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Modelling the fishing costs of French commercial vessels in the Bay of Biscay

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ABSTRACT

Ten years after the start of the European Data Collection Framework the availability of cost indicators for assessing the economic status of fisheries or bio-economic modelling is still deficient. Moreover, economic time series are difficult to maintain due to fishermen weariness and sample coverage is often insufficient. To overcome these problems, the paper builds predictive models per operational cost category (fuel, landing, other variable, fixed, salary and total) for the French Bay of Biscay fleet. The cost models had good fit and stressed the key role of gear and vessel size (length mostly) for explaining fishing costs. They suggested that only a small list of variables was needed to predict costs (days-at-sea, total revenue, vessel age, length and power, district and fishing zone). These variables are easy to obtain for all vessels. In addition, some fitted cost models (total, landing and fixed costs) could be applied to the neighbouring English Channel, which suggested similarities between their fishing cost structures. Finally, the comparison of design-based and model-based cost estimates for the Bay of Biscay French fleet confirmed that modelling fishing costs on the basis of a small set of explanatory variables is a good alternative to design-based estimates which generally require costly annual sampling programs.

1. Introduction

Since the publication of the FAO Code of conduct in 1995, consensus exists on ensuring long term sustainability of fisheries. More recently and particularly in the context of the EC reform of the common fishery policy (CFP), this objective is reaffirmed, considering ecological sustainability as well as economic and social ones. The collection of data for producing relevant economic fisheries indicators has been a big challenge for many countries for many years. These economic indicators are necessary for the assessment of the economic performance of fleets and fisheries (Ceriola et al., 2008; Anderson and Guillen, 2009; Brinson et al., 2009; Gasalla et al., 2010), for bioeconomic analyses and impact assessments of management measures (Salz et al., 2010; Simmonds et al., 2011; Prellezo et al., 2012) or analyses of optimal size and structure of fishing fleets (Bjorndal and Gordon, 2001; Pascoe, 2007). The data needs have recently considerably increased with the implementation of the Ecosystem Approach to Fisheries (EAF) (Garcia and Cochrane, 2005; FAO, 2005; Hilborn, 2011) for which the entire fishery system is to be considered in order to capture all the users' response to changes in resource dynamics (Salas and Gaertner, 2004).

Since 2001 under the EU Data Collection Framework (DCF), it is compulsory for EU member states to collect yearly cost and earnings data for commercial fishing vessels at national level. Cost data are collected through accounting data or face-to-face surveys (Le Floc'h et al., 2008; Le Corre et al., 2010). But increasingly, fishing firms are reluctant to provide economic information which they consider closely linked to their individual fishing strategy. Finally, information on fishing costs in most countries and regions of the world is still scarce, widely scattered and incomplete (Lam et al., 2011). For instance, the European Annual Economic report (Anderson and Guillen, 2009) focuses only on the important fleets at the European level, neglecting a large part of the coastal fisheries (Guyader et al., 2007). Even the DCF economic programme is now considered insufficient to support fishery management (Simmonds et al., 2011) because the available aggregated economic indicators do not reflect the situation of certain fisheries (see Commission Decision 2010/93/EU, Appendix III).

The challenge of insufficient cost data was recently faced by Rochet et al. (2012) when trying to develop a model coupling ecological, biological and economic components for French fisheries in the Bay of Biscay. Given the large number of commercial fishing fleets competing in the Bay of Biscay and their heterogeneity in terms of technical features and catch strategies (Daurès et al., 2009), the non-availability of economic time series data at the required regional and fleet scales hindered taking into account all vessels.

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To overcome the lack of cost data, a range of predictive models of operational costs are presented here.

To model fishing costs they need to be differentiated by type (or category) and subcategory (Davidse, 1993; Whitmarsh et al., 2000). It is common to distinguish between variable (or running) costs, fixed (or vessel) costs, crew payments and capital costs. The first two are operational costs and refer to a short term consideration of economic performance while capital costs, including depreciation and opportunity costs, are important for a long term perspective of fisheries performance (Le Floc'h et al., 2008). Variable costs are costs varying with fishing effort and commonly include costs linked to items consumed during the fishing trip (fuel, ice, bait, food) plus landing costs (Brinson et al., 2009). Fixed costs are supposed to be constant whatever the level of the fishing effort and mainly concern repairs and maintenance costs and insurance premiums. Crew payments or salary costs include wages and social payments (social security costs).

In France, a cost and earnings data collection program was started in 2001 at national level and since then very detailed economic variables (related to the previous year) are collected annually through a questionnaire (Daurès et al., 2008). Based on a data set of annual vessel costs for French vessels fishing primarily in the Bay of Biscay from 2000 to 2009, the first part of this study aimed to find the best model for four cost categories (*fuel cost*, *other variable costs*, *total fixed costs* and *salary costs*) using as explanatory variables basic vessel information which is easily and broadly available. We started with a set of a priori explanatory variables derived from the literature for fishing effort, fishing methods and/or vessel features. This part of the study was not intended to estimate short or long-run cost functions (sensu Pascoe, 2007) but rather to investigate how much the fishing strategy described by the gears used and the vessel technical features (length, fishing power, crew size, age of vessel) influenced fishing costs, and which cost category the variables could actually explain. In addition to the cost category models, two additional models were built in a similar manner, one for *gross added value* and one for *total costs*.

The second part of the study dealt with the generality of fishing cost structures by comparing the Bay of Biscay and the neighbouring English Channel. The question addressed is which of the models parameterised for the Bay of Biscay also performs well for the English Channel, which would make some fisheries economic analyses applicable for the entire French Atlantic shelf fishery.

In the final part of the study the precision of model-based cost estimates for the Bay of Biscay fleet was compared to that of design-based cost estimates. If there is good correspondence between the two estimations this might indicate ways to optimise the annual cost data collection under the DCF.

2. Material and methods

2.1. Data

Economic sampling data from French vessels operating primarily in the Bay of Biscay for the period 2000–2009 were used. These data were collected in face to face questionnaire interviews of a selection of vessel owners, stratified by harbours and vessel characteristics (size, gears). The vessel sampling strategy is proportional random with some vessels being kept in the sample for several years to increase the response rate, see full description in Van Iseghem et al. (2011). The economic sample data covered the range of vessel sizes about proportionally in all years except for larger vessels, which are generally bottom trawlers, which were under-represented (Fig. 1).

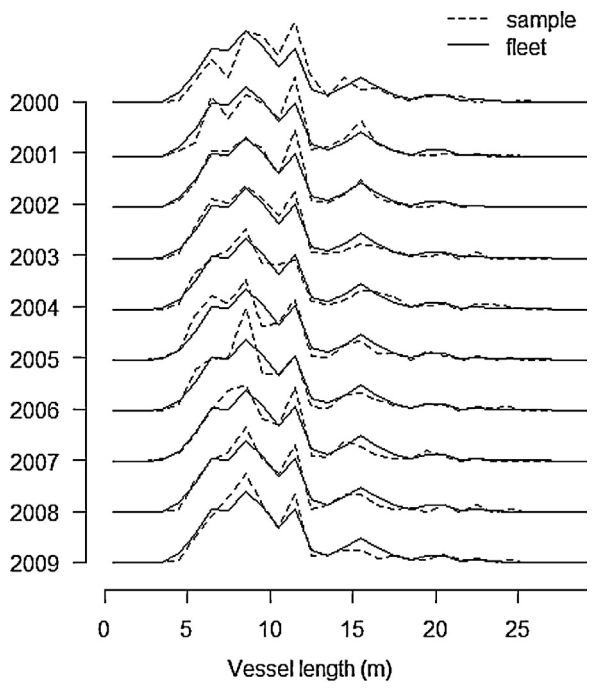

Fig. 1. Vessel size in economic sample and population for French vessels operating in the Bay of Biscay 2000–2009.

The annual data collected with the economic questionnaires were: number of seamen on board (*crew*) in addition to detailed information about the crew and the vessel sharing system, number of days at sea (*days-at-sea*), gross value of landings (*total revenue*) and detailed operational costs. These last items include costs for fuel (*fuel costs*) but also fuel volume (*fuelvol*; from 2002), costs for landings (*landing costs*), motor oil, bait, ice and subsistence of seamen, but also costs for maintenance and repairs of fishing equipment, gears and vessel parts, insurance premiums and administration costs.[1] Financial costs were not included in the analysis.

A number of derived cost variables were created. Total (or vessel) fixed costs (*total fixed costs*) are the sum of repairs and maintenance, insurance premium and administration costs. Other variable costs (*other variable costs*) are the sum of expenses for motor oil, bait, ice, subsistence of seamen, etc. Total variable costs are the sum of *fuel*, *landing costs* and *other variable costs*. Total costs (*total costs*) are defined here as the sum of total variable costs and total fixed costs, thus excluding crew payments (*salary costs*). Crew payments (*salary costs*) are based mostly on the sharing system and include all the crew on board including the skipper-owner, who is also paid according to the amount of capital invested. For this study only vessels that went fishing were considered. Finally, gross added value (*gross added value*) is *total revenue* minus *total costs.* An average annual fuel price per litre (*fuel price*) was derived as the mean of the ratio *fuel costs* to *fuelvol*; this is only available from 2002 as *fuelvol* was not recorded before.

In addition to these economic variables, information on vessel characteristics such as vessel *length*, engine *power* and *age* as well as the home harbour and maritime registration district (*district*) were available for all vessels (census data) and not only for those that filled in the economic questionnaire. Maritime registration districts were grouped into northern Brittany, southern Brittany, and central and southern Bay of Biscay. Further, certain information was collected for all vessels on a monthly basis: fishing zone, gears

[1] The questionnaire is available in French at http://sih.ifremer.fr/Acquisition-des-donnees/Enquetes-economiques.