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Par

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Who owns what? An analysis of the production means in the French Atlantic fishing sector

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For my mother, in loving memory and in remembrance of her lifelong fight against injustice and racism and her unwavering commitment to people.

Acknowledgment

‘*Ça touche à sa fin’* was what a friend told me yesterday after I had shared with him the news that I had only the Discussion left to write. ‘*Ça touche à sa fin’.* It sure sounds good in French. Almost there. There are many people who I would like to thank for the past four years. Some for their scientific advice, others for their love and support or for being such fantastic colleagues and friends.

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Context of the research

The research presented in this PhD thesis was carried out between November 2017 and June 2021, in the framework of a joint PhD agreement between the University of Western Brittany and Ghent University. In Brest, I was hosted by UMR-Amure for the entire period of the PhD thesis. In Ghent, I was hosted by the Department of Agricultural Economics at the Faculty of Bioscience Engineering. Funding was received from Région Bretagne and the University of Western Brittany, who each paid half of my PhD scholarship. Fieldwork and access to the Orbis database were funded by Ifremer and UMR-Amure under the *Politique de site Ownership* framework. For the attendance of conferences, I have furthermore received funding from the *Laboratoire d'Excellence* LabexMER (ANR-10-LABX-19) at the European Institute of Marine Sciences (IUEM), and from Ghent University. Finally, the Flanders Research Institute for agriculture, fisheries and food (ILVO) has played an important coordinating role in this PhD research.

The manuscript is written in English. It was first conceived as a thesis based on publications, but eventually took shape as a hybrid form between that and a classical thesis manuscript. Chapters 1 and 4 were produced for peer-reviewed publication, whereas Chapters 2 and 3 adopt a more classical 'chapter approach'. A separate section at the end of the manuscript lists all the references.

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Summary

The European fishing industry is often perceived as existing of a multitude of individually owned, locally operated fishing vessels. This appears to be a major oversimplification of a complex reality, however. Evidence shows that a growing number of fishing companies own and operate vessels across Member States, and that fishing capital is increasingly concentrated in the hands of a small number of large corporations. Furthermore, simple ownership structures are being replaced with more complex ones, and value chains become more and more integrated.

A recent study covering an EU-wide analysis of ownership and concentration of the production means in the fishing industry (vessels, quotas, licenses), has shown that these trends also take place in the French fishing sector. However, in most existing studies the focus is on a number of iconic case studies, mostly at the 'large-scale' or 'industrial' side of the fisheries spectrum. Yet, anecdotal evidence suggests that similar trends may also be taking place in the so-called 'artisanal' fisheries. Since the 1990s, French fisheries management is characterized by an institutional framework where fishing opportunities are capped, and limits are imposed on new vessel constructions. In this context, the second-hand vessel market has become a main entry point to the fishery. The second-hand market is also the main mechanism for the redistribution of fishing opportunities. Fishing opportunities are allocated to the so-called 'vessel-producer partnership' mainly based on historical track records. While market transactions of fishing opportunities are prohibited by law, they may be transferred indirectly through sales of vessels on the second-hand market. As such, investment in fishing vessels is the main way for producers to obtain access to (additional) fishing opportunities. Since 2006, producers have additional freedoms, e.g., to trade vessels while keeping the track records and/or licenses or to distribute track records among multiple fishing vessels in their fleet. This has given producers more flexibility with regards to their investment strategies, i.e., the option to buy and resell, and transfer track records in the process. In this context, multi-vessel firms gradually started to make their appearance in the artisanal fleet. However, without mechanisms in place to limit these transactions, it is believed that this holds a risk of concentration of fishing opportunities, and consequently, access problems for certain groups of fishers.

The aim of this PhD research is to provide a baseline study of who currently owns the means of production in the French Atlantic fishing sector, with a specific focus on the fishing vessels and associated fishing opportunities. This *'who owns what'* question is approached from different angles which crystallize into four sub-questions: (1) what is the organizational structure of multi-vessel fishing firms and what are the main drivers behind their evolution?; (2) who ultimately owns the fishing capital?; (3) does concentration of fishing capital and production occur?; (4) has the fisheries management system created any injustices towards artisanal fishers in the way fishing opportunities are allocated and redistributed?

We take an organizational perspective on 'ownership' in the fishing industry. In neoclassical economics, the firm is seen as a production unit in which inputs (i.e., combinations of the production means) are transformed into outputs without consideration of its organizational structure. In this '*black box*' conception, the firm is nothing more than a technological unit with a profit maximization purpose, and it is assumed that the market is responsible for the optimal allocation of resources. Following Williamson, we approach the firm instead as an organizational unit whose internal governance structure (including ownership structure) varies with changes in both the institutional environment (external drivers) and the attributes of economic actors (internal drivers). Processes like horizontal and vertical integration can be approached as a way for the organization to economize (i.e., on transaction costs) and/or as strategic choices for establishing themselves in the industry. In turn, the organization (structure) of the industry influences the investment behavior of firms. Other than that, the firm's investment behavior and possibilities are determined by the institutional environment

(e.g., TACs and national quotas, the quota management system in place, access to markets, access to credit, etc.).

In Chapter 1, we put under scrutiny the 'artisanal vs. industrial' dichotomy used by French fisheries management for classifying fishing operations. Recent evolutions in the Atlantic fishing sector urge us to question its applicability. The small-scale and family character of artisanal fishing have been shown to be in decline, and anecdotal evidence points towards the emergence of new forms of firm governance. On the basis of mixed-method research (interviews, multiple correspondence analysis (MCA) and hierarchical clustering), we propose a new typology for firm classification, based on six organizational attributes: ownership structure, firm structure, management strategy, firm size, fishing strategy, and valorization strategy. Our study shows that the mutually exclusive 'artisanal vs. industrial' classification is unable to capture the organizational diversity of modern-day fishing firms, and that French Atlantic fishing firms have evolved into an array of types which are separated based on following cluster-specific modalities: access to key information (e.g., bookkeeping and financial advice, vessel deals), legal form (e.g., sole proprietorship, limited liability company, etc.), standardization of fishing vessels and the organization of vessel maintenance (i.e., internalization or externalization), growth objectives (i.e., none, acquisition of fishing vessels, focused on processing and retailing), and management structure (embarked/shore-based owner, external manager). The final typology describes 5 distinct types: small-multi owners, medium to large-scale family fishing firms, fisher-processors, ownership-sharing models, and corporate fishing groups.

In Chapter 2, we present a methodological framework for the analysis of ownership of fishing vessels registered in the EU. Previous studies have identified issues related to data availability and quality as barriers for a comprehensive and comparative EU-wide analysis. Most studies have been obliged to adapt the scope of analysis accordingly, mostly by adopting a case study approach, or by focusing only on vessel ownership (ignoring fishing opportunities). In this chapter, we contribute to this field of study by proposing a multi-purpose framework for EU-wide analysis of vessel ownership, using a combination of fleet register data and commercial ownership data (the Orbis database, Bureau van Dijk). The proposed framework encompasses (1) the identification of available data sources and their potential for use in ownership analysis, (2) a conceptual framework for the analysis of vessel ownership in the EU fishing industry, and (3) a number of customized data extraction protocols for obtaining ownership data from the Orbis ownership database. The framework is subsequently applied to analyze ownership of the fishing vessels registered in the French Atlantic fishing sector in 2018. While this framework is not able to resolve all data issues identified by other studies, it surely presents new opportunities for comparative ownership analysis across Member States. Through the establishment of a Vessel-Company (VC) Register for France, we were able to bridge the gap between ownership information contained in the Union Fleet Register and detailed corporate ownership data in other databases. We argue that the customized protocols presented here provide promising new angles for comparative ownership analysis in the EU fishing sector.

In Chapter 3, we mobilize part of the data extracted in Chapter 2 to analyze concentration in the French Atlantic fishing sector. Excessive concentration of fishing capital and associated market power in the hands of a small number of owners is a cause for concern for fisheries managers, as it may lead to market manipulation and market failure. While in most fisheries restrictions are in place with regards to *who* can hold fishing opportunities and *how much*, this has often been insufficient to prevent concentration. From a legal point of view, dominant firms have the right to exist and guarding against monopolistic tendencies largely becomes a matter of *ad hoc* evaluations by competition authorities. The aim of this chapter is to provide a baseline study on the current state and the evolution (2008-2018) of concentration in the French Atlantic fishing sector in general, as well as for different subfleets: vessels targeting blue whiting (*Micromesistius poutassou*), European hake (*Merluccius merluccius*), scallops (*Pecten maximus*), and saithe (*Pollachius virens*). Concentration of different assets (volume and value of landings, fishing vessels, engine power, and gross tonnage) was assessed at different

hierarchical levels of ownership (operator, company (SIREN), Immediate Shareholder (ISH), Domestic Ultimate Owner (DUO), Global Ultimate Owner (GUO) and the 'inferred owner'). A number of concentration/inequality indices were used to measure concentration: concentration ratios (CR4, CR8, CR20) the Herfindahl-Hirschman Index, the Gini coefficient and the Theil Index. Preliminary results indicate that concentration in the French Atlantic harvesting sector has steadily increased since 2008. However, the sector cannot be considered 'concentrated' as such. Concentration of production was the highest for the 'mass species' blue whiting and saithe (also foreign-owned), but trends of concentration were also found on a smaller scale in the hake and scallops subfleets. We emphasize that a more disaggregated (case study) approach to concentration analysis is needed to better capture trends.

The central question in Chapter 4 is whether the French fisheries management system (focus on the allocation and redistribution of fishing opportunities) has created injustices towards artisanal and small-scale fishers. The chapter also investigates how fishers have navigated the institutional framework to obtain and secure fishing opportunities. French fisheries management emphasizes the collective management of fisheries resources, and the non-transferability of fishing opportunities as measures to prevent concentration and to protect artisanal fisheries. In practice, however, access problems are common, and concerns regarding concentration and the disappearance of the so-called 'artisanal fishing model' have been raised by researchers and fisheries managers. Using literature and new empirical data (interviews), we reflect on the French fisheries management system, and ask ourselves whether it can be considered 'just' from the perspective of artisanal fishers. In this chapter, we (1) describe the French fisheries management system, with an emphasis on the allocation and redistribution of fishing opportunities, (2) explore how this is perceived and experienced by artisanal fishers in the Atlantic fishing sector and (3) analyze how they have navigated this framework to overcome some of the hardship arising from this system. This study shows that the quota allocation system has created significant entry barriers for artisanal fishers, notably new entrants and small-scale producers, and that it has contributed to a shift away from family-based fishing and towards expansion. Government policies directed towards bringing more justice in the system have not delivered. Yet, on a positive note, some artisanal fishers seem to be finding new ways to anchor themselves in local economies and launch their businesses into an unsure future, both through the bottom-up initiatives and through partnerships (joint ventures) with large-scale fishing companies.

The insights developed in this PhD research are relevant for fisheries management in multiple ways. We have developed a methodological framework that can be readily applied for ownership analysis in the EU fishing industry. A good way to bring ownership analysis in the EU fishing industry forward would be through dedicated working groups in the framework of STECF or ICES and/or through EU research projects, given the need for better coordination of both data and methods. The next CFP reform would be an opportunity to improve transparency with regards to physical fishing capital and fishing opportunities through the establishment of public registers. On the national level, fisheries management must be aware of (1) the inequalities (access problems) created by the fisheries management system, (2) the current spectrum of organizational types among multi-vessel fishing firms and their dynamics, and (3) the trend of increasing concentration of landings and fishing capital in the Atlantic fishing sector.

Keywords: ownership analysis; concentration; foreign ownership; fishing opportunities; French Atlantic fisheries; organizational perspective; transaction costs; industrial organization; vertical integration; horizontal integration; EU fishing industry; fisheries management.

Scientific production

Publications

Kinds, A., Le Floc'h, P., Speelman, S., Guyader, O. (2021). The inadequacy of the "artisanal vs. industrial" dichotomy in French Atlantic fisheries: an organizational perspective (in press).

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Reports

STECF. 2020. Scientific, Technical and Economic Committee for Fisheries (STECF) - Social dimension of the CFP (STECF-20-14). Final Report. Edited by Ralf Döring, Mike Fitzpatrick and Jordi Guillen. Authors: Döring, Ralf; Fitzpatrick, Mike; Ballesteros, Marta; Brigaudeau, Cecile; Carpenter, Griffin; Delaney, Alyne Elizabeth; Frangoudes, Katia; Goti, Leyre; Guillen, Jordi; Jackson, Emmet; Jung, Armelle; **Kinds, Arne**; Kraan, Marloes; Lasner, Tobias; Malvarosa, Loretta; Nicheva, Simona; Pascual-Fernandez, Jose; Ribes Moreno, Isabel; Said, Alicia; Tzouramani, Irene; van Hoof, Luc.

Conference papers

Kinds, A., Guyader, O. and Le Floc'h, P. 2018. An analysis of ownership typologies and strategies in French and Belgian fisheries: a case study approach. Presentation at the Nineteenth Biennial Conference of the International Institute of Fisheries Economics and Trade (IIFET): Adapting to a Changing World: Challenges and Opportunities. Seattle, WA, USA.

Kinds, A., Guyader, O., and Le Floc'h, P. 2019. Understanding vessel ownership and firm organization in French Atlantic fisheries: a typology. In BICEpS Colloquium 2019 Book of Abstracts.

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“A well-known proverb says: *‘Give a man a fish, and you feed him for a day. Teach a man to fish and you feed him for a lifetime’*. The key issue is not to teach a man how to fish, it is who owns the fishing vessels“

Free interpretation of a young Dirk Van Duppen, whose view on the world I admire.

General introduction

1 General context

1.1 Introduction

The European fishing industry is often perceived as existing of a multitude of individually owned, locally operated fishing vessels. This image is consistent with a general understanding of fishing operations as small to medium-scale, family-owned and operated businesses (e.g., Menzies, 2003; Delbos, 2006; Guyader *et al.*, 2013). While this perception may indeed be accurate for many fishing firms (and fisheries) across the EU, this seems to be a major oversimplification of a complex reality. Evidence shows that a growing number of fishing companies own and operate vessels across Member States, and that fishing capital is increasingly concentrated in the hands of a small number of large corporations (Sykes *et al.*, 2014; Warmerdam *et al.*, 2016, 2018; EJF, 2018; MRAG *et al.*, 2019). In addition, simple ownership structures are being replaced with more complex ones, sometimes existing of global networks of subsidiary companies.

Overall, evidence for these trends remains scarce and anecdotal, mostly in the form of narratives published in fishing industry magazines and newspaper articles (Balsan, 2017)[1]. However, a couple of insightful studies have been carried out in recent years by NGOs (Bloom, 2013; Sykes *et al.*, 2014; EJF, 2018) and on behalf of the European Commission (Warmerdam *et al.*, 2016, 2018; MRAG *et al.*, 2019). These studies have focused mostly on large-scale fishing operations, resulting in a number of well-documented case studies of vertical integration and concentration by retailers and processors across the EU (see Warmerdam *et al.*, 2016 and EC, 2019). The NGO studies provide a critique of how vertical integration has led to a small number of corporations controlling the market, aided by privileges such as prime access to fishing opportunities and subsidies (see Bloom, 2013; Sykes *et al.*, 2014; EJF, 2018). Generally speaking, however, it is fair to say that questions related to ownership structure and ultimate ownership of fishing firms have received little attention by fisheries researchers, managers and policy makers.

1.2 The distributional effects of capacity management in fisheries: is concentration unavoidable?

Overcapacity of fishing fleets is a problem found in fisheries across the globe (FAO, 2018a). It results from open-access to fisheries resources, which creates a race for fish. As more participants enter the fishery average income starts to decline, and in an attempt to compensate for these losses, fishers invest in additional capacity. In vain, however, as this vicious cycle takes place until all rent in the fishery has dissipated (Gordon, 1954; Scott, 1955). This situation is known as 'the tragedy of the commons' (Hardin, 1968, 1998), or more generally as 'commons dilemmas'[2] (Ostrom, 1990, 2008; Ostrom *et al.*, 2002; Araral, 2014). Despite advocating wildly different approaches for managing such common-pool resource dilemmas (see Cavalcanti *et al.*, 2010), scholars agree on the fact that open-access is undesirable and inefficient for all participants. However, tackling overcapacity once it has been established is difficult, and policies aimed at doing so require a careful balancing of multiple societal objectives (economic, social, environmental) (Teh *et al.*, 2017). Capacity reductions

[1] E.g., https://www.ouest-france.fr/mer/peche/peche-un-acteur-neerlandais-de-poids-4784783; https://www.lavoixdunord.fr/862752/article/2020-09-09/les-pecheurs-boulonnais-s-inquietent-de-la-presence-hollandaise-dans-leur-port; https://www.lavoixdunord.fr/161043/article/2017-05-11/unipeche-s-associe-des-hollandais-pour-acheter-des-bateaux-le-modele-du-patron (Accessed on 12/04/2021)

[2] Today, it is widely accepted that open-access to fisheries resources produces "unsatisfactory" results (Crutchfield, 1979; Ostrom, 2008) – though not necessarily collapse as first posited by Hardin – and that adapted systems of management are needed to avoid this.

are typically associated with immediate economic and social hardship for fishers and fishing communities, such as loss of employment (FAO, 2008).

Over the decades, fisheries management has tried to deal with open-access and overcapacity in different ways – and with varying success. A first widely implemented policy was limited entry, in which operators need a permit to fish and a cap on total catch is established, known as the 'Total Allowable Catch' (TAC) (Graff Zivin and Mullins, 2015). While this resolves the open-access problem, it does not take away the incentive to invest. In the EU, this was further exacerbated by large-scale subsidization programs focused on fleet construction and modernization, notably during the 1980s and 1990s (Lindebo, 2005; Skerritt *et al.*, 2020). Limited entry programs are still widespread, but they are now usually matched with policies aimed at rationalizing fishing fleets. Through subsidized 'buyback' or 'decommissioning' schemes, vessel owners receive a payment for removing their vessels from the fleet (Munro and Sumaila, 2001; Clark *et al.*, 2005; Curtis and Squires, 2007; Teh *et al.*, 2017). Such programs have had mixed success (see Curtis and Squires, 2007 for a review), but were able to reduce capacity significantly in the EU fishing industry (1990s and early 2000s) (Lindebo, 2005)[3]. However, vessel decommissioning has also been associated with social costs such as job loss (Guyader *et al.*, 2004; Lindebo and Vestergaard, 2007; Mesnil, 2008), as well as industry contraction and concentration, further exacerbated by a logic of continuous modernization, specialization.

Despite their relative success in the context of the Common Fisheries Policy (CFP), it is generally accepted that decommissioning schemes are costly and rather inefficient (Graff Zivin and Mullins, 2015). Also, overcapacity in the EU fishing industry persists, and has been named one of the major structural failings of the CFP (Jensen, 1999; Sissenwine and Symes, 2007; Khalilian *et al.*, 2010; Coelho *et al.*, 2011; Peñas Lado, 2016). In this context, ITQ programs (Individual Transferable Quotas) are increasingly being proposed as a solution to the overcapacity problem, whilst tackling the root of the problem: the race for fish. ITQs are based on the premise that the allocation of secure property rights ('exclusive rights') to producers provides an economic incentive to minimize the cost of fishing and maximize the value of their allocation (Christy, 1996; Grafton, 1996; Arnason, 2006; Grafton *et al.*, 2006). The possibility of trading (and/or leasing) fishing rights in a quota market ('transferability') allows exiting producers to receive compensation for their loss of profits and incumbent producers to acquire additional fishing rights (Grafton, 1996). As such, the market takes over a considerable part of fisheries management, which increases the economic efficiency of the system as a whole. In a perfectly competitive quota market (i.e., without restrictions to trade), ITQs maximize the economic rent to be gained from the fishery.

As a policy instrument, the idea is that ITQs maximize the rent on the level of the fishery as a whole. However, the question remains: who *captures* the rent? Empirical studies have shown that ITQs increase average profitability of fishing operations (Grafton, 1996; Arnason, 2002; Jardine and Sanchirico, 2012; Thébaud *et al.*, 2012), but in many cases this only benefits the quota owners – not the crew, and certainly not the general public (Pinkerton and Edwards, 2009). In theory, the rent generated can be returned to the public through tax mechanisms, but these are uncommon in fisheries (Boncoeur *et al.*, 2006).
Second, initial allocations essentially determine who benefits from ITQs, as most often quota shares are given 'for free' to incumbent participants in the fishery, a practice known as 'grandfathering'[4] (Matulich and Sever, 1999; Macinko and Bromley, 2002; Bromley, 2009).

[3] The structural problem of overcapacity was recognized by the European Commission during the discussions preceding the 2002 CFP reform (COM(2000) 272 final, p. 5) (Lindebo, 2005). Also in subsequent reforms, decommissioning schemes remained the main tool for capacity reduction (DG MARE, 2013).

[4] Copes (1986) identifies three ways in which quota shares can be initially allocated: giving quotas away for free, selling quotas at a fixed price, and through quota auctions. In practice, most ITQ programs allocate rights for free to past participants due to considerations of political acceptability.

Grandfathering has been associated with long-term (intergenerational) injustices related to entry barriers for entrants without family ties in the sector or for small-scale producers.
A third criticism is that ITQs lead to concentration, due to the fact that larger firms with access to capital are more likely to acquire quotas than smaller firms. This may create significant distributional effects, such as the flow of fishing rights to a small number of large fishing firms and out of small fishing communities to other regions (Palsson and Pétursdóttir, 1997; Campbell *et al.*, 2000). Empirical evidence of concentration in ITQ-managed fisheries is, in fact, overwhelming (McCay, 1995; Pálsson and Helgason, 1996; Bernal *et al.*, 1999; Stewart and Callagher, 2011; Giry *et al.*, 2015; Høst, 2015; Agnarsson *et al.*, 2016; Haas *et al.*, 2016; Stephenson *et al.*, 2019; Byrne *et al.*, 2020). Most ITQ fisheries have built-in protections against monopolistic tendencies in the form of maximum holding restrictions[5] (Frost and Lindebo, 2003). Additional restrictions apply regarding the modalities of transferability and the socioeconomic profile of quota holders (see Carpenter and Kleinjans, 2017 for an overview in EU fisheries).

For our argument here, it is important to retain that limited entry schemes and capacity reduction – be it through vessel decommissioning or ITQs – have certain distributional effects which creates winners and losers in the fishery (Curtis and Squires, 2007; van Ginkel, 2009; Flaaten, 2010; Pomeroy and Andrew, 2011; Gallizioli, 2014; Urquhart *et al.*, 2014; Said and MacMillan, 2020). To put it simply, the winners are large-scale fishing companies with access to funding and a seat at the decision-making table, while the losers are small-scale fishers and the communities that depend on them (Said *et al.*, 2016, 2020; Said and MacMillan, 2020).

1.3 The inadequacy of the 'small vs. large' dichotomy

Worldwide, fishing operations differ vastly in terms of their size, motorization, fishing gears used and species targeted (FAO, 2018). This diversity is apparent on all geographical scales, and the characteristics of fishing operations can vary within a country, a region, or even within a single fishing port. The full spectrum of capture fisheries is often simplified and divided into discrete categories. A commonly used division is that of small-scale versus large-scale fishing operations. The concept was first introduced by Thomson (1980), in an attempt to distinguish company-owned large-investment fishing units from privately owned/managed small-scale units. Thomson's classification has since been updated by Maclean (1988) and later by Berkes *et al.* (2001), who included a description of common characteristics of small-scale fisheries. The conceptual framework was further expanded by Ruttan *et al.* (2000) (separation of the two categories on a relative scale, thus providing a more objective definition of small-scale fisheries), Sumaila *et al.* (2001) and Therkildsen (2007) (inclusion of a number of policy-relevant socioeconomic and environmental impact indicators). A comparative analysis of small-scale fisheries in the EU is provided by Guyader *et al.* (2013). In France, the most commonly used classification contrasts 'artisanal' fisheries with 'industrial' fisheries. Hereby industrial fishing operations are seen as capital-intensive (Reyes *et al.*, 2015) and artisanal operations as small to medium-scale, family-owned (Menzies, 2003; Reyes *et al.*, 2015) and requiring relatively low capital investments (Guyader *et al.*, 2013).

While such dichotomies successfully capture some of the worldwide diversity into manageable categories, they are also criticized for oversimplifying reality and for not being able to provide clear boundaries between the two categories (Sumaila *et al.*, 2001; Johnson, 2006; Smith and Basurto, 2019). This especially affects the position of small-scale fisheries and how they are perceived by fisheries managers. Smith and Basurto (2019) argue that the small- versus large-scale dichotomy is tacitly understood as a hierarchy that is both spatial and temporal, and in which large-scale industrial fisheries are considered as *succeeding* small-scale fisheries along a unilinear path toward 'progress' (i.e., the 'naturally dominant' and 'more efficient' mode of production) (Gibson-Graham, 2006; p. 115). In this view, small-scale fisheries are mere

[5] Maximum holding restrictions are found, among others, in the US (Anderson, 2008), Australia (Emery *et al.*, 2014), New Zealand (Stewart and Callagher, 2011) and Iceland (Agnarsson *et al.*, 2016).

'anachronistic anomalies' in a modern world (Høst, 2015; Sabau and van Zyll de Jong, 2015). A consequence of this dominant narrative is that small-scale fisheries are treated as the subordinate category, with a marginal status and a lower priority on national and global fisheries agendas (Jadhav, 2018). Said and MacMillan (2020) argue that EU fisheries management is permeated with a neoliberal ideology of economic efficiency and growth, in which small-scale fisheries represent "barriers to efficiency". In this climate, small-scale fishers are faced with the choice to either scale up or leave the sector altogether. Empirical evidence for this is found, among others, in the fishing ports of Denmark (Høst, 2015; Autzen and Winter, 2020; Said *et al.*, 2020), France (Menzies, 2002), Spain (Lloret *et al.*, 2016), Ireland (Donkersloot and Menzies, 2015) and Greenland (Jacobsen and Delaney, 2014).

1.4 Perspectives on ownership and concentration in the fishing industry

From a macro-economic point of view, concentration of the productive capital and fisheries production must be monitored. This is to guard against market dominance of a small number of firms, which poses a problem when the activities of such firms are deemed detrimental to competition (Haas *et al.*, 2016). While moderate levels of concentration in an industry may, in some cases, give rise to efficiency gains (Williamson, 1968; Lopez *et al.*, 2014) (e.g., economies of scale, market stability), it is well established that high levels of concentration may distort competition in the marketplace, with consequences for both producers and consumers (Anderson, 1991, 2008; McCay, 1995; Thom and Schwaab, 2010). Market economies usually have competition authorities in place to guard against the creation of cartels and monopolies. In the EU, the antitrust policies of the EU Single Market are outlined in the Treaty on the Functioning of the European Union (TFEU), in Article 101 (prohibition of agreements that restrict competition) and Article 102 (prohibition to abuse dominant market position) (EU, 2012). However, the point at which the benefits of mergers (e.g., scale economies) outweigh the costs to society is difficult to assess, and in practice disputes are only brought before antitrust authorities when the damage is already done.

A second 'macro' perspective revolves around corporate governance and control, and the lack of transparency on who owns what. The ultimate owners of large corporate fishing firms are often hidden behind opaque ownership networks and are difficult to identify (Sykes *et al.*, 2014; MRAG *et al.*, 2019). Evidence shows that large corporate fishing firms are using a range of tactics to circumvent regulations and maximize profits. Tactics include frequent flag changes, the use of shell companies and tax havens, and the maintenance of close ties with decision-makers (Sykes *et al.*, 2014; EJF, 2018). Sykes *et al.* (2014) also state that, by deliberately weakening governance through political influence, certain large industrial fishing companies obtain prime access to fishing opportunities and subsidies. This concern has also been voiced by the EU itself (EU, 2017, p. 8). In Denmark, the existence of such ties and the disproportional allocation of fishing rights to large companies was confirmed by the Danish government in 2017 (Rigsrevisionen, 2017)[6]. In this context, unraveling ownership networks and identifying who ultimately owns fishing vessels, quota and/or licenses is essential for holding owners accountable in case of fishing violations (e.g., IUU fishing, discarding), infractions on labor law (MRAG *et al.*, 2016), or tax evasion (OECD, 2013; Sykes *et al.*, 2014).

From a fisheries management point of view, it is important to have an understanding of the composition and dynamics of the sector beyond the usual descriptors (i.e., fleet capacity, fleet structure, employment, effort and production, total value added, profits) (see STECF, 2019). Monitoring ownership and ownership dynamics allows fisheries managers to anticipate and react faster and more aptly to certain trends (e.g., foreign investment and quota hopping, concentration of vessels and quotas, etc.). Moreover, since fishing opportunities represent endowments to a publicly-owned natural resource, it is of great public concern to know precisely who are the users and beneficiaries of these endowments (MRAG *et al.*, 2019). Concentration in the fishing sector has also been associated with a decline of fishing

[6] See Oceana (2017) for an English text on the subject.

opportunities in small-scale fishing communities (e.g., Pálsson and Helgason, 1996; Palsson and Pétursdóttir, 1997; Campbell *et al.*, 2000; Giry *et al.*, 2015), shifts in the social relations of fishing (owner-crew relations on board the fishing vessel, the decline of family-based fishing) (Menzies, 2002; St Martin, 2007; McCall Howard, 2012; van Ginkel, 2014; Symes *et al.*, 2015), and access problems for young entrants and small-scale fishers resulting from increased entry barriers (cost of entry) (Høst, 2015; Said *et al.*, 2016, 2020; Autzen and Winter, 2020).

On the micro-economic level (the level of the fishing firm), the profile of the owner has implications for the way production is organized in terms of crew management and remuneration (e.g., Menzies, 2002, 2003; St Martin, 2007; McCall Howard, 2012), fishing strategy (e.g., Smith and McKelvey, 1986; Kasperski and Holland, 2013), marketing channels (e.g., Gallick, 1984; Koss, 1999), local embeddedness (e.g., Knott and Neis, 2017) and succession of the business (e.g., Menzies, 2003; Marks, 2012; van Ginkel, 2014). Furthermore, Nøstbakken *et al.* (2011) argue that a closer consideration of the profile of the owner and the organizational structure of fishing firms (scale, vertical integration) is crucial for a better understanding of investment behavior, and thus, capacity development in the fishery as a whole (see further). Two points are invoked to support this. The first is that small owner-operated units may not respond to incentives the same way large-scale operations do, due to the different objective functions and "possibilities" of small-scale fishers (Nøstbakken *et al.*, 2011). Second, in economic models of investment behavior it is often assumed that the harvesting sector is independent of the processing sector. However, the possibility of vertical integration changes the investment problem and should be taken into account. A recent study by Edwards and Pinkerton (2019) about processor control in the Pacific Halibut fishery confirms this point, and even provides a sense of urgency to take these aspects into account when studying ownership and control.

1.5 Towards an organizational perspective of ownership?

The issues of ownership and concentration of the production means cannot be separated from the organization and evolution of fishing firms. In (orthodox) neoclassical economics, the firm is seen as a production unit in which inputs (i.e., combinations of the production means) are transformed into outputs without consideration of its organizational structure. In this '*black box*' conception, the firm is nothing more than a technological unit with a profit maximization purpose, and it is assumed that the market is responsible for the optimal allocation of resources. Williamson (1996) views the firm instead as an organizational unit whose internal governance structure varies with changes in both the institutional environment (external drivers) and the attributes of economic actors (internal drivers).

Fishing firms can grow by adding vessels to their fleet, by investing in fishing opportunities, or by venturing into new activities (e.g., processing, retailing). Growing the fleet can be considered a case of horizontal integration, as it involves the buy-out of one license holder by another. Within the framework of the CFP, EU Member States have devised their own systems of quota allocation and redistribution, including certain freedoms and limitations with regards to transferability of fishing opportunities (see Carpenter and Kleinjans, 2017 for an overview). In France, market transactions of fishing opportunities are prohibited by law, but they can be transferred with the fishing vessel when the vessel is sold (Larabi *et al.*, 2013). Acquisition of fishing vessels is thus the main vehicle for horizontal growth for French harvesting firms. Whereas artisanal fishing firms are characterized by stepwise growth (Friedmann, 1980; Menzies, 2002), large-scale companies are able to acquire entire fleets at once through mergers (MRAG *et al.*, 2019). At this level, horizontal integration is strategic, with motivations ranging from achieving economies of scale and scope, to increasing market share, reducing competition, and increasing production synergies (Porter, 1980; Thom and Schwaab, 2010). Vertical integration describes the situation in which a firm owns or exerts control over its suppliers (backward integration) or customers (forward integration) (Dawson, 2003; Thom and Schwaab, 2010). Vertical integration can be accomplished through contracts, exclusive dealing, ownership interests in vessels by downstream actors or outright vertical ownership

(hierarchy) (Gallick, 1984; Koss, 1999; Isaksen and Dreyer, 2000; Thom and Schwaab, 2010). Thom and Schwaab (2010) (after Dawson, 2003) identify four factors that may encourage vertical integration in commercial fisheries: (1) supply and demand security (price, quality, quantity, timing), (2) the presence of highly specific assets (non-malleability of capital), (3) the opportunity of capturing quasi-rents at another stage of the production chain, (4) the opportunity to foreclose competitors. Empirical studies have shown that efficiency (transaction costs, economies of scale) as well as strategic considerations play an important role (e.g., Gallick, 1984; Love *et al.*, 1995; Guillotreau and Le Roy, 1998; Koss, 1999; Isaksen and Dreyer, 2000; Thom and Schwaab, 2010). These findings correspond with what is described in a number of classic works in vertical integration literature (Salinger, 1988; Hart and Tirole, 1990; Mahoney, 1992) and transaction cost literature (see Williamson, 1996, p. 59-60).

From an industry perspective (cf. Porter, 1980), horizontal and vertical mergers and acquisitions may lead to consolidation in an industry. Where scale economies can be identified, firms have an incentive to increase the scale of production until significant cost reductions or efficiency gains can be accomplished (Thom and Schwaab, 2010; MRAG *et al.*, 2019). Also, the existence of appropriable quasi-rents (cf. Klein *et al.*, 1978) may create an incentive for growth through mergers (increase bargaining power), and thus a push towards consolidation in the industry as a whole (MRAG *et al.*, 2019). Other drivers may include a quest for market power, financial incentives (e.g., to increase position on the stock market, or to reduce shareholder risk), and access to new markets (MRAG *et al.*, 2019). In addition to industry-specifc drivers, mergers and acquisitions are influenced by the broader economic environment (e.g., interest rates, profitability) and the institutional framework of fisheries management (e.g., shifts in quota allocation systems). The latter is, in turn, closely linked to biological factors such as the state and distribution of fish stocks (MRAG *et al.*, 2019).

Nøstbakken *et al.* (2011) point out that most empirical studies of investment behavior take the vessel level as the analytical unit. The authors argue that analysis must instead be conducted at the level where decisions actually take place, which they argue is the firm or owner level. This “decision unit” may correspond to the household or the owner-operator in artisanal firms, or the managers and/or shareholders in the case of vertically integrated firms. The central argument is that investment decisions are influenced by the profile of the owner and the way in which production is organized. One of the objectives of this PhD research will be to develop a better understanding of the profile of multi-vessel owners in the French Atlantic fishing sector (see further).

1.6 Current status of ownership analysis in the EU fishing industry

Ownership analysis in the EU fishing sector is a relatively new area of research, and analysis has proven to be challenging – among others due to incomplete and patchy data, the existence of complex, opaque and fast-changing ownership structures, and diverging scope and ownership definitions between Member States (see MRAG *et al.*, 2019). The recent study by MRAG *et al.* (2019) was commissioned by the European Commission’s Executive Agency for Small and Medium-sized Enterprises (EASME)[7]. The study’s premise was to provide “an overview of the current ownership structure of fishing vessels and the means of production […] in the catching sector”, focusing on nine key Member States: Belgium, Denmark, France, Germany, Ireland, the Netherlands, Spain, Sweden, and the United Kingdom (sic.). More precisely, the study has looked at ultimate ownership and concentration of the production means in the EU fishing industry. Concentration was measured, where possible, for different assets: the fishing vessels, quota allocations and fishing rights (i.e., licenses). The study has identified data availability and transparency as major barriers for comprehensive ownership analysis of EU fishing vessels and fishing opportunities. Data were especially incomplete for

[7] Service Contract: EASME/EMFF/2016/1.3.2.1/SI2.766458

individual quota allocations, and vessel ownership was identified as the best basis for EU-wide comparative analysis.

While the identification of EU fishing vessels through the Community Fleet Register (CFR) is rather straightforward, their (ultimate) owners are often more difficult to track down. Calls for more transparency with regards to quota and vessel ownership (e.g., OECD, 2013; Hoefnagel *et al.*, 2015; EU, 2017) have been met with specific measures by certain Member States[8], but coverage remains patchy. Part of this patchiness is due to the wide range of quota allocation systems across Member States, which each mandate the monitoring of different aspects of ownership (see Carpenter and Kleinjans, 2017 for an overview). As a consequence, it is unclear what 'ownership analysis' in the EU fishing industry is actually about, and what should be measured – i.e., the ownership of vessels, fishing opportunities or both. For these reasons, most studies have adopted an approach predominantly focusing on case studies (Sykes *et al.*, 2014; Warmerdam *et al.*, 2016, 2018; MRAG *et al.*, 2019), with the MRAG study being the only one taking steps towards industry-wide comparative analysis. A major focus of this PhD research will be to provide new perspectives for the comparative analysis of ownership and concentration in the EU fishing industry.

2 Research questions and organization of the PhD thesis

The aim of this PhD research is to provide a baseline study of who currently owns the means of production in the French Atlantic fishing sector, with a specific focus on the fishing vessels and associated fishing opportunities. This *'who owns what'* question is approached from different angles which crystallize into four sub-questions:

(1) What is the organizational structure of multi-vessel fishing firms and what are the main drivers behind their evolution?
(2) Who ultimately owns the fishing capital?
(3) Does concentration of fishing capital and production occur?
(4) Has the fisheries management system created any injustices towards artisanal fishers in the way fishing opportunities are allocated and redistributed?

In **Chapter 1**, I aim to establish an understanding of the profile of the owners of multiple fishing vessels in the French Atlantic fishing sector (cf. Nøstbakken *et al.*, 2011). To this end, I have developed a typology of multi-vessel ownership based on the organizational attributes of fishing firms. The main hypothesis was that the 'artisanal vs. industrial' dichotomy used by fisheries management is outdated, due to the prevalence of multi-ownership and the emergence of new forms of firm governance. To construct the typology, a mixed-methods research approach was used (semi-structured interviews, multiple correspondence analysis and hierarchical clustering). Semi-structured interviews were conducted with fishers with two or more fishing vessels (n=80) between December 2017 and April 2019, in which they were asked about the organization of their firms. Participants were selected according to a quota sampling method, in order to cover the different fishing districts, vessel sizes and fleet segments. In addition, 20 interviews were conducted with key actors including fisheries administration (national and regional, n=2), representatives of POs (n=4) and fisheries committees (n=6), business lawyers (n=2), financial experts/vessel brokers (n=2), bank executives (n=2), wholesalers (n=1) and shipyards (n=1). Patterns in the interview data were then revealed through multiple correspondence analysis (MCA) in combination with hierarchical clustering.

Having dealt with the organizational aspects of ownership in Chapter 1, in Chapters 2 and 3 I shift my focus to the issues of ultimate ownership and concentration. The work for Chapters 2 and 3 was entirely based on desktop research, and included different methods of data

[8] The UK and Denmark have made quota allocations public in online registers: https://www.fqaregister.service.gov.uk/ and https://fiskeristyrelsen.dk/fiskeristatistik/statistik-for-fiskeriets-regulering/kvoteandelsberegner/ (Accessed on 09/04/2021).

extraction, exploration/validation and analysis in R Studio. In **Chapter 2**, I take ownership analysis beyond the usual 'case study approach', by developing a multi-purpose methodological framework for the analysis of ownership of EU-registered fishing vessels. The proposed framework encompasses (1) the identification of available data sources and their potential use in ownership analysis, (2) a conceptual framework for the analysis of vessel ownership in the EU fishing industry, and (3) customized data extraction protocols for obtaining ownership data from the commercial Orbis ownership database. The framework is subsequently applied to analyze ownership in the French Atlantic fishing sector. While Chapter 2 is mostly methodological in scope, a number of preliminary analyses are included at the end of the chapter, focused mainly on the evaluation of the extraction protocols and their comparison with default measures of ultimate ownership. In **Chapter 3**, I use part of the data extracted in Chapter 2 for the analysis of concentration of fishing capital (i.e., the fishing vessels and associated assets such as gross tonnage and engine power) and production (volume and value of landings) in the French Atlantic fishing sector, and a selection of case studies (the scallops, hake, blue whiting and saithe subfleets). Concentration was assessed on the basis of a number of inequality indices (concentration ratios, the Herfindahl-Hirschman Index and the Gini coefficient.

The interview data of Chapter 1 were also used in **Chapter 4**, in which I take a closer look at how shifts in the institutional framework of fisheries management in France have affected artisanal and small-scale producers. The narrative is constructed based on key aspects brought up during the interviews, as well as published sources (scientific literature and legislative texts). A number of quotes were drawn from the interviews in support of the narrative. The focus of Chapter 4 is on injustices generated by the allocation and distribution of fishing opportunities by fisheries management, and the strategies fishers have developed for obtaining and securing fishing opportunities in this institutional context. I consider injustices at three orders of governance (the meta, second and first orders), as proposed by Svein Jentoft and Ratana Chuenpagdee (after Kooiman, 2003) in a forthcoming book project on 'Blue Justice' edited by Svein Jentoft, Ratana Chuenpagdee, Moenieba Isaacs, and Alicia Said (scheduled for publication in July 2021). Chapter 4 of this thesis will be published as a chapter of the book. With permission of the authors (Jentoft and Chuenpagdee, *in press*), I have included some elements of the 'Blue Justice' framework in Annex 4.1.

In the '**Discussion and conclusion' chapter**, the results of the PhD thesis will be discussed in terms of their contributions and relevance for fisheries management. Also perspectives for further research will be proposed.

As such, this PhD research provides a multifaceted look into the current ownership structure of the French Atlantic fishing sector. An element that was finally not included in this PhD research is how ownership structure and organization affect the performance of fishing firms. In what follows, I will present the conceptual framework of the PhD.

3 Conceptual framework

Figure 0-1 shows the conceptual framework of the PhD thesis. At the center of this framework is the entrepreneur, who must mobilize different means of production or forms of capital in order to fish. Physical capital encompasses the vessels, gears and other material goods required for catching fish, but also any land-based facilities to accommodate production (e.g., warehouses, offices, trucks). Human capital represents the labor inputs needed for catching and handling the fish, including the intangible skills of the crew (e.g., knowledge of fishing grounds) (Pascoe and Coglan, 2002). In a context of limited-entry fisheries (cf. the CFP and French fisheries management), fishing activity cannot be carried out without holding fishing rights granting the operator access to the fishery (entry licenses) and/or to a specific share of the resource (output licenses; i.e., quota allocations). Depending on the freedoms associated with these rights, they may or may not be appropriated and/or traded by the rights holders (see further). In any case, fishing rights may be considered immaterial (intangible) capital of the fishing firm (Nøstbakken *et al.*, 2011), whether they represent an asset in the balance sheet of the firm (e.g., in Denmark, the Netherlands) (van Ginkel, 2009, 2014; Høst, 2015) or an implicit value tangled up in the price of fishing vessels (the case for France) (Guyader *et al.*, 2003) (see further). Fishing rights give the entrepreneur access to a share of the *resource flow* provided by the fish stock (the natural capital) (Bromley, 1991, 1992). This flow takes the form of landings. Finally, the entrepreneur's social capital (e.g., networks, values, identities, interpersonal relationships) (Putnam, 2000) can have important implications for the governance of the firm (Nahapiet and Ghoshal, 1998) as well as fisheries management (Grafton, 2005; Holland *et al.*, 2013).

In its most simple form, the entrepreneur has the double role of owner and operator of the fishing firm. As the firm grows, the entrepreneur may see the need to make changes to the governance structure of the firm. Following Williamson, we consider that these changes are a function of the distribution of transaction costs, and the ability of alternative governance modes to handle the transaction in a cost-effective way. These modes are markets, hierarchies (vertically integrated firms) and hybrids (Williamson, 1986) (see further). The box on the left of the fishing firm in the framework shows interactions with the market, while the box above it indicates hierarchy. Firms may decide to procure goods or services on the market (e.g., vessel maintenance, bookkeeping), or, alternatively, to internalize parts of the production process. Also the allocation of roles in the firm can be approached from a transaction cost perspective, which are then referred to as 'agency costs' (Alchian and Demsetz, 1972; Jensen and Meckling, 1976) (see further). In larger firms, ownership and management are often separated. In addition to transaction cost considerations, the owners and managers of fishing firms may also make strategic investment decisions, which are a function of industry structure (among others). The box above the fishing firm in Figure 0-1 describes the corporate ownership of the fishing firm, where this is relevant. The beneficial and ultimate owners of the fishing firm have cash flow rights and/or control rights in the fishing firm. Corporate ownership is thus a way for shareholders to capture surplus or rents from fishing without actually 'owning' the production means *per se*[9].

The fishing firm is embedded in an institutional context which is defined by EU and national policies. The general context is defined by the Treaty on the Functioning of the European Union (TFEU), the EU Single Market (including labor law, competition law, etc.) and the Common Market Organization (CMO) (agriculture and fisheries). This context determines to a great extent the economic environment (e.g., interest rates, market and industry structure, etc.). Fisheries-specific policies include the Common Fisheries Policy at the EU level, and national policies at the Member State level. Of particular importance for this PhD thesis, are the

[9] In Chapter 2, we will introduce the concept of 'divisibility' of the fishing capital. In short, we may consider that there are two ways of looking at the fishing vessel. The first is as the indivisible physical asset required for catching fish, the second is as an asset that is 'owned' by the shareholders of the fishing company on a *pro rata* basis.

definition of fishing opportunities at the EU level (TACs, definition of national quotas) and the definition and allocation of fishing opportunities at the national level. In France, fishing opportunities for EU-species are use rights which are non-appropriable and non-transferable by law (see further).

In what follows, we will zoom in on the theoretical underpinnings of the framework, and at the end of this section, some context is provided on fisheries management in the EU and in France.

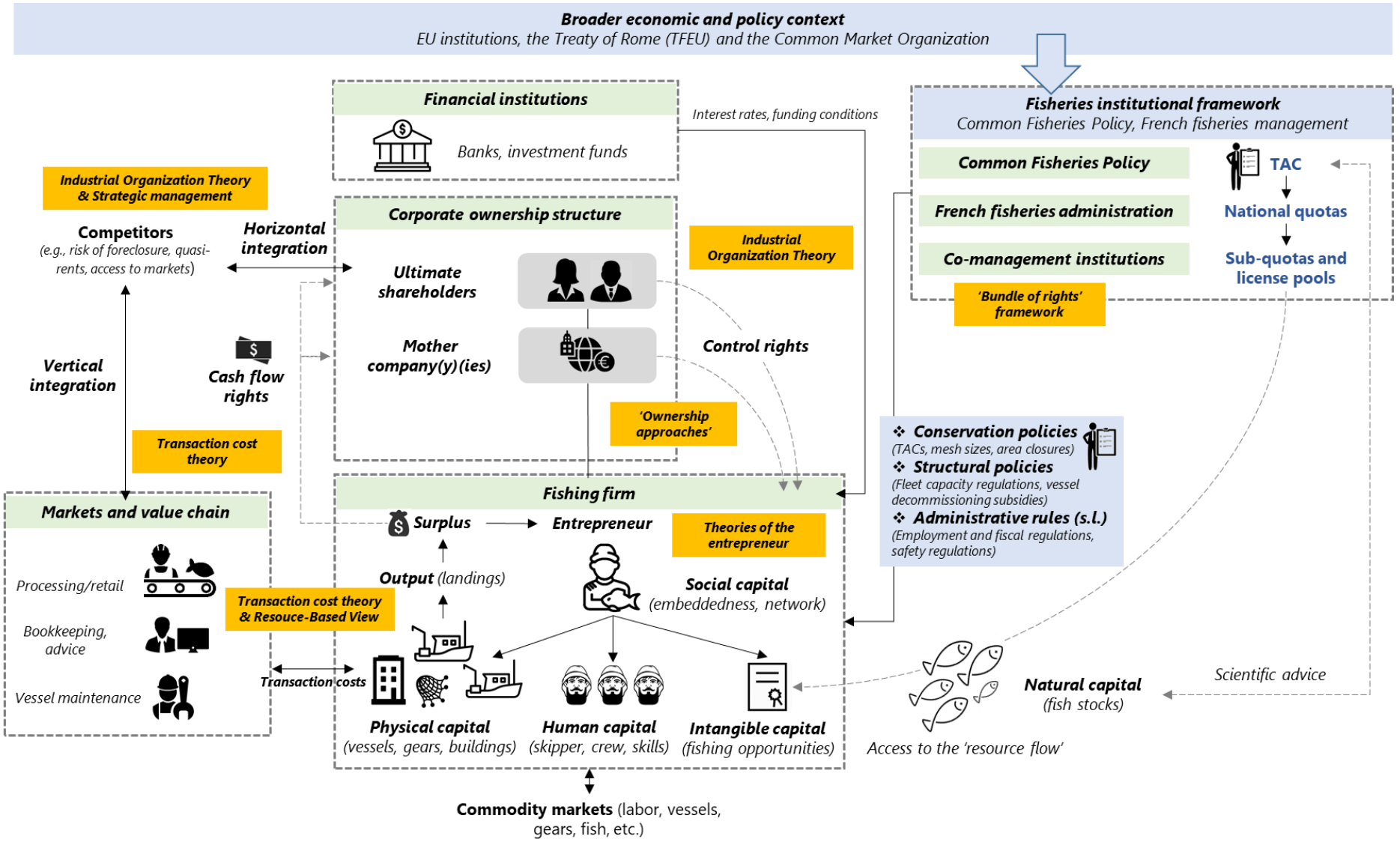


Figure 0-1: Conceptual framework of the PhD thesis. The entrepreneur at the head of the fishing firm is placed in the center of our framework.

3.1 The ownership structure of small and large fishing companies

The variety in fishing practices across the EU fishing fleet is matched with a wide variety of ownership structures. The choice of ownership structure may depend on many things, but pertains mostly to the characteristics of the fishery and the associated risk of investment (MRAG *et al.*, 2019). For example, large-scale pelagic fishing companies targeting herring require large initial investments (large vessels, high barriers to entry), but generate a reliable stream income to pay back these investments. Herring is a fast-growing species with a well-known biology (stock dynamics, migrations, distributions), making mass production possible. The presence of economies of scale makes supply chain (vertical) integration and horizontal mergers more likely. In such fisheries, firms' ownership structures are characterized by complex networks of shareholders and private equity funding (MRAG *et al.*, 2019). In smaller fleet segments, producers are often more dependent on external factors such as weather conditions and unpredictable species distributions (multiple target species). Income from fishing is less reliable, which mandates a simple ownership structure and more risk-averse investment behavior.

In artisanal fishing firms, the entrepreneur invests his/her own (personal) capital in the firm, which makes them also the owner of the firm. In France, artisanal fishing firms are traditionally sole proprietorships, in which the entrepreneur is both the owner and the skipper of (one of) the vessel(s) they own (Debeauvais, 1985). The combination of these different functions makes it difficult to distinguish remuneration from work and remuneration from invested capital (Boncoeur *et al.*, 2000a). In larger fishing companies, capital may be held by different entities and in different constellations through ownership interests (shares). Ownership shares give the holder a right to the returns of the company on a *pro rata* basis (cash flow rights). The nature and the amount of shares will furthermore determine the shareholder's level of control in the company (through voting rights in the company's board of directors and/or the general assembly) (Leech and Leahy, 1991). Based on the 'one share, one vote' principle (Demsetz and Lehn, 1985), the more shares an entity owns, the more voting power and the more control it has over a company's governance. As such, a spectrum of ownership structures is possible, in which fishing companies may be owned directly by one or multiple entities (in its most simple form the entrepreneur him/herself), or through a number of intermediaries along a path from the fishing company to its ultimate shareholders (natural or legal persons).

Based on the line of argument in section 1.3, we argue that mutually exclusive 'small vs. large' categories are too simplistic and therefore inadequate for the study of ownership in the EU fishing industry. A more functional view, one of economic organization, must be taken instead to ensure a fair consideration of all fishing firms without bias. Examples of such classifications exist. Stouten *et al.* (2011) have proposed a classification of Belgian fishing fleets based on 'strategic groups' – i.e., "clusters of firms within an industry that have common specific assets and thus follow common strategies in setting key decision variables" (Oster, 1999). In the French fishery, Rey *et al.* (1997) have developed a classification of fishing firms based on two elements: exploitation strategy (a continuum between profit maximization and diversification/cost minimization) and the mode of unit reproduction (growth-oriented, stable or shrinking). Then, different objective-orientated systems are identified based on combinations of two factors of production: labor and (physical) capital. Building on this work, Biais (1999) proposed a typology of the functioning and behavior of fishing enterprises in the Pertuis charentais fishery. In Chapter 1 of this PhD thesis, we will propose a classification of French Atlantic fishing firms based on a set of organizational attributes.

3.2 The role of the entrepreneur

The entrepreneur is a risk-taker, who is constantly innovating to deal with the uncertainties of the market economy. This innovation serves a double purpose: it reduces uncertainty for the entrepreneur and, at the same time, transforms the market economy (Boutillier and Uzunidis, 2014). In the firm, the entrepreneur is the decision-maker (i.e., the person effectively *allocating*

the resources), and does so in a world of imperfect information (Menger, 1883). Menger argues that the growth of knowledge is the cause of progress, and that this knowledge is applied by the entrepreneur in the formation of social networks. Building on this tradition, Casson (1982) considers that the entrepreneur is embedded in an economic environment, in which the family plays a key role. The presence of the family, together with access to key information, will determine entrepreneurial success. The family serves as a source of information, knowledge and funding (Casson, 1999; Boutillier and Uzunidis, 2014). At the same time, it harbors unique labor relationships that lower transaction and agency costs (see Casson, 1999 and Habbershon and Williams, 1999 for an overview and references). Outside the family, the independent entrepreneur may also benefit from membership in associations or clubs (Boutillier and Uzunidis, 2014). In the fishing industry, Producer Organizations (POs), purchasing cooperatives and co-management structures may be considered to belong to this category. In modern day ('late') capitalist societies, the role of the entrepreneur has evolved to one of specialization in management and organization of the firm (Boutillier and Uzunidis, 2014). This view was first articulated by Marshall (1920), who considered that the role of the entrepreneur is now divided between the owners (the shareholders) of the firm and its managers. In Marshall's view, shareholders of large firms bear the risks, while delegating nearly all strategic decisions to a salaried manager. Co-existing with this large firm constellation, is the entrepreneur as the owner and innovator of a small firm, much like the entrepreneur described by Menger (and later by Casson).

In a fisheries context, the profile of the entrepreneur may influence investment decisions and firm development. This profile may pertain to different aspects. A first aspect is the personal situation of the entrepreneur such as family relations and the age ('life stage') of the entrepreneur (Biais, 1999; Menzies, 2003; Delbos, 2006; Le Floc'h *et al.*, 2011), which has been shown to have implications for the succession of the business (Menzies, 2003; Marks, 2012; van Ginkel, 2014). Second, a number of socio-cultural elements influence decision-making. Such elements may include local embeddedness (birth locality, present living location) and the presence of complementary or alternative incomes (Ifremer, 2007), with consequences for crew management and remuneration (e.g., Menzies, 2002, 2003; St Martin, 2007; McCall Howard, 2012). Furthermore, small-scale and artisanal entrepreneurs may not fit the definition of rational profit maximizers around which most of fisheries economics is organized (Gordon, 1954; Scott, 1955; Clark *et al.*, 1979). Small-scale fishers who rely on fishing for their livelihoods may even operate at a net loss (Swan and Gréboval, 2005; Curtis and Jones, 2016; Højrup, 2018). Le Floc'h *et al.* (2011) argue that fiscal considerations (in addition to profits) are an important driver for investment decisions in the French Atlantic fishery, especially in the later career stages of boat owners.

3.3 Opening the 'black box': a neo-institutional approach to the study of organizations

In 'orthodox' neoclassical economics, the firm is seen as a production unit in which inputs are transformed into outputs without consideration of its organizational structure. In this '*black box*' conception, the firm is nothing more than a technological unit with a profit maximization purpose, and it is assumed that the market is responsible for the optimal allocation of resources. Orthodox economists assume that market value is determined by supply and demand, and thus by competition. Economic agents are considered to be rational self-interested individuals, out to maximize immediate gain, and competition is assumed to lead to an efficient allocation of resources in the economy. Williamson (1996) views the firm instead as an organizational unit whose internal governance structure varies with changes in both the institutional environment (external drivers) and the attributes of economic actors (internal drivers). Williamson and other economists belonging to the school of new institutional economics (NIE) (e.g., Ostrom, Coase, Alchian, Demsetz) explicitly distance themselves from the 'orthodox economists' of the neoclassical tradition. NIE assumes that bounded rationality and opportunism create opportunities for self-interest seeking and guile. Bounded rationality (as opposed to the hyperrationality in orthodoxy) is defined as "behavior that is intendedly rational, but only limitedly so" (Simon, 1961).

Following the suggestion by Nøstbakken *et al.* (2011) (see 1.5), we can take into account the firm's organizational structure by approaching the firm as an organizational unit combining and managing all the factors of production. In what follows, we will discuss Williamson's transaction cost economics (Williamson, 1981, 1986, 1996, 1998) and derived and complementary theories of the firm such as the contractual view of the firm and principal-agency theory (Alchian and Demsetz, 1972; Jensen and Meckling, 1976), and the resource-based view (Barney, 1991, 2001b). Finally, we will also add draw from industrial organization theory (Porter, 1980).

3.3.1 Williamson's transaction cost economics

In his paper *The Nature of the Firm* (1937), Ronald Coase argued that firms and markets are two alternatives for managing the same transactions, and that the "make or buy decision" (i.e., whether a firm produces for its own needs or procures a good or service on the market) depends largely on the size and the distribution of transaction costs (Coase, 1937; Williamson, 1996). Williamson considers that a firm's decision to organize a transaction internally or through the market is the result of transaction costs. Transaction costs may include information costs (e.g., discovering prices, supply, demand and market participants), contracting costs (e.g., agreeing on volumes and prices and writing it in a contract) and policing and enforcement costs (Mahoney, 1992). If the cost of producing an input is lower than the cost of buying it on the market, a firm will internalize this part of its production process through vertical integration (Williamson, 1981).

Williamson considers that transactions can in fact be allocated to either of three generic modes of governance – markets, hierarchies (vertically integrated firms) and hybrids (Williamson, 1986). The latter may include short and long-term contracts, franchising and joint ventures (Mahoney, 1992). For Williamson, the notion of transaction costs is essential for understanding why one mode of governance is chosen over another. The allocation of a given transaction to a governance mode depends both on the attributes of the transaction and on the competence and cost of alternative modes in managing the transaction (Williamson, 1996). The main hypothesis is that transactions are aligned with governance structures in a way that transaction costs are kept to a minimum.

In a fisheries context, transaction cost economics may provide insight, for example, into why certain firms outsource certain tasks (e.g., accounting or vessel maintenance), while others have internalized these aspects. Transaction costs can also explain the existence of hierarchical relationships within the firm, such as the hiring of a shore-based manager to

monitor operations (see below; agency costs). Relationships within the firm (and on board the fishing vessel) are often governed by incentive schemes to avoid problems associated with a misalignment of incentives (Vestergaard, 2010). However, vertical contracting and vertical integration cannot be explained solely from a transaction cost perspective. It is well established that strategic considerations also play an important role in the decision to vertically integrate (Porter, 1980; Perry, 1989; Mahoney, 1992). The resource-based view (RBV) and industrial organization (IO) theory provide complementary frameworks for studying these aspects of firm organization: RBV from the perspective of the firm's internal capabilities ('resources') (Barney, 1991, 2001a), IO theory from the perspective of the industry as a whole (Porter, 1980).

3.3.2 Barney's Resource-Based View (RBV)

The foundation for the resource-based view of the firm (RBV) was laid by Edith Penrose in '*The theory of the growth of the firm'* (1959) (cf. Kor and Mahoney, 2004; Newbert, 2007). In Penrose's view, firm growth – both internally and externally through mergers, acquisitions and diversification – is a function of the manner in which resources are deployed. It is not the mere *possession* of resources, but the effective and innovative *management* of those resources that will allow a firm to create economic value, and establish a competitive advantage (Mahoney, 1995). In addition to tangible assets (e.g., fishing vessels, delivery trucks, warehouses), firms dispose of a range of idiosyncratic assets ('capabilities') that cannot be replicated by the market, but are essential to a firm's competitiveness (Barney, 1991). Barney distinguishes between human capital resources and organizational capital resources. Human capital resources include the training, knowledge and experience of workers and managers in the firm, and the relationships between them. In the fishing sector, this may include formal training (i.e., fishing degrees from deckhand to skipper), tacit knowledge on fishing grounds and fish behavior (e.g., Thom and Schwaab, 2010*)* and skipper-crew relationships (e.g., Menzies, 2002). Organizational capital resources refer to how the firm is organized, both internally and in dealing with the external environment (e.g., competitors, buyers, producer organizations, government agencies, etc.). It encompasses both formal and informal structures. Formal structures include a firm's reporting structure, coordinating systems, scale, scope, integration and hierarchy, while informal structures refer to the firm's organizational culture (i.e., the set of beliefs and expectations including communication, teamwork, flexibility, trust, work ethic, etc.) (Barney, 1991; Teece, 1996).

3.3.3 The contractual view of the firm and agency theory

Complementary to Williamson's organizational unit (Williamson, 1996; p. 98) and Barney's resource-based view, Alchian and Demsetz (1972) and Jensen and Meckling (1976) view the firm as a grouping of contracts between parties, both inside and outside the firm. In this contractual view, contracts are considered the central coordinating instrument for allocating resources. In the light of the behavioral assumptions discussed above (bounded rationality and opportunism) all contracts are unavoidably incomplete. Although two contracting parties can account for a number of hazards ex-ante, they cannot account for all risks associated with the contract (this is especially true for contingencies that lie in the future). This, in turn, may open the door to opportunism, which, once detected, contracting parties can deal with by realigning incentives or choosing more appropriate governance structures for managing the transaction (Williamson, 1996).

In their 'theory of ownership structure', Jensen and Meckling (1976) combine insights from property rights theory, agency theory and theory of finance to help explain (among others) issues like the separation of ownership and control and optimal capital structure. For our analysis in Chapter 1, we are particularly interested in agency relationships within the firm.

Agency costs are often considered in the context of corporations[10], i.e., where there are clear cut principal-agent relationships. Agency costs then arise from a mismatch in incentives between the owner (the principal) and the manager (the agent). However, Jensen and Meckling (1976) argue that agency costs arise in any situation involving cooperative effort. Following Alchian and Demsetz (1972), we may approach fishing as a case of team production, in which the fish caught at the end of the day is the result of the collaborative effort of a number of team members[11] (Menzies, 2002; St Martin, 2007). Agency costs are related to the problem of shirking and monitoring, both on board the vessel and by shore-based managers (Vestergaard, 2010).

3.3.4 Industrial Organization theory

Industrial Organization (IO) theory is concerned with the analysis of industries, but may nonetheless provide important insights into the strategic choices of firms (Porter, 1981). The main assertion is that the performance of a firm in the market depends on the characteristics of the *industry* in which it competes (Porter, 1981). According to the structure-conduct-performance (SCP) paradigm (Mason, 1939; Bain, 1959), industry structure determines the behavior (conduct or *strategy*) of firms, which, in turn, jointly determine the collective performance of the firms in the marketplace – and thus, the industry as a whole. This framework was later expanded by Porter, (1980, 1981) to include feedback effects of firm strategy on market structure, e.g., through certain firm innovations that affect existing entry and mobility barriers.

In a fisheries context, barriers to entry are mainly thought of as the fishing opportunities needed to access the fishery. However, a fishing *industry* point of view requires, in fact, a supply chain perspective, encompassing the pre-harvesting, harvesting and post-harvesting stages of production. As such, barriers may also include (1) a high degree of control of proprietary knowledge (e.g., knowledge of fishing grounds may provide a significant competitive advantage); (2) the need for highly specific (non-malleable) assets (e.g., vessels and processing facilities); (3) the presence of significant economies of scale (e.g., entering the industry requires large investments in capital, personnel and development of organizational structure) (Thom and Schwaab, 2010). In an economy where entry and mobility barriers are high, firms have an incentive to vertically integrate (see incentives for vertical integration in section 1.5). Applied to the EU fishing industry, IO theory may provide valuable insights into the drivers behind trends like concentration and the integration of harvesters by processors (Warmerdam *et al.*, 2016, 2018; MRAG *et al.*, 2019).

3.4 Fishing opportunities as intangible capital in a bundle of rights

3.4.1 Fishing opportunities as intangible capital

Intangible capital is an important factor of production for companies. In addition to Barney's human and organizational capital resources discussed above, intangible capital may include patents, software, R&D expenditure, economic competencies, etc. The OECD (1998) considers intangible capital part of the business investment, but emphasizes the difficulty of telling apart capital accumulation from current expenses for these assets. As a consequence, intangible assets do not always show in the company's balance sheets (Marrocu *et al.*, 2012). In the fisheries sector, access to fishing opportunities (catch shares, licenses) has become a

[10] Jensen and Meckling (1976) define the corporate form of organization as having diffuse ownership, limited liability and the separation of ownership and control, and is opposed to individual proprietorships or partnerships.

[11] St Martin's generalization is nuanced by Campling *et al.*, (2012) who consider that this may only be true for some forms of artisanal fishing. According to the authors, the economic pressure imposed by competition in the marketplace may distort the harmonious relationship between owners and crew, even in what we consider 'artisanal' or 'household' fishing (see also Menzies, 2002).

strategic element for fishing firms whatever their size because they define *who* can fish and *how much*.

In the EU, fishing opportunities mostly constitute a combination of two elements. The first is an operation permit giving the operator the right to use a proportion of EU fishing capacity. The second are specific input or output licenses in which is stipulated where, when, how much[12] and with which gears one can fish. Output licenses give the operator access to a share of the TAC (see below). Other frequently used terms include 'quota shares', 'fishing rights' or 'property rights' (the latter is mostly used to denote private property rights such as ITQs). Throughout this PhD thesis, we will use the term 'fishing opportunities' to refer to input licenses ('licenses') and output licenses ('quotas' of 'fishing rights') (the operation permit will be mostly ignored).

In some EU Member States (e.g., Denmark, the Netherlands, and, formerly, the UK), fishing rights constitute an asset that can be owned and traded by the owner of a fishing operation according to rules laid down by the Member States' fisheries administrations (see below). In such cases, fishing rights are said to be 'private property rights' which appear in the balance sheet of the company and thus constitute a significant proportion of the fishing company's value, which is accepted as collateral by banks (Davidse *et al.*, 1999; van Ginkel, 2009, 2014; Høst, 2015; Carpenter and Kleinjans, 2017). In France, fishing rights constitute mere *use rights* (Bromley, 1991, 1992; Davidse *et al.*, 1999) which are non-appropriable and non-transferable by law. However, fishing rights may be transferred indirectly, through vessel sales on the second-hand vessel market (Quillérou and Guyader, 2012; Larabi *et al.*, 2013). Due to a strong emphasis on historical track records attached to the vessel (2001-2003) in yearly quota allocations (at different levels of governance, see Chapter 4) (Larabi *et al.*, 2013; Bellanger *et al.*, 2016), allocations remain quite stable in practice and are perceived secure by most fishers (Carpenter and Kleinjans, 2017). In that sense, we may consider that in France, quota allocations are *de facto* owned by fishing companies, through the ownership of fishing vessels. Despite the fact that fishing rights do not appear as an asset in the company's balance sheets, it has been shown that they constitute a significant value in second-hand vessel prices (Guyader *et al.*, 2003).

3.4.2 Fishing opportunities in a property rights framework: a bundle of rights

In addition to intangible assets in the firm, fishing opportunities can also be considered in a property rights framework. According to Bromley (1991, 1992) property rights can be understood as constituting the right to a share of the *resource flow* rather than a specific asset in the stock of fish. This definition acknowledges the common-pool and dynamic character of fish stocks by taking into account both the uncertainty related to natural stock replenishment and the dynamics of the resource as a result of fishing. According to Bromley (1992), there are two basic conditions for the existence of property rights. First, the *exclusion* of those outside the owner, user or group of users holding the rights, and second, the *protection* of those rights by authority[13]. Bromley identifies four broad regimes of property rights: state property, private property, common property and non-property (open access). Under state property, managing agencies have a right to determine rules of access or use and powers of delegation, and individuals have a duty to observe them. At the same time, users enjoy the benefits of their rights of access and use (cf. Davidse *et al.*, 1999 after Bromley, 1991). The 'state' should be interpreted here in a broader sense, and can in fact be any government – from local authorities and municipalities to international institutions such as the European Union.

[12] In the case of input licenses, limits are established through individual effort limitations (proxies like engine power and fishing time) and gear restrictions. In the case of output licenses, catch limits are determined in multiple ways: an equal share of the TAC (national quota) for all fishers, based on individual vessel capacity, historical catch records, or a combination of these (Boncoeur *et al.*, 2006).

[13] Bromley thinks of *legitimate authority* as the authority associated with officially recognized property relations, which "carries the implicit backing of the state" (Bromley, 1992, p. 9).

Conceptually, property rights regimes can also be viewed as existing of a 'bundle of rights' (Schlager and Ostrom, 1992). These rights are (adapted from Ostrom *et al.*, 2009): *access* (the right to access the fish stock); *withdrawal* (the right to harvest fish from the fish stock); *management* (the right to regulate the use patterns of (other) harvesters and to transform the fish stock by making improvements to the extraction regime); *exclusion* (a right to determine who has the right of access and withdrawal and whether that right can be transferred); and *alienation* (the right to sell or lease any of these rights). Schlager and Ostrom (1992) consider different levels of property rights and different types of users in the system, differing in the sets of rights and obligations that they hold (see Schlager and Ostrom, 1992; p. 253).

The property rights framework in the EU begins with the establishment of Total Allowable Catches (TACs) for specific species and stocks. TACs are then split up and divided among Member States based on relative stability (national quotas) (Symes, 1997; Sissenwine and Symes, 2007). Member States have, as such, only delegated powers over the resource (i.e., they have the *right* to design and implement access regimes and to allocate fishing opportunities to producers). Member States are relatively free to devise their own system of defining property rights, to choose how to allocate fishing opportunities to producers, and through which mechanisms they may be redistributed. Some rules regarding transparency and social criteria are outlined in Articles 16 and 17 of Council Regulation (EU) No 1380/2013[14].

In most Member States, the state delegates (part of) quota management to Producer Organizations (POs) in a co-management framework (Carpenter and Kleinjans, 2017). Member States differ greatly in the way they define and allocate 'property rights'. Following Ostrom *et al.*, (2009), it is the set of rules governing these rights at different levels which will define what is possible and what not. At the level of authorized users (i.e. the fishers), these rules will define whether or not fishers may sell or transfer their rights to other users – through a quota market or other (see Carpenter and Kleinjans, 2017).

3.5 The EU Common Fisheries Policy as a driver of fishing industry structure

In the EU, fishing activities are governed by the Common Fisheries Policy (CFP), which is historically focused around a conservation policy based on technical measures and top-down management approaches (see Holden (1994) and Peñas Lado (2016) for fully-documented historical perspectives on the CFP). The EU fishing industry is also embedded in the Single Market establishing free movement of goods, service, people and capital, known collectively as the 'four freedoms'. Here, we provide a short history of EU fisheries management and changes in industry structure, with a focus on the structural policy and the gradual shift towards rights-based approaches.

3.5.1 The unification of fisheries management in the EU: from open-access to regulated fisheries

Already in the Treaty of Rome establishing the European Economic Community (EEC, 1957), reference was made to a common policy for fisheries products (Title II – Agriculture, Article 38). The groundwork for the EU Common Fisheries Policy was laid in the late 1960s, which culminated in Council Regulation 2141/70 laying down a common structural policy for the fishing industry. The first discussions were focused around the need for of a common approach to the organization of domestic markets for fishery products, as well as the structural development of the fishing fleets of Member States[15] (Symes, 1997). Note that at this stage, the incipient 'Common Fisheries Policy' merely revolves around the creation of a common market for fisheries products as established in the Treaty of Rome, and a structural policy catering to this goal (i.e., Council Regulation 2141/70). Apart from the brief mention regarding

[14] See STECF (2020a) for an evaluation of how the social criteria outlined in Articles 16 and 17 have been taken into account.
[15] Council Regulation 2141/70, Article 1.

the “rational use” of biological resources in Article 1, there is no mention of conservation policies.

The 1970s were marked by a series of expansions of the Exclusive Economic Zones (EEZs) of countries in the North Atlantic region (Smith, 1986). This trend of extending EEZs was posing a threat to the incipient common organization of fisheries management in the European Economic Community (EEC). In 1973, a first enlargement of the EEC had taken place: the six founding members (1957) (France, West Germany, Italy, Belgium, the Netherlands and Luxemburg) welcomed Denmark, Ireland and the UK to the union. In this context, the expansion of members’ EEZs would radically alter the mobility and seasonal dynamics of fishing fleets (e.g., by breaking up traditionally shared fishing areas like the North Sea into exclusive zones) (Høst, 2015). The alternative worked out by policy makers and fisheries managers was based on the free access to EEZs, with the exception of coastal areas (i.e., *the common pond*) (Symes, 1997).

In 1983, a conservation policy was established with Total Allowable Catches (TACs) for shared species decided at the Community level and then split into national quotas based on historical catches (Holden, 1994). As such, the unification of fisheries management through the establishment of full-fledged Common Fisheries Policy in 1983 was characterized by a shift from open-access to ‘regulated state property’ through the introduction of TACs and national quotas based on the principle of relative stability (Jensen, 1999). The conservation policy also includes technical measures of conservation such as seasonal closures, area closures, gear restrictions, minimum landing sizes (MLSs), bycatch rates, etc. (see Jensen, 1999 pp. 34-42 for an overview of conservation instruments of the CFP).

3.5.2 The accession of new Member States in the 1980s and the issue of ‘quota hopping’

This new framework of TACs and national quotas thus combined international management of resources with the maintenance of national sovereignty. The principle was equal access to community fishing grounds, while guaranteeing to each Member State their share of the TAC. In subsequent years, however, this system of equal access on the basis of relative stability would increasingly come under pressure because of the accession of new Member States, and contradictions inherent to the institutional environment in which the CFP is embedded (e.g., Lequesne, 2000; van Ginkel, 2009; Coelho, 2010). A first major challenge was posed by the accession of Spain and Portugal to the European Community in 1986. This was associated with a significant increase in fishing capacity (i.e., a 75% increase in the number of vessels, and 65% in gross tonnage) (Symes, 1997). This created some concern among existing Member States, notably Ireland and the UK, who feared that the principle of equal access would result in an invasion of northern waters by the Spanish fleet, and subsequent quota reductions for established members. However, the principle of relative stability was applied and the *status quo* was maintained. The solution was a phased access to the full benefits of the CFP through a period of adjustment. A period of 16 years was originally agreed upon, but in 1994 the date of full accession was moved forward with 6 years after political pressure from Spain. Subsequent enlargements of the European Union in 1996 (Sweden, Finland), 2004 (Malta, Cyprus, Estonia, Latvia, Lithuania, Poland, Slovenia), 2007 (Bulgaria, Romania) caused similar problems in other sea basins (Symes, 1997, 2012)[16].

While averting a deeper institutional crisis, the accession of new members combined with the principle of relative stability posed a real threat to the fishing industries of certain established Member States. More precisely, the freedom of establishment and the free movement of capital – both key pillars of the EEC’s Common Market – enabled ship owners to purchase fishing vessels in other Member States, and utilize their quotas. This phenomenon is better

[16] The accession of Croatia in 2013 seems to not have caused these problems since fisheries are based on effort (and tuna fisheries are managed through ICCAT) (STECF, 2019a).

known as “quota hopping” (Lequesne, 2000; Hoefnagel *et al.*, 2015). During the transitional period, some Spanish vessel owners were able to buy vessels in other EU member states, thus obtaining access to their national quotas. Over the years, quota hopping would become a major way for EU fishers (most notably Spanish and Dutch) to circumvent quota restrictions due to the relative stability principle (Lequesne, 2000; van Ginkel, 2009).

The issue of quota hopping thus uncovered a major institutional weakness of the CFP: the incompatibility of the principles of ‘relative stability’ and ‘free establishment’ (Coelho, 2010). Lequesne (2000) argues that such liberal market norms are consistent with the EEC’s aim to build a European market, but are not in agreement with the territorial logic of an economic sector. On the contrary, they actively contribute to its deterritorialization. Member States have tried to mitigate the negative economic effects of quota hopping by requiring quota hoppers to demonstrate a ‘real economic link’ with the host country (e.g., Lequesne, 2000; Hatcher *et al.*, 2002; van Ginkel, 2009). In turn, this economic link was criticized for restricting competition, and a specific measure by the UK Government was even ruled against by the European Court of Justice for violating the principle of freedom of establishment (see Jensen, 1999, pp. 43-45 for an account of the "quota hopping trial").

3.5.3 Overcapacity and fleet adjustment: 1983 to present

The CFP’s first comprehensive structural policy was introduced in 1983 (Hatcher, 1999). With the exception of some financial aid in the early 1980s for the removal of fishing vessels following a reduction in fishing opportunities in third countries, the structural policy has focused on fleet construction and modernization throughout the 1980s and 1990s, and well into the 2000s (see Hatcher, 1999 for an overview of structural policies). To this end, extensive subsidization programs were implemented, which were only phased out in 2005 (Lindebo, 2005). A recent study by Skerritt *et al.* (2020) provides a retrospective of subsidies in EU fisheries in the past 20 years.

This created a structural problem of overcapacity which multiple reforms of the CFP were not able to resolve, despite the implementation of Multi-Annual Guidance Programs (MAGPs) to guide this process (Cueff, 2007). After recognizing the problem during the discussions preceding the 2002 CFP reform[17], the Commission implemented a reform of the structural policy focused on structural assistance and emergency measures for the scrapping (“decommissioning”) of fishing vessels (Lindebo, 2005). Also in subsequent reforms, decommissioning schemes remained the main tool for capacity reduction (DG MARE, 2013). In 2009, the European Commission’s Green Paper (EC, 2009) proposed an EU-wide system of transferable fishing concessions as a “more efficient and less expensive way” to reduce overcapacity. Although the proposal contained conditions for the protection of small-scale fishers and fishing communities (e.g., the exclusion of small-scale fishers from the system, non-appropriable and time-limited allocations, reserves for new entrants, etc.), the proposal was finally not implemented in the 2013 reform following pressure from NGOs and some Member States (e.g., France, on the basis that such system would lead to concentration) (Gouvernement Français, 2009). Notably a lobby group for small-scale fishers, the LIFE platform (*Low Impact Fishers of Europe*) was able to push for the inclusion of social and environmental criteria instead of the mandatory transferability to ensure a more equitable and fair allocation of fishing opportunities (STECF, 2020a).

[17] See COM(2000) 272 final, p.5.

3.6 Case study: the French Atlantic fleet

3.6.1 Historical perspective

The French Atlantic fleet (FAF) is the main case study for the four chapters of this PhD thesis. We may consider three pivotal moments in the post World War II development of the French fishing fleet. The first is the collapse of the industrial fishing fleet in the 1960s and the development of an independent artisanal fleet. The second is the crisis of the 1990s, caused by overfishing and unrestrained growth during the 1980s. In this period, many artisanal boat owners were pushed out of the fishery. The third pivotal moment is marked by the discontinuation of subsidies for vessel construction, a number of policy reforms aimed at capacity reduction and the development of a quota co-management system. A full account of the post-war development of the French Atlantic fishing sector is beyond the scope of this introduction, but we refer to Menzies (1997, 2003), Rieucau (1980), Le Gallic (2006), Ponsot and Mauget (2008), Delbos (1995, 1996, 2006), Deldrève (2001) and (Le Floc'h, 2018) for a detailed description.

The so-called 'artisanal fishing model' has been a key element in the development of the French Atlantic fleet after World War II (Meuriot, 1986) and was aided by the State through the establishment of financing instruments and governance structures, including fishing cooperatives (see Ponsot and Mauget, 2008 for a description). The artisanal model is usually characterized by following elements (Debeauvais, 1985; Deldrève, 2001; Delbos, 2006): The fisher (*artisan*) is owner or co-owner of his or her fishing vessel, and has the statute of embarked owner. They invest their own capital (sole proprietorship) and manage the firm technically and economically (Debeauvais, 1985); This 'owner-operator' has one fishing vessel, which is generally smaller than 12 meters in length, but may be up to 25 m according to legislation[18]. Crew size is generally small, with a maximum of 5-10 for larger vessels (Delbos, 2006). A number of other criteria are commonly used to contrast artisanal fisheries with industrial fisheries: a high degree of family involvement in the firm, strong local anchoring, the polyvalence of the fishing activity and relatively short fishing trips (Debeauvais, 1985; Menzies, 1997; Delbos, 2006; Ifremer, 2007; Reyes *et al.*, 2015).

During the 1980s and 1990s, the funding model of vessels and fleets was highly dependent on subsidies. Boncoeur *et al.* (2000b) reviewed the different types of subsidies and classified them according to their nature, purpose and allocation by beneficiary. More common financial aids included public aids (income transfers through subsidies or debt relief due to interest rates lower than market rates) and fiscal aids (derogatory regimes on taxes or capital gains upon resale of a vessel) (Le Floc'h *et al.*, 2011).

After the fishing crisis in the 1990s, the French government reacted with emergency funding support and introduced legislation that would allow for new forms of firm governance. The aim was to better protect owner-operators by allowing them to legally separate their personal and professional assets, and protect them and their spouses better against bankruptcy, divorce or death (Menzies, 2003; Delbos, 2006; Le Floc'h, 2018). Capacity was reduced through a series of decommissioning schemes between 1991 and 2010[19] (Guyader and Jacob, 2012). A contradictory policy focused on fleet renewal was implemented at the same time (Mesnil, 2008). Between 1992 and 2010, the size of the French Atlantic fleet was reduced by 35% (1736 vessels) (Van Putten *et al.*, 2012), and recent trends show that the number of vessels >12 m decreased by 45% between 2000 and 2020 (SIH, 2021) (Figure 0-2).

[18] Décret n° 93-33 du 8 janvier 1993.
[19] Most schemes were implemented following the 2002 Reform of the CFP (Guyader *et al.*, 2007).

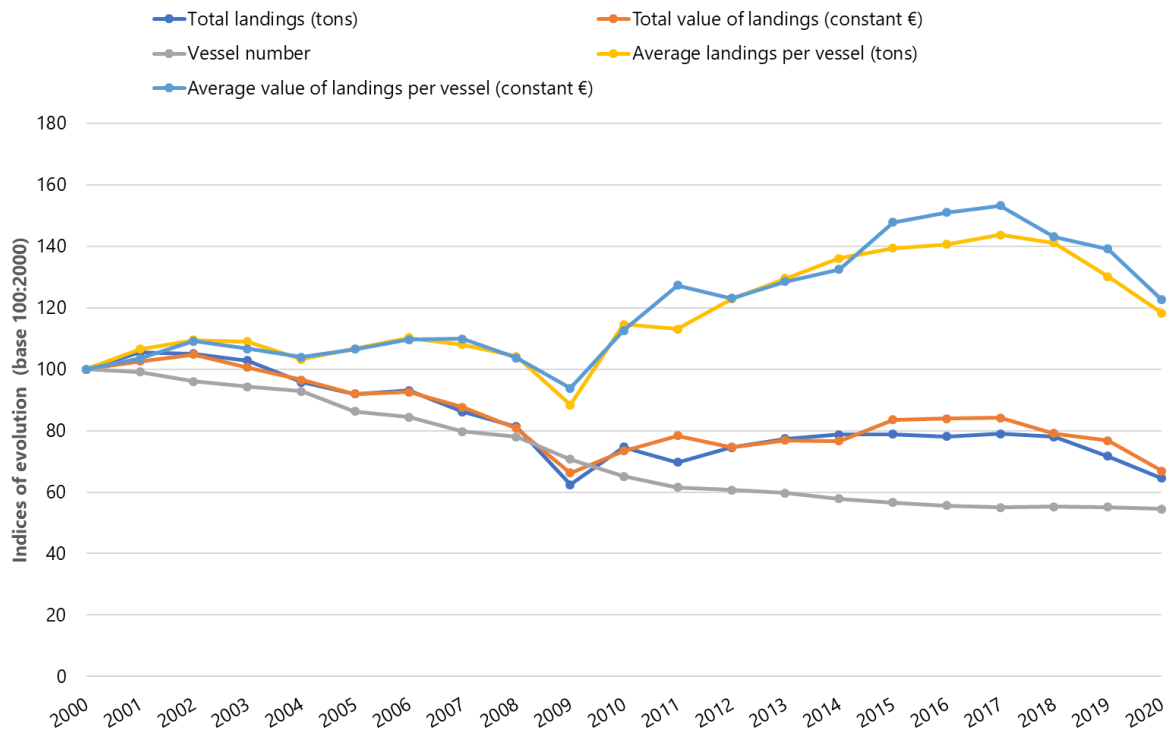


Figure 0-2: Key fleet indices for vessels above 12 meters between 2000 and 2020 (tropical purse seiners excluded). Source: SIH, 2021.

The second-hand vessel market became a key entry point because of capacity regulations, limits on new vessel constructions and the establishment of operation permits per vessel (Guyader *et al.*, 2006; Van Putten *et al.*, 2012). Figure 0-3 shows the evolution of the vessel transaction rate on the second-hand market for the French Atlantic fleet in the last 30 years[20]. Transaction rates were relatively high over the entire period (between 6% and 10%), with changes dependent on the economic and institutional context (Guyader, 2018).

[20] The transaction rate was approximated by the following ratio: (number of vessels that changed operator in a given year) / (number of vessels in population in year-1).

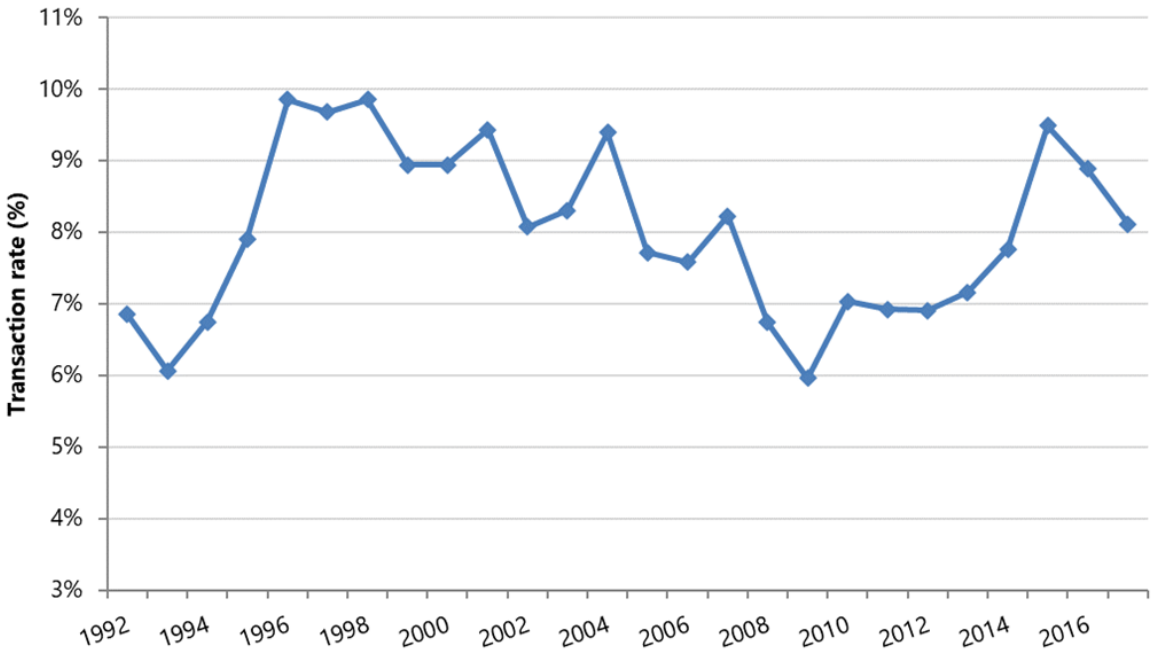


Figure 0-3: Evolution of the vessel transaction rate on the second-hand market (Atlantic fleet). Source: Guyader (2018).

3.6.2 Fisheries management in France

In France, fisheries resources are considered national resources belonging to the inhabitants (JORF, 1997, 2010), and fishing opportunities are non-transferable by law. Quota and license allocations constitute a *use right* for a given species, area and time period (maximum 1 year), rather than a property right fixed in time (Larabi *et al.*, 2013). While market transactions of fishing opportunities are prohibited by law, in practice (due to their strong link with historical track records) they may be transferred when the vessel is sold on the second-hand market (see Larabi et al., 2013). Management is the responsibility of POs (for TAC-managed species) and fisheries committees (for non-TAC managed species), alongside administrative authorities (Mongruel et al., 2017). Before any fishing vessel is eligible to fish, the operator must apply for an operation permit (*permis de mise en exploitation*, PME). The PME is replaced with a European fishing license once the vessel has entered the fleet, giving the operator the right to use a proportion of European fishing capacity (Lagière *et al.*, 2012). To access specific fisheries, the operator must apply for one or multiple fishing authorizations.

The administration may allocate fishing opportunities to POs and fisheries committees based on three criteria: historical track records, socioeconomic balances and market orientation (Legifrance, 2019). In practice, however, the vast majority of allocations are performed based on historical track records alone (Carpenter and Kleinjans, 2017). The same holds for the subsequent allocation of fishing opportunities to fishers or groups of fishers by POs and fisheries committees. Fishing opportunities are allocated to the so-called 'vessel-producer partnership' (*couple navire-armateur*). While market transactions of fishing opportunities are prohibited by law, in practice (due to their strong link with historical track records) they may be transferred when the vessel is sold on the second-hand market (see Larabi *et al.*, 2013). The focus on track records as a distribution criterion by the administration has created an incentive for POs to attract vessels with track records attached, and, consequently, for producers to invest in such vessels. As such, the main way for French fishers to acquire additional fishing opportunities is through investment in fishing vessels with track records and/or licenses attached.

3.6.3 Current fleet structure and value chain

According SIH (2021) the commercial fishing fleet registered on the Atlantic coast in 2019 was composed of 2901 vessels with a total engine power of approximately 504,000 kW and a total of 7636 crew members (SIH, 2021). The fishing effort deployed by this fleet represented 387,000 fishing days. Landings in quantity for all species reached approximately 372,000 tonnes for a landed value of € 932 million. Within this population, vessels over 12 meters in length represented 25% of the fleet, 55% of engine power, 52% of crews and 41% of fishing days. The landed value of vessels greater/less than 12 m represented around 73% and 27% of the total, respectively. The fleet is distributed all along the Atlantic coast with 40% of the vessels registered in Brittany (42% of power), 21% in Normandy (21%), 19% in Nouvelle-Aquitaine (19%), 11 % in Pays de la Loire (13%) and 8% in Hauts-de-France (4%).

Vessels >12 m are mostly exclusive trawlers (44% of vessels) and dredgers-trawlers. The other fleets are mainly gillnetters, pure dredgers, demersal seiners, purse seine vessels and vessels using hooks and line. Some of the vessels >12 m are potters specializing in crustaceans. The main fleets for <12 m are the fleets targeting European eel, potters, dredgers, gillnetters and longliners. The diversity of gear used is greater for vessels <12 m than for vessels >12 m. Fishing effort is mainly distributed in the Channel and the Bay of Biscay, but also in the Celtic and North Seas. The landed values come respectively from 66.8%, 18.4% and 11.3% of the French, British and Irish EEZs. The value extracted in the Norwegian EEZs including the areas of Svalbard and Jan Mayen Island is around 2.6%. Other EEZs contribute less than 1% of the overall value. The first 25 species landed account for about 85% of total landed value and for 73% of the total landed volume. The first five species are hake (12% of total landed value), monkfishes (9.6%), scallops (9.4%), sole (6.8%) and squid (3.9%). Within the top 25 species, the species with the highest volume are hake (9.4%), scallops (8.4%), herring (7.3%), sardines (6.6 %) and monkfishes (5.1%). The highest value species are lobster with a landing price of 20.5 €/kg, sole and sea bass (13.5 €/kg), langoustine (11.9 €/kg) and John Dory (11.1 €/kg). The average price across species is 2.4 €/kg (SIH, 2021). After increases in 2016 and 2017, the economic results of the French fleet fell in 2018 while remaining at a higher level than at the start of the decade (2011-2015). The gross value-added decreased due to the combination of stability in the value of landings and the increase in costs, in particular those of energy (Agreste, 2020). Key figures about the value chain in France are provided by FranceAgriMer (2020).

Chapter 1: The inadequacy of the "artisanal vs. industrial" dichotomy in French Atlantic fisheries: an organizational perspective

After: Kinds, A., Le Floc'h, P., Speelman, S., Guyader, O. (XXXX). The inadequacy of the "artisanal vs. industrial" dichotomy in French Atlantic fisheries: an organizational perspective (*manuscript submitted for publication in Marine Policy; in review*).

Abstract

In this chapter, we put under scrutiny the "artisanal vs. industrial" dichotomy used by French fisheries management for classifying fishing operations. Recent evolutions in the Atlantic fishing sector urge us to question its applicability. The small-scale and family character of artisanal fishing have been shown to be in decline, and anecdotal evidence points towards the emergence of new forms of firm governance. On the basis of mixed-method research (interviews, multiple correspondence analysis (MCA) and hierarchical clustering), we propose a new typology for firm classification, based on six organizational attributes (ownership structure, firm structure, management strategy, firm size, fishing strategy and valorization strategy). We have carried out a three-step analysis of organizational forms. First, the results of an MCA suggest that the diversity of organizational forms can be described to a great extent in terms of the profile of the owner and the firm's management and valorization strategies. The cluster analysis then separates organizational configurations in five types, based on cluster-specific modalities: access to key information, legal form, vessel maintenance and standardization, growth objectives and management structure. The final description of the types draws from additional interview data as well as variables that were not used in the analysis. The resulting typology captures the vast diversity in governance configurations currently existing in the sector, and also provides some insight into their origins and future trajectories. We conclude that the artisanal model is outdated and insufficient for describing the organizational diversity of modern-day fishing firms, especially those in the 12-18 m and 18-24 m segments. The presented typology may be useful as a decision-making tool for the allocation of fishing opportunities or funds to specific fisher profiles.

1 Introduction

For the purpose of study and management, capture fisheries are often divided into discrete categories. A commonly used division is that of small-scale versus large-scale (or industrial) fisheries (Thomson, 1980; Maclean, 1988; Ruttan *et al.*, 2000; Berkes *et al.*, 2001; Sumaila *et al.*, 2001; Therkildsen, 2007; Guyader *et al.*, 2013). In France, the small vs. large dichotomy traditionally revolves around elements of ownership and operation, as well as vessel size, gear characteristics, fishing zones and trip duration (FAO, 2005). The most commonly used classification contrasts 'artisanal' fisheries with 'industrial' fisheries. Hereby industrial fishing operations are seen as capital-intensive (Reyes *et al.*, 2015) and artisanal operations as small to medium-scale, family-owned (Menzies, 2003) and requiring relatively low capital investments (Guyader *et al.*, 2013). Artisanal fishing is usually described using two elements: first, the fisher (*artisan*) is (co-)owner of his or her fishing vessel, and has the statute of embarked owner. The owner-operator invests their own capital (sole proprietorship) and manages the firm technically and economically (Debeauvais, 1985). Second, the owner-operator typically has one fishing vessel, which is generally smaller than 12 meters in length, but may be up to 25 m according to legislation[21]. Crew size is generally small, with a maximum of 5-10 for larger vessels (Delbos, 2006). Other characteristics of the artisanal model include a high degree of family involvement, strong local anchoring and the polyvalence of fishing activity (Debeauvais, 1985; Menzies, 1997, 2003; Delbos, 2006; Ifremer, 2007; Reyes *et al.*, 2015). Industrial fishing operations can be understood as those with gross tonnage >50 GT, and of which the owner does not embark (Chaussade, 1984). The owner has multiple fishing vessels >24 m (and up to 90 m), each employing between 10 and 70 crew.

This classification lies at the basis of France's fleet development policies after World War II, and is still used in the context of fisheries management today (JORF, 1997, 2010). After WWII, the State's first rebuilding efforts were entirely focused on the industrial fleet, for which large investments were required. This reflected the State's decision to fully engage in international competition for fishery resources. Policies were even designed to encourage mergers so as to increase the fleet's investment capacity (Meuriot, 1986; p. 301). Only in the 1980s, the focus shifted to artisanal fleet development. Financial and other support was ensured through the establishment of fishing cooperatives (see Ponsot and Mauget (2008) for an overview. The fishing crisis in the 1990s (Le Floc'h, 2018) meant a massive blow for many artisanal fishing firms. A 1995 audit report (Mettling *et al.*, 1995) showed that 23% of 12-25 m vessels came out of the crisis facing financial difficulties (6% of vessels were objectively bankrupt) (Mesnil, 2008). The termination of EU subsidies in 2006 further impacted the profitability and competitiveness of artisanal fishing firms (Mesnil, 2008).

Furthermore, EU policies aimed at reducing overcapacity throughout the 1990s and 2000s resulted in a significant reduction in the number of fishing vessels (Quillérou and Guyader, 2012). A proportion of the freed-up capacity was bought up by remaining fishing firms, which led to an increase in the number of multi-vessel fishing firms (Quillérou *et al.*, 2011). Multi-ownership was further increased as a result of several reforms of fisheries management. This is due to the fact that, although fishing opportunities are non-transferable by law, they can be obtained indirectly, through vessel acquisitions on the second-hand market (see Chapter 4). Vessel prices on the second-hand market increased due to the value of the intangible assets (historical track records, operation permits and fishing licenses) attached to them (Guyader *et al.*, 2003; Quillérou *et al.*, 2011), creating significant entry barriers for artisanal fishers, especially for small-scale fishers and fishers without family ties in the sector (Claudon *et al.*, 2012; Autorité de la concurrence, 2015).

Multi-ownership challenges the '*one man, one vessel*' definition of artisanal fishing. Furthermore, anecdotal evidence suggests that family-based fishing is in decline: the

[21] Décret n° 93-33 du 8 janvier 1993.

emergence of multi-vessel fishing firms, joint ventures with corporate firms[22], crew increasingly found outside the family network, children being discouraged to take over their parents' firm, etc. In an attempt to remain competitive (Menzies, 2003), artisanal fishers are seen to adopt new elements of firm governance (Delbos, 2006) which to date remain poorly understood. Evolutions in the industrial fishing sector include horizontal growth through mergers and acquisitions, and backward vertical integration by retailers and processors (Warmerdam *et al.*, 2018; MRAG *et al.*, 2019). There is substantial evidence of concentration, most notably in the tuna industry, with the 2011 merger of three fishing companies[23] and the subsequent acquisition by a Dutch corporation in 2017. Foreign investment has increased in recent years, with investments by Dutch, Irish and Icelandic corporations catching the eye (MRAG *et al.*, 2019).

In light of these recent evolutions, we hypothesize that the traditional "industrial vs. artisanal" dichotomy is outdated. The artisanal fishing model in particular does no longer seem to match the structural and organizational complexity of modern-day fishing firms as observed in the field. A better understanding is needed of what drives fishing firms to expand horizontally and vertically, and how such expansion is reflected in (or mandated by) the firm's organizational structure. Overall, little research has been carried out on the relationship between organizational structure of fishing firms and their investment behavior. Nøstbakken *et al.* (2011) have suggested that organizational structure of fishing firms may be an important determinant of investment behavior, and that it may help understand capacity development on the level of the fishery. The authors argue that the firm (not the vessel) is the main decision-making unit, and thus the appropriate unit of analysis.

In this chapter, we present a typology of organizational structure of French Atlantic fishing firms with multiple fishing vessels. The aim is (1) to establish an understanding of what defines French Atlantic fishing firms in terms of organizational attributes, (2) to describe in detail the different organizational forms found in the fishing sector today, and (3) reflect on their trajectories (past, present, future).

2 The fishing firm as an organizational unit

More than a production function in which inputs are transformed into outputs, the firm is an organizational unit whose internal governance structure varies with changes in both the institutional environment (external drivers) and the attributes of economic actors (internal drivers) (Williamson, 1996). It is well-established that the organizational structure of firms is an important determinant of firm strategy (Barney, 2001b), innovation (Teece, 1996) and performance (Barney, 1991, 2001a, 2001b).

In addition to tangible assets (e.g., fishing vessels, warehouses), firms dispose of a range of idiosyncratic assets that cannot be replicated by the market, but are essential to a firm's competitiveness (Barney, 1991). *Human capital resources* include training, knowledge and experience of workers and managers in the firm, and the relationships between them. In the fishing sector, this may include formal training (i.e., fishing degrees from deckhand to skipper), tacit knowledge on fishing grounds and fish behavior (Thom and Schwaab, 2010) and skipper-crew relationships (Menzies, 2002; St Martin, 2007). *Organizational capital resources* refer to how the firm is organized, both internally and in dealing with the external environment (e.g., competitors, buyers, producer organizations, authorities). It encompasses both formal and informal structures. Formal structures include a firm's reporting structure, coordinating systems, scale, scope, integration and hierarchy. Informal structures refer to the firm's

[22] E.g., https://www.lavoixdunord.fr/161043/article/2017-05-11/unipeche-s-associe-des-hollandais-pour-acheter-des-bateaux-le-modele-du-patron (Accessed on 17/12/2020).

[23] The *Compagnie Française du Thon Océanique* (CFTO) is the result of the merger of the shipping companies France-Thon, Cobrecaf and Cobrepêche in January 2011.

organizational culture (i.e., the set of beliefs and expectations including communication, teamwork, flexibility, trust, work ethic, etc.) (Barney, 1991; Teece, 1996).

3 Material and methods

3.1 Case study description

In 2018, 2905 fishing vessels were registered in and operated out of France's Atlantic, Channel and North Sea fishing ports[24], 811 of which were multi-owned, corresponding to 28% of the entire fleet, 38% of total kW and 43% of landed value[25]. There were 2180 vessels (74.6%) <12 m and 725 (24.8%) >12 m. The fleet is diverse, both in terms of vessel size and fishing techniques. The main segments are demersal trawlers/seiners (n=591), drift and fixed netters (n=551), vessels using pots and traps (n=388), vessels using hooks (n=296), and dredgers (n=270) (see STECF, 2018 for a more complete description)

Compared to other fisheries in France, landings from the French Atlantic fleet are characterized by a high species diversity (Daures *et al.*, 2009). In 2018, total landings were 410,000 tons for a value of 981 M€, with nearly 75% of this value landed by vessels over 12 m (7 species made up 50% of the landed value). Main species in terms of value are hake (*Merluccius merluccius*), monkfishes (*Lophius spp.),* scallops (*Pecten maximus*), common sole (*Solea solea*), Atlantic cod (*Gadus morhua*) and Norway lobster (*Nephrops norvegicus*). In terms of volume, key species include pelagic species like herring (*Clupea harengus*), sardine (*Sardina pilchardus*), mackerel (*Scomber scombrus*) and saithe (*Pollachius virens*).

Fishing fleets are managed under the regulations of the EU's Common Fisheries Policy (CFP) (Peñas Lado, 2016). This includes the use of Total Allowable Catches (TACs) and national quotas as well as input controls such as gear restrictions and effort limitations aimed at limiting entry to the fishery (kW, GT, licenses) (Van Putten *et al.*, 2012). Fishing opportunities (quotas, licenses) are non-transferable by law (Legifrance, 2019). Their allocation has been delegated to Producer Organizations (POs) for TAC-managed species, and to Fisheries Committees (*Comités des Pêches*) for non-TAC species (Larabi *et al.*, 2013; Bellanger *et al.*, 2016).

3.2 Semi-structured interviews and key information

Semi-structured interviews were conducted with fishers with two or more fishing vessels (n=80) between December 2017 and April 2019. This group comprised both vessel owner-operators and managers of fishing firms. Participants were selected according to a quota sampling method, in order to cover the different fishing districts, vessel sizes and fleet segments. As such, our sample captured 315 vessels, representing 39% of vessels and 71% in terms of landed value of the subpopulation (operators with ≥2 fishing vessels) (Table 1).

Interview questions were prepared based on theory, expert knowledge and (anecdotal) evidence from the field. The interviews were conducted in the homes of fishers, at their landing sites or in their dockside offices. Interviews lasted between 1 and 3 hours. Respondents were asked about key elements related to the organization of their businesses, including: (1) ownership structure (owner profile, presence of ownership sharing with skippers, foreign ownership); (2) firm structuration (legal form, presence of holding); (3) funding strategy (debt, equity); (4) management strategy (presence of salaried manager, involvement of family members); (5) firm size (number and size of vessels, number of crew); (6) fishing strategy (type

[24] Throughout this chapter, we will use the term 'Atlantic' to group the Atlantic (*sensu stricto*), the Channel and the North Sea.

[25] We must note that this picture is still an underestimation of multi-ownership. Data on vessel ownership are collected at the level of the registered *operator*, who may be another entity than the *owner*. An owner (a natural or legal person) may own multiple operating fishing firms, but this cannot be discerned from the data (see Chapter 2).

of vessels, gears, target species, details about operations); (7) valorization strategy (markets, internalization of sales and processing, labeling). Additional information was collected about the fisher's personal history (age, education, generational fishing, activities prior to fishing, etc.) and firm development (access to fishing opportunities, perspectives on fisheries management, involvement in collective action, personal motives for investing, etc.).

Table 1-1: Ownership structure of the French Atlantic fleet (2018). NB: tuna vessels registered in Atlantic ports but fishing in other regions were excluded. (*): % of the total population; (**): % of sub-population interviewed. Operators were adjusted based on survey results. Sources: DPMA-Ifremer Fisheries Information System (SIH) (2018) and our survey.

No. vessels/operator	1	2	3-5	6-9	≥10	Total population	Sub-population >1 vessel*	Survey sample**
No. operators	2094	236	64	11	6	2411	317 (13%)	80 (25%)
No. vessels concerned	2094	472	194	72	73	2905	811 (28%)	315 (39%)
Total hp (10^3 kW)	310	75	46	31	40	502	192 (38%)	115 (60%)
Landed volume (10^3 tons)	229	52	54	35	39	409	180 (44%)	123 (68%)
Landed value (M€)	560	124	97	91	109	981	421 (43%)	301 (71%)

The interviews were transcribed verbatim. Then, each transcript was read through several times and coded manually following the framework set out by Riessman (Riessman, 2008) for thematic narrative analysis. Participants' answers were converted to discrete values (Table 1), and the resulting categorical variables were included in a database for further analysis. Finally, information collected via interviews was supplemented with data that we obtained indirectly (e.g., via other respondents, fishing industry newspaper articles, internet broadcasts), as well as data compiled from Ifremer's SIH database[26] (landings, fishing activity, characteristics of vessels and operators).

In addition to the interviews with fishers, 20 semi-structured interviews were conducted with key actors including fisheries administration (national and regional, n=2), representatives of POs (n=4) and fisheries committees (n=6), business lawyers (n=2), financial experts/vessel brokers (n=2), bank executives (n=2), wholesalers (n=1) and shipyards (n=1).

3.3 Selection of firm attributes for typology construction

Commonly used organizational attributes in the field of strategic management include firm size (Leech and Leahy, 1991; Moon and Bae, 2011), ownership and/or management structure (Alchian and Demsetz, 1972; Jensen and Meckling, 1976; Leech and Leahy, 1991; Mahoney, 1992; Chaddad and Cook, 2004); organizational culture and values (Barney, 1986; Teece, 1996); the degree of market power, rivalry and competition (Porter, 1980; Teece, 1996); the proportion of debt and equity funding (Teece, 1996); human resource management (Koch and Mcgrath, 1996); and the presence of strategic resources within the firm (Barney, 1991; Kogut and Zander, 1992; Becker, 1993; Mahoney, 1995; Traversac *et al.*, 2011).

To develop a typology of firm organization adapted to the fishing industry, we also took following elements into account. First, we consider that fishing firms can grow in two basic ways: either by adding vessels to their fleet (horizontally), or by expanding activities beyond fishing (e.g., processing, developing sales, etc.) (vertically). A second consideration is related to the specifics of fishing as an economic activity (e.g., its rural and family character, the organization of labor, crew remuneration, etc.) and its position within a broader socioeconomic context, and more specifically, a complex institutional environment (fisheries management). Finally, the French fishing industry exhibits a number of particularities in the way fisheries production is organized: e.g., the common property and the non-transferability of fisheries resources (Larabi *et al.*, 2013; Bellanger *et al.*, 2016), the organization of labor in trade unions (Delbos and Prémel, 1996), the strong cooperative tradition (Ponsot and Mauget, 2008), and, more generally, labor and fiscal law.

[26] See https://sih.ifremer.fr/ (Accessed on 18/12/2020)

Six attributes (themes) were selected for typology construction: ownership structure, firm structure, management strategy, firm size, fishing strategy and valorization strategy. For each attribute, one or more variables were constructed (17 in total). Then, for each variable, discrete categories were decided upon. Table 2 summarizes these themes and variables.

Ownership structure. Ownership structure has implications for firm governance and performance (Shleifer and Vishny, 1986; Pedersen and Thomsen, 2003; Nordqvist *et al.*, 2014). In fisheries, the variety of ownership structures is commonly placed on a spectrum, sometimes including elements of geographical location and the mode of production: i.e., from household producers and self-employed owner-operators (private businesses) to "capitalist"[27] fishing firms and (multinational) corporate fishing companies (Menzies, 2003; St Martin, 2007; Campling *et al.*, 2012; Marks, 2012; McCall Howard, 2012; Guyader *et al.*, 2013). A fishing company may be owned by one or more individuals, a family, or a corporation (Menzies, 2003; Campling *et al.*, 2012; Warmerdam *et al.*, 2016; MRAG *et al.*, 2019). In addition to this, different forms of joint ownership exist – between individuals, companies (joint ventures) or a combination of these. The profile of the owner(s) has implications for the way production is organized in terms of crew management and remuneration (Menzies, 2002, 2003; St Martin, 2007; Campling *et al.*, 2012), fishing strategy (Smith and McKelvey, 1986; Kasperski and Holland, 2013), marketing strategy (Gallick, 1984; Koss, 1999), local embeddedness (Knott and Neis, 2017), and succession of the business (Menzies, 2003; Marks, 2012). Another aspect of ownership structure is access to and use of different sources of funding (debt, equity, corporate).

Firm structure. The choice of legal form determines to a great extent the entrepreneur's outlook in terms of investment opportunities, tax regime and transmission of the company at retirement. Across the EU fishing industry, there seems to be a shift from simple legal forms (sole proprietorship or partnership companies) to limited liability companies (LLCs) (Menzies, 2003; van Ginkel, 2014; Høst, 2015; Cellérier, 2016). LLCs have a number of advantages for artisanal fishers, including tax optimization and a better protection of the co-owning partners as well as their spouses against debt, divorce or decease (van Ginkel, 2014). Under firm structure we also understand the objectives and direction of growth of the firm. Other aspects of firm structure are included as proxies for structural complexity: the presence of holdings, advanced structuration (i.e., a company structure for each vessel, held together by a holding; see Cellérier (2016)). The embeddedness of the entrepreneur and the firm in local, regional and national networks (Van Putten *et al.*, 2012) is furthermore included, as well as the objectives and direction of growth (Kor and Mahoney, 2004).

Management strategy. In France, family-based fishing has been a key element in the development of the artisanal fleet in the post-war period (Rieucau, 1980; Menzies, 1997, 2003; Deldrève, 2001; Ponsot and Mauget, 2008). Family firms are typically characterized by the alignment of ownership, management and control (Smith, 1969; Vestergaard, 2010). The economic model of family fishing firms in France based on (a) keeping productive capital within the family, (b) securing employment for family members on board of fishing vessels and (c) the possibility of drawing upon un(der)paid labor (Menzies, 2003). In non-family firms, the owners (the principals) delegate a part of the decision-making authority to another person (the agent) in order to avoid agency problems due to information asymmetry or moral hazard (Jensen and Meckling, 1976; Vestergaard, 2010). In its most simple form, agency relations exist between the skipper and the crew on board the fishing vessel (team production). In large fishing firms ownership and control are separated, and salaried managers may be employed to oversee the fishing operations from shore. This constitutes two additional agency relationships: between the manager and the skippers (Vestergaard, 2010), and between the manager and the shareholders (Alchian and Demsetz, 1972; Jensen and Meckling, 1976). For the purpose of this chapter, we are particularly interested in the choice of the 'right type' of agent (see

[27] For an examination of what makes a fishing firm "capitalist", we refer to St Martin (2007) and McCall Howard (2012), who present different perspectives.

Vestergaard, 2010) (e.g., a family member with a stake in the business versus an 'external' skipper or manager) and the incentive contracts that underlie these relationships.

Firm size. Decisions to invest or disinvest in physical capital are often based on economic incentives (Smith, 1968, 1969; Mackinson *et al.*, 1997; Pascoe and Revill, 2004). The number and size of vessels are important factors in this decision (Tidd *et al.*, 2011; Carvalho *et al.*, 2020) and will serve as proxies for firm size in our analysis. Also the total number of crew is taken into consideration.

Fishing strategy. Fishing firms may diversify their fishing activity to mitigate risk and maintain profitability (Smith and McKelvey, 1986; Marschke and Berkes, 2006). Generalist firms aim to keep total variable costs to a minimum so they can easily switch between fisheries. Diversification is commonly accepted as the default production strategy for small-scale and artisanal fishing in France (Ifremer, 2007; Reyes *et al.*, 2015). Specialization may simply be a consequence of the fishing opportunities available to the firm at a given point in time (and the markets that exist for them), but it may also be part of a broader strategic trajectory. Such trajectory is focused around realizing economies of scale and scope (Porter, 1980) through vertical integration, internalization of peripheral activities (e.g., bookkeeping, crew management, vessel maintenance) and standardization (e.g., a fleet of standardized fishing vessels) (Smith and McKelvey, 1986; Adger, 2000). These aspects may be associated with significant efficiency gains for the firm.

Valorization strategy. Guillotreau and Le Grel (2001) described a general trend of formalization and contracts along European fish supply chains, in particular for larger companies – a trend that has steadily continued (Warmerdam *et al.*, 2016, 2018; MRAG *et al.*, 2019). Also in other parts of the world, the default modes of selling fish on spot markets and through competitive auctions are being replaced with short and long-term contracts, sometimes involving exclusive dealing and ownership interests in vessels by downstream actors (Gallick, 1984; Koss, 1999; Isaksen and Dreyer, 2000). In addition to contracts, a trend of full vertical integration (vertical ownership, hierarchy) (Mahoney, 1992) is observed for both producers (forward integration) and downstream actors in the fishing industry (traders, retailers, processors) (backward integration) (Guillotreau and Le Grel, 2001; Thom and Schwaab, 2010). Empirical studies have shown that transaction costs as well as strategic considerations play an important role in a fishing firm's decision to vertically integrate (Gallick, 1984; Love *et al.*, 1995; Guillotreau and Le Roy, 1998; Koss, 1999; Isaksen and Dreyer, 2000; Thom and Schwaab, 2010).

3.4 Multiple Correspondence Analysis with hierarchical clustering

We use Multiple Correspondence Analysis (MCA) in combination with hierarchical clustering to reveal patterns in our dataset. In MCA, the dataset is represented as a cloud of points in a multidimensional Euclidean space. This is then transformed into a low-dimensional space in which the relative positions of the points and their distribution along these dimensions form the basis for interpretation. Its power lies in its capacity to uncover groups in complex multivariate datasets without needing to meet any *a priori* assumptions about the data (Costa *et al.*, 2013). This makes it a useful tool for typology construction. We selected 10 variables that captured the structure of the phenomenon under study well (Rosa *et al.*, 2016), and for which frequency distributions were balanced and association was low (Cramer's V kept as low as possible) (see Table 2). In a second step, a cluster analysis was carried out on the MCA results, to separate individuals into groups. The MCA and the subsequent cluster analyses were performed using the FactoMineR package (Lê *et al.*, 2008) in R Studio (version 1.1.463).

Table 1-2: Themes and variables considered for typology construction. (-) not included in the quantitative analysis; (S) not included in the quantitative analysis; supplementary variable. Count: number of occurrences in the interviews.

Theme	Variable		Categories	Count
Ownership structure	**Owner profile**	OWN1	Individual	40
		OWN2	Family	23
		OWN3	Shared (capital holdings)	11
		OWN4	Corporate	6
	Foreign ownership (S)	FOREIGN0	No foreign ownership	70
		FOREIGN1	Foreign ownership	10
	Capital funding (-)	FUND1	Mainly own funding	5
		FUND2	Mainly bank funding	66
		FUND3	Mainly corporate funding	4
		FUND4	Mixed	5
Firm structure	**Legal form**	LEG1	Sole proprietorship	35
		LEG2	Combination of sole proprietorship and limited liability company	10
		LEG3	Limited liability company	35
	Level of structuration (-)	STRUCT1	Simple (little structuration)	39
		STRUCT2	Medium (some structuration; with holding)	20
		STRUCT3	Completed (fully structured; as the owner wants it to be)	16
		STRUCT4	Advanced (company for each vessel)	5
	Growth objective and direction	GROW0	No real growth objectives	42
		GROW1	Focus on acquisition of fishing vessels	32
		GROW2	Acquiring vessels and expanding activities	6
	External advice and information	ADVICE1	Weak (no enabling environment)	38
		ADVICE2	Medium (access to good bookkeeping advice, sometimes also legal advice)	25
		ADVICE3	Strong (enabling environment with high level legal advice)	17
Management strategy	**Management strategy**	MANSTR1	Simple (owner = manager, embarked)	44
		MANSTR2	Medium (owner = manager, shore-based)	14
		MANSTR3	High (owner ≠ manager, salaried)	16
		MANSTR4	Outsourced (owner ≠ manager; third party)	6
Firm size	**Number of vessels (S)**	VES1	2 vessels	35
		VES2	3-5 vessels	28
		VES3	6-10 vessels	12
		VES4	>10 vessels	5
	Crew size (S)	CREW1	0 to 2	6
		CREW2	3 to 5	17
		CREW3	6 to 10	15
		CREW4	11 to 15	13
		CREW5	16 to 30	11
		CREW6	>30	18

Table 1-2 (*continued*): Themes and variables considered for typology construction. (-) not included in the quantitative analysis; (S) not included in the quantitative analysis; supplementary variable. Count: number of occurrences in the interviews.

Theme	Variable		Categories	Count
Fishing strategy	**Size of vessels (S)**	SIZE1	<=12m	33
		SIZE2	>12m	35
		SIZE3	Mix	12
	Specialization	SPEC0	No specialization strategy	26
		SPEC1	Specialization in a portfolio of target species	17
		SPEC2	Specialization in 1 or 2 target species or species groups	37
	Complementarity (S)	COMPL0	No complementarity of activity	67
		COMPL1	Complementarity of activity	13
	Standardization	STAND0	No standardization of fishing vessels	47
		STAND1	Standardization of fishing vessels: one fleet	24
		STAND2	Standardization of fishing vessels: subfleets	9
	Vessel maintenance	MAINT1	Simple (most maintenance is externalized)	60
		MAINT2	Medium (manpower dedicated to maintenance)	15
		MAINT3	Strong (internalization of maintenance, incl. workshops)	5
	Crew rotation	ROT1	None or opportunistic	57
		ROT2	Extensive	14
		ROT3	Intensive	9
Valorization strategy	**Valorization strategy**	VALOR1	Spot markets	49
		VALOR2	Direct sales + spot markets	20
		VALOR3	Processing and/or wholesaling	7
		VALOR4	Processing with sourcing strategy and/or backward integration	4

4 Results

4.1 Multiple Correspondence Analysis and Hierarchical Clustering

4.1.1 Multiple Correspondence Analysis (MCA)

A first MCA was performed which included the maximum possible number of dimensions, calculated as the sum of variable categories (n=33) minus the number of variables (n=10). This yielded 23 dimensions, with a calculated total inertia of 2.3 (the maximum number of dimensions divided by the number of variables). Subsequently, the number of dimensions to retain was determined based on the eigenvalue report. This was done in two steps. First, we examined the scree plot of the eigenvalues following the method proposed by Bendixen (1996)[28]. This suggested the retention of 2 dimensions (Dim 1 and Dim 2 explain 25.48% and 12.39% of the inertia, respectively). A second criterion for retaining a dimension is that its eigenvalue is above 0.2 (Hair *et al.*, 2014). This suggested a retention of 3 dimensions (eigenvalues 0.586, 0.285 and 0.205 respectively). Following Gifi (1990), we also examined the MCA biplots and decided to keep the first three dimensions. The three-dimension solution accounted for 46.78% of variance (1.076/2.3). Discrimination measures are summarized in Table 1-3 and Figure 1-1 shows a biplot of variable categories. Note that in addition to the 10 variables participating in the analysis, 4 supplementary variables[29] are plotted in Figure 1-1a (FOREIGN, COMPL, VES, SIZE, CREW). These dummy variables were deemed useful for interpreting the results.

Table 1-3: MCA dimensions and discrimination measures.

	Dim1	Dim2	Dim3	Mean
OWN	0.71	0.26	0.42	0.46
LEG	0.74	0.16	0.04	0.31
ROT	0.47	0.04	0.13	0.21
MAINT	0.33	0.23	0.25	0.27
SPEC	0.41	0.24	0.09	0.25
STAND	0.57	0.22	0.01	0.27
GROW	0.62	0.42	0.13	0.39
ADVICE	0.78	0.12	0.22	0.37
VALOR	0.41	0.58	0.56	0.52
MANSTR	0.82	0.58	0.21	0.54
Active total	5.86	2.85	2.06	3.59
% of variance	25.48	12.39	8.91	15.59

For the first dimension, the strongest contributions were found for MANSTR (0.82), ADVICE (0.78), LEG (0.74) and OWN (0.71), but all variables have a significant contribution (p-values<0.05) to the eigenvalue of the first dimension. This may be partly due to the fact that there is considerable association between MANSTR and several other variables (Cramer's V-test; ADVICE: 0.61; LEG: 0.62, OWN: 0.60). The most discriminant variables for dimension 2 are MANSTR (0.58), VALOR (0.58) and GROW (0.42). Finally, dimension 3 is explained by the variables VALOR (0.56) and OWN (0.42). Taking into account all three dimensions, we could conclude that OWN, VALOR and MANSTR and present the highest discrimination measures overall.

Based on this and visual examination, we may name the dimensions as follows – dimension 1: "Business structuration"; dimension 2: "Valorization and growth" and dimension 3: "Valorization and ownership".

[28] Two metrics were calculated: 1/(number of individuals-1) = 1/79 = 1.27% in terms of rows; 1/(number of variables-1) = 1/9 = 11.11% in terms of columns. According to Bendixen, any axis with a contribution higher than the maximum of the two metrics, is to be retained.

[29] These were excluded after consecutive rounds of testing, for one or multiple of the following reasons: low representation of variable categories across the population, association with other variables, limited relevance/pertinence according to the research team.

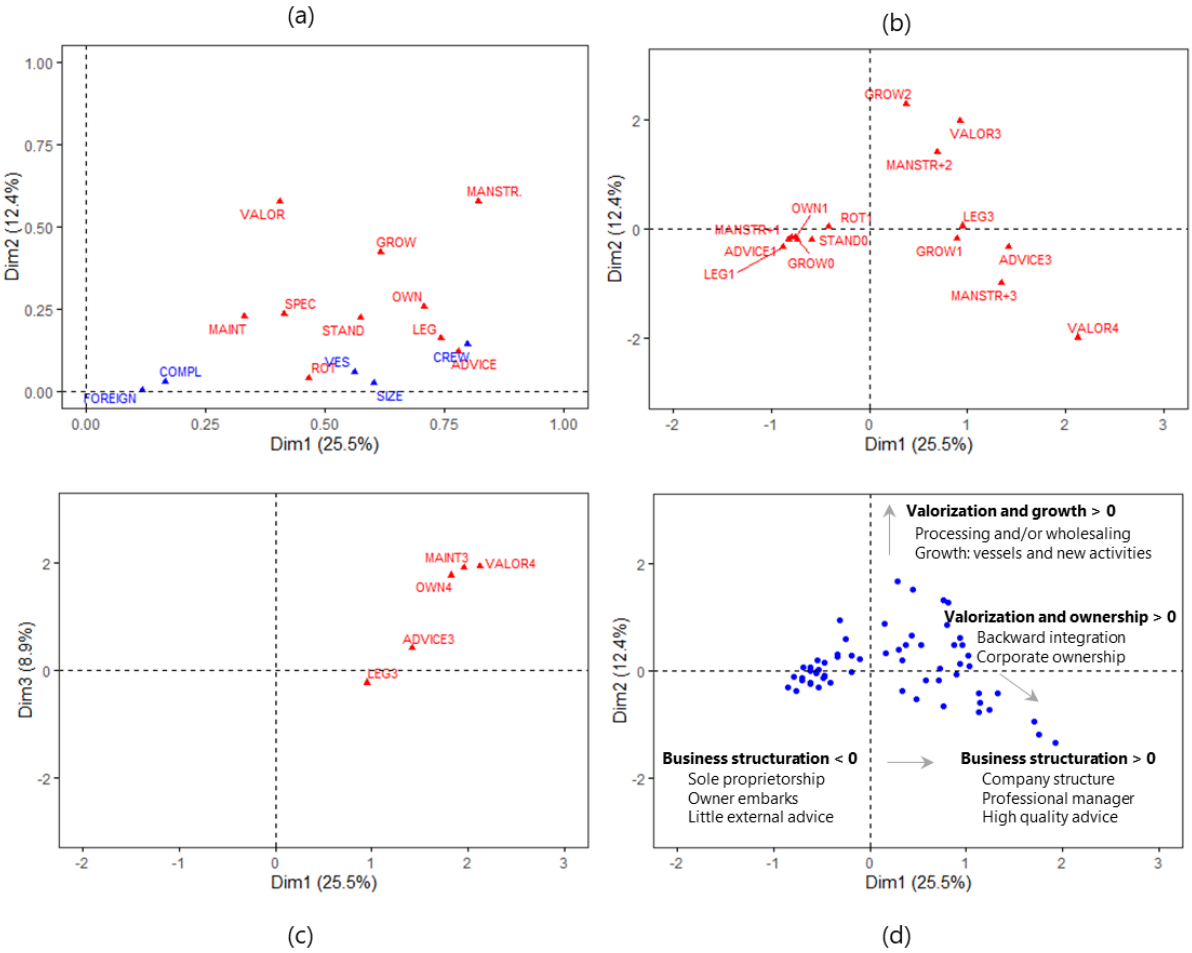


Figure 1-1: Description of the MCA dimensions. (a) Biplot of discrimination measures. Red: participating variables; Blue: supplementary variables; (b) Joint category plot of the variable categories (dim 1 and dim 2). Only the 15 most contributing categories with the highest quality of representation are shown (cos2>0.4); (c) Joint category plot of the variable categories (dim 1 and dim 3). Only the 5 most contributing categories with the highest quality of representation are shown (cos2>0.4); (d) Plot of the individuals and axes descriptions.

4.1.2 Hierarchical clustering based on the MCA results

A hierarchical clustering was performed on the MCA results. In order to reduce noise in the analysis, only the first 13 dimensions were included in the analysis (representing 90.53% of the total variance). The analysis was performed using the 'hclust' function in the FactoMineR package (Lê *et al.*, 2008). This function uses the Ward method to construct a hierarchy, which consists in aggregating two clusters such that the growth of within-inertia (within sum of squares, WSS) is minimal and between-inertia (between sum of squares, BSS) is kept high (Husson *et al.*, 2010). The lower the inertia within a cluster, the more homogeneous it is. Several clustering solutions were explored (3 to 6 clusters). The number of clusters was decided based on the aforementioned inertia considerations, as well as our field observations. As such, a stable[30] five cluster solution was retained (WSS=1.09; BSS=0.14) (Figure 1-2).

[30] A stable solution was considered a solution in which the allocation of individuals to a certain cluster did not change when reducing the number of dimensions of the MCA result on which the clustering was performed. This was tested through the step-by-step reduction of the number of dimensions from 23 to 13, for each of the solutions.

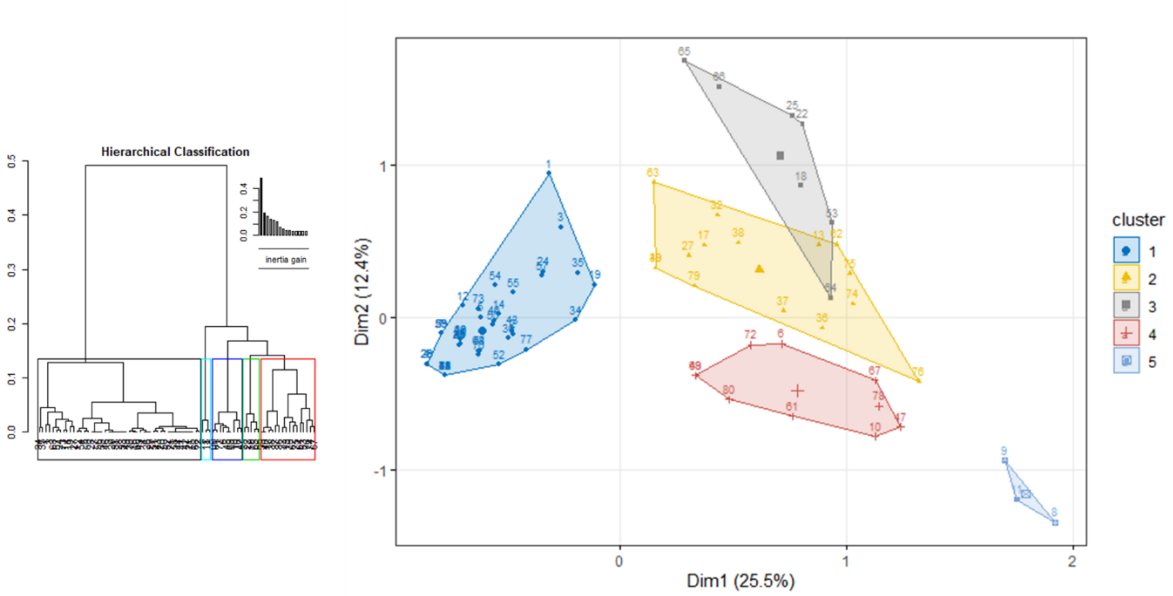


Figure 1-2: Hierarchical clustering. Left: dendrogram. Right: cluster plot of the individuals.

A Chi-squared test was performed to test the link between the variables and the cluster variable (with n_{clust} ranging from 1 to 5). A significant link was found with all variables ($p<<0.05$). Cluster 1 is characterized mainly by MANSTR1 (95.56% of individuals in the cluster), ADVICE1 (84.44%), LEG1 (77.78%) and OWN1 (84.44%); cluster 2 by OWN2 (80.00%), LEG3 (86.67%) and MANSTR4 (40.00% of individuals in cluster 2, but 100% of all individuals with this category are in this cluster). Cluster 3 is characterized by VALOR3 (100%) and MANSTR2 (85.71%), cluster 4 by OWN3 (90.00%), MANSTR3 (100%) and GROW1 (100%); cluster 5 by VALOR4 (100%), MAINT3 (100%) and OWN4 (100%).

Table 1-4: Description of the clusters based on variable categories. Only the five most significant categories are included. Cla/Mod: proportion of category s in cluster n; Mod/Cla: proportion of cluster n in category s; Global: proportion of category s in the global population.

	Cla/Mod (%)	Mod/Cla (%)	Global (%)	p-value	v-test
Cluster 1					
MANSTR=MANSTR1	97.73	95.56	55.00	4.80E-19	8.92
ADVICE=ADVICE1	100.00	84.44	47.50	4.66E-16	8.12
LEG=LEG1	100.00	77.78	43.75	5.51E-14	7.52
OWN=OWN1	95.00	84.44	50.00	2.56E-13	7.32
GROW=GROW0	90.48	84.44	52.50	2.55E-11	6.67
Cluster 2					
OWN=OWN2	52.17	80.00	28.75	6.53E-06	4.51
MANSTR=MANSTR4	100.00	40.00	7.50	1.67E-05	4.31
LEG=LEG3	37.14	86.67	43.75	0.000253	3.66
ROT=ROT3	66.67	40.00	11.25	0.001062	3.27
STAND=STAND1	41.67	66.67	30.00	0.001429	3.19
Cluster 3					
VALOR=VALOR3	100.00	100.00	8.75	3.15E-10	6.29
MANSTR=MANSTR2	42.86	85.71	17.50	6.46E-05	4.00
GROW=GROW2	66.67	57.14	7.50	0.000316	3.60
SPEC=SPEC2	18.92	100.00	46.25	0.003241	2.94
STAND=STAND1	20.83	71.43	30.00	0.025568	2.23
Cluster 4					
OWN=OWN3	81.82	90.00	13.75	2.32E-09	5.97
MANSTR=MANSTR3	62.50	100.00	20.00	4.86E-09	5.85
GROW=GROW1	31.25	100.00	40.00	3.92E-05	4.11
LEG=LEG3	28.57	100.00	43.75	0.000111	3.86
STAND=STAND2	44.44	40.00	11.25	0.013054	2.48
Cluster 5					
VALOR=VALOR4	75.00	100.00	5.00	4.87E-05	4.06
MAINT=MAINT3	60.00	100.00	6.25	0.000122	3.84
OWN=OWN4	50.00	100.00	7.50	0.000243	3.67
MANSTR=MANSTR3	18.75	100.00	20.00	0.006816	2.71
ADVICE=ADVICE3	17.65	100.00	21.25	0.008277	2.64

Table 1-4 summarizes the composition of the clusters based on the variable categories. Firms in Cluster 1 are characterized mainly by an embarked owner-operator (95.6% of individuals in the cluster), who is the single owner (84.4%) of a sole proprietorship (77.8%), and who do not benefit from high-level external advice (84.4%). Firms in Cluster 2 are limited liability companies (86.7%) owned by families (80.0%). Outsourcing of management is found for 40.0% of firms in the cluster. Cluster 3 is characterized by shore-based managers (of which 85.7% were formerly owner-operator) and valorization through forward vertical integration (processing and/or wholesaling; 100%). Cluster 4 is characterized by 'ownership sharing' between skippers and owners (90.0%), and by the presence of shore-based managers (external, salaried; 100%) and a focus on the acquisition of fishing vessels (100%). Cluster 5 is characterized by backward vertical integration (valorization and supply security; 100%), strong internalization of vessel maintenance (100%) and corporate ownership (100%).

4.2 Review of organizational types

In this section, the description of the Types based on the MCA and cluster analysis is enriched with additional interview data.

Type 1: Small-multi-owners (n=45). This group comprises small fishing firms generally composed of 2 to 3 fishing vessels (n=38) smaller than 12 m (n=32). The firm is owned and managed by an individual, and has a simple legal form (sole proprietorship). Management is characterized by an embarked owner-operator who either alternates between vessels (often seasonally) or commands one vessel while delegating the operation of their other vessel(s) to someone else (mostly their son). The owner's spouse is rarely involved, and if they are, they have little decision power. There is generally no real growth objective among small multi-owners. They became multi-owner out of practical considerations: access to fishing

opportunities (diversification), out of fiscal considerations, or simply when opportunities came up.
Besides the shared characteristics which define Cluster 1 at the selected threshold (WSS=1.09; BSS=0.1), there is quite some variation between the firms, which causes some of them to break away from the core of the cluster. These 'emerging entrepreneurs' (n=9) have grown their companies up to 3 to 4 vessels, and may be on their way to acquire more. As such, they start resembling fishing firms in the periphery of Cluster 2. They often combine sole proprietorship with a company structure, and are in the middle of restructuring the firm and formalizing management roles. Fishing is characterized by more specialization, which sometimes goes hand in hand with a proactive marketing approach (e.g., developing new markets, direct sales).

Type 2: Medium to large-scale family fishing firms (n=16). Fishing firms within this group are family-owned and managed. They are characterized by a sole focus on fishing, targeting either a portfolio of target species (n=9) or one specific target species for which strong spot markets exist (auctions) (n=7). The firms are owned by fishing families (n=12), with large fishing fleets up to 16 vessels (5.7 vessels on average; SD=4.2), all >12 m. In most cases (n=14), vessel size is greater than 18 m (18-24 m: 7 firms; 24-40 m: 7 firms). These companies strive towards optimization of production by standardizing their fleets and maximizing vessel time at sea. In its most simple form, the standardization strategy consists in investing in vessels of similar size and equipped for fishing with the same gears. For more profitable firms, a fleet renewal strategy is observed. Vessel replacement with state-of-the-art vessels, often 'sister ships', allows for the internalization of vessel maintenance. This ranges from the allocation of manpower (n=6) to having a proper workshop with a constant stock of spare parts (n=1). Vessel time at sea is maximized by sophisticated crew rotation schemes (n=13), either 'extensive' (replacement of a couple of crew members at a time, n=7), or 'intensive' (replacement of the entire crew between fishing trips, n=6). The latter is sometimes combined with advanced bases (n=4), satellite fishing ports (in France or abroad) where the vessels regularly dock, fish is landed, and where crew is flown into. These companies often employ a person or a small team for overseeing crew management and other administrative tasks.
A closer look at ownership and management reveals a subgroup (n=6), characterized by the complete outsourcing of management. These are Spanish fishing families that own vessels in both Spain and France, specialized in trawling and mainly targeting European hake. Their French vessels are managed and operated by legal entities in France (required by law[31]), who take care of everything from crew management and bookkeeping to vessel operations, maintenance, negotiations with POs, and bringing the catch to market.

Type 3: Fisher-processors (n=7). Fishing firms in this group specialize in one target species or species group (crustaceans: n=2; scallops: n=3; pelagics: n=2). Their specialization strategy encompasses all stages of the production process: harvesting, processing and marketing. They have developed their firms in discrete steps. First, they have grown their fleet by investing in fishing vessels with interesting licenses and track records attached. They own and operate fishing fleets up to 13 vessels (6.3 vessels on average; SD=3.8). Within firms, vessels are mostly of similar size and equipped for fishing with the same set(s) of gears. This clear focus on growth and standardization has allowed them to establish market dominance in their respective ports or regions. In turn, this has led them to structure their businesses and to venture into new activities, most notably the processing and marketing of their own catch. In terms of firm structure, we see that all firms have a company structure, with a holding overarching the different activities. Administrative tasks such as bookkeeping and crew management are often internalized once the business has reached a certain size. Companies with more than three vessels (n=4) have dedicated manpower to deal with maintenance tasks. Firm management is characterized by a strong involvement of family members. The fisher's spouse often plays a pivotal role in the business. Her responsibilities include tasks like crew management, bookkeeping, managing orders and deliveries. Sometimes the owner's children

[31] Article R921-4 of the Code Rural.

are involved or being prepared to lead the company when their parents retire. In most cases, the owner is a self-taught manager (n=6), who started their career as deckhand.

Type 4: Ownership-sharing models (n=9). Firms in this group all have shared ownership in one form or another, and have a strong focus on the acquisition of fishing vessels (>12 m) with track records or licenses attached. The firms are heterogeneous in terms of size (crew size, number of vessels) and fishing strategies. This may be explained to a great extent by the relative newness of some of these firms and the uncertainty in which direction they will develop. Most firms in this group (n=6) belong to the cooperative tradition that has historically shaped the French fishing sector. In its original form (n=3), it is characterized by shared ownership between the cooperative structure on the one hand and the skipper-owners on the other. The main aim is to allow skippers to gradually acquire shares until they have full ownership over their vessels. The cooperative is characterized by a hierarchical management structure, with at the top a shore-based manager who has the double responsibility of managing the company (e.g., human resource management, administration, negotiation with banks, etc.) and following up production for each vessel.
Recently, a new type of cooperative emerged from this tradition, including new elements designed to make the cooperative model "more adapted" to the current economic context (n=3). Finally, we also find three private fishing companies for which ownership is shared with skippers. These companies are part of a corporate ownership structure, for which they constitute only a fraction of total production.

Type 5: Corporate fishing groups (n=3). Despite the presence of only a few cases in our sample, these fishing firms form a distinct and well-defined group in the Atlantic fishing sector. They operate large vessels (≥40 m) in a corporate ownership structure sometimes involving multiple mother companies. Management is overseen by a salaried manager, who mostly runs the fishing company independently of the corporate group. There is a pronounced internalization of vessel maintenance and administrative tasks. Besides employing a team of people in administration, these firms also have their own workshops and a team of mechanics to oversee maintenance. Similar to firms in Type 2, vessel time at sea is optimized through crew rotation schemes (intensive) and advanced bases. Their valorization strategy is based on volume: they specialize in species for which demand is high and for which strong markets and/or integrated value chains exist, such as Atlantic cod (*Gadus morhua*), blue whiting (*Micromesistius poutassou*), and saithe (*Pollachius virens*). The market for saithe is heavily integrated. One fishing company is responsible for 79% of landings, which are bought directly by a processor who then distributes the frozen filets through its own retailing branch.

5 Discussion

5.1 Growth of "artisanal" fishing firms

Based on literature, we may take the traditional one-vessel, polyvalent and family-based fishing firm – the so-called "artisanal" firm – as the default organizational form (vessels <25 m), from which more modern configurations may arise (Debeauvais, 1985; Menzies, 1997, 2003; Delbos, 2006; Ifremer, 2007; Reyes *et al.*, 2015). This perspective is validated by the interviews. However, the fieldwork also revealed that the development of multi-vessel enterprises and the concentration of capital was more significant than envisaged at the start of the study.

Multi-vessel ownership is a major way to increase resource access and expand production. Expansion happens gradually in artisanal firms, through the stepwise acquisition of second-hand vessels with historical track records attached. This is in sheer contrast with corporate companies of Type 5, which are able to acquire entire fleets at once through mergers (MRAG *et al.*, 2019). However, not all artisanal firms grow out to be large companies. Most Type 1 firms did not have an objective of growing beyond their current size (2-3 vessels <12 m). Our results show that investment decisions depend on a range of factors, including the age and

personal situation of the entrepreneur, the type of fishery, the availability of fishing opportunities, and the entrepreneur's financial capacity to invest. Furthermore, the involvement of family members reduces the business's cost structure. The ability to draw upon un(der)paid family labor has certain economic advantages for family fishing firms (Menzies, 2003). Often, administrative tasks are carried out by the fisher's spouse, allowing the fisher to focus solely on fishing (Frangoudes *et al.*, 2020).

The interviews furthermore show that the development of fishing firms happens in phases that are closely linked with the life/career stages of the entrepreneur: they start out as crew members, become skippers and eventually become owner. Once a critical size[32] has been reached, the entrepreneur may decide to shift from embarked owner-operator to shore-based manager (rarely before the age of 50). As the firm grows, incremental changes are made to its structure. Small multi-owners are driven by a logic of risk aversion, income diversification and cost optimization through the internalization of maintenance tasks and the outsourcing of bookkeeping. Later in the firm's development, bookkeeping is internalized, people are hired to oversee crew management, etc. Our results show a substantial diversity in the organization of small and medium-sized fishing firms, despite their common origins. This confirms our hypothesis that the artisanal vs. industrial dichotomy is insufficient and outdated.

5.2 Drivers of horizontal integration

The number of "mass species" for which economies of scale may typically be realized through specialization, standardization of vessels and vertical integration (Guillotreau *et al.*, 2008; Thom and Schwaab, 2010), is limited. Exceptions include Atlantic cod, saithe, blue whiting, Atlantic herring and Atlantic mackerel, which are harvested by ≥40 m trawlers (Type 5). Yet, also in other fisheries and fleet segments, firms pursue specialization (species or species groups) and standardization. Their main objective is cost efficiency, which is accomplished through cost reduction (e.g., more efficient engines, modern technology), and sometimes the ability to negotiate fish prices based on volume of landings. All Types are concerned, and include firms specialized in trawling or Danish seine for demersal species in the Channel and the Celtic Sea (18-24 m), scallop dredgers in the Channel (10-16 m), nephrops trawlers (10-18 m) in the Bay of Biscay, and small-scale netters and whelk potters (<12 m).

For most entrepreneurs in Type 1, the strategy of having several vessels is governed by regulatory factors (e.g., license allocation mechanisms, seasonal closures) and their risk averse attitude, rather than a search for scale economies. Each vessel is dedicated to one fishery and cannot be used in another (specific vessel/gear combinations; switching costs are high). Specialization/standardization is limited by the financial capacity of operators to acquire second-hand vessels with adequate track records, let alone build new vessels (Van Putten *et al.*, 2012; Kinds *et al.*, 2021) (see Chapter 4).

In contrast to small independent firms (Type 1), many larger firms exhibit, in addition to a focus on fleet expansion, a pronounced fleet renewal strategy. This is accomplished through the stepwise replacement of old vessels with standardized *sister ships*, financed by the vessels currently in the company. This, in turn, seems to create an opportunity for the integration of vessel maintenance. One fishing company in Brittany (Type 2) has its own workshop in which it employs 40 people for maintaining their 16 trawlers. Such full integration of vessel maintenance was seen only in handful of cases (in Type 2, n=2; and Type 5, n=2). A more common strategy is to employ someone for day-to-day maintenance tasks and the creation of a stock of spare parts (seen across Types). Finally, companies with large fishing vessels (mainly 24-40 m and >40 m, some 18-24 m) are preoccupied with maximizing vessel time at

[32] The rule of thumb unanimously evoked by interviewed fishers is a minimum of three fishing vessels for this to be worthwhile.

sea through sophisticated crew rotation schemes (replacement of a large proportion of crew after every fishing trip) and the use of advanced bases.

Crew is increasingly found outside the family network, and even outside the communities in which they are embedded. It is not uncommon to see Spanish, Portuguese and Senegalese crew working on board of large and even medium-sized ("artisanal") fishing vessels. This is consistent with STECF (2019b), which reports 12% foreign crew at national level (8% EU, 4% non-EU).

5.3 Forward and backward vertical integration

The default mode of selling landed fish in France is through auctions even though direct sales to consumers is also common for small-scale vessels (Daures *et al.*, 2013). Of the small multi-owners of Type 1, 14 (33%) use marketing channels outside the auction, and 5 (14%) rely heavily on them (mostly fish stalls managed by family members). For fisher-processors (Type 3), forward vertical integration may be understood as a way to increase efficiency and consolidate market dominance after having gathered vessels with ample fishing opportunities. It mostly concerns non-TAC species (e.g., crustaceans, scallops) for which markets are traditionally dominated by retailers and processors (e.g., Lesur-Irichabeau *et al.*, 2016). However, dominant fishing firms may try to capture economic rents by integrating (part of) the value chain (processing, sales). This is implemented through contracts or mutual agreements with buyers, and the establishment of processing and water tank facilities. These give producers more control over the market and give them access to high-end niche markets (live scallops, crabs, lobster).

The acquisition of fishing vessels by processors and retailers (backward vertical integration) can be understood by their dominance in retail markets for a number of high-volume species (Atlantic cod, saithe, blue whiting). To consolidate this dominance and achieve a sustained competitive advantage, they seek to control the harvesting sector (Thom and Schwaab, 2010). Other than strategic, this approach is transaction cost economizing, as the processing companies in the corporate group buy the raw product directly from the company owning the ship (contractual agreements).

5.4 Towards new ownership models

The past twenty years have been marked by very limited possibilities for the renewal of vessels due to policies aimed at reducing and controlling fleet capacity (Daures and Guyader, 2000; STECF, 2019c). While the last five years have been more favorable (i.e., new possibilities for vessel construction and a higher supply of vessels on the second-hand market due to a spike in retirement rates), the ban on subsidies for vessel construction and the purchase of second-hand vessels pose greater constraints to the financing of investments. In addition, the price of new vessels is very high for independent entrepreneurs[33], considering that entering the sector or growing one's fishing business implies the need for acquisition of second-hand vessels and associated fishing opportunities (Van Putten *et al.*, 2012). Most multi-vessel companies only have recourse to bank loans (with the exception of corporate firms which have access to corporate funding), with generally 20% self-financing by the operators themselves or by local actors (shipyards, fish merchants, cooperatives) and in a few cases regional public funds. The general strategy of multi-vessel companies across Types is to repay the loans of a new vessel with the cash flows of vessels that are already paid off (Cellérier, 2016).

More and more multi-vessel firms are securing their capital by creating as many companies as they own vessels, and by consolidating their management through a holding company, using

[33] Vessel prices (interviews): 11 m: 0.4 M€ (2016); 16 m: 1.2 M€ (2018); 20.5m: 3 M€ (2017); 22 m: 2.3 M€ (constructed in Morocco in 2019; "30% cheaper than in France"); 24 m: 3.5 M€ (constructed in Spain in 2016).

legal forms such as SAS and SASU[34]. These are considered more adapted to the needs of modern-day fishing firms by financial experts, in terms of investment, depreciation, tax optimization and transmission to children (Cellérier, 2016). They also provide a way around the preemption of track records (20%) associated with vessel transactions (Bellanger *et al.*, 2016). That is, when the change in owner is also associated with a change in operator, 20% of the track records flow back to two 'track records reserves' (14% go to the PO reserve and 6% to the national reserve). To avoid such loss, companies are usually sold in their entirety (all vessels at once, and the operator does not change). But when companies are large, investments become too heavy for peers (other independent fishing firms) to bear, and firms become interesting targets for corporate (and foreign) investors. This point was evoked by multiple respondents. Advanced structuration with a holding is a way around this limitation, as it allows to sell off vessels separately (Cellérier, 2016) and thus to avoid the loss of (or control over) local fishing capital.

There are few traditional cooperative fishing firms remaining along the Atlantic coast compared to their peak in the 1980s (about 20 structures) (Ponsot and Mauget, 2008). The cooperative model has been of major importance for the development of the 12-24 m segment. It allowed skippers to progressively acquire full ownership of their vessel until they were the single owner, while most of the financial risk was borne by the cooperative structure. Additional vessels were financed with the profit generated by vessels already in the structure, and with subsidies. As such, these firms have been severely impacted by the end of EU subsidies for vessel construction and capacity reduction. Our study shows that new models of ownership sharing are arising from the ashes of the cooperative model, organized around private structures, and backed by financial institutions, local investors and POs. They strive to maintain the means of production and associated fishing opportunities in the territory (most cases encountered), and favor access to capital for young fishers (all cases encountered). However, full ownership by skippers is no longer the rule. This has two reasons: (1) equity of skippers is limited relative to investments needed (Ponsot and Mauget, 2008), and (2) the lack of subsidies has urged firms to look for investors to match funding, which they usually find locally (value chain actors, see below). We will come back to these new forms of firm governance in Chapter 4.

Ownership sharing is also seen by some respondents as a means of retaining skilled skippers and encouraging them to operate and maintain the fishing unit as if it were their own. However, for most firms, the share-based remuneration system (Guillen *et al.*, 2017) is considered sufficient as an incentive scheme – and it allows owners to maintain full ownership and control over the vessel and attached track records. Monitoring at sea is difficult and costly, and all the more difficult when shore-based managers are unacquainted with the conditions on board a fishing vessel. Agency problems related to shirking and monitoring of team production are less of a problem in family fishing firms because in most cases, skippers as well as executive managers are the children of the owner (Vestergaard, 2010). Our results confirm this.

A particular ownership model was introduced in France with the so-called 'quota hoppers' that were attracted by freed-up capacity and fishing opportunities in the 1990s. In the case of France, these are mainly Spanish fishing families investing in French fishing capital because of quota constraints in their home country (Lequesne, 2000). In 2016 there were an estimated 65 Spanish-owned vessels fishing under French flag, with a projected further increase (FranceAgrimer, 2016). As part of demonstrating a 'real economic link' with France, operations need to be run by a "stable establishment situated on French territory, [which disposes of the] infrastructure, material means and human assets necessary to operate and manage a fishing operation in France" (Article R921-4 of the *Rural Code*) (Legifrance, 2019). Over the years, this has led to the emergence of specialized companies representing multiple Spanish fishing firms. One such company currently represents 17 vessels and functions as a large organization from which collective scale advantages arise. Their role far surpasses any legal requirement, and includes negotiations with POs over quota opportunities, organizing collective freight

[34] Respectively Société par Actions Simplifiée and Société par Actions Simplifiée à Associé Unique.

transport of fish to Spain, sophisticated crew rotation platforms, collective vessel adaptations, etc. For analytical purposes, the question rises whether they should be treated as separate entities or as *de facto* large-scale fishing companies.

5.5 Outlook

A significant improvement in the economic performance of the French fishing industry in recent years combined with an aging population of vessel owners (STECF, 2019a) has fostered a dynamic of creation and growth of multi-vessel companies. The industry benefits from bank loans at historically low rates and strong competition between banking operators, many of which have reorganized internally to more adequately finance blue growth. Some of them offer investment fund mechanisms to finance capital operations. These seem to have limited success, however, as most operators wish to maintain their capital independence and because investment funds require much higher returns than bank loans. Even though fishing opportunities cannot be integrated into companies' balance sheets as is the case in other countries (Davidse *et al.*, 1999; van Ginkel, 2014), banks report that they do take into account the fishing opportunities portfolios of operators before financing a project. Because fishing opportunities are not considered specific assets, vessels are financed much like any other physical asset, and loans are relatively short term (7 to 12 years) compared to the significant amounts and long-term character of these investments. A high burden of debt repayment could weaken companies, especially if their overall economic situation were to deteriorate.

One of the positive points is that the fishing sector attracts investors. On the one hand, there are the investors already active in the local maritime economy (e.g., fish mongers, shipyards, etc.) investing in the 12-18 m and 18-24 m segments. They are strongly driven by their conviction to keep the vessels and associated fishing opportunities in their territory (fishing port or maritime sector). On the other hand, there are the private investors that have historically been important for the development of the larger fleet segments (24-40 m and ≥40 m). A well-known example is the retailer *Intermarché* and its corporate group *Les Mousquetaires*, who have their own fishing company, *Scapêche* (Warmerdam *et al.*, 2016, 2018; MRAG *et al.*, 2019). In recent years, Scapêche has diversified its fishing portfolio by buying shares in structures operating vessels in smaller fleet segments (<24 m)[35]. This is also seen for other corporate fishing companies. The aim of association with companies or (formerly) independent producers is to secure supplies and capture economic rent generated by fleets for which profit margins are weak. Operators report a significant need for funding to finance fleet renewal. Vessels are often old and, in some cases, repair and maintenance costs can be as high as the loan repayment charge for new vessels (Cellérier, 2016). For them, such joint ventures are part of the solution. In all examples encountered, the operators were majority shareholder, and thus the legal owner of the track records attached to the vessel (Larabi *et al.*, 2013).

The uncertainties regarding Brexit negotiations are likely to weaken companies (multi-vessel or other) whose whole or part of their activity is located in the UK EEZ. Dependence on UK waters is estimated at 19% in terms of value and 24% in terms of volume (Sobrino Heredia, 2017), but this dependence could be higher for certain multi-vessel firms. Dépalle *et al.* (2020) have considered the implication of effort re-allocation in case of UK EEZ closures, but the medium-long term consequences of the various scenarios (including 'no deal') on companies' (dis)investment strategies is more difficult to anticipate. The same holds for the consequences of the current COVID-19 health crisis, which are expected to be severe (NEF, 2020).

5.6 Conclusions and recommendations

We argue that the definition of the "artisanal" fishing model insufficiently captures the organizational diversity found in the field. The diversity can instead best be described in terms

[35] E.g., https://www.armement-apak.fr/wp-content/uploads/2017/03/P%C3%AAche.-Un-nouvel-armement-artisanal-%C3%A0-Lorient-Mer-LeTelegramme.fr_-1.pdf (Accessed on 17/12/2020)

of organizational attributes, most notably access to information (knowledge networks), legal form, vessel maintenance and standardization, growth objectives and management structure. We have furthermore shown that elements that are typically associated with industrial fishing, such as vertical integration, the separation of management and control and accumulation of fishing capital, also make their appearance in smaller fleet segments.

In a context that is marked by recovering fish stocks for French fleets (STECF, 2020b), limited fishing opportunities due to entry barriers and increasingly competitive markets (Menzies, 2002; McCall Howard, 2012), firms are urged to rethink themselves to remain competitive (Said and MacMillan, 2020). We have shown that this can be accomplished in a myriad of ways, but the general response is the same: scale increase, rationalization of management, product valorization and access to information. The role of knowledge networks (POs, fisheries committees, shipbroker and fish trading networks) in the development of fishing firms deserves more attention, especially with regards to access to fishing opportunities.

This typology may be used in fisheries management, as a basis for adjusting public policies such as the allocation of funds through the European Maritime and Fisheries Fund (EMFF) or the allocation of fishing opportunities to specific producer profiles. We argue that a similar analysis could be useful for case studies in other EU Member States.

Chapter 2: A methodological framework for ownership analysis of EU fishing vessels and its application to the French Atlantic fishing sector

Abstract

In this chapter, we will present a methodological framework for the analysis of ownership of fishing vessels registered in the EU. Previous studies have identified issues related to data availability and quality as barriers for a comprehensive and comparative EU-wide analysis. Most studies have been obliged to adapt the scope of analysis accordingly, mostly by adopting a case study approach, or by focusing only on vessel ownership (excluding fishing opportunities). In this chapter, we aim to contribute to this field of study by proposing a multi-purpose framework for EU-wide analysis of vessel ownership, using a combination of fleet register data and commercial ownership data (the Orbis database, Bureau van Dijk). We adopt a stepwise approach to walk the reader through the development process and the methodological choices made along the way. The proposed framework encompasses (1) the identification of available data sources and their potential for use in ownership analysis, (2) a conceptual framework for the analysis of vessel ownership in the EU fishing industry, and (3) customized data extraction protocols for obtaining ownership data from the Orbis ownership database. The framework is subsequently applied to analyze the ownership of fishing vessels registered in the French Atlantic fishing sector in 2018. While this framework is not able to resolve all data issues identified by other studies, it surely presents new opportunities for comparative ownership analysis across Member States. Through the establishment of a Vessel-Company (VC) Register for France, we were able to bridge the gap between ownership information contained in the Union Fleet Register and detailed corporate ownership data in other databases. We argue that the customized protocols presented here provide promising new angles for comparative ownership analysis in the EU fishing sector. Based on the preliminary analyses carried out in the context of this PhD research, we argue that the bottom-up protocol is readily applicable for analysis on a larger scale. The data-poor 'DM' (Directors/Managers) protocol has shown potential but needs more rigorous testing. More than anything, this chapter aims to foster discussion about the scope of and methods for ownership analysis in the EU fishing industry.

Introductory remarks

A slightly divergent chapter structure was adopted for Chapter 2. The aim of this structure is to walk the reader through the different phases of the thought process which has led to the framework presented here: from the first conception of what the framework must be capable of doing, over some of the data issues encountered along the way, to its final blueprint and application to the French Atlantic fishing industry.

Ownership analysis in the EU fishing sector is a relatively new area of research, and analysis has proven to be challenging – among others due to incomplete and patchy data, the existence of complex, opaque and fast-changing ownership structures, diverging scope and ownership definitions between Member States, and so on (see MRAG *et al.*, 2019). By including part of the trial-and-error approach underlying the framework in this chapter, we hope that it may serve as practical guidelines for ownership analysis in the EU fishing industry and as a basis for discussion and improvement of the proposed method.

The chapter is subdivided into five discrete sections:

1. Scope of ownership analysis in the fishing industry
2. Building a framework for ownership analysis
3. Extraction of ownership data from Orbis
4. Use of extracted ownership data for the analysis of vessel ownership
5. Discussion

This chapter is largely methodological in scope, with a short 'Results' section at the end (section 4). In section 1 we will build a case for the analysis of *company ownership* so as to include both the tangible and intangible assets needed for fishing. In section 2, we will establish how the fishing vessel and its holding-company ("the vessel-holding company") relate to each other, and how they can be linked. In section 3 we will present a methodology for the extraction of ownership data from Orbis (a commercial database). In section 4 (Results), we will present some preliminary analyses based on extracted ownership data for the French Atlantic fishing sector. In the Discussion we will reflect on this process and contemplate further steps to be taken.

Chapter 3 uses a part of the data extracted and developed here to analyze concentration in the French Atlantic fishing sector. It is important to note that the framework and the data presented in this chapter go far beyond what was finally used in Chapter 3.

1 Scope of ownership analysis in the fishing industry

1.1 The means of production and two perspectives on ownership

In simplified form, the means of production in marine capture fisheries may be understood as the fishing vessels and fishing opportunities, both of which are needed to harvest the fish. The catch is then sold on commodity markets, and surpluses are generated, which may remain in the company (added value to pay the factors of production) or may be paid to the company's shareholders in the form of dividends (Figure 2-1). We may say that the ability to generate income (and surplus) from fishing is what constitutes the value of a fishing firm. As such, other than the fishing vessel, the property rights represent value in the fishing firm, related to the current and future benefits of access to the resource flow (Davidse *et al.*, 1999).

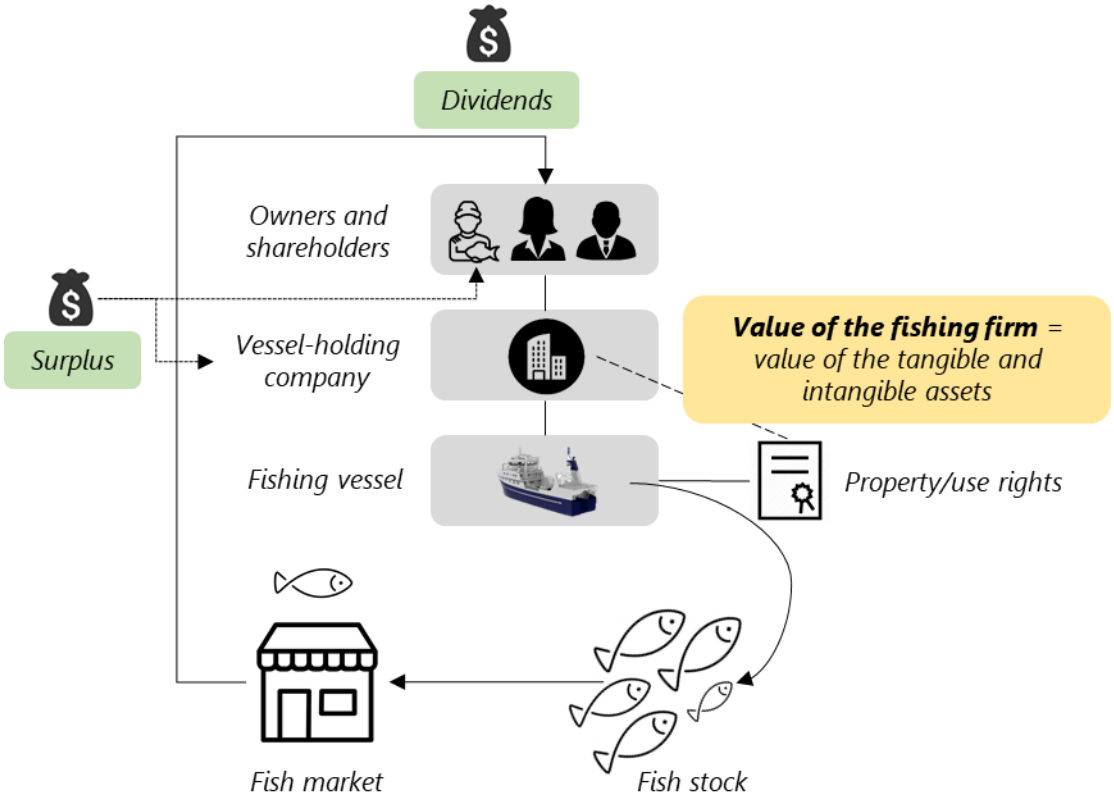


Figure 2-1: Conceptual model of the 'perks of ownership'. Ownership of the fishing company and its tangible and intangible assets gives the owner(s) right to the surpluses of fishing. The owner-operator is remunerated for their labor, while shareholders may have a right to a share of the profit in the form of dividends. Value from fishing is created by selling fish on commodity markets, while the intrinsic value of the firm is determined by the fishing vessels, the tangible (including fishing vessels) and intangible resources (including fishing opportunities; *resource access*) in the firm.

The conceptual model suggests two different perspectives from which ownership in the fishing sector may be approached: 'ownership'[36] over (access to) the *resource* through fishing opportunities, and ownership (possession) of the physical (vessels) and intangible assets (human capital, organizational capital) held by *fishing companies*. In what follows, we will consider these aspects in more detail.

[36] The term 'ownership' is introduced here as a concept, but is placed between quotation marks because the 'ownership' properties of fishing opportunities depend on the fisheries management system in place. In France fishing opportunities constitute use rights rather than property rights.

1.1.1 'Ownership' over the resource

Fisheries resources are common-pool resources. The resource base is the natural stock of fish, whose biological characteristics and mobile character present a number of challenges for its management. In law, fish stocks are referred to as *res nullius*, meaning that it is impossible for anyone to 'own' the resource (e.g., as a part of the ocean floor) like one can own a plot of land (cf. Gordon, 1954). In France, fisheries resources are considered national resources belonging to the inhabitants (JORF, 1997, 2010).

Access to the resource flow is established through fishing rights in a property rights framework. In some EU Member States (e.g., Denmark, the Netherlands, and, formerly, the UK), fishing rights constitute an asset that can be owned and traded by the owner of a fishing operation according to rules laid down by the Member States' fisheries administrations. In such cases, fishing rights are said to be 'private property rights' which appear in the balance sheet of the company and thus constitute a significant proportion of the fishing company's value, which is accepted as collateral by banks (Davidse *et al.*, 1999; van Ginkel, 2009, 2014; Høst, 2015; Carpenter and Kleinjans, 2017). In France, fishing rights constitute mere *use rights* (Bromley, 1991, 1992; Davidse *et al.*, 1999) which are non-appropriable and non-transferable by law. However, fishing rights may be transferred indirectly, through vessel sales on the second-hand vessel market (Quillérou and Guyader, 2012; Larabi *et al.*, 2013). Due to a strong emphasis on historical track records attached to the vessel (2001-2003) in yearly quota allocations (Larabi *et al.*, 2013; Bellanger *et al.*, 2016), allocations remain quite stable in practice and are perceived secure by most fishers (Carpenter and Kleinjans, 2017). In that sense, we may consider that in France, quota allocations are *de facto* owned by fishing companies, through the ownership of fishing vessels. Despite the fact that fishing rights do not appear as an asset in the company's balance sheets, it has been shown that they constitute a significant value in second-hand vessel price. Guyader *et al.* (2003) found that in 2000, intangible capital represented about half of the vessel price on average. Recent evidence from brokers suggests that this has further increased since then (Chapter 4).

1.1.2 Ownership of the vessels and the fishing company

In a capitalist economy, goods and services are produced for profitable exchange in commodity markets, and the means of production are mostly under private ownership (Brayshay, 2009). The capitalist mode of production is based on the accumulation of capital and its reinvestment for further production. From this perspective, the more fishing vessels (and associated fishing opportunities) one owns and controls, the more fish can be harvested, sold on commodity markets and turned into profit.

Elaborating on this line of thought, we may consider that ownership of the *fishing company* as a whole, with all its tangible and intangible assets, is what we should be looking at. In addition to fishing vessels, fishing companies may also hold other tangible (e.g., warehouses, delivery trucks, office spaces, etc.) and intangible assets that are essential to its functioning and profitability. Intangible assets may include human capital (skills, knowledge, training, etc.), and organizational capital (competencies, policies, culture, information, technology, etc.) (Habbershon and Williams, 1999). Furthermore, fishing opportunities in the form of licenses and/or property rights could also be considered intangible assets of the fishing firm (Malvarosa *et al.*, 2006).

Ownership of a fishing company may come in different forms: the owner may simply be the entrepreneur (owner-operator) of a self-established and independent fishing company, but also any natural or legal person with an ownership interest (shares) in a company. The nature and the amount of shares will furthermore determine the shareholder's cash flow rights and level of control in the company (Leech and Leahy, 1991).

1.2 The fishing company as the main unit of analysis

As established above, a comprehensive analysis of ownership should ideally cover both the ownership of the fishing vessels and of the fishing opportunities. However, in the EU, ownership data are not always available at the desired levels, especially regarding individual quota allocations, and analysis of vessel ownership is considered the most feasible (MRAG *et al.*, 2019; p. 35). Furthermore, in countries where fishing opportunities are licenses and use rights attached to the fishing vessel (e.g., France, Belgium), vessel ownership may even be a decent proxy for *access* to the resource. In Belgium, this is definitely the case as transparent criteria (engine power in kW) are used for the allocation of quotas (STECF, 2020a). In France, quotas are attributed to the vessel-producer partnership (French: *couple navire-armateur*, see further) based mainly on the historical track records attached to the vessel. However, information about vessel track records and quota allocations is not public, and even mostly unknown to most stakeholders, including researchers[37]. It must also be noted that quota allocations by POs do not necessarily follow the actual track records of the operator's vessels, and that reallocations of subquotas among members within the same PO are common (Larabi *et al.*, 2013; Bellanger *et al.*, 2016). Other elements obscuring the link between vessel ownership and resource access include: (1) a relative freedom for producers in choosing how to distribute fishing opportunities among multiple vessels (JORF, 2006); (2) the possibility to sell their vessels while retaining all or part of the track records/licenses, on the condition that they remain active in the fishery (i.e., they operate at least one vessel). In spite of these issues, vessel ownership is still the best available proxy for access to the resource in France, especially when combined with actual production data on the vessel level (landings volume and value) (see Chapter 3).

While we may consider that the vessel is the smallest possible analytical unit for ownership analysis in the EU fishing industry, it may not be the most appropriate. Nøstbakken *et al.* (2011) argue that analysis must be conducted at the level where decisions actually take place, i.e., at the firm or owner level. Considering that (1) multiple fishing vessels may be held by the same fishing company, and (2) the value and profitability of a company is the result of the presence and deployment of a range of tangible and intangible assets and resources within the company (cf. Barney, 1991), we argue that the analysis of *company ownership* best covers the different aspects of ownership discussed in subsection 1.1. Furthermore, as we will see below, it adds new perspectives to the study of ownership, such as the 'divisibility property' of fishing vessels, and the concept of corporate control.

1.3 Percentage ownership, corporate control and the 'divisibility property' of fishing vessels

Fishing companies may be owned directly by the entrepreneur (owner-operator) or through one or multiple legal entities (mother companies), and ultimately by one or multiple ultimate owners (natural or legal persons). For the purpose of this chapter, any entity with an ownership interest will be considered a 'beneficial owner'[38].

[37] While a number of studies have obtained access to quota allocation data for specific case studies (e.g., Guyader *et al.*, 2003; Bellanger *et al.*, 2016), it was not feasible to obtain such access for present PhD thesis.

[38] It must be noted that this definition deviates from the official definition of beneficial owners by the OECD, which only applies to natural persons (IDB and OECD, 2019). The term was employed by us to distinguish more clearly between 'ultimate' shareholders and 'regular' shareholders along the ownership path from a company to its ultimate owner(s). We will often refer to the former as 'ultimate owners', and to the latter as 'beneficial owners'.

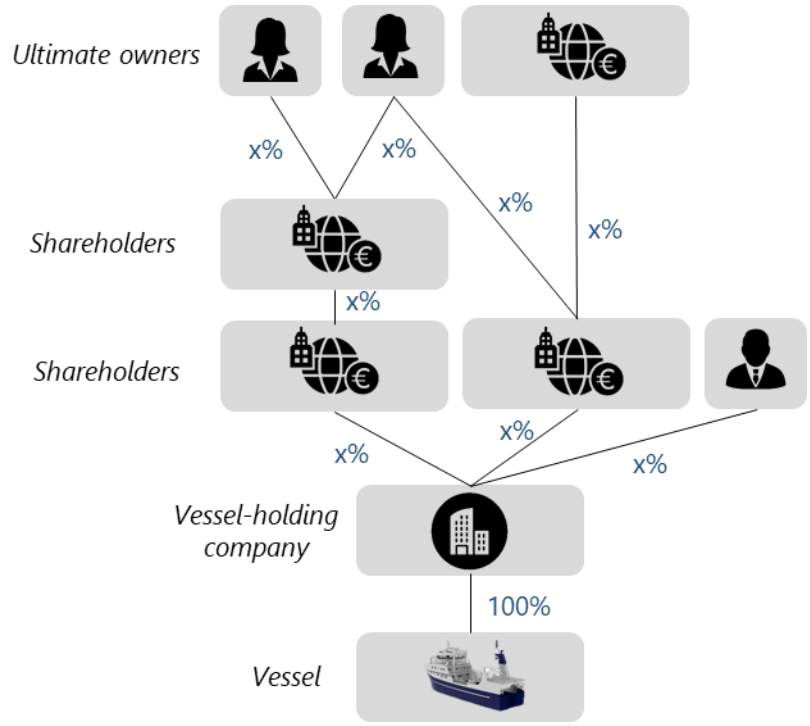


Figure 2-2: Corporate ownership structure of a fishing company, conceptual model. As a physical asset, the fishing vessel is the property of the vessel-holding company. This company may in turn be owned by multiple levels of shareholders (both legal and natural persons). Ownership percentages at different levels of ownership can be used to calculate ownership along the path from the subject company to its ultimate owner(s) (the highest entities – natural or legal persons).

The simplified conceptual model in Figure 2-2 shows that multiple levels of analysis are possible, and relevant statements can be made about vessel ownership or concentration at the level of the vessel-holding company, its shareholders and its ultimate owners. Ownership is expressed as ownership interests (shares), giving the holder a right to the returns of the company on a *pro rata* basis.

The concept of 'percentage ownership' in this framework provides an interesting feature for the analysis of vessel ownership and concentration. In reality, fishing vessels are indivisible physical assets. However, conceptually, we may look at the ownership of a fishing vessel as anyone's ownership share in the company holding that vessel. Just like the returns of fishing, we may thus consider that the vessel's landings (volume and value) and fishing capacity (GT, kW) are 'owned' *pro rata* among shareholders. Ownership databases such as Orbis (see further) provide percentages at the shareholder level (direct ownership). Furthermore, total ownership can be calculated at any desired level along the path from a subject company (i.e., the vessel-holding company in Figure 2-2) to its ultimate owner(s).

A second feature of the framework in Figure 2-2 is the perspective of corporate control. Ownership of fishing capital (vessels and fishing opportunities, and/or assets such as landings, GT and kW) can also be studied from the perspective of who *controls* them. Shareholders dispose of voting rights in the company's board of directors and/or the general assembly. Based on the 'one share, one vote' principle (Demsetz and Lehn, 1985), the more shares an entity owns, the more voting power and the more control it has over a company's governance (both day-to-day management[39] and long-term strategic decisions such as acquisitions and

[39] The influence that shareholders have on directors and managers depends on many factors, among which the corporate culture within the firm, respect for local customs in case the firm is ultimately owned by foreign shareholders, etc.

mergers). We recognize that this is a heavily simplified representation of corporate governance, however, as the 'one share, one vote' principle is not universal.

1.4 Chapter outline

Based on the concepts introduced here, we will design a framework for the extraction and use of ownership data from different sources (sections 2 and 3), and apply it to the French Atlantic fishing sector (section 4). The framework is designed in such a way that it is applicable to any set of EU fishing companies, and that it can serve three purposes. These purposes are: the identification of a fishing company's ultimate owners and their ownership percentages, concentration analysis, and the detailed description of the corporate group to which the company belongs.

The remainder of the chapter is organized as follows. First, we will construct a conceptual framework for comprehensive ownership analysis in the EU fishing industry (section 2). For this, we will explore and collate data from different sources. Second, we will present the analytical framework in more detail, and will extract ownership data for the French Atlantic fishing sector from the Orbis database (Bureau van Dijk) based on both standard and customized protocols (section 3). Third, we will analyze vessel ownership in the French Atlantic fishing sector and assess the added value of the customized protocols compared to the default metrics provided by Orbis (section 4).

2 Building a framework for ownership analysis

2.1 Available data sources

There are several databases at the EU and national level which contain ownership data that may be considered for ownership analysis. These databases are: (1) the Union fishing fleet register, (2) national information systems with fisheries-specific data on the vessel level, and (3) the EU Business Register. However, closer inspection of some of these databases shows that their applicability is, in fact, limited, and that additional data sources are needed for a comprehensive analysis of ownership. In this light, we have also included the Orbis database in our overview. The Orbis database (Bureau van Dijk) is commonly used for ownership studies, and more recently also for ownership analysis in the fishing sector (Warmerdam *et al.*, 2018).

2.1.1 The Union fishing fleet register

The legal framework for the collection of ownership and vessel information is provided by Regulation (EU) No 1380/2013. According to Article 24 of the Regulation, Member States are required to collect information on ownership, vessel and gear characteristics, and activity of fishing vessels flying their flags. This information is then submitted to the European Commission, which is required by the Regulation to keep a Union fishing fleet register. The implementation of Article 24 is laid out in Regulation (EU) 2017/218. It establishes procedures for the collection, validation and recording of the information by Member States (Article 5 and Annex I), as well as the submission of these data to the Commission in a standardized format (Articles 6 and 9). Table 2-1 gives an overview of the required vessel and ownership information as outlined in Annex I of the Regulation.

The 'Common fleet register (CFR) number' is the key vessel identifier in the Union fishing fleet register. This unique identification number is allocated to every Union fishing vessel[40] upon first registration in a Member State, and can under no circumstances be altered or reassigned. This has two important consequences for the study of ownership and concentration. First, it makes it possible to monitor the movement of vessels across Member States resulting from transfers. Second, it provides an unambiguous link between the vessel-specific information in the fleet register and information contained in other information systems related to fishing (e.g., landings and sales data collected under the 'Control Regulation', (EC) No 1224/2009). Other than the CFR number, the IMO number presents a second vessel identifier in the fleet register. It is attributed to marine vessels by the International Maritime Organization (IMO), and follows the same principle as the CFR number, in that it stays with the vessel until it is scrapped. However, its application in ownership analysis is limited, as (1) an IMO number is not obligatory for vessels under 100 GT and (2) only motorized vessels over 12 meters in length qualify for one (PEW, 2017).

There are several issues with regard to the collection and use of these data. The first limitation is that the collection of most ownership information listed in Annex I of Regulation (EU) 2017/2018 is, in fact, non-compulsory (see Table 2-1). There may thus be little incentive for Member States to collect these data – let alone report them to the Commission. Second, the non-standardized (text) format of the collected information may be a source of confusion. Often, ownership data are collected through questionnaires, whose output is dependent upon the approach of the administrator(s) responsible for their collection and interpretation. This may be further complicated by intermittent and *ad hoc* updates. Third, Annex I of Regulation (EU) No 1380/2013 only considers the legal owner of the vessel, defined as "any natural or legal person that appears on the vessel's registration documents as having the legal title of ownership of the vessel". However, in reality vessels are held by *companies* (legal persons)

[40] 'Union fishing vessel': a fishing vessel flying the flag of a Member State and registered in the Union (Article 4 of Regulation (EU) No 1380/2013).

only. These firms can, in turn, have one or multiple owners, depending on the company's legal form and ownership structure. Fourth, in the public version of the Union fleet register, some information is aggregated for reasons of confidentiality, and ownership information is lacking altogether. The national fleet registers are a better way to go, but access would need to be negotiated directly with the administrations at the Member State level.

The main obstacle, however, is that the collected ownership information excludes any kind of firm identification number. In other words: the fleet register allows us to identify with certainty all EU vessels but not their direct owners. It seems that this information may be collected by Member States upon registration of the fishing vessel and/or when the owner applies for a fishing license. Regulation (EC) No 404/2011 lays down the detailed rules for the issuance and management of fishing licenses. Annex II of the Regulation lists the minimum information to be collected. It includes the name and address of the license holder[41] and fishing vessel owner[42], but not the company's identification number.

Member States may nevertheless collect this information for their own administrative purposes, and through other frameworks. In France, the SIREN number[43] of the vessel-holding company may[44] be collected by the authorities when a vessel is registered, when it changes owner, or when applying for a fishing license or for membership in a Producer Organization (PO). A link with the fleet register is provided through the CFR number. However, it remains unclear to us whether this information is centralized and consolidated (and by which authorities), and how it can be accessed. On the other hand, information on the vessel operator (French: *armateur*) has since long been part of national data collection. The operator is attributed a specific identification number (*code armateur*) by the administration, which is composed of 8 digits (in the case of sole proprietorships) or the prefix 'SPR', followed by 4 digits (in the case of limited liability companies). As such, all vessels operated by the same operator can – in theory – easily be identified. *In theory*, because in practice, the entrepreneur may own and operate vessels in multiple fishing firms, which complicates analysis significantly (see further).

[41] Holder of a fishing licence: 'a natural or legal person to whom a fishing licence as referred to Article 6 of the Control Regulation has been issued' (see Article 2(3) of Regulation (EC) No 404/2011)

[42] Ship owner: 'the natural or legal person registered as the owner of the ship, including the natural or legal person owning the ship for a limited period pending its sale or handover to a ship recycling facility, or, in the absence of registration, the natural or legal person owning the ship or any other organisation or person, such as the manager or the bareboat charterer, who has assumed the responsibility for operation of the ship from the owner of the ship, and the legal person operating a state-owned ship' (see Article 3(14) of Regulation (EU) No 1257/2013)

[43] The SIREN number is a unique 9-digit identifier attributed to legal units in France.

[44] "*May* be collected": based on the information found in the *Code rural et de la pêche maritime* and other online sources, the mention of the SIREN number is not always compulsory – e.g., for vessel registration or change in ownership, the application documents ask for the natural *or* legal person. Documents for registration or change of owner: https://www.ecologique-solidaire.gouv.fr/francisation-et-immatriculation-des-navires-professionnels-commerce-et-peche; documents for the application for a fishing license: https://www.formulaires.service-public.fr/gf/cerfa_15595.do)

Table 2-1: Provisions for the collection of ownership information by Member States in their national fleet registers. Note that we only included information related to ownership here, as well as a number of key vessel identifiers. For the complete table, we refer to Annex I of Regulation (EU) 2017/218.

Name of data	Definition and comments		Compulsory (C)/Compulsory if available (CIF)/Optional (O)[45]
Common fleet register (CFR) number	Unique identification number of a fishing vessel in the Union ISO-3 code of the Member State followed by an identifying series (nine characters). Where a series has fewer than nine characters, additional zeros must be inserted on the left-hand side		C
Unique Vessel Identifier (UVI)	Unique Vessel Identifier (IMO number) pursuant to Regulation (EU) No 404/2011		CIF
Registration number	The registration number given by the Member State		O
Name of vessel	The name of the fishing vessel registered in the national register Code		C
MMSI	Maritime Mobile Service Identity		O
For contacts/legal owner	*Name*	Natural person: name, first name Legal person: name	CIF
	Legal Person Indicator	'Y' for a legal person, 'N' for a natural person – code	O
	Street	Street name and box	CIF
	PO box	Post-office box	O
	City	City name	O
	Post code	Post code	O
	Country	Country – code	O
	Phone number	International phone number	O
	Fax number	International fax number	O
	Email address	Email address	O
	Nationality	Nationality of the contact – code	O
	IMO company identifier	IMO unique company and registered legal owner identification number	O
For contacts/operator	*Name*	Natural person: name, first name Legal person: name	CIF
	Legal Person Indicator	'Y' for a legal person, 'N' for a natural person – code	O
	Street	Street name and box	CIF
	PO box	Post-office box	O
	City	City name	O
	Post code	Post code	O
	Country	Country – code	O
	Phone number	International phone number	O
	Fax number	International fax number	O
	Email address	Email address	O
	Nationality	Nationality of the contact – code	O
	IMO company identifier	IMO unique company and registered legal owner identification number	O

2.1.2 *Fisheries-specific data on the vessel level (national information systems)*

The rules for the monitoring of catches, landings, transshipments and sales (on the vessel level) are laid down in the 'Control Regulation' (EC) No 1224/2009 and are implemented through Regulation (EU) No 404/2011. Economic variables are also collected at the level of the fishing vessel and include income, costs, capital and investments, employment, and energy consumption (see Appendix VI of the Decision). Data are reported to the Commission on aggregated levels, but Member States keep national information systems in which primary data can be consulted at the level of individual fishing vessels, provided that access is granted. The vessel's CFR number provides the key to link different data sources together. For France, we had access to the SIH Information System (*Systèmes d'Informations Halieutiques*)[46] developed and managed by Ifremer and the French Directorate of Sea Fisheries and Aquaculture (DPMA) (Leblond *et al.*, 2008).

[45] Detailed rules are available in the Vessel Implementation Document on the Master Data Register (MDR) of the Commission Fisheries website: http://ec.europa.eu/fisheries/cfp/control/codes/index_en.htm

[46] More precisely, through the *Harmonie* and *SACROIS* databases (Leblond *et al.*, 2008).

Access to data on the vessel level (i.e., landings, sales, socioeconomic data) permit us to assess ownership beyond the question of *who owns* the production means. It allows for deeper analysis, focused around the question: who *benefits* from owning and controlling the production means? In other words, how does ownership and concentration of production means translate into landings and, ultimately, income from sales?

2.1.3 Ownership data at the company level (Business Registers)

The Business Register Regulation (EC) No 177/2008 establishes a common framework for compiling and maintaining business registers for statistical purposes. A wide array of data sources may be used to supply the national registers: administrative data, surveys, and data from national statistics offices. Administrative sources constitute the main supply of information in most Member States, and include VAT registers, registers kept by taxation authorities, social security administrations and chambers of commerce (EU, 2010). The information in the national business registers is hierarchically organized (by statistical units[47]), as established in Regulation (EC) No 2223/96 and described in the European System of National and Regional Accounts (ESA) (EU, 2013). The Business Register Regulation also establishes a link with the NACE Rev. 2 classification of economic activities (Regulation (EC) No 1893/2006). A single NACE Rev. 2 code is assigned to each unit recorded in the business registers, according to its principal economic activity[48] (EC, 2008). As we will see further on, the NACE Rev. 2 codes provide an alternative entry point for the extraction protocol when company identifiers are unknown.

The registers contain identification characteristics, demographic characteristics, economic/stratification characteristics and characteristics related to the control and ownership relations between statistical units[49]. We are interested in these data at the level of the fishing firm. In the Business Register, the *enterprise* represents the economic unit in which production is organized. However, at the basis of the economic activities carried out by the enterprise, is a *legal unit*[50]. The legal unit is an entity of public or private law, i.e., a natural or legal person and may take different forms. When a company is registered with the competent national authorities, a legal form is chosen and a unique identifier is assigned to it. Only a legal unit may enter into contracts or can be an owner of property, rights or goods (i.e., the factors of production) (EU, 2010). In France, a SIREN number is attributed to legal units (only legal persons) by the National Statistical Institute INSEE and accessible through the Sirène database (the French Business Register Identification System)[51]. INSEE also registers financial and ownership links between companies through the LIFI survey[52]. This survey aims to identify groups of enterprises operating in France, and their ownership or control by foreign groups.

[47] These statistical units are: the enterprise group, the enterprise, the kind-of-activity unit (KAU), the local unit, the local kind-of-activity unit (local KAU), the institutional unit, the unit of homogeneous production (UHP), the local unit of homogeneous production (local UHP). We refer to the Annex of Council Regulation (EEC) No 696/93 for a detailed description.

[48] While a unit can have multiple economic activities, the NACE code is assigned to the activity which contributes most to the value added. We refer to chapter 3 of EC (2008) for a detailed description of how this is calculated.

[49] We refer to the Annex of Regulation (EC) No 177/2008 for an overview of the information collected for each unit (OJ L61 pp. 12-16).

[50] Paragraph 7.8 of (EU, 2010): 'To give a correct description of the economic world, a unit must be created in which the production factors are combined in a way that production is possible and manageable. This economic unit is the enterprise. The enterprise is therefore a statistical unit, consisting of one or more legal units for which statistical data can be provided'.

[51] See https://www.sirene.fr/sirene/public/accueil and https://www.insee.fr/en/metadonnees/source/serie/s1020 (accessed on 03/04/2020)

[52] See https://www.insee.fr/en/metadonnees/source/serie/s1249 (accessed on 03/04/2020)

Access to business register data for EU-wide analyses may be limited, however, due to national laws and regulations regarding data protection and confidentiality – especially when it concerns data on the level of individual units (EU, 2010). Using the supplying administrative (national) sources would be an option, but the problem is that international analysis would require many negotiations with the authorities that collect, compile and manage these data.

2.1.4 *The Orbis database (Bureau van Dijk)*

The international character of corporate ownership also requires access to data sources from outside the EU. The Orbis database (Bureau van Dijk, BvD) contains information on 360 million companies worldwide (116 million in Europe) and provides numerous tools for company analysis and comparison (https://www.bvdinfo.com/en-gb/). BvD captures and treats data from more than 160 providers and "hundreds of [their] own sources" (BvD, 2020). While there are similar products on the market, they are not as comprehensive as Orbis or cover only certain parts of the world. Examples include the Thomson Reuters Ownership Database (US only), Hoovers Online (80 million companies worldwide) and the LexisNexis Company Dossier (40 million companies worldwide). Furthermore, Orbis presents itself as the forerunner in corporate ownership data and analysis (BvD, 2020). Access to the online Orbis database is subscription-based. Users have access to an interface for building queries and exploring and exporting data. Orbis draws from the same (and similar) administrative data sources as the national business registers, as well as from additional public and private databases (Figure 2-3). Given the difficulty to access data from the national business registers, Orbis provides a particularly useful data source for the analysis of ownership.

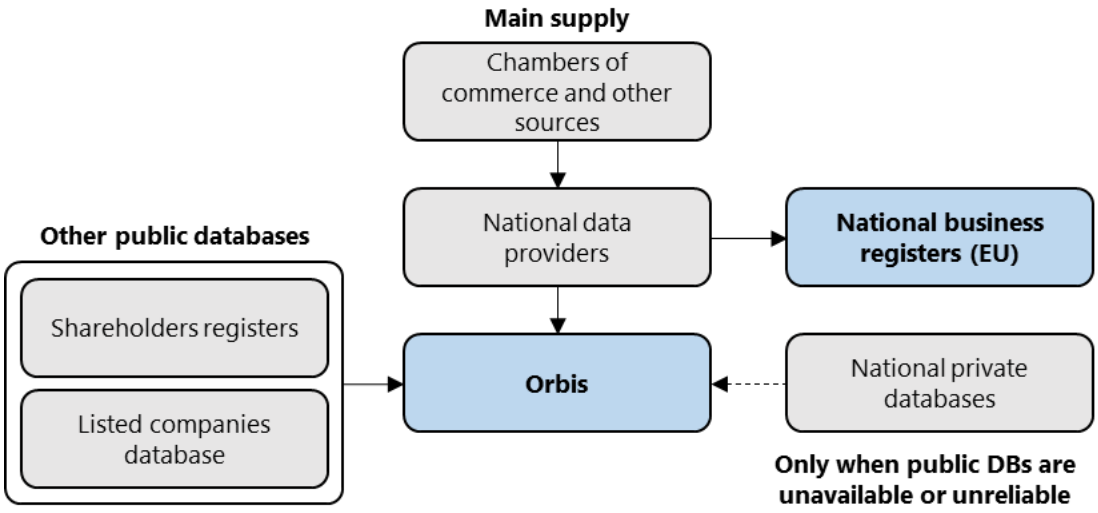


Figure 2-3: Data supply to Orbis (after Ribeiro and Menghinello, 2010). National data providers include National Statistical Institutes (NSIs), but also regional statistical offices, ministries, etc. The data sources that supply the national business registers are also used to supply Orbis.

2.2 Constructing a conceptual data framework for ownership analysis

2.2.1 *Step 1: construction of 'Vessel-Company Registers'*

As we have seen above, in the Union fleet register any connection is lacking between the CFR number of the fishing vessel and the unique identifier assigned to the company (business registers) holding the vessel (VAT number or equivalent; in France: SIREN number). To overcome this, registers must be established. We propose to name these registers 'Vessel-Company (VC) Registers'. In essence, these are the national fleet registers with one field added: the national firm identification number. In France, a first effort to combine vessel and ownership information in a database was undertaken by the French Directorate of Sea

Fisheries and Aquaculture (DPMA) of the Ministry of Agriculture and Food. More precisely, it concerns the addition of SIREN numbers to the French vessel register for all registered fishing vessels in 2016. Similar registers likely exist for other EU Member States, but we were unable to confirm this at the time of writing.

The challenge in constructing VC Registers is to link the fishing vessels to their respective holding company (identified by a SIREN number). It seems that holding companies were identified by the DPMA based on operator information in the fleet register, which in some cases led to misidentification. Annex 2.1 discusses some of the origins of misidentification in more detail. The SIREN numbers obtained by the DPMA for 2016 were subjected to a quality control by us (see below), and updated to include all SIREN numbers for vessels registered in 2018. It was also supplemented with data from the national information system SIH (through the CFR number). The updated VC Register thus contains technical vessel data as well as production data on the vessel level (Figure 2-4). We refer to Annex 2.2 for an overview of information contained within the VC Register.

Cross-checks were performed by looking up available pieces of information found in the fleet register (e.g., name of the vessel, operator name and address) in online databases such as www.societe.com, www.dirigeant.com, and www.infogreffe.fr, as well as the Orbis database (i.e., NACE Rev. 2 code for economic activity, street address, listed managers, etc.).

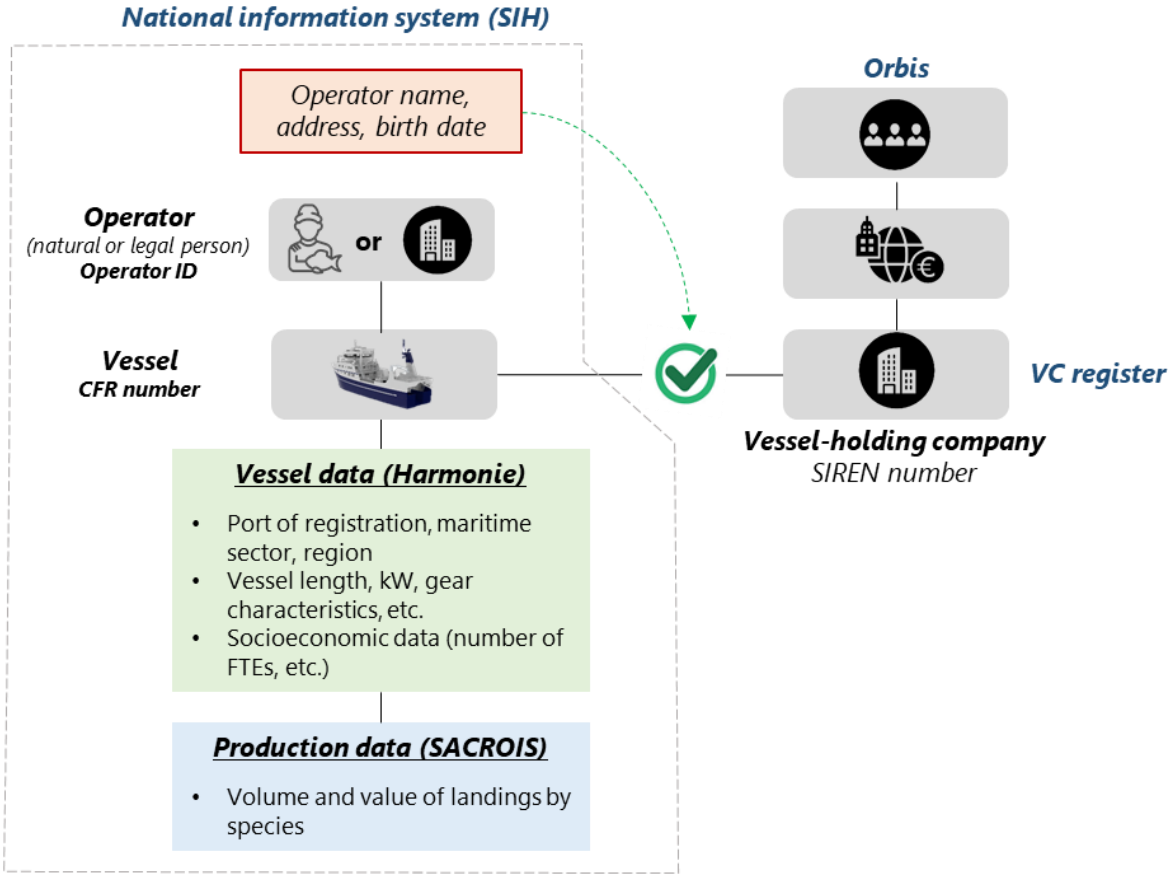


Figure 2-4: Connecting the vessel to its holding company. The green dotted arrow indicates the effort to identify the SIREN number based on information about the operator. The operator can be a natural or legal person, and is not necessarily the owner of the fishing vessel (vessel ownership is described by the SIREN number).

The updated Vessel-Company Register provides a snapshot of the vessels present in the French fleet register on 31 December 2018. A total of 4373 fishing vessels were registered in mainland France[53] in 2018. Of these, 2921 were registered on the Atlantic side (including the

[53] French: *France métropolitaine*. This area also comprises Corsica and a number of islands in the Atlantic Ocean and the English Channel, but excludes France's overseas areas.

North Sea and the English Channel) and 1452 were registered in Mediterranean ports. In the updated version of the Register, all fishing vessels registered in Atlantic fishing ports (*sensu lato*) were linked to a SIREN number. The original dataset received from the DPMA in 2017 (VC Register 2016), covered only 95.4% of vessels and provided SIREN identifiers for 84.8% of vessels.

2.2.2 Step 2: linking the Vessel-Company Register with ownership data from Orbis

VC registers are needed to link the fishing vessels to a SIREN number, but this is only the first step in the construction of an analytical framework. A link with corporate ownership databases such as Orbis is also required to identify the beneficial and ultimate owners of fishing companies. The SIREN numbers of vessel-holding companies serve as entry points for ownership queries in the interface of the Orbis database (provided that a prefix 'FR' is added to the SIREN number). Starting from these 'BvD ID numbers' of vessel-holding companies, our approach consists of the stepwise (hierarchical) identification of shareholders (legal and natural persons), until the highest shareholders are found (see section 3). Then, ownership data are exported in Excel spreadsheets so that they can be used for different analytical purposes.

Where VC registers cannot be constructed, and depending on the scope of the analysis, alternative entry points may be chosen: IMO numbers (known or unknown sub-population of vessels[54]) or the NACE Rev. 2 classification of economic activities (large geographical scope possible) (see Annex 2.3). The use of IMO numbers and NACE codes falls beyond the scope of this chapter.

[54] Known: a subset of marine fishing vessels of interest. IMO numbers are valid BvD ID identifiers for which the ultimate owners can be identified through Orbis just like is done for vessel-holding companies; Unknown: all marine fishing vessels in a given geographical area, based on a combination of entity type (Marine Vessel) and NACE Rev. 2 activity code (Marine Fishing) (see Annex 2.3)

2.2.3 Three objectives for ownership analysis

Figure 2-5 summarizes the resulting framework for ownership analysis, outlining the different analytical purposes that may be envisaged.

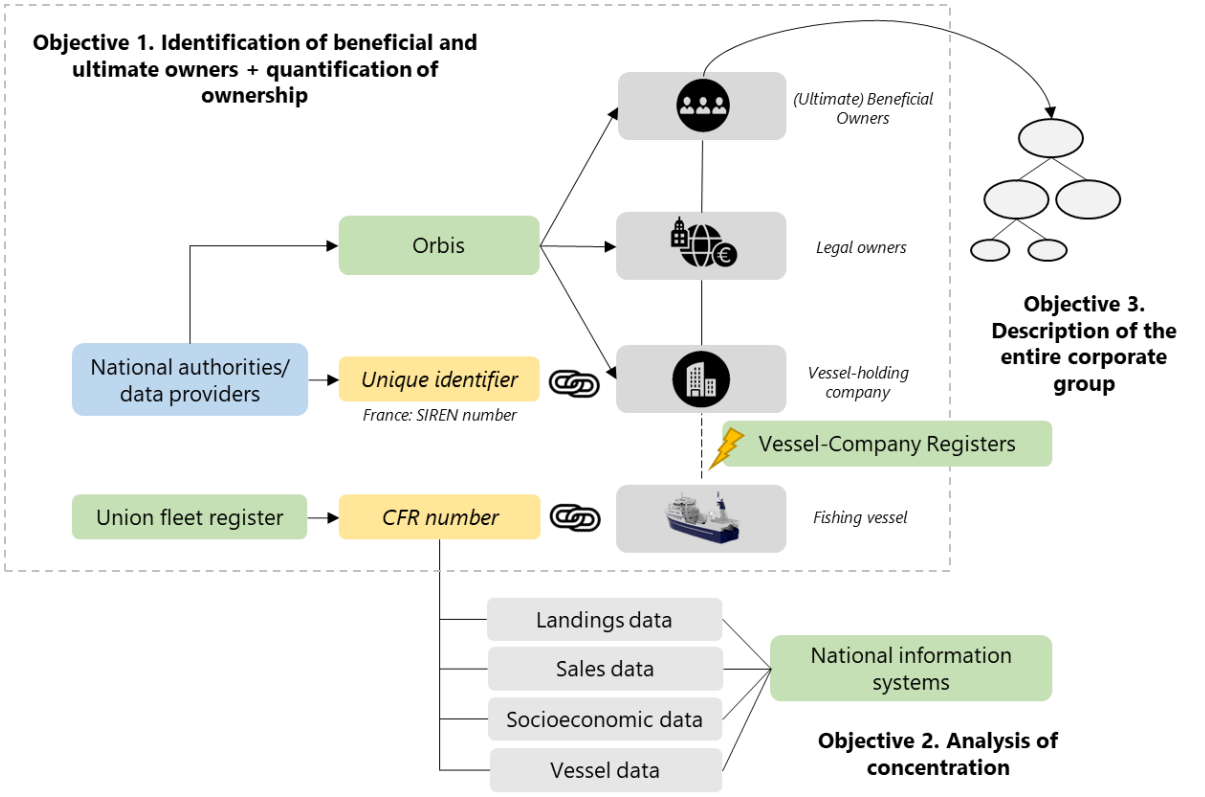


Figure 2-5: Conceptual data framework for ownership analysis in the EU fishing industry. The upper part of the scheme (dotted frame) constitutes the focus of our analyses in this chapter. Adapted from Guyader (2017). Yellow: company and vessel identifiers; Green: data sources used; Blue: secondary data sources.

The methodological framework is designed in such a way that it can serve multiple analytical purposes, inspired by, among others, the study by MRAG *et al.* (2019) and the recommendations made by the authors. These objectives are:

- ***Objective 1a***. The identification of all **beneficial owners**, i.e., **who has a right to** the returns of fishing and **how much**? In this chapter, we understand this as all entities, both natural and legal persons, who, through direct and indirect ownership interests in fishing companies, reap the benefits of fishing. In other words, these are **all shareholders**, both direct and indirect[55], of the subject company;
- ***Objective 1b***. The identification of **who ultimately owns and controls** the fishing companies. In this chapter, the ultimate owners will be considered at the level of the Global Ultimate Owner (GUO) (see further), as well as on more detailed levels defined by us through customized data extraction protocols;
- ***Objective 2***. The **analysis of concentration** in the fishing sector based on quantified ownership links (percentages). In this chapter, the ownership data necessary for concentration analysis in Chapter 3 are extracted and prepared;
- ***Objective 3***. The detailed **description of the corporate ownership structure** in which the fishing firm is embedded, on a case study basis. This includes both the description of the corporate structure from which the fishing firm depends directly, and

[55] Indirect shareholders are shareholders who have an ownership interest in the subject company through one or multiple other companies in the path from the subject company to its ultimate owner(s).

the description of the **entire corporate group**. The latter allows for an examination of the importance of fishing in the group's investment portfolio.

3 Extraction of ownership data from Orbis

In this section, we will present a methodology for the extraction of ownership data from Orbis (Bureau van Dijk, BvD). We have developed a methodology which is able to extract detailed ownership data from large datasets. The main objective here is to identify the beneficial and ultimate owners of fishing companies, and to extract the data necessary for further analysis. The extraction protocols presented here can be applied to any set of fishing companies registered in the EU. In what follows, we will refer to these companies, the vessel-holding companies, as 'Level 0' companies.

3.1 Corporate ownership in Orbis

From a corporate ownership and governance perspective, a primary concern is to identify the ultimate owners of Level 0 companies, and more precisely, ultimate owners who are also majority shareholders. The majority owners are those with not only the highest rights to the returns of the company, but also with the highest control rights. Many researchers have used data from Orbis and similar databases to study ultimate ownership (e.g., Bloch and Kremp, 1997; Faccio and Lang, 2002; Laeven and Levine, 2008; Kalemli-Ozcan *et al.*, 2013, 2015; Croci and Giudice, 2014; Levy and Szafarz, 2017; Horobet *et al.*, 2019). Other than identifying the ultimate owners, it is our objective to identify all beneficial owners, regardless of how big or small their stake in the Level 0 company or whether or not they can exercise effective control.

Figure 2-6 shows a conceptual model of the ownership structure of a vessel-holding company based on Orbis definitions. Bureau van Dijk (BvD) considers that the Ultimate Owner (UO) of a subject company is the shareholder with the highest direct or total ownership percentage, given that this shareholder is an independent company (see Horobet *et al.*, 2019 p. 8 for a description of Orbis independence indicators). BvD distinguishes between two types of UOs: the Domestic and Global Ultimate Owners (DUO, GUO) (see further). All shareholders in the path from the Level 0 company to its ultimate owner(s) are labeled 'Controlling Shareholders' (CSHs).

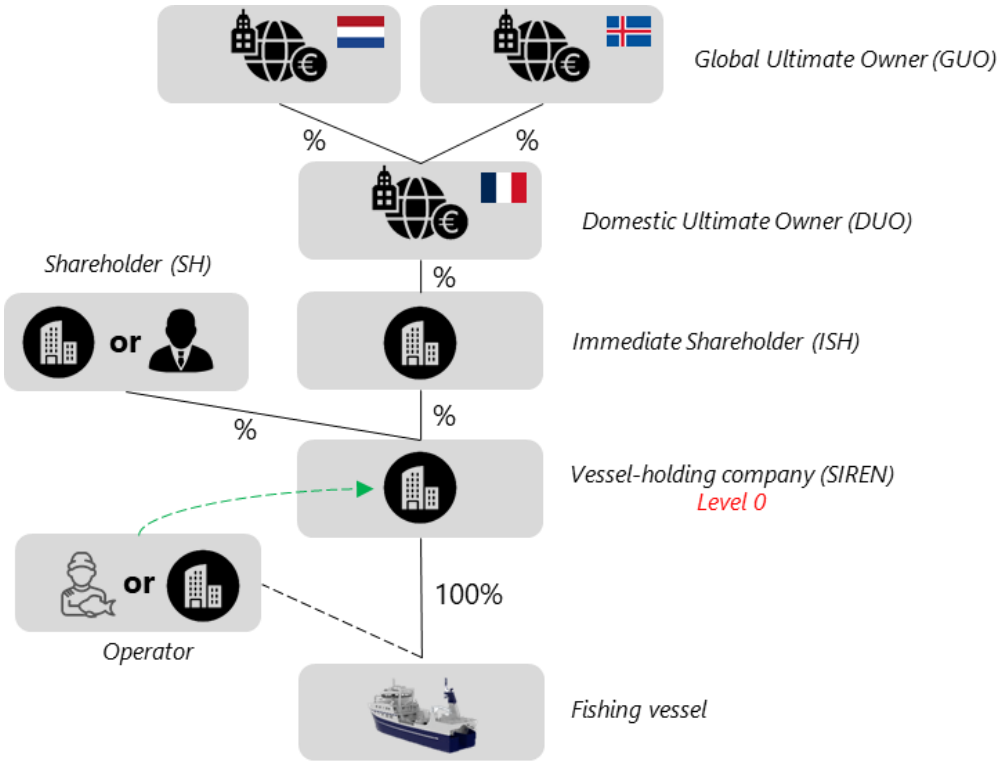


Figure 2-6: Ownership structure of a vessel-holding company based on Orbis definitions, conceptual model. For completeness, we have added the operator to the scheme. The dashed green arrow from the operator to the vessel-holding company indicates the effort to find the SIREN number based on operator information (VC Register).

Let us consider the scheme from the bottom up. The fishing vessel is held by the fishing company (Level 0). The dashed green arrow from the operator to the vessel-holding company indicates the effort to identify the vessel-holding company (SIREN) based on operator information (i.e., construction of the VC Register, see section 3). In the path from the Level 0 company to its ultimate owner(s), BvD identifies following entities (BvD, 2013)[56]:

- ***Immediate Shareholders (ISHs)***. ISHs are the first shareholders in the path from the subject company to its Ultimate Owner (UO). For example, the 'Shareholder' (SH) in the figure is not part of this path. As we will see further on, this makes the use of the UO pathway as defined by BvD insufficient for the identification of all beneficial owners. In the customized extraction protocols developed further on in this chapter, 'ordinary' shareholders play a crucial role. Despite not having control over the subject company, they are nonetheless *beneficial owners* and should be identified;
- ***Domestic Ultimate Owner (DUO)***. BvD defines the DUO as the highest entity in the path between the subject company and its Global Ultimate Owner (GUO) that is located in the same country as the subject company;
- ***Global Ultimate Owner (GUO)***. The GUO is the shareholder with the highest direct or total % ownership (globally). In the Orbis interface, the GUO can be defined at two different thresholds by the user, 25.01% or 50.01%, indicating the minimum total % from the subject company to its GUO.

Criteria for the selection of the GUO can be chosen by the user. For our purposes here, we have defined the GUO at 25.01%, without additional criteria regarding their type or public or private character (see BvD (2013) slides 39-41 for an overview of criteria). Given that a detailed assessment of corporate control is beyond the scope of this chapter, the 25.01% level (GUO25) is preferred, because it yields a greater number of GUOs. We have considered a company to be a GUO when it has no identified shareholders or if shareholder percentages are not known. In other words, when no shareholders are identified, the GUO of the subject

[56] See https://www.slideserve.com/naasir/bvd-ownership-database (Accessed on 20/03/2021)

company is the company itself (Figure 2-7). We emphasize that (1) DUOs/GUOs can be natural or legal persons, and (2) a subject company may have more than 1 GUO when considered at the 25.01% level.

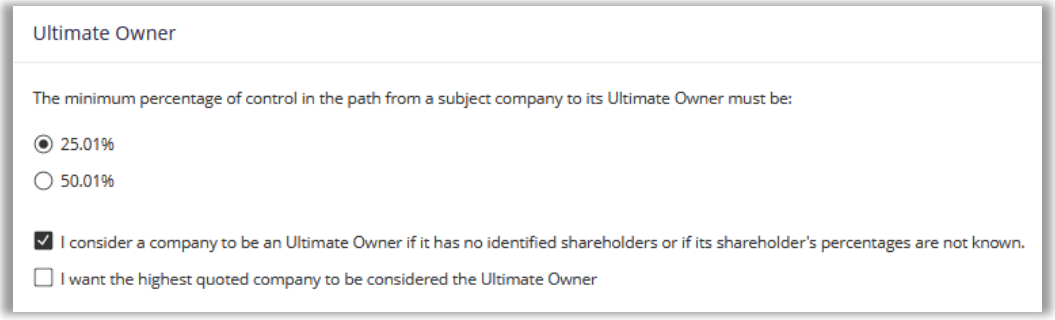


Figure 2-7: Screenshot of GUO selection criteria in the Orbis interface.

3.2 Issues with the Orbis approach to ownership analysis

There are two major issues that make the Orbis approach insufficient for our purpose here, which is the identification of *all* ultimate and beneficial owners:

- First, the identification of a fishing company's ultimate owners through the DUO and GUO is only possible for companies for which shareholders are listed. In section 4 we will see that for the vast majority of Level 0 companies extracted for the French Atlantic fishing sector (97%), no shareholders are listed in Orbis. For these companies, the GUO was chosen to be the company itself (see Figure 2-7). For most of these companies, this may be a good approximation of the actual ownership situation. It mostly concerns sole proprietorships and limited liability companies owned and managed by a single person (the owner-operator). In other cases, however, the owner-operator may in fact be heading multiple fishing operations, and ownership and concentration would be underestimated when the concept of the GUO is used. Finally, a fishing firm may also be headed by two or more partners (e.g., partnership, *société en nom collectif*)[57], and the use of the GUO would lead to an overestimation of ownership.
- Second, even at the smallest ownership level (25.01%), the GUO approach still does not identify all beneficial owners. As established above, it only identifies the controlling shareholders in the path from the subject company to its ultimate owner (defined as the GUO). From a corporate governance perspective, shareholding at the 25% or 50% threshold is an indication of control over the subject company. While this is the primary interest of many ownership studies, we are interested in identifying *all* beneficial owners, as well as their direct and total ownership percentages to be able to study concentration (Chapter 3). It is our aim to also include 'ordinary' shareholders (SH) in our extractions, so that a complete image of the ownership structure can be drawn.

3.3 Customized approach: two additional pathways

Because of the limitations described in 3.2, we have developed a number of customized extraction protocols, which will be used in tandem with the GUO approach described above (Figure 2-6).

[57] See http://sedigroup.com/en/information-leaflets-french-market/how-to-form/subsidiary/index.html (Accessed on 20/03/2021)

Figure 2-8 shows our conceptual framework for the identification of all ultimate and beneficial owners of Level 0 companies. In addition to the GUO approach (the **Orbis pathway)**, two customized pathways are proposed:

- In **Pathway 1 (the 'bottom-up protocol')**, all beneficial owners are identified in an iterative process starting from the Level 0 company. The first round identifies the company's direct shareholders. In subsequent rounds, also the indirect shareholders are identified (i.e., the shareholders' shareholders). The process comes to an end when all shareholders are identified. After the bottom-up protocol, a **top-down protocol** is applied to extract data for the recomposition of the corporate group (Objective 3 in Figure 2-5). The approach consists in identifying the subsidiaries for every shareholder identified in the bottom-up process. However, as this step is not essential to the identification of beneficial and ultimate owners, it will not be dealt with in great detail in this chapter.
- **Pathway 2 (the 'Directors/Managers (DM) protocol')** is applied to infer the ultimate owners of the Level 0 companies through manager/director role hierarchies. This approach was specifically designed to infer the owners of companies with 0 listed shareholders.

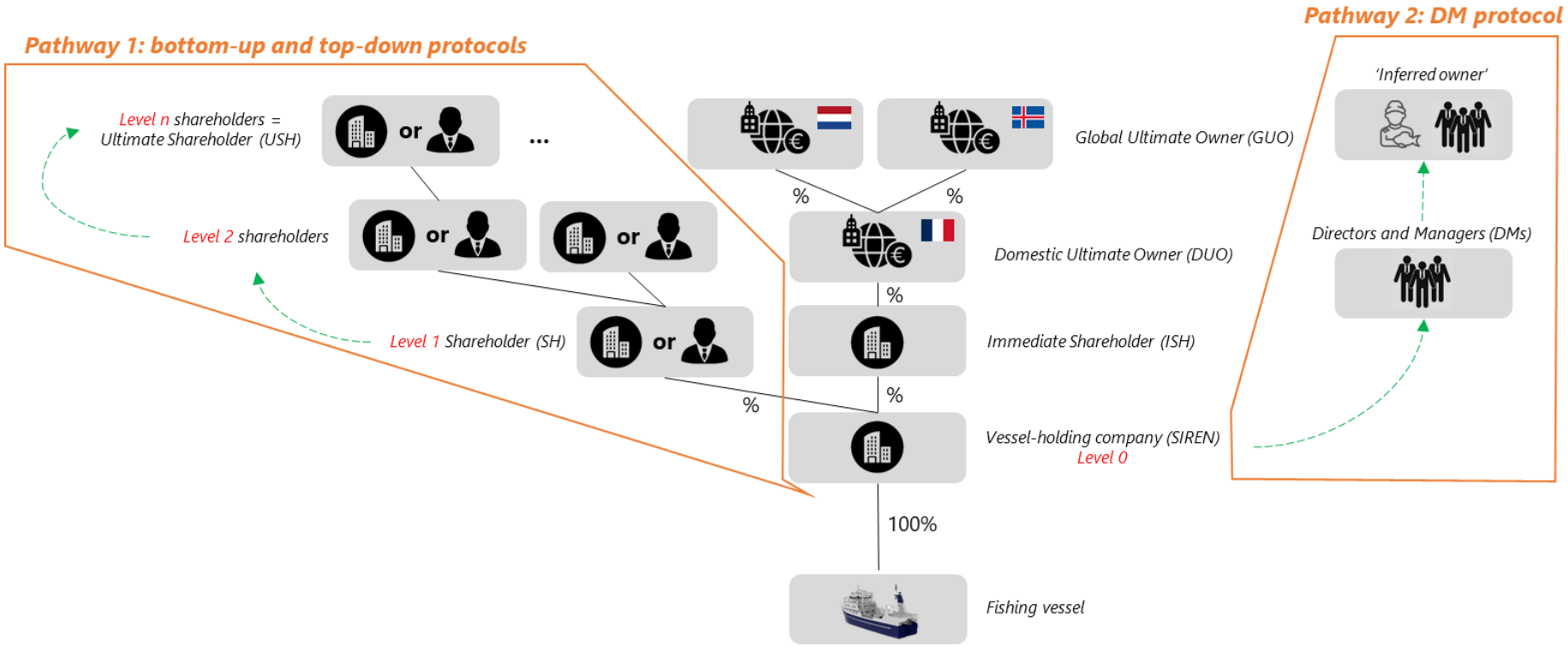


Figure 2-8: Two pathways for extraction of ownership data in addition to the default ownership metrics provided by Orbis. The scheme is presented as an extension of Figure 2-6. In Pathway 1, all beneficial owners are identified in an iterative bottom-up protocol. The process comes to an end when all ultimate shareholders (USHs) are identified. This approach will identify all shareholders, including the ISH, DUO and GUO as defined by Orbis. After the bottom-up protocol, a top-down protocol is applied to reconstitute the subsidiaries of every shareholder identified in the bottom-up process. Pathway 2 is applied *a posteriori* to infer the ultimate owners through manager/director role hierarchies.

3.4 Ownership data: shareholders, subsidiaries and information on directors/managers

In the Orbis interface, users may select ownership data ('columns') to produce a customized data table. For a given company set, data can be exported to an Excel spreadsheet. Table 2-2 and Table 2-3 show a summary of which data are extracted. We note that the templates were designed to be as exhaustive as possible, with some information included only for interpretation purposes.

Three categories of data are extracted from Orbis:

(1) Company and shareholder information. This includes data that describe the Level 0 company and their shareholders: BvD ID number, type of entity, BvD independence indicator, legal form, country code, status, address, etc. (Table 2-2). Table 2-2 furthermore includes information on subsidiaries. Recall that subsidiary information is collected in the 'top-down protocol' for every shareholder identified in the bottom-up protocol. This information can be used to provide detailed descriptions of corporate groups, on a case study basis (e.g., vertical integration, investment portfolio) (Objective 3). *This info is collected in*: Pathway 1 (at every iteration) and the default Orbis pathway (once, for the Level 0 companies).

(2) Quantitative ownership information. Data needed to quantify the link between the subject company and its shareholders and subsidiaries, and to calculate total ownership along that path (shareholder BvD ID numbers, direct/indirect ownership percentages, etc.). See Table 2-2. *This info is collected in*: Pathway 1 (at every iteration) and the default Orbis pathway (once, for the Level 0 companies).

(3) Information on the company's directors and managers (DMs). This includes the number of DMs (current and previous), type of role, personal information, etc. See Table 2-3. *This info is collected in*: Pathway 2. Further on, we will describe how manager/director role hierarchies will inform the identification of the ultimate (inferred) owner(s) for companies with 0 listed shareholders.

Table 2-2: Companies, shareholders and subsidiaries – overview of extracted data (*): the Orbis independence indicator is used by BvD to infer the ultimate owners (see Horobet *et al.*, 2019).

Category	Column name
Entity information	Company name, BvD ID number, Type of entity, Country ISO code, Standardised legal form, National legal form, Status, BvD Independence indicator (*)
Industry information	NACE Rev. 2, core code (4 digits), NACE Rev. 2 core code - description
Corporate group	No of companies in corporate group, No of shareholders, No of subsidiaries, No of subsidiaries (ultimately-owned included)
Shareholders	Shareholder – Name, BvD ID number, Type, NACE code, ownership (Direct, Total) %, address, country ISO code
Specific shareholder entities (inferred by Orbis)	ISH (Immediate Shareholder) – Name, BvD ID number, Type, NACE code, ownership (Direct, Total) %, address, country ISO code DUO (Domestic Ultimate Owner) – Name, BvD ID number, Type, NACE code, ownership (Direct, Total) %, address, country ISO code GUO (Global Ultimate Owner) – Name, BvD ID number, Type, NACE code, ownership (Direct, Total) %, address, country ISO code
Subsidiaries	Subsidiary – Name, BvD ID number, Type, NACE code, ownership (Direct, Total) %, address, country ISO code

Table 2-3: Directors and managers – overview of data extracted from Orbis.

Category	Column name
Entity information	Company name; BvD ID number
DM info	Number of directors & managers; Number of previous directors & managers; Number of current directors & managers
DM identifiers	DM Full name; DM Title; DM Salutation; DM First name; DM Middle name; DM Last name; DM Suffix; DM UCI (Unique Contact Identifier); DM Corresponding BvD ID (when applicable); DM Current or previous
DM job information	DM Job title; DM Job title (in English); DM Appointment date; DM Resignation date
DM personal information	DM Gender; DM Birth date; DM Age; DM Age bracket; DM Birth place; DM Country/ies of nationality; DM Address; DM Country; DM E-mail address; DM Biography
DM role information	DM Type of role; DM No of cos in which a current role is held; DM Board, committee or department; DM Level of responsibility; DM Has a signatory right; DM Has a power of attorney; DM Also a shareholder; DM Confirmation date(s); DM Date(s) last received from IP(s); DM Not valid after date; DM Information source(s); DM Information Provider(s)

3.5 Synopsis of the extraction protocols

In what follows, the protocols introduced in 3.3 will be discussed in more detail. To implement them, a suite of R scripts was developed (not included in this PhD manuscript).

3.5.1 Bottom-up (Pathway 1) and top-down protocols

Figure 2-9 shows a schematic representation of the bottom-up and top-down protocols for the extraction of ownership data from Orbis. The protocols are designed such that large company sets may be queried and processed at once. The bottom-up protocol starts from all vessel-holding (Level 0) companies in the initial dataset, and gradually works its way up, one level at a time. To start, a text file containing all Level 0 BvD ID numbers is queried in the Orbis interface. The output of the first cycle of the protocol consists of (1) a text file with a list of BvD ID numbers of Level 1 shareholders, and (2) an Excel spreadsheet containing ownership data for all Level 0 companies. The list of Level 1 BvD ID numbers is then used to start the next cycle. This process is iterated as long as not all identified shareholders are natural persons (in other words: as long as there are companies among the shareholders). Each natural person constitutes a 'STOP' in the protocol as Orbis does not recognize the BvD ID numbers of natural persons, and the next cycle along that path cannot be started. This is the sign that all shareholders have been identified. Indirect ownership can now be calculated for all entities along the path from the Level 0 company to its ultimate owners. The highest owning entities of the Level 0 companies were dubbed 'Ultimate Shareholders' (USHs)[58], to distinguish them from the ultimate owners defined by Orbis (DUO, GUO). For a more detailed description of the bottom-up protocol we refer to Annex 2.4.

[58] In Annex 2.4, a further distinction will be made between USHs which are legal persons (Ultimate Legal Shareholders – ULSHs) and USHs which are natural persons.

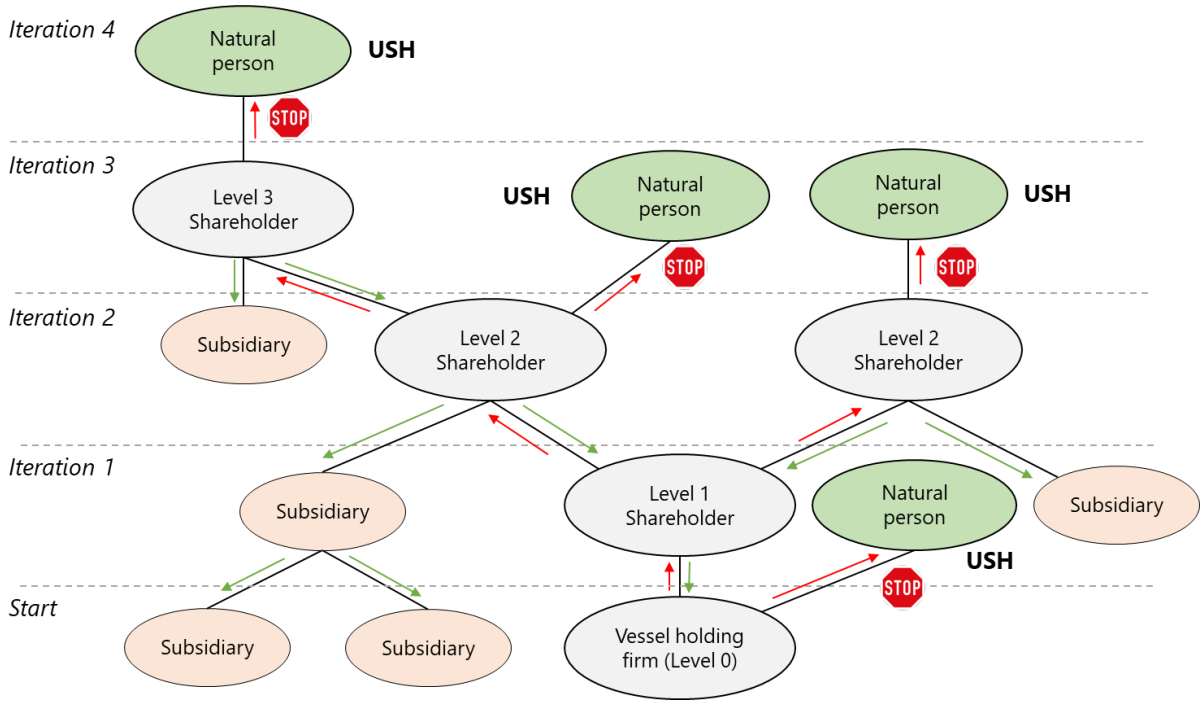


Figure 2-9 : Schematic representation of the bottom-up and top-down protocols. Starting from the vessel-holding company, an iterative bottom-up approach is applied until all newly identified owners are natural persons (red arrows). Subsequently, a top-down approach is applied to identify the subsidiaries of all shareholders identified in the bottom-up protocol (green arrows). Whenever a natural person is queried in Orbis, the iterative process comes to end for that specific path. USH = Ultimate Shareholder. The level right below the USH is referred to as the Ultimate Legal Shareholder (ULSH, see Annex 2.4).

Once the bottom-up protocol is completed, the top-down protocol is launched. We recall that this is not required for the identification of the ultimate and beneficial owners (Objective 1b). However, this information is needed to make a detailed description of the corporate group possible (Objective 3; outside the scope of this chapter). In the top-down protocol, the subsidiaries of the highest legal person (company) in the hierarchy are identified. Note that some of the shareholders identified in the bottom-up approach will also appear as subsidiaries in the top-down approach. This part of the protocol does not require an iterative process: a single query in Orbis is enough to identify and extract all subsidiaries. We note, however, that a 'batch' approach as for the bottom-up protocol is not recommended to avoid computational overload. The top-down protocol is best applied on a case-by-case basis.

3.5.2 The Directors/Managers (DM) protocol (Pathway 2)

The directors and managers of a company are natural persons who can be identified on the basis of a 'Unique Contact Identifier' (UCI) in Orbis. A given UCI can have multiple roles in one or more companies. However, not all roles are associated with ownership. The principle of the DM protocol is to isolate one or multiple UCIs who, based on their DM roles, is (are) likely the owner(s) of the company in question. Figure 2-10 shows the basic principle of the DM protocol.

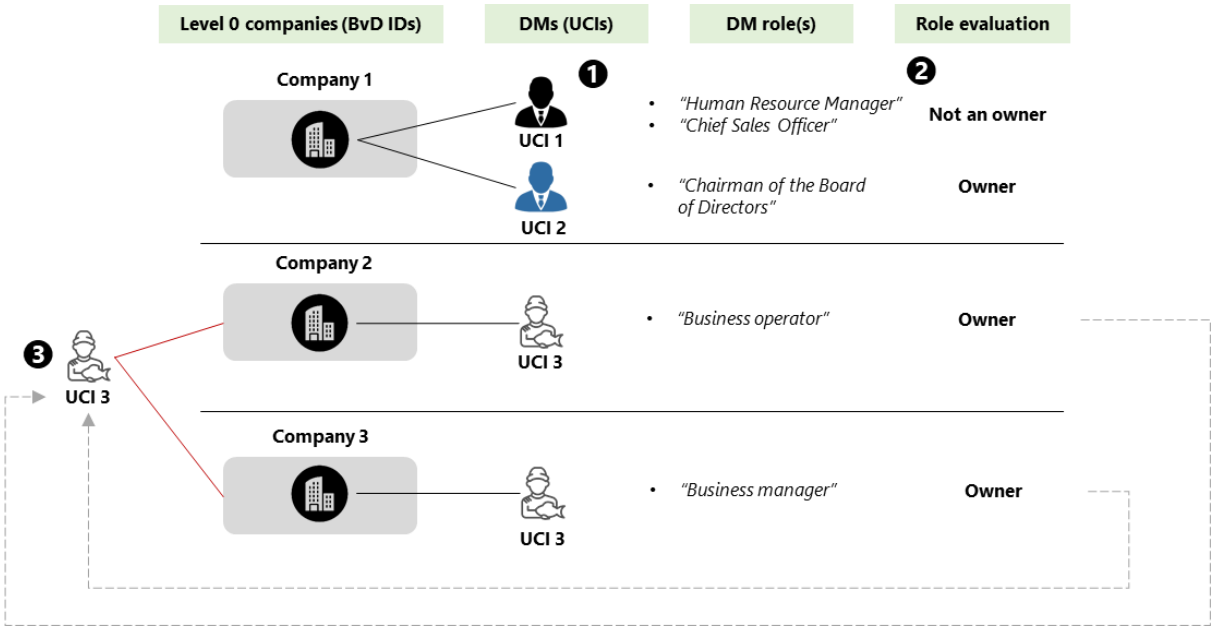


Figure 2-10: Inferring the owner based on the DM protocol, conceptual model. First, the directors and managers (UCIs) of the company (BvD ID number) are identified. Second, their roles are assessed on whether or not they imply ownership (stepwise exclusion protocol, see further). Third, the UCI is linked to the BvD ID number as being its inferred owner.

In what follows, we will give a step-by-step account of the methodology. DM roles were defined as a combination of four variables in the data extracted from Orbis: type of role, job title (English), job title (French) and level of responsibility. For the population of interest (the French Atlantic fishing sector, see further), this yields 98 unique roles. In a first step, we isolated all combinations for which ownership is implied (this involves 63 roles). Roughly speaking, following categories were considered to imply (co-) ownership (only job title is mentioned here, see Table 2-4 for a full overview):

- Business Manager/Business Operator
- Associate Business Manager/Joint Operator
- Chairman/President of the Board of Directors/Executive Board/Supervisory Board
- Member of the Board of Directors/Executive Board/Supervisory Board
- Executive Officer
- Owner

For ease of understanding, we will refer to them collectively as 'owner roles'. A complete overview of owner roles is provided in Table 2-4, and Table 2-5 shows the DM roles that were considered to *not* imply ownership[59]. In a second step, role hierarchies (priorities) were defined. The idea is to prioritize some roles over others when multiple owner roles occur in a company. The last column of Table 2-4 shows how related roles (clusters) are considered at the same

[59] It is important to note that none of these roles occurred as the only role, they were always accompanied by at least 1 'owner role'. This is important for the stepwise exclusion protocol described further on.

priority level. This is because the owner roles in question are mutually exclusive[60]. In a third step, one or a couple UCIs are isolated for each company in a stepwise exclusion protocol based on role priorities. This happens in a 'batch approach', i.e., for all companies at once, on the basis of an R script. This process can be summarized as follows:

- **For companies with 1 DM role**: The inferred owner is the UCI corresponding to that role, regardless of which role that is. We must note that, for our population, the single DM role was always an owner role;
- **For companies with ≥ 2 DM roles**: First, all non-owner roles are discarded. Second, we pass through role priorities one by one, starting with the highest priority. The principle is simple: if one or more priority 1 roles are found, their corresponding UCIs are isolated and linked to the BvD ID number of the company, and the process is terminated. If not, we pass to priority 2, etc. until all DM roles have been accounted for.

For most companies, this approach will lead to the identification of 1 UCI. However, it is important to note that the same role may sometimes occur for different UCIs. This is the case for partnerships, for instance, where ownership is shared between two UCIs, labeled as 'Associate Business Manager', 'Co-Business Manager' or 'Joint Operator'[61].

We emphasize that the method proposed here is work in progress and should not be understood as a fully verified method for inferring the ultimate owners of fishing firms. That being said, it has proven to work well for a selection of case studies and preliminary sensitivity tests have shown good results. Sensitivity tests included the comparison of different versions of role hierarchies[62] and the application of the protocol to several case studies known to the research team. Tests were not ready for publication here.

[60] Roles being mutually exclusive also explains why some crucial roles seem to have low priority (due to high-ranking number). The six other scenarios tested involved alternative orders, but gave very similar results. A detailed and coherent description of these sensitivity analyses could not be included in this manuscript.

[61] Similar remark as above. One will notice the differences in priority, while in fact these roles are quite similar and lead to the same conclusions about ownership (i.e., shared ownership). However, the differences in priority do not affect the result because they are mutually exclusive. In other words, an Associate Business Manager' would never occur together with a 'Co-Business Manager' or 'Joint Operator'.

[62] Once 'owner roles' were identified, seven different versions of role hierarchies were tested. As explicated above, owner roles appear in clusters and roles within a cluster are mutually exclusive. The same holds for roles across clusters: we found that the order in which clusters were tested had little effect on the outcome.

Table 2-4: Combinations of role type, job title and level of responsibility identified as being associated with an 'owner' position. Data in the table were included exactly as they were extracted from Orbis. Note the doubling of some roles due to slight differences in punctuation, repetition or other textual errors.

Type	Job title (English)	Job title	Level of responsibility	Priority
BoD	Chairman	Chairman	President / Chairman	1
BoD	Chairman of the Board of Directors	Administrateur;Président du Conseil d'administration	President / Chairman	1
BoD	Chairman of the Board of Directors	Membre;Président du Conseil d'administration	President / Chairman	1
BoD	Chairman of the Board of Directors	Président	President / Chairman	1
BoD	Chairman of the Board of Directors	Président du Conseil d'administration	President / Chairman	1
BoD	Chairman of the board of directors	Président du Conseil d'Administration	President / Chairman	1
BoD	Chairman of the Board of directors	Président du conseil d'administration	President / Chairman	1
BoD	Chairman of the Board of Directors; Director of the Board of Directors	Administrateur;Président du Conseil d'administration	President / Chairman	1
BoD	Chairman of the Board of Directors	Administrateur;Président du conseil d'administration	President / Chairman	1
BoD	Director	Administrateur	Member	4
BoD	Director of the Board of Directors	Administrateur	Member	4
BoD	Director of the Board of Directors; Chairman of the Board of Directors	Administrateur;Président du Conseil d'administration	President / Chairman	1
BoD	Director of the Board of Directors; Vice-Chairman	Administrateur;Vice-Président	Vice President / Vice Chairman	4
BoD	Member of the Board of Directors	Administrateur	Member	5
BoD	Member of the board of directors	Administrateur	Member	5
BoD	Member of the Board of Directors	Membre	Member	5
BoD	Vice-Chairman	Vice-Président	Vice President / Vice Chairman	8
BoD	Vice-chairman of the board of directors	Vice-Président	Vice President / Vice Chairman	8
ExeB	Chairman of the Executive Board	Président du Directoire	President / Chairman	2
ExeB	Member of the executive board	Membre du directoire	Member	6
ExeB	Member of the Executive Board	Membre du Directoire	Member	6
ExeB	President of the Executive board	Président du Directoire	President / Chairman	2
ExeB	President of the Executive board	Président du directoire	President / Chairman	2
Oper	Joint operator	Exploitant en commun	Operations & Production executive	16
SenMan	Associate Business Manager	Associé-gérant	Unspecified executive	18
SenMan	Associate Business Manager	Associé-Gérant	Unspecified executive	18
SenMan	Associate Business Manager; Shareholder	Associé-gérant	Unspecified executive	18
SenMan	Associate Business Manager; Shareholder	Associé-Gérant	Unspecified executive	18
SenMan	Business Manager	Gérant	Highest executive	12
SenMan	Business manager	Gérant	Highest executive	12
SenMan	Business Manager	Gérant	Unspecified executive	12
SenMan	Business Manager; Chief Executive Officer	Directeur Général;Gérant	Highest executive	12
SenMan	Business Operator	Exploitant	Unspecified executive	13
SenMan	Chief Executive	Directeur	Highest executive	3
SenMan	Chief Executive Officer	Chief Executive Officer	Highest executive	3
SenMan	Chief Executive Officer	Directeur Général	Highest executive	3
SenMan	Chief Executive Officer	Directeur Général;Président	Highest executive	3
SenMan	Chief Executive Officer	Président directeur général	Highest executive	3
SenMan	Chief executive Officer	Président directeur général	Highest executive	3

Table 2-4 (*continued*): Combinations of role type, job title and level of responsibility identified as being associated with an 'owner' position. Data in the table were included exactly as they were extracted from Orbis. Note the doubling of some roles due to slight differences in punctuation, repetition or other textual errors.

Type	Job title (English)	Job title	Level of responsibility	Priority
SenMan	Co-business manager	Co-gérant	Highest executive	17
SenMan	Co-business manager	Co-Gérant	Highest executive	17
SenMan	Co-Business Manager	Co-gérant	Highest executive	17
SenMan	Deputy Chief Executive Officer	Directeur Général Délégué	Deputy executive	7
SenMan	Joint Business Manager	Co-gérant	Unspecified executive	15
SenMan	Joint Business Manager	Co-Gérant	Unspecified executive	15
SenMan	Owner	Owner	Unspecified executive	11
SenMan	Owner	Propriétaire	Unspecified executive	11
SenMan	Owner; Business Operator	Exploitant	Unspecified executive	11
SenMan	Owner; Business Operator	Exploitant;Propriétaire	Unspecified executive	11
SenMan	Partner	Associé	Unspecified executive	14
SenMan	President	Co-gérant;Président	Highest executive	9
SenMan	President	Directeur Général	Highest executive	9
SenMan	President	Directeur général	Highest executive	9
SenMan	President	Gérant;Président	Highest executive	9
SenMan	President	Président	Highest executive	9
SenMan	Proprietaire	Propriétaire	Highest executive	11
SenMan	Vice President	Directeur Général Délégué	Deputy executive	10
SenMan	Vice President	Directeur général délégué	Deputy executive	10
SenMan	Vice President	Vice-Président	Deputy executive	10
SenMan	Vice president	Vice-président	Deputy executive	10
SupB	Chairman of the Supervisory Board	Membre du Conseil de Surveillance;Président du Conseil de Surveillance	President / Chairman	1
SupB	Chairman of the Supervisory Board	Président du Conseil de Surveillance	President / Chairman	1
SupB	Member of the Supervisory Board	Membre du Conseil de Surveillance	Member	5

Table 2-5: Combinations of role type, job title and level of responsibility identified as not being associated with an 'owner' position. Data in the table were included exactly as they were extracted from Orbis. Note the doubling of some roles due to slight differences in punctuation, repetition or other textual errors.

Type	Job title (English)	Job title (French)	Level of responsibility
BoD,SenMan	Independent Business Manager	Gérant Non Associé	Member; Unspecified executive
BrOff	Chief Branch Officer	Directeur d'établissement	Chief Branch Officer; Branch executive
FinAcc	Accountant	Comptable	Finance & Accounting employee
FinAcc	Accounting manager	Chef comptable	Finance & Accounting manager
FinAcc	Chief Accounting Officer	Directeur Comptabilité Gestion	Chief accountant (Chief Accounting Officer)
FinAcc	Chief Financial Officer	Chief Financial Officer	Chief Financial Officer (CFO); Financial executive
FinAcc	Executive Officer	Autre Dirigeant	Financial executive
FinAcc,AdmDep	Chief Administrative and Financial Officer	Directeur administratif et financier	Chief Financial Officer (CFO); Financial executive; Administration Chief Officer; Administration executive
FinAcc,AdmDep	Chief Administrative and Financial Officer	Directeur Administratif et Financier	Chief Financial Officer (CFO); Financial executive; Administration Chief Officer; Administration executive
HR	Chief Human Resource Officer	Directeur Ressources Humaines	Human Resource Chief Officer; Human Resource executive
HR	Human Resource Manager	Responsable du Personnel;Responsable Ressources Humaines	Human Resource manager
HR	Human Resource Manager	Responsable Ressources Humaines	Human Resource manager
HR	Payroll Executive	Directeur paie	Human Resource executive
IT&IS	Chief IT Officer	Directeur Informatique	Chief Information Officer; IT & IS executive
IT&IS	IT & IS Manager	Responsable Informatique	IT & IS manager
MarkAdv	Chief Marketing Officer	Directeur Marketing	Chief Marketing Officer; Marketing executive
MarkAdv	Marketing Manager	Responsable Marketing	Marketing manager
Oper	Operating Systems Executive	Directeur d'Exploitation	Operations & Production executive
OthDep	Assistant	Assistante	Employee
OthDep	Management Assistant	Assistant de Direction	Employee
OthDep	Management Assistant	Assistante de Direction	Employee
OthDep	Studies and Development Officer	Directeur Études et Développement	Employee
Proc	Chief Purchasing Officer	Directeur des Achats	Chief Purchasing Officer; Purchasing executive
Proc	Purchasing Manager	Responsable des Achats	Purchasing manager
Qual	Quality Control Executive	Directeur Qualité	Quality Assurance executive
R&D	Chief Technical Officer	Directeur Technique	R&D / Engineering Chief Officer; R&D / Engineering executive
Sales	Chief Sales Officer	Directeur Commercial	Sales Chief Officer; Sales executive
Sales	Sales Manager	Responsable Commercial	Sales manager
SenMan	Chief Communication Officer	Directeur de la Communication	Public relations
SenMan	Collaborating Spouse	Conjoint-collaborateur	Senior management employee
SenMan	Company Secretary	Secrétaire Général	Company secretary
SenMan	Liquidator	Liquidateur	Liquidator
SenMan	Secretary	Secrétaire	Company secretary
SenMan	Spouse-Collaborator	Conjoint-collaborateur	Senior management employee
SenMan,MarkAdv	Vice president communication	Directeur communication	Deputy executive; Chief Marketing Officer; Marketing executive

4 Use of extracted ownership data for the analysis of vessel ownership

In this section, we will present a number of preliminary analyses of vessel ownership in the French Atlantic fishing sector (cf. Objective 1b, Figure 2-5). Our main aim is to demonstrate the advantage of the customized protocols (Pathways 1 and 2) over the use of the default Orbis metrics. We will do this through comparative analysis.

4.1 Ultimate owners in the French Atlantic fishing sector: a first appraisal

The population considered here are the companies holding 2923 fishing vessels in the French Atlantic fishing sector (*sensu lato*) in 2018, corresponding to 2347 BvD ID numbers. We refer to Chapter 3 for a more detailed description of the population. The scope of analyses presented here is limited because the data extracted for France in the bottom-up protocol were part of an EU dataset containing 131266 Level 0 companies (identified based on NACE Rev. 2 activity codes, see Annex 2.3). We have applied the bottom-up protocol to the entire dataset, for which it took 33 iterations to identify all USHs. While it is possible to isolate the French Level 0 companies from the original dataset based on their country code, it is impossible to isolate their paths to their Ultimate Shareholders (USHs) at this stage. For this, an additional 'reverse' protocol is required (R script must be developed; see Discussion)[63]. However, some insights regarding their GUOs will be included, as well as the number of shareholders and the number of entities in the corporate group.

4.1.1 Ownership analysis of fishing vessels: operator ID number vs. SIREN number

In Annex 2.1, we have built a case for the use of the SIREN numbers of *vessel-holding companies* instead of vessel *operators* for analyzing ownership. Previous studies have considered vessel ownership in France only at the level of the operator (e.g., Guyader *et al.*, 2003, 2013; Quillérou and Guyader, 2012). We have argued that this level of analysis considerably underestimates ownership. Table 2-6 shows a synthesis of the comparison between both levels (operators and SIREN numbers). The table confirms our hypothesis: multi-vessel ownership is underestimated in the operator scenario compared to the SIREN scenario (25.3% vs. 32.5%). The largest underestimations occurred for 2 vessel holdings (+2.6%), 3 vessel holdings (+2.0%) and 4 vessel holdings (+1.5%).

[63] Note that this is a limitation entirely due to a methodological choice made by us. A reapplication of the bottom-up protocol on the French company set would be the most elegant solution. See Discussion.

Table 2-6: Comparison of the ability of the operator and SIREN scenarios in identifying multi-ownership. The main point is that single-vessel ownership is overestimated in the operator scenario.

Number of vessels per entity	Operator ID scenario			SIREN scenario		
	Nb. operator IDs	*Nb. vessels*	*% of total*	*Nb. SIREN*	*Nb. vessels*	*% of total*
Entities with 1 vessel	2183	2183	74.7%	1974	1974	67.5%
Entities with 2 vessels	242	484	16.6%	281	562	19.2%
Entities with 3 vessels	40	120	4.1%	59	177	6.1%
Entities with 4 vessels	6	24	0.8%	17	68	2.3%
Entities with 5 vessels	1	5	0.2%	2	10	0.3%
Entities with 6 vessels	4	24	0.8%	4	24	0.8%
Entities with 7 vessels	1	7	0.2%	-	-	-
Entities with 8 vessels	2	16	0.5%	3	24	0.8%
Entities with 10 vessels	1	10	0.3%	1	10	0.3%
Entities with 11 vessels	1	11	0.4%	2	22	0.8%
Entities with 12 vessels	1	12	0.4%	1	12	0.4%
Entities with 13 vessels	1	13	0.4%	2	26	0.9%
Entities with 14 vessels	1	14	0.5%	1	14	0.5%
Total	**2484**	**2923**	**100%**	**2347**	**2923**	**100%**

4.1.2 Profile of the direct and ultimate owners of French Atlantic fishing vessels

As mentioned above, an analysis of the Ultimate Shareholders (USHs) for France was not possible at this stage because the shareholders had been extracted in the customized bottom-up protocol as part of a large EU dataset, and could not be isolated for separate analysis. What is included here is a first rudimentary assessment of the profile of direct (SIREN) and ultimate (GUO) owners of French Atlantic fishing vessels, in terms of legal forms, number of shareholders, and shareholder nationality.

4.1.2.1 Vessel-holding companies (SIREN)

Table 2-7 shows the distribution of legal form for all vessel-holding companies (i.e., the direct owners of the fishing vessels) in the population, and indicates how many have 0 listed shareholders. Firstly, for the 2347 SIREN numbers extracted from Orbis, shareholders were listed for only 69 companies (3%). ‘Agricultural companies’ and ‘Personal firms’ together make up 86% (n=2019) of vessel-holding companies. None of them have shareholders listed. In fact, across all legal forms, the majority of companies had no listed shareholders. It is not clear why for some legal forms, shareholder information is present for certain companies and not for others. Inconsistencies may be due to different data providers and/or rules governing the disclosure of shareholders, but further analysis is needed to confirm this. It must be noted, for clarity, that ‘Number of Shareholders’ is a variable provided by Orbis. As such, even when their names are undisclosed for reasons of privacy, one would still expect non-zero values for this variable – e.g., for all public limited companies, which by definition always have shareholders. Yet, shareholders were listed for only 9 out of 33 public limited companies.

Table 2-7: Synthesis of legal forms found in vessel-holding companies in the French Atlantic fishing sector, and their shareholder information in Orbis. 'Legal form' indicates standard international categories, while 'National legal form' indicates definitions specific to France. Abbreviations: SDF = Société de Fait; SNC = Société en Nom Collectif; EARL= Société Agricole à Responsabilité Limitée; SAS = Société par Actions Simplifiée; SARL = Société de Responsabilité Limitée; EURL = Société Unipersonnelle à Responsabilité Limitée; SA = Société Anonyme; SASU = Société par Actions Simplifiée Unipersonnelle.

			0 shareholders			≥ 1 shareholders		
Legal form	**National legal form**	**Count**	**0 SH**	**% of total**	**% of legal form**	**≥ 1 SH**	**% of total**	**% of legal form**
Companies with unknown/unrecorded legal form	(no match)	1	1	0.04%	100%	0	0.00%	0%
Other legal forms	Agricultural company	980	980	41.76%	100%	0	0.00%	0%
	De facto corporation - SDF	13	12	0.51%	92%	1	0.04%	8%
	Jointly held property	2	1	0.04%	50%	1	0.04%	50%
	Private institution	1	1	0.04%	100%	0	0.00%	0%
Partnerships	Civil company	2	2	0.09%	100%	0	0.00%	0%
	General partnership - SNC	2	1	0.04%	50%	1	0.04%	50%
	Holding company of profession	1	1	0.04%	100%	0	0.00%	0%
Private limited companies	Agricultural company with limited liability - EARL	3	2	0.09%	67%	1	0.04%	33%
	Limited company. simplified - SAS	62	43	1.83%	69%	19	0.81%	31%
	Limited liability company - SARL	123	99	4.22%	80%	24	1.02%	20%
	One-person company with limited liability - EURL	84	71	3.03%	85%	13	0.55%	15%
Public limited companies	Limited company - SA	9	5	0.21%	56%	4	0.17%	44%
	Limited company with managing body	1	0	0.00%	0%	1	0.04%	100%
	One-person limited company. simplified - SASU	23	19	0.81%	83%	4	0.17%	17%
Sole traders/proprietorships	Liberal profession	1	1	0.04%	100%	0	0.00%	0%
	Personal firm	1039	1039	44.27%	100%	0	0.00%	0%
	Totals	2347	2278	97.06%	-	69	2.94%	-

4.1.3 Global Ultimate Owners (GUOs)

From the 2347 BvD ID numbers queried, Orbis identified a GUO for 277 companies at the 25.01% threshold. A total of 270 *unique* GUOs were identified, 230 of which were legal persons, and 40 were natural persons. Some key findings are listed below.

- Recall that we have considered the company itself to be the GUO when it has no identified shareholders or if shareholder percentages are not known. This option (proposed by Orbis in the interface) does not seem to do deliver on the promise, however, since of the 2278 companies without listed shareholders only 211 had themselves as GUO. It could not be verified what lies at the basis of this discrepancy – e.g., an exploration based on companies' legal form did not uncover any pattern;
- Only 62 companies have (a) GUO(s) that is (are) different from the company itself. Here, it concerns primarily private limited companies (SARL, SAS, EURL), and some public limited companies (SA, SASU) (see Table 2-7 for abbreviations). The latter make up only a small proportion (1.4%) of vessel-holding companies, but include some of the largest fishing companies in France. Other major French fishing companies are listed as SAS (2.6%);
- Most GUOs are registered in France or have the French nationality (for natural persons), although foreign ultimate ownership is significant, especially by natural persons (in terms of number of entities at least[64]) (Table 2-8). Further analysis is needed for a better understanding with regards to the kind of fishing operations and species that are targeted by foreign investors, and which proportion of the French Atlantic fishing sector is effectively 'foreign owned' (see also Chapter 3).

Table 2-8: Country of registration (for legal persons)/nationality (for natural persons) of Global Ultimate Owners of French Atlantic fishing companies.

	GUOs	
Country of registration/nationality	***Legal persons***	***Natural persons***
France	222	10
Italy	1	-
Netherlands	2	-
Spain	3	6
Iceland	-	1
Unknown worldwide	2	23
Totals	230	40

4.2 Exploration of case studies: added value of the protocols and issues encountered

Three company level case studies were selected, based on two criteria. First, their ownership structure was known to the research team prior to analysis, and second, they can be used to emphasize specific issues related to the extraction of ownership data from Orbis (e.g., the presence of 'infinite loops', hidden owners). Main sources of prior knowledge included the interviews conducted for Chapter 1, manual explorations of ownership structure using the 'ownership explorer' in the Orbis interface, as well as findings by Warmerdam *et al.* (2018) and MRAG *et al.* (2019).

In case study 1, we will assess the ability of the bottom-up extraction protocol (Pathway 1) to identify the ultimate owners of the vessel-holding company, and to recompose the corporate group. In case study 2, we will focus on the occurrence of infinite loops in the data and discuss how we have dealt with them. In case study 3, we will explore how the DM protocol (Pathway 2) is used to infer the owner of multiple vessel-holding companies when shareholder information in Orbis is missing. In what follows, company names and identifiers are only inlcuded for company information extracted from Orbis (no restrictions with regards to data

[64] When it comes to proportion of shares owned, we see that most natural persons are minority shareholders.

confidentiality[65]). In case study 3, we have hidden the name of the independent fisher (data from the VC Register).

4.2.1 Case study 1: Euronor

In what follows, we will compare the recomposition of the corporate group based on the output of the customized extraction protocol with a recomposition based on Orbis metrics GUO25 and GUO50. For clarity, it must be noted that this 'recomposition' is not the detailed description of the corporate group to which is referred in Figure 2-5 (Objective 3). Objective 3 requires the use of the data extracted in the top-down protocol, which is not included here.

Table 2-9 shows the result of the bottom-up protocol (Pathway 1) starting from vessel-holding company 'Euronor' (BvD ID FR485366819). It takes six cycles to identify all 30 shareholders. In total, 23 Ultimate Shareholders (USHs) were identified: 16 natural persons and 7 legal persons. These legal persons are 'Stichting Administratiekantoor Aandelen in PP Groep Katwijk', 'Framinvest SP/F', 'Moshvoll EHF', 'Dorf EHF', 'Raben EHF', 'Eignarhaldsfelagid Steinn EHF', and 'Rakel Olsen'. The recomposed corporate group is shown in Figure 2-11.

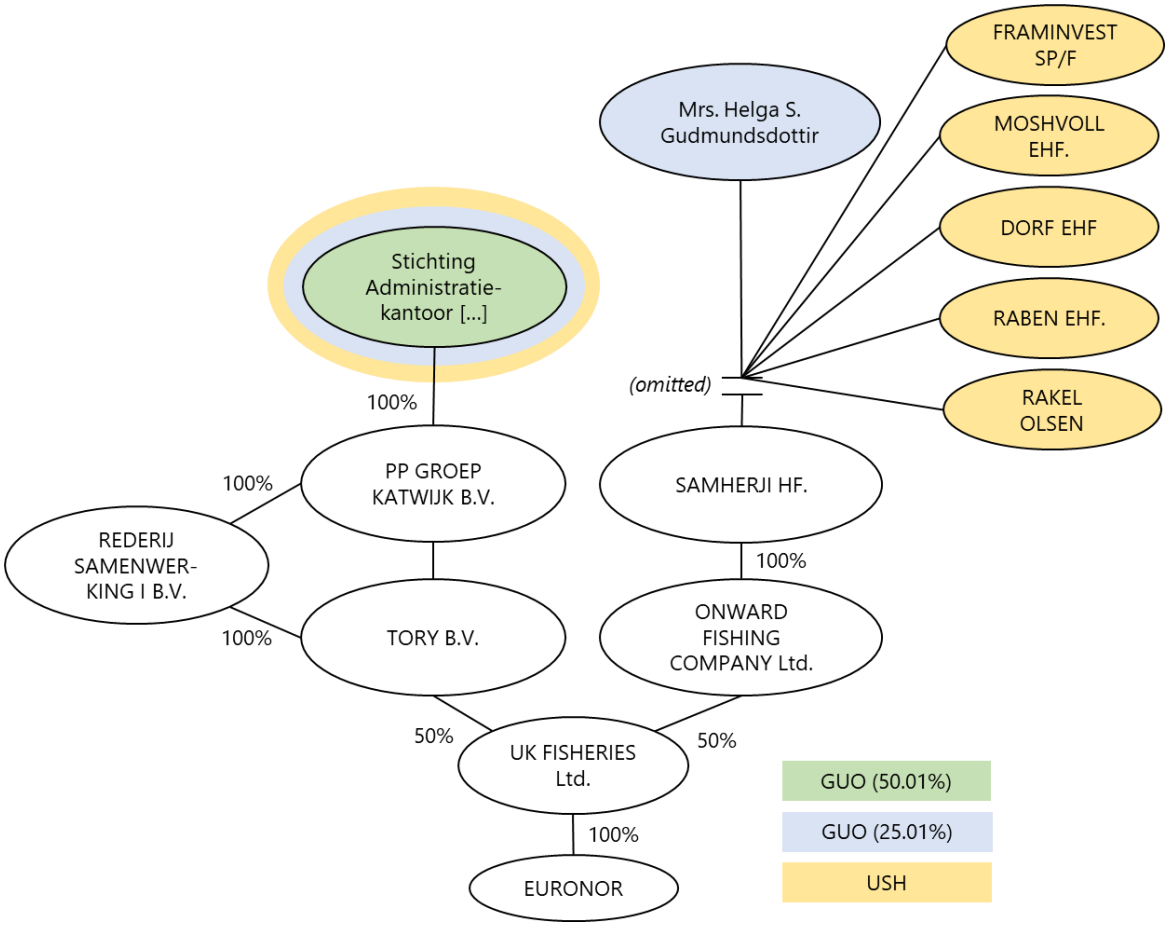


Figure 2-11: Recomposition of the corporate group of Euronor (BvD ID FR485366819).

Let us now examine the ability of Orbis' 'ownership explorer' to obtain the same result. More precisely, we need to confirm whether the ultimate shareholders (GUO25, GUO50) listed by Orbis yield the same corporate group as the customized protocol (Pathway 1). In March 2019, Orbis defined 2 GUOs at the 25.01% threshold: 'Stichting Administratiekantoor Aandelen in PP Groep Katwijk' and 'Mrs. Helga S. Gudmundsdottir'. If we were to reconstruct the ownership tree based on the GUO25 definition, we would only be able to account for the left side of the

[65] Orbis data processing was carried out under the subscription contracts Ifremer-BvD VAN DIJK Editions Electroniques N°4500039769 and N°4500052341.

tree (i.e., the path from 'Stichting […]' all the way down to Euronor in Figure 2-11; the same result as when the GUO50 definition would have been chosen). The reason why the right side of the tree cannot be recomposed (not even using the GUO25 definition), is that Mrs. Helga S. Gudmundsdottir is a natural person and thus has a BvD ID number that is not recognized when queried in Orbis in the iterative bottom-up protocol. Our customized protocol has a way around this. It retains the shareholder at Level n-1 (a company, in this case 'Eignarhaldsfelagid Steinn EHF' – omitted in Figure 2-11). From this path, and the paths originating from the other six USHs that are legal persons, the entire tree can be reconstructed. The USHs that are natural persons (such as Mrs. Helga S. Gudmundsdottir) can be added *a posteriori* to complete the ownership structure.

Table 2-9: The bottom-up approach applied to the French vessel-holding company Euronor (FR485366819). (25): GUOs identified at the 25.01% threshold, (50): GUOs identified at the 50.01% threshold, (c): Legal persons identified as USHs in the customized protocol. Italic = natural person. Bold = all USHs identified in the customized protocol (23 in total)

Level	Company name	BvD ID	No. SH	Shareholder name	BvD ID	Type of entity
0	COMPTOIR DES PECHES D EUROPE DU NORD	FR485366819	1	UK FISHERIES LIMITED	GB05219340	Corporate
1	UK FISHERIES LIMITED	GB05219340	2	ONWARD FISHING COMPANY LIMITED	GB00069212	Corporate
				TORY B.V.	NL28079054	Corporate
2	ONWARD FISHING COMPANY LIMITED	GB00069212	1	SAMHERJI HF.	IS6102973079	Corporate
	TORY B.V.	NL28079054	2	REDERIJ SAMENWERKING I B.V.	NL28019696	Corporate
				PP GROEP KATWIJK B.V.	NL28042057	Corporate
3	SAMHERJI HF.	IS6102973079	8	EIGNARHALDSFELAGID STEINN EHF.	IS5508070410	Corporate
				MR KRISTJAN V VILHELMSSON	*IS*110188073565*	One or more named ind. or fam.
				FJARFESTINGAFELAGID FJORDUR EHF	IS5511993129	Financial company
				BLIKI EHF.	IS6801982339	Corporate
				MRS KOLBRUN INGOLFSDOTTIR	*WW*110188073567*	One or more named ind. or fam.
				RAKEL OLSEN	YY*110187749587	Corporate
				BALDVIN THORSTEINSSON	*IS*110187749588*	One or more named ind. or fam.
				MRS KATLA THORSTEINSDOTTIR	*WW*110187749589*	One or more named ind. or fam.
	REDERIJ SAMENWERKING I B.V.	NL28019696	1	PP GROEP KATWIJK B.V.	NL28042057	Corporate
	PP GROEP KATWIJK B.V.	NL28042057	1	STICHTING ADMINISTRATIEKANTOOR VAN AANDELEN IN PP GROEP KATWIJK	NL41167084	Foundation/Research institute
4	**EIGNARHALDSFELAGID STEINN EHF.(c)**	IS5508070410	1	***MRS HELGA S GUDMUNDSDOTTIR(25)***	*IS*110020335846*	One or more named ind. or fam.
	FJARFESTINGAFELAGID FJORDUR EHF	IS5511993129	2	EIGNARHALDSFELAGID STEINN EHF.	IS5508070410	Corporate
				MR KRISTJAN V VILHELMSSON	*IS*110188073565*	One or more named ind. or fam.
	BLIKI EHF.	IS6801982339	10	FRAMINVEST SP/F	IS5603999369	Financial company
				MOSHVOLL EHF.	IS7006051750	Corporate
				DORF EHF	IS6109050210	Corporate
				MR GUDMUNDUR TH JONSSON	*IS*110154117284*	One or more named ind. or fam.
				MR JON KJARTAN JONSSON	*IS*110150039108*	One or more named ind. or fam.
				MR STEFAN THOR INGVASON	*IS*110154117283*	One or more named ind. or fam.
				RABEN EHF.	IS4501060620	Corporate
				MR GESTUR GEIRSSON	*IS*110150039106*	One or more named ind. or fam.
				MR ARNGRIMUR BRYNJOLFSSON	*IS*110150039110*	One or more named ind. or fam.
				MR HLYNUR VEIGARSSON	*IS*110150039111*	One or more named ind. or fam.
	RAKEL OLSEN(c)	YY*110187749587	0	No identified shareholders	-	-
	STICHTING ADM.KANTOOR […](25)(50)(c)	NL41167084	0	No identified shareholders	-	-
5	**FRAMINVEST SP/F(c)**	IS5603999369	0	No identified shareholders	-	-
	MOSHVOLL EHF. (c)	IS7006051750	2	***MR HARALDUR GRETARSSON***	*IS*610106000*	One or more named ind. or fam.
				MRS HARPA AGUSTSDOTTIR	*IS*610106001*	One or more named ind. or fam.
	DORF EHF(c)	IS6109050210	1	***MR OSKAR AEVARSSON***	*IS*110169604584*	One or more named ind. or fam.
	RABEN EHF.(c)	IS4501060620	1	***MR BALDVIN GUSTAF BALDVINSSON***	*IS*110150034123*	One or more named ind. or fam.

4.2.2 Case study 2: Scapêche

In what follows, we will discuss a number of issues regarding corporate ownership structure, and how the customized protocol is adapted to deal with these. We will use for this the example of French fishing company Scapêche, known as the fishing company of French retailer Intermarché (Warmerdam *et al.*, 2018).

At any cycle n, the first R script of the bottom-up protocol (see Annex 2.4*)* reads the export table, collects the shareholder BvD IDs and isolates from these the ones that have not previously been identified. Only these BvD IDs are then used to query Orbis in the next cycle (n+1). This approach was implemented to avoid needless repetitions in database requests. This has two reasons. First, it reduces the number of iterations tremendously, which is an advantage when working with large datasets (risk of computational overload). Second, it avoids repetitions that result in the circular identification of the same shareholders at every step. We will focus on the latter. In an earlier (test) version of the protocol (in which this feature had not been implemented), we noticed that the number of shareholders would increase at every step, until an asymptote[66] was reached. While we would indeed expect the number of shareholders to increase for a number of iterations (see example of Euronor above, Table 2-9), at some point, we would expect it to drop to 0 (i.e., when all USHs are found). The asymptote was caused by a number of shareholders which had themselves and/or earlier identified shareholders with cross-ownership links as shareholder. Without the systematic removal of these elements, the process would never come to an end.

There are essentially three situations that may lead to the identification of previously identified shareholders. These can all be demonstrated using the case of Scapêche and the corporate structure it belongs to. First, two different Level 0 companies[67] may have the same immediate owner or may be indirectly owned by the same shareholder(s). Figure 2-12 shows this for Level 0 companies 'Scapêche' (FR401540851) and 'Scapêche Bretagne Ouest' (FR313307894), which are both ultimately owned by 'Union des Mousquetaires' (USH). When considered separately, the USH would be identified in cycle 2 for Scapêche Bretagne Ouest, and only in cycle 5 in the case of Scapêche. The newly implemented feature ensures that, after the USH is identified in cycle 2 (for Scapêche Bretagne Ouest), the process for Scapêche comes to an end earlier, i.e., at cycle 4. The last database request is canceled because of the prior identification of the USH in the bottom-up process. Second, the combination of direct and indirect ownership links within the same corporate group (see Scapêche Bretagne Ouest) will likewise result in the early identification of the USH following one of the paths. The third situation is more problematic, as it has implications both for the correct functioning of our protocol and for the interpretation of ownership and control. Cross-ownership is the situation in which two companies own shares in each other. This design is commonplace in the financial sector, with the purpose of increasing voting power (Devriese *et al.*, 2004). Through cross-ownership, the controlling shareholder has formal control over assets while only being entitled to a fraction of cash-flow rights (see Devriese *et al.*, 2004 p. 105 for an example). Other reasons for cross-holding may be strategic, financial, historical or for reasons of cross-monitoring. Cross-ownership is also found in the corporate structure of Scapêche and Scapêche Bretagne Ouest[68] (Figure 2-12c). Without the newly implemented feature, the launch of a cross-owned company in the bottom-up process would result in a never-ending loop in which the same shareholders keep reappearing. Other than that, cross-ownership may complicate the interpretation of ownership and control. If many cross-ownership links exist in a corporate

[66] The protocol was based on all shareholders, and would use the cumulative number of shareholders to query the Orbis database.
[67] Recall that the bottom-up process is based on batch identification of shareholders for an entire company set.
[68] More precisely, it concerns the subsidiaries of a Level 2 shareholder of Scapêche and Scapêche Bretagne Ouest (Itm Entreprises SA).

group, this is referred to as 'circular ownership'. Bureau van Dijk warns for misinterpretation and states that "calculations involving circular indirect ownership are counterintuitive"[69].

[69] https://www.bvdinfo.com/en-gb/blog/compliance-and-financial-crime/exploring-integrated-ownership-circular-and-aggregate (accessed on 15/01/2021)

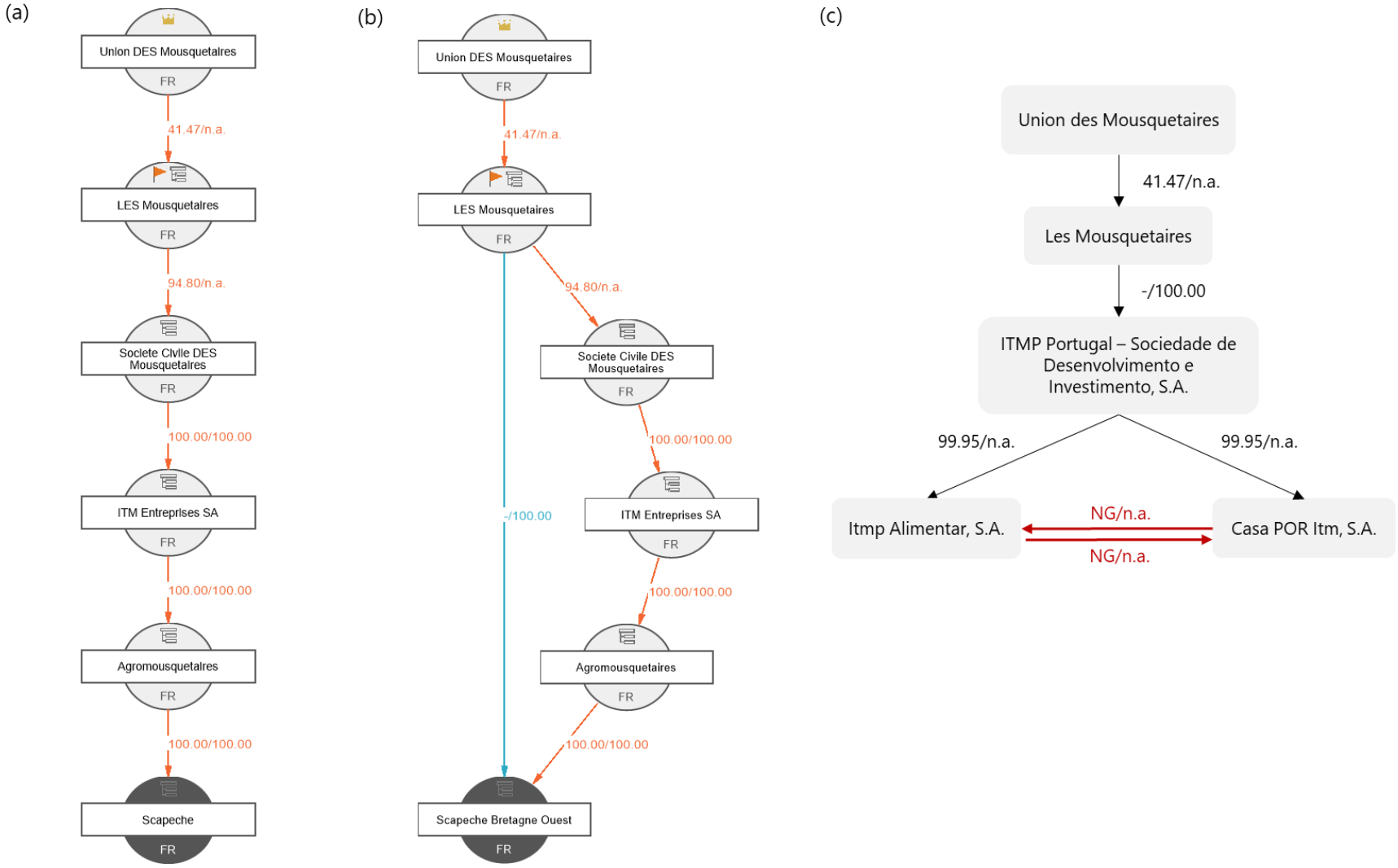


Figure 2-12: The ownership structure of Scapêche and Scapêche Bretagne Ouest (screenshot from the Orbis ownership explorer). (a) Scapêche; (b) Scapêche Bretagne Ouest; (c) cross-ownership in a subsidiary of Les Mousquetaires.

4.2.3 Case study 3: Fisher "X"

Over the past years of exploring ownership in the French Atlantic fishing industry, one example has grown out to be our go-to case study for discussing the limits of the bottom-up protocol for independent firms with 0 listed shareholders. We will refer to this fisher as "Fisher X", because the data presented here also include interview data (which was not the case for the case studies presented above). In the 2018 fleet register, Fisher X, a natural person, appears as the operator of two fishing vessels. However, based on an interview with him in January 2018, and multiple newspaper articles from June 2018, we know that he owns and operates at least 4 vessels at the end of 2018. The status of another 2 vessels is less clear.

Vessel 1 and *Vessel 2* appear under his own name, whereas *Vessel 3* and *Vessel 4* appear under operator name 'Le Loup' (fictitious name) (Table 2-10). In 2010, Fisher X acquired a fishing vessel (also named *'Le Loup'*), which he renamed *Vessel 3.* In this transaction, Fisher X took over the entire fishing firm (SARL Le Loup), crew included. The ownership status of two other vessels, *Vessel 5* and *Vessel 6*, is less clear. *Vessel 6* left the shipyard in March 2019 and seems to have replaced another vessel that was acquired purely for the associated fishing opportunities. This vessel was found back under another operator ID code (nothing to do with Fisher X) on 31/12/2018, confirming that it was resold by Fisher X. Based on the interview, we know that the vessel was sold without track records and licenses, which were needed for the new vessel construction (fishing opportunities transferred to the new vessel).

The sixth vessel appears under the operator name '*Minsk'* (fictitious name) in the fleet register, and has no apparent link with Fisher X at first sight. It is only through exploration in Orbis that it becomes clear that this vessel is indeed owned by Fisher X (see further).

Table 2-10: Vessels owned and operated by Fisher X in 2018. Vessel 6 only entered the fleet in March 2019.

Ultimate Owner	Operator name	Company name	Vessel name
Fisher X	Fisher X	Company 1	Vessel 1
Fisher X	Fisher X	Company 1	Vessel 2
Fisher X	Le Loup	Company 2	Vessel 3
Fisher X	Le Loup	Company 2	Vessel 4
Fisher X	Minsk	Company 3	Vessel 5

If we would only have information about the operator name and code, we would wrongfully conclude that Fisher X owns and operates two fishing vessels (*Vessel 1* and *Vessel 2)*. Given that the customized bottom-up protocol does not apply for most fishing companies in our population, the number of such wrong conclusions would be very high if we would rely on either the Orbis pathway or customized Pathway 1.

In what follows, we will evaluate the DM protocol's ability to infer that Fisher X is indeed the owner of all relevant fishing vessels in the fleet register. For companies 1 and 2, this is straightforward: based on a single DM role, the DM protocol identified Fisher X as the owner of both companies (Table 2-11). For company 3, the protocol identifies 3 owners (UCI 2, UCI 3, UCI 4). UCI 4 has two roles in the company, only one of which is associated with an 'owner role' (see Table 2-4). UCI 2 and UCI 3 are companies, not natural persons. This was uncommon in the population: of the 2750 unique UCIs identified, only 31 were companies[70]. This poses an additional hurdle. However, through the Orbis variable 'corresponding BvD ID number', we were able to identify the corresponding BvD ID number for 6 of these 31 UCIs. One of these was UCI 2. An additional query of the corresponding BvD ID number in Orbis then yields Fisher X as the UCI of that company. In conclusion, the DM protocol was only able to identify Fisher X as the ultimate owner of 4 vessels. For the fifth vessel, an additional effort was needed.

[70] In Orbis, UCIs starting with 'P' indicate persons, and UCIs starting with 'C' are companies.

Table 2-11: Result of the application of the DM protocol. Note that 'DM role' is simplified here. Recall that DM role is in fact a combination of 4 variables in Orbis (see Table 2-4). For companies 1 and 2, Fisher X is identified as the owner. For company 3, 3 owners are inferred (UCI 2, 3 and 4). An extra effort identifies Fisher X as a co-owner of company 3 as well.

Company name	Number of DM roles	DM role	UCIs with owner roles	Application of hierarchy	Inferred owners (DM protocol)	After extra effort
Company 1	1	Business Operator (Exploitant)	UCI 1(= Fisher X)	Retained	Fisher X	Fisher X
Company 2	1	Business Manager (Gérant)	UCI 1 (= Fisher X)	Retained	Fisher X	Fisher X
Company 3	4	Chairman of the Board of Directors	UCI 2	Retained	UCI 2	Fisher X
		Chairman of the Board of Directors	UCI 3	Retained	UCI 3	UCI 3
		Chairman of the Board of Directors	UCI 4	Retained	UCI 4	UCI 4
		Business Manager	UCI 4	Ignored	-	-

5 Discussion

In this chapter, we have constructed a multi-purpose methodological framework for the analysis of vessel ownership in the EU fishing industry. We have considered that vessels are held by fishing companies, which may in turn be owned by one or multiple shareholders (natural and/or legal persons). Vessel ownership may thus be described at different hierarchical levels along the path of the vessel-holding ('Level 0') company up until its ultimate owner(s). The core of the framework presented here is a methodology for the extraction and treatment of ownership data from the Orbis database. The framework was designed in such a way that extracted data can serve three purposes: the identification of a fishing company's ultimate owners and their ownership percentages, concentration analysis, and the detailed description of the corporate group to which the company belongs. In this chapter, we have focused on the first objective. In what follows, we will reflect on the development process, the preliminary results for the French Atlantic fishing sector, and the implications and scope of this research for (comparative) ownership analysis in the EU fishing industry.

5.1 Data issues and the construction of a Vessel-Company Register for France

MRAG *et al.* (2019) have named issues of data quality, transparency and coverage as great concerns for comparative ownership analysis in the EU fishing industry. In their study, the authors study ownership for four types of assets: quotas, licenses, vessels, and companies. Data issues are greatest for initial quota allocations, while vessel and company ownership were more straightforward to identify. Regarding company ownership, however, the authors point out that data are often hidden behind a 'pay wall'. As such, vessel ownership was recommended as a key asset for EU-wide comparative analysis.

Our analyses have shown, however, that the identification of vessel owners is not that straightforward. This is true for both direct and ultimate owners. First, we have demonstrated that the EU framework for the collection of vessel ownership data (Regulation (EU) 2017/218) shows some serious flaws: (1) the collection of most information is not mandatory, (2) the non-standardized (text) format is a potential source of confusion, (3) there is no use whatsoever of a company identification number to identify the legal owner(s) of fishing vessels. In France, 'ownership' information seems to be collected only at the level of the operator. While it is often used for making assertions about vessel ownership in French fisheries (Guyader *et al.*, 2003; Quillérou *et al.*, 2011, 2013; Quillérou and Guyader, 2012; Van Putten *et al.*, 2012), the operator level has certain flaws which results in the underestimation of multi-vessel ownership. More precisely, the use of the operator ID code disregards how firms are organized internally, which in most cases leads to an underestimation of vessel ownership. We have shown this

conceptually in Annex 2.1, and later empirically in section 4. We found that the operator scenario consistently underestimates the level of multi-vessel ownership as compared to the use of the SIREN number of the vessel-holding company. In Chapter 3, we will demonstrate this further by comparing the calculation of concentration indices at different hierarchical levels.

Another perk of the use of SIREN numbers is that ownership can be assessed beyond the level of the direct owner of the fishing vessel (the vessel-holding company). A key accomplishment of this chapter is the construction of a Vessel-Company Register for France, which provides a link between vessel information contained in the fleet register and ownership information in the Orbis database. We emphasize that without the prior identification of VAT numbers (in France: SIREN numbers) of vessel-holding companies, analysis of beneficial and ultimate ownership would not be possible. For the analysis of concentration of production (see Chapter 3), an additional link to landings data (volume and value) is required. This is accomplished through national information systems (in France: *Systèmes d'Informations Halieutiques; Harmonie* database). For EU-wide analysis of vessel ownership based on the methodological framework presented here, VC Registers must be constructed for all Member States. At this point, it is unknown to us which Member States dispose of registers including the VAT number of vessel-holding companies.

5.2 The customized protocols: application and scope for EU-wide analysis

In section 3 we have built a case for the development and use of customized extraction protocols that go beyond the default approach proposed by the Orbis interface. While the default metrics provided by Orbis are useful for identifying ultimate owners of fishing companies and for quantifying ownership links at this level, they do not allow to make assertions about ownership at lower hierarchical levels. Our framework specifically aimed at identifying *all* beneficial owners (all shareholders). In section 4, we have demonstrated, on the basis of a number of case studies, that the bottom-up protocol was indeed successful in identifying all shareholders. It was also shown that the ultimate shareholders (USHs) identified using this method included all GUOs defined by Orbis at the 25.01% and 50.01% thresholds, and in addition to that, as was expected, a number of USHs with ownership interests <25.01%. Our approach identifies all shareholders, no matter their ownership interest. Up until this point, we have been preoccupied with developing an approach that was as exhaustive as possible, without questioning which level of ownership would be relevant to make assertions regarding control over the fishing company.

Our bottom-up protocol (Pathway 1) makes it possible to identify all shareholders along the path from the Level 0 company to its ultimate owners, based on iterative batch identification (i.e., all Level n companies are queried in Orbis in one go). We argue that this 'batch identification' is a particularly powerful feature of the methodology. It allows, in principle, for a periodical (e.g., yearly) extraction of the shareholders and ultimate owners of all EU fishing companies. Given further development of tools for data exploration on the basis of such a dataset, we can imagine multiple applications that go beyond the *ad hoc* case study approach used in recent studies (Warmerdam *et al.*, 2016, 2018; MRAG *et al.*, 2019). We may imagine, for instance, tools that visualize ownership trees at the desired level, based on a simple query of the VAT number of interest. This could be the Level 0 company (reconstructing the ownership tree from the bottom up) or the ultimate owner (developing the tree from the top down).

A first version of such a tool was developed by Mathieu Merzéréaud in the context of this PhD research (Figure 2-13). The visualization tool also includes the output of the top-down protocol (not included in this chapter) allowing a detailed description of the corporate group beyond fishing (see Objective 3 in Figure 2-5). This could be interesting for studying the share of fishing in the investment portfolios of vertically integrated companies, for instance (as is shown for *Les Mousquetaires* in Figure 2-14). Other tools may be focused on the identification of specifc

shareholders with ownership interests across EU fishing firms, with or without the option of defining a minimum holding percentage.

A database and a suite of tools at the EU level would mean a great step forward for the EU-wide analysis of vessel and company ownership. MRAG *et al.* (2019) have argued that data availability is a major barrier for comparative analysis. In addition to the *ad hoc* approach adopted in recent studies[71] (Warmerdam *et al.*, 2016, 2018; MRAG *et al.*, 2019), a validated database and a suite of tools would allow EU-wide comparative analysis of vessel ownership through coordinated action. A range of analyses can be envisaged, e.g., by Member State, by year, fleet segment, gear category, company size, profit, and combinations of these. The application of such tools may be envisaged for different forms of research collaborations in the context of EU projects or working groups. A prerequisite would be that VC Registers are constructed and made available to research institutes in the framework of research projects or working groups. We recall that, in the context of this PhD research, we have used the bottom-up protocol to extract an exhaustive set of ownership data for all 27 EU Member States, and the United Kingdom, Norway and Iceland (2019). It took 33 iterations to identify all ultimate shareholders of the 131266 Level 0 companies identified based on NACE Rev. 2 activity codes (see Annex 2.3). Yet, without VC Registers, these companies cannot be linked to fishing vessels[72].

If the ambition is to extend the scope of ownership studies in the EU beyond a small number of corporate groups, the DM (Directors/Managers) protocol must be further tested and improved, and adapted for use in other Member States (different 'owner roles' apply). In France, as much as 97% of vessel-holding companies do not have listed shareholders, and there is no reason to expect that this would be different for other Member States. For these companies, the bottom-up protocol does not apply. The DM protocol shows great potential but different issues need to be resolved, e.g., the inclusion of confidence intervals and the development of a robust method for the repartition of ownership between multiple UCIs. For instance, in the current version of the DM protocol, we have prioritized 'Director of the Board of Directors' over 'Member of the Board of Directors', leading us to ignore the members, even though they may also have an ownership interest in the company. However, it must be noted that no matter how well-informed these decisions are, they will always be associated with a considerable amount of inference. That being said, a first step in improving the protocol would be to design a robustness study in which results of the DM protocol are compared with survey data.

[71] Note that *ad hoc* analyses would still be possible by mining the validated dataset for case studies of interest.

[72] For clarification: based on the NACE Rev. 2 code we have extracted an exhaustive set of companies, supposedly including all vessel-holding companies, but in addition to these also other companies. VC Registers could be used to identify vessel-holding companies among this sample. In other words: the extracted EU database may be mobilized for use in ownership analysis if VC registers exist.

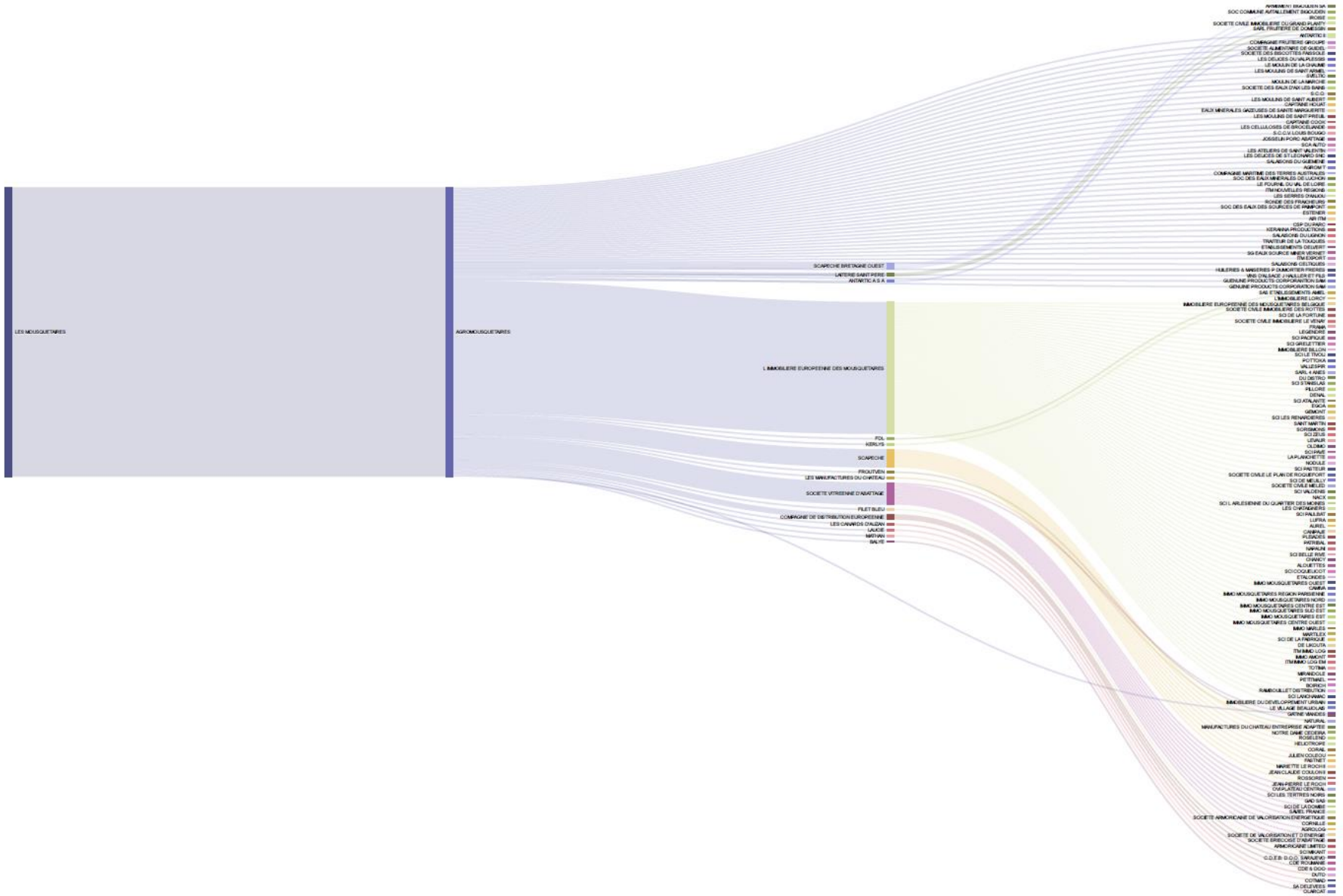


Figure 2-13: Screenshot of the visualization of the corporate group to which Scapêche and Scapêche Bretagne-ouest belong. Dynamic graph produced by Mathieu Merzéréaud (2019).

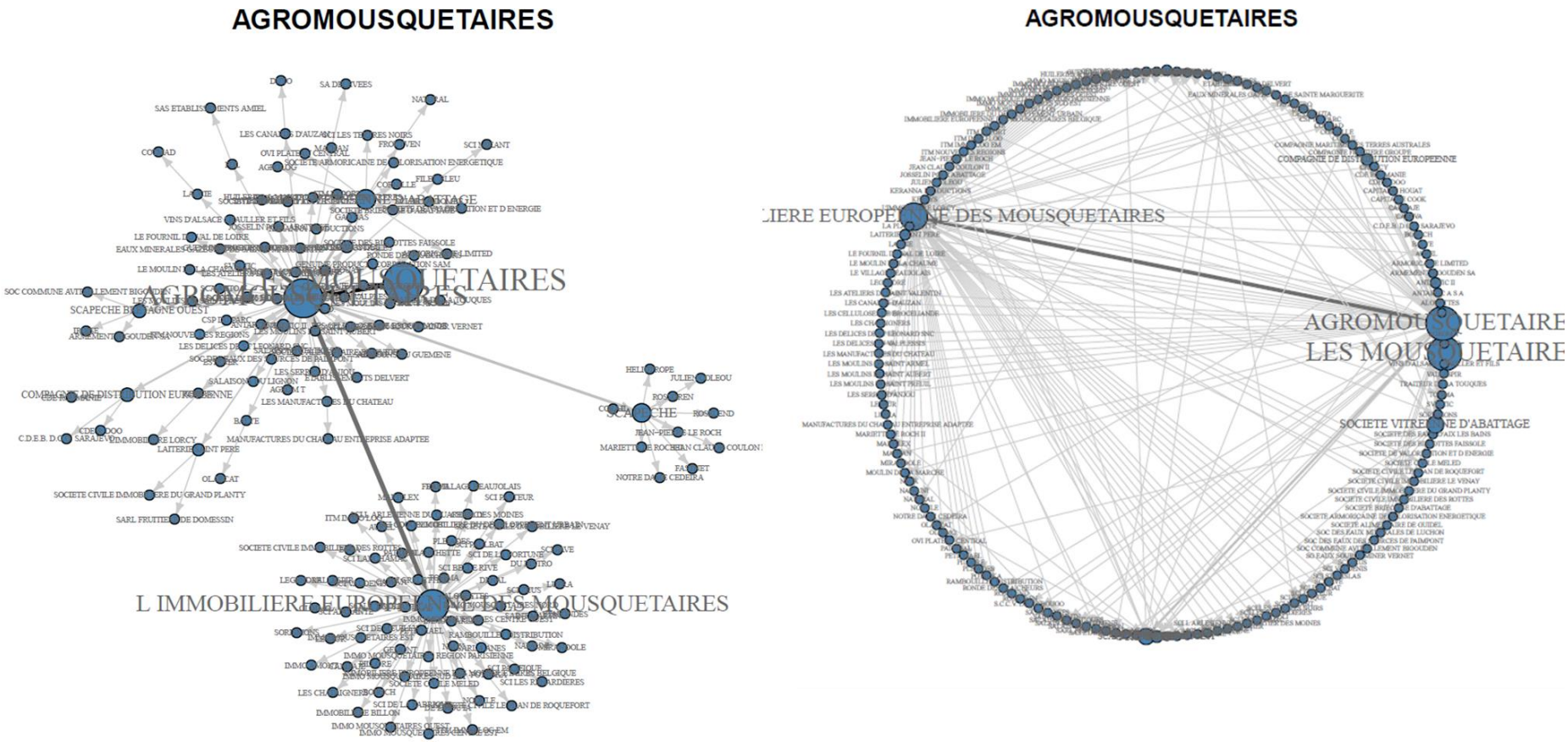


Figure 2-14: Screenshot of the visualization of the corporate group to which Scapêche and Scapêche Bretagne-ouest belong – Alternative version. Graphs produced by Mathieu Merzéréaud (2019).

5.3 Profile of the direct and ultimate owners of French Atlantic fishing vessels

Given that the French Level 0 companies were extracted as part of an EU dataset, and that the bottom-up protocol works based on batch identification[73], their ultimate owners could not easily be isolated from the extracted datasets. This is because the output of every iteration is a list of shareholders that can only be reconnected to the Level 0 companies *a posteriori* on the basis of an R script. This R script was not available at the time of analysis and due to time constraints it could not be applied within the time frame of the PhD research. This is why only preliminary analyses could be included at this point. Note that, instead of applying such an *a posteriori* script, it would be better to reapply the bottom-up protocol for the French company set separately.

Preliminary findings about the profile of vessel-holding companies include that the vast majority (86%) were 'personal firms' (cf. sole proprietorships) and 'agricultural companies'. The most common form of limited liability company was the *Société à Responsabilité Limitée* (SARL) (5%). This is consistent with what was claimed by financial experts, PO directors and several fishers in the interviews for Chapter 1 (see also Cellérier, 2016). Analyses on the profile of the GUO are less conclusive, however, due to unresolved data issues and given that only a small subset of GUOs was different from the Level 0 company itself.

5.4 Policy recommendations and future research

Based on the assessment of ownership data collected under Regulation (EU) 2017/218, we recommend the inclusion of the VAT number of the vessel-holding company alongside the vessel operator. At the time of writing, we do not know why they have not been included and are unaware of any possible sensitivities with regards to their inclusion. The same holds for the fact that most information to be collected is indicated as 'optional' or 'compulsory if available' (see Annex I of the Regulation).

Future research efforts must focus on three things. First, the DM protocol for France must be improved and validated based on the elements discussed above. Second, a more thorough analysis of ownership of fishing vessels and fishing firms in the French Atlantic fishing sector is needed. Profiles such as the preliminary ones described in section 4 must be made for Level 0 companies and their ultimate owners, and ownership must be quantified at different levels. Part of this includes developing a better understanding of certain data issues in Orbis (e.g., what makes that shareholder information is listed or not). Third, a better understanding of corporate ownership and control must be developed, including cross-ownership.

[73] i.e., the query of an entire set of companies at every iteration.

Chapter 3: Measuring concentration in the French Atlantic harvesting sector: a preliminary analysis

Abstract

Excessive concentration of fishing capital and associated market power in the hands of a small number of owners is a cause for concern for fisheries managers, as it may lead to market manipulation and market failure. While in most fisheries restrictions are in place with regards to *who* can hold fishing opportunities and *how much*, this has often been insufficient to prevent concentration. From a legal point of view, dominant firms have the right to exist and guarding against monopolistic tendencies largely becomes a matter of *ad hoc* evaluations by competition authorities. The aim of this chapter is to provide a baseline study on the current state and the evolution (2008-2018) of concentration in the French Atlantic fishing sector, as well as different subfleets: vessels targeting blue whiting (*Micromesistius poutassou*), European hake (*Merluccius merluccius*), scallops (*Pecten maximus*), and saithe (*Pollachius virens*). Based on data extracted in Chapter 2, concentration of different assets (volume and value of landings, fishing vessels, engine power, and gross tonnage) was assessed at different hierarchical levels of ownership (operator, SIREN, Immediate Shareholder (ISH), Domestic Ultimate Owner (DUO), Global Ultimate Owner (GUO) and the 'inferred owner'). A number of concentration/inequality indices were used to measure concentration: concentration ratios (CR4, CR8, CR20) the Herfindahl-Hirschman Index, the Gini coefficient and the Theil Index. Preliminary results show that concentration in the French Atlantic harvesting sector has steadily increased since 2008. At the level of the inferred owner, 20 entities own almost 50% of landed volume (with the 4 largest entities owning almost 40%). High levels of inequality (Gini coefficient) are found for all assets except fishing vessels (and especially for volume and value of landings). Inequality has been high throughout the entire reference period due to the fact that landings are shared between many small entities and only a few large ones. The slight increase in inequality between 2008 and 2018 is due to concentration in the large-scale fleet. Concentration was found to be high for the saithe and blue whiting fisheries, which are ultimately owned by foreign (Dutch, Icelandic) shareholders. The hake fishery shows a high degree of inequality, which is due to a small number of specializers (among which Spanish 'quota hoppers'). Overall inequality is low in the scallop fishery, but results point towards a small number of specializers concentrating production in local value chains (4 firms are responsible for 8.8% of landings, whereas the 50% least producing entities jointly produce 9.2%).

1 Introduction

1.1 Concentration in the fishing industry

Excessive concentration of fishing capital and associated market power in the hands of a small number of owners is a cause for concern for fisheries managers (Connor, 2000; Stewart and Callagher, 2011; Høst, 2015; Haas *et al.*, 2016; Byrne *et al.*, 2020). From an economic perspective, concentration may lead to market manipulation and market failure (Anderson, 1991, 2008; McCay, 1995; Thom and Schwaab, 2010). While moderate levels of concentration in an industry may, in some cases, give rise to efficiency gains (Williamson, 1968; Lopez *et al.*, 2014) (e.g., economies of scale, market stability), it is well established that high levels of concentration may distort competition in the marketplace, with consequences for both producers and consumers (Harberger, 1954; Bator, 1957). Concentration in the fishing sector has also been associated with a decline of fishing opportunities in certain communities or locations (McCay, 1995), shifts in the social relations of fishing (owner-crew relations on board the fishing vessel, the decline of family based fishing) (Menzies, 2002; St Martin, 2007; McCall Howard, 2012; van Ginkel, 2014; Symes *et al.*, 2015), and access problems for young entrants and small-scale fishers resulting from increased entry barriers (cost of entry) (Høst, 2015; Said *et al.*, 2016, 2020; Autzen and Winter, 2020).

In literature, most references to concentration in the fishing industry are found in relation to the implementation of Individual Transferable Quotas (ITQs) (e.g., McCay, 1995; Pálsson and Helgason, 1996; Stewart and Callagher, 2011; Giry *et al.*, 2015; Høst, 2015; Agnarsson *et al.*, 2016; Byrne *et al.*, 2020). Secure property rights in the form of ITQs are implemented to tackle overcapacity in a fishery, whilst providing incentives which, in theory, ensure an optimal allocation of resources and put an end to the race for fish (McCay, 1995; Grafton, 1996; Arnason, 2006; Grafton *et al.*, 2006). The possibility of trading and leasing fishing rights in a quota market is central to reaching that goal, as it allows exiting producers to receive compensation for their loss of profits and incumbent producers to acquire additional fishing rights[74] (Grafton, 1996). As such, an increase in concentration of fishing rights is an expected (and intended) consequence of the implementation of ITQs (Connor, 2000; Byrne *et al.*, 2020). That being said, most ITQ fisheries have built-in protections against monopolistic tendencies in the form of maximum holding restrictions (Frost and Lindebo, 2003). Such restrictions are found in the US (Anderson, 2008), Australia (Emery *et al.*, 2014), New Zealand (Stewart and Callagher, 2011) and Iceland (Agnarsson *et al.*, 2016). In the Netherlands, the ITQ system is embedded in a co-management framework, making such explicit restrictions obsolete (van Hoof, 2013), and in Denmark rules regarding maximum quota holdings are in place[75], but have been insufficiently enforced (Rigsrevisionen, 2017; Nielsen *et al.*, 2018). Often, additional restrictions apply regarding the modalities of transferability and the socioeconomic profile of quota holders (see Carpenter and Kleinjans, 2017 for an overview in EU fisheries). Yet, despite these limitations, excessive concentration in the hands of a small group of quota holders has been reported for ITQ fisheries around the world, among others in Canada (Haas *et al.*, 2016; Edwards and Pinkerton, 2019), the US (Macinko and Bromley, 2002), New Zealand (Stewart and Callagher, 2011), Iceland (Giry *et al.*, 2015; Byrne *et al.*, 2020), Denmark (Høst, 2015; Autzen and Winter, 2020; Said *et al.*, 2020), and Malta (Said *et al.*, 2016, 2020).

[74] This is based on the premise that incumbent producers who expect to be more efficient in catching the fish than the exiting producers, will acquire these fishing rights. Reasons may include pre-existing advantages (e.g., the number, age, type of fishing vessels) or economies of scale resulting from the purchase of additional fishing rights (cf. Grafton, 1996; Byrne *et al.*, 2020).

[75] For demersal stocks, operators cannot hold more than 10% of the quota (Carpenter and Kleinjans, 2017, p. 96).

1.2 Guarding against concentration in market-based economies

In market-based systems, competition authorities are installed to guard against the creation of cartels and monopolies (Haas *et al.*, 2016). In the EU, the antitrust policies of the EU Single Market are outlined in the Treaty on the Functioning of the European Union (TFEU), in Article 101 (prohibition of agreements that restrict competition) and Article 102 (prohibition to abuse dominant market position) (EU, 2012). However, the point at which the benefits of mergers (e.g., scale economies) outweigh the costs to society is difficult to assess. From a legal point of view, dominant firms have the right[76] to exist (Haas *et al.*, 2016). It is only when their activities are deemed detrimental to competition (often by competitors, *nota bene*[77]), that the case is taken before an antitrust authority. Furthermore, Haas *et al.* (2016) point out the ambiguous relation between fisheries management and competition. Economic theory of fisheries management essentially proposes privatization as the solution to overcapacity and a means to avoid the tragedy of the commons. This is implemented through different kinds of 'property' rights regimes – i.e., ranging from collective management and the allocation of use rights to transferable property rights (ITQs). The foundation of this line of economic thought was laid in the 1950s by Gordon (1954) and Scott (1955) and their concept of the 'sole owner' as a single harvester acting in the benefit of society[78]. ITQs as a management instrument follow directly from this line of thought, but emphasize the role of the market (instead of centralized government) in redistributing fishing rights and maximizing economic rent. The contradiction lies in the fact that, from a purely economic-theoretic point of view, any restriction of transferability would impair the intended market-driven restructuring of the fleet under ITQs (Frost and Lindebo, 2003). From this perspective, competition authorities' guarding against monopolies may be considered a restriction of transferability, and thus the free market.

1.3 Evidence for capital accumulation and concentration in the French fishing industry

In France, fishery resources are managed through collective and individual allocations of *use rights*. Unlike ITQs, these allocations cannot be owned and traded by participants in the fishery. In 2009, the French administration took position against the European Commission's proposal (EC, 2009) for an EU-wide system of transferable fishing concessions (Gouvernement Français, 2009). It was argued that a market-based approach would lead to the concentration of fishing vessels and associated rights. French fisheries management emphasizes the collective nature of fisheries resources, and the non-transferable and non-appropriable character of fishing opportunities (Marine Fisheries Act of 1997 and LMAP, 2010), and seems to associate this with the protection against certain adverse effects of the market (e.g., concentration, the preservation of the 'artisanal model'[79]).

However, incentives for capital accumulation and concentration exist nonetheless. Fishing opportunities are allocated to the vessel-producer partnership by Producer Organizations (POs) (TAC-species) or fisheries committees (non-TAC species) in a co-management framework. For TAC-species, quota allocations are mostly based on historical track records

[76] E.g., Marris (1972, p. 113) defends the growth of firms a fundamental right of capitalism and denounces any interference of governments that would limit this freedom. This point is raised but then refuted by Williamson (1972) in his assessment of antitrust policies.

[77] A good example is the case against pulse trawling by Dutch fishers, initiated by actors in the French and UK fishing industry.

[78] The extent to which the 'sole owner' is actually a monopolist, is the subject of debate among scholars. Scott (1955) himself asserts that the sole owner is not a monopolist, because the sole owner has no control over market price. According to Scott, sole ownership is "merely the complete appropriation of all of a natural resource in a particular location". Bromley (2009) refutes Scott's argument and argues that the sole owner is indeed a monopolist.

[79] E.g., http://www.dirm.sud-atlantique.developpement-durable.gouv.fr/IMG/pdf/17-02-17-fiche_enjeux_1_-_peche.pdf; and http://www.euroconsulting.be/wp-content/uploads/2019/05/ST_8941_2019_REV_1_X.pdf

(2001-2003) (Larabi *et al.*, 2013; Bellanger *et al.*, 2016). While market transactions of track records and licenses are prohibited by law, they can be transferred with the fishing vessel when the vessel is sold. Since 2006, producers also have a number of additional freedoms: they may distribute track records among multiple vessels, and sell a vessel while keeping its track records. This has given producers more flexibility with regards to their investment strategies, i.e., the option to buy and resell, and transfer track records in the process (Larabi *et al.*, 2013). The strong link between track records and quota allocations have furthermore created an incentive for producers to invest in fishing vessels with track records or licenses attached. As such, fishing opportunities can be *de facto* owned through the acquisition of fishing vessels on the second-hand market. Larabi *et al.* (2013) have warned that this may lead to concentration, since there are no mechanisms in place to limit these transactions.

Guyader *et al.* (2003) have found that fishing rights represented about half of the vessel price in 2000, and recent evidence from the field (interviews) suggests that since then the implicit value of fishing rights has increased. The importance of the second-hand market in reallocating fishing opportunities was demonstrated by Quillérou and Guyader (2012) who found that between 2000 and 2010, 6 to 12% of vessels in the Atlantic fleet changed owner each year. In the period 1993-2008, both vessel and operator numbers in the Atlantic fishing sector have declined (Quillérou and Guyader, 2012) (Figure 3-1). The authors report that multi-ownership ("concentration") increased after 1999, due to vessel owners leaving the fleet and freed-up capacity being redistributed among remaining operators[80] through second-hand vessel trades.

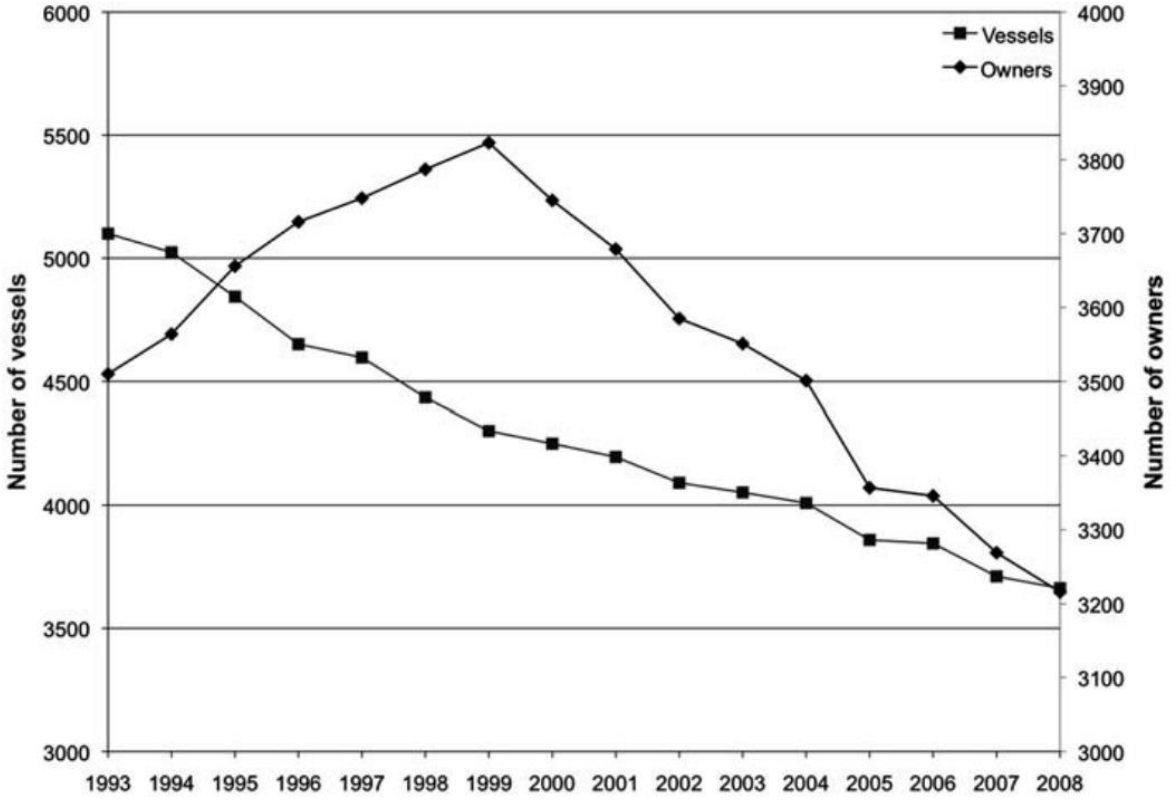


Figure 3-1: Evolution of vessel and operator numbers in the French Atlantic fishing sector: 1993 to 2008. Figure copied from Quillérou and Guyader (2012).

More recently, studies by Warmerdam *et al.* (2016, 2018) and MRAG *et al.* (2019) have confirmed that concentration is occurring. MRAG *et al.* (2019) reports an increase in multi-vessel ownership and describes in great detail the vertical/horizontal integration, foreign

[80] Vessel trades on the second-hand market were also shown to be the main mechanism for first time entries in this period (see Table 3 in Quillérou and Guyader, 2012). See also Van Putten *et al.* (2012).

ownership and concentration of production for a number of specific case studies in the French Atlantic fishing sector.

1.4 Measuring concentration of fishing assets in the EU fishing industry

The recent study by MRAG *et al.* (2019) was commissioned by the European Commission's Executive Agency for Small and Medium-sized Enterprises (EASME)[81]. The study's premise was to provide "an overview of the current ownership structure of fishing vessels and the means of production […] in the catching sector", focusing on nine key Member States: Belgium, Denmark, France, Germany, Ireland, the Netherlands, Spain, Sweden, and the United Kingdom (sic.). More precisely, the study has looked at ultimate ownership and concentration of the production means in the EU fishing industry. Concentration was measured, where possible, for different assets: the fishing vessels, quota allocations and fishing rights (i.e., licenses). The study has identified data availability and transparency as major barriers for comprehensive ownership analysis of EU fishing vessels and fishing opportunities. Data were especially incomplete for individual quota allocations, and vessel ownership was identified as the best basis for EU-wide comparative analysis. In France, information on quota allocations is not publicly available, and even for research purposes difficult to obtain. Vessel ownership is a good proxy for concentration of production, however, given the strong link between vessel ownership and access to the resource (Larabi *et al.*, 2013).

1.5 Chapter aims and objectives

The aim of this chapter is to provide a baseline study on the current state (and the evolution) of concentration in the French Atlantic fishing sector, as well as different subfleets: vessels targeting blue whiting (*Micromesistius poutassou*), European hake (*Merluccius merluccius*), scallops (*Pecten maximus*), and saithe (*Pollachius virens*).

Concentration of different assets (vessels, GT, kW, production data) will be measured at different hierarchical levels: the vessel, operator, fishing firm (SIREN), immediate shareholder (ISH), domestic and global ultimate owner (DUO, GUO) and a level called 'inferred owner' (i.e., an additional level of ownership to account for undisclosed ownership links, see Chapter 2). Assets are aggregated (cumulated) at every level before concentration indices are calculated (see further).

While previous studies have considered vessel ownership and/or concentration only at the level of the operator (e.g., Guyader *et al.*, 2003, 2013; Quillérou and Guyader, 2012; Bellanger *et al.*, 2016), we have shown in Chapter 2 that looking at this level of analysis only would considerably underestimate ownership. In Chapter 2, we have demonstrated the discrepancy between analysis on the level of the operator versus that of the fishing company (SIREN number). We found that the operator scenario underestimates multi-vessel ownership by 7.2% compared to the SIREN scenario. Here, the objective is to investigate the degree of concentration at multiple hierarchical levels of asset ownership. We expect a similar discrepancy between the operator and the SIREN level for all assets, and further it is evident that concentration will be higher at higher hierarchical levels of corporate ownership[82]. The point of interest is to know how much. This chapter provides an empirical study on concentration in the French Atlantic fishing sector, today and in the past 11 years (2008-2018).

It must be noted that, due to time limitations, this Chapter is still 'work in progress'. It includes more analyses than strictly necessary to bring a clear message across. It also includes certain methodological errors that could not be reassessed in time for this PhD thesis to be submitted. These will be given the necessary attention in the Discussion.

[81] Service Contract: EASME/EMFF/2016/1.3.2.1/SI2.766458

[82] This is because asset ownership is cumulated with each increasing ownership level (see Methods).

2 Methods

2.1 Case study description

The population under study here are all fishing vessels registered in Atlantic and North Sea/Channel fishing ports in 2018 (Figure 3-2), and the respective entities to which they belong (operators, fishing firms, corporate groups – see further). In addition to strictly 'Atlantic' fishing vessels (n=2905), another 18 vessels targeting tuna in the high seas were included. These vessels are owned and operated by fishing companies with main activities and roots in Atlantic ports. As such the population under study consists of 2923 fishing vessels. Furthermore, for analysis of the evolution of concentration, similar criteria were applied to define the vessel and operator populations between 2008 and 2017.

The evolution of metrics like the number of vessels, gross tonnage and engine power per operator suggests that multi-vessel ownership is increasing (Table 3-1). Vessel trade on the second-hand market is the main mechanism for this redistribution (Quillérou *et al.*, 2013). While the number of new vessel constructions has increased in recent years, it remains limited in scope (see Supplementary Materials, Figure A-4).

Table 3-1: Vessel and operator numbers, and average number of vessels, kW and GT per vessel and per operator, 2008-2018. (*) kW is expressed as 10^3 kW, GT as 10^5 tons. Source: DPMA-Ifremer Fisheries Information System (SIH) (2018).

	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Vessels	3672	3468	3324	3201	3156	3105	3078	2984	2961	2930	2923
Ops.	3235	3078	2947	2854	2808	2750	2703	2610	2553	2511	2484
kW(*)	676	632	598	572	566	564	562	551	556	552	559
GT(*)	171	159	149	141	137	137	138	135	139	137	143
kW/ves	184	182	180	179	179	181	183	185	188	189	191
GT/ves	4658	4584	4487	4393	4356	4411	4484	4528	4695	4692	4883
Ves/op	1.14	1.13	1.13	1.12	1.12	1.13	1.14	1.14	1.16	1.17	1.18
kW/op	209	205	203	200	202	205	208	211	218	220	225
GT/op	5287	5165	5061	4927	4896	4980	5106	5177	5446	5475	5746

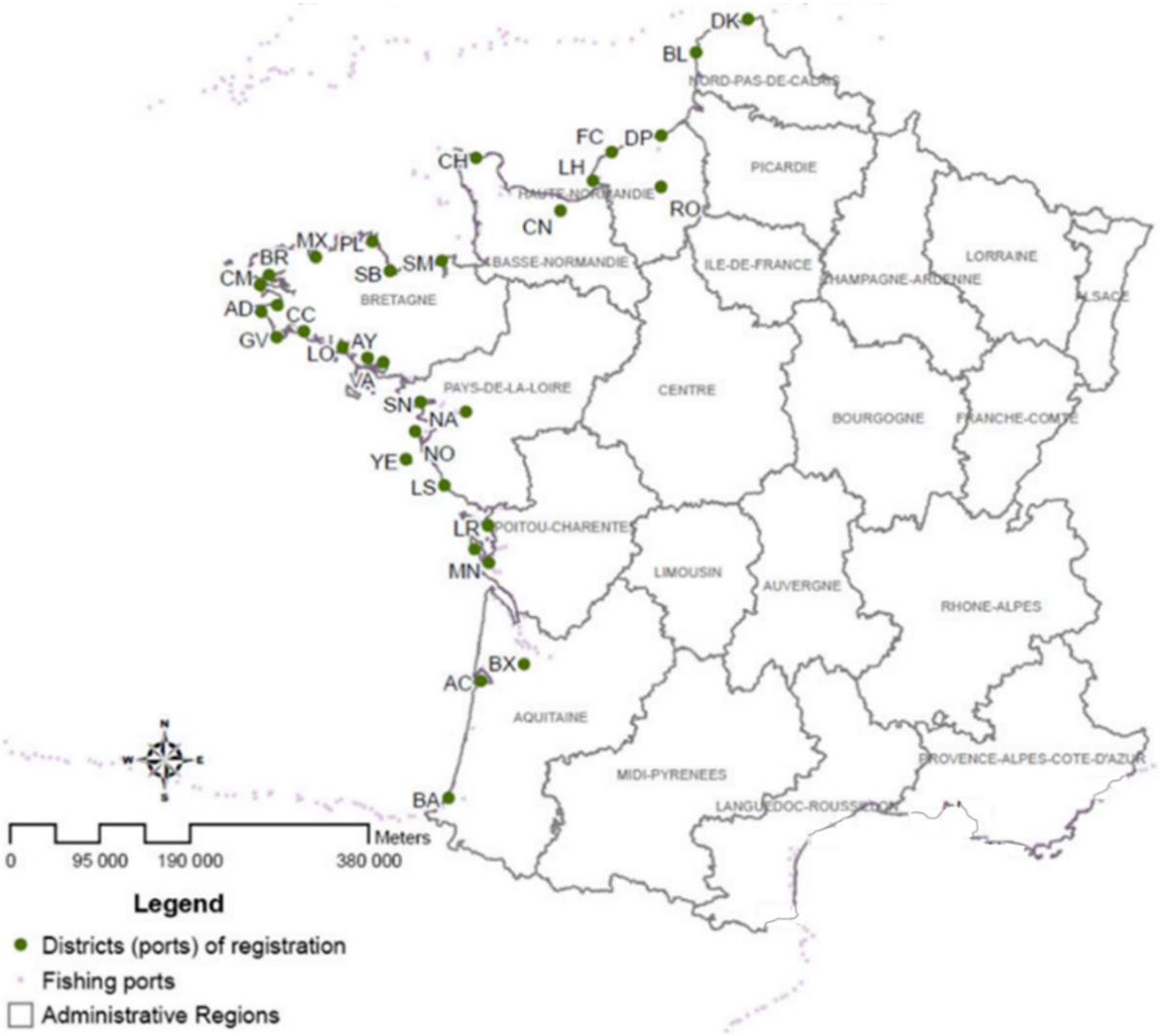


Figure 3-2: Study area (figure copied and adapted from Quillérou *et al.*, 2013). The map has not been adapted for recent changes in France's administrative regions.

Table 3-2 and Table 3-3 further describe the population in terms of number of vessels, functional groups and fleet capacity.

Table 3-2: Description of the population in terms of number of vessels, kW and GT. ATL: Atlantic Ocean, NS: North Sea, CH: Channel. Source: DPMA-Ifremer Fisheries Information System (SIH) (2018).

	No. of vessels		**kW (in 10^3 kW)**		**GT (in 10^3 tons)**	
Segm.	**ATL**	**NS,CH**	**ATL**	**NS,CH**	**ATL**	**NS, CH**
<10m (n=1502)	869 (30%)	633 (22%)	71.6 (13%)	54.3 (10%)	327.3 (2%)	266.1 (2%)
[10-12[m (n=678)	314 (11%)	364 (12%)	43.1 (8%)	54.6 (10%)	393.0 (3%)	509.4 (4%)
[12-18[m (n=388)	190 (7%)	198 (7%)	47.1 (8%)	47.7 (9%)	884.8 (6%)	924.6 (6%)
[18-24[m (n=216)	137 (5%)	79 (3%)	55.0 (10%)	32.2(6%)	1691.6 (12%)	1037.4 (7%)
[24-40[m (n=107)	77 (3%)	30 (1%)	46.3 (8%)	17.5 (3%)	2032.8 (14%)	575.3 (4%)
≥40m (n=32)	18 (1%)	12 (0%)	62.2 (11%)	27.5 (5%)	3084.3 (25%)	3548.1 (15%)
Total (n=2923)	1607 (55%)	1316 (45%)	317.3 (57%)	31.4 (43%)	8413.7 (62%)	5859.7 (38%)

Table 3-3: Métiers in the population (fishing gear and size categories) (Ifremer typology). Number of vessels. Source: DPMA-Ifremer Fisheries Information System (SIH) (2018).

Métier	**<10m**	**[10-12[m**	**[12-18[m**	**[18-24[m**	**[24-40[m**	**≥40m**	**Totals**
(Unidentified)	9	4	3	4	1	-	21
Purse seiners (Bolincheur)	-	4	26	2	-	-	32
Bait boats	-	-	-	-	1	-	1
Potters	162	44	2	10	1	-	219
Traps and pots; hook-and-line métiers	75	13	-	-	-	-	88
Bottom trawl (exclusively)	22	49	119	135	53	15	393
Bottom trawl (non-exclusively)	92	227	124	6	1	-	450
Diverse coastal métiers	73	6	1	-	-	-	80
Dredgers	133	99	36	5	-	-	273
Netters	134	90	55	26	20	-	325
Netters/Potters	182	50	11	1	-	-	244
Netters; hook-and-line métiers	68	25	1	2	1	-	97
Inactive	163	30	9	8	1	-	211
Hook-and-line métiers	136	24	1	2	20	-	183
Seiners	-	-	-	-	-	2	2
Bottom seiners	-	-	-	15	8	-	23
Tropical seiners	-	-	-	-	-	15	15
‘Tamiseurs’	253	13	-	-	-	-	266
Totals	1502	678	388	216	107	32	2923

In this chapter, we will primarily study concentration in the population as a whole, which, for ease of reference, we will refer to as the 'Atlantic' fleet. A detailed analysis of concentration for specific fisheries is beyond the scope of this chapter. However, a first attempt was made to look at a number of subfleets: i.e., vessels targeting blue whiting (*Micromesistius poutassou*), European hake (*Merluccius merluccius*), scallops (*Pecten maximus*), and saithe (*Pollachius virens*). Subfleets were defined solely based on target species, and do thus not necessarily represent actual fisheries[83]. All vessels for which landed volume for these target species was greater than zero in 2018, were included in the respective subfleets (Table 3-4 and Table 3-5).

Table 3-4: Subfleets – tonnage and engine power. Source: DPMA-Ifremer Fisheries Information System (SIH) (2018).

		GT (in 10^3 tons)			kW (in 10^3 kW)		
	No of vessels	Total	% of pop.	Mean GT/vessel	Total	% of pop.	Mean kW/vessel
Population	2923	14273.7	100%	4.9	559.1	100%	0.2
Blue whiting	36	949.8	7%	26.4	15.8	3%	0.4
Hake	988	7377.5	52%	7.5	261.8	47%	0.3
Scallops	720	1632.7	11%	2.2	112.8	20%	0.2
Saithe	454	5535.9	39%	12.2	153.7	28%	0.3

Table 3-5: Subfleets – value and volume. Dependency is calculated as the average of vessel dependencies for the respective species. Source: DPMA-Ifremer Fisheries Information System (SIH) (2018).

	Volume (in 10^3 tons)			Value (M€)		
	Total	% of pop.	Mean vessel dependency	Total	% of pop.	Mean vessel dependency
Population	478.4	100%	-	1060,8	100%	-
Blue whiting	16.4	3%	4% (SD = 16%)	11.2	1%	4% (SD = 16%)
Hake	38.9	8%	12% (SD = 23%)	115.8	11%	10% (SD = 23%)
Scallops	31.7	7%	49% (SD = 33%)	87.6	8%	47% (SD = 33%)
Saithe	17.1	4%	2% (SD = 9%)	18.2	2%	1% (SD = 7%)

These specific subfleets were selected based on (1) relevance of the species in terms of volume and value (in the fishery as a whole or for the participants) (Table 3-5), and/or (2) trends described in literature and new information from the field gathered over the course of the PhD research.

Blue whiting. The European blue whiting value chain is heavily integrated and quota are heavily concentrated (MRAG *et al.*, 2019). In France, following a series of mergers and acquisitions between 2006 and 2011, the main producer of blue whiting is now ultimately owned by foreign shareholders (MRAG *et al.*, 2019). We hypothesize that, in France, blue whiting 'ownership' and concentration follows a similar pattern like in other EU Member States: the relatively small number of vessels targeting blue whiting are concentrated in a limited number of companies, with the bulk of production concentrated in only a fraction of the latter.

European hake. Hake was included as a case study because it is known to be the main target species of the so-called '*armateurs franco-espagnols*[84]*'*. These are Spanish owners operating vessels under French flag (so-called 'quota hoppers'). These are fishing families from northern Spain who invest in fishing vessels across the border, due to quota constraints in their home country (Coelho, 2018; Villasante *et al.*, 2019). Their main aim is to gain access to foreign quota, mainly for fishing hake (Lequesne, 2000; Warmerdam *et al.*, 2016). A significant number of French vessels are detained by Spanish capital, with an estimated 65 Spanish-owned vessels fishing under French flag in 2016 (FranceAgrimer, 2016).

Scallops. A study on seller and buyer dynamics in the scallop fishery by Lesur-Irichabeau *et al.* (2016) indicates that incentives may exist for producers to vertically integrate, related to the surplus that may be earned in one mode of selling over another, and/or by consolidating their dominant market position. In addition, these authors found that the presence of 'processing

[83] The blue whiting subfleet does coincide with the blue whiting fishery, which is due to the degree of specialization in both the harvesting and the processing sectors. For the other subfleets it should not be assumed that this is the case.

[84] Another often-heard term is '*armateurs communautaires*', i.e., '[European] Community fishers'.

operators'[85] in a management area has a negative effect on scallop price, notably affecting those producers who are depending on spot markets to market their catch. The accumulation of fishing capital in the scallop fishery is also mentioned in grey literature (e.g., Le Marin, 2019), and was confirmed in the interviews conducted for Chapter 1.

Saithe. The study by MRAG *et al.* (2019) found high concentration for saithe, especially in Denmark and the UK. Saithe quota (along with quota for cod and other demersal species) are highly solicited by large fishing corporations, which has resulted vertical integration, consolidation and concentration of the production means at both EU and international levels. In France, one company was identified as the main producer of saithe and cod. It is our aim here to assess the situation in France in more detail.

2.2 Data

While a number of studies have obtained access to quota allocation data for specific case studies (e.g., Guyader *et al.*, 2003; Bellanger *et al.*, 2016), it was not feasible to obtain such access for this PhD thesis. Neither did we obtain access to information on licenses from the DPMA as did MRAG *et al.* (2019). Instead, we will use vessel ownership and production data (volume and value of landings) as a proxy for an entity's access to the resource. Concentration will be calculated for a number of assets: production data, the number of fishing vessels and their cumulative engine power (kW) and gross tonnage (GT).

2.2.1 Fleet, production and operator data

The population of reference is defined by the 2923 fishing vessels registered in fishing ports in the Atlantic (n=1607), the North Sea/Channel (n=1316) in the year 2018. This also includes a number of inactive vessels (n=215)[86]. The species subfleets (blue whiting, hake, scallops, saithe) are defined based on vessels of the population for which landed volume of the respective species was greater than 0 kg. Vessel and operator data were obtained from Ifremer's *Harmonie* and *SACROIS* databases (respectively for fleet and production data) (Leblond *et al.*, 2008). Key vessel data include the unique vessel identification number (CFR number), landings (volume, value), capacity metrics (GT, kW), vessel length (fleet categories), fishing gear, port of attachment. Main operator data include the unique operator ID code, and the CFR numbers of the vessels operated by them. This allows a first assessment of vessel ownership, in line with the level considered by, e.g., Guyader *et al.* (2003, 2013), Quillérou and Guyader (2012) and Bellanger *et al.* (2016). In addition, variables were obtained from the *Harmonie* database that may help with the interpretation of the results of the concentration analysis: operator age category, postal code and mean length of operated vessels. The latter was not included in the *Harmonie* database as such, and was calculated by summing up the individual lengths of the operator's vessels and dividing it by the number of vessels, and subsequently turning it into discrete categories. Broad categories (≤12 m and >12 m) were chosen to minimize the risk of wrong conclusions[87].

[85] Cf. the 'fisher-processors' in Chapter 1.

[86] In the fleet register, 215 vessels were listed as 'inactive', although 17 of them did have landings in 2018. This is due to the fact that vessel status is listed as of 31 December of the reference year. A more relevant statistic would be the number of vessels that have 0 reported catch in 2018, regardless of their status. There were 10 such vessels in 2018. For another 229 vessels, no information was available in the fleet register (NAs).

[87] The use of the original vessel categories (EU fleet register or the higher resolution classification by Ifremer), would lead to wrong conclusions in some cases. An example from the dataset: an operator with 2 vessels; 1 is 7.48 m in length, the other 15.30 m, attributed to the <10 m and the [12-18 m[categories. Following the proposed method, the mean length is 11.39 m, corresponding to category [10-12 m[, to which neither of the vessel belongs. This is avoided by choosing broad categories (≤12 m and >12 m).

In addition to the 2018 dataset, historical fleet and production data (2008-2017) were obtained from the *Harmonie* and *SACROIS* databases, to analyze the change in concentration over time. At this stage, this could only be done at the level of the population as production data for the subfleets were not available for analysis[88].

2.2.2 Ownership data

Data on the ownership of fishing vessels beyond the operator level were obtained from two additional sources. The first source is the *Vessel-Company (VC) Register* established by us in Chapter 2 (see Chapter 2, section 2.2.1). The VC Register provides a link between the vessel and its holding company, through a unique SIREN number, and incorporates fleet register and production data (see Annex 2.2). The second source is the subscription-based Orbis database (Bureau van Dijk), which provides ownership links and metrics at different hierarchical levels. The levels beyond the SIREN number included for analysis here are the immediate shareholder (ISH) and the domestic and global ultimate owners (DUO, GUO).

In Chapter 2 we have extracted ownership data for French Atlantic fishing firms (see Chapter 2, section 3.4 for a description). Production data were attributed to the entities *pro rata*, based on their (total) ownership percentages[89] (see further). An additional level of detail was added by us through the 'inferred owner', to account for ownership links not reflected in the Orbis dataset. Of the 2755 SIREN numbers extracted, 2652 (96.2%) had no listed shareholders in Orbis. For these companies, the default hierarchical levels (ISH, DUO, GUO) were considered to be the company itself[90] (i.e., the SIREN number).

The 'inferred owner' method defines the ultimate owner based on an inference method developed by us (see Chapter 2, section 3.5.2). This method was developed in an attempt to find a solution for the lack of ownership data for 96.2% of SIREN numbers. While the method needs more rigorous testing, it has proven to work well for a selection of case studies and preliminary sensitivity tests have shown good results. This 'inferred owner' is defined as the *Unique Contact Identifier* (UCI) of the manager or director who was identified as an owner based on their role in the company. In case multiple UCIs were identified as potential owners in the DM protocol, a single owner was selected, based on role hierarchies (see Chapter 2). A single owner was considered for methodological reasons and time considerations. Ideally, however, ownership percentages would be shared equally between n UCIs for which an ownership role is assumed based on role hierarchies, but this could not be developed within the time frame of this PhD thesis.

We consider the 'inferred owner' the most detailed measure of ultimate ownership. Note that for companies with listed shareholder information, the inferred owner is taken to be the same entity as the company's GUO (default metric provided by Orbis). As such, compared to the GUO, the inferred owner level adds a layer of information 'only' for those companies in the dataset who are not their own GUO (see Chapter 2, section 4.1.2).

2.2.3 Concentration analysis at different levels of ownership

A dataset was prepared in which (a) vessel numbers, (b) production data, and (c) technical vessel data (vessel length, engine power, gross tonnage) at the vessel level were aggregated in a stepwise and hierarchical manner: on the level of the operator, the fishing firm (SIREN

[88] The analysis was conducted during the peak of the COVID-19 health crisis in 2020-2021. The SACROIS server could not be accessed remotely for reasons of data protection, which is the sole reason these data are not included here.

[89] Total ownership percentages are provided by Orbis and are the result of calculations of direct and indirect percentages along the path from the subject company to its ultimate owners.

[90] We recall that Orbis listed less companies as their own ultimate owner (GUO) than what was expected based on the definition chosen in the interface. Here, we have manually adapted the Orbis output to make sure that for every company with 0 listed shareholders, the ISH/DUO/GUO is that company itself.

number), the immediate shareholder (ISH), the domestic ultimate owner (DUO), the global ultimate owner (GUO), and the inferred owner (see Chapter 2 for definitions). At each level, production data were repartitioned among the owners according to their ownership percentages in the Orbis database. Where percentages were lacking, a simple inference method was used (i.e., ownership was considered to be divided in equal shares: e.g., 50/50, shares of 33.3%, etc.).

In Chapter 2, we have introduced the 'divisibility property' of fishing vessels and companies (see Chapter 2, section 1.3). Figure 3-3 shows a representation of how ownership percentages are taken into account for the calculation of concentration of different assets (vessel and sub-vessel level). Concentration may be calculated based on different metrics (number of vessels, kW, GT, volume and value of landings) and at different levels of ownership (vessel, operator, firm, ISH, DUO, GUO, inferred owner). However, the degree of detail available in the different data sets does not allow analysis at all levels (see further). Analyses were performed using the *ineq* (Zeileis, 2015) package in R Studio (version 1.1.463).

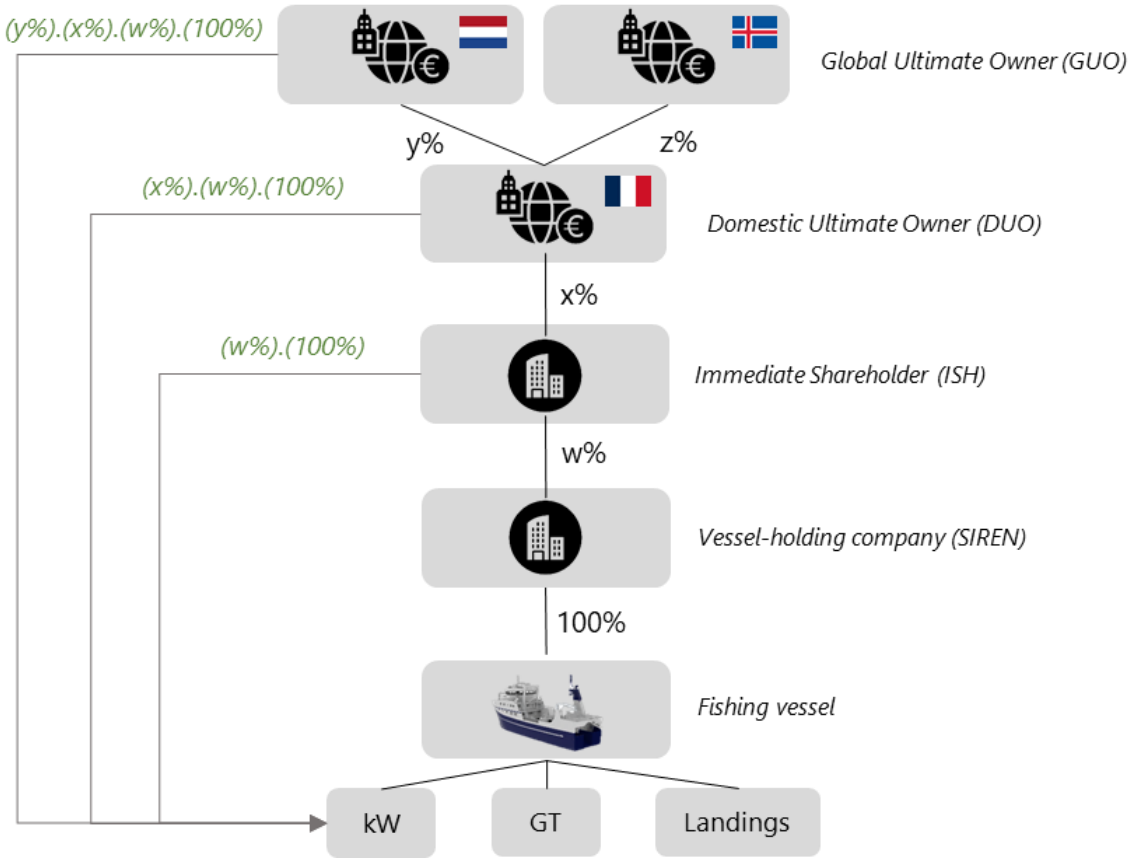


Figure 3-3: Conceptual representation of the use of ownership data at different hierarchical levels (the inferred owner is not included in the figure). The vessel and all the assets of interest on the sub-vessel level can be considered to be owned *pro rata* based on calculations of ownership along the path from the vessel-holding company to its ultimate owners. Where percentages are lacking, they are divided into equal shares. The method of calculation is the one used by Orbis.

2.3 Concentration indices

A number of inequality indices were used to measure concentration in the French Atlantic harvesting sector: concentration ratios CR4, CR8, CR20 (e.g., Stewart and Callagher, 2011; Haas *et al.*, 2016; MRAG *et al.*, 2019), the Herfindahl-Hirschman Index (e.g., Stewart and Callagher, 2011; Abayomi and Yandle, 2012; Bellanger *et al.*, 2016; Haas *et al.*, 2016; MRAG *et al.*, 2019), the Gini coefficient (e.g., Adelaja *et al.*, 1998; Abayomi and Yandle, 2012; Sumaila *et al.*, 2015; Bellanger *et al.*, 2016; Haas *et al.*, 2016; MRAG *et al.*, 2019) and the Theil Index

(e.g., Bellanger *et al.*, 2016). The use of multiple concentration indices is intended to build a complete image of the degree of concentration in the fishing sector. In what follows, we will give an overview of the different indices, their mathematical equations and their advantages and disadvantages. Table 3-6 summarizes the indices (after Bellanger *et al.*, 2016).

Table 3-6: Inequality metrics and their characteristics (after Bellanger *et al.*, 2016). Formulas: n is the size of the population, and y represents the substitute for "income" in the original formulas (used to study inequality in income distribution): volume and value of landings, cumulative kW or GT of the respective entities (vessels, operators, SIREN numbers, ISHs, DUOs, GUOs and inferred owners).

Index name	Formula	Pros	Cons
Concentration ratios	$CRn = \sum_{i=1}^{n} m_i$	Intuitive	Only considers market shares of dominant firms; Distribution of market shares is not taken into account
Herfindahl-Hirschman Index (HHI)	$HHI = \sum_{i=1}^{N} (m_i)^2$	Takes all firms and their distribution into account, applicable in a variety of contexts	Correlated with number of firms
Gini coefficient	$G = \frac{1}{2n^2\bar{y}} \sum_{i=1}^{n} \sum_{j=i}^{n} \lvert y_i - y_j \rvert$	Intuitive	Not easily decomposable; Different distributions may give the same value
Theil Index	$T = \sum_{j=1}^{m} s_j \times T_j + \sum_{j=1}^{m} s_j \times \ln \frac{\bar{x}_j}{\bar{x}}$	Decomposable	Non intuitive

Most indices presented below have been designed to measure inequality in income distribution, but are also commonly used to assess industry concentration. To adapt their explanations to fit a fisheries context, we will use generic terms such as 'metric' and 'asset' to denote any metric for which the index can be calculated (i.e., number of vessels, landed volume, landed value, kW, GT) – i.e., instead of the term 'income'. Where substitution is difficult, we will use the term 'volume' as a collective noun. The term 'entity' is used to denote any of the hierarchical levels considered in this chapter (i.e., vessel, operator, SIREN, ISH, DUO, GUO, inferred owner).

2.3.1 Concentration Ratios (CR4, CR8, CR20)

Concentration Ratios (CR4, CR8, CR20) are a commonly used and very intuitive metric for concentration in an industry. It is expressed as a value between 0% and 100%, representing the share of the top four, eight or twenty firms in the industry. Following Sawyer (1985), its generic calculation is given by:

$$CRn = \sum_{i=1}^{n} m_i$$

where m_i is the share of each entity i, and n is de i^{th} company being counted. The share (%) is calculated as the volume landed by entity i as a proportion of total landings. A similar approach can be followed to analyze concentration of engine power and tonnage. The CR provides a very intuitive measure of concentration in the upper end of the distribution (i.e., the largest firms in the industry), but does not tell us anything about the distribution as a whole.

2.3.2 The Herfindahl-Hirschman Index (HHI)

The Herfindahl-Hirschman Index (HHI) ranges between 0 and 1 (the higher the value, the more concentrated)[91]. It is considered more comprehensive than the CRs as the HHI gives a weighting to each entity based on its market share. For CRs, a weighting of 1 is attributed to

[91] That is, when percentages are used for its calculation. If actual (market) shares are used, the index ranges between 0 and 10000 (where 1 firm with total market share is expressed as $100^2 = 10000$).

the top firms, and a weighting of 0 to the others (Haas *et al.*, 2016). Following Coulter (2019), its calculation is given by:

$$HHI = \sum_{i=1}^{N} (m_i)^2$$

where N is the total number of entities in the fishery and m_i represents the share (%) calculated as the volume landed by entity i as a proportion of total landings. A similar approach can be followed to analyze concentration of engine power and tonnage. Because of the weighting, larger entities have a strong influence on the outcome. HHI has been criticized for not conveying information about the entire distribution (despite the incorporation of all data) (Krivka, 2016; MRAG *et al.*, 2019).

Together, CRs and the HHI are the standard measures used in competition policy to determine whether an industry is oligopolistic and whether there is 'too much' market power (MRAG *et al.*, 2019). Often, the change (∆) in HHI is used to assess how a merger would influence the level of concentration in the industry (Table 3-7).

Table 3-7: Interpretation of HHI based on (1) its current value and (2) its change following an acquisition or merger. Copied and adapted from MRAG *et al.* (2019).

HHI	**∆ < 0.01**	**0.01 < ∆ < 0.02**	**∆ > 0.02**
<0.15	Unlikely to harm competition	Unlikely to harm competition	Unlikely to harm competition
[0.15; 2.5]	Unlikely to harm competition	Potentially raise significant competitive concerns	Potentially raise significant competitive concerns
>0.25	Unlikely to harm competition	Potentially raise significant competitive concerns	Presumed to be likely to enhance market power

2.3.3 The Gini coefficient

The Gini coefficient (Gini, 1921) was originally designed for assessing income inequality (Lorenz, 1905; Gini, 1921), but has been applied to analyze concentration in the fishing industry (e.g., Pálsson and Helgason, 1996; Abayomi and Yandle, 2012; Sumaila *et al.*, 2015; Bellanger *et al.*, 2016; Haas *et al.*, 2016; MRAG *et al.*, 2019). The Gini coefficient ranges between 0 and 1; 0 meaning perfect equality and 1 meaning perfect inequality (with 1 entity being responsible for 100% of production). The visual expression of the Gini coefficient is the Lorenz curve, which plots the cumulative percentage of the population (entities *i*), in ascending order of asset ownership or market share, against the cumulative percentage of those assets. For the calculation of the Gini coefficients, we based ourselves on following equation by Sen *et al.* (1997):

$$G = \frac{1}{2n^2\bar{y}} \sum_{i=1}^{n} \sum_{j=i}^{n} |y_i - y_j|$$

where n is the number of entities in the population, and y can take different forms, depending on the asset studied: the number of vessels held by each entity, the volume/value of the landings by each entity, or the total kW/GT per entity.

MRAG *et al.* (2019) aptly describe the advantage of the Gini index, especially when used in tandem with CRs and the HHI, which are both heavily weighted toward describing what happens at the upper end of the distribution. In contrast, the Gini coefficient helps understand the shape of the entire dataset. It is most informative when interpreted alongside the total number of entities in the population. Also, histograms and frequency tables may help to better understand the origin of the unequal distribution.

There are, however, some issues associated with the Gini coefficient. First, the Gini coefficient is a relative measure of inequality, and does not say anything about absolute inequality. So,

mathematically, the same value may arise from different distribution curves, even though absolute inequality may differ. Second, it does not provide relative contributions of subgroups (e.g., length and gear classifications, geographical location) to inequality in the population. For the latter, the Theil index provides a solution (see below) (cf. Bellanger *et al.*, 2016).

2.3.4 The Theil Index

Following Bellanger *et al.* (2016), we also consider the Theil index – which has a distinctive advantage over the Gini coefficient, in that it can be decomposed into the contributions of different *subgroups* to the inequality in the entire population (Haughton and Khandker, 2009). Here, we will consider *Theil's L*, which is an expression of the Generalized Entropy Index (GEI), for which parameter α = 0. Alfa regulates the weight given to distances between values at different parts of the distribution (Cowell, 2003)[92]. Theil's L (α = 0) is more sensitive to differences at the lower end of the distribution than Theil's T (α = 1)[93]. Theil's L is given by following expression:

$$GEI(0) = T_L = \frac{1}{N}\sum_{i=1}^{N} \ln\left(\frac{\overline{y}}{y_i}\right)$$

where y_i, for a given asset, represents the value of entity i and $\bar{y}$ is the average value of the population. Mathematically, the Theil index can also be expressed as a weighted average of inequality within subgroups, plus inequality among those subgroups (Bourguignon, 2004):

$$T = \sum_{j=1}^{m} s_j \times T_j + \sum_{j=1}^{m} s_j \times \ln\frac{\overline{x_j}}{\bar{x}}$$

where m is the number of defined subgroups in the population, s_j is the entity's share of the total value of the asset. T_j is the Theil index for subgroup j, and $\overline{x_j}$ represents the average landings in subgroup *j*. In the equation, the term $(s_j \times T_j)$ is the *within* subgroup inequality (or: the contribution of subgroup *j* to the total inequality T). The *between* component (i.e., the contribution of the inequality among subgroups to the total inequality) is given by $(\sum_{j=1}^{m} s_j \times \ln\frac{\overline{x_j}}{\bar{x}})$.

2.4 Scope, objectives and limitations of concentration analysis in this chapter

The combined datasets allow for (1) an assessment of ownership and concentration in 2018; (2) an assessment of the contributions of different subgroups to inequality (concentration); (3) an assessment of how concentration has evolved over the period 2008-2018; (4) analysis of sensitivity with regards to the inclusion of increasing hierarchical levels of vessel ownership.

The scope of analysis at the different hierarchical levels is dictated by the data. The 2018 vessel and respective owner datasets contain information for a thorough analysis of ownership and concentration. The link between the fishing vessels and their holding firms is provided by the Vessel-Company Register, which is only available for 2018. Concentration analysis for all hierarchical levels could thus only be carried out for the 2018 population. For the evolution of concentration between 2008 and 2018, analysis was limited to the only two levels contained within the *Harmonie* and *SACROIS* databases: the vessel and operator levels. Table 3-8 shows an overview of the levels of analysis considered for this chapter.

[92] Parameter α can range between −∞ and +∞. For large and positive α, the index is especially sensitive to the existence of large values, whereas for small (negative) α the index is especially sensitive to small values in the population.

[93] After initial data exploration and the application of both Theil indices, Theil's L was retained as Theil's T resulted in 'inf' [infinite] values for some combinations.

Table 3-8: Overview of metrics for concentration analysis at different levels. The table contains all levels at which analysis is possible, given the current datasets.

Objective	Vessel	Operator	SIREN, DUO, GUO, inferred owner	Remarks
Concentration in 2018 and sensitivity analysis	Population: kW, GT, volume and value of landings Subfleets: kW, GT, volume and value of landings	Population: number of vessels, kW, GT, volume and value of landings Subfleets: number of vessels, kW, GT, volume and value of landings	Population: number of vessels, kW, GT, volume and value of landings Subfleets: number of vessels, kW, GT, volume and value of landings	Priority is given to volume of landings as a metric for concentration analysis. Where possible, analysis is carried out at the highest hierarchical level (i.e., the inferred owner), unless analysis on lower hierarchical levels is deemed more relevant.
Decomposition of concentration by relevant subgroups (Theil Index)	Population: kW, GT, volume and value of landings Subfleets: kW, GT, volume and value of landings	Population: number of vessels, kW, GT, volume and value of landings Subfleets: number of vessels, kW, GT, volume and value of landings	No analysis possible	Priority is given to volume of landings as a metric for concentration analysis. Relevant explanatory variables were available only at the vessel and operator levels.
Evolution of concentration	Population: kW, GT, volume and value of landings Subfleets: no analysis possible	Population: number of vessels, kW, GT, volume and value of landings Subfleets: no analysis possible	No analysis possible	Beyond the operator, no analysis of evolution is possible because ownership data at these levels are not available before 2018. Furthermore, for subfleets, analysis was not possible due to time constraints (see footnote 88)

Secondly, there are also limitations related to the choice of fleet segmentations used for disaggregated analysis through the decomposition of the Theil Index. Such variables are available on the vessel level, and, to some extent, on the operator level. However, they are lacking for all subsequent hierarchical levels, for which these variables cannot easily be aggregated. Explanatory variables include:

- On the vessel level: fishing gear, fleet segment (size classes), port of attachment (maritime district);
- On the operator level: average vessel size (≤12 m; >12 m) (see footnote 87), postal code, operator age class.

We follow Bellanger *et al.* (2016) in their use of the Theil Index as the main quantitative tool for assessing subgroup contributions to overall inequality in the population. The authors emphasize that, in comparing two situations (e.g., 2008 and 2018), attention should be given not only to the changes in the within and between group components, but also to the change in subgroup means, as well as the deviation from the population mean. Indeed, changes in group contributions only indicate that their relative contributions to what is being measured have changed. An increase/decrease in the contribution of a specific group between 2008 and 2018 indicates that the distribution has become more heterogeneous/homogeneous, but does not say anything about how the within subgroup mean has changed. Bellanger *et al.* (2016) aptly point out that inequality indices measure *variability*, and do not quantify *trends* per se. Finally, following MRAG *et al.* (2019), we also include the percentage of foreign ownership in our analysis. This is relevant because of the relative stability principle of the Common Fisheries Policy and Member States' preoccupation with keeping fishing quotas under their control (Lequesne, 2000).

Given the complexity of this chapter due to a multitude of (i) case studies, (ii) hierarchical ownership levels, (iii) production/capacity metrics, (iv) concentration indices and (v) objectives, we have included a table that summarizes what can be expected in the remainder of this chapter (Table 3-9).

Table 3-9: Overview of analyses included in this chapter at different levels. WHB = Blue whiting, HKE = European hake, SCE = scallops, POK = saithe.

	Case studies					Ownership levels							Metrics			
	Pop.	WHB	HKE	SCE	POK	Ves.	Op.	Firm	ISH	DUO	GUO	Own_inf	Volume	Value	GT	kW
Concentration in 2018	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sensitivity analysis	X	-	-	-	-	X	X	X	X	X	X	X	X	X	X	X
Decomposition of concentration	X	-	-	-	-	X	X	-	-	-	-	-	X	-	-	-
Evolution of concentration	X	-	-	-	-	X	X	-	-	-	-	-	X	-	-	-

3 Results

For the purpose of this chapter, we will focus our analyses primarily around volume of landings. The volume and value of landings best represent an entity's market share and can thus be used to assess the concentration of *production*. Priority here is given to volume, and not value, as the latter depends on the structure of the market as well as actors' abilities to valorize their products (which could not be taken into account here). For a full understanding of the extent of concentration, however, it is important to simultaneously look at different metrics such as fishing capacity expressed as number of vessels owned by an entity, their cumulative gross tonnage (GT) and engine power (kW). These metrics can be used to infer something about the ownership and concentration of *physical assets*. This is important to account for all fishing vessels present in the fleet (some of which were inactive and did not contribute to total production in 2018 - see footnote 86). Yet, these vessels present an important *catch potential* for the entities owning them – be it through their future deployment or replacement with a new vessel. These metrics will be included for some analyses, but only where it is necessary to provide additional context.

The Results section is organized as follows. First, we will analyze the datasets to describe major evolutions in vessel ownership in the French Atlantic fishing sector, based on ownership information on the operator level, as included in the fleet register. Second, we will conduct a more thorough analysis of concentration through the calculation of concentration indices. We will do this for the entire population (for which we will also include a sensitivity analysis), and for the different subfleets. Third, we will assess changes in concentration over the period 2008-2018 based on a selection of concentration indices (only on the level of the entire population). Fourth, we will use the decomposability property of the Theil Index to evaluate the contributions of specific subgroups to inequality.

3.1 Trends in multi-vessel ownership based on fleet register data

Figure 3-4 shows the evolution of vessel holdings (number of vessels per operator) between 2008 and 2018. The stacked bars show the proportions of n vessel firms in each year; the line graphs show the evolution of total number of vessels and operators in the reference period.

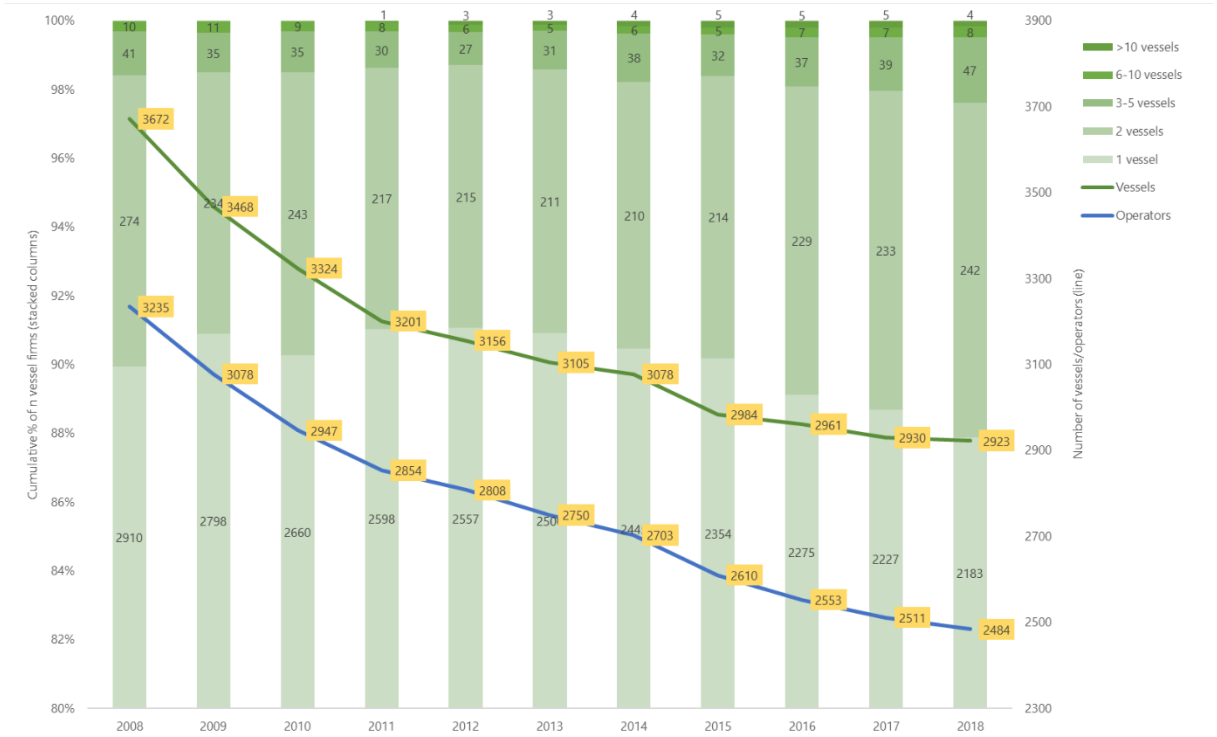


Figure 3-4: Evolution of vessel ownership in the French Atlantic harvesting sector. Line graphs: evolution of number of vessels and operators. Stacked bars: relative proportions of n vessel operators. For a larger figure, see Supplementary Materials (Annex 3.1).

The graph shows a decline of 25% in the number of single vessel holdings between 2008 and 2018, while increases in the number of multi-vessel holdings are rather dismal. As both the number of vessels and the number of operators decline, the relative share of multi-owners (and multi-owned fishing vessels), becomes greater. Until 2012, we see similar rates of decline in both operators and vessel numbers (in line with Quillérou and Guyader, 2012). From 2013 onwards, operator numbers start declining faster than vessel numbers, while multi-ownership starts increasing – indicating that the vessels of exiting operators were being bought up by remaining operators (see Table 3-10).

Table 3-10: Rate of decline in vessel and operator numbers, 2008-2018.

	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18
Vessels	-5.5%	-4.2%	-3.7%	-1.4%	-1.6%	-0.9%	-3.1%	-0.8%	-1.0%	-0.2%
Operators	-4.9%	-4.3%	-3.2%	-1.6%	-2.1%	-1.7%	-3.4%	-2.2%	-1.6%	-1.1%

Furthermore, while total GT and kW stabilize in 2012, GT and kW per vessel and per operator start increasing around that time (Table 3-11). This indicates a surge in investment in the sector, at least by a part of the operator population.

Table 3-11: Average number of vessels, kW and GT per operator, 2008-2018.

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Ves/op	1.14	1.13	1.13	1.12	1.12	1.13	1.14	1.14	1.16	1.17	1.18
kW/op	209	205	203	200	202	205	208	211	218	220	225
GT/op	5287	5165	5061	4927	4896	4980	5106	5177	5446	5475	5746

In 2008, multi-owned fishing vessels represented 21% of the total vessel population, in 2018 this was 25%. It must be noted, however, that in absolute terms, the number of multi-owned fishing vessels decreased from 762 in 2008 to 740 in 2021 (Table 3-12).

Table 3-12: Multi-ownership of fishing vessels: 2008 vs. 2018.

n vessel firms	Number of vessels concerned	
	2008	2018
Operators with 1 vessel	2910 (79%)	2183 (75%)
Operators with 2 vessels	548 (15%)	484 (17%)
Operators with 3-5 vessels	135 (4%)	149 (5%)
Operators with 6-10 vessels	79 (2%)	57 (2%)
Operators with > 10 vessels	0 (0%)	50 (2%)

The stacked bar plot of Figure 3-4 shows that there has been a steady decline in single vessel holdings since 2011, both proportionally and in absolute numbers. The proportion of 2 vessel holdings has remained relatively stable over the same period (7.2% on average between 2011 and 2018, SD=0.5). In 2014, the proportion of 2 vessel holdings, 3-5 vessel holdings and 6-10 vessel holdings starts to increase. Holdings with more than 10 vessels make their appearance for the first time in 2011 (i.e., 1 company with 11 vessels). In 2018, there are 4 such companies, good for 50 vessels and responsible for 15.6% of total landings in volume and 11.3% in value (Figure 3-5).

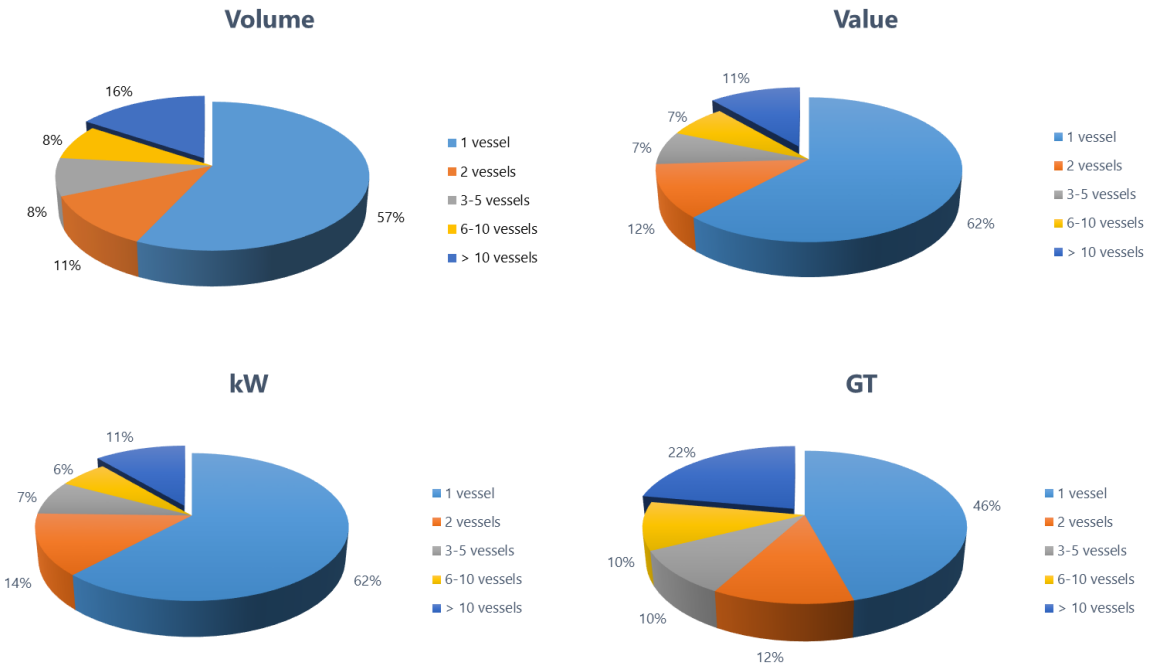


Figure 3-5: Share of landed volume, landed value, kW, GT by n vessel holdings in 2018 (operator data). The share of >10 vessel holdings is emphasized.

Finally, an exploration of vessel size classes present in each of these n vessel holdings (2008 vs. 2018) shows that multi-vessel ownership has increased across all classes of vessel size (Table 3-13). In 2018, holdings with more than 10 vessels were present in all but the two smallest size categories. However, operators with only one vessel are still dominant in all size classes, except for vessels ≥40 m. In 2008, vessels in this size class were predominantly owned by vessel holdings operating 6-10 vessels (65%), whereas by 2018, this had shifted to entities with >10 vessels (44%) (with 6-10 vessel holdings still accounting for 28% of ≥40 m vessels), suggesting that this is due to gradual growth of fishing companies (see Chapter 1).

From this first exploration based on fleet register data (i.e., vessel holdings on the level of the operator as defined in the fleet register), we can conclude that multi-vessel ownership has increased in the period 2008-2018. While the data clearly point towards the accumulation of fishing vessels across fleet segments (however most pronounced for vessels ≥40 m), the analysis is insufficient to draw conclusions with regard to industry concentration. Furthermore, it must also be noted that the use of fleet register data is likely an underestimation of actual vessel ownership, as established in section 4.1.1 of Chapter 2.

Table 3-13: Distribution of vessel size classes over operator categories, 2008 versus 2018. Cat.%: indicates the distribution of vessels of a given size category among operator categories. Pop.%: indicates the share that vessels of a given size class represent in the total in each of the operator categories.

2008	**<10m**			**[10-12[m**			**[12-18[m**			**[18-24[m**			**[24-40[m**			**≥40m**		
	Ves.	Cat. %	Pop. %	Ves.	Cat. %	Pop. %	Ves.	Cat. %	Pop. %	Ves.	Cat. %	Pop. %	Ves.	Cat. %	Pop. %	Ves.	Cat. %	Pop. %
Operators with 1 vessel	1486	80%	40%	650	84%	18%	461	85%	13%	238	69%	6%	70	57%	2%	5	13%	0%
Operators with 2 vessels	311	17%	8%	103	13%	3%	57	11%	2%	55	16%	1%	18	15%	0%	4	10%	0%
Operators with 3-5 vessels	54	3%	1%	18	2%	0%	20	4%	1%	21	6%	1%	17	14%	0%	5	13%	0%
Operators with 6-10 vessels	0	0%	0%	0	0%	0%	2	0%	0%	33	10%	1%	18	15%	0%	26	65%	1%
Operators with > 10 vessels	0	0%	0%	0	0%	0%	0	0%	0%	0	0%	0%	0	0%	0%	0	0%	0%
Totals	1851	100%	50%	771	100%	21%	540	100%	15%	347	100%	9%	123	100%	3%	40	100%	1%
2018	**<10m**			**[10-12[m**			**[12-18[m**			**[18-24[m**			**[24-40[m**			**≥40m**		
	Ves.	Cat. %	Pop. %	Ves.	Cat. %	Pop. %	Ves.	Cat. %	Pop. %	Ves.	Cat. %	Pop. %	Ves.	Cat. %	Pop. %	Ves.	Cat. %	Pop. %
Operators with 1 vessel	1141	76%	39%	540	80%	18%	304	78%	10%	137	63%	5%	58	54%	2%	3	9%	0%
Operators with 2 vessels	284	19%	10%	106	16%	4%	45	12%	2%	28	13%	1%	19	18%	1%	2	6%	0%
Operators with 3-5 vessels	72	5%	2%	22	3%	1%	20	5%	1%	17	8%	1%	14	13%	0%	4	13%	0%
Operators with 6-10 vessels	5	0%	0%	10	1%	0%	7	2%	0%	15	7%	1%	11	10%	0%	9	28%	0%
Operators with > 10 vessels	0	0%	0%	0	0%	0%	12	3%	0%	19	9%	1%	5	5%	0%	14	44%	0%
Totals	1502	100%	51%	678	100%	23%	388	100%	13%	216	100%	7%	107	100%	4%	32	100%	1%

3.2 Industry concentration at different hierarchical levels

3.2.1 Atlantic fleet in 2018

Table 3-14 shows the number of n vessel entities for each hierarchical level (operator, SIREN, ISH, DUO, GUO, inferred owner). The results confirm that multi-vessel ownership is underestimated when considering only the operator level (i.e., 2183 operators own 1 vessel compared to only 1974 SIRENs). At the level of the inferred owner, the number of 1 vessel entities is 14% lower than at the operator level. The difference of 5% between the inferred owner and the GUO level is due to the 96.2% of SIREN numbers that have shareholder information in Orbis. At the level of the GUO, these companies were considered to be their own GUO, but when using the inference method developed in Chapter 2 (based on role hierarchies), it becomes clear that many of these vessels are in fact part of multi-vessel entities (see for example the case study of Fisher X in section 4.2.3 of Chapter 2).

Table 3-14: The number of n vessel entities for each hierarchical level (n ranges from 0.5 to 22 vessels). Entities are shown in order of increasing hierarchy. Note that for the GUO non-natural numbers appear in the first column, due to the fact that vessel ownership was shared among multiple GUOs. Such numbers do not occur at the inferred owner level because of the methodological choice explained in section 2.2.2.

Number of vessels owned	Operator	SIREN	ISH	DUO	GUO	Inferred owner
0.5(*)	-	-	-	-	10	-
1	2183	1974	1972	1969	1963	1874
2	242	281	281	280	279	299
3	40	59	59	60	60	60
4	6	17	16	15	15	16
4.5(*)	-	-	-	-	2	-
5	1	2	3	4	4	4
6	4	4	4	4	3	7
6.5(*)	-	-	-	-	2	-
7	1	-	-	-	-	1
8	2	3	2	2	2	2
9	-	-	-	-	-	3
10	1	1	1	1	1	1
11	1	2	2	1	1	1
12	1	1	1	2	2	2
13	1	2	1	1	-	1
14	1	1	1	1	1	1
21	-	-	1	1	1	-
22	-	-	-	-	-	1

Table 3-15 shows how this underestimation affects the calculation of concentration and inequality indices. The table shows concentration indices for each hierarchical level, calculated using different metrics: number of vessels, volume of landings, value of landings, kW and GT. At first glance, we see that the index values are consistently higher for higher hierarchical levels. This is in line with the expectations, of course, as they are computed using metric values that are aggregated on these levels. Note that, in passing from the DUO to the GUO level, index values go slightly down for number of vessels. This is due to a slight disaggregation at this level related to dispersed ownership. Indeed, some fishing companies have multiple GUOs, thus dividing the metric's value over all GUOs (based on their percentage ownership shares). For hierarchical levels below the DUO and GUO, there is a 1:1 relationship between a vessel and its holding entity. For the inferred owner, we have assumed a 1:1 relationship out of methodological considerations (see paragraph 2.2.2).

Table 3-15: Concentration and inequality indices on different hierarchical levels (2018).

CR4	Vessel	Operator	SIREN	ISH	DUO	GUO	Inferred owner
No. vessels	0.001	0.017	0.018	0.021	0.021	0.020	0.021
Volume	0.131	0.263	0.316	0.321	0.321	0.321	0.358
Value	0.052	0.158	0.170	0.176	0.176	0.181	0.207
kW	0.028	0.140	0.144	0.150	0.150	0.147	0.166
GT	0.085	0.309	0.321	0.330	0.330	0.345	0.392
CR8							
No. vessels	0.003	0.028	0.031	0.034	0.035	0.033	0.035
Volume	0.181	0.346	0.381	0.386	0.386	0.396	0.410
Value	0.083	0.205	0.226	0.233	0.236	0.245	0.264
kW	0.055	0.175	0.189	0.195	0.196	0.202	0.212
GT	0.150	0.403	0.431	0.440	0.442	0.454	0.470
CR20							
No. vessels	0.007	0.048	0.054	0.056	0.056	0.055	0.064
Volume	0.289	0.430	0.457	0.462	0.465	0.469	0.488
Value	0.152	0.282	0.305	0.311	0.316	0.317	0.347
kW	0.119	0.231	0.250	0.253	0.256	0.256	0.276
GT	0.304	0.490	0.514	0.519	0.522	0.523	0.551
HHI							
No. vessels	0.000	0.001	0.001	0.001	0.001	0.001	0.001
Volume	0.008	0.027	0.036	0.036	0.036	0.037	0.040
Value	0.002	0.011	0.012	0.012	0.012	0.013	0.015
kW	0.001	0.009	0.010	0.010	0.010	0.010	0.011
GT	0.006	0.045	0.047	0.048	0.048	0.050	0.056
Gini							
No. vessels	0.000	0.137	0.175	0.176	0.177	0.179	0.196
Volume	0.809	0.834	0.842	0.842	0.843	0.843	0.865
Value	0.680	0.714	0.724	0.725	0.726	0.725	0.762
kW	0.493	0.543	0.557	0.558	0.559	0.559	0.578
GT	0.817	0.847	0.853	0.854	0.855	0.854	0.866
Theil							
No. vessels	0.000	0.093	0.121	0.126	0.128	0.126	0.146
Volume	1.704	2.205	2.362	2.378	2.386	2.405	2.510
Value	0.962	1.371	1.438	1.459	1.469	1.481	1.608
kW	0.542	0.953	1.005	1.021	1.028	1.033	1.115
GT	1.769	2.557	2.631	2.656	2.665	2.701	2.849

Below, a closer inspection of the inequality indices at the level of the inferred owner is given – with a focus on volume. The Theil Index is not discussed here, but in paragraph 3.4.

Respectively 35.8%, 41.0%, and 48.8% of volume is captured by the 4, 8 and 20 largest entities in the population ($n_{\text{inferred owner}}$ = 2273). This is matched with relatively low values for vessel numbers (2.1%, 3.5% and 6.4%, respectively), and relatively high values for GT (39.2%, 47.0% and 55.1%). CR4 for these different metrics are largely the same companies, and also for CR8 there is a strong association. This indicates market dominance by a small number of fishing companies operating a few large fishing vessels. Furthermore, for all metrics 3 out of the 4 entities are foreign (Dutch) owned. For CR8 based on volume, 3 entities are Dutch, 1 entity is Spanish, 1 entity is Irish, and 1 entity is Italian.

For given distribution, HHI ranges from 4×10^{-4} (calculated as 1/N = 1/2273) to 1. Based on volume the HHI was 0.040, suggesting that the industry as a whole is not concentrated (cf. Brezina *et al.*, 2016). Yet, the Gini coefficient of 0.865 points towards a high degree of inequality in the distribution across entities. Figure 3-6 shows the Lorenz curves for volume and value of landings, kW and GT (inferred owners). The curves show that 25% of owners are responsible for ca. 90% of the catch in terms of volume, and ca. 80% in terms of value. Capacity (GT) ownership is also highly unequal, with ca. 95% of capacity owned by 25% of owners at the upper end of the distribution. The distribution of kW is more equal, which is due to the fact that kW as a measure of capacity is only loosely associated with vessel ownership (number of vessels) and volume of landings, as small vessels may have disproportionally high engine power. An example are small vessels (<10 m, often <6 m) targeting linefish species such as seabass (*Dicentrarchus labrax*) and pollock (*Pollachius pollachius*), which requires high-powered engines to move around between fishing grounds.

While the low HHI suggests low concentration, the high Gini coefficients point towards high levels of inequality. In combination with a low HHI, a high Gini coefficient suggests that volume

(or value) of landings is shared among many small players, and only a few large players. This is indeed the case at the level of the French Atlantic fleet (Table 3-14). In Supplementary Materials (Annex 3.1), we have included histograms and frequency tables for all case studies.

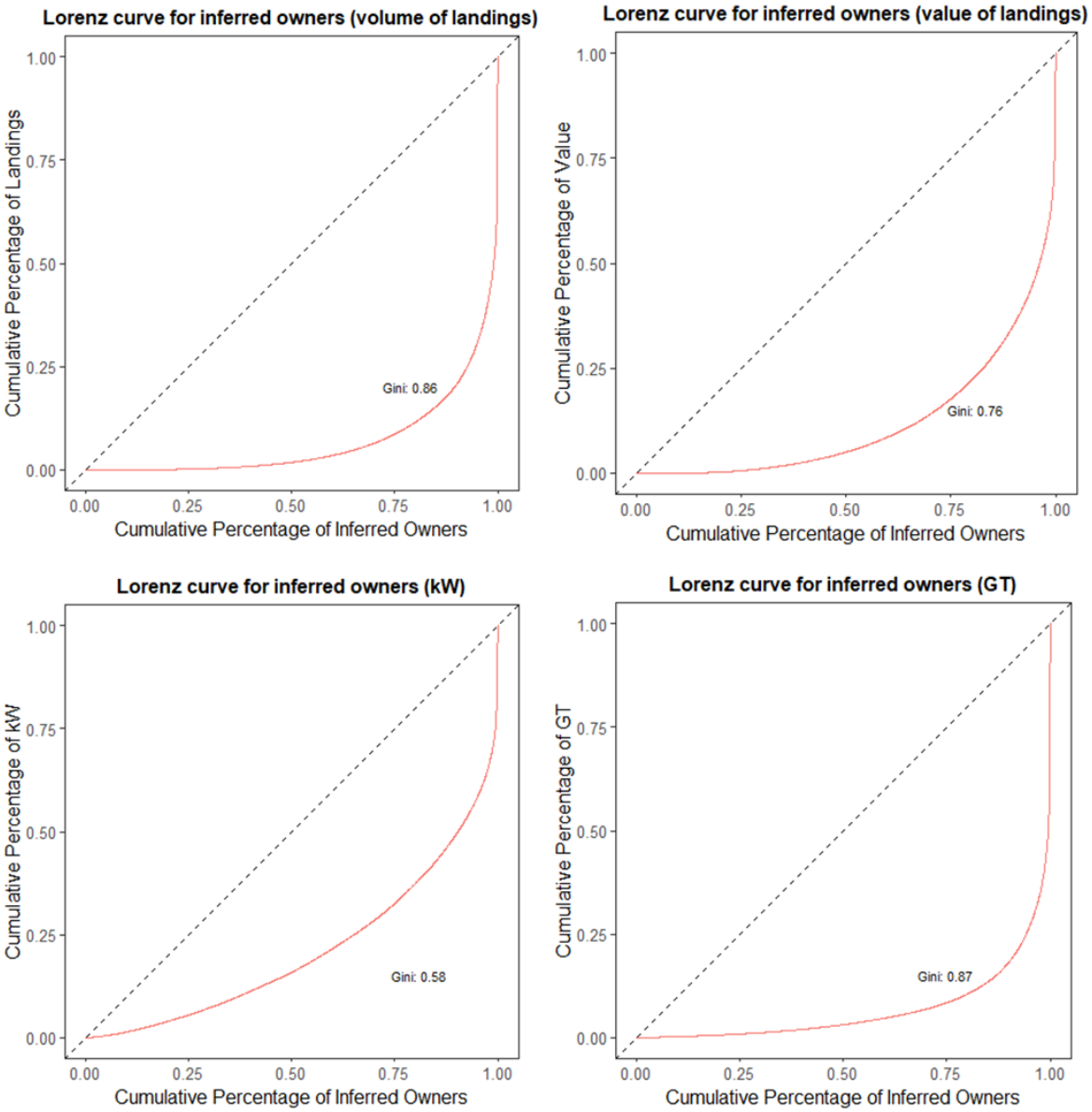


Figure 3-6: Lorenz curves for inferred owners (2018).

3.2.2 Case studies

Table 3-16 summarizes the concentration and inequality indices for each of the case studies (inferred owner only). Concentration is particularly high for blue whiting and saithe. For blue whiting, 4 entities are responsible for virtually all of the production. In fact, the two largest producers account for 80.4% and 17.8% of production, respectively. Both of these ultimate owners are Dutch companies. Saithe is present in the catches of 453 vessels. Yet, of the 338 inferred owners, only 4 are responsible for 99.7% of catches. As such, almost the entire production of saithe in France is foreign owned – mainly by Dutch entities (n=2; 98.2% of volume). The others are Spanish (n=1; 1.4% of volume) and Irish entities (n=1; negligible). A similar situation occurs for blue whiting, in which the same two Dutch companies jointly own 99.9% of production.

Table 3-16: Concentration and inequality indices (inferred owner) for each of the case studies, by increasing level of concentration. 'N' denotes the number of ultimate owners for each case study. The ranges of the Herfindahl-Hirschman Index are indicated in the table.

	Scallops	Hake	Blue whiting	Saithe
CR4	**N=634**	**N=783**	**N=32**	**N=338**
No. vessels	0.039	0.049	0.222	0.106
Volume	0.088	0.315	1.000	0.997
Value	0.097	0.332	1.000	0.994
kW	0.060	0.147	0.627	0.286
GT	0.100	0.280	0.881	0.473
CR8				
No. vessels	0.056	0.080	0.333	0.168
Volume	0.123	0.423	1.000	0.997
Value	0.131	0.437	1.000	0.995
kW	0.085	0.218	0.744	0.406
GT	0.142	0.369	0.958	0.585
CR20				
No. vessels	0.093	0.140	0.667	0.254
Volume	0.198	0.646	1.000	0.999
Value	0.211	0.660	1.000	0.997
kW	0.144	0.322	0.910	0.542
GT	0.225	0.497	0.992	0.718
HHI	**[0.0016-1]**	**[0.0013-1]**	**[0.0313-1]**	**[0.0030-1]**
No. vessels	0.002	0.002	0.035	0.006
Volume	0.007	0.043	0.580	0.679
Value	0.008	0.044	0.576	0.676
kW	0.003	0.009	0.172	0.030
GT	0.007	0.027	0.358	0.078
Gini				
No. vessels	0.111	0.193	0.102	0.239
Volume	0.603	0.926	0.950	0.995
Value	0.611	0.929	0.950	0.995
kW	0.340	0.569	0.635	0.668
GT	0.535	0.800	0.878	0.860
Theil				
No. vessels	0.078	0.178	0.051	0.264
Volume	0.703	2.562	2.849	5.245
Value	0.738	2.614	2.843	5.226
kW	0.249	0.841	0.966	1.195
GT	0.600	1.744	2.011	2.139

The HHI indicates that both the blue whiting and the saithe fisheries are heavily concentrated. For the scallops and hake subfleets, concentration is low. However, the Gini coefficient for hake is high (0.926 for volume), suggesting considerable inequality among producers. Figure 3-7 shows the Lorenz curves for all case studies (the Atlantic fleet is plotted as a reference). For hake, the 96% 'least producing' entities jointly make up for only 25% of the catch. This means that ca. 4% of producers are responsible for 75% of the catch. This corresponds to 33 entities, 24 of which are owned by Spanish fishing families (73%). Furthermore, one entity is an Irish fishing company, and one is a Dutch fishing company – it concerns the same entities mentioned above for the blue whiting and saithe fisheries.

Compared to other subfleets, inequality in the scallop fishery is much lower. Yet, the 50% least producing entities jointly produce only 9.2% of total scallop catch. The four dominant firms

produce 8.8% of landings. The dominant firm operates 13 vessels and is responsible for 5.7% of landings. The second firm only produces 1.1% of landings, with 3 vessels.

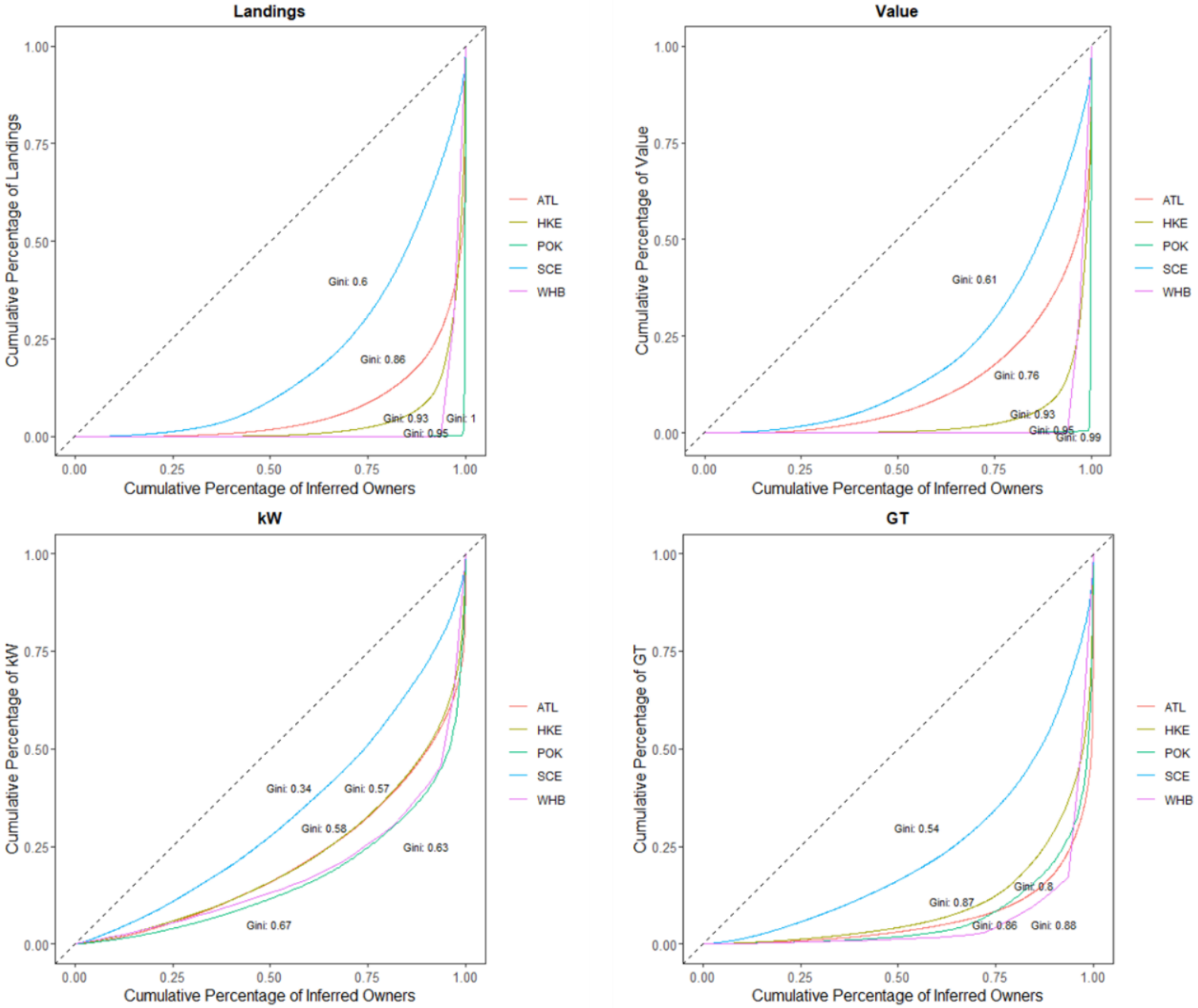


Figure 3-7: Lorenz curves for all case studies, for landings (volume and value), kW and GT.

3.3 Evolution of industry concentration 2008-2018

A detailed analysis of the evolution of concentration could not be provided for the hierarchical ownership levels extracted from Orbis due to data limitations (see footnote 88). However, an analysis on the level of the operator could be included. Above, we have established that concentration measures increase when calculating them at a higher hierarchical level. We may assume, for now, that any increase in concentration on the operator level corresponds to an increase on all other levels. Table 3-17 shows the evolution of concentration indices based on volume of landings on the level of the vessel and the operator.

Table 3-17: Evolution of concentration indices (volume of landings) between 2008 and 2018 (vessel and operator level).

	Index	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Vessel	CR4	0.129	0.062	0.151	0.073	0.125	0.136	0.141	0.127	0.116	0.121	0.131
	CR8	0.172	0.094	0.180	0.107	0.160	0.181	0.183	0.165	0.159	0.168	0.181
	CR20	0.258	0.165	0.240	0.184	0.239	0.273	0.264	0.259	0.258	0.271	0.289
	HHI	0.006	0.003	0.014	0.003	0.007	0.007	0.008	0.007	0.007	0.007	0.008
	Gini	0.798	0.783	0.800	0.778	0.792	0.807	0.811	0.820	0.822	0.821	0.825
	Theil	1.594	1.276	1.612	1.292	1.470	1.589	1.595	1.646	1.635	1.658	1.704
Operator	CR4	0.171	0.119	0.194	0.112	0.166	0.169	0.176	0.208	0.227	0.246	0.263
	CR8	0.251	0.163	0.231	0.170	0.228	0.242	0.258	0.317	0.326	0.332	0.346
	CR20	0.331	0.236	0.297	0.254	0.320	0.342	0.360	0.411	0.415	0.427	0.430
	HHI	0.010	0.006	0.016	0.006	0.010	0.011	0.012	0.016	0.019	0.023	0.027
	Gini	0.811	0.796	0.808	0.790	0.805	0.820	0.828	0.844	0.846	0.846	0.846
	Theil	1.824	1.494	1.765	1.491	1.699	1.800	1.863	2.091	2.126	2.175	2.205

Figure 3-8 shows the evolution of concentration ratios (CR4, CR8 and CR20) and the Gini coefficient between 2008 and 2018. An increase is observed for all indices, and across all metrics (volume, value, GT, kW). A pronounced increase was found for concentration ratios across metrics – e.g., an increase of 10% based on volume. More precisely, where the 4 largest operators jointly produced 17% of landings in 2008, this was 26% in 2018. The sharp increase in 2010 cannot be explained based on the data, but may be related to a good year for one or several target species.

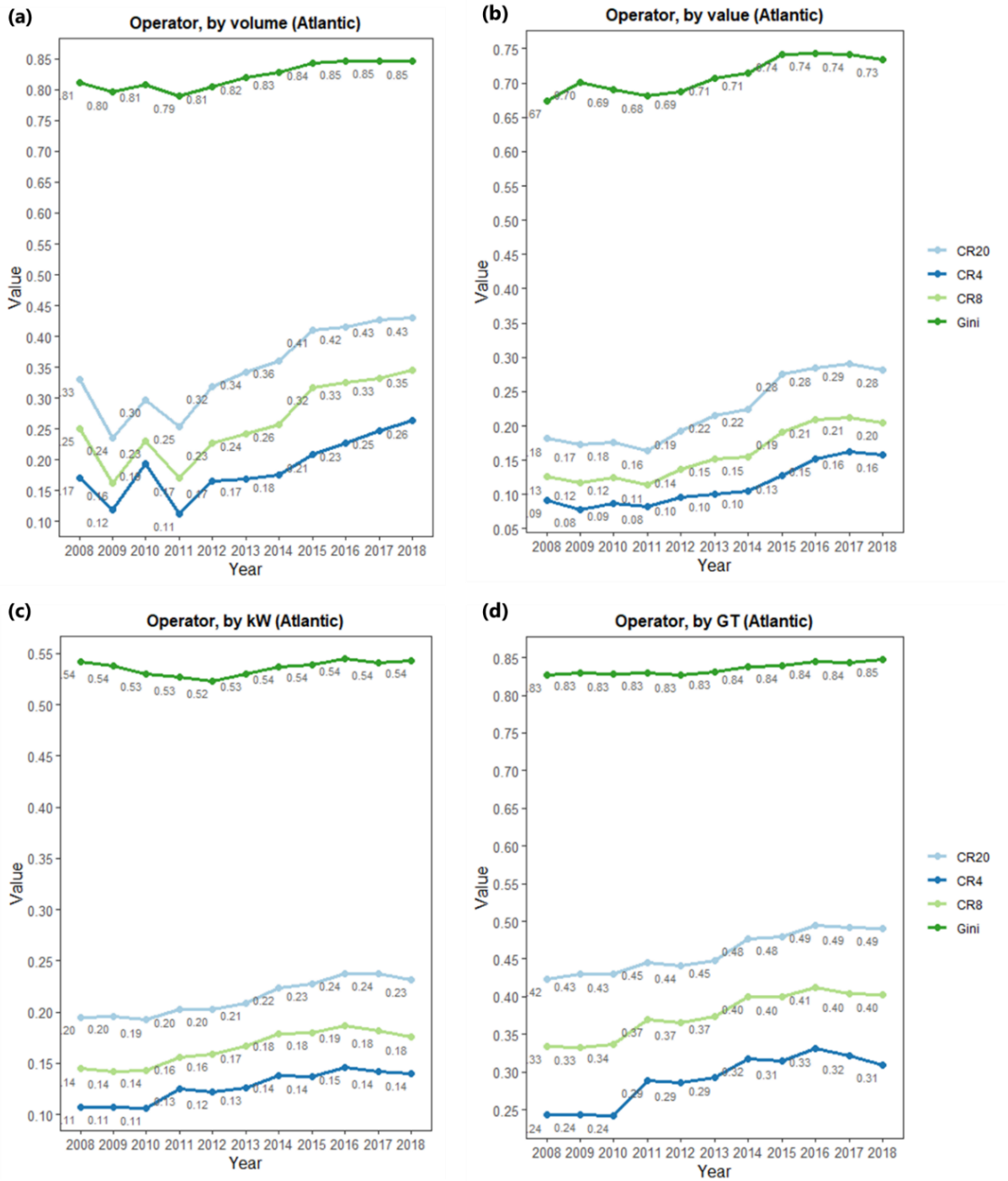


Figure 3-8: Evolution of concentration indices between 2008 and 2018 (CR4, CR8, CR20, Gini coefficient), by operator.

For calculations based on GT, the increase in concentration happens in discrete 'jumps'. These jumps are most pronounced for CR4, but are also present for CR8 and CR20. Upon closer inspection, we find that the same four operators have been dominant over most of this period in terms of total GT held. The two top operators have retained their dominant position since 2011[94], while the two operators below them have alternately occupied the 3rd and 4th position.

[94] In fact, this trend can actually be traced back to 2008. Mergers and subsequent name changes may act as a confounding factor.

In contrast to the CRs, the Gini coefficient shows only incremental changes over the period 2008-2018. The Gini coefficient is relatively high across years in comparison with other inequality indices. This is due to the fact that landings are shared among many small players, and only a few large players (see histogram in Supplementary Materials, Annex 3.1). The data have been skewed in this manner over the entire period 2008-2018, which results in high Gini coefficients across years. Figure 3-9 shows the Lorenz curves for 2008 and for 2018. Let us consider the curves for landed volume and value. For the first 50% of operators, the curves coincide, meaning that the cumulative share of landings of the 50% least producing operators has not changed over this entire period. For the second half of operators (and more so for the last 25%), inequality has increased. In other words, change has happened mainly in the upper part of the operator population. A similar pattern in the GT curve (albeit more skewed towards the upper end of the distribution) suggests that this is linked to the ownership and exploitation of large vessels.

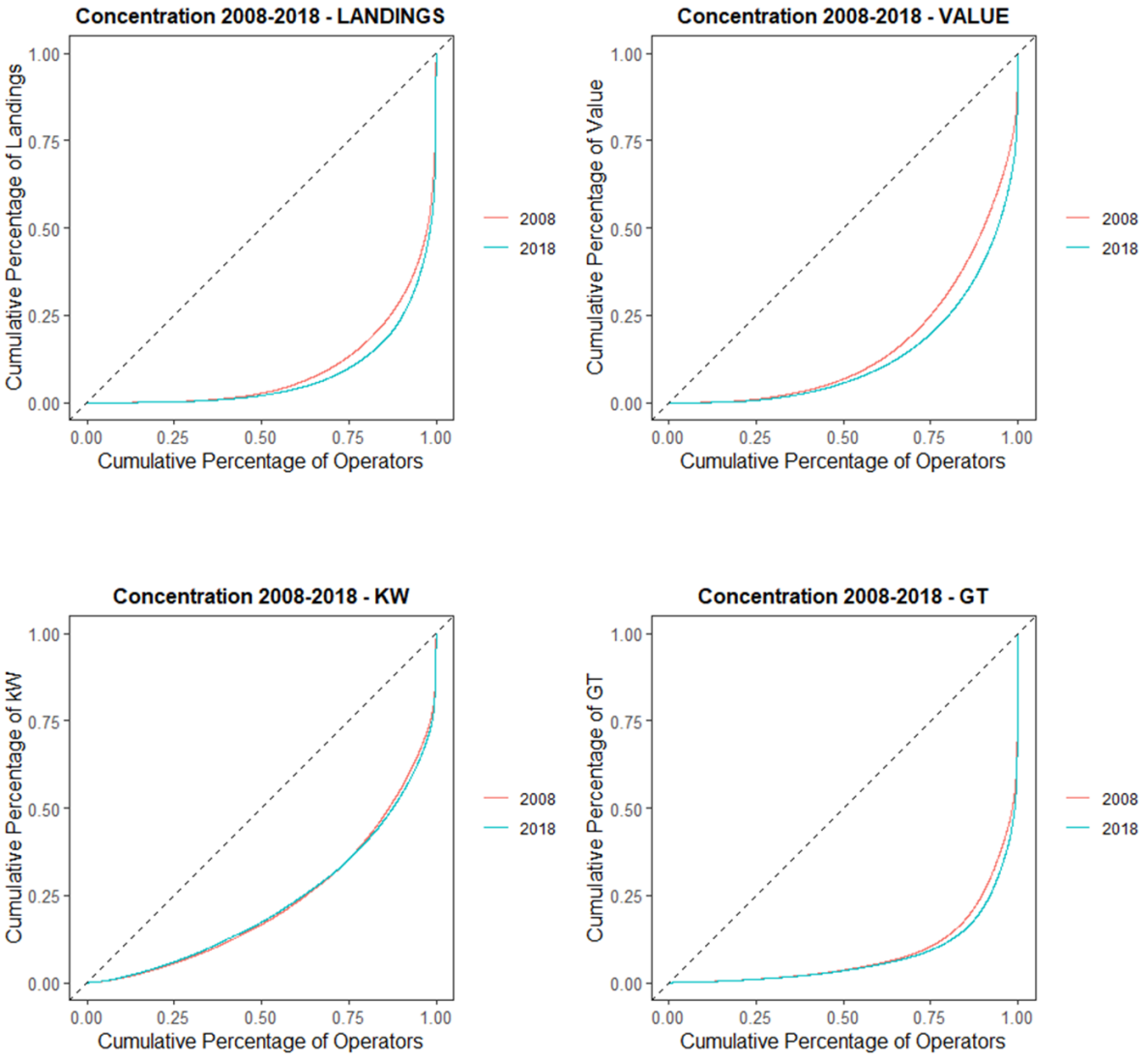


Figure 3-9: Lorenz curves for volume and value of landings, kW and GT (operator level): 2008 vs. 2018.

The HHI has tripled between 2008 and 2018, but the change (Δ) over that period equals 0.02 which, combined with the current value (0.027) is unlikely to harm competition (see Table 3-7).

3.4 Contribution of subgroups to concentration: the decomposition of the Theil Index

The contribution of different subgroups to the inequality observed in the French Atlantic fishing sector was evaluated based on the decomposability property of the Theil Index. Two levels were considered, the vessel and operator, each with a number of fleet segmentation criteria. On the vessel level: fishing gear, fleet segment (size classes), port of attachment (maritime district); on the operator level: average vessel size (≤12 m, >12 m), postal code, operator age class.

As mentioned earlier, this choice is mostly dictated by the data as these explanatory variables were not available at all hierarchical levels. While aggregation is difficult for variables such as fishing gear and vessel size due to the variation within a single entity, geographical, demographic or other variables could in principle be considered. For the purpose of this chapter, however, we limit ourselves to the variables presented above, for two hierarchical levels. We will do this only for the Atlantic fleet as a whole.

Figure 3-10 and Figure 3-12 show the contributions of the relevant subgroups on the vessel and operator levels, respectively. The Theil Index is calculated based on landings (volume). Small subgroup contributions indicate that the distribution within the subgroup is homogeneous. When the contribution is large, values in the subgroup are distributed in a heterogeneous manner. The between-groups component indicates how much of the total inequality is explained by differences between the groups (based on differences in subgroup means). As such, a large between-groups component implies substantial differences between subgroups and high homogeneity within subgroup categories.

3.4.1 On the vessel level

The decomposition of inequality based on gear shows a large within-subgroup contribution for exclusive trawlers (*chalutiers exclusifs*), indicating a high degree of variability within this subgroup. The second largest contribution is by dredgers, other subgroups are more homogeneous in their distribution of landings. The high contribution to inequality by exclusive trawlers is likely related to their weak association with any particular size class. Indeed, analysis shows that exclusive trawlers make up large proportions of landings in most size classes, with highest proportions found in [18-24[m (73.1% of landings), [24-40[m (47.6%) and ≥40 m (55.4%) (see Supplementary Materials, Annex 3.1).

The decomposition based on fleet segment shows a large between-subgroups component, indicating that there are important differences in terms of landed volume between fleet segments that contribute to overall inequality. It furthermore indicates that size class is a well-chosen segmentation criterion for the analysis at hand. While the distribution of landings within subgroups is quite homogeneous across the entire spectrum, higher degrees of heterogeneity are found at the lower end of the size spectrum (<10 m; [10-12[m), and, to a lesser extent, at the higher end of the size spectrum (≥40 m). Higher variation in landings within the smaller fleet segments are in line with what could be expected, given the high variation in species and gears used in these segments. The most homogeneous (i.e., “equal”) are the [18-24[m and [24-40[m subgroups. This may be due to a higher degree of standardization associated with the dominant métiers in these groups[95], but this could not be confirmed by the data. Further analysis of landings by species at the vessel level is needed for this.

The decomposition based on maritime district shows a relatively high degree of heterogeneity in the Fécamp (FC) and Concarneau (CC) districts (see Figure 3-2). In Fécamp, within group variation is high, despite the fact that 95.6% of landings are by exclusive trawlers. Of these, 94.3% are by trawlers ≥40 m. This indicates that variation in landings is large for this specific

[95] [18-24[m: exclusive trawlers (73.1%); [24-40[m: exclusive trawlers (47.6%), netters (26.7%), longlining (14.7%).

size-gear combination[96] (≥40 m exclusive trawlers). A métier approach also taking into account the species landed would be needed to draw more conclusions from the data. In Concarneau, the relatively high contribution to inequality seems to be due to the presence of two main fishing methods, and the dominance of one of them: purse seiners (bolincheurs) (13.1% of landings) and tropical seiners (80.5% of landings).

Figure 3-11 shows the relative contributions of different fleet segments (size classes) to the Theil Index between 2008 and 2018. The between-subgroup components have steadily increased over the past 11 years, indicating that differences between size classes have increasingly contributed to the inequality in the population. Additional insights can be derived from this graph when it is evaluated alongside the evolution of the number of vessels per size class, and the evolution of multi-ownership. Vessel numbers have decreased across size classes (-21.6% on average) (Table 3-18), while multi-vessel ownership has increased (+4.7% on average[97]) (see Table 3-13).

Table 3-18: Evolution of vessel numbers per size class.

Size class	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	$\Delta_{08/18}$
< 10 m	1851	1778	1732	1679	1645	1610	1607	1541	1529	1507	1502	-19%
[10-12[m	771	740	718	697	699	695	694	684	684	684	678	-12%
[12-18[m	540	497	463	447	434	426	417	406	396	390	388	-28%
[18-24[m	347	302	273	247	244	240	230	223	217	216	216	-38%
[24-40[m	123	114	102	98	103	103	99	99	103	102	107	-13%
>= 40 m	40	37	36	33	31	31	31	31	32	31	32	-20%

Figure 3-11 shows that the within-subgroup variation has decreased (homogeneity has increased) for all subgroups except for vessels ≥40 m. The increase in multi-ownership and the increase in concentration resulting from this, appears to have had a homogenizing effect on landed volume within size classes. However, further analysis is needed to confirm this, and to assess in which fisheries this effect is occurring, and where it is the strongest. Other factors contributing to this may be regulatory in nature, e.g., catch limits per vessel, etc.

[96] Similar comparisons for other maritime districts and size classes show a rather 'homogenizing' effect of the dominance of certain size-gear combinations (e.g., exclusive trawlers in the [18-24[m and [24-40[m segments for Guilvinec).

[97] This is calculated as the share (%) of vessels in each category that passed from a single vessel holding to a multi-vessel holding between 2008 and 2018. <10 m: 4%; [10-12[m: 4%; [12-18[m: 7%; [18-24[m: 6%; [24-40[m: 3%; ≥40 m: 4%.

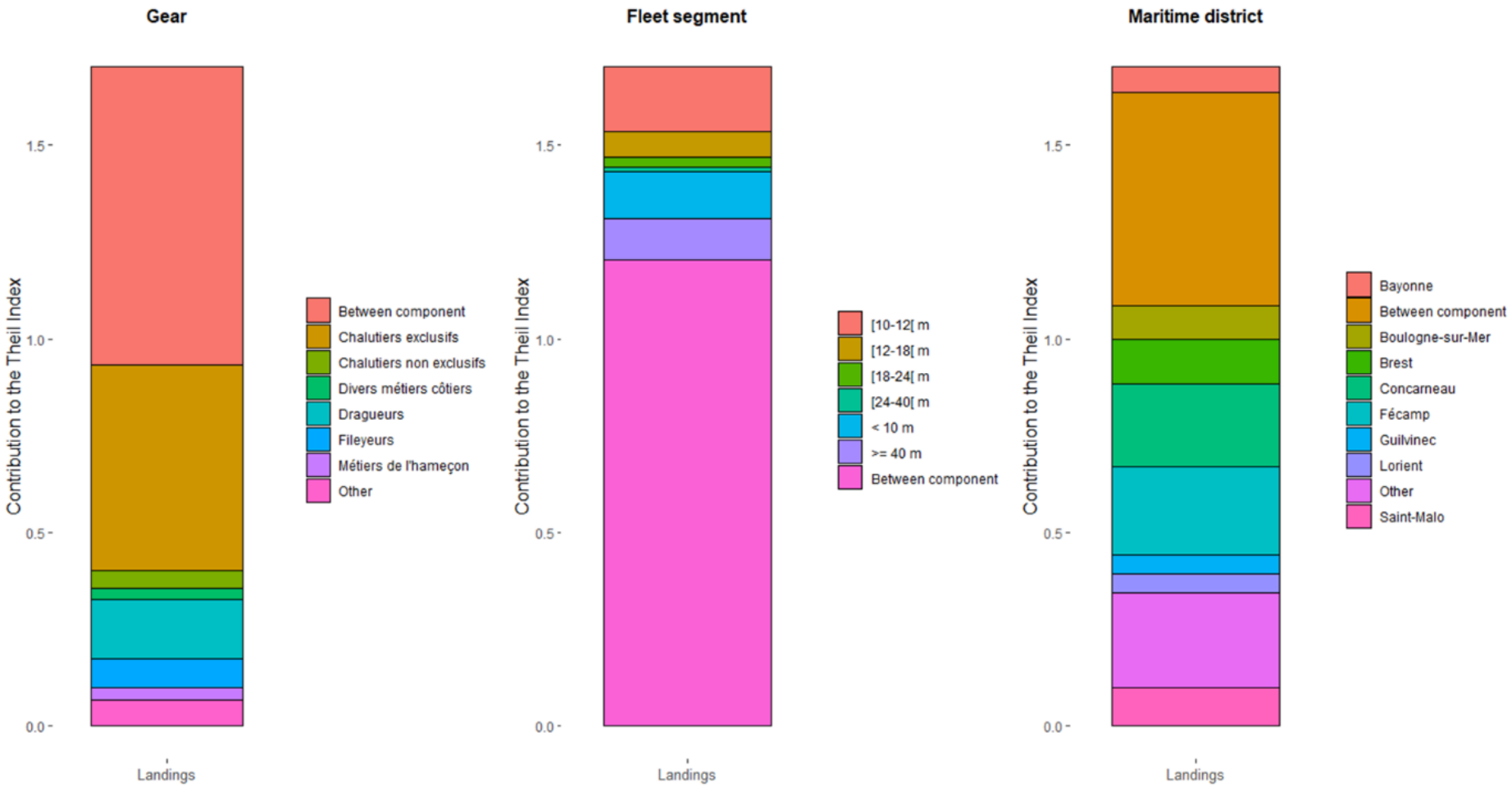


Figure 3-10: Decomposition of the Theil Index (vessel level; T_L=1.704): gear, fleet segment, maritime district. The 'other' categories in the 'gear' and 'maritime district' graphs represent the cumulative percentage of subgroups for which contributions to the Theil Index were smaller than 2% and 4%, respectively.

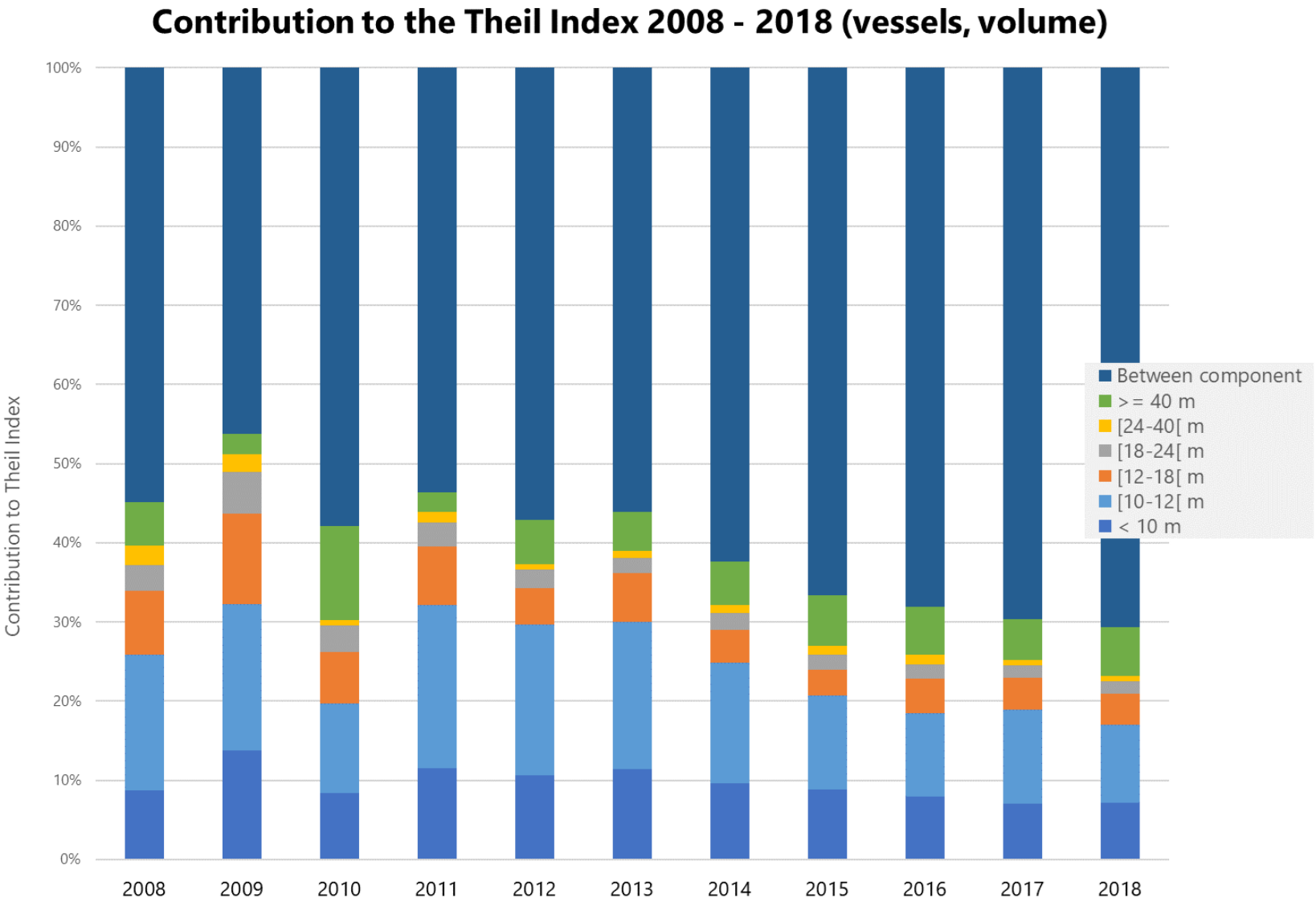


Figure 3-11: Relative contributions to the Theil Index based on volume, 2008-2018.

3.4.2 On the operator level

The decomposition of inequality based on operator age shows high homogeneity in most subgroups. The most heterogeneous subgroups are the age categories]40-45],]45-50] and]50-55]. This may simply be due to the fact that multi-ownership is more prevalent in these age categories (Chapter 1). However, interpretation is difficult due to the large proportion of operators for which no age information was present in the *Harmonie* database. Based on mean vessel size, contribution is highest for operators with vessels >12 m. This is also due to the fact that multi-vessel ownership (and thus: higher catch volumes) is more common for operators with larger vessels.

Finally, for the decomposition based on postal code, a large between groups component ($C_{between}$=1.3, or 59% of the Theil Index) is found, indicating that the operator's place of registration contributes strongly to the inequality in the population. The highest within-subgroup variation is found for postal code 29900, for Concarneau. This indicates that the same effect that was observed on the vessel level, applies here. For Fécamp (postal code 76400), however, the variability due to differences in landings among same size vessels (and fishing with the same gear), is not observed here. The postal code does not even show on the graph, which means that it included under "other" (contribution <2%). Upon closer inspection, we find that, of the 11 vessels registered in *armements* with postal code 76400, 5 are owned by the same company, which may explain why the effect observed on the vessel level is leveled out.

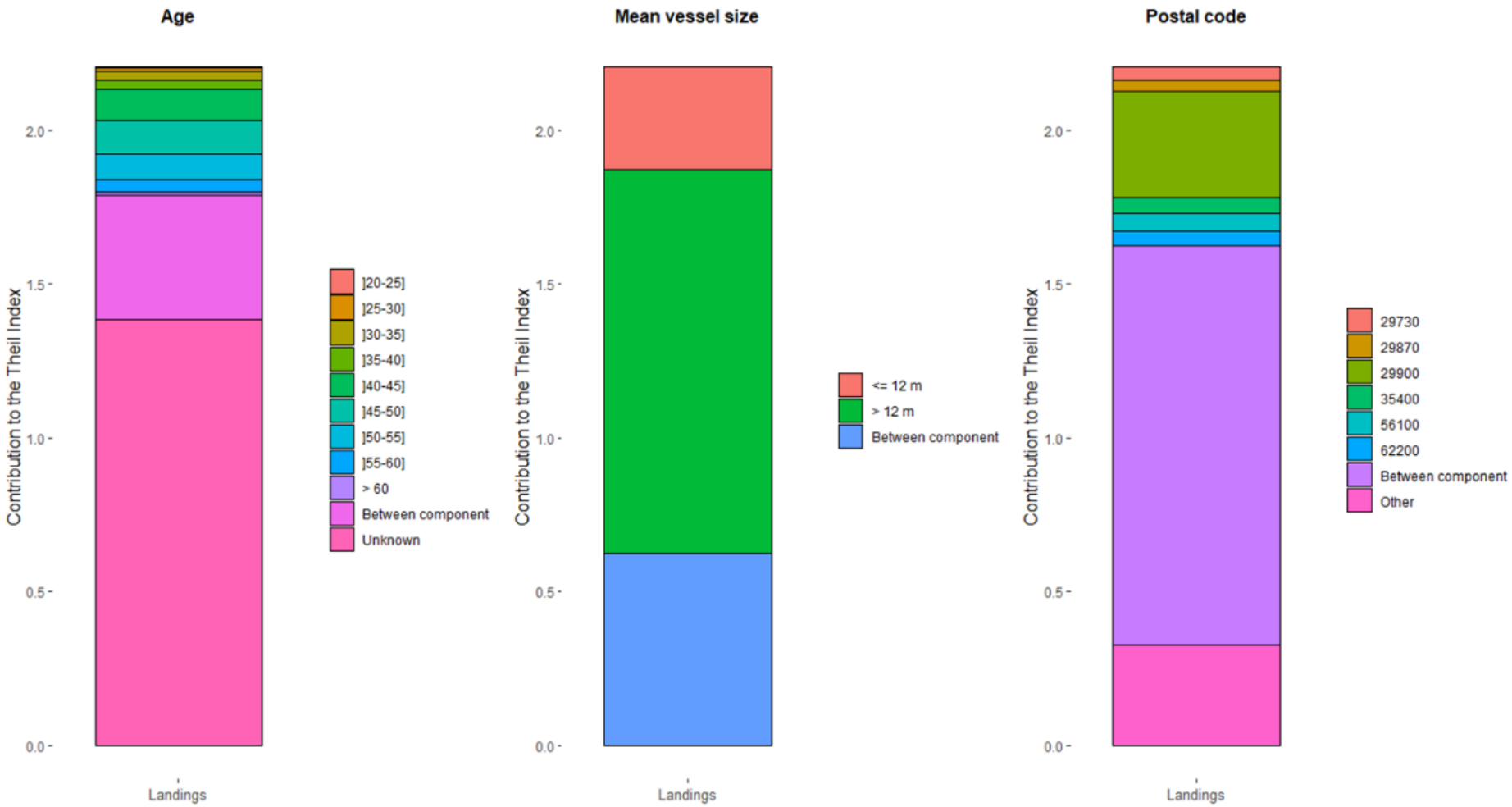


Figure 3-12: Decomposition of the Theil Index (operator level; T_L=2.205): age, mean vessel length, postal code. The 'other' category in the 'postal code' graph represents the cumulative percentage of subgroups for which contributions to the Theil Index were smaller than 2%.

4 Discussion

Our analyses show that the concentration of productive capital and production in the French Atlantic fishing sector has increased over the period 2008-2018. While the sector as a whole cannot be considered 'concentrated' as such, our results indicate that concentration is occurring in large-scale fleet segments. However, we emphasize that analyses presented here are only a first assessment of concentration, and that a case study approach is needed to uncover trends in smaller fleet segments and specific fisheries. In what follows, we will discuss some of the findings.

4.1 Accumulation of fishing vessels

The significance of multi-ownership of fishing vessels has increased during the period 2008-2018. This is best expressed in relative terms, however, as absolute numbers have slightly declined (762 vessels in 2008 versus 740 in 2018). This is linked to the general trend of declining vessel numbers during that period (-20.4%, from 3672 in 2008 to 2923 in 2018). The number of single vessel holders declined with 25% in this period, resulting in shifts in the proportions of multi-vessel owners (12% in 2018 compared to 10% in 2008) and of vessels that are 'multi-owned' (26% in 2018 compared to 21% in 2008).

While these shifts may seem insignificant on the industry level, they represent real change when considered on the appropriate scale. In absolute numbers, vessels held in holdings with 6-10 and >10 vessels increased substantially for size classes 12-18 m and 18-24 m. For size classes 24-40 m and >40 m, such increase was only found for >10 vessel holdings (due to a shift from 6-10 holdings to >10 vessel holdings, following expansion of operations). Of vessels ≥40 m, 72% are now owned by holdings with 6 or more vessels (44% are in holdings with >10 vessels). The increase of >10 vessel holdings in the 18-24 m segment is due to a shift from the category below (6-10 vessels). The latter, in turn, seems to be supplemented with vessels from categories below. This suggests that this is due to gradual growth of fishing companies (see Chapter 1). Finally, in the 12-18 m segment[98], the most remarkable shift is the emergence of large holdings (6-10 vessels, >10 vessels) between 2008 and 2018.

These latter shifts may be significant in the sense that they may alter market relations and relations among producers – sometimes on small, local scales. During the interviews conducted for Chapter 1, such examples were found for a scallop fisher in Normandy, a crustacean/scallop fisher in Normandy, and two crustacean/scallop fishers in Brittany. Their strategy is one of fleet expansion to ensure access to the resource and consolidate their dominant market position. This is often combined with a strategy of integrating local value chains (processing, wholesale). The 2020 acquisition of the company consolidating the crustacean value chain in Normandy by a large national player, demonstrates how incremental growth may lead to potentially game-changing situations (*https://actu.fr/economie/vendu-a-des-societes-boulonnaises-l-armement-favrou-restera-a-dieppe_36493754.html*).
Furthermore, anecdotal evidence collected over the course of this PhD research suggests that capital accumulation is occurring in certain scallops and crustacean fisheries, sometimes on small geographical scales. While this is negligible on the level of the Atlantic fleet, (changes in) capital accumulation and concentration at local levels may have far-reaching consequences for access to the resource, especially for small-scale producers.

In larger fleet segments (18-24 m, 24-40 m), especially for trawlers, large vessel-holdings have been the norm since the 1980s – both in cooperative and private fishing firms. While continuous horizontal growth is observed for such companies, there is also a higher turnover of vessels due to vessel replacement. In the 24-40 m and ≥40 m segments, multi-vessel ownership is associated with a strong horizontal (and vertical, see below) integration strategy

[98] Note that the 10 vessels in the 10-12 m segment that are part of large holdings (6-10 vessels), are in fact part of holdings made up primarily by 12-18 m vessels.

and a quest for fishing opportunities. This is clearly manifest for companies operating freezer trawlers targeting species like saithe and blue whiting (see further).

The evolution of multi-ownership could only be analyzed at the level of the operator as included in the fleet register (cf. *Harmonie* database). After the recomposition of hidden ownership links for 2018 through the DM protocol (see Chapter 2, section 3.5.2), 394 multi-owning entities are found at the level of the inferred owner, where this was only 297 at the level of the operator. However, despite this underestimation on the industry level, consequences for the interpretation of trends presented here, are limited.

4.2 Concentration and foreign ownership

While concentration of production (and other assets) has increased over the period 2008-2018, the Herfindahl-Hirschman Index shows that the level of industry concentration is low. The observed increase in concentration and inequality is related to concentration in the upper part of the distribution, i.e., mostly by large fishing companies operating fishing vessels ≥40 m. However, it must be noted that the importance of these entities is overemphasized in our analyses, for at least two reasons.

First, by including all Atlantic fishing vessels in our analyses, the distribution of the assets under study (volume, value, GT, kW) is heavily skewed (i.e., a large number of entities at the lower end of the distribution, and a handful of entities at the upper end). Certain inequality indices such as the Gini Index are heavily affected by such distributions (Gastwirth, 2017). For a better interpretation of concentration and inequality, a more disaggregated approach is recommended (see further). The second reason is related to the choice of the hierarchical level for analysis. The inferred owner represents the highest level of aggregation. At the lower end of the distribution (i.e., 'small' fishing firms), it more accurately describes multi-vessel ownership compared to the GUO level, due to the recomposition of hidden ownership links at this level. As such, it may to some extent counterbalance the bias described above. At the upper end of the distribution, the degree of aggregation at the level of the inferred owner is similar to that at the GUO level (due to ownership links already included in Orbis).

Analysis on smaller scales and taking into account 'functional groups' (métiers, fleets, fisheries) is required for a more accurate and truthful image of what is going on in the French Atlantic fishing sector. In a first attempt to do this, we have included analyses for a number of case studies here. However, these case studies are defined as subfleets based on presence/absence data of landings for specific species, instead of actual fisheries or functional sets of fishing vessels. This makes interpretation difficult. Present analyses would have benefited from the use of more conservative criteria for inclusion. In addition to presence/absence data, minimum landings thresholds should have been defined to better approach actual (targeted) fisheries. For future analysis, a geographical/métier approach should be adopted, as was suggested by the decomposition of overall inequality (Theil Index).

Nonetheless, these preliminary analyses for the blue whiting, saithe, hake and scallops subfleets do yield some valuable insights. The blue whiting and saithe subfleets coincide because the top producing vessels target both species (and to a lesser extent also hake). The top owning entities identified at the level of the inferred owner are Dutch companies. At the GUO level, however, we see that for one entity, ownership is shared between an Icelandic and a Dutch company. MRAG *et al.* (2019) have described the ownership structure and the strategy of these corporations in great detail. In fact, these companies are part of a small number of companies capturing fishing opportunities across EU Member States, whilst vertically integrating value chains. Their strategy is one of access to fishing opportunities in the EU, as well as market control through the integration of processors.

While concentration in the hake subfleet was found to be low, inequality in terms of landed volume per operator was high. This view is likely biased because of stark differences in landings between operators. A better image would be obtained by selecting only those

operators actively targeting hake (i.e., by introducing a minimum threshold), or even by assessing specific fisheries, adequately taking into account relevant aspects related to maritime district, gear and vessel size. In the scallops subfleet, the four dominant producers jointly capture 8.8% of all landings, while the 50% least producing entities capture 9.2%. Interestingly, each of these entities are situated in a different maritime district. This may suggest that there is room for only 1 dominant producer per district, but further research is needed to confirm this.

Although the hake subfleet as a whole was found to be not concentrated, our analysis indicates that concentration of production is taking place by a subgroup of hake producers: 4% of producers are responsible for 75% of the catch, the majority of which are Spanish nationals owning and operating fishing vessels in France[99]. This mechanism of obtaining access to EU fishing opportunities, known under the popular term 'quota hopping (Lequesne, 2000; Hoefnagel *et al.*, 2015), has been a major way for EU fishers to circumvent quota restrictions due to the relative stability principle since the inception of the CFP. In the 1980s, Spanish fishing firms increasingly started registering fishing vessels in other EU Member States because of quota restrictions in their home country. They did so in the UK at first, but later their focus shifted to France. In France, Spanish fishing firms are mainly capturing hake quota, along with a number of other trawl species for which strong markets exist in Spain. Lequesne (2000) attributes the success of the Spanish 'export' model to the strong domestic market for fishery products in Spain, resulting in high income for fishers. With the cash flow generated by their vessels in Spain, these fishers (often fishing families) can invest in additional vessels abroad. Today a significant number of French vessels are detained by Spanish capital (an estimated 65 vessels in 2016) (FranceAgrimer, 2016).

4.3 Hierarchical levels considered: sense or non-sense?

In this chapter we have explored vessel ownership and concentration of production at different hierarchical levels of ownership. The premise of this chapter was that the extent of concentration in the sector risks to be underestimated when looking only at concentration on the level of the fishing firm. In Chapter 2, we have established that vessel ownership at this level is substantially underestimated when considering the operator instead of the SIREN number. In this case, the underestimation stems from the lack of the full spectrum of ownership data at this level.

In addition, we have argued that relevant ownership assessments can be made at multiple hierarchical levels. Here, the question becomes more about choosing the *appropriate level* of analysis. For instance, assessing market dominance in the scallop fishery requires a different level of analysis than doing so for saithe or blue whiting. The corporate ownership chain presented here (vessel, operator, SIREN, ISH, DUO, GUO, DUO, inferred owner) remains conceptual and a strong driver behind its choice was data availability. We emphasize that analyses presented here are work in progress, and that also holds for some methodological choices. Some levels turn out to have little practical use or applicability (e.g., ISH). Further analyses must take into account the data extracted through the customized bottom-up protocol described in Chapter 2. Unfortunately, these data could not be mobilized within the time frame of this PhD research. In the bottom-up protocol, ownership data are extracted for all shareholders (not only the default Orbis metrics used here).

Overall, the results of this chapter show that it is important to consider ownership at different hierarchical levels. Our analyses were, whenever possible, focused on the highest hierarchical level – i.e., that of the inferred owner. The advantage of this level over the GUO defined by Orbis is that it can recompose ownership links for companies with no listed shareholders in Orbis (this was the case for 96.2% of SIREN numbers in our population). That being said, the

[99] It must be emphasized that the hake fleet is likely ill-defined because of the use of presence/absence data without further criteria with regards to minimum landings, which results in the high degree of inequality observed.

inference method (see Chapter 2, section 3.5.2) is work in progress and should not be understood as a fully verified method for inferring the ultimate owners of fishing firms. We emphasize, however, that this may constitute a promising new method for ownership analysis in fisheries, as it uncovers links that would otherwise remain hidden. However, the level at which ownership/concentration analysis is most informative, depends on what is being studied (e.g., access to the resource by national investors, market dominance by foreign investors, etc.). In this chapter, our main focus has been on the analysis of concentration in the French Atlantic fleet as a whole at the level of the ultimate owners (GUO, inferred owner) regardless of their nationality or 'corporate' identity. In other words, the ultimate owners form an extremely diverse group in terms of entity type (natural person, company), legal form, economic activity (NACE Rev. 2 code), company size, country of registration, etc. For instance, the ultimate owners of the blue whiting and saithe subfleets are the foreign shareholders of French fishing companies. An assessment at the level of the GUO or inferred owner thus tells us something about foreign ownership of these companies, but ignores concentration at the national level (for which the highest level is the DUO). In addition, fishing companies belong to a spectrum of ownership structures ranging from owner-operated businesses to corporately-owned fishing firms. Their ultimate owners are all pooled at the same level (GUO or inferred owner), and as a consequence, it is not always clear what we are comparing. These issues confirm the point raised above, that it is better to analyze ownership and concentration for specific fisheries and/or functional groups instead of the Atlantic sector as a whole.

In conclusion, the inferred owner would be[100] the ideal level of analysis for independent firms without ownership information in Orbis. For these firms, it is superior to both the operator level and the SIREN level. These levels simply do not provide enough information, which results in the underestimation of concentration. For corporately owned firms, the SIREN, DUO and GUO levels are complementary levels of analysis. The SIREN and DUO for studying ownership and concentration at the national level, and the GUO for studying foreign ownership. The GUO level furthermore opens up possibilities for EU-wide analysis. For example, it could be of interest to know how much of a specific species (e.g., saithe) a company 'owns' on the EU level (i.e., as a proportion of EU landings).

4.4 Data issues

Next, a couple of notes should be taken with regards to the data used for concentration analysis. First, in our assessment of concentration, we have prioritized all fishing vessels present in the fleet register in respective reference years. Based on our analyses, it cannot be assumed that all vessels produced at 'maximum' or even 'normal' (average) capacity. Due to our focus on 'ownership' (i.e., who 'owns' what? – be it the physical means of production or the fish landed and sold on commodity markets), we may have underestimated concentration due to vessels that produced less than they 'normally' would (or could). Evidence from the field shows that buying and selling of fishing vessels to obtain fishing licenses and quota is common practice, also among so-called 'artisanal' fishers (see fisher quotes in Chapter 4). In this practice of buying and selling, it is common that fishing vessels remain inactive for a certain period of time before being reaffected to a newly formed legal structure (see Cellérier, 2016) or being replaced with a newly constructed vessel. In the latter case, the acquisition of a fishing vessel on the second-hand vessel market is merely a way of acquiring fishing opportunities to support the construction of a new fishing vessel (see Cellérier, 2016). In our dataset, landed volume is zero for 10 vessels, and for 229 vessels, landed volume is undisclosed (NA). In our analyses for the Atlantic fleet, we have assumed zeros for all 239 vessels. Of these, 174 vessels (72.8%) were owned by single vessel operators. While this adds to the skewness of the data[101], it is unlikely that this would affect our conclusions regarding the level of

[100] I.e., given consolidation of the inference method (DM protocol).

[101] Note that, other than zeros, there are also small values in the distribution which influence the distribution (e.g., 1 vessel caught 0.5 kg of fish in 2018). The solution for this would be to introduce more conservative selection criteria and/or to assess concentration for specific functional groups and fisheries.

concentration in the sector. Inactive vessels that are part of multi-vessel structures, on the other hand, could bias our understanding of the level of concentration, and complicate comparisons between years. In spite of this, we argue that the inclusion of such (temporarily) 'sleeping' fishing capital is relevant and important for understanding ownership dynamics in the sector. Further analysis is needed to assess whether it concerns sleeping capital as part of a business restructuration or fleet renewal or whether it is due to an artefact in the data. The Rural Code stipulates maximum time spans for vessel replacements (to be looked into further).

A second point of discussion is the method of repartition used. At the level of the GUO, volume of landings was repartitioned among ultimate owners based on their % ownership share in the vessel-holding company. Ideally, the same approach is applied to the inferred owner, but due to time constraints, we were only able to attribute vessels and landings to a single entity. It is difficult to say how this has affected the results on average, but probably it has resulted in a slight overestimation. Overestimation of concentration occurs when multi-owners are wrongfully attributed all of the landings, while in fact they should be shared among multiple co-owners. In case where these co-owners also appear as separate entities in the fleet register (i.e., with their own business), *their* total landings may be underestimated.

Finally, the quality of the ownership links in Orbis could not be confirmed within the time frame of this PhD research, other than the *ad hoc* comparisons with data from the interviews for Chapter 1 and prior knowledge of the sector. Data from Orbis and similar databases are frequently used to study ultimate ownership and concentration in an industry (e.g., Bloch and Kremp, 1997; Faccio and Lang, 2002; Laeven and Levine, 2008; Kalemli-Ozcan *et al.*, 2013, 2015; Croci and Giudice, 2014; Levy and Szafarz, 2017; Horobet *et al.*, 2019). A comparison with data from the National Statistical Institute INSEE would be a good place to start.

Chapter 4: Navigating institutional change in the French Atlantic fishing sector: how do artisanal fishers obtain and secure fishing opportunities?

After: Kinds, A., Said, A., Speelman, S., and Olivier, G. (2021). Navigating institutional change in the French Atlantic fishing sector: how do artisanal fishers obtain and secure fishing opportunities? In S. Jentoft, R. Chuenpagdee, A. Said, and M. Isaacs (Eds.). Blue Justice: Small-Scale Fisheries in a Sustainable Ocean Economy. Springer, MARE Publication Series (in press).

Abstract

French fisheries management emphasizes the collective management of fisheries resources, and the non-transferability of fishing opportunities as measures to prevent concentration and to protect artisanal fisheries. In practice, however, access problems are common, and concerns regarding concentration and the disappearance of the so-called 'artisanal fishing model' have been raised by researchers and fisheries managers. Using literature and new empirical data (interviews), we reflect on the French fisheries management system, and ask ourselves whether it can be considered 'just' from the perspective of artisanal fishers. In this chapter, we (1) describe the French fisheries management system, with an emphasis on the allocation and redistribution of fishing opportunities, (2) explore how this is perceived and experienced by artisanal fishers in the Atlantic fishing sector and (3) analyze how they have navigated the institutional waves to overcome some of the hardship arising from this system. This study shows that the quota allocation system has created significant entry barriers for artisanal fishers, notably new entrants and small-scale producers, and that it has contributed to a shift away from family-based fishing and towards expansion. Government policies directed towards bringing more justice in the system have not delivered. Yet, on a positive note, some artisanal fishers seem to be finding new ways to anchor themselves in local economies and launch their businesses into an unsure future, both through the bottom-up initiatives and through partnerships with large-scale fishing companies.

1 Introduction

1.1 The French artisanal fishing model

France is one of a handful of countries in the EU (along with Belgium, Germany, Ireland, Poland, Portugal, and Spain) where fisheries resources are considered national resources belonging to the inhabitants (Hoefnagel *et al.*, 2015; Carpenter and Kleinjans, 2017). In the case of France, this has been clearly established in legal documents acknowledging the collective nature of fisheries resources, and the non-transferable character of fishing opportunities (Marine Fisheries Act of 1997 and LMAP, 2010). The shared objective of aforementioned countries is the protection of traditional fishing communities, the family-based structure of fishing firms and the social and employment benefits associated with a large small-scale sector (Hoefnagel *et al.*, 2015). In France specifically, the maintenance of the so-called 'artisanal fishing model'[102] is a main focal point.

The artisanal fishing model has been a key element in the development of the French Atlantic fleet after World War II (Meuriot, 1986) and was aided by the State through the establishment of financing instruments and governance structures, including fishing cooperatives (see Ponsot and Mauget, 2008 for a description). The artisanal model is usually characterized by following elements (Debeauvais, 1985; Deldrève, 2001; Delbos, 2006):

1. The fisher (*artisan*) is owner or co-owner of his or her fishing vessel, and has the statute of embarked owner. They invest their own capital (sole proprietorship) and manage the firm technically and economically (Debeauvais, 1985);
2. This 'owner-operator' has one fishing vessel, which is generally smaller than 12 meters in length, but may be up to 25 m according to legislation[103]. Crew size is generally small, with a maximum of 5-10 for larger vessels (Delbos, 2006).

A number of other criteria are commonly used to contrast artisanal fisheries with industrial fisheries: a high degree of family involvement in the firm, strong local anchoring, the polyvalence of the fishing activity and relatively short fishing trips (Debeauvais, 1985; Menzies, 1997; Delbos, 2006; Ifremer, 2007; Reyes *et al.*, 2015). The French government has often referred to the artisanal model as one that needs to be preserved[104]. In 2009, the French administration took position against an EU-wide system of transferable fishing concessions (Gouvernement Français, 2009) as proposed by the European Commission (2009). It argued that a market-based approach would lead to the concentration of fishing capital.

1.2 Artisanal fisheries in a changing institutional environment

In recent decades, the institutional context of French fisheries management has undergone profound transformations. The fishing crisis in the 1990s (Le Floc'h, 2018) and policies aimed at reducing overcapacity have effectively reduced the number of fishing vessels in the Atlantic fleet (Quillérou and Guyader, 2012) – from 5100 in 1993 to 3663 in 2008 (-28%). Capacity was further rationalized through successive reforms of the quota management system (Larabi *et al.*, 2013). Vessels leaving the fleet were bought up by remaining fishing firms, which led to an increase in the proportion of multi-vessel fishing firms.

[102] The term 'model' refers to an operational mode in the French fishing sector, commonly referred to as 'the artisanal (fishing) model' (French: '*le modèle (de pêche) artisanal(e)*').
[103] Décret n° 93-33 du 8 janvier 1993.
[104] E.g., http://www.dirm.sud-atlantique.developpement-durable.gouv.fr/IMG/pdf/17-02-17-fiche_enjeux_1_-_peche.pdf; and http://www.euroconsulting.be/wp-content/uploads/2019/05/ST_8941_2019_REV_1_X.pdf (Accessed on 5 April 2021)

In 2018, 301 of the 2484 registered fishing firms in the French Atlantic fishing sector operated two or more fishing vessels[105]. Of these, 242 firms operated 2 fishing vessels, 47 firms operated 3-5 vessels, 8 firms operated 6-10 vessels and 4 firms operated more than 10 vessels. While the majority of <25 m vessels are owned in single-vessel firms (82%), the proportion of vessels that are multi-owned has increased with 4% since 2008. Notably in the smaller fleet segments (<12 m and 12-18 m), the number of vessels operated in large multi-vessel firms (≥6 vessels) has increased: from 2 vessels[106] in 2008 to 34 in 2018. This evolution deserves our attention because vessels in these segments are traditionally operated by firms that best resemble the artisanal archetype described above. Other changes in this archetype include a shift away from household production (Delbos, 2006), as well as a shift in legal form (i.e., from sole proprietorships to limited liability companies) (Cellérier, 2016).

In French fisheries management, there is a strong link between vessel ownership and access to the resource. As we will see below, fishing opportunities are allocated to the vessel-producer partnership primarily based on historical track records attached to the fishing vessel. While fishing opportunities are non-transferable by law, they can be obtained through vessel acquisitions on the second-hand market. In this context, concerns may be raised about artisanal fishers' access to fishing opportunities, which is directly linked to their ability to invest in (additional) fishing vessels. This chapter investigates whether the institutional setup of French fisheries management – and notably the way in which fishing opportunities are allocated and distributed – generates injustices towards artisanal fishers.

We will first explore the institutional framework for allocating and redistributing fishing opportunities in France and study how it has affected access for artisanal fishers. Thereby we analyze whether any injustices have developed (second order governance). Second, we will explore how fishers have dealt with this context through their own actions and in relation with other stakeholders (first order governance). Third, we will interpret these injustices and innovations in the light of the meta-order principles (i.e., those of the EU, through the Common Fisheries Policy) that guide the main institutions of fisheries management. We refer to Annex 4.1 for more information on the 'justice in three orders' framework (Jentoft and Chuenpagdee, *in press*).

2 Methods

We use a mixed-methods approach. By contrasting new (fieldwork) and existing empirical data with literature and legislative texts, we aim to get a holistic image of the injustices produced by the institutional framework. Between December 2017 and April 2019, we conducted semi-structured interviews with 63 artisanal fishers (multi-vessel firms only[107]) along the French Atlantic coastline. Participants were selected according to a quota sampling method covering the different Atlantic fishing districts, gears and fleet segments. Our sample captured 212 vessels (<25 m), representing 30% of all multi-owned vessels in the Atlantic sector in 2018 (and 9% of vessels <25 m). The interviews (1-3 hours) were conducted in the homes of fishers, at their landing sites or in their dockside offices. We also interviewed key actors, including producer organizations (n=4), fisheries committees (n=6), business lawyers (n=2), financial experts (n=2), bank executives (n=2) and other supply chain actors (n=2). Interviews were transcribed verbatim. Then, each transcript was read through several times and coded manually following the framework set out by Riessman (2008) for thematic narrative analysis.

[105] Statistics are derived from the Ifremer/DPMA SIH database (2018). In this chapter, we use the term 'Atlantic' to refer to fishing firms and vessels registered along the French Atlantic coast, including the Channel and the North Sea.

[106] For clarity, other vessels in these >6 vessel holdings belonged to larger fleet segments.

[107] The interviews are part of a larger set of 80 interviews with owners of multi-vessel fishing firms, also including large-scale and corporately owned firms. The interviews were conducted and used by Kinds et al. (in review) to construct a typology of organizational structure. Respondents were asked about key elements related to the organization of their businesses, including ownership structure, firm structuration, funding strategy, management strategy, fishing strategy and valorization strategy.

Additional data sources were used for triangulation, e.g., articles in newspapers and industry magazines, as well as television and internet broadcasts.

3 The legal framework of French fisheries management

In France, as in the rest of the EU, conservation of fishery resources is regulated by the EU Common Fisheries Policy (CFP), and the State only has delegated powers or powers of execution. However, the State has extensive conservation and management power in the 12 nautical mile zone, in which French fishing vessels also have privilege of access[108]. State action in the area of fisheries management is carried out at national and regional levels, either by the administrative authority alone, or, more often, in partnership with professional bodies within a co-management framework: fisheries committees (FCs) and producer organizations (POs) (Mongruel *et al.*, 2017). According to the Rural Code (Legifrance, 2019), the administration allocates fishing opportunities to POs and FCs based on three criteria: historical track records (landings), socioeconomic balances and market orientation. In practice, however, the vast majority of allocations are performed based on track records alone (Carpenter and Kleinjans, 2017). The same holds for the subsequent allocation of fishing opportunities to fishers or groups of fishers by POs and FCs.

The Code establishes a clear distinction between EU species (managed under Total Allowable Catches; TACs) and non-EU species (for which the definition and allocation of fishing opportunities is a national matter). Generally speaking, EU species are managed by the POs while non-EU species are the responsibility of the fisheries committees.

3.1 Fishing opportunities for EU species: history and current situation

The introduction of a quota management system in France in 1990 meant a departure from open-access, which persisted even after TACs had been introduced by the CFP in 1983 (Mesnil, 2008). In 1990[109], the French State divided national quotas for a number of heavily exploited species into sub-quotas. These were then distributed by the Department for Marine Fisheries and Aquaculture (DPMA) in a hierarchical manner. In this system, sub-quotas were attributed to POs according to 'sliding' track records, i.e., based on the average landings by their members' vessels over the last three years (Larabi *et al.*, 2013). A first reform of the system took place in 1997. In the Marine Fisheries Act (1997), two allocation criteria were added to this system: market trends and a 'socioeconomic equilibrium' criterion to compensate for the fact that certain small-scale vessels did not have track records for EU species. In 2005, the administration froze vessel track records based on the reference period 2001-2003, and subsequently changed their modalities in a legal statute[110]. From now on track records were assigned to the 'vessel-producer partnership', making the operator the legal holder of the track records. Track records are not entitlements as such, but function as leverage in quota negotiations with POs, which apply different criteria for redistributing sub-quotas among their members (Lagière *et al.*, 2012). In most POs, however, the decisive criterion is the amount of track records the producer brings in (Bellanger *et al.*, 2016).

[108] It should be noted that artisanal fisheries do not exclusively take place in the 12 nm zone. Artisanal fisheries could further be subdivided into a coastal fleet (*pêche côtière*) (≤12 m vessels fishing inshore) and an offshore fleet (*pêche hauturière*).

[109] Journal Officiel de la République Française (JORF). Arrêté n° 2413-90 du 24 août 1990 portant répartition de certains quotas de pêche accordés à la France pour l'année 1990.

[110] Journal Officiel de la République Française (JORF) n° 301 du 29 décembre 2006 page 19953 texte n° 104: Arrêté du 26 décembre 2006 établissant les modalités de répartition et de gestion collective des possibilités de pêche (quotas de captures et quotas d'effort de pêche) des navires français immatriculés dans la Communauté européenne (https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000000819682) (Accessed on 5 April 2021).

Access to EU species for vessels without PO membership is managed by the administration. For this, collective allocations corresponding to about 1% of national quotas are set aside. As such, non-PO producers are competing in a race for fish in which premature closures are common (Bellanger *et al.*, 2016). The POs thus constitute an indispensable entry point for fishers who want to target EU species.

3.2 Fishing opportunities for non-EU species: history and current situation

Allocation of fishing opportunities for non-EU species[111] is mainly governed by fisheries committees (FCs) at the national and regional level, under the control of the administration. In the 1970s, different licenses were introduced by the FCs for specific species and/or gears, to avoid conflicts between fleets. Though limited in scope, licensing schemes with *numerus clausus* were also developed, covering mostly coastal fisheries (e.g., scallops, crustaceans). In 1990, two decrees[112] specified the rules underpinning the licensing regime, and the Marine Fisheries Act of 1997 marked the widespread implementation of fishing licenses. Licenses are issued by the administrative authority or under its control within a framework of deliberations by the FCs. Most licenses are input permits which contain limitations regarding fishing gears, fishing time or season, vessel size and engine power. Individual catch limits (i.e., quota per vessel per unit of time) are in place for highly sought-after species like abalone, scallops and seabass. The number of licenses issued and their distribution is contingent upon fishing opportunities, and sometimes socioeconomic criteria. Even though licenses can be considered precarious (they generally cover a maximum period of 12 months and are non-transferable), they are generally renewed every year and can be transferred under conditions when the vessel is sold.

4 Findings

The narrative presented here is constructed based on (1) key aspects brought up during the interviews and (2) published sources (literature, legislative texts). Interview quotes were added in support of the narrative[113].

4.1 An exploration of second order injustices

4.1.1 Fishers' perceptions about resource access

Among interviewed small-scale producers[114], there was a consensus that fisheries management caters mainly to the needs of larger and industrial fishing companies, and that there are too few fishing opportunities for small métiers (cf. Ulrich *et al.*, 2012). They perceive the system as marginalizing and unjust, as explicated in their views:

- "There are not enough opportunities for small-scale fishers."
- "I'm member of the PO, but it doesn't really matter much for us because we fish non-quota species." (…) "Our métier is ill-represented – it's the big ones that have a lot of power."
- "When the administration speaks about fisheries, they mean trawlers – not the netters, liners, estuarine fishers. For Europe, it's all about the trawlers. The small métiers, coastal fisheries, etc. – that's non-existing for them."

Artisanal fishers expressed their inability to compete with large fishing companies on multiple fronts – i.e., for market share, fishing opportunities and even for the attention of fisheries management. Many expressed themselves negatively about the future of the artisanal sector,

[111] Examples include scallops (*Pecten maximus*), European spider crab (*Maja brachydactyla*), North Sea crab (*Cancer pagurus*), abalone (*Haliotis tuberculata*) and seabass (*Dicentrarchus labrax*).
[112] Décrets n° 90-94 et n° 90-95 du 25 janvier 1990.
[113] Certain quotes have been adapted to protect the identity of respondents.
[114] The term 'small-scale' is used to refer to operators with coastal vessels ≤12 m.

and had a negative perception of fisheries management, which they believe is not in harmony with the needs of the sector at large:

- "What's going to happen is concentration of fishing fleets. It's the non-written strategy of the administration. It's evident that a fishery with three interlocutors is easier to manage than a fishery with many artisanal fishers of the type 'one man, one vessel'."
- "The future [of French fisheries] is either the very small ones or the big ones. The State favors the big ones, which are well-structured and are managed by directors they know personally and with whom they can discuss as equals."
- "I prefer many artisanal fishers over a big group catering to the needs of the Parisians. […] An entire local economy depends on the artisanal model. So, the concentration by large fishing companies, I find that a shame."

Investing in additional fishing vessels is a major way to increase resource access and expand production. Small-scale fishers (often without PO membership, and thus limited access to quotas – see further) explain that they adopt a diversification strategy to overcome constraints with regard to fishing opportunities. They apply for an array of licenses which they need to target multiple species throughout the year:

- "We saw the seabass stock go down every year: from 3 tons, to 2 tons, to 1 ton, to 500 kg last year. We're trying to diversify, to fish a bit of sea bream and pollock. It's hard to make ends meet with hook-and-line fishing, especially now that the bait has gone up in price."
- "To fish scallops, you need a slow and powerful vessel, whereas my second vessel is a *formula 1*. I am obliged to fish for scallops in winter. If not, everything I earned in summer is lost during the winter months."
- "Each year I use at least five métiers. This year there were seven […] We are super versatile."
- "I'm an opportunist. When the price for mackerel is good, I go after mackerel." (…) "I'm not going too far out, I don't play poker. I need a safety net, with other species right next to my fishing spots, such as pollock when targeting seabass."
- "Since I have the second boat, I can go further out, to target anglerfish and John Dory for direct sale."
- "I have all the licenses I need." (…) "I wanted a package for everything, but not for large volumes, just enough to supply my fish stall."

In addition to institutional barriers, small-scale producers claim that *de facto* entry barriers exist in certain coastal fisheries[115], in the form of semi-privatized fishing areas (note that this concerns *first order* interactions between producers):

- "You may get all the quotas and licenses you need but if you don't get the territory, you can't fish. Many young skippers face this problem."
- "It's a disaster – everyone has their own little spot. Some are dominant, others are dominated." (…) "There's a constant war out there, especially for seabass. Someone told me: if you come back here, you'll end up in the hospital. I listened to him; I was close to my retirement."
- "We try to be discrete, very discrete. Around here, if something works, there will be fierce competition […] There is a nasty mentality. It was difficult for me in the beginning. You have to stand your ground, otherwise [the other fishers] will eat you alive […] There is an implicit understanding of territorial fishing rights […] You have to target what the others are not fishing."

4.1.2 An implicit and unregulated market for fishing opportunities

In France, market transactions of fishing opportunities are prohibited by law, and their allocation and redistribution is the responsibility of the POs and FCs. In practice, however, 'fishing opportunities' (i.e., through track records) may be transferred between producers through vessel transactions on the second-hand market. The seller also has the possibility to keep (part of) the track records (see Larabi *et al.*, 2013).

The focus on track records as a distribution criterion by the administration has created an incentive for POs to attract vessels with track records attached, and, consequently, for producers to invest in such vessels. Relative scarcity and high demand have created an active informal market for track records through second-hand vessel sales. This has caused vessel prices to rise beyond what many fishers can afford. This issue was also raised during the interviews:

[115] This was observed, among others, in a scallop fishery in Normandy and in a linefish fishery in Brittany.

- Small-scale fisher: "Young people don't have the means to buy a vessel with track records attached, especially when the vessel itself is basically worthless."
- Older operator: "Young skippers cannot establish themselves alone. You need other vessels to pay for that."

Guyader *et al.* (2003) found that in 2000, intangible capital represented about half of the vessel price on average. Recent evidence from brokers suggests that since then the implicit value of fishing rights has increased. Other than track records, operation permits and certain fishing licenses have also accrued value (e.g., scallops, crustaceans). Between 2000 and 2010, 6 to 12% of vessels in the Atlantic fleet were exchanged on the second-hand market each year (Quillérou and Guyader, 2012), which suggests that this constitutes a main mechanism for the redistribution of fishing opportunities.

These "shadow prices" suggest that fishing opportunities are perceived as secure by fishers (Carpenter and Kleinjans, 2017). This is confirmed by our interviews, given the high incidence of artisanal fishers consciously investing in vessels with track records or licenses attached.

- "In October I'm replacing one of my vessels. The vessel will be exported to Ireland and I'm keeping all licenses, track records and PME[116]." (…) "I bought a vessel from [name] in Cherbourg with PME and track records. The PME – the kWs and tonnage – of the [vessel I'm exporting] allows me to increase the PME of my two other vessels. That will serve me well when I want to sell them later."
- "When I obtained the license for abalone, that was a blessing. It was destiny."
- "Once you have obtained a license for nephrops, you don't let it go. It has a lot of value."
- "The license *Baie de Seine* is a little gold mine, a very lucrative fishery with very few costs."

This has created a socioeconomic divide between fishing firms, as some operators have the purchasing capacity to follow a path of growth through investment, while others are struggling to get the bare minimum. This institutional setup has been named "unjust" (Claudon *et al.*, 2012) and "discriminatory" (Autorité de la concurrence, 2015) towards new entrants (mostly young skippers without family ties in the sector) and vessels without PO membership (mostly small-scale fishers with little or no track records). Due to falling quotas POs are increasingly reluctant to accepting prospective members without track records (Bellanger *et al.*, 2016). This has especially affected access to the resource for small-scale producers and local fishing communities. In addition to the high entry cost, there is the fact that access rights were given for free to the operators active in the fishery at the time (2001-2003). This is also expressed in the views of a small-scale PO director:

- "A question that keeps me up at night is how some producers have been able to acquire fishing rights without paying for them. It's surreal. […] Producers who invested in vessels without track records have a significant competitive disadvantage." (…) "It's fine that they use the reference period 2001-2003 but they should have given the opportunity to producers to *buy* them, like they did in the UK."

Claudon *et al.* (2012) have referred to this as "intergenerational injustices" because of the persistence of inequality over time. Bellanger *et al.* (2016) furthermore report that initial allocations have disadvantaged small-scale producers from the onset due to severe underestimations of their catches by the administration. One could argue that if fishers knew that historical records would be used to inform future policies, they would have taken better care in documenting and declaring them.

Demographic factors (i.e., old age of current operators, lack of skilled crew, low recruitment of young skippers) and vessel dynamics (i.e., aging fleet, outflow of vessels from small fishing ports, acquisition by foreign-owned companies), have further deepened the divide. Fleet renewal has been identified as a key priority for the sector (e.g., FranceAgriMer, 2018), but for

[116] Before any fishing vessel is eligible to fish, the operator must apply for an operation permit (*permis de mise en exploitation*, PME). It is replaced with a European fishing license once the vessel has entered the fleet, giving the operator the right to use a proportion of European fishing capacity (Lagière *et al.*, 2012).

individual firms vessel replacement is a particularly costly operation[117], as was also expressed in the interviews:

- Director of a small-scale PO: "A vessel of 20m costs about 2.5 million euros. If you have to add fishing rights to that, it becomes impossible for a young skipper-owner. As a result, there's very few '*pure artisans*' who establish themselves."
- Fisher with two vessels: "A new vessel [of 16 m] costs 2 million euros. I don't feel like investing this much so close to my retirement."

Fishers perceive this as having to pay twice: once for an old vessel with track records attached, and once for the construction of a new vessel:

- Young operator: "The vessels are already expensive, so now we have to buy quotas before constructing a vessel? I'll be 45 before I'll be able to do that. […] Buying fishing rights becomes impossible for young skippers."
- Older operator: "Today you have to eliminate your company to be able to build a new vessel."

Yet, certain operators have succeeded in building sizeable (up to 9 vessels) and competitive fishing firms. These operators target EU species in multi-species fisheries (trawlers) or specialize in non-EU species (e.g., scallops, crustaceans). Some of them jumped on opportunities to 'capture' the market, others were able to establish market dominance by buying out competitors and integrating local value chains:

- "I bought 5 fish stalls from competitors. But I had to buy the vessels to do that. One vessel I paid €60,000 and sold it back for €20,000. It was the stall that interested me."

4.1.3 Institutional buffers as counter-measures: preemptions and track records reserves

In an attempt to address these unintended side effects of the institutional framework, the French government took two specific measures. First, track records reserves (a PO reserve and a national reserve) were created to be redistributed to producers under certain conditions. Second, any change of legal vessel operator would henceforth be associated with a loss of 20% of track records, and their subsequent return to these reserves. More precisely, 14% flow back to the PO reserve and 6% to the national reserve[118]. Also, upon cessation of activity, 30% flow back to the national reserve and 70% to the PO reserve. Track records of vessels without PO affiliation flow back to the national reserve entirely (Larabi *et al.*, 2013). These reserves were designed to provide the POs and FCs with some flexibility in allocating quota, and thus to slightly ease the inflated vessel prices. A key objective is to support new entrants to establish themselves[119].

These measures have had limited success, however. Bellanger *et al.* (2016) argue that, at the time of writing, the taxed track records mainly benefited established PO members through the increase of POs' collective allocations – instead of setting them aside for new entrants. Furthermore, the interviews revealed that the national reserve is not being redistributed whatsoever:

- Director of a small-scale PO: "The quota that went back to the national reserve have never been repartitioned." (…) "There is also no transparency – we have no clue what this means in terms of species."

Nevertheless, it may be expected that this 20% rule has severely affected many fishers, especially those with a limited understanding of this new measure. The director of a large-scale PO said the following about this:

[117] Some indicative vessel prices collected in the interviews: 11 m: €0.4 million (2016); 16 m: €1,2 million (2018); 20.5 m: €3 million (2017); 22 m: €2.3 million (constructed in Morocco in 2019; "30% cheaper than in France"); 24 m: €3.5 million (constructed in Spain in 2016).
[118] Article R. 921-45 of the Rural Code.
[119] We refer to Article R. 921-47 and 48 of the Rural Code for an overview of conditions for redistribution.

- "An example is a trawler in co-ownership between two fishers; one has 70%, the other, the skipper, 30%. The skipper is listed as the operator, so when the other wants to disinvest, it will be considered a rupture of the partnership, and 20% of track records will be lost. […] They should have listed their co-ownership as the legal operator instead."

Better informed fishers were able to circumvent this measure by changing the legal form of their firms, i.e., from the default sole proprietorship to a limited liability. Vessel deals thus involve the transaction of the entire company, which is registered as the operator (*armateur*) of the vessel. There is no rupture of the vessel-producer partnership, only a change in the ownership of the company. The preservation of all track records gives the seller higher leverage in price negotiations, and gives the buyer more leverage in quota discussions with the PO.

Limited liability companies also allow for the transfer of shares to family members or skippers (preparation of takeover), as mentioned in the interviews:

- "I created a limited liability company so that my wife can have shares in the company, and for reasons of security. My wife is listed as *capitaine d'armement*, so in case something happens to me, she keeps the company and all fishing rights."
- "If I would sell my vessel, I would lose my license '*Baie de Seine'*. That's why I'm going to construct a limited liability company, and sell the boat to my son."

4.2 An exploration of first order interactions

4.2.1 Membership in fisheries committees and POs

All fishers are *de facto* members of fisheries committees, while PO membership is voluntary. In our sample, 57 fishers (90.5%) were member of a PO. In addition to access to fishing opportunities, POs also provide other services (e.g., marketing, professional representation, access to information, etc.) (Larabi *et al.*, 2013). PO membership also seems to play a role in risk assessments by banks. Two fishers mention that it had been a requirement for getting a loan. This supports the argument put forward by Carpenter and Kleinjans (2017) that fishing rights, despite non-transferability, are considered secure rights – apparently even by financing institutions. In countries with a formal quota market, the acceptance of catch shares as collateral by banks is normal practice (Davidse *et al.*, 1999; van Ginkel, 2009; Høst, 2015), but in France it is generally accepted that this is not the case.

There are nine POs along the Atlantic coast, most of which are operating locally. POs are free to choose their allocation system: e.g., collectively for all vessels or only for specific sub-groups, through yearly vessel allocations, based on vessel track records (2001-2003 or other reference periods) or otherwise. Certain small-scale POs have been favorable to small-scale fishers and local fishing communities by giving them access to collective quota pools, and have denounced refusals[120] based on track records adopted by some large-scale POs (Bellanger *et al.*, 2016).

Access to information is paramount for fishers on the lookout for additional fishing opportunities. The FCs and POs constitute important knowledge networks, which are eagerly used by some fishers. Fishers who are member of a PO can count on some information trickling down to them, but many emphasized the importance of being present at meetings to secure their interests (for which many fishers say to not have the time). Weighing in on decisions is accomplished by getting elected in the board of directors. Non-PO fishers may similarly get access to prime information through participation in working groups or by landing a seat on the board of the FC. This is supported by following quotes:

[120] This was also deemed untransparent by the French Competition Authority, referring to Article 17 of EU Regulation No 1379/2013, which mentions as one of the principles of the internal functioning of POs: "*the definition of rules on the admission of new members and the withdrawal of membership*". In France, no written justification for refusals is required from POs.

- "I'm a bit everywhere, elected in the board of the PO […] and at the [regional committee]." (…) "I always want to know everything. That's my curiosity. I always want to act, to try to make things work and make the things more humane, more democratic […]."
- "I want to understand the juridical framework and understand the evolution of the métier."

Certain fishers have understood the benefits of being present in a range of social structures, and do not care to hide their selfish motives. Some are true rent-seekers who obtain favors from administrators or who misuse their own position to increase access to the resource:

- "All meetings I attend, I do with a reason. The most important is to be up to date about what is decided, so that I can get out of it what is best for me. […] I let my own fishing calendar be revoted. I brought all fishers that agreed with me in the car [to the regional meeting] to weigh in on the decision. You have to show some muscle, do you get what I'm saying? […] It's better to be there because in general things are decided on the spot."
- Small-scale fisher about another fisher: "He's sitting on a *mountain* of track records. He left the PO with about 200 tons of fishing rights and 4 or 5 vessels. He's the president of the syndicate but only thinks about himself […] [He] is the textbook example of a concentrator."

4.2.2 Innovative firm governance as a way to secure fishing opportunities

In this competitive climate, the small size and family character of artisanal firms is threatened, and firms are driven to expansion (Menzies, 2003). Operators must adapt or leave the sector altogether (*adapt or perish*; Said and MacMillan, 2020). Running a modern-day fishing business takes, apart from excellent fishing skills, a great deal of entrepreneurship, financial insight and networking skills (Gibbs, 2008). While some fishers manage to use these capabilities to their advantage, others may lack these skills or they may be effectively prevented from participating in decision-making (Said and MacMillan, 2020). Such firms may rely on cooperative or private structures to back their businesses and make them more resilient and competitive.

Cooperative fishing firms have a long-standing tradition in France's fishing industry. They allowed skippers to progressively acquire full ownership of their vessel until they were the single owner, while most of the financial risk was borne by the cooperative structure. At their peak in the 1980s, there were as many as 20 cooperative structures along the Atlantic coast (Ponsot and Mauget, 2008). Since the 1990s, the model has been in decline due to (among others) the termination of EU subsidies and the limited equity of skippers relative to investments needed.

The interviews suggest that the cooperative model may be entering a new era, based on ownership sharing with skippers backed by financial institutions, local investors and POs. New structures are emerging from the ashes of the traditional cooperatives, focused on attracting vessels to the port – notably with certain track records attached. In all observed cases (n=4), a local PO was the driving force behind the structure. Through its double role, the PO has greater flexibility in planning production and attracting new vessels to the port.

- "We bought a vessel without quota, but in good shape. There was unexploited quota in the Channel, which I knew of only because I'm the director of the PO."
- "More and more operators are retiring […] We need to keep the vessels in the port […] It's time we take action – we have to do *something*."
- "Our vision is, over a period of 7 to 8 years, to renew the entire fleet […]. We identify vessels that represent an important proportion of production and install young skippers on those operations."

The cooperative firm is a limited liability company and is registered as the vessel operator, making it the legal owner of the track records (and protecting it against the preemption measure). Every vessel is held by a separate limited liability company. Vessels are financed through a combination of equity (skipper and cooperative firm), debt (bank loans, investment funds), and in some cases investments from downstream value chain actors.

- "The problem with a [traditional] cooperative is that it can't capture private funds."

- "We want to compete with private investors […]. The focus is on buying quota, and *use* the quota fully. […] If we buy a vessel, it's our aim to earn the equivalent in revenue. […] This way, we become financially stronger to reinvest."

Artisanal fishers may obtain access to quotas at a relatively low cost and with reduced risk. The way in which shares can be acquired by skippers differs from structure to structure.

- "Skippers can be co-owner until 49.9%. We never want to be minority shareholders. The next step is immediately 100%. We might lose grip as minority shareholders, and we risk losing fishing rights. For the skipper, the option stays open to keep 20 to 30% and stay on payroll."
- "Our goal is to sell shares to the skipper early on. […] We don't want to stay the majority shareholder as is the case for other cooperative structures."

A second response is the association of formerly independent owner-operators with a private partner. Co-ownership between peers has always been a way for artisanal fishers to combine forces and know-how, and share risk. Today, co-ownership is being pushed to another level, with skippers engaging in partnerships with large-scale fishing companies. The model is based on the construction of new vessels, made possible by a capital injection by a private partner. The private partner, who is the minority shareholder, takes over the administrative burdens of the skipper (negotiation with banks and POs, bookkeeping, vessel maintenance, crew management). The private partner selects skippers based on performance history and thus receives a fairly easy return on investment. We encountered three such cases in our sample. In two of them, the private partner is an established fishing company with vessels well above the size of the artisanal vessels they are now investing in for the first time (18-24 m and 24-40 m). This suggests that they are out to consolidate market power by capturing rent from artisanal fisheries. This is supported by several newspaper articles[121] pointing towards an image change of industrial fishing firms following criticisms by NGOs.

Collectively, these responses may be understood as innovations to deal with the second order injustices created by the French fisheries management system. Interestingly, the gap created by government policy (i.e., reduced access to fishing opportunities for artisanal fishers) is being filled not by new government policies, but by private and financial institutions. While at first sight we may see a new mode of governance designed to preserve the artisanal fishing model, it also unmistakably represents a way for industrial fishing companies and banks to extend their activities into new territory.

5 Conclusions and policy recommendations

This chapter has shown that French fisheries management has failed to ensure equal access to fishing opportunities, despite the government's explicit intention to avoid inequitable outcomes by holding on to principles of collective property and non-transferability. The system can be considered unjust in two major ways. First, it has disadvantaged certain (notably small-scale) producers from the onset. The systematic underestimation of their catches by the administration for the period 2001-2003 has resulted in small quota allocations upon implementation of the quota management system. Second, the overemphasis on track records in quota allocations has created entry barriers for small-scale fishers and young skippers which have proven difficult to overcome. Government policies directed towards increasing quota allocations for these fishers (i.e., track records preemptions and reserves) have been largely ineffective. Active involvement in POs and FCs seems to be a way for fishers to weigh in on decisions and secure their own interests, but in practice this is limited to a small group of fishers. Other than that, some fishers have been able to protect their interests by changing the legal form of their firms. However, further research is needed to confirm its importance on the regional or national level.

[121] E.g., https://www.meretmarine.com/fr/content/lorient-lapak-et-la-scapeche-creent-un-nouvel-armement (Accessed on 5 April 2021)

The gap created by policy is being bridged by private institutions (bottom-up 'cooperatives', partnerships). Our assessment of this situation is double. On the one hand, it is a hopeful sign that artisanal fishers are finding their way within the system to navigate the institutional barriers they are clearly facing. On the other hand, a situation where government forsakes to deal with the situation in an adequate manner, leaving a void to be filled by private institutions, is undesirable. We argue that, by allowing large-scale fishing companies to step in to resolve problems without apparent 'government' solutions, fisheries management may unwittingly be giving these companies leverage to push for (quota) reforms later on.

In addition to access problems, concerns regarding concentration and the disappearance of the artisanal model have been showcased for years (Menzies, 2003; Delbos, 2006; Bellanger *et al.*, 2016). This case study reaffirms that the system has created a spectrum of winners and losers within the artisanal fleet. One end of the spectrum is characterized by aging fleets, difficulties to find and motivate skilled crew and too few fishing opportunities, while the other is pushing the boundaries of what is legally considered 'artisanal fishing' – their strategy is one of continuous investment and accumulation of fishing rights, thereby directly affecting peers and contributing to a general trend of resource concentration (MRAG *et al.*, 2019). Similar trends have been reported for other EU countries, including Portugal, Malta, Spain and Denmark, as a recent study has illustrated (Said *et al.*, 2020). The study shows that although the CFP imposes on Member States social criteria for the distribution of fishing opportunities, the provisions are not sufficient to ensure access for small-scale fishers. Access to fishing opportunities in the EU remains determined by a political economy of market efficiency and conservation objectives. These meta-order principles are often not tangible but are embedded in the CFP's 'sustainability' rhetoric, which is rooted in principles of economic efficiency, growth and prosperity (e.g., EC, 2009). However, given the clear ideological differences between the French approach to management and the one proposed by the European Commission, we may view the injustices created by the fisheries management system as unintended consequences rather than the result of a government policy that is purposefully shaping the industry this way.

Concerning the future, the current government has expressed a clear commitment to implement the EU's Blue Growth strategy and to modernize the fishing fleet (Le Marin, 2017): e.g., "[Given the appropriate means for innovation], the fishing and aquaculture sectors are at a point where they may become *extremely competitive* tomorrow". However, despite clear implementation roadmaps in certain Regions (e.g., Région de Bretagne, 2018), it remains unclear how this commitment will be translated into policies at the national level, let alone how it will benefit artisanal fishers. The promise of Blue Growth for artisanal fishers has been put under scrutiny (Hadjimichael, 2018; Said and MacMillan, 2020). The studies argue that an artisanal sector in a Blue Growth framework requires protection through sector-specific assistance such as fishing opportunities which can only be utilized by the sector, and rigorous monitoring of the 'market' for fishing opportunities. Moreover, state support focused on studying and strengthening new modes of bottom-up governance could be another way by which the State can regain the upper hand in determining the future of the artisanal fleet.

General discussion and conclusion

1 Summary of the main findings

This PhD research has provided a baseline study of who currently owns the means of production in the French Atlantic fishing sector, with a specific focus on the fishing vessels and associated fishing opportunities. We have adopted an organizational view on the fishing industry (see Figure 0-1). On a micro-economic level, we have considered that the fishing firm is the main decision-making unit, with the entrepreneur as the primary decision-maker (and sometimes owner) and the person who allocates resources within the firm. An additional chain of ownership (i.e., shareholders, ultimate owners) and/or command (i.e., managers, shareholders in the board of directors) may be present for corporately owned and/or vertically integrated firms. On the macro-level, we may think of current industry structure as both an outcome and a driver of fleet evolution – an *outcome* in the sense that capacity reduction policies have resulted in industry contraction and concentration, and a *driver* in the sense that industry structure may create incentives for vertical and horizontal integration (and thus, further concentration). In France, recovering fish stocks and low interest rates have created a climate of opportunity in the sector (Guyader, 2018), and this is matched with the emergence of new governance structures (e.g., joint ventures, new fishing cooperatives, holding structures) and financial vehicles (e.g., investment funds). The institutional context is characterized by a number of reforms of the quota management system, which has resulted in access problems for small-scale fishers and new entrants. Mitigation measures have so far not been able to resolve the problem. Despite its explicit focus on inclusion, French fisheries management is embedded within a European policy context of economic efficiency and Blue Growth, in which the position of artisanal and small-scale fisheries remains unclear.

The PhD was organized around four specific research questions:

(1) What is the organizational structure of multi-vessel fishing firms and what are the main drivers behind their evolution?
(2) Who ultimately owns the fishing capital?
(3) Does concentration of fishing capital and production occur?
(4) Has the fisheries management system created any injustices towards artisanal fishers in the way fishing opportunities are allocated and redistributed?

In Chapter 1, we have constructed a typology of firm organization for fishing firms owning and operating multiple fishing vessels. Multi-ownership is an explicit deviation from the 'artisanal' archetype, which is characterized by an embarked owner-operator who commands a single fishing vessel <12 m (but can be up to 25 m according to legislation[122]) and who invests his or her own (personal) capital in the production unit. Additional elements include: a maximum of 5 to 10 crew, a high degree of family involvement, strong local anchoring and the polyvalence of fishing activity (Debeauvais, 1985; Menzies, 1997, 2003; Delbos, 2006; Ifremer, 2007; Reyes *et al.*, 2015). Researchers have reported shifts in the artisanal fishing model in recent decades, such as a decline in family-based and household fishing, the emergence of new forms of firm governance, and a general struggle to remain competitive (Menzies, 2003; Delbos, 2006). Anecdotal evidence furthermore points towards capital accumulation in fisheries that would normally be classified as 'artisanal' (e.g., Le Marin, 2019). In this context, we have questioned the relevance of the 'artisanal vs. industrial' dichotomy used by fisheries management. Using a mixed-methods research approach (interviews, multiple correspondence analysis and hierarchical clustering), we have constructed a typology of firm organization based on six organizational attributes (ownership structure, firm structure, management strategy, firm size, fishing strategy and valorization strategy). Our study shows that the 'artisanal vs. industrial' dichotomy is unable to capture the organizational diversity of modern-day fishing firms, and

[122] Décret n° 93-33 du 8 janvier 1993.

that French Atlantic fishing firms have evolved into an array of types which are separated based on following cluster-specific modalities: access to key information (e.g., bookkeeping and financial advice, vessel deals), legal form (e.g., sole proprietorship, limited liability company, etc.), standardization of fishing vessels and the organization of vessel maintenance (i.e., internalization or externalization), growth objectives (i.e., none, acquisition of fishing vessels, focused on processing and retailing), and management structure (embarked/shore-based owner, external manager). Our final typology describes 5 distinct types: small-multi owners, medium to large-scale family fishing firms, fisher-processors, ownership-sharing models, and corporate fishing groups.

Int this way, Chapter 1 has provided us with insight into the organizational diversity of multi-vessel fishing firms, and therefore into the different 'ownership profiles' (cf. Nøstbakken *et al.*, 2011) currently existing in the French Atlantic fishing sector. To take the *who?* question beyond the direct owners to the 'ultimate' owners of fishing vessels, we first needed to develop a methodology to link the fishing vessels to the companies holding them. Establishing this link is not straightforward, given that in the framework of Regulation (EU) 2017/218, information on vessel ownership is only collected at the level of the operator (who is not necessarily the owner). Moreover, any company identification number is lacking. Building on a first effort by the French Directorate of Sea Fisheries and Aquaculture (DPMA), we have constructed a 'Vessel-Company (VC) Register' linking all French fishing vessels registered in 2018 to their company identification numbers (SIREN numbers). Furthermore, through the Community Fleet Register (CFR) number, the VC Register also includes production data (value and volume of landings) on the vessel and company level. The VC Register is needed to connect vessel data to corporate ownership data which are contained in other databases (in our case, the Orbis database). As such, the register allows us to identify the ultimate owners of French fishing vessels (Chapter 2) and to analyze concentration of assets and production (Chapter 3).

The main objective of Chapter 2 was to develop a multi-purpose methodological framework for EU-wide and comparative analysis of vessel ownership in the EU fishing industry. Recent studies have analyzed ownership mostly on a case-study basis, due to issues of data quality, transparency and coverage. We have developed an approach that is able to extract and treat large amounts of ownership data at once, for multi-purpose use: (1) ultimate owner identification, (2) ownership calculation/concentration analysis at different levels along the path from the vessel-holding company to its ultimate owner(s), and (3) detailed description of the corporate group to which the company belongs. We argue that this methodology shows great potential for comparative analysis on the EU level, under the condition that VC Registers for all EU Member States are established and that appropriate tools for ownership exploration are developed.

In Chapter 3, we have mobilized part of the data extracted in Chapter 2 to analyze concentration in the French Atlantic fishing sector. The phrase *who owns what?* in the title of the PhD thesis makes a quip to the fact that multiple assets may be considered for ownership and concentration analysis. *What?* may refer to the fishing vessels, fishing opportunities, or entire fishing firms, but also to specific assets that are proxies for (market) dominance in the fishing sector. These include gross tonnage, engine power, and landings (volume and value). In Chapter 3, we have considered all of these assets in our analysis of concentration. We found that in the Atlantic fleet, the 4 largest entities are responsible for almost 40% of total production. Concentration was found to be high for the saithe and blue whiting fisheries, which are ultimately owned by foreign (Dutch, Icelandic) shareholders. The hake fishery, which is mostly practiced by independent fishing firms, shows a high degree of inequality. This is due to the presence of only a small number of specializers (among which Spanish 'quota hoppers') for a large number of participants in the fishery. In the scallop fishery overall inequality is low, but results point towards a small number of specializers concentrating production in local value chains (4 firms are responsible for 8.8% of landings, whereas the 50% least producing entities jointly produce 9.2%).

The central question in Chapter 4 was whether the French fisheries management system (focus on the allocation and redistribution of fishing opportunities) has created injustices towards artisanal and small-scale fishers. The chapter also investigated how fishers have navigated the institutional framework to obtain and secure fishing opportunities. A mixed-method research approach was used, combining thematic narrative analysis and a literature study. Following the framework proposed by Jentoft and Chuenpagdee (*in press*), we have considered injustices at three orders of governance. First, we have considered the *second order*, i.e., the institutions of fisheries management in France, and the rule sets devised and implemented by them. At this order (and applied to the question at hand), justice is a matter of ensuring that the rules pertaining to access to the fishery lead to fair and equitable outcomes. An important aspect therein, is how small-scale and artisanal producers are able to participate and weigh in on the decision-making process that affects them. Our results show that the institutions of fisheries co-management have not been able to ensure a fair and equitable distribution of fishing opportunities, and that the rules that govern access affect small-scale producers and young entrants in particular. Also, mitigation measures such as track records reserves have not yet delivered on their promise. Participation in decision-making is foreseen at different levels, but in practice access to the decision-making table is a matter of time allocation, which again mostly affects embarked small-scale and early-career owner-operators. At the *first order* of governance, we find interactions between stakeholders as the main locus for (in)justice. In Chapter 4, we have focused on interactions between producers and/or with institutions in the broader environment (e.g., POs, banks, supply chain actors) to devise governance arrangements which result in the better securing of fishing opportunities, but also in a better protection against the competitive forces of the market. Several of these arrangements were found, of which a new form of cooperative fishing company is perhaps the most remarkable. Finally, the results were discussed against the background of EU rhetoric of economic efficiency and Blue Growth. This constitutes the *third (meta) order* of governance. We found that in the French fishing sector, like elsewhere in Europe (Said *et al.*, 2020), the Blue Growth agenda has unclear implementation pathways. While the meta order has strongly influenced the design of French fisheries co-management, the French government has held on to non-transferability (based on arguments of inclusion), in spite of the Commission's push for Transferable Fishing Concessions (TFCs). We argue therefore that many of the injustices created by the French fisheries management system were in fact unintended consequences rather than the result of a government policy that is purposefully shaping the industry this way.

2 Recontextualization of the findings and main contributions

In what follows, we will recontextualize the thesis findings by linking them to the broader institutional context, as well as empirical, methodological and theoretical work. Main contributions of the thesis will be highlighted.

2.1 What can be expected from organizational types?

The work in Chapters 1 and 4 is embedded in a growing body of literature on capital and owner dynamics in the French Atlantic fishing sector (Guyader *et al.*, 2003, 2006; Quillérou *et al.*, 2011, 2013; Quillérou and Guyader, 2012; Van Putten *et al.*, 2012) and the institutions of fisheries management (Larabi *et al.*, 2013; Bellanger *et al.*, 2016), as well as a large body of ethnographic literature mostly describing shifts in the so-called 'artisanal fishing model' (Debeauvais, 1985; Delbos and Prémel, 1995, 1996; Menzies, 1997, 2002, 2003; Rey *et al.*, 1997; Delbos, 2006; Mesnil, 2008; Ponsot and Mauget, 2008). While the typology in Chapter 1 is a photograph of the diversity of organizational structures currently found in the Atlantic fishing sector, it is worth exploring their origins and fate in a bit more detail, based on key insights from the literature. By zooming in on the dynamics of the second-hand vessel market and key evolutions in the institutional context of fisheries management, we may be able to make assertions about the future of these organizational types.

In France, the second-hand vessel market is a main entry point for capital-constrained, first-time owners (Guyader *et al.*, 2006; Van Putten *et al.*, 2012). The importance of the second-hand market must be understood in the context of limits imposed on new vessel constructions by fisheries management (in place since 1992), as well as capital constraints (i.e., new vessels are too expensive) (Guyader *et al.*, 2006; Van Putten *et al.*, 2012). Decommissioning schemes (1992-2005) have resulted in a decrease in the number of vessels (-35% between 1992 and 2010; Van Putten *et al.*, 2012), exit of owners (-10% between 1993 and 2012; Quillérou and Guyader, 2012) and increases in catches and economic efficiency among remaining vessel owners (Guyader *et al.*, 2006). In this context of high profitability, the rate of vessel transactions increased[123] between 1992 and 2001. Between 2002 and 2009 there was a steady decrease, linked to decreased profitability and decommissioning schemes (Van Putten *et al.*, 2012). In 2010, the number of transactions started to increase again (improved profitability), and recent anecdotal evidence suggests that the current rate of transactions is high (Guyader, 2018 and interviews conducted in the context of this PhD research).

However, a side note must be made here with regards to the nature of (some of) these transactions. Whereas the acquisition of vessels on the second-hand market is since long a vehicle for access to the resource, in 2006 new freedoms were introduced for vessel owners: (1) the freedom to distribute track records among multiple vessels of which they are the owner; and (2) the freedom to sell a vessel while keeping its track records. This has given producers more flexibility with regards to their investment strategies, i.e., the option to buy and resell, and transfer track records in the process (Larabi *et al.*, 2013). This, combined with the strong link between track records and quota allocations, has furthermore created an incentive for producers to invest in fishing vessels with track records attached. Larabi *et al.* (2013) have warned that this may lead to concentration, since there are no mechanisms in place to limit these transactions. With regards to these freedoms, Quillérou *et al.* (2013) have stated that this policy had not caused any notable shifts in market transactions at the time of writing. However, anecdotal evidence now shows that fishers across the spectrum make use of these freedoms to buy and sell vessels only for the track records attached. This is revealed by the interviews (see quotes in Chapter 4), but also by analyses based on fleet register data, which showed anomalies such as vessels remaining inactive after acquisition, and being resold the next year. While data on fishing 'rights' (historical track records) attached to fishing vessels were not available to us, interviewed fishers and experts unanimously agreed that these kinds of schemes are indicative of a strategy focused on the acquisition of track records.

Due to a lack of data, the precise extent of such schemes is difficult to assess. However, it is generally accepted that they are widespread (cf. interviews). The interviews further indicated that vessel prices have already exceeded what most new entrants can pay[124], taking into account that they have to buy an old vessel with fishing rights attached, which they then demolish to redeem the track records and licenses[125]. These are then transferred to a new vessel. In a context of a rapidly aging fleet (SIH, 2019) and limited access to fishing opportunities, we can only expect this trend to become more prevalent, and that prices will continue to rise. Moreover, given that also the owner population is aging (SIH, 2019), there is a great deal of pressure on young owner-operators to revitalize the artisanal fishing sector.

In this economic and institutional context, we may ask ourselves what the fate of 'artisanal' fishing may be. Ethnographic studies provide overwhelming evidence for the decline of family-based and household fishing (Menzies, 2003; Delbos, 2006), shifts in operator-crew relationships (Menzies, 2002), and increasing competition on international commodity markets

[123] This is probably due to increased profitability following reduced fleet numbers; causal inference was reported to be difficult (Van Putten *et al.*, 2012).

[124] Especially young skippers rely heavily on the second-hand market to enter the fishery (Van Putten *et al.*, 2012).

[125] Fishers reported that the vessels they could afford (with the required track records and licenses attached) were "basically worthless" and that fishing with them was not cost-effective. New entrants thus accept that they have to "pay twice" for a fishing vessel.

pushing fishing units towards expansion (Menzies, 2003). The interviews did not only confirm this, but they also added new perspectives with regards to how some of the types identified in Chapter 1 may evolve. An important insight from the interviews is that fleet renewal and/or investment in additional fishing opportunities can only be accomplished if other vessels in the firm can pay for it.

With respect to the points raised above, we may make a number of assertions with regards to the 'viability' and fate of different types, and the movement between them. The most stable firms are those with enough fishing vessels to pay for fleet renewal, as well as the organizational capital to run a competitive business (e.g., innovation, cost-efficiency, vertical integration, etc.). Generally speaking, corporate fishing firms (Type 5), large-scale family fishing firms (Type 2), and also fisher-processors (Type 3) may be able to thrive in the economic and institutional context described above. The three types of ownership-sharing models (Type 4) may vary greatly in their ability to keep up. For instance, the traditional cooperative model has been associated with weak internal governance and limited access to funding after the termination of subsidies in 2004. The recent takeover and large-scale restructuration of one such company (*Arcobreizh*) confirms this[126]. In 2020, the cooperative fishing company *CAPAM* in Cherbourg associated with a private fishing company (*Armement Cherbourgeois*) to form a new structure named *Armement Ouest-Normandie*[127], which now seems to operate two 25 m vessels (to be confirmed). Regarding the 'new' cooperative models organized around small-scale POs and local value chain actors, it is hard to predict how they will evolve. Their evolution deserves our further attention. Lastly, stability can be expected for the model based on ownership sharing between (formerly independent) skippers and a corporate fishing company, given that they benefit from the organizational structure and firm attributes of the latter.

It was common for many respondents (mostly large multi-owners) to think of themselves as social entrepreneurs, sometimes even 'saviors', with a duty to protect the social capital (French: *tissu local*) of their fishing community. Ironically, however, the success of large multi-vessel fishing companies (e.g., family fishing firms of Type 2) may make them more vulnerable for takeover by corporate groups and/or foreign investors. This came up multiple times during the interviews. Due to their critical size, only a few 'local' (French) fishing companies qualify as potential buyers. Examples of takeovers of large multi-vessel trawling companies by foreign investors are already known for France, such as the acquisition of *Armement La Houle* by the Irish company *Celtic Consortium* in 2016[128]. In Fécamp, *SPES armement*, life's work of Yvon Neveu, was sold to *France Pélagique*[129], a corporate fishing company ultimately owned by the Dutch group *Cornelis Vrolijk*[130].

Movements between types can also be inferred for other types. The small multi-owners of Type 1 may move to Type 2 through the acquisition of fishing vessels, or directly to Type 3 through the integration of fish sales. This can be as simple as direct sales in fish stalls or through home delivery. More advanced vertical integration strategies (processing, retailing, holding tanks) (Type 3) are mostly seen when firms have reached a critical fleet size (i.e., movement from

[126] https://www.ouest-france.fr/economie/entreprises/peche-l-entreprise-finisterienne-arcobreizh-repris-par-l-armement-breton-6323307 (Accessed on 20/04/2021).
[127] https://actu.fr/normandie/cherbourg-en-cotentin_50129/nouvel-armement-nouveau-chalutier-le-port-peche-cherbourg_31505807.html; https://actu.fr/normandie/cherbourg-en-cotentin_50129/peche-a-cherbourg-le-chalutier-les-hanois-repris-par-l-armement-ouest-normandie_39013621.html (Accessed on 20/04/2021).
[128] https://lemarin.ouest-france.fr/secteurs-activites/peche/25774-larmement-la-houle-cede-en-partie-des-irlandais (Accessed on 20/04/2021).
[129] Le Marin implies that Yvon Neveu, having specialized in herring and mackerel in the Channel and the North Sea, made an interesting business partner for France Pélagique (https://lemarin.ouest-france.fr/secteurs-activites/peche/27319-normandie-un-chalutier-surgelateur-passe-sous-pavillon-francais) (Accessed on 20/04/2021).
[130] SPES Armement is a subsidiary of France Pélagique (MRAG *et al.*, 2019).

Type 2 to Type 3)[131]. This evolution must be followed up closely in some fisheries, notably in the scallop fishery (traditionally considered a typical 'artisanal' fishery), for which we have found that 4 dominant producers capture almost 9% of landings (for reference: the same proportion is captured jointly by the 50% smallest producers). In passing from Type 1 to Type 2/Type 3, entrepreneurs are seen to make radical changes to the organizational structure of their firms (e.g., scale increase, the hiring of someone to oversee production, becoming shore-based manager, etc.). Interviews suggest that there is an intermediate stage (see the 'emerging entrepreneurs' in Chapter 1) at which firms either grow out to become large multi-vessel firms or revert back to Type 1 or even single-vessel fishing firms. We may refer to them as 'make or break' companies.

A conceptual model of evolution and movements between types is included in Figure 0-1. We hypothesize that there are two main types of flows. The first is 'evolutionary' and is closely linked to the life stages of the entrepreneur (personal growth, age, family situation, etc.). The second movement is constituted by flows of varying nature in which fishing capital moves to corporate fishing firms through mergers and acquisitions[132].

[131] E.g., https://www.ouest-france.fr/normandie/ouistreham-14150/la-mafia-des-coquilles-saint-jacques-4620220; https://www.villedesaintcastleguildo.fr/images/MARINS_PECH_2.pdf (Accessed on 20/04/2021).

[132] Depending on the type of fishery and the economic model of the corporate fishing firm, focus may be on the acquisition of fishing vessels and associated fishing opportunities, regardless of the organizational structure in which they are embedded, while in other cases focus may be on acquiring robust organizations, including crew, management structure, etc.

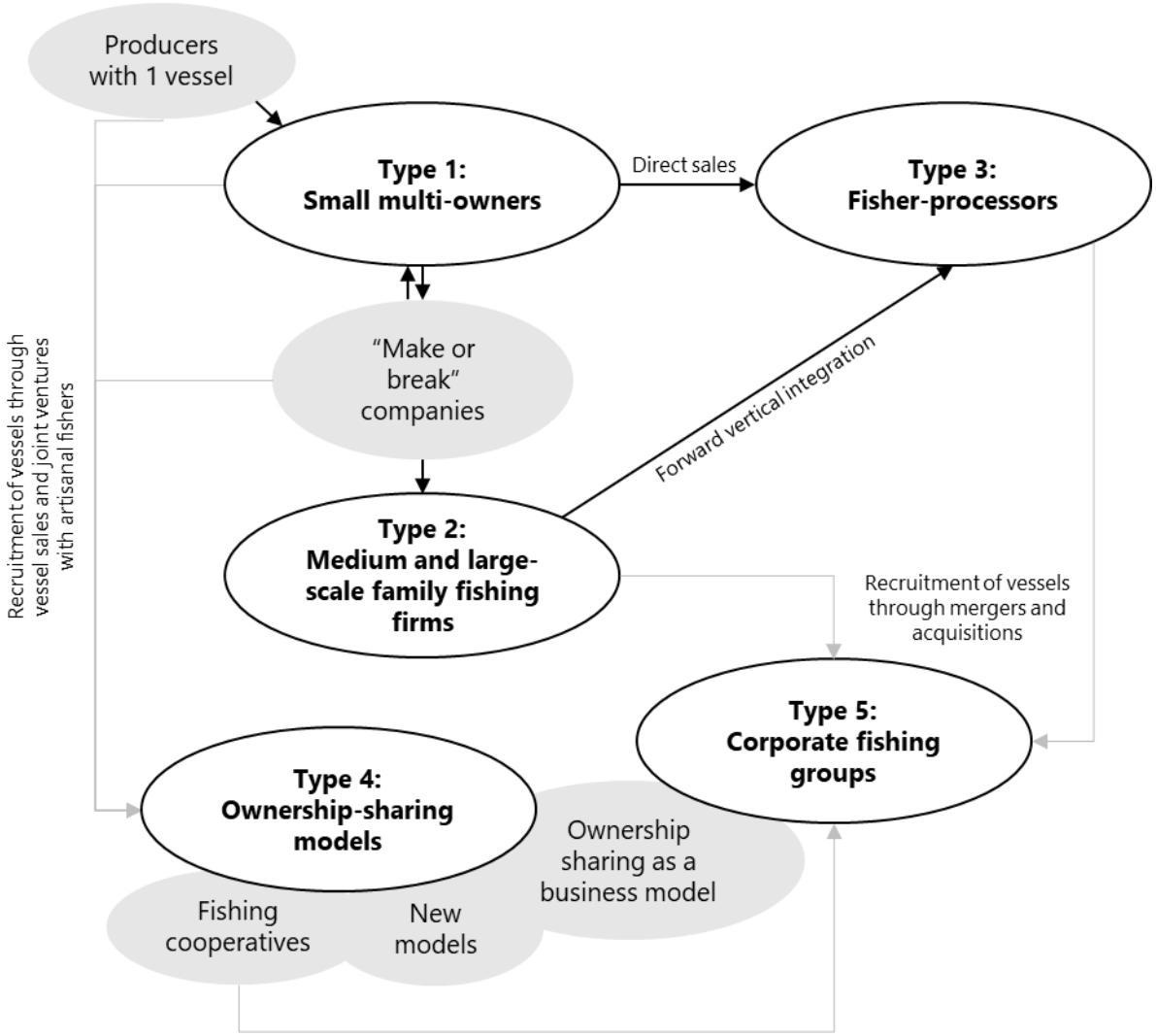


Figure 0-1: Conceptual model of evolution and movements between types. Two main types of flows may be discerned. The first is 'evolution' and is closely linked to the life stages of the entrepreneur. The second flow is a flow of fishing capital from different sources to corporate fishing groups through acquisitions and mergers.

In this PhD research, we have asked ourselves how and why multi-vessel fishing firms grow, but have ignored how multi-vessel firms originate in the first place. We may consider that ontogenetically speaking, 'artisanal' multi-vessel fishing firms were once single-vessel firms. The framework proposed by Friedmann (1980), and used by Høst (2015) and Menzies (2002, 2003) provides an interesting angle from which to approach firm growth in the fishing sector. In fisheries or agricultural production systems, we may differentiate between two basic modes of production. These are simple commodity (i.e., 'household') production and the capitalist mode of production[133](Høst, 2015; Højrup, 2018). A production mode is a cyclic process describing one possible way to organize production, including the reproduction of its preconditions. Central to the concept of production modes is the ownership of the means of production and the labor input, as well as the appropriation of the end product (Høst, 2015). In capitalist commodity production, the appropriation of surplus value by the capitalist creates an inherent tendency towards accumulation and increased scale of production (Friedmann, 1980). In simple commodity production, the income gained in the production process is used for the reproduction of the household and the production unit – i.e., to pay the costs of production, to feed the household and to reinvest in the instruments of labor. The simple commodity producer

[133] The degree to which fisheries production can be considered 'capitalist' (and where to draw the line) is the subject of debate among scholars (Menzies, 2002; St Martin, 2007; Campling *et al.*, 2012; McCall Howard, 2012). We will not get into this here.

thus produces his own product, and with that the very conditions for his existence (Høst, 2015). As such, there are no economic factors that create a tendency for capital accumulation and expanded production[134]. Friedmann (1980) argues, however, that demographic factors such as the presence of "more than one son" may lead to fission – i.e., in which the income generated in one household is used to establish "a new one on the same scale" (see also Menzies, 2002, 2003). Menzies (2002) aptly points out that under simple commodity production, expanded production results in *more firms* competing with each other, whereas under capitalist commodity production, the number of firms is decreased and competition is reduced.

2.2 The French Atlantic fleet: industry drivers, scale economies and opportunities for rent capture

In this PhD thesis, we have looked at investment decisions mainly as internally motivated. For instance, in Chapter 1 we have found that the decision to invest is a function of, among others, the age and personal situation of the entrepreneur, the type of fishery, the availability of fishing opportunities, the entrepreneur's financial capacity to invest, and fiscal considerations. Based on these and other factors, the entrepreneur's investment strategy may take on different general forms (e.g., income diversification, cost reduction, risk aversion, profit maximization, etc.). Apart from internal factors, however, investment decisions are also influenced by external considerations, and not the least by the structure of the fishing industry (cf. Porter, 1980, 1981). We will focus here on potential drivers (both micro-economic (internal) and macro-economic (external/industry)) for horizontal mergers, vertical integration and foreign ownership in the French fishing industry.

MRAG *et al.* (2019) argue that mergers in the EU fishing industry often result from micro-economic drivers at the firm level (efficiency considerations). In fact, the firm's strategy is a function of these micro-economic drivers and a range of external factors such as access to credit, the state of the resource, the institutional environment (e.g., quota management) and so on. A main industry driver in the fishing industry is the presence of scale economies (MRAG *et al.*, 2019). Scale economies can typically be realized for pelagic and schooling fish species (e.g., herring, mackerel, blue whiting, tropical tuna species), but also for some demersal species caught in large amounts (e.g., Atlantic cod, saithe). For such 'mass species', firms may achieve efficiency gains by increasing the scale of operation and consolidating quotas on fewer but larger fishing vessels (MRAG *et al.*, 2019). This, in turn, creates an incentive for vertical integration. Other motivations to vertically integrate may be strategic in nature and depend on the structure of the industry and the supply chain: secure supply/demand, protection of profits from non-malleable assets (vessels), capture of quasi-rents from other parts in the supply chain (e.g., processing, retailing), and preventing competitors from acquiring a key input (market foreclosure) (Dawson, 2003; Thom and Schwaab, 2010). An industry structure in which rivalry and strategic stakes are high is also prone to horizontal mergers. Where appropriable quasi-rents exist, horizontal mergers may be a way for firms to increase bargaining power and/or prevent their competitors from increasing theirs. As such, firms may try to achieve market power, which can be described as a firm's ability to capture economic rents from fishing in the long term (cf. Poole and Van de Ven, 2004). From an industry perspective (cf. Porter, 1980), the result of mergers and acquisitions in an industry is consolidation.

The elements listed above were compiled from a number of literature sources on horizontal and vertical integration in the fishing industry (Gallick, 1984; Love *et al.*, 1995; Guillotreau and Le Roy, 1998; Koss, 1999; Isaksen and Dreyer, 2000; Dawson, 2003; Thom and Schwaab, 2010; MRAG *et al.*, 2019). In practice, it is difficult to pinpoint exactly which drivers are at the basis of observed industry evolutions. MRAG *et al.* (2019) have studied industry drivers in the

[134] We assume, for the sake of the argument, that technological innovations do not affect the scale of operation.

EU fishing industry. They identified the presence of scale economies as a main driver for industry change (MRAG *et al.*, 2019). In France, the study mentions the acquisition of *Armement Dhellemmes* by *Scapêche* as an example of cost reduction through scale economies, to compensate for the immediate economic losses incurred due to rebuilding of fish stocks (i.e., reduced access). However, in France the number of 'mass species' for which economies of scale may typically be realized through specialization, standardization of vessels and vertical integration (Guillotreau *et al.*, 2008; Thom and Schwaab, 2010), is limited. Exceptions include Atlantic cod, saithe, blue whiting, Atlantic herring and Atlantic mackerel, which are harvested by ≥40 m trawlers. Yet, economies of scale may also exist on other levels of operation, as was shown for the 'family fishing firms' and 'fisher-processors' in Chapter 1. Overall, large-scale operations (in size and number of vessels) are more prone to horizontal mergers, vertical integration and attracting interest of foreign investors.

Another important structural element in the case of France has been access to credit, and the end of mass subsidies. Access to credit has been made easier in recent years. Firstly, the traditional bank for fishers, *Le Crédit Maritime*, has to deal with increased competition from non-specialized banks, most of which have developed a branch dedicated to supporting Blue Growth. Secondly, the cost of credit has also fallen sharply due to the decrease in medium to long-term interest rates, which has facilitated investments in a context of improved economic performance of vessels. Many respondents also considered that the end of construction subsidies has "cleaned up" the sector. Even though the economic and organizational models of fishing companies are strongly influenced by the regulatory context of fisheries, the choice of legal form and funding model are largely inspired by company models in other parts of the economy. This is in contrast with the agricultural sector in France, for which specific legal forms have been established. In fisheries only one such structure currently exists – the *société de pêche artisanale* – with advantages in terms of fiscality. However, this structure has had limited success, and most fishers seem to choose for classic limited liability companies (Cellérier, 2016)

2.3 Methodological contributions to ownership analysis in the EU fishing industry

Ownership analysis in the EU fishing sector is a relatively new area of research, and analysis has proven to be challenging – among others due to incomplete and patchy data, the existence of complex, opaque and fast-changing ownership structures, diverging scope and ownership definitions between Member States, and so on (see MRAG *et al.*, 2019). Up until now, research has mostly focused on a number of iconic case studies of vertical integration and foreign ownership (Sykes *et al.*, 2014; Warmerdam *et al.*, 2016, 2018; EJF, 2018; MRAG *et al.*, 2019). However, our research has shown that concentration may also be occurring in smaller fleet segments and at local levels. While such concentration is insignificant when considering it from the perspective of the EU (i.e., limited risk of distortion of competition), it warrants further research for at least two reasons. First, understanding the extent of concentration (and the drivers behind it) is important to ensure adaptive fisheries management. Second, if these trends exist in France, they likely exist elsewhere in the EU, and the study of integration and concentration in small fishing communities in France may yield insights that are relevant for fishing communities across Europe.

MRAG *et al.* (2019) are the first to have taken ownership analysis in the EU beyond the usual case study approach (e.g., Warmerdam *et al.*, 2016, 2018), and remains, to date, the most significant and complete work on ownership and concentration in the EU fishing industry. It was our objective in this PhD research to provide new perspectives for the EU-wide comparative analysis of ownership and concentration through the construction of a methodological framework. In doing so, we have directly addressed two concerns voiced by the MRAG study. First, we have partly resolved the issue regarding ownership data for France (although only for vessel ownership). Second, our methodology is able to extract data for all EU Member States, which opens up the possibility of creating an EU-wide and centrally

managed database fostering comparative analysis of vessel ownership and concentration (see Discussion Chapter 2).

For concentration analysis in Chapter 3, we have considered that fishing vessels are held (for 100%) by fishing companies, which are in turn owned by shareholders at different hierarchical levels and at different ownership percentages. Based on the 'divisibility' property of fishing firms and fishing vessels (Chapter 2, section 1.3), we assume that, at each hierarchical level, the fishing vessel is owned at the same percentage as the fishing company itself. Lower-level assets such as GT, kW and landings follow the same principle. We may thus say that all of these assets are 'owned' *pro rata* by the different shareholders of the vessel-holding company (direct ownership) and along the path to its ultimate owners (total ownership; calculated). While this has remained largely conceptual in the thesis, we emphasize that it may open up new perspectives for ownership analysis in fisheries.

This being said, the assumption that ownership shares in a fishing company are a good proxy for an entity's 'ownership' of that company, needs to be looked into further. This requires a better understanding of corporate governance and control, notably of cash flow and voting rights in different legal forms and ownership structures. But more importantly, the assumption that ownership gives shareholders 'ownership' over the *resource*, is too simplistic. In our conceptual model, we have implicitly assumed that any shareholder receiving dividends from a company that generates surpluses from fishing, 'owns' part of the fishery and its output. However, the real question with regards to 'ownership' is not where the profits go, but who captures the rents from fishing.

3 Policy implications

A key insight from this PhD research is that the collection of data on vessel ownership at the EU level is insufficient. There are two main problems with the data collection in the framework of Regulation (EU) 2017/218 (Annex I). First, the collection of most ownership information is non-compulsory ('optional' or 'compulsory if available'). By making all fields compulsory (especially the fields '*Legal Person Indicator'* and '*Name'*), reconstruction of ownership links would become easier. However, it is unlikely that this will be enough for most Member States (our analyses for France have clearly shown that it is not). The biggest obstacle is that there is no inclusion of any kind of company identification number. If included, the manual effort of constructing VC Registers would not be necessary. A validated and periodically updated database at the EU level would also be more cost-efficient. While we are not aware of the considerations that have led to the formulation of Annex I, it is likely that privacy issues play a role. That being said, we emphasize that, if the EU is serious about further promoting ownership analysis in the fishing industry (cf. EU, 2017; MRAG *et al.*, 2019), it must include the company identification (VAT) number in the data collection on the vessel level in the next CFP reform.

This does not resolve the data issues with regards to (initial) quota/license allocations, however, which is largely a national matter which must be negotiated directly with the respective administrations and/or co-management institutions. Fact of the matter is that the European Commission has little control over how Member States organize their quota allocation systems in terms of the definition of rights (e.g., who can hold rights and how much, are rights property rights or mere use rights, are they transferable, etc.)[135]. The EU-wide system of Transferable Fishing Concessions (TFCs) proposed in the Commission's Green Paper (EC, 2009), was not withheld in the 2013 reform of the CFP. While TFCs were proposed as a cost-effective solution to the persistent overcapacity problem, such a standardized system would also result in better oversight for the Commission as to who owns the fishing opportunities.

[135] Article 16 of the CFP (Council Regulation (EU) No. 1380/2013) establishes that Member States are free to choose their allocation system, but that they have an obligation to report it to the Commission.

In Council Regulation (EU) No. 1380/2013, TFCs were eventually replaced with social and environmental criteria for the allocation of fishing opportunities (Article 17)[136], on the basis that such criteria could be transformative in a way similar to what was envisaged by TFCs (STECF, 2020a, pp. 31-32). Article 17 of the CFP stipulates that criteria must be "transparent and objective". In France, such criteria were established in the Rural Code (Legifrance, 2019), e.g., with regards to the reallocation of fishing opportunities in track records reserves (Article R. 921-48 in the Rural Code). However, until now fisheries management has failed to implement the reallocation of fishing opportunities on any significant scale, and the process behind it is everything but transparent. The testimonies of fishers across the artisanal spectrum suggest that the situation is urgent.

Based on the insights developed in this PhD thesis, we recommend that European fishing policy takes into account the full extent of the mechanisms of concentration and foreign ownership. So far, these phenomena have been dealt with mostly in an institutional setting defined by fisheries management, without much consideration given to the broader policy context. However, recent evidence shows that ownership and control are increasingly accomplished through acquisitions, mergers and ownership interests in fishing companies. Such acquisitions and mergers are governed by policies and institutions beyond the institutions of fisheries management – i.e., the EU Single Market and EU Competition Law. Based on the insights of this thesis and insights from the literature (e.g., Sykes *et al.*, 2014; EJF, 2018), we argue that a better articulation between the CFP and other EU policies will be needed to better confront this challenge.

4 Limitations of the PhD research

The work presented in this thesis could have benefited from a last thorough round of editing. Time constraints have been an issue for me throughout the course of the PhD, partly because of methodological choices made along the way, partly due to my relative newness to the field of fisheries economics, and partly because of my constant curiosity to find new (and especially heterodox) angles to study the problem at hand. I have no regrets whatsoever with regards to the PhD trajectory but there are some things I would do differently if I were to start over. First, in retrospect, I have spent too much time on coding the interviews. My mistake has been to start coding before having clearly formulated my research questions. Doing so earlier on would have saved me some time.

Second, my ambitions with regards to ownership/concentration analysis in the EU fishing industry were set too high. It was expected that we would be able to provide conclusive evidence of ultimate ownership in both France and Europe. Instead, most of the time was dedicated to the construction of the methodological framework for data extraction and analysis, with only little time left for analysis. Getting the protocols right was a tedious job, for reasons not elaborated here. An alternative route *could* have been taken, focused on producing publishable output. In that case, analysis would have focused only on a subset of EU fishing vessels, i.e., those with an IMO number. For IMO fishing vessels, the chain of corporate ownership in Orbis seems complete, and no inference methods need to be applied. That being said, the framework presented in Chapter 2 is a most valuable output, potentially with applicability on the EU level. My next focus will be on getting the methodology published and to apply it to a selection of French case studies.

[136] Article 17: "When allocating the fishing opportunities available to them, as referred to in Article 16, Member States shall use transparent and objective criteria including those of an environmental, social and economic nature. The criteria to be used may include, inter alia, the impact of fishing on the environment, the history of compliance, the contribution to the local economy and historic catch levels. Within the fishing opportunities allocated to them, Member States shall endeavour to provide incentives to fishing vessels deploying selective fishing gear or using fishing techniques with reduced environmental impact, such as reduced energy consumption or habitat damage."

Third, while the preliminary results of Chapter 3 give a first insight in trends of ownership and concentration in the French Atlantic fishing sector, the chapter could have benefited from a better consideration of the research approach. Time constraints have led to some sort of path dependency in the way the chapter was approached, which has resulted in a somewhat unclear focus. This path dependency expresses itself in several ways – in the choice of analytical levels (i.e., including the unverified inferred owner level), the mix of case studies and the inclusion/exclusion of analyses based on data availability. This affects the readability of the chapter. In the end, there was insufficient time to critically re-evaluate the writings and to restructure where necessary.

While initially identified as an objective for the thesis, it was not possible due to time constraints to study the implications of ownership structure and organization on the economic performance of fishing firms. It would have been especially interesting to study if and how multi-ownership of fishing vessels influences the firm's profitability. It can be hypothesized that multi-vessel firms outperform single-vessel entities, and that they are more cost-efficient due to the presence of scale economies. These elements have been approached conceptually in this PhD, but empirical evidence is lacking. It is likely (based on the interviews) that the observed standardization of fishing vessels and the freedom to divide fishing opportunities among multiple fishing vessels increases the productivity of the factors of production, but this hypothesis remains to be tested. The interviews furthermore seem to suggest that large multi-vessel fishing firms are more profitable, and that the significant cash flows generated from fishing with multiple vessels increases their purchasing power for further horizontal growth. It is suggested that this strategy is adopted for two reasons. First, it allows firms to obtain access to additional fishing opportunities, and second, it may generate the cash flow needed for fleet modernization. This is supported by the interviews and anecdotal evidence from the field, but further research is needed to confirm this. This could accelerate the trend of concentration already observed, in the advantage of certain operators.

Given more time, I would also have liked to include a Belgian case study, as was planned at the onset of the thesis. The Belgian fishing sector is characterized by a small fleet (68 active vessels in 2019), mainly targeting sole (*Solea solea*) and plaice (*Pleuronectes platessa*) with the beam trawl method (71% of total volume) (DLV, 2018). Investments are significant[137] for fishing entrepreneurs, who usually own a single fishing vessel. Beam trawlers (cutters) are found in two standard sizes – the 'classic' cutters are between 30 and 46 meters long (engine power >221 kW), while 'eurocutters' are smaller than 24 meters in length with an engine power <221 kW. Recent anecdotal evidence points towards fleet renewal (Rederscentrale, 2021)[138]. Brexit poses a big threat to the Belgian fishing fleet, given its dependence on British waters. As of 1 January 2021, the United Kingdom has left the CFP. This was decided as part of the *EU-UK Trade and Cooperation Agreement* (TCA) reached on 24 December 2020 between the European Union and the UK government. While this aspect of Brexit had long been anticipated (Sobrino Heredia *et al.*, 2017; Le Gallic *et al.*, 2018), the modalities of the UK's withdrawal from the EU's institutions have remained unclear. Also for the Belgian fishing sector, it is yet unclear what Brexit will mean exactly, and how much bargaining power Belgian shipowners and their representatives (including administrators) will have in negotiating a bilateral agreement with the UK government (Hans Polet, pers. comm.). In addition to Brexit, the Belgian fishing sector has been the target of Dutch quota hoppers for decades, leaving a staggering 32.4% of vessels and 25.2% of fishing opportunities in the hands of Dutch owners (MRAG *et al.*, 2019). In the

[137] According to a 2019 news report, a large beam trawl vessel costs around 6 million euros (https://www.focus-wtv.be/nieuws/vissers-investeren-weer-schepen) (Accessed on 02/05/2021)

[138] E.g., https://kw.be/nieuws/samenleving/belgische-vissersvloot-vernieuwt-in-volle-vaart/ ; https://kw.be/nieuws/samenleving/belgische-vissersvloot-verwelkomt-in-2021-drie-nieuwe-vaartuigen/ ; https://www.focus-wtv.be/nieuws/vissers-investeren-weer-schepen; https://www.visserijnieuws.nl/nieuws/padmos-ontwerpt-nieuwe-belgische-boomkorkotter; https://visserij.nl/2019/12/19/belgische-rederij-bestelt-nieuwe-kotter-bij-damen-maaskant/ (Accessed on 02/05/2021)

context of imminent Brexit and widespread foreign ownership, it would be interesting to know how production is currently organized (organizational forms and ownership structure), and how they differ in their projected performance and/or resilience under different Brexit scenarios.

5 Perspectives and further research

5.1 Ownership analysis in an EU setting

We have established how the methodological framework can be used for EU-wide ownership analysis and we have outlined some additional steps that need to be taken before being able to do so (i.e., establishment of VC Registers for all EU Member States). A good way to bring ownership analysis in the EU fishing industry forward would be through dedicated working groups in the framework of STECF or ICES and/or through EU research projects, given the need for better coordination of both data and methods. Regarding the scope of ownership analysis, two main recommendations can be made. First, recent studies on ownership and concentration in the EU fishing industry have been largely descriptive in scope (this PhD thesis included). A stronger analytical approach would be recommended. Second, a value chain perspective must be taken to take into account the links between harvesting firms and downstream actors in the seafood market. Third, the next CFP reform would be an opportunity to improve transparency with regards to physical fishing capital and fishing opportunities through the establishment of public registers. Such registers may provide opportunities for better monitoring of ownership issues through indicators, which may in turn inform the definition of new socioeconomic objectives in the CFP.

5.2 Who captures the rents of fishing?

Guyader (2007) studied the micro-economic implications of the evolution of fleet structure on individual (firm) and collective (fleet) performance in terms of rent capture, but has not taken into account the ownership structure and organizational attributes of fishing firms. As is emphasized by the author, such analysis requires economic data, production data and data on fishing opportunities – which are not always easily accessible. This is especially true for fishing opportunities, and for production data on the firm level. Our analyses have shown that the operator level does not adequately represent the fishing firm, due to missing (hidden) ownership links. Linked to this question, we may ask ourselves how rents from fishing are distributed in the sector, as proposed by Guyader and Thébaud (2001).

5.3 Perspectives for small-scale fisheries

We have briefly touched upon justice aspects of fisheries governance, but further empirical research is needed to confirm the trends that were identified on the basis of the interviews. Of particular interest is a better understanding of the 'new cooperative structures' organized around small-scale POs and local value chain actors. It was expressed in the interviews that their aim is to compete with large private fishing companies for access to the resource and to markets, while at the same time attracting new vessels to the port and protecting small-scale fisheries and the socioeconomic networks in which they are embedded.

As such, they might be able to capture part of the rent created by restored fish stocks, and allow small-scale producers (skippers) to share in the rent. Once these emerging structures have attained a critical size and are fully functional, it may be hypothesized that skippers benefit from scale economies created by the structure. Structures like this may be a way around multi-vessel ownership as a prerequisite for access to the resource (and the rent created by fisheries management)[139]. However, in the bigger scheme of things, we may

[139] Note that the multi-vessel management organizations in which Spanish fishing firms are embedded follow the same principle. In many ways they act as *de facto* fishing companies.

question the desirability of a situation in which private institutions[140] come in to resolve deep-rooted problems of fisheries management. Whether they are quick fixes or durable solutions for small-scale fisheries remains to be seen. By 'playing the game', it may be argued that these institutions are in fact contributing to the very problem they are trying to resolve. Ironically, these institutions may simply be exporting the problem to other ports and regions.

Two lines of research may be proposed to develop a better understanding of these structures. The first is inspired by the aforementioned study by Guyader (2007) and focuses on the capture and distribution of rents. The second line of research is focused on describing and understanding the institutions of governance and is rooted in a rich body of literature on fisheries governance (e.g., Kooiman, 2003; Jentoft, 2007; Bavinck *et al.*, 2013; Kooiman and Bavinck, 2013), and particularly in a number of recent papers on small-scale fisheries in relation to the Blue Economy (Said *et al.*, 2016; Jentoft, 2017; Hadjimichael, 2018; Said and MacMillan, 2020) and the United Nations' Sustainable Development Goals (SDGs) (Said and Chuenpagdee, 2019; Said *et al.*, 2020).

[140] Here we solely focus our attention on the new cooperatives. Partnerships between small-scale producers and large-scale fishing firms have additional selfish interests.

Annexes

1 Chapter 2, Annex I: Notes on the operation and ownership of fishing vessels in France

In France, fishing opportunities are allocated to the 'vessel-producer partnership' (*couple navire-armateur*), mainly based on historical track records attached to the vessel (Larabi *et al.*, 2013). At the top of this productive entity is the operator (*armateur*), which is listed in the national fleet register under an operator ID code. In its most simple form, the operator is a natural person, often referred to as the 'owner-operator'. However, the operator may also be a legal person.

It is important to note that the operator is the legal owner of the track records attached to the vessels, but not necessarily the owner of the fishing vessel itself. This being said, in the majority of cases they are one and the same entity[141]. Exceptions to this rule may occur when: (1) the vessel is part of a cooperative ownership structure or a private partnership (i.e., co-owned by the operator and the cooperative/corporation), (2) the vessel is co-owned between two or more peers (partnership) of which only one is listed as operator, or (3) the vessel is operated and owned by two separate entities in the corporate structure. The latter refers to the situation in which the entrepreneur may organize their operation by creating a vessel-holding company for each vessel to rationalize management (Kinds *et al.*, n.d.). In some cases, the vessel is owned by one entity and operated by another, and both entities are held and managed by a mother company (holding).

In France, the operator ID code is often used by fisheries managers and researchers to make assertions about the number of owners in the fishing sector or the number of vessels per owner-operator (e.g., Guyader *et al.*, 2003; Quillérou *et al.*, 2011, 2013; Quillérou and Guyader, 2012; Van Putten *et al.*, 2012). In our framework, we will focus on the vessel-holding company instead identified by a unique SIREN number, because the operator ID code disregards how the fishing operation is organized internally. This makes it unsuitable for a detailed analysis of vessel ownership, as it may result in the misinterpretation of vessel ownership at the appropriate level:

- ***Example 1***. In Figure A-1, using the operator ID would wrongfully attribute all vessels directly to the operator, while in reality they are held by two separate companies (2 SIREN numbers) owned by the operator (in this case a natural person). While this correctly identifies the ultimate owner of the vessels, it misjudges the ownership structure.

[141] This needs to be nuanced, however, as the nature of both entities (operator and vessel-holding company) are different. The operator is a natural or legal person operating a fishing vessel and does not necessarily represent an economic or statistical unit (see Chapter 2, p. 48). That economic/statistical unit is the vessel-holding company, which can be identified through a unique identification number (derived from the VAT number)

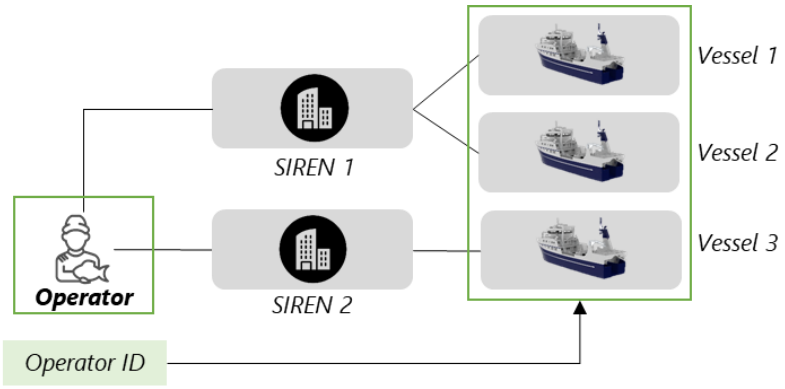


Figure A-1: Misinterpretation of ownership structure. Green rectangles represent what would be identified as the operator's property if the operator ID was used as the main identifier instead of the SIREN number.

- ***Example 2***. Figure A-2 shows how vessel ownership and concentration may be underestimated when analyzed on the level of the operator. The first business holds 2 vessels, the second business 1 vessel. However, in reality, the natural person identified as the operator of the first business is also the entrepreneur behind the second business. This situation is quite common for independent producers who have acquired fishing vessels after already operating one or more vessels under their own name (i.e., in a sole proprietorship). The acquisition of additional vessels increasingly happens through the takeover of entire vessel-holding companies, to avoid a 20% loss of track records (Kinds *et al.*, 2021, n.d.).
  Note that the use of the SIREN number does not provide a solution here either. An additional effort is needed to establish that both businesses are indeed owned by the same person.

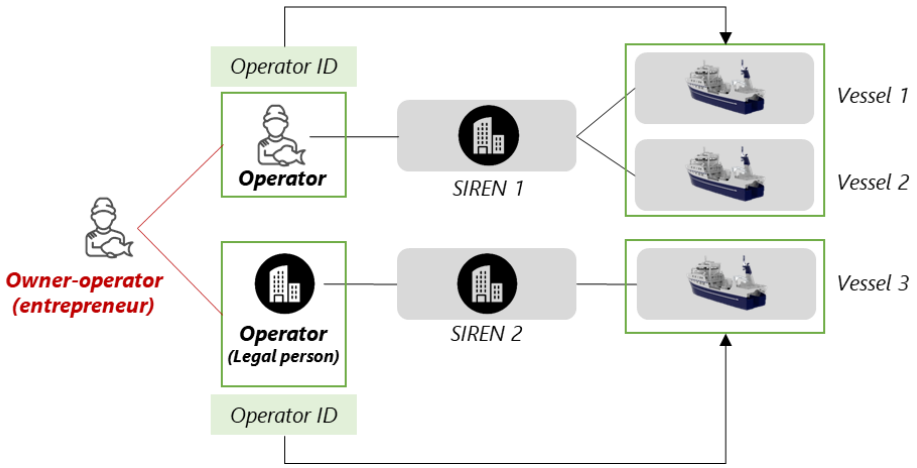


Figure A-2: Underestimation of ownership and concentration. Green rectangles represent what would be identified as the operator's property if the operator ID was used as the main identifier instead of the SIREN number. Red lines represent hidden ownership links that are not captured when ownership is considered at the level of the operator.

2 Chapter 2, Annex II: Overview of variables in the Vessel-Company (VC) Register for France

Table A-1: Variables from different sources included in the Vessel-Company Register for France.

Origin	Variable name	Explanation
	AN_REF	Year
Ifremer Fisheries Information System (FIS) (*Harmonie*) **Source: Vessel and operator registers (DPMA)- Activity calendar and fleet segmentation (FIS)**	NAVS_COD	Vessel identifier (ID)
	CARN_NOM	Vessel name
	DATE_REF	Date of information
	PRESENT_3112	Vessel registered or not at the 31/12 of given year
	QAM_COD	District registration code
	QAM_LIB	District registration name
	QAM_RG	Region registration code
	SRG_LIB	Sub-region registration code
	FACADE_LIB	Area of operation code
	PORT_EXPL_ACT_COD	Harbor of operation code
	PORT_EXPL_ACT_LIB	Harbor of operation name
	CARN_ANNEE	Vessel construction year
	CARN_AGE	Vessel age
	NAVP_LONGUEUR_HT	Vessel length
	NAVLC7_COD	Vessel length category (7 categories)
	NAVLC9_COD	Vessel length category (9 categories)
	Cl_long2	Vessel length category (2 categories)
	NAVP_JAUGE_GT	Vessel tonnage (GT)
	NAVP_PUISSANCE_AD	Vessel engine power (kW)
	CARN_EFFECTIF	Crew size
	NB_MOIS_ACT	Number of month active in a year
	FLOTTILLE_IFREMER_LIB	Fleet segment (Ifremer segmentation)
	DCR_GRANDE_FLOTTILLE_LIB	Fleet segment (EU DCR segmentation)
	DCR_SEGMENT_CE_LIB	Fleet segment (EU DCR segmentation)
	PER_COD	Operator Identifier (ID)
	NOM_PRENOM_ARM_FPC	Operator first and last name recomposed by SIH base on historical records
	NOM_PRENOM_ARM_FPC_ORIGINAL	Operator name
	ARM_ADR	Operator address
	PER_NOM	Operator last name
	PER_PRENOM	Operator first name
	ARM_NAISS_DATE	Operator birth date
	ARM_NAISS_AN	Operator birth year
	ARM_AGE	Operator age
	INT_REGISTRATION_CODE	Vessel international registration code
	nb_unit_Arm	Number of vessel operated by a given operator
	cl_nbUnit_Arm	Number of vessel operated by a given operator per category
	ROL_COD	Collective or individual social security identifier (ID)
	ROL_COLLECTIF	Collective or individual social security status for the crew
	nb_unit_Role	Number of vessels operated in collective social security status
	cl_nbUnit_Role	Number of vessels operated in collective social security status per category
Fisheries Information System (FIS) (*Harmonie*) **Source: SACROIS**	QTE_tot_2018	Vessel landings in live weight (kg)
	VAL_tot_2018	Vessel landings in value (€)
Added by DPMA	SIREN_2016	SIREN numbers identified by the DPMA
Updated/added by us	SIREN_2018	SIREN numbers verified/identified by us
	Comments	-

3 Chapter 2, Annex III: Alternative entry points for queries in Orbis: NACE Rev. 2 codes and IMO numbers

1. Foreword and situation of the Annex

The protocols described in Chapter 2 use BvD ID numbers (derived from national identification numbers present in the EU Business Register) as their starting point. In this Annex, we provide two alternative entry points in case Vessel-Company (VC) registers do not exist and cannot be constructed. Depending on the scope of analysis, researchers may use IMO numbers or the NACE Rev. 2 classification of economic activities. This Annex is meant as practical guidelines for researchers who wish to conduct ownership analysis but do not have access to VC registers. References to the Orbis interface are made throughout this Annex.

2. Alternative 'Level 0' entry points: NACE codes and IMO numbers

The 'Level 0' companies of the population (or subset) of interest constitute, jointly, the entry point to the bottom-up protocol. This Level 0 company set can be selected in multiple ways. As we have described in Section 3 of Chapter 2, the link between the CFR number of the fishing vessel and the vessel-holding company must be established in Vessel-Company (VC) Registers. As such, when VC Registers are available, the preferred company set consists of all vessel-holding companies (BvD ID numbers) for the population of interest. However, where VC registers do not exist and cannot be constructed, alternative entry points may be chosen. Depending on the scope of analysis, researchers may identify relevant companies through the NACE Rev. 2 classification of economic activities (large geographical scope possible, but no link with fishing vessels) or use the IMO numbers of fishing vessels (sub-population of certain vessels of interest).

2.1. NACE Rev. 2 classification

Text Box 1 describes the structure of the NACE Rev. 2 classification. The company set of interest may be defined based on NACE criteria (e.g., NACE Rev. 2 Class 03.11 'Marine fishing') and for a given geographical area (e.g., EU27). This way, one may capture an exhaustive set of EU fishing companies, even though not all companies included in this set are vessel-holding companies. However, without VC registers it is impossible to know which ones are.

If, for instance, the aim is to account for all EU27 fishing companies, a query may be launched in Orbis that is parameterized as follows:

(1) First, the geographical area is defined as all EU Member States. Orbis offers the possibility to either select all 27 Member States as a set or to select all countries manually. The latter allows for quick consistency checks for countries for which the actual number of vessel-holding companies is known through VC registers (e.g., France).
(2) Second, the NACE Rev. 2 codes of interest are defined. In 'Division 03 – Fishing and Aquaculture', there are two groups ('Fishing' and 'Aquaculture') and four classes ('Marine Fishing', 'Freshwater Fishing', 'Marine Aquaculture' and 'Freshwater Aquaculture') (Table A-2). In order to be exhaustive, the inclusion of freshwater fishing firms is recommended for analysis of EU27 fishing firms. First, commercial freshwater fishing represents an important economic activity in certain Member States, such as Finland and Romania (Ernst & Young, 2006). Even when one wants to study marine fishing operations only, it is still recommended to include freshwater fishing in the query. Indeed, the separation between freshwater and marine fisheries may not always be that straightforward. This is the case for certain estuarine fisheries, such as the glass eel (*Anguilla anguilla*) fishery in France (Castelnaud *et al.*, 2008). Second, we have noticed that marine activities like oyster or mussel farming have an ambiguous

classification. Some of these operations are classified as 'Marine Aquaculture' (class 03.21), while others are considered 'Marine Fishing' (class 03.11)[142].

Table A-2: NACE code descriptions for fishing and aquaculture activities. Descriptions copied from (EC, 2008).

NACE Rev. 2 code	NACE Rev. 2 text	Description
03.11	Marine Fishing	"This class includes: (1) fishing on a commercial basis in ocean and coastal waters; (2) taking of marine crustaceans and mollusks; (3) whale catching; (4) taking of marine aquatic animals: turtles, sea squirts, tunicates, sea urchins etc. This class also includes: (1) activities of vessels engaged both in marine fishing and in processing and preserving of fish; (2) gathering of other marine organisms and materials: natural pearls, sponges, coral and algae."
03.12	Freshwater Fishing	"This class includes: (1) fishing on a commercial basis in inland waters; (2) taking of freshwater crustaceans and mollusks; (3) taking of freshwater aquatic animals. This class also includes: gathering of freshwater materials."
03.21	Marine Aquaculture	"This class includes: (1) fish farming in sea water including farming of marine ornamental fish; (2) production of bivalve spat (oyster, mussel etc.), lobsterlings, shrimp post-larvae, fish fry and fingerlings; (3) growing of laver and other edible seaweeds; (4) culture of crustaceans, bivalves, other mollusks and other aquatic animals in sea water. This class also includes: (1) aquaculture activities in brackish waters; (2) aquaculture activities in salt water filled tanks and reservoirs; (3) operation of fish hatcheries (marine); (4) operation of marine worm farms."
03.22	Freshwater Aquaculture	"This class includes: (1) fish farming in freshwater including farming of freshwater ornamental fish; (2) culture of freshwater crustaceans, bivalves, other mollusks and other aquatic animals; (3) operation of fish hatcheries (freshwater); (4) farming of frogs."

We assume that the resulting set of companies encompasses all EU-registered vessel-holding companies. However, the Level 0 population obtained through this approach will contain a considerable amount of companies that do not actually hold fishing vessels or even carry out fishing activities.

2.2. IMO numbers

IMO numbers can, just like company identifiers, be used to build queries in Orbis. In addition, they are recognized as branches of their holding company. This as opposed to non-IMO vessels for which the holding company must first be established in VC registers before being able to query Orbis. Marine fishing vessels (IMO vessels with activity code Marine Fishing) are queried by applying the search step 'Entity type: Marine vessels' in combination with NACE class 'Marine Fishing'. Another option is to directly use a selection of IMO numbers of particular interest as input for the bottom-up approach of the protocol. In the latter case, IMO numbers can be queried directly in Orbis (they are recognized BvD ID identifiers).

[142] This is likely related to whether or not the operator harvests wild spat as part of the production process. A better understanding requires a closer look at the NACE codes of the different sub-units that make up the enterprise.

Text Box 1. NACE Rev. 2 classification

NACE (*Nomenclature générale des Activités économiques dans les Communautés Européennes*) is a standardized activity classification used by all EU Member States. It is also a structural element of the international integrated system of economic classifications (e.g., UNSTAT, Eurostat) (EC, 2008), which makes it suitable for international comparisons. Essential to the NACE classification is that each statistical unit is a specific entity that cannot be confused with any other unit (EC, 2008)[1]. These units are hierarchically organized. A single NACE code is assigned to each unit recorded in statistical business registers, according to the unit's principal economic activity[2]. The NACE code is subdivided in a hierarchical, four-level structure (see EC, 2008, p. 15):

- ***Sections*.** Headings identified by an alphabetical code (e.g., A – Agriculture, forestry and fishing);
- ***Divisions*.** Headings identified by a two-digit numerical code (e.g., 03 – Fishing and Aquaculture);
- ***Groups*.** Headings identified by a three-digit numerical code (e.g., 03.1 – Fishing);
- ***Classes*.** Headings identified by a four-digit numerical code (e.g., 03.11 – Marine Fishing).

For the purposes described here, the unit of analysis is the enterprise, and we are interested in the NACE classes (i.e., four-digit numerical codes).

[1] These units are described in (EEC) No 696/93 of 15 March 1993 on the statistical units for the observation and analysis of the production system in the Community; https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A31993R0696 (Accessed on 02/01/2020)

[2] While a unit can have multiple economic activities, the NACE code is assigned to the activity that contributes most to the value added. For a detailed description of how this is calculated, we refer to Chapter 3 of EC (2008).

4 Chapter 2, Annex IV: Methodology for the extraction of ownership data from Orbis: technical description of the bottom-up protocol

Figure A-3 summarizes the protocol from an operational-technical perspective. In a first step, the BvD ID numbers of the Level 0 companies are loaded into the Orbis interface and an output table is generated, based on the 'Shareholders' template[143] (see Table 2-2). It shows all Level 0 companies and their direct (Level 1) shareholders. The Level 1 shareholders are then loaded into Orbis, and so on. For ease of understanding, we will refer to the queried companies as 'Level n' and to their shareholders as 'Level n+1'.

Table n serves a double purpose. Firstly, it allows us to extract the BvD ID numbers of the shareholders, which will be used to launch the next cycle (Table n+1). Secondly, Table n will serve to isolate the Ultimate Legal Shareholders (ULSHs) – defined (by us) as the highest parent companies[144] of the fishing companies in the population. The ULSH is identified and isolated at level n, based on two possible criteria: either it has no n+1 shareholders; either all n+1 shareholders are natural persons. In the latter case, the shareholders are not recognized by Orbis when the next (n+2) cycle is launched. This is an important feature of the protocol: we know that all the ULSHs of the Level 0 companies have been found when none of the newly identified shareholders are recognized as entry keys by the interface when trying to launch the next iteration.

Two R scripts were developed to facilitate this process. The first script, *ORBISrecomp_SH*, reads the export table at each step of the iteration process, collects the shareholder BvD IDs and isolates from these the ones that have not previously been identified. This is to avoid repetitions in database requests (i.e., cross-holding/cross-ownership and circular ownership; see section 5 of Chapter 2). Those (*new*) shareholders are written to a text file that can be used to query Orbis in the next round (format: '*shareholdersYYYY-MM-DD hh_mm_ss.txt*'). At the end of the process, the file named '*shareholders.txt'* (a cumulative record of all detected shareholders) is updated to include the newly identified shareholders. The second script, *ORBISrecomp_ULSH* compares two consecutive Orbis export tables (table n and table n+1) to identify the ULSHs and all natural persons among the n+1 shareholders. Then, the ULSHs and the natural persons are written to distinct incremental tables named '*ULSH*' and '*PERdata*'. *PERdata* includes the persons' names, identifiers and types, their associated BvD IDs, and their ownership percentages. This database will later be mobilized to make a link with the output table from the top-down approach (not included here).

[143] The 'Shareholders' template is an output template for the extraction defined by us in the Orbis interface. The most relevant data fields (columns) are presented in Table 2-2.

[144] The term 'Legal' was added to differentiate between legal persons (companies) and natural persons. In Chapter 2, we have described the Ultimate Shareholders (USHs) as both the legal and natural persons.

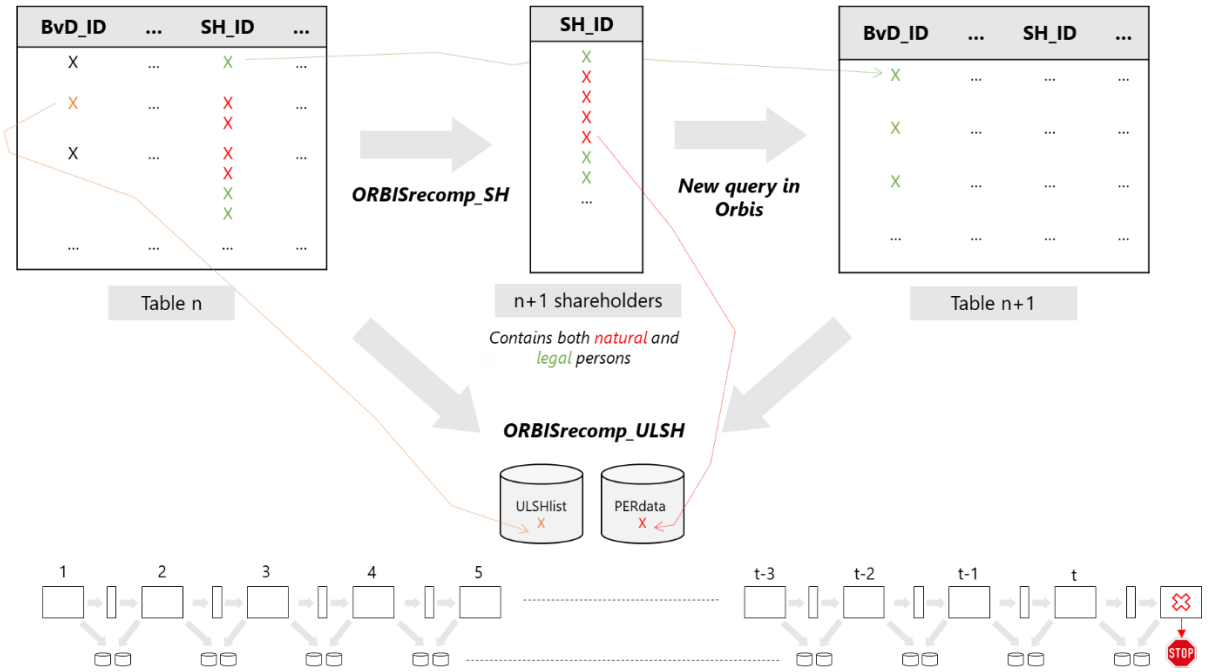


Figure A-3: Technical description of the bottom-up protocol. The orange 'X' only has natural persons (red 'X') as shareholders, leading to its identification as Ultimate Legal Shareholder (ULSH) (written to database ULSHlist). Of the identified shareholders (legal and natural persons), at each cycle, the natural persons are written to a database (PERdata). When the n+1 shareholders are used to launch the next query in Orbis, only the legal persons (green 'X') will be recognized by Orbis, and the process starts over again.

This process is then repeated until (a) no more shareholders are found or (b) all newly identified shareholders are natural persons. In other words, until table n+x is empty (i.e., after t iterations, see Figure A-3). At the end of the process, a list of ULSHs (*ULSHlist*) is formatted to be used as input file to query Orbis in the top-down process.

5 Chapter 3, Annex I: Supplementary materials

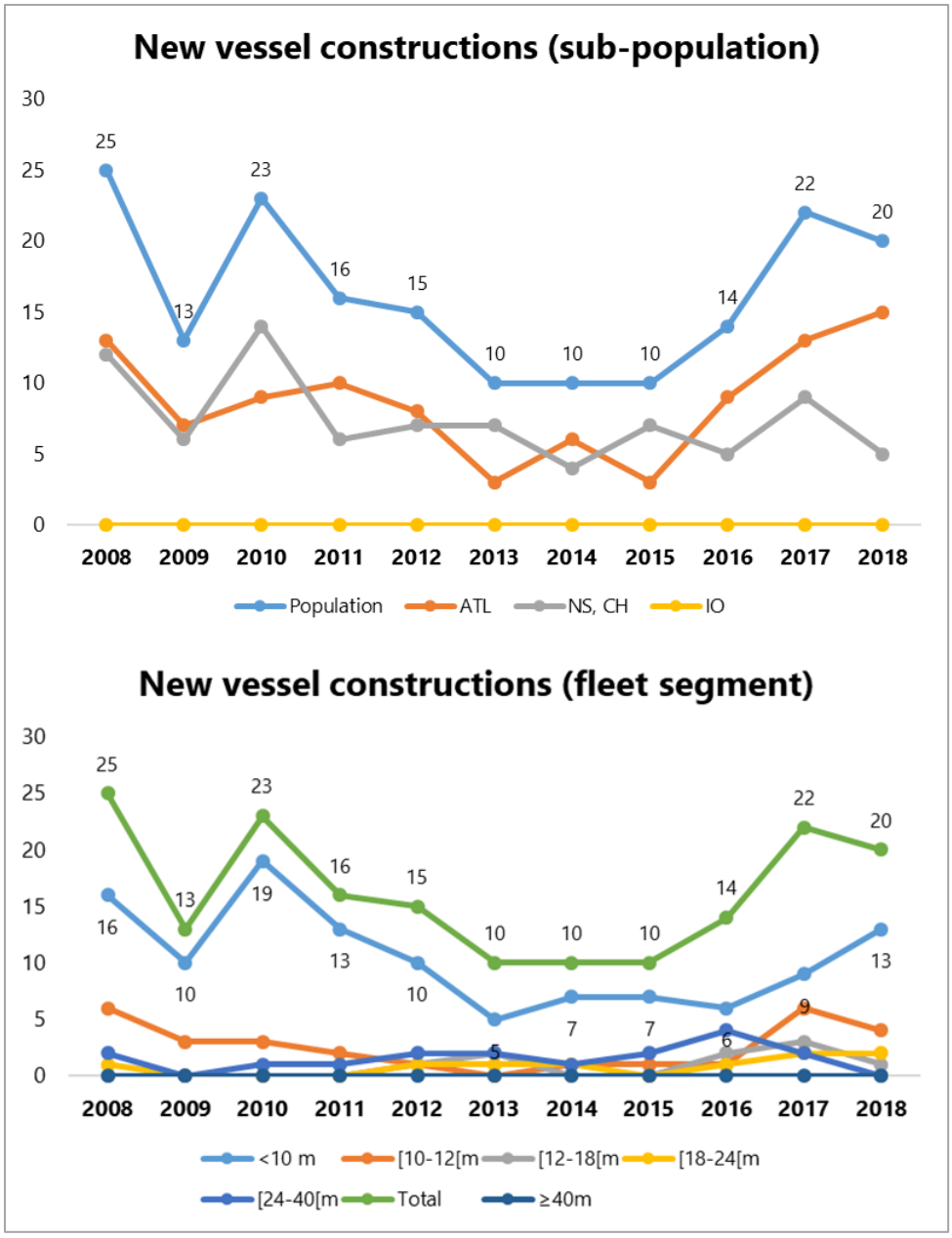


Figure A-4: Vessel constructions by year. Top: by sub-population; Bottom: by fleet segment.

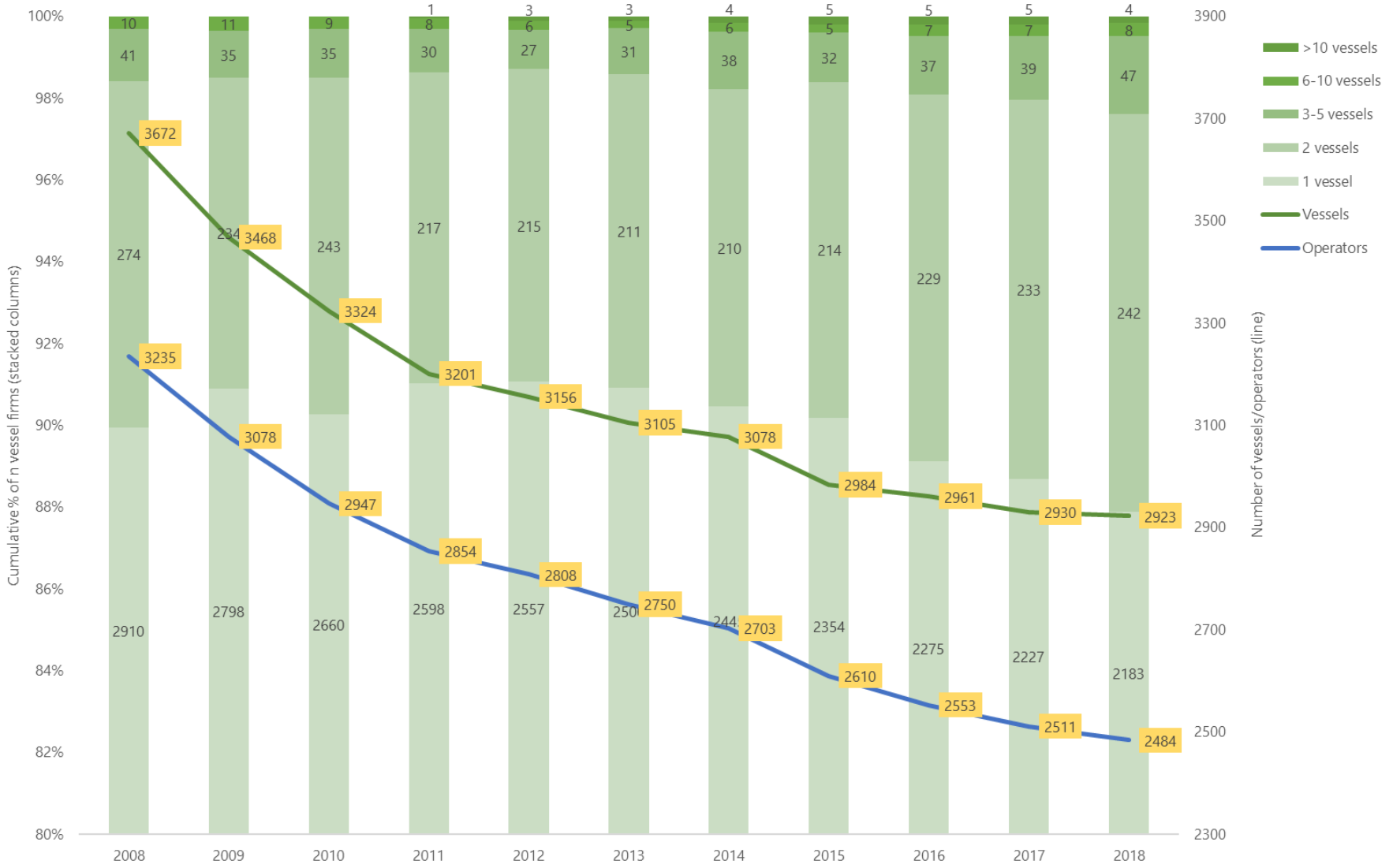


Figure A-5: Evolution of vessel ownership in the French Atlantic harvesting sector. Line graphs: evolution of number of vessels and operators. Stacked bars: relative proportions of n vessel operators.

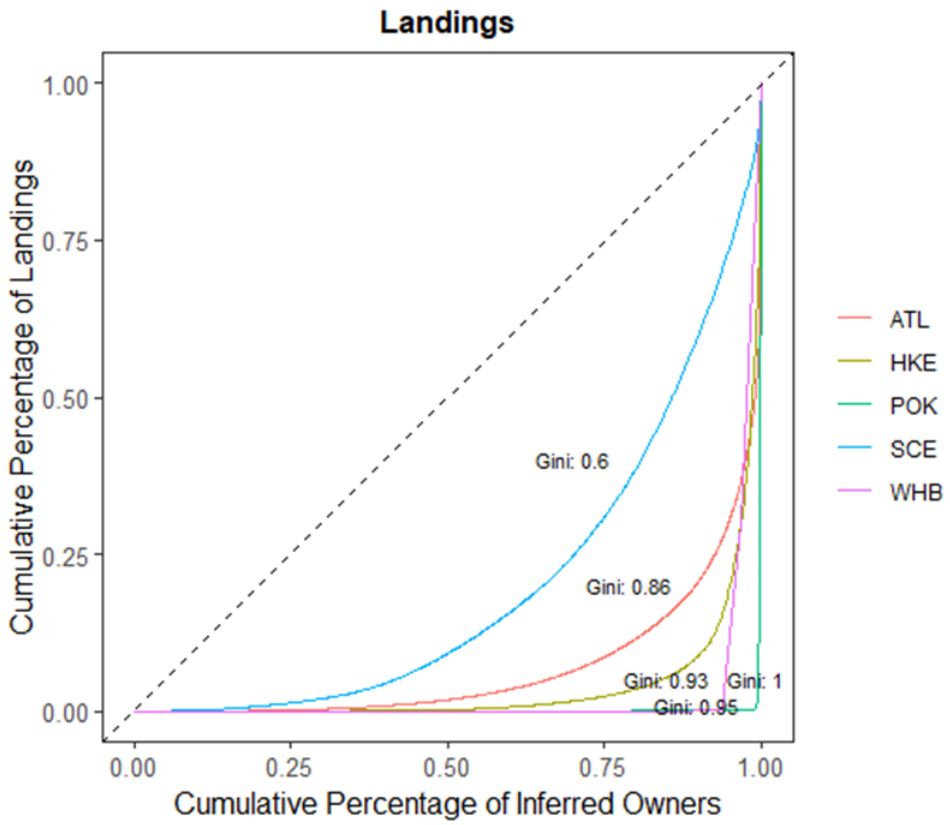


Figure A-6: Lorenz curves for all case studies, based on landings (inferred owner).

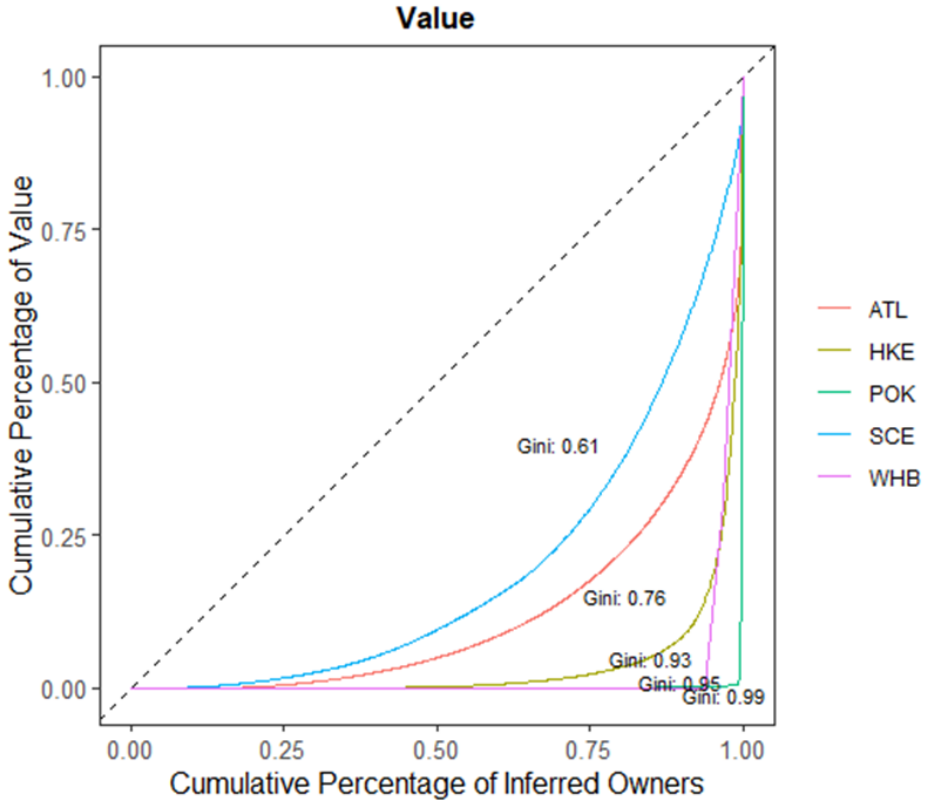


Figure A-7: Lorenz curves for all case studies, based on value (inferred owner).

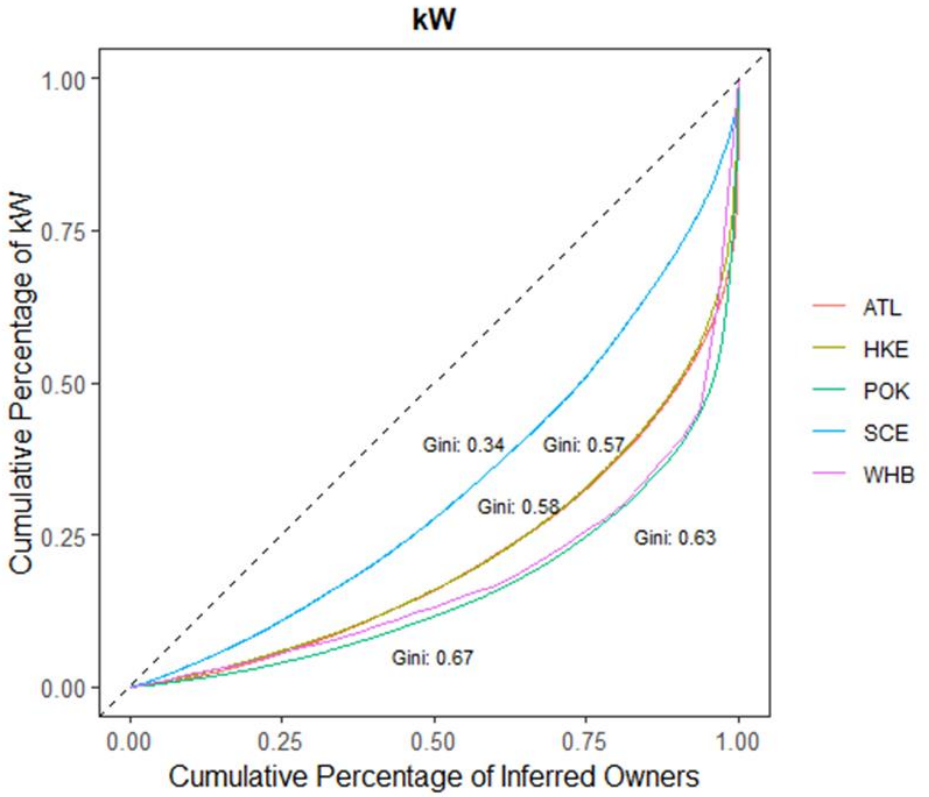


Figure A-8: Lorenz curves for all case studies, based on kW (inferred owner).

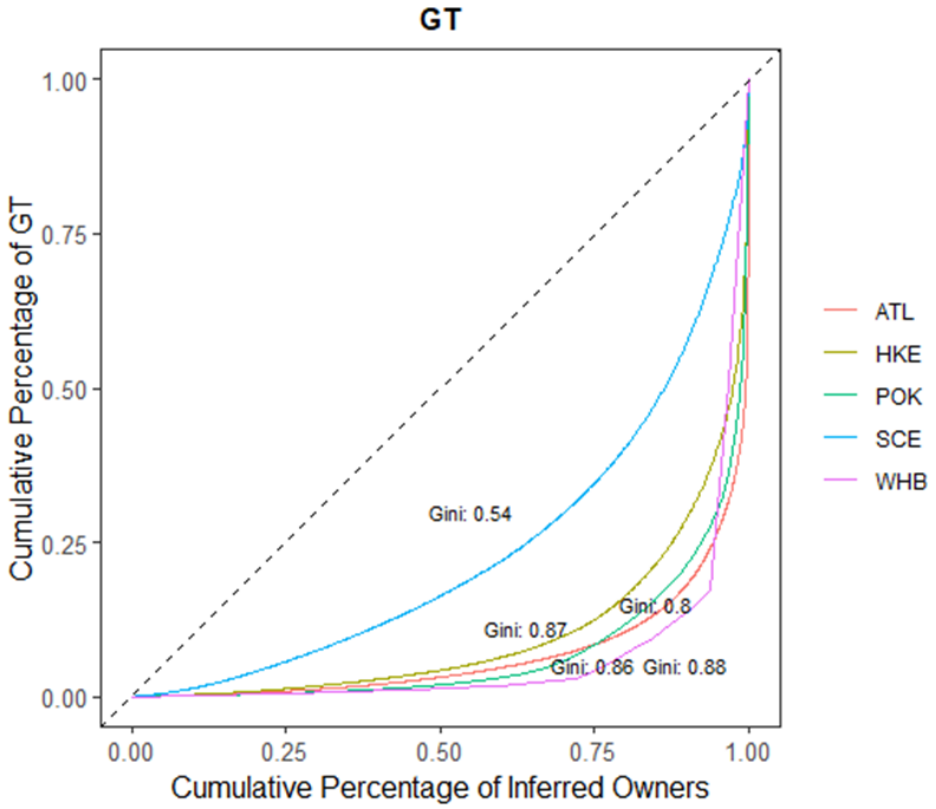


Figure A-9: Lorenz curves for all case studies, based on GT (inferred owner).

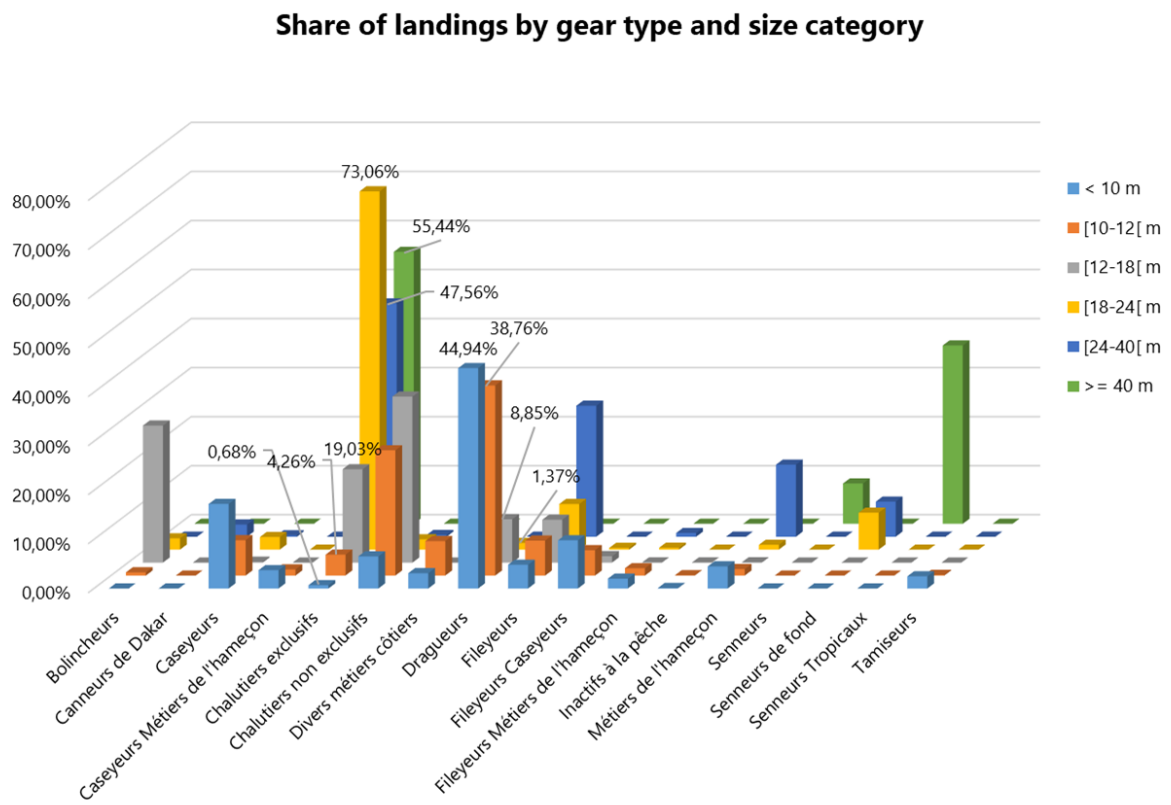


Figure A-10: Share of landings by gear type and size category. Data labels included for exclusive trawlers and dredgers only.

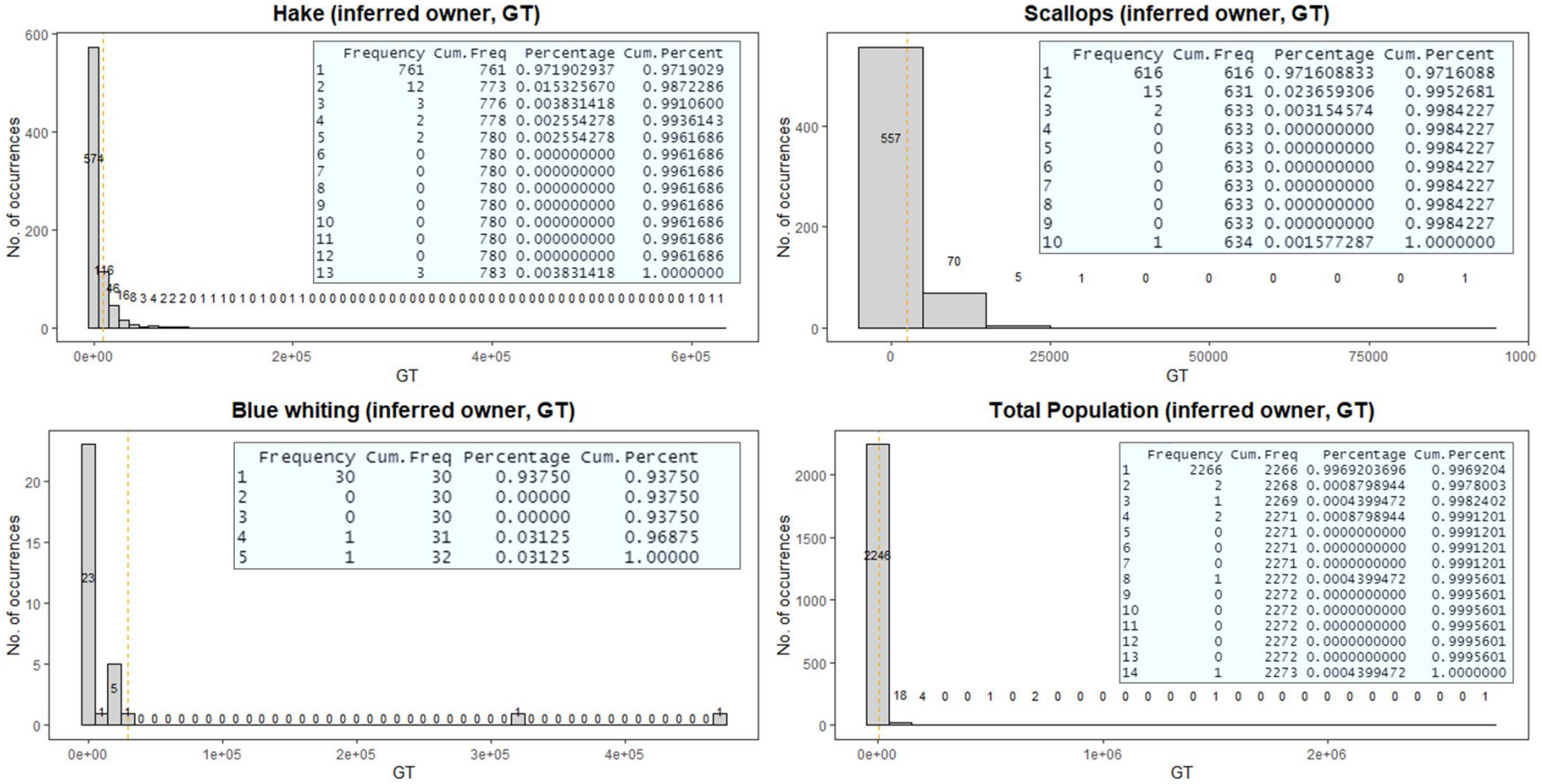


Figure A-11: Histograms of GT for the different subfleets (inferred owner).

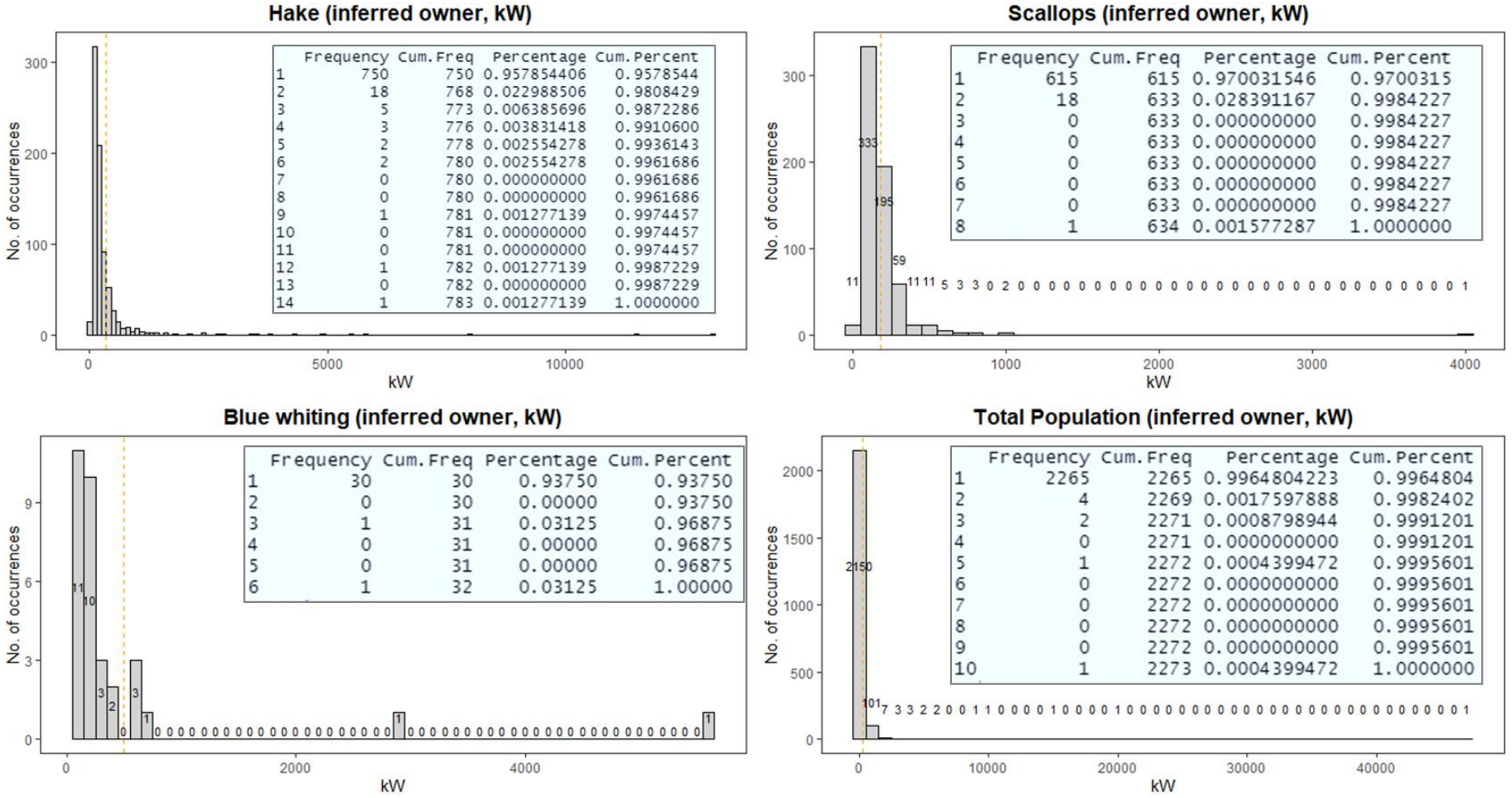


Figure A-12: Histograms of kW for the different subfleets (inferred owner).

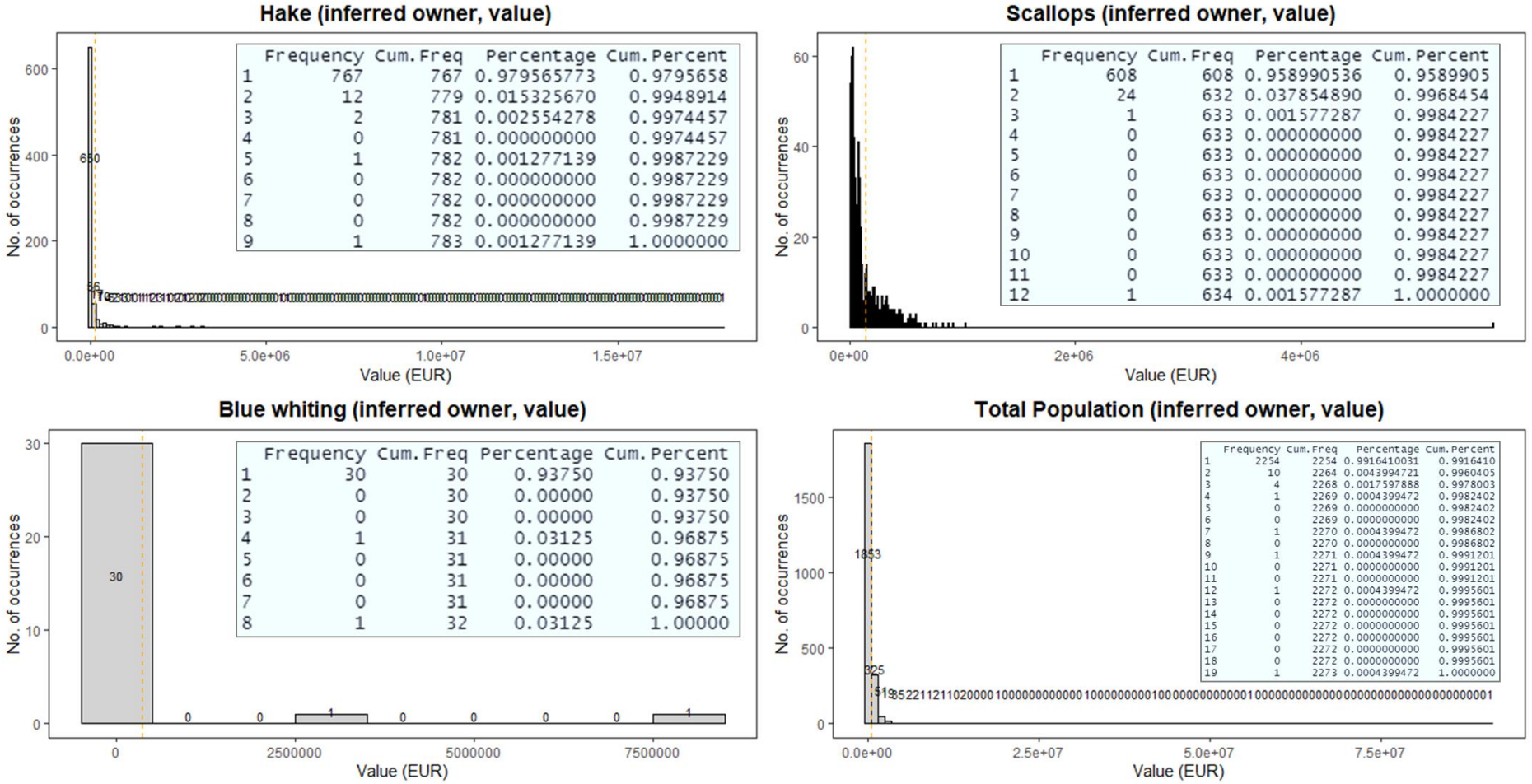


Figure A-13: Histograms of value for the different subfleets (inferred owner).

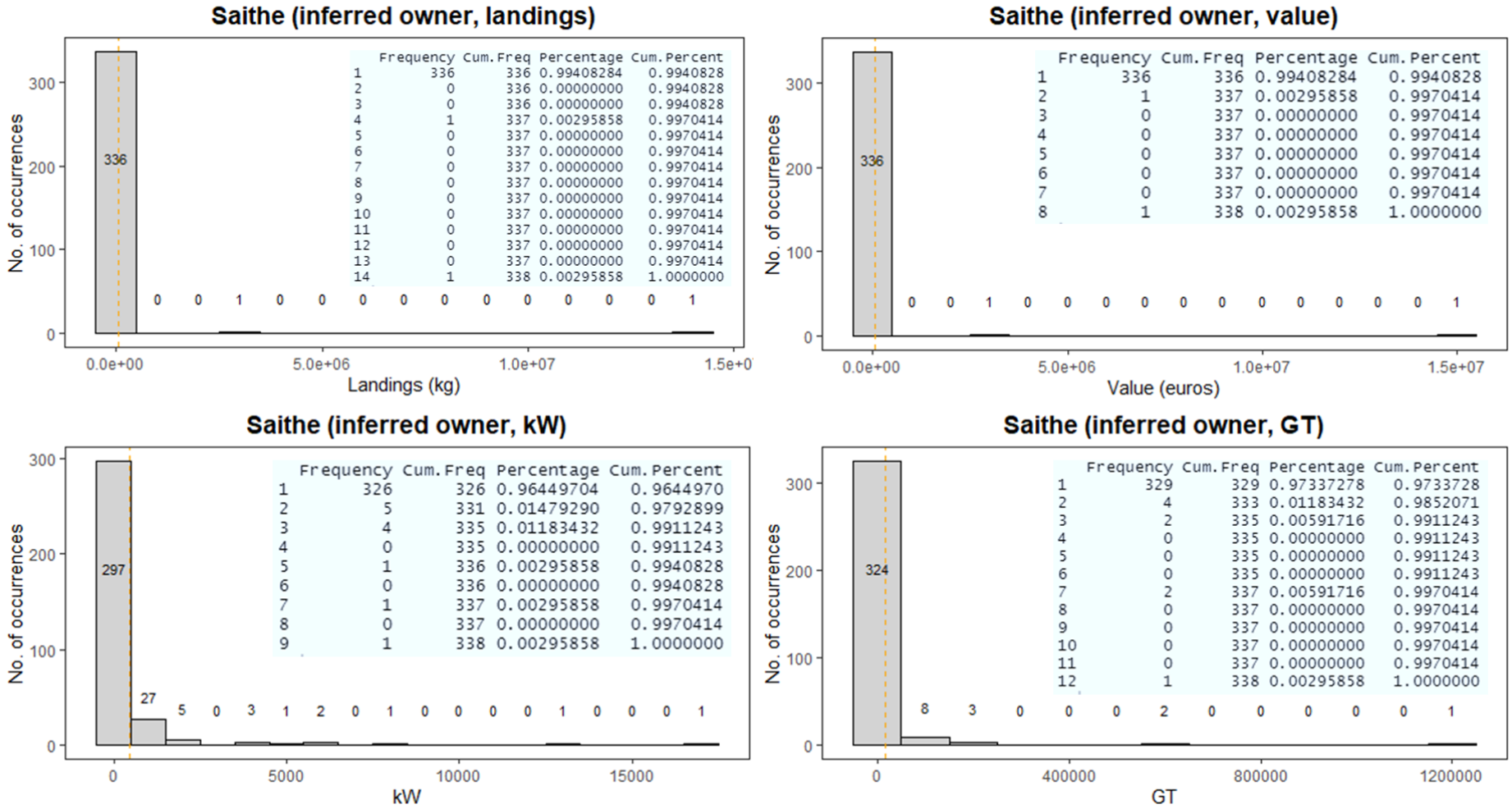


Figure A-14: Histograms for saithe (volume, value, kW, GT) (inferred owner).

Table A-3: Shifts between owner categories, for operators that have been present in the fleet register for the 11 consecutive years studied (2008-2018). Draft, preliminary idea.

	Shift (2008/2018)	**Number of operators**
+	From 1 to 2	84
	From 1 to [3-5]	9
	From 2 to [3-5]	13
	From 2 to [6-10]	1
	From [3-5] to [6-10]	2
	From [6-10] to >10	1
-	From 2 to 1	83
	From [3-5] to 1	8
	From [3-5] to 2	7
	From [6-10] to 3-5	1
No change	No change	1213

6 Chapter 4, Annex I: 'Blue Justice' in three orders

Chapter 4 was written in the context of a forthcoming book project by the *Too Big to Ignore* (TBTI) consortium on 'Blue Justice', edited by Svein Jentoft, Ratana Chuenpagdee, Moenieba Isaacs and Alicia Said and scheduled for publication in July 2021. Chapter 4 assumes a certain prior knowledge about fisheries governance, the 'Blue Economy' and justice frameworks which are introduced in a dedicated chapter in the beginning of the book, written by Jentoft and Chuenpagdee. Below, we will briefly introduce some of these concepts to provide the reader with the necessary background for understanding the broader context in which the research in Chapter 4 is embedded.

It must be emphasized that the presentation of elements below (e.g., inclusion and order of theoretical concepts, links established) is our interpretation of forthcoming work by Jentoft and Chuenpagdee. We take no credit for this work other than the selection of elements relevant for this PhD thesis.

1. Introduction: justice in the context of the Sustainable Development Goals (SDGs)

In 2015, the United Nations (UN) proposed 17 Sustainable Development Goals (SDGs) to address global concerns such as deprivation and hunger, inequality, education, clean water, climate change, ocean and land resources, etc. (UN, 2015). Only one of these goals, SDG14b, is specifically directed towards small-scale fishers (SSFs). It literally states: "Provide access for small-scale artisanal fishers to marine resources and markets". However, Said and Chuenpagdee (2019) argue that "a sector that draws livelihoods from the oceans, has close connection to land and sea" and point towards the interconnectedness between different SDGs in the context of small-scale fisheries: e.g., SSFs may also play an important role in achieving food security (SDG1), reduced poverty (SDG2), community wellbeing (SDG3), gender equality (SDG5) and economic growth (SDG8). This interconnectedness was recognized by the FAO (2018) and the FAO's Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries ('SSF guidelines') were identified as a suitable instrument to reach all SDGs in this sector (Said and Chuenpagdee, 2019).

Notably SDG16, "Peace, justice and strong institutions", is important for our discussion here (cf. Jentoft and Chuenpagdee, *in press*). The authors argue that justice and strong institutions are needed to achieve SDG14 as well as interconnected. According to Jentoft (2013), fisheries governance should be evaluated on the basis of *justice principles*. However, he argues, more than principles, justice is also a necessary *condition* for the governability of fishing systems as without them, stakeholders would revolt against any governing efforts. In the forthcoming book, Jentoft and Chuenpagdee consider that justice can be analyzed using Kooiman's (2003) three-order governance framework (see further). We will use this framework in Chapter 4 to assess (1) whether the fisheries management system in France has created injustices with regards to access to fishing opportunities for artisanal fishers and (2) how artisanal fishers have navigated the system to obtain and secure fishing opportunities.

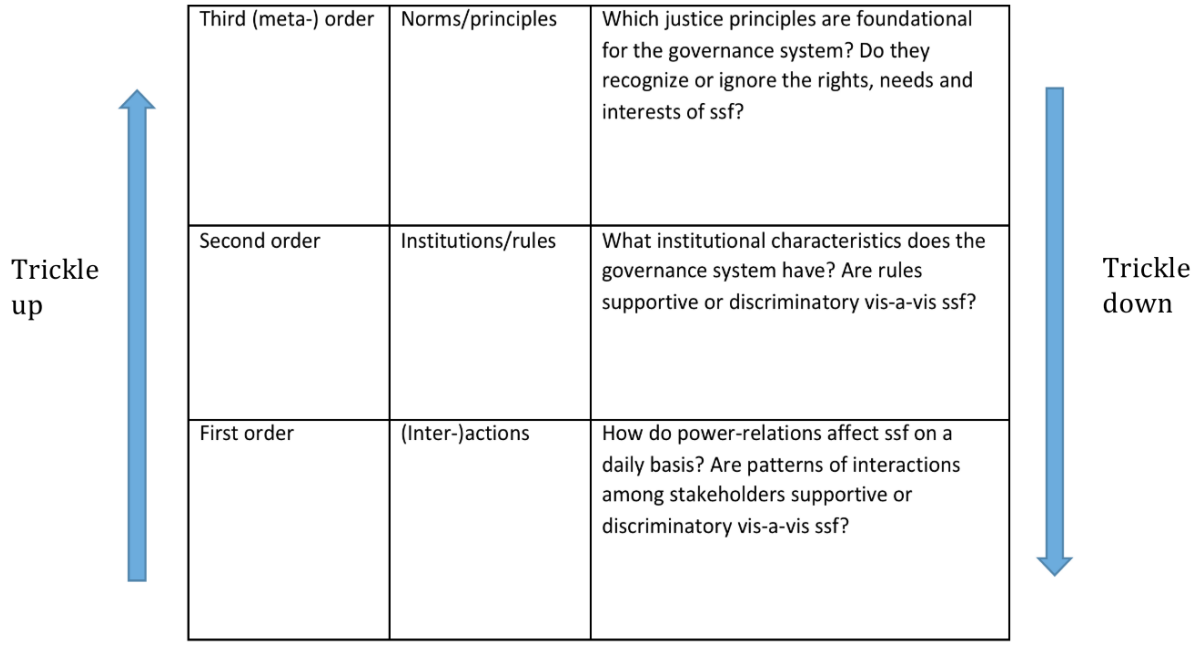
2. Blue Growth and the position of small-scale fishers

The 'Blue Growth' (or the 'Blue Economy') agenda of the EU is focused on the development of maritime sectors with a "high potential" for sustainable jobs and growth, such as aquaculture, coastal tourism, marine biotechnology, ocean energy and seabed mining (EC, 2017). It is unclear where fisheries fit in, however, given that growth in fisheries is associated with environmental impact, which goes against conservation targets (Stobberup *et al.*, 2017). The promise of 'Blue Growth' for small-scale fishers has been scrutinized by scholars in recent years (e.g., Hadjimichael, 2018; Voyer *et al.*, 2018; Said and MacMillan, 2020), and concerns are being raised about whether the EU's Blue Growth/Blue Economy agenda will help protect the already disadvantaged and marginalized small-scale fishers in the EU (Jentoft and Chuenpagdee, *in press*).

While the institutions of fisheries (co-)management often have provisions that pertain to justice and inclusion of small-scale fishers, they often remain dead letter and/or they legitimize the agendas of dominant actors by "[repackaging] power dynamics in the rhetoric of participation" (Flannery *et al.*, 2018). A recent publication by Said *et al.* (2020) confirms that small-scale fishers In the EU are poorly represented in the decision-making process. In that sense, strong institutions (SDG16) at local and higher scales are a first necessary condition to protect small-scale fishers from injustices such as 'ocean grabbing' – i.e., a situation in which other stakeholders occupy the space of small-scale fishers (Barbesgaard, 2018; Said and MacMillan, 2020).

3. 'Blue Justice' in three orders

Strong institutions (SDG16) are a first condition for ensuring justice (Bavinck *et al.*, 2013), but is it enough? The TBTI network proposes the concept of 'Blue Justice' as a new paradigm for studying justice in small-scale fisheries. The concept was first introduced by professor Moenieba Isaacs at the World Small-Scale Fisheries Congress in Chiang Mai, Thailand, in 2018. She describes it as an approach to "critically examine the political, economic, and ecological processes of blue economy development initiatives"[145]. The forthcoming TBTI book on Blue Justice draws from Jan Kooiman's interactive governance framework, stating that Blue Justice should be explored at all three orders of governance: the meta-order, second order and first order (Kooiman, 2003) (see Figure 1).



Third (meta-) order	Norms/principles	Which justice principles are foundational for the governance system? Do they recognize or ignore the rights, needs and interests of ssf?
Second order	Institutions/rules	What institutional characteristics does the governance system have? Are rules supportive or discriminatory vis-a-vis ssf?
First order	(Inter-)actions	How do power-relations affect ssf on a daily basis? Are patterns of interactions among stakeholders supportive or discriminatory vis-a-vis ssf?

Figure A-15: Justice in three governance order, after Kooiman (2003). Figure copied from Jentoft and Chuenpagdee (*in press*).

At the **third (meta) governance order**, justice is related to the images, values and norms of a particular social system, including their governance (Jentoft and Chuenpagdee, *in press*). In the context of EU fisheries management, 'meta' order principles may be considered as heavily influenced by the neoliberal ideology of efficiency underpinning the CFP's market and conservation policies (e.g., Said *et al.*, 2016, 2020; Hadjimichael, 2018; Said and MacMillan, 2020). At the **second order of governance**, the focus is on the institutions and organizations of fisheries management which have a duty to ensure that the rules of fisheries management are 'just', and have equitable and fair outcomes. An important aspect is whether small-scale

[145] https://www.plaas.org.za/blue-justice-for-small-scale-fisheries/ (Accessed on 21/04/2021).

fishers have access to the decision-making process, where the rules that affect them are being established (Jentoft and Chuenpagdee, *in press*). However, while institutions may be able to guide and steer the outcomes of governance, they do not have full control over the interactions between stakeholders at the **first level of governance**. Kooiman (2003) sees governance as *interactive* and dynamic, with outcomes that are strongly dependent upon strategic and real-time interactions among stakeholders with differential powers (Jentoft and Chuenpagdee, *in press*).

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Scientific publications in journals/books with peer review

2021	Kinds, A., Said, A., Speelman, S., and Olivier, G. (2021). Navigating institutional change in the French Atlantic fishing sector: how do artisanal fishers obtain and secure fishing opportunities? In S. Jentoft, R. Chuenpagdee, A. Said, and M. Isaacs (Eds.). Blue Justice: Small-Scale Fisheries in a Sustainable Ocean Economy. Springer, MARE Publication Series (in press). Kinds, A., Le Floc'h, P., Speelman, S., and Guyader, O. (*in review*). The inadequacy of the "artisanal vs. industrial" dichotomy in French Atlantic fisheries. Submitted to Marine Policy.
2016	Kinds, A., Sys, K., Schotte, L., Mondelaers, K., and Polet, H. (2016). VALDUVIS: An innovative approach to assess the sustainability of fishing activities. Fisheries Research, 182, 158–171. https://doi.org/10.1016/j.fishres.2015.10.027.

Titre: Qui possède quoi? Une analyse des moyens de production dans le secteur des pêches français

Mots clés: analyse de la propriété; concentration; pêcheries françaises en Atlantique; industrie des pêches de l'Union Européenne; ghestion des pêcheries; opportunités de pêche; droits de pêche

Résumé : L'objectif de cette thèse est de fournir un premier travail visant à identifier les propriétaires actuels des moyens de production dans le secteur des pêches en France sur la façade Atlantique. L'accent est mis sur les navires de pêche et les possibilités de pêche associées. La question centrale « *qui possède quoi* » est déclinée en quatre sous-questions : (1) quelle est la structure organisationnelle des entreprises de pêche à plusieurs navires et quels sont les principaux facteurs de leur évolution ? ; (2) Qui sont les propriétaires ultimes du capital à la pêche ? ; (3) Y a-t-il une tendance à la concentration du capital et de la production ?; (4) Le système de gestion des pêches a-t-il créé des injustices envers les pêcheurs dits artisanaux en particulier dans la manière dont les opportunités ou droits de pêche sont allouées et redistribuées ?

Les résultats montrent que la classification couramment utilisée pour distinguer voire opposer « pêche artisanale » et « pêche industrielle» est incapable de saisir la diversité organisationnelle des entreprises de pêche. En fait, les entreprises de pêche françaises de l'Atlantique ont évolué pour devenir un éventail de types qui coexistent actuellement dans un environnement institutionnel complexe. Cet environnement, et plus particulièrement le système de gestion des quotas, semble avoir principalement répondu aux besoins des entreprises de pêche établies, tout en empêchant les jeunes entrants et/ou les petits pêcheurs de s'établir. Une tendance modérée à la concentration des moyens de production et de la production se manifeste par ailleurs dans le secteur. En plus de fournir des informations précieuses sur la structure de propriété des entreprises de pêche française en Atlantique, cette recherche contribue au domaine de l'analyse économique de la propriété par le développement d'un cadre méthodologique qui peut être facilement appliqué pour analyser la propriété et la concentration dans l'industrie de la pêche à l'échelle de l'Union Européenne.

Title: Who owns what? An analysis of the production means in the French Atlantic fishing sector

Keywords: ownership analysis; concentration; French Atlantic fisheries; EU fishing industry; fisheries management; fishing opportunities; fishing rights

Abstract: The aim of this PhD research is to provide a baseline study of who currently owns the means of production in the French Atlantic fishing sector, with a specific focus on the fishing vessels and associated fishing opportunities. This *'who owns what'* question is approached from different angles which crystallize into four sub-questions: (1) what is the organizational structure of multi-vessel fishing firms and what are the main drivers behind their evolution?; (2) who ultimately owns the fishing capital?; (3) does concentration of fishing capital and production occur?; (4) has the fisheries management system created any injustices towards artisanal fishers in the way fishing opportunities (fishing rights) are allocated and redistributed?

The research finds that the commonly used 'artisanal vs. industrial' classification is unable to capture the organizational diversity of modern-day fishing firms. In fact, French Atlantic fishing firms have evolved into an array of types which currently coexist in a complex institutional environment. This environment, and most notably the quota management system, appears to have catered mostly to the needs of established fishing companies, while making it hard for young entrants and/or small-scale fishers to establish themselves. A moderate trend of concentration of production means and production is furthermore apparent in the French Atlantic fishing sector. Other than providing valuable insights into the ownership structure of the French Atlantic fishing industry, this PhD research contributes to the field of ownership analysis through the development of a methodological framework that can be readily applied to analyze ownership and concentration in the EU fishing industry.