



# Identifying choke species challenges for an individual demersal trawler in the North Sea, lessons from conversations and data analysis



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## A B S T R A C T

A likely side-effect of introducing the landing obligation of the 2013 Common Fisheries Policy into mixed fisheries is the occurrence of the “choke species” problem. When discarding no longer is an option, leasing quota or changing fishing practices remain important tools to avoid choke species. Here, the scale and tactics linked to using avoidance behaviour to reduce choke species is investigated by analysing the fishing behaviour of a single demersal trawler in the North Sea. Analysis combined qualitative information collected from through interviews with the vessel owner and skipper, along with quantitative analysis on fisheries data. From the interviews, saithe and cod were identified as potential choke species and subsequent analysis focused on these two species. The analysis of catch and quota composition showed that cod would choke the fishery early if no catch-quota balancing options were available, resulting in a 87% reduction in revenue, while saithe could choke the fishery later, resulting in a 43% reduction in revenue. Avoidance behaviour was difficult to detect from fisheries data, which was explained by avoidance taking primarily place through very fine-scale tactical choices rather than large displacements. Catch composition showed that saithe is distributed more patchily than cod, with most hauls containing small amounts of saithe and a few hauls containing large amounts. In conclusion this paper supplies an view on the choke species problem seen from the perspective of an individual fisher and highlights the amount of real-time tactical decisions and trade-offs that need to be made when operating in mixed-fisheries.

## 1. Introduction

When the landing obligation of the 2013 Common Fisheries Policy is fully implemented in 2019, and provided that it is accurately enforced and controlled, fishers will no longer have the option to discard, i.e. return fish to the sea, in order to avoid landing unwanted catches [1]. The landing obligation requires that all catches (i.e. everything retained in the fishing gear when hauling) of stocks under catch limits and/or with a legal minimum conservation reference size (MCRS) are to be recorded and, where applicable, counted against quotas. Some exemptions might apply, such as for protected species, for species with a high survivability and for small amounts of discards, that cannot be easily reduced further through selectivity and avoidance measures (*de minimis* exemptions). However, many species occur frequently as bycatch to the targeted species, especially in mixed fisheries, where it can be difficult to reduce catches of a single species when several species are caught together [2–4]. Thus, one of the main concerns raised against the landing obligation is the risk for early closures of fisheries, when the quota of one species is exhausted before the others. This is

referred to as the “choke species” effect. The choke species can be either target or bycatch species, and they can be limiting either because of low productivity of the stock and reduced fishing opportunities, or because of discrepancy between historical right allocation compared to current abundance (e.g. Northern hake) [5]

Within the EU, the national quotas are fixed shares of the overall TAC by stock, using the relative stability key established in the early times of the CFP [6]. They are themselves shared across the various quota users, using often complex allocation systems that differ from country to country. These various layers of quota sharing have traditionally been based on some historical records of landings, not of catches, and have largely not been updated over time in spite of changes in fisheries’ and fish stocks’ distribution. For some stocks, discarding has thus emerged from the mismatch between the catching capacity of an individual vessel and the vessels landing opportunities. Historically, this mismatch has been partially mitigated through bilateral quotas exchanges (“quotas swaps”) between countries, but uncertainty remains on how these informal agreements will develop under the new CFP [7]. Addressing this mismatch by renewing the allocation keys with the

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implementation of the landing obligation would thus in theory relax one of the main drivers of discarding, but in practice the political complexity of this update means that at the time of writing, it still appears unlikely to take place in European fisheries.

In Denmark, the demersal fisheries management switched in 2007 from a system based on weekly rations to a Vessel Quota Share (VQS) system, a form of individual transferable quota where the share is linked to the vessel, implying that quota transfer requires buying the corresponding vessel out. The shares were based on the 2004–2006 recorded landings, but not on total catches [8]. Thus, fishers were granted a fixed share of the national quota. However, as at the national level, the issue of quota mismatch between actual catch and quota allocation was created at individual level as well. To overcome this, fishers quickly formed quota pools, enabling the fishers to lease quota, either directly between vessels or through common pools (e.g. [www.puljefisk.dk](http://www.puljefisk.dk)), correspondingly to the national quota swaps. However, the situation might change with the landing obligation. Hatcher [9] predicted that fishers would likely have more difficulties to predict their own needs for quota, as the catches previously discarded would need to be landed and deducted from their quota. This would mean that fishers would become reluctant to lend quota to others to safeguard their own needs, and rental prices may increase, due to less supply and a larger demand. Thus, if the landing opportunities of the vessel cannot be adjusted to its catching capacity, the choke species issue will have to be addressed the other way around, by adjusting the catching capacity to its landing opportunities. Incentivizing fishers to reduce unwanted bycatch is indeed the underlying objective of the landing obligation. This takes place by modifying the catch composition of the fishing operation, either by switching to more selective gears [10] or through changes in when, where and how to fish [11,12]. Changes in gear selectivity have often proven effective in reducing bycatch, however the voluntary uptake of selective gears has so far remained very low by lack of appropriate incentives to fish more selectively. Additionally, the current technical measures regulations, along with complex approval guidelines, limits the possibility to develop new gears [13], although some work is ongoing to address this [14,15]. The other option is thus changing where, when and how to fish, also referred to here as avoidance behaviour, where the fisher selects areas known to contain few choke species or displace the fishery if a large catch of choke species is encountered. The effectiveness of avoidance behaviour depends on the skills and choices of the skipper; nevertheless, its outcomes can also remain uncertain if the species to be avoided is largely distributed over the same areas as the target species or has a patchy distribution in large numbers [9].

To investigate the scale and tactics linked to using avoidance behaviour to reduce the choke species problem, the fishing behaviour of a single demersal trawler in the North Sea was analysed. The aim is to understand how a fisher perceives and decides upon changes in behaviour, and to analyse whether these changes can be detected with high-resolution fisheries data derived from the vessel.

## 2. Material and methods

The analysis was based on a quantitative analysis of fisheries data from a Danish demersal trawler, supported by information collected from a suite of meetings and interviews with the owner and the skipper of the vessel. The vessel is a 28 m trawler, with at-sea packing facilities, conducting a mixed fishery primarily in the North Sea. The vessel was participating in a Fully Documented cod catch quota management (CQM) trial, where discarding was still allowed but all catches of cod were to be deducted from the vessel quota, against a 30% quota uplift on cod only [16]. As participant in the CQM trial, the vessel was conducting fully documented fishery (FDF), including remote electronic monitoring (REM) with CCTV cameras and reporting catches on a haul-by-haul basis. Additionally, the vessel was obliged to land all TAC species above MCRS [17]. Interviews with the owner and the skipper of

the vessel revealed that the main challenge during the CQM trials was to avoid cod (*Gadus morhua*) and saithe (*Pollachius virens*), as the vessels initial quota was not sufficient to land all catches of these species, when targeting valuable species such as monkfish (*Lophius piscatorius*) and hake (*Merluccius merluccius*). It was thus decided to focus the analyses on these two species, while all other species caught was grouped into a single group.

### 2.1. Data

Data from the vessel was collected both from the fisher and from the Electronic logbook and fishery auction. Data included position at haul-in, species composition in the landings, weight and value of landings, size sorting from the fishery auction, initial VQS of the vessel and quota lease through the period. The data also included information on cod discard collected from the participation in the CQM trial [16], where cod discard was estimated by electronic monitoring. Data from 2013 to 2015 were used, to investigate whether and how choke species were a problem for the fisher. During this period, the stock of cod in the North Sea and Skagerrak experienced a slight increase in biomass and Total Allowable Catch (TAC), while the TAC for saithe in the North Sea, Skagerrak and West of Scotland decreased by 28% whereas its biomass remained stable [18]. The data covered fishing operations in the years 2013, 2014 and 2015 and included a total of 140 trips with 47 trips annually in 2013 and 2015, and 46 trips in 2014. A trip lasted on average 7.4 days [2–11 days] and contained on average 15 hauls [2–27 days]. The total landings in the years were between 1023 t and 1357 t, with approx. 20% cod, 35% saithe and 45% other species. There were no records of discards of saithe, however as the vessel was a part of a cod quota management scheme, discards data on cod were available. A total of 6 t of cod was discarded over the three years (2013:1.6 t, 2014:2.5 t, 2015:1.9 t) with an average discard ratio per trip of 0.2%. The low discard was a part of the CQM directives, as the vessel was only allowed to discard damaged fish and fish below MCRS. The estimated discard ratio for the entire stock of North Sea cod is around 25% [19]. Thus, the discard was a negligible part of the catch and was not included in the subsequent analysis.

### 2.2. Interviews

Knowledge on fine-scale tactics was obtained through informal discussions and interviews with the vessel owner and the vessel skipper (hereby referred together as “the fisher”) in three meetings, conducted prior and during the analysis work. The interviews aimed to obtain information on perceived current and expected challenges with the landing obligation, along with fishing strategies during the period 2013–2015. The unstructured interviews were chosen to maintain an open dialogue, where the interviewees would not feel restricted by a line of questioning and where unforeseen topics could arise.

### 2.3. Time of choke and quota usage

Estimation of if and when a choke species problem occurs in the fishery were conducted, using an analysis of the temporal development in quota accumulation and quota usage. Catches data was extracted from the electronic logbook of the vessel and the accumulated catches across the year for each of the three years were calculated. The time of year where the catch accumulation intercepted with the start of year quota was used as an indicator of when the fishery would be choked if no other quota acquisition options were available. This analysis was supplemented by a quota acquisition analysis, where the quota accumulation across the year, which included quota leasing, adjustments and CQM trial quota additions, was calculated. This was conducted to evaluate the tactical decisions made by the fisher to acquire quota in relation to the catch.

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