Fisheries Research 181 (2016) 116–126

Contents lists available at ScienceDirect

Fisheries Research

journal homepage: www.elsevier.com/locate/fishres

A new approach to determine the distributional effects of quota management in fisheries

Manuel Bellanger*, Claire Macher, Olivier Guyader

Ifremer, UMR AMURE, Unité d'Economie Maritime, BP 70, F-29280 Plouzane, France

ARTICLE INFO

Article history:
Received 19 December 2015
Received in revised form 1 April 2016
Accepted 2 April 2016
Handled by A.E. Punt
Available online 22 April 2016

Keywords:
Distribution
Inequality
Producer organizations
Catch shares
Common-pool resources
Fishery management

ABSTRACT

Quota allocation mechanisms have distributional effects that are highly relevant to the economic organization of fisheries. In France, where fishing allocations are non-transferable, quotas are shared among Producer Organizations (POs) based on the historical landings of their members. Each PO is then responsible for implementing their own internal rules that provide individual or collective allocations to their members. This study investigates the distributional effects of the various quota management systems adopted by POs on quotas and production for the Bay of Biscay sole fishery. A comparison between initial allocations by vessel based on historical landings and actual observed landings is presented. Inequality metrics are used to quantify distributional effects, and a new method that is based on the decomposability property of the Theil index is introduced. Results show that the French management system successfully avoided concentration of production while reducing the fishing capacity through decommissioning schemes. The non-transferability of fishing allocations is a critical element that favored this outcome by allowing POs to control the distribution of catch shares in the fishery. Besides, it appears that the allocation strategies developed by POs were notably influenced by their local roots and their fishing fleet profiles. The various quota allocation systems among POs had contrasting effects on vessels' production, including greater equity within particular subfleets, benefits to vessels most dependent on sole in most POs, and benefits to the small-scale fisheries in a few POs.

1. Introduction

In Europe, the management of fisheries mainly relies on Total Allowable Catches (TACs) set by fish stock and distributed to member states according to historical allocation keys (Holden, 1994). Each member state is then responsible for managing its own quotas, and different countries allocate their quotas among producers using various systems (Le Floc'h et al., 2015). In its Green Paper on European Union Common Fisheries Policy (CFP) reform, the European Commission (2009a) suggested that individual Transferable Fishing Concessions (TFCs)—a right-based management system similar to the well-known Individual Transferable Quotas (ITQs)—should be considered, at the European level, as a potential solution to tackle the deep-rooted problem of overcapacity seen as the main structural failing of the CFP. Some EU countries (The Netherlands, Denmark, Spain and the United Kingdom) have actually implemented ITQs systems in the past decades (González Laxe, 2006; Marchal et al., 2009; Aranda and Murillas, 2015). However, the French administration, following the position of fishermen's representatives, took position against the generalization of ITQs (Gouvernement Français, 2009; p.29) in a memorandum arguing that ITQs would eventually result in fishing rights concentration and destabilization of local fishing communities. In order to maintain economic and social equilibriums in French territory, the French administration supported the current quota co-management system implemented by Producer Organizations (POs) (Larabi et al., 2013).

Quota allocations in catch share programs deal with important issues because of their biological (Branch, 2009), economic (Squires et al., 1995; Grafton, 1996; Asche et al., 2008) and social (Pálsson and Pétursdóttir, 1997; Soliman, 2014) implications. Issues of wealth redistribution and heterogeneity may disrupt the performance of quota management systems (Karpoff, 1987; Grainger and Costello, 2015) and distributional effects of quota allocation on production and economic returns are critical towards addressing issues of fairness and acceptability (Copes, 1986). Yet these distri-

* Corresponding author.
E-mail address: manuel.bellanger@ifremer.fr (M. Bellanger).

http://dx.doi.org/10.1016/j.fishres.2016.04.002
0165-7836/

butional effects are rarely studied and many authors have argued that they should be given more attention (e.g., Bromley and Bishop, 1977; Copes, 1986; Copes and Charles, 2004; Matthíasson, 1992; Wilen and Casey, 1997; Guyader and Thébaud, 2001; Thébaud et al., 2012). These issues are particularly significant in the French context where large-scale and small-scale fisheries coexist (Daurès et al., 2009; Guyader et al., 2013) and equity in rights of access to fisheries resources is at stake (Le Gallic et al., 2005; see also Gray et al., 2011 for an English case study). Quota distribution also relates to environmental concerns about the usage of active (e.g., trawls) vs. passive (e.g., gillnets) fishing gear for the harvest of demersal species (Branch, 2009). Besides, the French quota management system is based on POs that have strong territorial roots and as such their strategies in terms of membership dynamics (e.g., POs are not required to accept any membership requests from fishermen) and quota distribution may also influence the rights of access to resources of local fishing communities. This study therefore addresses the questions of quantifying the distributional effects of the French quota governance system and whether the quota management by POs limits inequalities and concentration of production.

The debate that occurred in France—and in other EU countries—during the Common Fisheries Policy reform raised the question of which quota management system should be adopted (European Commission, 2010). Two main options were Individual Transferable Quotas (ITQs) markets and co-management systems where allocations are granted to groups of harvesters. Extensive literature exists on their respective potential to provide solutions as sustainable fishery management systems (e.g., Jentoft, 1989; Ostrom, 1990; Copes and Charles, 2004; Grafton et al., 2006; Costello et al., 2008; Gutiérrez et al., 2011; Deacon, 2012), but little is known about their influence on wealth distribution in terms of winners/losers within a fishery. There are two main approaches used to study distributional effect in the fisheries economics literature. The first uses theoretical models to investigate outcomes of alternative management regimes (Dupont and Phipps, 1991; Salvanes and Squires, 1996; Armstrong and Clark, 1997; Sumaila and Armstrong, 2006). The second is the application of inequality metrics to empirical data to quantify the changes in harvest distributions, often related to a change in management such as the introduction of ITQs (Connor, 2000; Hamon et al., 2009). Our paper falls into this later type of approach and addresses the case of PO-based co-management, as implemented in some EU countries, and which has not yet been empirically addressed in a quantitative way.

Quantifying distributional effects first necessitates a clear understanding of the initial situation or initial quota allocation from which redistribution occurs. Then it requires selecting appropriate metrics. The inequality metrics that are most commonly found in the fisheries economics literature typically measure inequality in the population as a whole (Hamon et al., 2009; Adelaja et al., 1998; Gauvin et al., 1994), and not much attention is paid to the inequality *within* and *between* subgroups of vessels (Armstrong and Clark, 1997). In particular, consideration of different scales offers insight for the analysis of distributional changes to the primary and secondary contributors to the fishery, which is essential in the context where large-scale and small-scale fisheries operate alongside one another using various fishing gears. Our paper discusses the relevance of different inequality metrics for the exploration of distributional effects of quota management and introduces a new method which uses the decomposability property of the Theil index (Theil, 1967; Bourguignon, 1979) to decompose the inequality into subgroups of vessels and determine the *between* and *within* components.

The Bay of Biscay common sole (*Solea solea*) fishery was the first fishery where individual vessel quotas (IVQs) were used in France in 2006, and this management innovation tends to be generalized to many of the most important French fisheries (Le Floc'h et al., 2015). This paper therefore uses this influential fishery to investigate the distributional effects of the quota management systems adopted by POs on sole landings based on the 2011 reference year. Actual landings observed were compared to a simulated initial situation based on historical landings by vessel that corresponds to the current rule defined by the French administration for allocating collective sub-quotas to POs and could virtually be used as an individual initial allocation in an ITQ system. Decompositions by fishing gear used, length class and maritime district were employed to analyze the differences between the initial and the final situations.

1.1. Structure and evolution of the Bay of Biscay sole fishery

The demersal fisheries of the Bay of Biscay—i.e. operating in ICES divisions VIIIa-b—are commonly referred to as mixed fisheries, because the catches of vessels operating in this area are usually composed of a mix of various species. The common sole fishery has a long history of being one of the main fisheries in the Bay of Biscay as sole has been the first species in value for the last several decades. These fisheries are mainly composed of French vessels that catch about 92% of the TAC, and trawl and gillnet are the main fishing gears used.

In 2011, the French Bay of Biscay sole fishery was composed of 472 vessels that landed more than one ton of sole (Table 1). The number of vessels operating in the sole fishery (Fig. 1a) has been decreasing between 2000 and 2011 (−21%), due mainly to decommissioning schemes (Quillérou and Guyader, 2012).

Total landings of sole in 2011 were 4259 t (Fig. 1b) and generated gross revenue of 54 million euros. The sole gillnetters were the greatest sole producers (22.6 t per vessel in average) as well as the most dependent on this species (57.4% of their gross revenue in average). Their contributions to the fishing mortality of sole were about 68%. The mixed gillnetters (that catch a mix of species) constituted a smaller fleet less dependent on sole, with smaller vessels and smaller crew sizes than the sole gillnetters. The trawlers—for which the sole could either be a target species or a bycatch—accounted for more than half of the vessels participating in the fishery. The Nephrops trawlers can be differentiated by their degree of specialization—i.e. the share of their gross revenue depending on nephrops (*Nephrops norvegicus*)—which also corresponds to diverse fishing strategies along the course of the year (Macher et al., 2011; Raveau et al., 2012). Although their dependence on sole was quite low, their contribution to sole fishing mortality was significant (respectively 8% for the non-specialized nephrops trawlers and 7% for the specialized nephrops trawlers). The mixed bottom trawlers catch a mix of species, including hake (*Merluccius merluccius*), nephrops and sole. The inshore mixed bottom trawlers had an average dependency to sole of 19.4% and average sole landings of 3.2 t whereas offshore mixed bottom trawler were less dependent on sole (8.6%) and had greater landings (5.5 t).

1.2. Quota co-management

Common sole in the Bay of Biscay has been subject to an EU TAC since 1984 that is divided into Member State quotas according to fixed historical keys (Holden, 1994), and the French share accounts for more than 90%. According to the French quota co-management system, the national quota is shared out into sub-quotas per PO as defined by legal statutes dating from 2006 (JORF, 2006). The POs are groups of harvesters that manage collectively-granted fishing allocations. They are geographically-relevant – typically, a PO has its headquarters in a fishing harbor city and most of its members are from the same area, although it is not a rule and there are no area restrictions. They were not established on target species cri-