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Likely status and changes in the main economic and fishery indicators under the landing obligation: A case study of the Basque trawl fishery

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ABSTRACT

We modelled fleet dynamics and the economic impact of three implementations of the EU landing obligation for fisheries, and contrasted the results with those obtained under a scenario of no landing obligation. Simulations were performed using a dynamic state variable model of effort allocation for the Basque trawl fleet, assuming that the landing obligation had been implemented in 2012. The three implementations of the landing obligation involved different policy arrangements: (i) quota increases; (ii) international swapping of quotas; and (iii) inter-species quota flexibility. All three scenarios resulted in changes to fishing patterns caused by choke species and improved selectivity of harvest, but also resulted in a negative short-term impact on the economic performance of the fleet. We report average reductions in net revenue of up to 60% when compared with results obtained under a no landing obligation scenario. Our model results suggested that these negative short-term impacts could be alleviated by incorporation of inter-species quota flexibility in the implementation of the landing obligation. Our results indicate that there will be a strong incentive to use this policy arrangement to alleviate the choke effect problem where species with limiting quotas constrain the fishery.

1. Introduction

All current European policy frameworks for the marine environment are aimed at the progressive implementation of an ecosystem approach to fisheries, to ensure a stable, secure, and healthy food supply for EU citizens. An important component of the new EU fisheries policy is the introduction of a landing obligation (also known as a discard ban) prohibiting the at-sea disposal of commercially valuable species (Article 15 in EU, 2013; Borges, 2015). Since 2015 all catches of quota-regulated species must be recorded and limited by species-specific total allowable catches (TACs). Furthermore, fishing vessels must have adequate quotas for all species they are likely to catch during the course of their operations. Once a quota for any stock is exhausted, the fisheries are either restricted or closed, even if quotas are still available for other species.

The purpose of the landing obligation is twofold: to create economic incentives for the industry to reduce the capture of unwanted species and undersized individuals through improvements in selectivity (Kindt-Larsen et al., 2011; Mangi and Catchpole, 2014) and to improve accuracy in recording catches (FAO, 1996). However, in mixed fisheries, there is a potential mismatch between allocated TACs for different species and their catch distribution (Kraak et al., 2013; Poos et al., 2010). While the ecological and economic effects of the landing obligation are unknown for many mixed fisheries, it is likely that fishing fleets will respond adaptively to the new policy, and will attempt to sustain viable fisheries under the new policy constraints (Alzorriz et al., 2016; Batsleer et al., 2016). This will likely occur via the development and adoption of selective devices (Alzorriz et al., 2016; Catchpole and Gray, 2010; Kindt-Larsen et al., 2011) or adjustments in fishing behaviour (Batsleer et al., 2016; Condie et al., 2014; Prellezo et al., 2016b; Simons et al., 2015).

A total discard ban may compromise the profitability of some discard-intensive fisheries (at least in the short term) because retaining, manipulating and landing size categories or species that were previously discarded will reduce income-per-unit-effort (Condie et al., 2014). However, Article 15 of the Common fisheries Policy (CFP) states that the following flexibilities and exemptions to the landing obligation will be accommodated: de-minimis exemption of up to 5% of the total annual quota to be discarded under certain circumstances (and up to 7% and 6% in the first two years respectively), quota swaps between EU member states, banking and borrowing (year-to-year transfer) of quotas, and inter-species quota flexibility allowing up to 9% of the

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quota for one species to be used for landing another species (EU, 2013).

The Spanish trawl fleet operating in the Bay of Biscay, and particularly that of the Basque country, comprises vessels using either bottom otter trawl (OTB) or high vertical opening pair bottom trawl (PTB; Iriondo et al., 2008). The trawlers using OTB fishing gear are able to exploit a mix of species, with the main target species being anglerfish (*Lophius budegassa* and *Lophius piscatorius*), megrim (*Lepidorhombus whiffiagonis*), and hake (*Merluccius merluccius*). Depending on the season and quota availability, this fleet also targets red mullet (*Mullus surmuletus*), squid (*Loligo* spp.), pouting (*Trisopterus* spp.), sole (*Solea solea*), horse mackerel (*Trachurus trachurus*) and mackerel (*Scomber scombrus*; Iriondo et al., 2008). The fleet using PTB mainly targets hake (80–85% of total catch). In these fleets, discarding of target and bycatch species can be substantial. For example, in 2012, discards represented about 60% and 15% by weight of the total estimated catch of OTB and PTB, respectively (12,991 t and 6622 t, respectively; Rochet et al., 2014). Around 80% of the discards are discarded to adhere to fishing regulations. Vessels in this fishery discard catch when there is a lack of quota for certain species (mackerel), when captured individuals are smaller than the minimum landing size (hake), or in the absence of a market (horse mackerel and blue whiting) (Rochet et al., 2014). These activities typify multi-species fisheries: species with restrictive quotas are discarded to maximize the quota use for species with ample quotas (Batsleer et al., 2015). The introduction of the landing obligation is thus expected to negatively affect the fishery as it will reduce the short-term economic flexibility provided by discarding as a means of accommodating several quota species for which single-species quotas are set.

Here we use a dynamic state variable model (Clark and Mangel, 2000) and data on the fishing activities of Basque trawlers in the Bay of Biscay from 2003 to 2012, to project the likely effects of a landing obligation in this multispecies, quota-regulated, fishery. Using ecological and economic indicators, we compare the response of the fleets under a scenario that permits discards (the existing policy, Scenario I) to three landing obligation scenarios, involving a complete discard ban with quota increases (Scenario II), international quota swaps (Scenario III), or use of inter-species quota flexibility (Scenario IV).

2. Methods

2.1. The Basque trawl fishery

Data for Basque trawlers for the period 2003–2012 were collected under the EC Data Collection Framework (EC, 2008). Trawlers averaged 37 m in length, with an average engine power of 465 kW. As described above, trawlers used two gear types (OTB and PTB) and fished in one of three fishing areas (Fig. 1; ICES sub-areas 6, 7 and 8 [divisions 8a, 8b, and 8d, which we refer to as sub-area 8 for simplicity]). Vessels with OTB fishing gear fished in all sub-areas, while those with PTB fishing gear fished in sub-area 8 only. We compiled data for four stocks (northern hake, megrim, northeast Atlantic mackerel, western horse mackerel) that are likely to be affected by a landing obligation policy because they are managed under TAC constraints, and in some cases show evidence of high discard rates. We compiled data on catches of other fish species (e.g. anglerfish, red mullet, squids, pouting, sole, conger (*Conger conger*), blue whiting, haddock, skates and nephrops) as a single group (which we refer to as 'others'). Catches of the four stocks amounted to 95% of the total landings of these fleets and 98% of gross revenue. Catches of the 'others' group contributed to the gross revenue of the fleet, but did not constrain their fishing opportunities. These data were used to estimate seasonal size-structured landings, discards, and fishing effort. Catches were size structured using the regulatory Minimum Conservation Reference Size (MCRS; EC, 1998), apart from the 'others' group that was simply categorized as either discards or landings. MCRS for hake, megrim, mackerel and horse mackerel were 27 cm, 20 cm, 20 cm and 15 cm respectively.

From 2003 to 2012, 8669 trips were undertaken by the fleet (Table 1). Trips generally lasted 6–7 days. Average catch was 19,000 t per year. Average weight of discards was approximately 6800 t, ~13% of which was discarded because individuals were below MCRS guidelines (Table 1). Catches of different species and size classes varied with season, fishing gear and fishing area. The fishing effort per vessel and per season varied with the type of fishing gear used and the fishing area (Table 2).

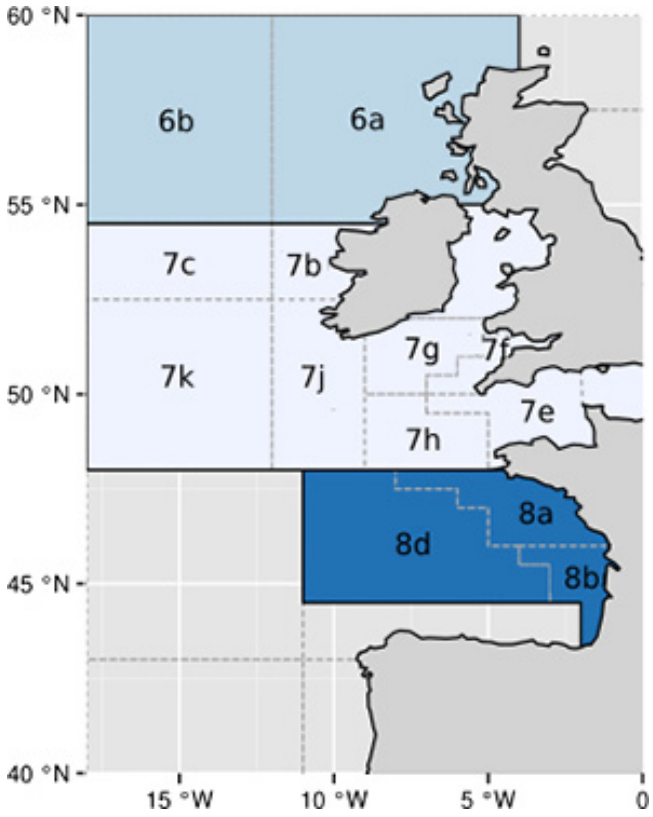

Fig. 1. Study area in the Bay of Biscay showing the fishing areas where the Basque trawler fleet operates.

Information about the cost structure of Basque trawlers was obtained from accounting data (Prellezo et al., 2016a). The variable costs represented around 86% of the total costs, and included fuel costs (~40%), crew share (~35%), gear maintenance (~4%), and landing costs (~5%), including cost associated with handling, transport, boxes and ice. Fuel costs depended on gear used, trip effort and fuel price. Fuel costs were estimated to be approximately 1240 € day^{-1} (Prellezo et al., 2016a). Gear maintenance costs were assumed proportional to fishing effort, landing costs proportional to the total weight landed, and crew share variable costs proportional to the landings income. The price of the marketable catch of each species was calculated from the 2012 sales slip data. In the model, prices were assumed to be constant over time and independent of supply (Table 3).

2.2. Catch quota calculations

The Basque trawl fleet was managed through total allowable landings (TALs) and total allowable effort (TAE), as well as other technical and physical measures (Iriondo et al., 2013). During the study period, fishing effort was not constraining by the TAE due to historical reductions in the fleet size (Iriondo et al., 2013; Prellezo et al., 2016a). The EU allocates landing quota TALs across Member States are based on the principle of relative stability (Table 4 for 2012) (EU, 2013). Quotas, or parts of, could be swapped between Member States, to accommodate annual fishing opportunities distinct from those provided by the relative stability principle. Spanish quotas (B in Table 4) were divided