Gear technical contributions to an ecosystem approach in the Danish bottom set nets fisheries

The European Union is implementing a sustainable fisheries management framework called the Ecosystem Approach to Fisheries, with the main basis provided in the objectives of the Marine Strategy Framework Directive and the Common Fishery Policy (landing obligation). As fishing can affect other components and not just targeted species, the ecosystem as a whole must be considered. Although the fleet has reduced since the mid-1990s, gill- and trammel nets still represent about 80% of the Danish fleet in number of vessels. Gill- and trammel nets have the advantage of low energy consumption and good size selectivity. However, there is limited knowledge about the ecosystem effects of bottom set nets. Focus was given to methodological development (Paper IV), catch pattern (Papers I, II and III) and habitat effects (Paper IV). Regarding catch pattern, one can intend to minimize the catch that is unwanted (Papers I and II), or to maximize the part of the catch that is wanted, e.g., by adjusting the fishing tactic (Paper I) or by improving catch quality of the target species (Paper III).

The limited information on passive gears is partly due to historical focus on active gears, but also because data collection and analysis calls for the development of appropriate innovative assessment methodologies to properly assess the new type of information which has to be gathered as part of an Ecosystem Approach to Fisheries. A stereo imaging method to assess in-situ the dynamic behavior of passive gears was identified, adapted, tested and used (Paper IV). Comparing bottom set nets fishing operations can be challenging as the measure of fishing effort depends on various factors such as the combination of netting characteristics, net length, or soak time. Statistical methods that have recently been developed were identified and used for estimating the relative catch efficiency between two different designs of a passive fishing gear (Paper I) or to standardize data to a wide range of effort variables by including the landed portion of the fishing operation with the use of discard ratios (Paper II).

Gear technologists can play a key role in searching for win-win solutions so that fishing can continue in an ecologically sustainable manner, i.e., avoiding unwanted catch and habitat damage. The selection properties of gillnets may be improved by changing the gear characteristics, e.g., mesh size or netting material, but in many cases the fisher’s operational tactic plays a preponderant role, as new selective technologies involving more complex gear are usually limited in passive fisheries. Gear technological considerations, i.e., gear design and operational tactics, can help to implement an Ecosystem Approach to the Danish bottom set nets fisheries. The effects of gear design, i.e., light and heavy nets, on habitat effects (Paper IV) and fisher’s tactic, i.e., soak duration or choice of target species, on catch pattern and quality (Papers I, II and III) were explored. In Paper I, the effect of fisher’s soak tactic on catch pattern in the Danish gillnet plaice fishery was investigated by estimating the length-dependent catch efficiency, or relative size selectivity, of three different soak patterns, i.e., 12h at day, 12h at night and 24h. By adjusting their soak tactic, i.e., 12h at day, fishers participating in the coastal summer fishery for plaice can maximize their catch by catching more plaice at commercial size when they are more available to the gear, and limit handling time by catching less dab and crabs when they are less available to the gear.

In Paper II, discard ratios of regulated fish species under the landing obligation in the Danish bottom set nets fisheries for cod, plaice and sole in the North Sea were described using the discard data from observers at sea, and the effects of soak duration, depth, latitude and longitude on discards were investigated by the use of a beta distribution. Discard ratios ranged from 1.10 to 100%, with high variability between fishing operations, species and fishery, discard of undersized individuals due to the use of small mesh sizes in the sole fishery being the main challenge identified. In the North Sea cod fishery, there was a decreased probability of cod discard with depth, with greater effect in the more recent years.

In Paper III, the effect of soak time (12 and 24h) on catch quality, as well as if the registered damages on whole fish have an effect on processed products such as fillets, were investigated aboard a coastal gillnetter and at a specialized processing factory. Damage in fish was significantly more likely for whole than filleted fish, and significantly more likely for longer soak times. With the optimum soak time, gillnets can deliver good quality fish.

In Paper VI, a stereo imaging method was identified, adapted, tested and used to quantify in-situ the movement of the leadline of light and heavy gillnets, deployed on the bottom in sandy habitats, using the Danish gillnet coastal plaice fishery as a case study. The direct physical disruption of the seabed of gillnets was minimal as the leadline was moving but not penetrating into the seabed. Whereas the general perception is that heavy gears are more destructive to the habitat, it was demonstrated here that light nets were moving significantly more than heavy ones.

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