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The landing obligation in view of different management regimes

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ABSTRACT

The European Union adopted a landing obligation in 2015 implying that all catches of fish subject to quota management must be landed. We compare and contrast the economic consequences for fisheries of the landing obligation in view of the management system on which it is super-imposed. Four types of management are assessed: open access, shared quota, individual transferable quotas and economically optimal fishery. A standard non-linear programming bio-economic model is applied, providing illustrative numerical examples based on hypothetical parameter values. It is shown that the landing obligation has the strongest influence on both industry profitability and catch of unwanted species in the case of management with shared non-transferable quotas. In addition, the move from management with shared quotas to individual transferable quotas (ITQ) increases industry profitability and reduces unwanted catches. It is concluded that the effects of introducing the landing obligation in ITQ management systems are complex, but small.

1. Background and purpose

Since the adoption of the Common Fisheries Policy (CFP) of the European Union (EU) in January 1983, the European Commission has repeatedly addressed the issue of discarding fish (EC, 2002, 2007, 2009; Borges, 2015), until the landing obligation (LO) was introduced in 2013 with implementation from 2015 (EC, 2013). This rule of landing is obligatory for all fisheries targeting species subject to TAC/quota management, independently of other management measures adopted by the individual member states. TACs (total allowable catches) are fixed for fish stocks, while quotas are allocations of TACs to Member States. The LO applies to all EU waters, however, the LO is gradually extended to apply also to species that are not subject to TAC but only to minimum landing sizes for the Mediterranean. It must be expected that the effects of the LO, both with regards to fisher economy and to reduction of unwanted catches, will depend on the management system on which the LO is superimposed. This paper investigates how the LO will affect fisher behaviour and profitability under management systems evolving from open access to fully-implemented management with individual transferable quotas (ITQ).

Generally, the fisheries of the EU are diverse, with fish ranging from high-value species for human consumption to fish used for fishmeal and fishoil. A number of technological and biological interactions make it difficult for fisheries to be completely selective (Catchpole et al., 2005; Quirijns and Pastoors, 2014). Thus, it can be an economic advantage for fishers to discard fish, for several reasons, such as that: (i) the quota management in place may limit the catch possibilities in mixed fisheries, thus creating incentives to discard low quota species to be able to catch a larger part of the quotas of other species and/or to highgrade, i.e. discard small low-value fish in favour of larger higher-value fish, and (ii) market and sorting inconsistencies, e.g. discarding of low-quality or damaged fish (Catchpole et al., 2013).

Total allowable catches (TAC) were introduced and allocated to Member States as quotas with the CFP of 1983, using the relative stability principle. Distribution of the quotas between fisheries within a member state was, and is, the responsibility of the individual member state, and this ranges from shared quotas to ITQ systems. However, all member states had to apply a minimum landing size (MLS) of fish for human consumption, introduced with the CFP of 1983, combined with and supported by minimum mesh size regulations, leading to compulsory discard of fish below the minimum size. The technical measures apply to all EU waters. Mesh sizes in fishing gear and minimum size of fish mainly apply to the EU-waters outside the Mediterranean. For the Mediterranean, a range of other technical measures are used to take into account the specific biodiversity of this area (EC, 1998; Reeves et al., 2008). From a conservation point of view, the MLS regulation would help keep stocks at sustainable levels if (i) only fish above MLS was caught, or (ii) if fish discarded below MLS survived. However, in a strict sense, the MLS regulation would only assure sustainability if the MLS was above the age of first maturity.

Three aims of the minimum landings size principle were of importance from an economic point of view.

- Protect the market for human-consumption fish as a lack of

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selectivity in fishing gear caused different species and fish of different sizes to be caught together as is the case for e.g., sole and plaice, cod, haddock and whiting (Quirijns and Pastoors, 2014). Thus, in multi-species, multi-fleet fisheries, temporary large landings of small fish for human consumption would disrupt the market and exhaust the quota. Often, high grading (i.e., discarding fish to make room for more valuable fish) was carried out to make the fishery more profitable. Furthermore, it could be profitable in the industrial fisheries to catch e.g., small haddock and whiting for fishmeal and fishoil which deprives fleets fishing for human consumption of income opportunities. Minimum landing sizes aided in preventing such market disturbances, and it was thought to benefit the growth of fish stocks if catches of small-size fish could be avoided. This process was supported by the introduction of producer organizations (POs), whose aim initially was to stabilize the fish markets and secure fisher's income through purchasing fish that did not fetch a minimum reference price for later processing and marketing. Later POs evolved in some member states to include also management of the quotas.

- Impact fishers' behaviour. The hope was that fishers would avoid targeting certain species and sizes of fish if it was illegal, and thus costly, for then to carry such fish on board.
- Avoid early stops in yearly fisheries because of choke species. This was a problem particularly for the industrial fisheries, in which large bycatches of fish that otherwise could be used for human consumption and hence exhaust the quota were caught in small mesh gear, and furthermore in mixed demersal fisheries where low quota species could choke a fishery early in the year.

However, the possibility for a discard ban was discussed with the revision of the CFP in 2002, given that discard was, and is, seen as waste of possible food resources and as accelerating the already severe decline observed in many fish stocks for human consumption (EC, 2002, 2007; Borges, 2015). Along with the political development, an increasing number of activities took place in terms of international conferences (e.g., FAO, 1996a,b; Pascoe, 1997; NCM, 2003), and purely theoretical work specifically addressing the subject of discard starting in the mid-1990s (Ward, 1994; Boyce, 1996). Ward et al. (2012), and Frost et al. (2013) provided reviews of later results related to the effects of discard. Before 2002, several countries, e.g., Iceland, the Faroe Islands and Norway, had already implemented a discard ban and prohibited fishing in certain areas if the landings of small fish became too high. And also in other parts of the world there has been a growing interest for alleviating discard and misreporting.

Thus, the introduction of a LO with the revision of the CFP adopted in 2013 can be seen as a natural and expected development towards a long-term sustainable fishery regulation regarding both decreasing the economic loss from fisheries due to quota collision and increasing the sustainability of fish stocks. However, given that the LO is a command and control measure and not an economic measure, the effects of this on fishers' behaviour and profitability are still uncertain (Borges, 2015). It must be assumed that these effects will depend on the management system on which the LO is super-imposed, and thus that the LO may affect fishers from different member states, fishing on the same fish stocks, but having different management systems in place, differently. This question is the focus of this paper.

Fisher behaviour regarding unwanted catches, i.e., catches of non-target species in open access and ITQ-managed fisheries, has previously been assessed (Ward, 1994; Boyce, 1996; Turner, 1997). These illustrative economic theoretical models typically include two species (target and non-target) and two fleets exploiting one or both species. The models are used to identify effort levels and effort allocation that leads to maximization of profit (or resource rent). Other theoretical approaches in the 1990s addressed high grading. Seminal papers in this field are Arnason (1994) and Anderson (1994), which show that a traditional ITQ system increases the incentive to high grade. Turner (1997) analysed a value-based ITQ system and found an optimal level of high grading from a welfare-economic point of view. While it seems obvious that fishers high grade to make the best possible use of their quota share in the ITQ management system, it is less clear why they want to high grade under open access or effort management rather than land the whole catch. The reason is high opportunity costs of landing fish, particularly the limited hold and processing capacity on board the vessel, along with the distance between the fishing ground and the port (Vestergaard, 1996). The seminal paper regarding compliance with the regulation is Sutinen and Andersen (1985), and in a recent paper, Hatcher (2014) addresses the incentives to discard and shows how the penalty for discarding/illegal landings, costs of discarding and the quota prices interact. He concludes: "Whether or not a discard ban is potentially welfare improving in any given situation, therefore, will depend on a number of complex factors, of which the regulatory cost of imposing such a ban is but one." Although compliance is an important topic it is not included in our investigation, in which full compliance is assumed for all scenarios.

Several recent papers have addressed the incentives for and effects of the LO. Condie et al. (2013) argue against the opinion of the EU Commission that a discard ban will create strong incentives for more selective fishing practices and a reduction in unmarketable catches of all species. Guillen et al. (2014) address the MSY objectives and say that in certain fisheries biomass at MSY can be significantly different when accounting or not for discard. Prellezo et al. (2016) use a bioeconomic simulation tool (FLBEIA) to anticipate the effects of the landing obligation on the Bay of Biscay Basque trawling fleet and find that there is a negative short term economic effect of the landing obligation and therefore incentives to improve the selectivity and to reduce the discard levels. Simons et al. (2015) investigate two discard prevention strategies for the North Sea saithe fishery where cod is a by-catch species. One was beneficial in protecting the saithe and cod stocks and in increasing net profits while the other had a negative impact on the saithe stock. Batsleer et al. (2016) model the potential effects of a discard ban on the annual fishing strategy of individual fishers in a mixed fishery under individual quota management and apply it to the North Sea beam trawl fishery. It is shown that a discard ban provides an incentive to implement more selective fishing gears. Alzorriz et al. (2016) analyse the selective properties of a bottom trawl fitted with different gear types (mesh sizes) used by Basque bottom otter trawlers and argue that the landing obligation will create an incentive to improve gear selectivity. Garcıa et al. (2017) evaluate the economic impact of the landing obligation policy on the Spanish demersal fleet operating in the Iberian Sea region, and show that the fleet dynamics impacts the result and the landing obligation should be accompanied by a management system with multi-stock reference points. Villasante et al. (2016) investigate the potential social and economic impacts of the discard ban in European small-scale fisheries and critical factors for its successful implementation and argue that compliance with the landing obligation of the small scale fisheries will be difficult to achieve without high economic costs. Finally, Heath et al. (2014) investigate discarding by fisheries in an ecosystem context. Discarded fish are food for a range of scavenging species, thus ending discard practises may have ecological consequences.

While most of the papers from the 1990s, discussing discarding from a theoretical and general point of view, address specific management systems, the recent papers directly concerned with the EU LO do not address the underlying management systems explicitly and the impact of the LO on fisher behaviour and profitability subject to these systems. Thus, the aim of this paper is to investigate how different management systems affect economic performance when catches of fish smaller than a reference size must be discarded or landed respectively. The paper specifically addresses management with shared quotas contra ITQ management, and looks at how fishers' profit-maximizing behaviour encourages the discarding of fish and what the economic repercussions of the landing obligation are for these management cases. The ITQ