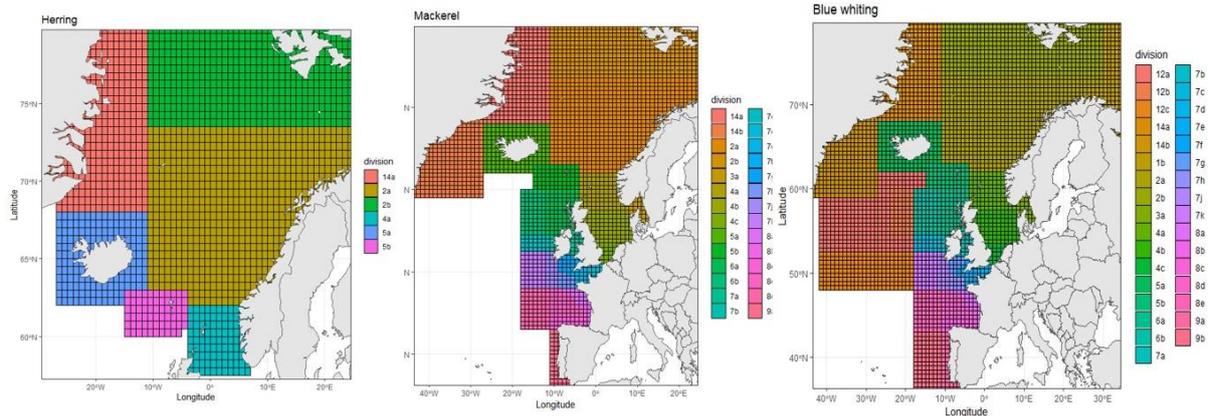


Fig. 1. Divisions and ICES rectangles used for calculation of Herring, Mackerel and Blue whiting distribution area.

Biomass per area

Czamanski et al. (2011) investigated, among others, the elemental carbon (C) contents in 15 wild-caught species of fish typical of the pelagic/neritic domain including mackerel (*S. scombrus*). The water content of all species was found to be represented $73.6 \pm 0.7\%$ of wet weight.

Furthermore, the percentage concentration of carbon in *S. scombrus* was determined to be 46.8% of dry weight when the whole fish was analysed Czamanski et al. (2011). Assuming herring and blue whiting to have similar carbon percentages as mackerel, we can arrive at the following estimation of fish surface biomass (g C m^{-2}).

Table 1. Pelagic fish biomass per surface area.

Species	Total area (km ²)	SSB (tonnes)	Biomass (g WW m ⁻²)	Biomass (g DW m ⁻²)	Biomass (g C m ⁻²)
Herring	3261291	5195850	1.593	0.421	0.197
Mackerel	6289812	3410201	0.542	0.143	0.067
Blue whiting	9188877	4764962	0.519	0.137	0.064

References:

ICES, 1977. ICES statistical rectangle coding system. ICES Document CM 1977/Gen:3.

Czamanski, M., Nugraha, A., Pondaven, P., Lasbleiz, M., Masson, A., Caroff, N., Bellail, R., Tréguer, P. (2011). Carbon, nitrogen and phosphorus elemental stoichiometry in aquacultured and wild-caught fish and consequences for pelagic nutrient dynamics. *Marine Biology*. 158. 2847-2862. 10.1007/s00227-011-1783-7.