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Debates sobre quién, cómo y con qué implicaciones sociales, económicas y ecológicas alimentará el mundo.

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Marine fishing aquaculture in Turkey: fish farms as a fix or a new commodity frontier?

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Abstract

As one of the fastest growing food-producing sectors, aquaculture's share in global seafood production compared to capture fisheries is rising significantly. This transforms the practices of seafood production while allowing capital to expand to new marine commodity frontiers. Building on the conceptualization of aquaculture as a new frontier of capture fisheries, the article aims to uncover how the expansion of commodity frontiers takes place within the intensive marine aquaculture sector using the case of recent marine intensive aquaculture growth in Turkey. Relying on 22 in-depth interviews conducted with key social actors in Turkey and a review of academic articles, sector and state reports, and relevant legislations of Turkish state and European Union; this article analyzes this transformation and argues that a similar three-pronged horizontal, vertical, and taxonomic expansion, which had already been observed in industrial capture fisheries, takes place in the marine intensive aquaculture through commodity widening, deepening, and marketing strategies of aquaculture firms.

Introduction

Seafood is an important source of protein, the global demand for which has risen remarkably in recent decades (FAO 2016). Parallel to rising demand, especially since the 1950s onwards, industrial fishing expanded step by step—horizontally, from coastal waters to open seas; vertically, from shallow-waters to deep-seas; and taxonomically, from bigger species to smaller ones; in other words, by 'fishing down marine food webs' at lower trophic levels (Pauly *et al.* 1998). More recently, however, due to the ecological limits capture fisheries face, a further expansion has taken place in the form of marine intensive aquaculture production, which leads to new ways of producing seafood in encircled spaces in marine areas (Longo *et al.* 2015; Saguin 2016).

As a result of the increase in global seafood consumption and the stagnation in catches especially due to overfishing, aquaculture has gained increasingly more attention and become one of the fastest growing food-production industries. In the last three decades, the volume of global aquaculture production increased dramatically, at an annual average rate of 8.6%, and compared to capture fisheries, its share in global seafood production has been rapidly rising. Currently, almost half of the fish supply for human consumption is provided by aquaculture (FAO 2016). This trend transforms the practices of seafood production from capture to farming, while opening new frontiers for capital, with new types of investments.

Traditional studies on aquaculture usually represent it as a solution to declining fisheries, defining it as ‘rearing or cultivation of aquatic organisms *beyond the natural capacity* of the environment’ (EC 2012, p.7) and emphasizing its biological, technical or economic dimensions (Coull 1993, Lee *et al.* 2003, Irz and McKenzie 2008, Nielsen 2012). In contrast, critical research on the political economy and political ecology of aquaculture is relatively scarce (for some examples see Clausen & Clark 2005; Mansfield 2011; Longo & Clark 2012; Saguin 2016). Moreover, while most studies focus on Asia or Latin America in terms of geography and on salmon and shrimp in terms of farmed species (Vandergeest *et al.* 1999; Cruz-Torres 2000; Hall 2003; Barton & Floysand 2010; Bustos-Gallardo 2013), research on Mediterranean aquaculture and species is rather limited (for recent studies see Mente *et al.* 2007; Perdikaris & Paschos 2011; Longo & Clark 2012; Hadjimichael *et al.* 2014). Following Moore’s ‘capitalism as a world-ecology’ approach (2015, p.3), we argue that examining newly opened marine frontiers and the spatial and taxonomic expansion of the seafood industry in different geographies is crucial to thoroughly understand how aquaculture transforms spaces and production relations, since ‘capital not only occupies but also produces, space’ (Lefebvre 1991 in Moore 2015:10).

In particular, we draw on Moore’s framework on the expansion of commodity frontiers (2000, 2010a, 2010b), which is often used in relation to the geographical expansion of land-based extractive industries that exploit natural resources and raw materials, such as oil and minerals, in host places far from where manufacturing and selling takes place (Martinez-Alier *et al.* 2010; Orta-Martínez & Finer 2010; Conde & Kallis 2012; Silva-Macher & Farrell 2014). Here, we aim to expand this body of literature by examining the expansion of *marine* commodity frontiers and the resulting social and ecological relations of production (Campling 2012; Veuthey & Gerber 2012; Saguin 2016) that remain under-investigated.

Research on marine commodity frontiers has explored their expansion in industrial fisheries (Campling 2012) and argued that aquaculture offers a new frontier for capture fisheries (Saguin 2016). As experienced in the historical expansion of industrial capture fisheries that sought new commodity frontiers (Campling 2012), ‘commodity widening’ and ‘commodity deepening’ strategies—that steadily shift places of production toward ecologically less exploited areas and use advanced technology to intensify production and increase profits—have enabled a similar expansion in intensive marine aquaculture production (Saguin 2016). Building on this body of literature and the conceptualization of aquaculture as a new frontier for capture fisheries, we aim to gain insight into the transformation in seafood production from capture fisheries to aquaculture by examining how commodity frontiers expand within the intensive marine aquaculture sector, based on the case of recent growth in marine intensive aquaculture in Turkey.

To address this question, we will examine the horizontal expansion of the marine intensive aquaculture sector from Europe—the largest importer of seafood products (EUMOFA 2016)—to Turkey, an EU accession country at the periphery of the EU Common Fisheries Policy. The relatively late but remarkable

growth in marine intensive aquaculture in Turkey, which witnessed an almost quadrupling in production volume between 2000 and 2015 while marine capture fisheries experienced fluctuations and followed a downward trend (MoFAL 2016), hints both at an expansion of the sector into new areas and a shift from capture fisheries to marine aquaculture; a transformation of seafood production observed both in Turkey and worldwide. In this article, we analyze this transformation in Turkey and the associated export-oriented rise in farmed fish production—especially sea bass and sea bream, the most produced marine aquaculture species—and argue that the horizontal, vertical and taxonomic expansion observed in industrial capture fisheries is similarly taking place in marine intensive aquaculture through the commodity widening, commodity deepening, and what we call ‘commodity marketing’ strategies employed by aquaculture firms.

The approach we adopted in this study encompasses qualitative methods based on semi-structured in-depth interviews with key social actors in Turkey, as well as a review of sector and state reports, and the relevant legislations in Turkey and the European Union. In late 2015 and 2016, 22 interviews were conducted with 30 actors in Ankara, the capital and home to the various Ministries; Istanbul, Turkey’s biggest metropolis with important trade connections; and Mugla and Izmir, the largest production provinces for marine aquaculture (Appendix 1). Interviewees included representatives from the General Directorate of Fisheries and Aquaculture attached to the Ministry of Food, Agriculture and Livestock; the Ministry of Environment and Urbanization; small-scale and large-scale aquaculture producers; aquaculture producer organizations in Ankara, Izmir, and Mugla; fish feed producers; consultants in the aquaculture sector; scientists and academics working on issues related to seafood production; marine biologists; non-governmental organizations and civil society organizations; environmental litigation lawyers; small-scale and industrial fishing cooperatives; and industrial fishermen. The interviews were transcribed and coded through open-coding methods, then analyzed by identifying and categorizing main points associated with the expansion of marine intensive aquaculture in Turkey, with a focus on its drivers and resulting social and ecological relations of production. Together with the data gathered from secondary sources, the interviews made it possible to uncover how marine intensive aquaculture expanded in Turkey.

The article is structured as follows: The theoretical framework related to the expansion of (marine) commodity frontiers—on which this study is built—is explained in the next section. The third section describes the growth in intensive marine aquaculture in Turkey, focusing on the last 15 years, and illustrates why this constitutes a recently opened commodity frontier. The fourth and fifth sections analyze and discuss the spatial expansion and intensification of aquaculture commodity frontiers in Turkey through ‘commodity widening’ and ‘commodity deepening’ strategies of aquaculture firms, respectively. The sixth section examines what we call the ‘commodity marketing’ strategies of capital that aim to ensure the demand side of intensified production, and the concluding section discusses the maturing conditions of aquaculture commodity frontiers in Turkey by elaborating on their implications for marine commodity frontiers.

Theorizing Marine Commodity Frontiers

Industrial production and its expansion rely heavily on the accelerating use of raw materials and energy, among other factors. Industrialized economies seek new and high quality natural resources that can be extracted and processed cheaply, easily and safely in return for higher profits (Bunker 1996, Krausmann *et al.* 2008). One way to explore the interaction between the world economy and local ecosystems, or ‘the interrelationships between production in one place, and the expansion of capitalist space in general’ is provided by Moore (2000, p.411), who elaborates on the concept of ‘commodity frontiers’ by framing capitalism as a ‘world-ecology’ where nature and labor are simultaneously appropriated and exploited to produce commodities for exchange (Moore 2010a, 2015). Building on this theoretical framework, he studies the expansion of commodity frontiers—a term usually associated with the geographical expansion of the extractive industry that removes natural resources and raw materials from the earth, such as oil and minerals—by focusing on the production side of these frontiers from a world-historical perspective (Moore 2000; Orta-Martínez & Finer 2010; Conde & Kallis 2012; Andreucci & Kallis 2017). Commodity frontiers are expanding mainly in order to meet the rising material and energy demands of industrialized economies resulting from their increased social metabolism, and to broaden the scale and scope of the commodification of natural resources (Moore 2000; Conde & Walter 2014).

The expansion of commodity frontiers helps the operations and capital accumulation of extractive industries in three ways. First, when the quality and/or quantity of a natural resource is decreasing, it enables them to replace the extracted resource with a better quality and/or more abundant resource from another region in return for higher profits (Moore 2010a). Second, it allows them to relocate to new geographies, nationally or internationally, whenever socio-ecological conflicts arise due to environmental degradation caused by the extraction activity (Martinez-Alier *et al.* 2010; Conde & Walter 2014). Third, it gives them the possibility of moving their activities to places where profit margins are higher and production is cheaper or safer—in terms of exploitation of labor, appropriation of nature or socio-political power exercised in the new area (Hilson & Yakovleva 2007). Overall, with the expansion of commodity frontiers, raw materials are extracted in places far away from where they are processed, marketed and ultimately consumed.

Meanwhile, the relationship between labor and capital in production processes has been changing as well; production for sustenance has gradually been replaced by the production of commodities for exchange. Consequently, exploring different commodity frontiers is essential in order to ‘track not only capitalist expansion but also the unevenness of that expansion’ (Moore 2000, p.411), and this requires uncovering the strategies of capital accumulation. According to Moore, the expansion of commodity frontiers offers two such strategies (2010b). The first, called ‘commodity widening’, refers to relocating the extraction to new geographies whenever the raw materials exploited in a region

begins to diminish in terms of quantity or quality; this opens new areas to extraction and leads to the greater commodification of natural resources. The second is termed 'commodity deepening' and describes increased extraction and intensified production at a given site through socio-technical innovations, as observed in going deeper for mineral extraction or the industrialization of agriculture (Moore 2010b, Knapp 2016).

Here, we will add the analysis of a third strategy that we call 'commodity marketing', which enables further capital accumulation by expanding products to new markets while maintaining current position in existing ones. This strategy aims to ensure demand is created for intensified production, and markets are secured for *commodities* produced for exchange. To examine this strategy, we will still follow the commodity frontiers approach, which focuses on primary production as opposed to commodity chain analysis that focuses on the final product. However, because all of these three strategies work together to generate horizontal, vertical and taxonomic expansions, we will also look into the 'commodity marketing' strategies of these firms, which seek and secure markets to exchange the commodities produced by their increased and intensified production. Thus, by looking at capitalism 'as an ecological regime that reproduces itself through new commodity frontiers' (Campling 2012, p.255), we will examine both the supply and the demand ends of commodity production for exchange in an interlinked manner.

Although the expansion of commodity frontiers and the subsequent commodification of marine spaces occurred relatively later, they occurred at a rapid and intense rate, resulting in complex and interrelated agrarian changes that can only be understood through meticulous political, economic and ecological analyses. Capture fisheries are a noteworthy example of the expansion of commodity frontiers based on the extraction of living resources. Especially from the 1950s onwards, expansion intensified horizontally, vertically and taxonomically (Pauly *et al.* 1998; Longo *et al.* 2015) as a result of the commodity widening and commodity deepening strategies fishing companies employed, which enabled them to boost their catch and their profits (Campling 2012). Through these strategies, the fishing fleets of different countries moved from exploited or overexploited marine areas to new seas that offered a higher 'ecological surplus', or increased their catch rate with advanced technologies in 'mature frontier conditions' where ecological surplus was shrinking and stocks were dwindling (*ibid.*). This is how new marine areas and resources became commodified (Clausen & Clark 2005; Longo & Clausen 2011; Campling 2012; Longo & Clark 2012).

Expansion on the basis of these strategies resulted in the global overexploitation of marine resources and the collapse of important fish stocks in some regions (see Bavington 2009, for the depletion of the Newfoundland cod fisheries; Radovich 1982, for the collapse of California's once abundant sardine stock). Fish has long been considered a renewable and 'inexhaustible' resource; a view prevalent especially until the late nineteenth century and still echoed by some in the fishing industry today (Pauly *et al.* 2003; Bavington 2009). Yet recent

studies show that industrial fishing intensified so much in the second half of the twentieth century that ‘peak fish’—the maximum amount of fish that can be captured, followed by continuous, fluctuating decline—was already reached in late 1980s (Watson and Pauly 2001, Pauly and Zeller 2014). This level of intense exploitation not only threatens the sustainability of fish stocks and the marine ecosystem but also hits fishing companies hard, since the declining catch rate puts a severe limit on further capital accumulation. Following the expansion strategies of capital in capture fisheries, a relatively recent development in marine spaces has been the emergence of intensive marine aquaculture production (Veuthey & Gerber 2012; Longo *et al.* 2015), in which aquaculture ‘provides a spatial and sectoral frontier to industrial capture fisheries by enrolling new places, practices and environments in fish production’ (Saguin 2016, p.18).

Unlike fisheries, which were once common resources, aquaculture requires enclosing marine spaces and allocating them to private property, where production process can be better controlled. As a rapidly-growing food production sector, it employs technological advances to compensate for the rising costs of finding, extracting and transporting a resource that is declining in quantity and/or quality—in terms of size or marine trophic level—in other words, it has become a ‘technological treadmill in natural resource industries’ (Bridge 2009, p.1229). As such, it is a new commodity frontier in marine areas, the development and expansion of which was achieved mainly through commodity deepening strategies, advanced technology and intensified production (Saguin 2016). It represents a new type of investment in the same marine space—and new opportunities for capital accumulation—instead of having to head further offshore or go to other countries’ seas in order to catch more fish. In short, it involves not the geographical expansion of a commodity frontier but rather a spatial transformation in seafood production, achieved by enclosing marine areas.

Building on Saguin’s conceptualization of aquaculture as a new frontier for capture fisheries, we will examine the recent growth in marine intensive aquaculture in Turkey to uncover its three-pronged—horizontal, vertical and taxonomic—expansion, and how this became possible through the commodity widening, commodity deepening and commodity marketing strategies employed by aquaculture firms. In line with our analysis, we argue that intensive aquaculture is not the final marine commodity frontier; rather, expansion continues within the aquaculture industry, in close relationship to capture fisheries, by transforming the practices and spaces of seafood production. In this way, we aim to contribute to existing research on the expansion of fishing-related human activities in marine areas, and the literature on commodity frontiers; thus, to the broader literature on the political economy and ecology of agrarian change in marine spaces.

Aquaculture Commodity Frontiers in Turkey

Intensive marine aquaculture is a ‘young sector’ in Turkey compared to

agriculture and livestock husbandry (FAO 2011, p.9). Moreover, Turkey is a latecomer compared to other European Mediterranean countries such as Greece, Italy and Spain (FEAP 2016); in other words, a relatively new frontier in marine intensive aquaculture production, the main farmed marine species being gilthead sea bream (*Sparus aurata*) and European sea bass (*Dicentrarchus labrax*)¹ produced from 1985 onwards. While production levels were initially quite low in the late 1980s, the sector began to witness growth in the 1990s, although Turkey's total production volume was still very limited compared to its competitors.

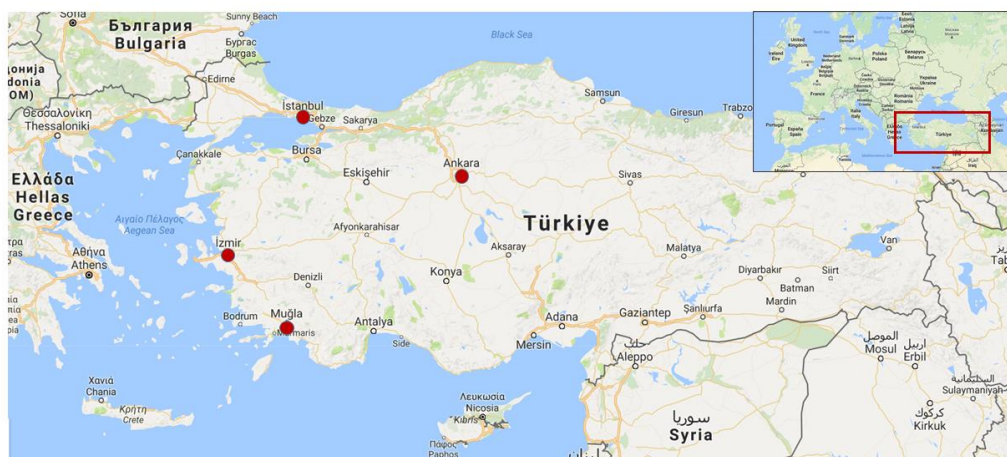


Image 1. Map of the fieldwork sites in Turkey

During the next decade, and especially after the 2001 economic crisis, the sector grew remarkably, reaching 32% annual growth in production of marine species between 2002 and 2015 (MoFAL 2016). This corresponded to a 424 and 344% volume increase in sea bass and sea bream production, respectively (MoFAL 2017). Thus, in the 2000s, aquaculture became ‘one of the fastest growing industries in Turkey’ (FAO 2011, p.2), and despite its latecomer status, the growth rate in marine aquaculture in Turkey skyrocketed over the past 15 years, even surpassing global growth rates—around 7.2% between 1995-2004 and 5.8% between 2005-2014 (FAO 2016).

It is important to note that around 75% of the European sea bass and gilthead sea bream farmed in Turkey is exported to European Union countries (FAO 2011). In 2012, Turkey ranked first in sea bass and second in sea bream production in Europe, occupying 25% of the European sea bass and sea bream market (Deniz 2013). Currently, it is the largest producer of farmed sea bass and sea bream among all European Mediterranean countries—the others being Greece, Spain, Italy, Croatia, Portugal, Cyprus and France. Although Turkey's aquaculture sector was not an ambitious rival of its European counterpart in the 1990s, its rapid

¹ Approximately 95% of the farmed sea bass and sea bream comes from the Aegean Region, especially from the provinces of Izmir and Mugla (Image 1), where the fieldwork was conducted (FAO 2011).

growth in the last 15 years (especially after the economic crisis in Greece) made it the main exporter of sea bass and sea bream to Europe (FEAP 2016).

Meanwhile, Turkey represents an important case of the transformation in seafood production, where the contribution of marine intensive aquaculture to total seafood production volume (together with capture fisheries) increased from around 6% in 2000 to 20.6% in 2015, while the total amount obtained from marine capture fisheries declined from around 460,000 tons in 2000 (about 79% of total production) to around 266,000 tons in 2014 (about 49.5% of total production).

The declining share of capture fisheries in total seafood production is not only related to the growth of aquaculture in Turkey, but also to reduced catch and a tendency to overfish. Although some years it was possible to compensate for the reduced catch by intensifying fishing efforts, most years, the fishing fleet was able to boost catch rate only by targeting smaller pelagic species because the stocks of top predators had already collapsed (Goulding *et al.* 2014). To understand this shift and the agrarian change in marine areas in a broader sense, the relationship between marine fish farms and capture fisheries, and the rising share of aquaculture production have to be taken into account.

In the next three sections, we will examine this transformation by looking at how commodity frontiers expand in the marine intensive aquaculture sector, using the illustrative case of the sector's recent growth in Turkey. To this end, we will focus on the expansion and capital accumulation strategies—commodity widening, commodity deepening and commodity marketing—aquaculture firms in Turkey employ, sometimes simultaneously.

Commodity Widening and Spatial Expansion

In line with the horizontal, vertical and taxonomic expansion witnessed in industrial fisheries in newly opened commodity frontiers, we will begin by examining how the commodity widening strategies in intensive aquaculture first enable a horizontal expansion, where the appropriation of marine resources moves to new, relatively unexploited geographies (Saguin 2016).

Following the rapid development of marine intensive aquaculture in various European Mediterranean countries such as Greece, Italy and Spain in the 1980s and 1990s (FEAP 2016), Turkey—a country on the periphery of the European Common Fisheries Policy— appeared on the scene in the 2000s as an important regional aquaculture producer. Most European countries on the Mediterranean, where sea bass and sea bream fish farms had spread prior to Turkey, were already facing conflicts related to the various uses of marine spaces (Hadjimichael *et al.* 2014; Ertör & Ortega-Cerdà 2015; Perdikaris *et al.* 2016), and barriers to further growth and expansion (Hofherr *et al.* 2012; FEAP 2016). When stagnation hit Europe (STECF 2013), the sector expanded toward marine areas in Turkey, and as a new commodity frontier, Turkey's marine intensive aquaculture sector generated high profits in the late 1990s and early 2000s (Arisoy *et al.* 2012).

Marine aquaculture was introduced to Turkey initially with the support of external experts. Regarding these early stages, Knudsen has argued that the ‘involvement in Turkey can be seen as part of a global process where Norwegian companies have established themselves from Chile to Tasmania as expert consultants or operate farms in joint ventures’ (1995, p.5). While attempts to produce salmon in the Black Sea in collaboration with Norwegian technicians mostly failed at this stage, the production of other marine species—namely, sea bass and sea bream—followed a different trajectory, and the successful application of commodity widening strategies led to a horizontal expansion from European Mediterranean countries to Turkey.

According to our interviews, Turkey seems to have ventured into intensive aquaculture mostly due to the developments in Europe—initial significant growth followed by stagnation despite high demand—resulting in a horizontal expansion of the sector toward new hinterland geographies (Interviewees #8, #9, #13) that offered one or more of these features: ‘free gifts’ of nature (Moore 2011) including favorable seawater conditions—in terms of temperature, oxygen level, currents and waves, water circulation, and wind speed and strength—suited sea bass and sea bream production along with unexploited or less-exploited resources of higher quality; an absence of intense conflicts related to the use of marine areas; and the availability of low-cost labor that made production cheaper and more profitable. An academic from the Faculty of Fisheries and Aquaculture in Izmir (Interviewee #9) argues:

We would never have grown this much had Europe not wanted us to. The only reason the sector grew is because Europe sees us their backyard. There are various actors and stakeholders against its development; environmentalists, tourism sector representatives, ecologists all have negative perceptions of aquaculture. Other European countries like Spain are the forefront of aquaculture production. They prefer to sell us technology and get the products cheaply. Our state allows this growth and development only because this is what Europe wants. They let it happen and support Turkey in doing the dirty work. Otherwise we would have never come this far and reached 235,000 tons of production.

Another interviewee (Interviewee #8) who represents both the academia and the aquaculture sector further claims: ‘Of course they [Europe] want us to grow; our production is cheaper and we sell at cheap prices. Why would they pollute their seas when they can buy farmed fish at such cheap prices from us? It’s also more costly for them to produce the fish.’

Indeed, relationships with Europe and the market capacity especially of Western Europe have played a decisive role in the expansion of the aquaculture sector, for 75 to 80% of the sea bass and sea bream currently farmed in Turkey is sold to European markets; mostly Italy, France, Spain and Germany (FAO 2011). The rapid growth of export-oriented production—rather than for local consumption—was made possible by appropriating nature and exploiting relatively cheap labor simultaneously, i.e. by taking advantage of both suitable

seawater conditions, and lower wages for unskilled and high qualified workers alike (ibid.). Hence, the introduction of marine intensive aquaculture in Turkey and its subsequent intensification illustrates a case of commodity widening, enabling the horizontal expansion of commodity frontiers to new marine areas.

The horizontal expansion of commodity frontiers through commodity widening strategies is not only limited to expansion between different countries; the zones allocated to developing marine aquaculture can also change and expand within the same country. For instance, from 1985 onwards, the sea bass and sea bream farms in Turkey were situated near the coastline, in sheltered bays of the Aegean and the Mediterranean. They usually consisted of cubic wooden cages floating in the water, measuring 5 meters in each dimension (FAO 2011). These small cages were traditionally placed very close to the coast, 'at distances that one could swim' (Interviewee #9). In contrast, by the late 2000s, most of these smaller cages were replaced by larger ones and placed further off the coast (Yucel-Gier *et al.* 2009; Arisoy *et al.* 2012). Through this horizontal expansion, new marine spaces were enclosed for larger fish farms with greater investment capacity.

There are various drivers that help explain the spatial expansion of marine intensive aquaculture in Turkey: First, aquaculture companies—especially the more economically powerful ones—aimed to simultaneously achieve economies of scale and produce greater quantities of fish, which could only be realized by placing bigger cages further off the shore and at greater depths, resulting in spatial expansion that was both horizontal and vertical. According to a representative from one of the biggest sea bass and sea bream producers in Turkey (Interviewee #19), their company predicted this necessity much earlier than the rest of the sector and moved most of their farms farther away from the coastline in the early 2000s. This enabled them to increase production volume from 1,500 fish per farm (4x4x4 meter wooden cages) in the 1990s to 1 million fish per farm in circular cages with a diameter of 50 meters, corresponding to an annual production change from 400-500 kg to about 4,000 tons per year. According to Interviewee #14, not just the surface but also the depths of the sea became a space of production with the spatial expansion of fish farms: 'The resources of the world are limited, and on land, you can't go up so production is only possible on the surface; but in marine areas you can go down. It is difficult to produce on square meters, which is why we try to produce in cubic meters'.

Second, aquaculture firms wanted to move production to new marine areas with better quality resources (especially seawater); due either to environmental legislations or potential risks to production. Fish farms in sheltered bays—where water circulation is less compared to offshore seas—cause significant change to the physical and chemical characteristics of seawater, leading to a higher nutrient load, eutrophication, pollution, reduced oxygen concentration and modified hydrology and sedimentation (Perdikaris *et al.* 2016). To avoid negative environmental impacts of this kind, Turkey's Environment Law² was amended in 2007, according to which fish farms had to be more than 0.6 nautical miles

² Amendment to Environment Law No. 2872, published in the *Official Gazette* No. 26413, January 24, 2007.

(almost 1.1 kilometers) off the shore and at a depth greater than 30 meters. Even without environmental legislation, deterioration of the seawater, sedimentation, and eutrophication would have had a negative effect not only on the marine ecosystem around fish farms, but also on aquaculture production, because sea bass and sea bream cannot survive in polluted waters with low concentrations of oxygen (Ökte 2002). Therefore, from 2008 onwards, due both to the environmental legislation and the cumulative impact of fish farms, aquaculture companies had to relocate their farms to new sites with higher circulation and better water quality in order to continue to secure a high 'ecological surplus' from production (Moore 2010a; Campling 2012). This illustrates a known case of the commodity widening strategies of capital, aimed at appropriating a higher quality resource whenever seawater quality and profits begin to shrink at a given site.

Commodity Deepening and Intensification of the Capitalist Model

The second strategy of capital that enables further expansion of marine commodity frontiers in aquaculture is commodity deepening, which is defined as strategies to intensify production 'through enhanced capitalization and socio-technical innovation' (Campling 2012, p.256). In marine areas, this manifests as bigger, mechanized and more capitalized fish farms. Aquaculture firms use technological advancements and automated production processes for feeding, gathering and packaging, which allow them to apply strategies of scale economies and mass production. In the case of Turkey, the fact that the majority of aquaculture production—about 98%—comes from intensive farming systems (FAO 2011) illustrates how intensely aquaculture firms use these strategies, which enables them to continue growing and accumulating capital while expanding commodity frontiers.

Growing Companies, Growing Farms

Commodity frontiers opened by the introduction of marine intensive aquaculture in Turkey have led to further intensification through commodity deepening strategies. Producers aimed to increase production output per unit of space while decreasing costs, which would enable them to benefit more from the ecological surplus. In this context, the number of fish farms almost doubled between 2002 and 2015, while their capacity increased by 857% (MoFAL 2017, p.27). Research and innovation efforts were driven by a desire to run more mechanized and capitalized farms managed via automation and advanced technologies to achieve economies of scale. These strategies made it possible to raise more fish to market size more quickly by benefitting from technological advances and biotechnology, which was only available to 'growing companies [with] growing farms' (Interviewee #18). For instance, Interviewee #18 stated that bigger and mechanized firms like theirs already achieved increased productivity, and that while they used to generate 1 unit of production from 10 units of space, they now generated 20 units of production from 100 units of space, adding that 'this growth is also a vertical one'. Mechanization and automation are crucial for

vertical expansion that aims to produce more fish over a given time period because whenever the diameter of fish farms exceed 20 meters, it becomes impossible to manually feed or harvest the fish (Interviewee #19).

The intensification in marine aquaculture in Turkey and associated investments could only be undertaken by firms with substantial financial strength and business capacity (Knudsen 1995), and the direct or indirect elimination of small-scale fish farms by 'growing companies and growing farms'. Many companies have been changing hands, and mergers, acquisitions, and new joint ventures have become common in recent years (TAGEM 2013). By the late 2000s, many smaller firms had been sold to bigger capital owners—some of which were fish feed producers—following the horizontal and vertical expansion of the commodity frontiers. Currently, 'marine fish farming [in Turkey] is mostly operated by large private enterprises with local communities rarely being involved' (FAO 2011, p.6). Most interviewees who represented the aquaculture industry or state institutions confirmed that the sector began to swallow small actors who were unable to reduce costs, and added that the sector would comprise of even fewer firms in the future.

Parallel to the expansion strategies of firms, the Turkish State itself facilitated the expansion of marine commodity frontiers in aquaculture through a series of administrative and legislative changes, especially in the last decade. One such change was a 2006 directive issued by the Ministry of Agriculture, Article 5 of which states: 'To ensure the efficient use of areas allocated to aquaculture, applications to invest in marine aquaculture less than 250 tons per year will be denied'. With this directive, the state not only cleared the path for intensification, but also eliminated other alternatives on the basis of the efficiency argument. Another change was the transfer of jurisdiction over determining the areas for aquaculture production from the Ministry of Environment to the Ministry of Food, Agriculture, and Livestock (Directive No. 2006/1). The MoFAL aimed to 'support sustainable sector development', so, it collaborated with FAO to determine aquaculture zoning plans (Deniz 2013; EUNETMAR 2014), while cage farms had to move away from the coast in 2007 (FAO-MARA 2008).

A third change concerned the leasing of marine areas, jurisdiction over which was transferred from provincial governments to the MoFAL from 2011 onwards. Accordingly, the task of determining leasing fees was delegated to the Provincial Directorates of the MoFAL³, and the average leasing fee for one decaire of marine area fell from 1,862 TL in 2010 to 510 TL in 2011 (SUYSERBIR 2014). These changes have been important drivers of growth by shortening the duration of applications and allowing extended lease periods (EUNETMAR, 2014). In brief, regulations of the state and relevant structural and institutional transformations not only opened the way for further expansion of commodity frontiers in marine areas, but also promoted bigger fish farms by larger but fewer companies.

Intensifying Production through Vertical Integration

³ No. 27951 of the *Official Gazette of the Turkish Republic*, published June 1, 2011.

Another significant way to decrease costs, and currently the most common commodity deepening strategy used by marine aquaculture firms in Turkey is vertical integration. By following a ‘fully vertically integrated business model’ (Deniz 2013), the biggest and more capitalized marine aquaculture firms control each step of the supply chain: They have fleets to catch their own raw materials, fishmeal and fish oil factories, fish feed production facilities, hatcheries for breeding and raising juveniles, adaptation units, farms for rearing fish, fleets for harvesting and large sea vessels for transporting juveniles; they also manage processing, packaging, transportation, logistics and marketing all by themselves. Interviewee #18 explains this process:

If you had 100 farms, you would still have the same level of production. However, through vertical integration, you can venture into hatcheries, fish feed, logistics, transportation, export, etc. For the aquaculture firms in Turkey, the main part of production costs is fish feed. That’s why you have to produce your own fish feed and have factories that process fishmeal and fish oil. We buy the raw materials for fish feed from all over the world and produce our own fish feed. Last year, we also began to make investments in other countries such as Mauritania, where we produce fishmeal. We have two factories and fish fleets there, which catch fish and produce fishmeal for us.

In other words, the transformation in seafood production is marked by an advanced level of control and ownership, where aquaculture firms maximize the profits generated from each step of the value chain. As Clausen and Clark state (2005, p.436): ‘...aquaculture represents not only a quantitative change in the intensification and concentration of production; it also places organisms’ life cycles under the complete control of capitalist ownership. This new industry boasts of having ownership from egg to plate and substantially alters the ecological and human dimensions of a fishery’.

The most important aspect of vertical integration—and of the vertical expansion of aquaculture commodity frontiers—is the production of fish feed, which is the main component of aquaculture firms’ costs. Globally, fish feed accounts for between 45 and 70% of the costs in the intensive production of carnivorous species such as sea bass and sea bream. In Turkey, this figure is in the highest range, between 65 and 70% (Korkut *et al.* 2015; TAGEM 2013). Although the aquaculture industry globally wants to decrease the fish oil and fishmeal content of fish feed and replace them with other sources of protein—soy, wheat gluten, algae, insects, by-products, etc.—fishmeal and fish oil are still seen as essential components of fish feed (EEA 2016), which are costly and affordable only for bigger and capitalized firms.

Changing Uses of Capture Fish

The rise of fish farming in Turkey seems to be closely linked to the need to identify new sources of fish feed and the depletion of many major marine fishery resources (Arisoy *et al.* 2012). In general, feed for carnivorous species must be composed of 60 to 80% of ingredients based on animal proteins. The feed used for

sea bass and sea bream in Turkey consists of 40 to 45% fishmeal, 12 to 13% fish oil, and 40 to 45% other protein sources (Tacon & Metian 2008; TAGEM 2013). Moreover, the feed conversion ratio (FCR)—the amount of feed needed for farmed fish to gain a kg of body weight—for the sea bass and sea bream produced in Turkey is on average 2.1 and 1.9, respectively (Tacon & Metian 2008). According to an industrial fisherman and fishmeal producer in Turkey (Interviewee #24), ‘this creates its own capture fishing economy and increases the pressure on wild fish stocks instead of decreasing it. So, it leads to a paradox between capture fisheries and marine intensive aquaculture production’.

In Turkey, this paradox manifests in the European anchovy (*Engraulis encrasicolus*) catch, which takes place in the Black Sea region. European anchovy is the most efficient and preferred species for fish feed production; compared to two other species used partly for this purpose—European sprat (*Sprattus sprattus*) and European pilchard (*Sardina pilchardus*)— it yields a remarkably higher percentage of fishmeal and fish oil (Fisheries Centre Research Reports 2016). Yet it is also a prize catch in terms of human consumption, which gives rise to a dilemma that might be better understood by looking at how its use has transformed over the past decades.

Between 1950 and 1960, ‘90% of [European anchovy] landings [in Turkey] was destined for direct human consumption’, while the remaining 9.9% was destined for other uses (mainly fertilizers), and only 0.1% for fishmeal and fish oil (FMFO) production (Fisheries Centre Research Reports 2016, p.26). In the last decades, the rate of European anchovy landings used for FMFO climbed to around 50%, reaching 56% in 2013, and the rate for direct consumption fell remarkably (ibid.). In 2013, 260,000 tons of fish were captured in the Eastern Black Sea; 156,000 tons of it went directly to fishmeal and fish oil factories, and only 90,000 tons were used for human consumption (TAGEM 2013). These shares imply that the common use of the small fish has shifted from direct human consumption to FMFO production.

Another crucial matter regarding this issue is whether this transformation affects the volume especially of European anchovy landings and its stock. The head of a small-scale fishermen’s cooperative (Interviewee #20) criticizes this transformation, claiming that the only ones benefiting from this shift are fishmeal factory owners. He notes:

The anchovy ‘we’ should eat goes to factories. They [industrial fishermen] catch hundreds of tons of anchovy in just one night, and it’s not that abundant as before. If its stock collapses, we would have no fishermen left. Another issue is what we would tell citizens. People might not advocate for their right to other species such as the bonito, tuna or other bluefish; but if the anchovy disappears, even those in Diyarbakir—a city in Southeastern Turkey without a coastline—would be vocal about their rights. They can’t fish the entire anchovy stock in one night and send them to factories. That would be akin to plunder... Besides, if there is no anchovy, what will you feed the fish in fish farms? If you can feed them

corn, okay. But you can't use the small fish; this has no end. There is no such 'feed' in the sea.

Returning to the paradox, it becomes crucial to examine the data on the European anchovy stock in the Black Sea in order to understand whether its use for fish feed production increases its intensive extraction and leads to a risk of the stock's collapse. The most recent data on anchovy stocks and fishing efforts in Turkey point to the fact that Turkish capture fisheries have been a significant pressure on European anchovy stocks at least from the 1970s onwards (Ulman *et al.* 2013; Goulding *et al.* 2014; O'Higgins *et al.* 2014; Fisheries Centre Research Reports 2016). After the catch and stocks of high-value commercial species declined somewhat in the 1970s, industrial fisheries underwent a taxonomic expansion and turned to smaller pelagic species, as a result of which anchovy and sprat stocks also collapsed in the late 1980s and early 1990s (Goulding *et al.* 2014). Although these two stocks had gradually but cyclically recovered in 2000s, 'the exploited biomass could not reach its levels before 1980s' (Black Sea Commission 2008). Moreover, while the maximum sustainable yield—the maximum amount of a species that can be caught to allow its reproduction and maintain healthy stocks—for European anchovy is around 200,000 tons per year, the catch rate in Turkey between 2011-2014 was on average around 302,000 tons (Goulding *et al.* 2014).

Currently, anchovy fishing capacity exceeds by 200% in the Black Sea, while Turkey's other seas have an excess capacity of $\geq 500\%$ for all species. If overcapacity persists, catch per unit effort, fish length, and stock sizes will continue to decline (Ulman *et al.* 2013). This is why, in line with the insights gained from the dynamics of overfishing in Turkey, '[as the commodity frontier of capture fisheries], aquaculture presents an opportunity to address crises in industrial overexploitation in capture fisheries by providing new spaces for and new practices of producing fish' (Saguin 2016, p.5). Hence, instead of providing a solution to declining fish stocks, the intensive marine aquaculture of carnivorous species only solves the crisis of capital in the short-term, and its expansion ends up putting more pressure on fisheries.

Recently, the largest aquaculture firms in Turkey have entered a new phase of horizontal expansion due to the high cost of fish feed, the pressure on fish stocks, and fierce competition among fishing fleets—in other words, due to 'mature frontier conditions' in industrial fishing (Campling 2012). Accordingly, they not only have their own fleets, but also move to new geographies to catch raw materials. They use their catch to produce fishmeal, fish oil, and fish feed in their own factories, which are then transported long distances. This means a combination of commodity deepening and commodity widening strategies are at play, and the intensification of production in aquaculture has led capital once again to look for new areas to exploit, so as to be able to benefit from a relatively higher ecological surplus from captures that will then be turned into feed for the fish in their farms.

In sum, we argue that the increasing investments by aquaculture companies

reflect that the marine commodity frontier in aquaculture is already ‘maturing’ requiring firms to pursue commodity deepening strategies in order to continue to exploit a reduced ecological surplus. Thus, marine intensive aquaculture does not only provide a commodity frontier for capture fisheries (Saguin 2016), but also creates its own horizontal, vertical, and taxonomic expansion of commodity frontiers.

Commodity Marketing and the Expansion of Market Power

The initial trials of marine intensive aquaculture production in Turkey had encountered one major barrier: a lack of marketing (Knudsen 1995). The later growth in sea bass and sea bream farming was therefore closely linked to marketing opportunities, and the sector became increasingly export-oriented because domestic levels of fish consumption (6.2 kg per capita/year) were much lower than European (24.5 kg per capita/year in 2013) and global averages (above 20 kg per capita/year in 2015⁴) (FAO 2011; EUMOFA 2016; MoFAL 2016). Following the commodity widening and commodity deepening strategies that generated an increased supply, an overarching capital accumulation strategy—‘commodity marketing’—came into play to address the demand side of broader commodification.

Since profit margins have recently been falling, aquaculture firms consider it vital to discover and enter new markets while maintaining their position in existing ones (Interviewees #12, #13, #18). Interviewee #18 explains that most aquaculture companies in Turkey are still unprepared for global competition because their production model is not oriented towards marketing. This had previously in the 1990s led sea bass and sea bream producers in Turkey—and other countries—to generate excessive supply without securing demand, as a result of which prices declined both nationally and internationally (Rad & Köksal 2000). In short, for a growing industry that aims to continue with growth and capital accumulation, marketing and creating the demand for farmed fish became a main concern.

The growth, expansion and export capacity of the aquaculture industry have often been facilitated by state interventions. State-sector collaboration forms an important part of such growth production processes (Veuthey & Gerber 2012; Saguin 2016), and in Turkey, the state has traditionally always been an important actor in determining the fate of nature-based industries (Adaman & Arsel 2012). In the context of marine intensive aquaculture, Turkish politics and policymaking have often followed and responded to the trajectory, needs, and demands of the sector (Interviewees #9, #11, #15, #25, #26, #27). For instance, the General Directorate of Fisheries and Aquaculture under the Ministry of Food, Agriculture and Livestock declared that its vision for 2023 was to increase aquaculture production to 500,000 tons per year; however, recent growth has not been so

⁴ <http://www.fao.org/news/story/en/item/421871/icode/>

high, and the Ministry revised the target as 400,000 tons in 2017 (Deniz 2013; MoFAL 2017).

Individual or joint efforts by both the state and sector in Turkey have helped to promote and expand the marketing opportunities of marine intensive aquaculture by keeping prices down through directly subsidizing firms, promoting both internal and external consumption and demand, opening new markets, and achieving species and product diversity. We argue that these efforts made significant contributions to the expansion of the sector and marine commodity frontiers in aquaculture through the simultaneous application of both commodity marketing and commodity widening strategies, and thus resulted in the transformation of seafood production from capture fisheries to fish farming in Turkey.

Direct Subsidies

Aquaculture was included in the scope of agricultural support schemes in Turkey in 2003, right after the 2001 economic crisis (MoFAL 2013), and the Ministry of Agriculture began to directly subsidize aquaculture producers for each kilogram of production (Yucel-Gier et al. 2009). For over a decade, the state has been providing direct income support to sea bass and sea bream producers (as well as producers of rainbow trout, mussels or new species), where the only eligibility requirement was being registered in the Ministry's Fish Farm Registry.

By 2013, following a full decade of direct subsidies, sea bass and sea bream producers were receiving 0.85 Turkish Lira (TL) per kilogram of production⁵. According to many interviewees, state subsidies were the main driver for the remarkable growth rate observed in sea bass and sea bream farming in Turkey between 2002 and 2015; an average of 30% annual production growth in tons (around 388% in total) (MoFAL 2017). In other words, direct subsidies played a major role in intensifying production and keeping prices down, and were welcomed by the sector—until they began to create problems in exports.

Opening New Markets: Exports, Trade Relations and Conflicts over Existing Markets

To boost sales in the face of rising production, larger aquaculture companies had to identify new markets while maintaining their position and power in existing ones. While it had been the intention of both the state and the sector to increase domestic consumption levels, rates have not risen much, fluctuating between 7,1 and 5,5 kg per capita since 2010 (MoFAL 2016). In fact, with the consolidation of the sector, the farms that only served domestic consumption have gradually disappeared over the last decade. Consequently, the growth of aquaculture in Turkey was enabled and expanded by the export targets of the larger firms that entered into international markets⁶. The government also gave 'active support [to such expansion] through export subsidies' (EUNETMAR 2014). Currently,

⁵ No. 28612 of the *Official Gazette of the Turkish Republic*, published April 8, 2013.

<http://www.resmigazete.gov.tr/eskiler/2013/04/20130408-5.htm>

⁶ Turkish Seafood Promotion Committee: http://www.turkishseafood.org.tr/?page_id=31&lang=tr

approximately 75 to 80% of the farmed sea bass and sea bream is exported to European countries; especially to Italy, France, Spain and Germany (FAO 2011).

This trend of identifying and targeting new markets, in turn, generated conflicts over existing markets between the Turkish and European aquaculture sectors. In August 2015, the European Commission initiated ‘an anti-subsidy proceeding concerning imports of European sea bass and gilthead sea bream originating in Turkey’⁷ after receiving a complaint lodged by the Association of Spanish Marine Aquaculture Producers (APROMAR), which represents the producers of over 25% of the total EU production of both species. The complaint demanded protection against subsidized imports from countries that were not members of the European Community—which was later backed by 60% of all sea bass and sea bream producers in the EU⁸—and claimed that the Turkish subsidies on both species were causing ‘material injury to the EU industry’. The complaint read, APROMAR ‘has provided evidence that volume of imports of the product under investigation from Turkey have increased overall in absolute terms and have increased in terms of market share’. The proceeding was terminated⁹ after APROMAR withdrew its complaint following a decision by the Turkish government to remove the subsidies in May 2016, effective the beginning of 2016¹⁰. Ultimately, the proceeding concluded without the imposition of any measures, unlike the previous complaint against Turkey regarding trout subsidies.

In the aftermath of the trade conflicts with European producers, and Turkish producers’ adoption of EU quality standards related to fish welfare and fish safety by the late 2000s (Gozgozoglu & Deniz 2010; Deniz 2013), in 2016, Turkey became a member of the Federation of European Aquaculture Producers (FEAP) in order to remain in close contact and collaborate with the European sector and market. Moreover, sector representatives in Turkey grew in favor of the abolishment of direct subsidies because they did not want to lose their high level of exports¹¹ and instead, preferred state support aimed at boosting consumption (Interviewees #5, #18, Haberturk 2015¹²).

Promoting Consumption and Demand

The state-sector collaboration in Turkey has played an important role in commodity marketing strategies geared to boosting domestic and overseas consumption and demand for farmed seafood in a context where national annual per capita consumption of seafood was low; i.e. 6.2 kg in 2015 (MoFAL 2016). The FAO report on Turkey asserts that due to low total domestic fish consumption, only 10% of which is composed of farmed species, ‘the Turkish Government has

⁷ http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2015_266_R_0006&from=EN

⁸ <http://www.mispecies.com/nav/actualidad/noticias/noticia-detalle/APROMAR-hace-balance-de-2016-y-presenta-perspectivas-para-2017/#.WGtjKzJh2u5>

⁹ <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016D1360&from=EN>

¹⁰ On May 5, 2016, a decree was published in the Turkish *Official Gazette* whereby Turkish authorities annulled the main subsidy scheme, effective January 1, 2016.

¹¹ <https://www.dailysabah.com/business/2015/08/06/turkish-fishermen-face-antidumping-case-in-eu-call-for-govt-action>

¹² <http://www.haberturk.com/yazarlar/abdurrahman-yildirim-1018/1111544-abden-levrek-ve-cipura-sorusturmasi>

shown a clear intention to increase the per capita fish consumption by increasing the production in the aquaculture sector which seems to be the only option for achieving this increase' (FAO 2011, p.5).

In efforts to improve the public image and acceptance of marine aquaculture and increase domestic seafood consumption, not only private advertisements by aquaculture firms became more frequent, but also public service announcements (PSAs) recommending eating fish at least twice a week began to appear on televisions¹³. However, the aquaculture industry claims that PSAs have low impact since they appear only at night, when not many people are watching television. They feel it is necessary for the sector to take the initiative and put effort into developing effective private ads in different media, promotions, videos, and publications, and distributing farmed fish for free (Interviewee #5).

The Turkish Seafood Promotion Committee—founded in 2008 and composed of aquaculture companies and exporters, and various aquaculture farmers' and producers' organizations—also engaged in projects to increase marketing and consumption, such as distributing fish sandwiches to schoolchildren (Interviewee #5). Other state-supported commodity marketing strategies to ensure the growth of both consumption and production consisted of enabling the participation of firms in national and international fairs and conferences; organizing annual workshops for sector representatives (SUYMERBIR 2014), and producing brochures claiming that 'health organizations and dieticians recommend eating fish at least twice a week' (FAO-MARA 2008).

Species and Product Diversity: Taxonomic Expansion and Innovations in Processing and Packaging

Diversifying species and products is another key strategy employed by aquaculture firms, which involves producing various species concurrently and trying to grow new species by examining their physical adaptability to farming and profitability. This is how commodity frontiers that reach 'mature conditions' in one species expand taxonomically toward other species, because benefits from the ecological surplus gradually diminish over time. The state in Turkey is also supportive of attempts to produce new species in fish farms; the MoFAL has been providing the highest direct subsidies to the production of new species—1 TL per kg¹⁴. The main underlying reasons of such attempts include creating new markets with the new species, benefitting from being a first comer in the sector, and producing new niche luxury products that will draw higher prices in export markets; especially in the EU.

Another way to diversify products is by making innovations in processing and packaging, the lack of which has been considered a barrier to growth for aquaculture in Turkey (EUNETMAR 2014). Advances in processing and packaging are thought to add value to products in two ways: First, by enabling greater consumption of the commodity through easier ways to prepare, cook and eat fish

¹³ <https://www.youtube.com/watch?v=iiRkqhw5W8A>

¹⁴ No. 28612 of the *Official Gazette of the Turkish Republic*, published April 8, 2013.

(fillets, canned fish, fish chips and sea bass soup ready to cook); and second, by creating niche products that are more expensive (such as smoked or marinated sea bass and sea bream). A sector representative noted that one of the key issues related to the product is that it spoils easily and quickly (Interviewee #18). He argued that this was an issue that separated farmed fish from other industrial products, even from other nutritional products like grains or fermented goods. Thus, 'matter matters' (Bakker & Bridge 2006, p.18), and marketing is a crucial aspect of the capital accumulation and expansion strategies of aquaculture companies.

Lastly, the larger aquaculture companies in Turkey—especially those with greater financial resources—are currently planning to approach the growing United States market and negotiate with new host countries in the Caribbean and Central America, such as the Dominican Republic. There are also plans to invest in new farms or facilities in different countries, such as Albania, Somalia, Mauritania, Libya, and Kazakhstan, where they would either pay less taxes for production or be closer to different markets (Interviewees #17, #18, #19) (TAGEM 2013). In short, the objective of expanding to new markets brings further commodity widening and geographical expansion through simultaneously applied strategies of aquaculture firms.

Conclusion: Maturing and Expanding Marine Commodity Frontiers

The horizontal expansion of intensive marine aquaculture from European Mediterranean countries to Turkey initially resulted in a very profitable industry in the newly opened frontier during the late 1990s and early 2000s. Following consolidation in the sector, only the larger firms with greater capital that had the capacity to employ commodity deepening strategies and ensure vertical integration continued to benefit from the ecological surplus, while smaller ones had to sell their farms and quit the industry. Meanwhile, intensified production required an export-oriented mindset in order to make sure products would be marketed. Recent trends in the sector and the perceptions of sector representatives imply that marine commodity frontiers opened through intensive aquaculture in Turkey are slowly maturing.

This is the underlying reason for the more aggressive commodity deepening and commodity marketing strategies, such as controlling the entire supply chain, looking for new markets, and maintaining a strong presence in existing ones. Future projections are not showing much profit; the sector in Turkey more and more resembles an almost fully-exploited marine frontier. Thus, capital is already looking for new marine commodity frontiers and new production areas to expand into. In other words, both commodity deepening and commodity marketing strategies led to new commodity widening strategies, where aquaculture firms established their own fish fleets, looked for new geographies to harvest smaller pelagic fish for fish feed, built fish feed factories in other countries where production costs are lower, and all the while spent effort to boost both the supply

and the demand of their increased production.

Given these state of events, the recent growth of marine intensive aquaculture in Turkey offers a good example of how marine commodity frontiers expand geographically and spatio-politically. Based on this case, we followed Moore's framework and aimed to uncover how expansion takes place in the intensive marine aquaculture sector. By building on the conceptualization of aquaculture as a new frontier for capture fisheries, we argued that marine intensive aquaculture is not only a frontier for capture fisheries, but rather continues to expand within the sector: horizontally, by enclosing different marine areas both nationally and internationally; vertically, by establishing bigger farms at greater depths and intensifying production; and taxonomically, by producing different species and processing them differently, and by turning small fish into fish feed to produce economically more valuable fish, thus benefitting from a different ecological surplus.

Based on our analysis, we argued that this three-pronged expansion was made possible by three different strategies that aquaculture companies use, sometimes simultaneously: namely, commodity widening, commodity deepening, and commodity marketing. First, commodity widening enables aquaculture firms to establish farms in new geographies (domestic or overseas) where seawater conditions are suitable, enclosing marine areas is easier and production is cheaper. Additionally, they expand further horizontally with bigger farms situated farther off the shore and at greater depths. Second, commodity deepening strategies provide growing aquaculture companies reduced input costs and greater control over the entire production chain through vertical integration. These strategies meanwhile lead to further commodity widening strategies, where firms begin to look for new sites to capture small fish; the raw materials needed to produce fish feed to be used in their farms. Third, although our unit of analysis followed the commodity frontiers approach and focused on primary production, we also incorporated an analysis of commodity marketing strategies that generate demand and boost consumption, since they simultaneously enable further commodity widening strategies and geographical expansion. As commodity frontiers mature, the pursuit of increasing profits by exchanging a relatively cheaply-produced commodity involves commodity marketing strategies, which ensure that intensified production meets demands—mostly in international markets. The commodity widening, deepening, and marketing strategies thus lead to further expansions, where new areas and new practices of seafood production serve the interests of capital.

Finally, by employing the framework of the expansion of commodity frontiers in this article, we have shown how expansion transforms the practices and spaces of seafood production from capture to intensive farming; illustrated the relations between capture fisheries and intensive marine aquaculture, in other words, the dependence of the latter on the former; and highlighted the strategies capital employs to further extend and intensify its accumulation in marine areas. Our data illustrated that instead of providing a solution to depleting fish stocks, the intensive marine aquaculture of carnivorous species creates another source of

pressure for fisheries, where exploitation leads to further expansion and intensification. On this basis, we argued that continuous expansion implies how capital produces nature, spaces and socio-ecological regimes with the intention of overcoming not social or ecological crises related to declining stocks and capture fisheries, but crises of decreasing profits. This is how capital creates new spaces and production relations in intensive aquaculture; by further enclosing and commodifying marine areas to extend its reach and continue to accumulate.

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Nazioarteko Hizketaldia

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