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Understanding sorting grid and codend size selectivity of Greenland halibut (*Reinhardtius hippoglossoides*)

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ABSTRACT

We studied the size selectivity of Greenland halibut (*Reinhardtius hippoglossoides*) using the fish morphology-based FISHSELECT methodology, size selectivity data from two sets of sea trials carried out in the Barents Sea and the Norwegian Sea, and historical selectivity data collected for this species from 1981 onwards. When compared, the historical codend size selectivity data fitted well with the selectivity predictions from the FISHSELECT analyses. The historical grid selectivity data and the results from the two sea trials showed considerably lower L50 values than what would be expected from the morphological-based limit estimated by FISHSELECT. The size selectivity results obtained from the analysis of the two sea trials differed significantly, even though they were conducted using grid sections with similar bar spacing that previously were shown to have similar selective properties for other species. The differences were not caused by differences in the ability of the fish to contact the grid. Instead, these differences can be explained by differences in the ability of the fish to turn before they attack the grid. In earlier grid selectivity studies, the influence of angle of attack (θ) was not quantified. We show that the ability to contact the grid with a more or less optimal θ differs between individuals. This is important to consider in grid selectivity studies for flatfish species such as Greenland halibut because it can potentially influence results considerably and therefore can be a source of variability in results between cruises.

1. Introduction

Greenland halibut or Greenland turbot (*Reinhardtius hippoglossoides*), a flatfish that belongs to the family *Pleuronectidae*, lives in polar and cold regions of the North Atlantic and North Pacific oceans (Sohn et al., 2010). Despite its wide distribution in depth (200–1600 m), it is mostly considered a deep water fish because it is commonly harvested at the edge of the continental shelf at depths between 300 and 1000 m. In the Northeast Atlantic, Greenland halibut is harvested by means of gillnets, longlines, and trawls. Trawls are one of the most widely used gears to harvest Greenland halibut. In Norway, for example, 39% of the Greenland halibut captured in 2011 was captured as bycatch in the demersal trawl fishery (Fiskeridirektoratet, 2012). Selectivity studies for this species and these gears can be found in the literature (Boje et al., 1997; Woll et al., 1998; Huse et al., 1999; Lisovsky et al., 2004).

In the Northeast Atlantic, sorting grids have been used in combination with diamond mesh codends as a selection measure for the bottom trawl fisheries since the mid 1990s (Larsen and Isaksen, 1993).

Traditionally the size selectivity of sorting grids and codends was investigated solely based on sea trials. In recent years the experimentally based methods have been supplemented by theoretical methods.

FISHSELECT is such a method that can be applied to investigate the basic size selective properties of sorting grids and meshes of different shapes and sizes for individual fish species (Herrmann et al., 2009). The methodology is based on fish morphology data and computer simulations and has been applied in the North Atlantic for *Nephrops* and a variety of roundfish species, including redfish (*Sebastes* spp.), cod (*Gadus morhua*), and haddock (*Melanogrammus aeglefinus*) (Herrmann et al., 2009, 2012; Frandsen et al., 2011; Krag et al., 2011; Sistiaga et al., 2011). However, FISHSELECT has not been applied previously to flatfish species, and therefore the method was specifically developed further to this end. The body shape of roundfishes and flatfishes has different characteristics that have potential implications for the selectivity of these species. Therefore, a morphological-based analysis that relates the characteristics of a

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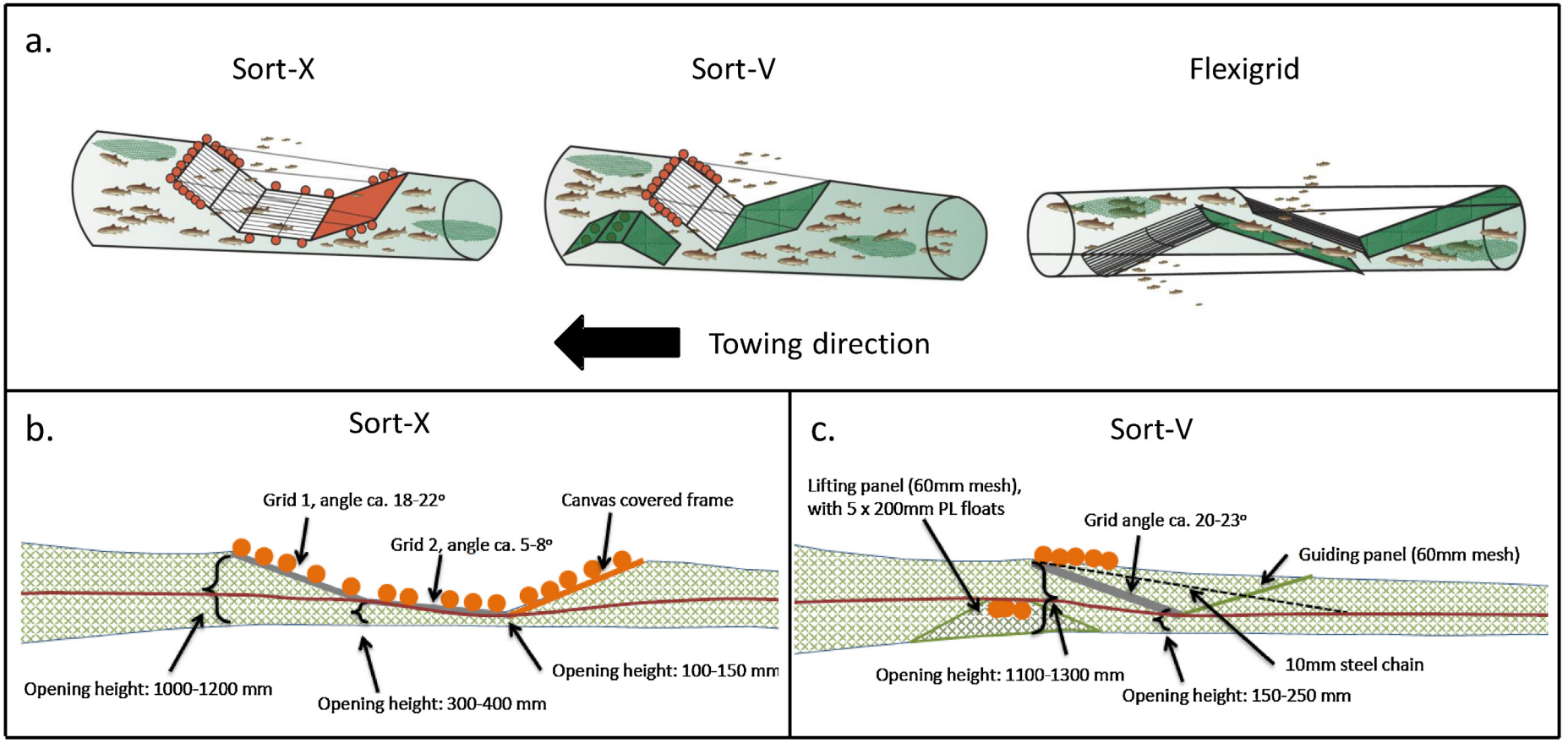

Fig. 1. Design of the three sorting grid systems used in the Barents Sea today (a). Details about the Sort-X grid (b). Details about the Sort-V grid (c).