Bell-shaped size selection in a bottom trawl: A case study for Nephrops directed fishery with reduced catches of cod

Monotonous size selection curves have traditionally been sufficient to describe the size selection in the aft end of a bottom trawl. Such modelling is a good approximation when the size selective system consists of a single selective device. However, in some fisheries the demands for species and size selectivity have motivated the development of selective systems in trawl fisheries that utilize more than one selective device simultaneously. An example can be found in the Swedish demersal trawl fishery targeting Norway lobster (Nephrops norvegicus), which simultaneously aims at avoiding catches of Atlantic cod (Gadhus morhua). In this fishery, the selective system consists of a Nordmøre type sorting grid followed by a size selective square mesh codend. The size selection curve for this system has a characteristic bell-shaped curvature, which cannot be sufficiently described by a monotonous selection curve. An approach that can handle a bell shaped curvature is to use a more flexible empirical size selection model. However, such models primarily use a curve fitting procedure, and do not allow the possibility to investigate the contribution of the individual parts of the selection system. Therefore, we choose to use a structural based model that directly models the contributions of the individual selectivity devices to the overall performance of the system. We demonstrate that this approach can appropriately describe the experimental size selection data for both Nephrops and cod in a system composed of a sorting grid followed by a size selective codend. Furthermore, this approach provides a direct quantification of the selective processes of the individual parts of the system to the overall size selection in the fishing gear. In addition, we demonstrate how this approach can provide fisheries managers with a new tool when trying to develop more sustainable fisheries through improving fishing gear size and species selectivity.