TRACKING THE SEABASS AND SEA BREAM VALUE CHAIN AND ITS SUSTAINABILITY FROM WEST AFRICA TO TURKISH AQUACULTURE

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ABSTRACT

The escalating global demand for seafood, driven by a growing population and increased need for animal proteins, has led to rapid expansion of intensive aquaculture production, prompting concerns about its socio-ecological impacts. This growth has also given rise to complex international trade dynamics between developed and developing nations. Despite numerous studies on global seafood value chains, there is a literature gap regarding the evaluation of the Turkish farmed seabass and sea bream (SBSB) industry, the main supplier to EU and UK markets. Using Global Commodity and Global Value Chain frameworks, this study aims to shed light on Turkish aquaculture companies' role in this chain, examining trade dynamics and socio-ecological sustainability. Through in-depth interviews with aquaculture and fish feed sector representatives, and analysis of governmental documents and the ITC Trade Map database, the study finds that the SBSB global value chain is subject to quality and sustainability certifications mandated by lead firms (major EU and UK supermarkets and retailers) on farmed fish suppliers. Thus, the chain is characterized as buyer-driven, with Turkish aquaculture firms achieving some vertical integration. However, certification schemes alone are inadequate for addressing most socio-ecological challenges across the value chain. Overfishing, declining fish stocks, and rising fish feed prices necessitate aquaculture firms to explore alternative feed technologies, which may have a greater impact on shaping the sector's future than third-party sustainability certification.

BATI AFRİKA'DAN TÜRK SU ÜRÜNLERİ YETİŞTİRİCİLİĞİNE DENİZ LEVREĞİ VE ÇİPURA DEĞER ZİNCİRİNİN VE SÜRDÜRÜLEBİLİRLİĞİNİN İZLENMESİ

ÖZET

Küresel nüfusun artması ve hayvansal protein ihtiyacının yükselmesiyle birlikte deniz ürünlerine olan küresel talep hızla artmaktadır, bu da yoğun su ürünleri yetiştiriciliğinin hızlı bir şekilde gelişmesine ve sosyo-ekolojik etkileri hakkında soruların ortaya çıkmasına yol açmaktadır. Bu genişleme, gelişmiş ve gelişmekte olan ülkeler arasında karmaşık uluslararası ticaret dinamiklerine neden olmuştur. Küresel deniz ürünleri değer zincirleri hakkında birçok bilimsel çalışmaya rağmen, Türkiye'nin Avrupa Birliği ve Birleşik Krallık pazarlarına başlıca tedarikçi olan deniz levreği ve çipura (SBSB) endüstrisinin değerlendirilmesine ilişkin bir literatür boşluğu bulunmaktadır. Küresel Mal ve Küresel Değer Zinciri çerçevelerine dayanarak, bu çalışma Türk su ürünleri şirketlerinin bu değer zincirindeki rolünü, ticaret dinamiklerini ve sosyo-ekolojik sürdürülebilirliği incelemeyi amaçlamaktadır. Kültür balıkçılığı ve balık yemi sektörlerinden temsilcilerle yapılan derinlemesine görüşmeler ve hükümet belgelerinin ve ITC Ticaret Haritası veritabanının incelenmesiyle, çalışma, SBSB'nin küresel değer zincirinin büyük perakendeciler ve perakende satış noktalarının üreticilere dayattığı birçok kalite ve sürdürülebilirlik sertifikasına tabi olduğunu ortaya koymaktadır (AB ve İngiltere'deki büyük süpermarketler ve perakendeciler). Bu nedenle, zincir, Türk su ürünleri şirketlerinin belirli bir düzeyde dikey entegrasyon elde ettiği alıcıya dayalı bir değer zinciri olarak karakterize edilebilir. Sonuçlar, sertifikasyon düzenlemelerinin tüm değer zinciri boyunca sosyo-ekolojik zorlukları değerlendirmek için yeterli olmadığını göstermektedir. Bununla birlikte, aşırı avlanma, azalan balık stokları ve balık yemlerinin artan fiyatları, su ürünleri şirketlerinin alternatif yem teknolojileri aramasını gerektirmektedir, ki bu da gelecekte sertifikasyonun ötesinde su ürünleri sektörünü şekillendirebilir.

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LIST OF SYMBOLS/ABBREVIATIONS

EU	European Union
FAO	Food and Agriculture Organization
MOAF	Ministry of Agriculture and Forestry
TAGEM	General Directorate of Agricultural Research and Policies
UK	United Kingdom
US	United States
TURKSTAT	Turkish Statistical Institute

1. INTRODUCTION

The expected rise in the world population, which is projected to reach 9.7 billion by 2050[1], is likely to lead to an escalation of the need for animal protein (Henchion et al., 2017) and a surging demand for seafood, as an important source of protein (Naylor et al., 2021). Recognized for its nutritional diversity and lower environmental impact compared to land-based production, seafood is often considered a unique and promising solution to meet the rising global food demand while mitigating environmental and health concerns (Costello et al., 2020).

To meet the growing demand for seafood, aquaculture, the farming of aquatic organisms, has experienced steady growth in the last decades, reaching 122.6 million tonnes of global production in 2020, marking a 6.7 million-tonne increase from 2018 (FAO, 2022). Wild-caught seafood production, on the other hand, is stagnating, due to socio-ecological factors such as pollution of water sources, marine habitat degradation, increased coastal development, climate change, overfishing, and declining fish stocks (Kroetz et al., 2022). Over 90% of global aquaculture output comes from Asian countries, with aquaculture being the fastest-growing food production sector globally, expected to double its production volumes by 2050 (Stentiford et al., 2020). China leads seafood consumption with 65 million tonnes, followed by the United States (7.1 million tonnes), Indonesia (7.3 tonnes), Japan (7.4 million tonnes), and the European Union (13 million tonnes) (Guillen et al., 2018). In 2021, seafood trade surpassed beef, pork, and poultry trade, underlining the big role of trade in the seafood sector (Sharma & Nikolik, 2022). However, despite its exponential growth, the aquaculture industry has faced social and environmental challenges, such as pollution, habitat degradation, and overfishing of wild stocks, tarnishing its reputation (Roebuck, 2023).

The escalating demand for seafood protein is set to increase pressure on marine resources for additional fishmeal production (Tacon & Metian, 2015), because the growth in aquaculture is contingent on the supply of sustainable protein feed for aquatic animals, highlighting the growing importance of sustainability amid environmental impacts in aquaculture, with respect to its raw material supply and production processes.

[1] https://population.un.org/wpp/

Surrounded by the Black Sea, the Sea of Marmara, the Aegean and the Mediterranean Seas, Turkey's aquaculture sector has been growing for the last several decades, supported by direct and indirect government subsidies, with the aim to grow exports of the county. To the contrary, wild capture fisheries in the surrounding seas of the country have been stagnating due to overfishing, overcapacity and environmental pollution (Ulman et al., 2020). As a response, the aquaculture sector is assuming a bigger role both in terms of providing cheaper proteins to the citizens as well as in terms of supporting economic growth in the country. The aquaculture sector particularly focuses on the farming of European seabass (*Dicentrarchus labrax*, *levrek* in Turkish), and gilthead sea bream (*Sparus aurata*, *çipura* in Turkish) and rainbow trout (*Oncorhynchus mykiss, Türk somonu* in Turkish). In 2022, aquaculture represented approximately 60.6% of total seafood production in Turkey (TURKSTAT, 2023). However, seafood consumption in Turkey remains relatively low, with per capita consumption at 6.26 kg in 2019 (TURKSTAT, 2020), significantly below the European average of 23.28 kg per person (European Commission, 2022). Turkey is a significant producer and exporter of farmed sea bream and seabass to Europe and the UK. Greece leads the world in European seabass production, while Turkey leads gilthead sea bream (Llorente et al., 2020). Yet, farming of seabass and sea bream requires substantial amounts of fishmeal and fish oil which are used for feeding these two carnivorous species. For instance, anchovy caught in the Black Sea serves as an important source of fishmeal that is then supplied to the aquaculture industry. However, anchovy stocks are not sustainably harvested anymore due to the overcapacity of the industrial fishing fleet of Turkey in this sea (Ulman et al., 2013).

As a response to stagnating wild fish catches of anchovy, the biggest vessels turned their attention to African waters, especially to Mauritania, backed by bilateral governmental agreements between Turkey and this country. As a result, there has been a notable increase in exports of this fishmeal to Turkey (SFP, 2020). Yet, the catches of wild pelagic fish species in West Africa are currently under threat from Turkey's industrial fleet, as well as very large-scale Chinese and European vessels (Corten et al., 2017). Moreover, these extractivist fishing activities are also posing important challenges for local livelihoods of small-scale fishers in the coastal communities of West Africa (Merem et al., 2019; FAO, 2022). Intensive aquaculture is faced with substantial public resistance in the coastal regions of Turkey as well, as the sector is often accused of polluting the sea and posing damages to public health as well as the tourism industry. As such, while farmed seabass and sea bream are valuable end products with substantial export value for Turkey, their entire value chain is prone to socio-ecological contradictions both in West Africa and Turkey (Ertör & Ortega-Cerdà, 2018).

Given this context, the present study investigates the rise of Turkey as an important supplier of farmed seabass and sea bream to the European and UK markets by focusing on the global value chain of seabass and sea bream, the financial support which provided the initial impetus for the growth in the sector, as well as the ecological sustainability of this industry. More specifically, the thesis explores how the inputs (fishmeal and oil) are supplied to the aquaculture industry, how the farmed fish are grown, and which destinations they are mainly exported to. In that sense, the thesis attempts to track the value chain of fishmeal and fish oil from West Africa to Turkish aquaculture companies and beyond, with a specific reference to its environmental impacts and sustainability, based on in-depth interviews conducted with sector representatives from both the fishmeal and aquaculture sector in Turkey.

The results suggest that the export-oriented growth of the Turkish aquaculture sector drives the Turkish industrial fleet with biggest vessels and capital into international waters, particularly, to West Africa and the Indian ocean chasing pelagic fish to be supplied to the fish processing factories, that is in turn to be used for fish feed in the aquaculture sector. This leads to some degree of vertical integration throughout the value chain for seabass and sea bream, which can be characterized as a buyer-driven value chain, where the biggest retailers, namely lead firms such as Tesco supermarkets and other retailers in Europe, require increasingly stringent quality and sustainability certifications for the end products of farmed seabass and sea bream. While the Turkish aquaculture companies try to keep up with these requirements, they also search for plant-based alternatives to be used as feed, instead of wild fish, in order to address the biggest challenge in the aquaculture sector, namely, the depleting wild fish stocks (such as those of anchovy). However, these certifications fail to address important socio-environmental challenges of the aquaculture industry, such as rapidly declining fish resources in West African seas and the dispossession of the local coastal communities from their marine resources and livelihoods in West Africa.

2. LITERATURE REVIEW

2.1 The Global Aquaculture Sector

Aquaculture is a rapidly expanding industry. Researchers predicted that total fish supply will rise from 154 million tons in 2011 to 186 million tons in 2030, with aquaculture accounting for the entire increase (Kobayashi et al., 2015). More than 80% of the farmed fish is produced in developing countries, mainly in Asia, primarily carried out by small-scale enterprises, while North America, Europe, and Japan account for 60–70% of the demand (Ababouch, 2023). However, Garlock et al. (2020) suggest that even though Asian countries accounted for around 89% of worldwide aquaculture production in 2016, exclusive attention to Asian aquaculture ignores the reality that the so-called “Blue Revolution" is taking place in most regions of the world. The term "Blue Revolution" describes the significant expansion and development of aquaculture production worldwide, especially in developing countries, between the middle of the 20th century and today (Ponte et al., 2014; Ahmed & M. Turchini, 2021).

The growing worldwide aquaculture industry is mainly reliant on wild fish catches. Consequently, the rapidly developing aquaculture sector, which uses fishmeal as a key protein source in compounded feed, has significantly led to increases in demand and prices for fishmeal, raising concerns that this may lead to overfishing (L. Olsen & R. Hasan, 2012). Aquaculture products, a highly globalized food commodity, have drawn the attention of diverse stakeholders who analyze industry dynamics, economic costs, and benefits through the global value chain (GVC) approach, emphasizing its role in understanding key players' functions, value addition, creation, and in formulating policies for the industry's sustainability (Ababouch, 2023). In the following, I will be summarizing the global value chain (GVC) and global commodity chain (GCC) approaches, tracing their emergence and evolution over time, and their application as robust analytical frameworks to understand and analyse the complexities and growth of the aquaculture industry. But before that, the next subsection provides a short summary of the expanding frontiers of the seafood industry in general.

2.2 Expanding Frontiers of the Seafood Industry

The terms “commodity-widening” and “commodity-deepening” are particularly relevant for studying the marine fish catches and the expanding global aquaculture sector. With respect to marine fish catches, Campling (2012) highlighted how European tuna fishing fleets have moved geographically into new frontiers to find high ecological surpluses. A "commodity-widening strategy" (Moore, 2010) is a notion that describes how new frontiers are initially formed to appropriate huge ecological surpluses that create a boom in a newly discovered resource area. The mature frontier conditions, on the other hand, are indicated by production costs that eventually converge to the sectoral average as socio-ecological advantages in this frontier stagnate or diminish. As a result, capital responds by implementing a "commodity-deepening strategy" (Moore, 2010) that involves capitalization and socio-technical innovation to intensify production and create a new frontier centered on intense development. This is justified by the claim that capitalism is always looking for ways to expand itself into new commodity frontiers in terms of geographical extent or productive intensity (Campling, 2012). For instance, although no new geographical frontiers were globally available to the tuna industry when the stocks were overfished, tuna catches still could increase via socio-technical innovations (Campling, 2012). Ertör and Ortega-Cerdà (2018) have applied these two concepts specifically to the intensive and expanding marine aquaculture sector in Turkey and found that the adoption of both commodity deepening and commodity marketing strategies has subsequently given rise to commodity widening strategies within aquaculture firms. These firms are now venturing into new territories, operating their own fish fleets to harvest smaller pelagic fish for fish feed (ibid).

In a similar analysis, Tickler et al. (2018) created high-resolution maps of fish catches from 1950 to 2014 to examine the geographic expansion of industrial fishing. Between 1950 and 2014 fish caught at the high seas or in the EEZs of other countries grew by more than 600%, with West Africa being a primary target for this expansion (Tickler et al., 2018). Noting that global industrial fishing reached "peak catch" in 1996 and has steadily dropped in productivity since then, the researchers warn that the world's industrial fishing fleets may be approaching the physical limits of expansion in capture fisheries (ibid).

A recent report by Greenpeace (2021) focused on the trade and supply chain links between the West African fishmeal and fish oil (FMFO) business and the European market. Every year, tons of small pelagic fish are caught off the coast of West Africa and used as feed for aquaculture and

agricultural farming, dietary supplements, cosmetics, and pet food items produced outside of Africa (Greenpeace, 2021). The fishing agreements between the EU and Mauritania date back to the 1980s. In 2012, the EU pelagic fleet's fishing limit increased in Mauritania from 13 to 20 nautical miles (nm) offshore to reduce the risk of interactions between industrial trawlers and local canoes in the coastal regions and to conserve the over-exploited stocks of round sardinella (Corten, 2014). Mauritania's fishmeal industry commenced in 2011 with a new industrial fishing zone allocation for the fishmeal factories by the Mauritanian government, requiring artisanal fishermen from Senegal to catch round sardinella in the Mauritanian coast to meet the growing demand for pelagic fish in fish facilities (Corten, 2017). Between 2010 and 2020, the number of fishmeal and fish oil processing companies in Mauritania increased dramatically, increasing from 5 to 40; however, constrained by a limited supply of fish, these plants were only functioning at 30-50% capacity by the mid-decade (Bocoum et al., 2023). To solve this, the government established a charter regime, invited Turkish purse seiners to participate in the fisheries, and formally acknowledged Turkish vessels as part of the national fleet as part of the "coastal fishing" category under this arrangement (ibid). The Turkish fishing fleet began to catch fish in the Western African fishing zones of the Islamic Republic of Mauritania in 2015 (Öztürk, 2017). Among the top aquaculture companies, Kılıç Holding, was a pioneer in encouraging Turkish industrial fishers to fish in the waters of Mauritania (ibid). This fleet grew fast, accounting for the vast bulk of small pelagic catches landed in the country in 2018, with over 630,000 tons of total landing by then (Touron-Gardic et al., 2022). To strengthen the bilateral relations between these two countries, a Cooperation Agreement in the Field of Fisheries and Maritime Economy between the Government of the Republic of Turkey and the Government of the Islamic Republic of Mauritania was signed on February 28, 2018, in Nouakchott[2].

Although the scientific literature on the activities of Turkish fishers in Mauritania are quite limited, one study by Ulukan (2019) conducted face-to-face in-depth interviews to understand the migration and labor processes, working and living conditions of fish workers migrating from Turkey to Mauritania for the purpose of fishing. The fishing season officially closed for industrial fishers in Turkey, from April 15 to September 1 each year. This allows juvenile fish to grow and increases the quality of the catch. However, this reduces the number of fishing days for industrial fishers and fish workers. Therefore, the Turkish fish workers migrate to Mauritania with expanded

[2] No. 31650 of the Official Gazette of the Turkish Republic published November 5, 2021.

hopes of more income, with a guaranteed 12-month job security there, while stating that there is no future for fishing in the Black Sea anymore (ibid).

Touron-Gardic et al. (2022) investigated the value chain of West African fisheries. Accordingly, after 2012, Nouadhibou became the main hub for industrial fishing in West Africa, and sardinella resources are harvested by Turkish vessels, supplying the large fishmeal and oil industry based in Mauritania. However, this poses substantial pressure on the stocks of small pelagic fish species, with most species currently being overexploited (ibid). Recently, Ozturk (2018) indicated that the Mauritanian government has urged foreign companies to focus on producing value-added products like canned or packed fish instead of fish oil and meal to enhance exports of fisheries products as branded and value-added items rather than raw material.

2.3 Global Commodity Chain (GCC) and Global Value Chain (GVC) Approaches

Global commodity chain (GCC) and global value chain (GVC) frameworks have been frequently utilized to evaluate the dynamics of the global economy. The full range of activities involved in a product's design, production, and marketing is called a “commodity chain” (Gereffi and Korzeniewicz, 1994; Gereffi, 1994). The GCC approach provides an analytical framework for investigating the new forms of global economic coordination and control, which in turn affect the composition, organisation, and geography of diverse economic activities (Lim & Neo, 2014). The concept of GCC emerged in the mid-1980s and was reformulated by Gereffi and his collaborators in the late 1990s (Lee, 2010). GCC refers to different types of governance mechanisms used to produce globally manufactured commodities by exploring the power relations among the actors in the chain, and distinguishes between producer-driven and buyer-driven chains (Lee, 2010).

The key difference between "buyer-driven" and "producer-driven" types of governance, as suggested by Gereffi (1994), is still crucial to comprehend the ways in which the global economy is changing today. Export-oriented industrialization is facilitated by buyer-driven commodity chains in which labor-intensive production is concentrated in small to medium-sized private domestic enterprises mostly in the developing countries where labor is cheap (Gereffi, 1994). Buyer-driven commodity chains are managed by “lead firms” such as retailers, marketers, and brand manufacturers, who utilize a diverse range of independent suppliers linked via sourcing networks and thus have low entry costs. These mainly occur in labor-intensive consumer products industries such as apparel and footwear, for instance (Gereffi, 1999; Gereffi, 2001; Lee, 2010). Producer-

driven commodity chains, on the other hand, are where producers take a central role in coordinating and upgrading chain activities. They are associated with capital- and technology-intensive industries supported by economies of scale such as automobiles and computers (Lee, 2010). The GCC framework has focused on a variety of commodities, for instance, agro-commodities, textiles, and electronics (Daviron & Gibbon, 2002; Gereffi, 1994).

Gereffi (1994) acknowledged four crucial elements in a GCC: an input-output structure, territoriality, governance, and institutions (Lee, 2010). The input-output structure entails connecting products and services in a value-adding order, with “lead firms” playing a critical role in coordinating these operations and extracting most of the value in the commodity chain. The governance dimension refers to the power dynamics and networks that shape resource allocation and market access. The territoriality dimension investigates the spatial dispersion of production networks to gain resource access, whereas the institutional dimension investigates the formal and informal arrangements that are embedded in the value chain. A fundamental principle of the GCC approach is that development necessitates linking up with the biggest "lead firms" in the industry (Gereffi, 1999).

Later, the term “commodity chain” was seen to be too restrictive as it mainly examined undifferentiated, homogenous end products. Hence, a new concept, the global value chain (GVC) was suggested instead in order to embrace a broader range of activities and end products with more product differentiation (Hamilton-Hart & Stringer, 2016). Humprey and Schmitz (2000) used the term 'global value chain,' to emphasize where and by whom value is added along the chain, because within the previous GCC framework, the term 'commodity' was mainly used to refer to standardized products made in large volumes. To the contrary, the GVC analysis was proposed to analyze the global trade in differentiated products. As such, the GVC was defined as “a series of stages involved in producing a product or service that is sold to consumers, with each stage adding value, and with at least two stages being produced in different countries” (Antràs, 2020, p. 3). In that sense, Gereffi’s early work on GCC was the forerunner of the GVCs. Recently, GVCs have grown in significance and popularity among international academic research as it covers “the full range of activities that firms and workers perform to bring a specific product from its conception to its end use and beyond” (Gereffi & Fernandez-Stark, 2011, p. 4).

Gereffi, Humphrey, and Sturgeon (2005) characterized different types of governance structures to demonstrate power relations between the contracting parties in a global value chain in order to

outline the factors influencing various forms of inter-firm governance in global industries. Accordingly, a GVC can employ five types of governance: i) market, ii) modular, iii) relational, iv) captive, and v) hierarchical with increasing levels of managerial control and hierarchical relationships as one moves from i) to v). These five types can sometimes co-exist simultaneously within a specific global value chain for different nodes in the value chain. Market type of governance is on the one end of the spectrum, whereas the hierarchical is on the other end. In market coordination, there are often repeated transactions with a diverse set of suppliers, as the costs of switching from one supplier to another are quite low. To the contrary, in the hierarchical governance mode, there is a very high level of vertical integration within the value chain, and a high level of managerial control flowing from managers to subordinates or from headquarters to subsidiaries and affiliates. Modular, relational and captive types of governance are often between these two extremes. In modular value chains, suppliers adhere to customer specifications, offering services with generic equipment and production processes suitable for a broad customer base. Relational value chains involve complex interactions, creating mutual dependence between different nodes of the chain and they often rely on non-codified, social ties. In captive coordination, suppliers experience one-way dependency on the leading firms, and are strongly monitored by them, as switching costs to other suppliers are quite high (Gereffi et al., 2005). This is a governance typology based on the degree of explicit coordination and power asymmetries on a spectrum high versus low as Figure 2.1 demonstrates. While Gereffi's early work categorized the governance structure into two ideal-typical forms of producer-driven and buyer-driven to elucidate the power dynamics within inter-firm networks and differentiating between capital- and labor-intensive industries; the more recent classification of these five governance types as described above have added to a more nuanced understanding of the global value chains, as this five-tiered categorization implies that power is a contingent property based on the power relations between different nodes (Gibbon et al., 2008).

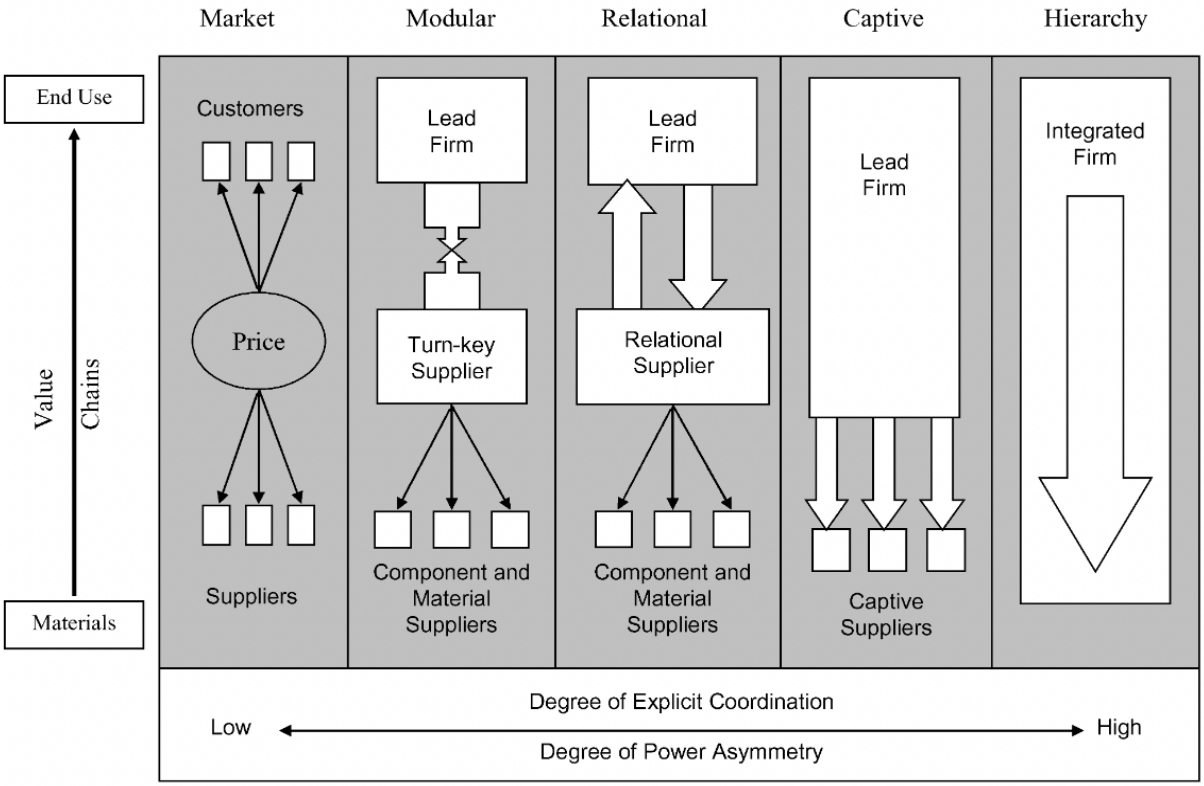


Figure 2.1. Five global value chain governance types. Source: Gereffi et al. (2005)

Two key terms emerge from this literature for understanding and analysing the GVC farmed fish. One is the concept of "lead firms" imposing their own conditions on the suppliers in the chain, and the other is the term "upgrading". Suppliers in global value chains, such as the GVC of farmed fish, often involve linkages to the "lead firms". Further, it is crucial to understand the relations between different nodes in the chain to conceptualize how upgrading occurs in the chain. According to its initial definition, upgrading is "a process of improving the ability of a firm or an economy to move to a more profitable and/or technologically sophisticated capital- and skill-intensive economic niche" (Gereffi, 1999, pp. 51-52). The term is therefore significant for understanding how development and value creation occurs throughout the chain. Gereffi (1999) defined four types of upgrading in a GCC: i) within factories, it involves moving from cheap to expensive, simple to complex, small to large orders; ii) from mass production to flexible and differentiated goods; iii) at the local/national level, upgrading implies a progress from basic assembly lines to integrated manufacturing, such as vertical integration between suppliers and end producers; iv) the fourth type involves the transitions from regional bilateral trade flows to intra-regional division of labor across the commodity chain. Later on, Humphrey and Schmitz (2002) provided a basic template for classifying upgrading within a GVC: process upgrading, product upgrading, functional upgrading and chain upgrading. Process upgrading implies optimization of

internal efficiency, striving for superiority in inventory management and timely deliveries. Product upgrading revolves around the rapid introduction of new or improved products, while functional upgrading seeks to boost value by adjusting and improving the mix of different activities, and chain upgrading signifies a shift to an entirely new value chain (Humphrey & Schmitz, 2002).

Ponte and Gibbon (2005) point out another important governance mechanism in contemporary agri-food chains: the use of quality grades and standards. Accordingly, because lead firms businesses are able to include intricate quality information into most commonly accepted standards, codification and certification, global value chains are becoming more and more "buyer-driven." Kaplinsky (2000), for instance, examined the dynamic processes of two global value chains, canned deciduous fruit and automobile components. The research underlined the importance of three elements in global value chains: rent dynamics within the chain, governance of the chain, and systemic efficiency. Beyond conventional industry analysis, Kaplinsky's study was significant because it shed light on the factors that shape income distribution over time both within and between countries. Value chain analysis, through its focus on rent dynamics, directs attention toward developing capabilities and institutional trajectories that can sustain national incomes over time. The author used these two case studies to demonstrate how global value chains might explain the winners and losers in the globalization of production and trade (ibid).

2.4 The Global Value Chain of Farmed Fish and Its Sustainability

Currently, most of the aquaculture production takes place in the developing countries, involving mostly small-scale operators, while 60 to 70% of the demand (in value) occurs in Europe, North America, and Japan (Ababouch, 2023). As a consequence, the institutional and operational capacity of the producing countries have to be adjusted to the increasingly demanding regulations and standards originating from the developed countries in the name of consumer protection, and social, and environmental requirements (ibid). Globalization of trade and the favorable economics of semi-intensive and intensive farming methods have fuelled significant expansion in the production of farmed species such as salmon, shrimp, seabass, sea bream, tilapia, and catfish (Ababouch, 2023). However, aquaculture producers are often restricted by the availability of local resources; that is why they work on a worldwide scale, taking advantage of continually changing locations all over the world (Deutsch et al., 2007).

In this context, salmon and shrimp aquaculture have received significant scientific attention recently (Tran et al., 2013; Saidul Islam, 2008; Y. Gudbrandsdottir et al., 2021), and there is a particular regional scientific focus on South America and Asia (Jespersen et al., 2014; Belton et al., 2018), The GVC of the farmed salmon is particularly interesting for scientists due to its global characteristics of production. Rainbird & Ramirez (2012) suggested that the Chilean salmon farming GVC is a good example of the concept of a 'buyer-driven' value chain because large retailers and food distributors such as Walmart and Tesco play a crucial role in setting industry's product and process standards; they are in a position to buy large quantities of farmed salmon, often purchasing the whole production run of a specific producer, and exert constant pressure on prices. However, Phyne and Mansilla (2003) argued that farmed salmon has characteristics that distinguish it from other 'buyer-driven' chains, for example, economies of scale rapidly became a necessary requirement for entering the Chilean salmon farming industry unlike other buyer-driven commodity chains. On the other hand, the Norwegian salmon value chain is often considered a producer-driven value chain because integrated salmon firms like MOWI (Marine Harvest), with ownership of feed plants in Norway and Scotland, have their food manufacturing factories in Europe for producing value-added products for the European retail and foodservice markets (Olafsdottir et al., 2019).

Another critical aspect of global seafood value chains is their environmental sustainability. Whether the aquaculture industry will be able to expand further, while preserving the essential natural resource base used for production (wild fish catches), is a major question mark (Subasinghe et al., 2009). Seafood consumption is expected to double by 2050 (Naylor et al., 2021), and this is why the sustainability dimension of the aquaculture industry has gained prominence. Significant inputs of wild fish are needed to feed carnivorous species that are farmed. If the expanding aquaculture sector is to continue contributing to global fish supplies, it must be able to reduce its use of wild fish as feed and use ecologically conscious management practices (Naylor et al., 2000). Since 2000, there have been four major developments in the aquaculture supply chain that have reduced dependency on wild fish resources to some extent: a rapid rise in the production of omnivorous species; improved feed conversion ratios (FCRs[3]); increased use of substitute protein and oil ingredients in feed; and increased production and use of fishmeal and fish oil from bycatch and fish processing wastes (Naylor et al., 2021). However, whether these technological advancements will be quick enough to address the increasing rates of overfishing in the seas and oceans is not known.

[3]Feed conversion ratio (FCR) is the feed requirement in kg per kg body weight gain of the farmed fish (Wenk et al., 1980)

Little et al. (2018) take a value chain approach for studying the sustainability of the farmed aquatic animals produced in Asia and exported mainly to Europe. They highlight the need for a comprehensive evaluation of sustainability beyond the farm level. Valenti et al. (2018) developed 56 sustainability indicators, covering the economic, social, and environmental dimensions for assessing the sustainability of the aquaculture industry. In addition, life cycle assessments are crucial to analyze the sustainability of the sector. Several life cycle assessments have been carried out for seabass and sea bream as well (Zoli et al., 2023; Kallitsis et al., 2020); however, they often fall short of comprehensively addressing the extended ecological impacts associated with the raw material use in forms of wild fish catches. A life cycle inventory of sea bream and seabass production in Greece revealed that feed production, electricity, fossil fuel usage, and direct emissions during fish rearing significantly contribute to the overall environmental impact. Scientists found that seabass has a higher environmental impact than sea bream because of its higher FCR ratio (Kallitsis et al., 2020).

Recently, certification programs for ensuring quality and environmental sustainability of the production are becoming more important in the aquaculture sector and its trade. However, certification is essentially a strategy used by buyers to prevent unfavorable market reputation through the outsourcing of reputational risk to suppliers, as a result, the suppliers often bear the costs (Bush et al., 2013; Belton et al., 2011). Certification and rating schemes have emerged as private governance arrangements to shape demand for sustainable aquaculture production, yet, the two largest certification groups, the Aquaculture Stewardship Council (ASC) and the Global Aquaculture Alliance Best Aquaculture Practice (GAA-BAP) standards only account for 3% of the global aquaculture production (Naylor et al., 2021). Moreover, the sector's shift toward various forms of market-based governance (Gereffi & Humphrey and Sturgeon, 2005) including certification and labeling schemes that promote "sustainable" or "responsible" products, has been criticized for increasing costs for producers and excluding small-scale producers from global value chains (Bush et al., 2013). For instance, according to Tran et al. (2013), if third-party certificates become a requirement for market access, small-scale producers in Vietnam, as well as the traders who support them, may suffer exclusion from more profitable markets in the EU and US.

Irarrázaval & Bustos-Gallardo (2018) demonstrated how Atlantic salmon farming involves complex ecological contradictions at different stages of the production chain and, to mitigate these contradictions, how various measures were taken, including a shift in the territorial spread of production sites, enforcing changes in the smolt stage, and enhancing control measures at different

production stages, such as vertical integration and expanding firm functions. This expansion of the territorial production sites is similar to the capital's commodity widening strategies that was discussed in Section 2.2. This strategy is often adopted to attain a higher quality resource, if the quality and earnings begin to decline at a given site (Ertör & Ortega-Cerdà, 2018).

2.5 Expanding Frontiers of the Turkish Aquaculture Sector

Turkey's marine resources and its geographical location provide an ideal environment to support the emergence of an expanding intensive aquaculture sector. Aquaculture production accelerated for sea bream/bass in the Aegean and the Mediterranean in the mid-1980s, and for salmon farming in the Black Sea in the 1990s (Kayhan & Olmez, 2014). European seabass, gilt-head sea bream, and rainbow trout are among the most commonly farmed species. Currently, the amount of aquaculture production has surpassed the total catches of wild fish species in Turkey (MoAF, 2019). In particular, commercially valuable farmed fish species such as seabass, sea bream, and rainbow trout have gained popularity and contributed to the economy's exports and economic growth. However, this growth has brought with it some significant challenges. Cultivating these carnivorous fish species requires inputs such as fishmeal and fish oil (FMFO) and puts tremendous pressure on marine resources. Turkish marine resources are insufficient to meet this demand due to overcapacity and overfishing of the industrial fishing fleet and fall in fish stocks (Ulman et al., 2020). This situation has led several of the Turkish industrial fishers with the biggest vessels and capital to fish in international waters, particularly, in Georgia, Abkhazia, and later in West Africa, which has raised an important issue in terms of the environmental sustainability of the sector (Ertör-Akyazi, 2019).

Turkey and Greece are the world leading producers of farmed seabass and sea bream, respectively. To the contrary, the production of sea bream and seabass has been stagnating in traditional producer countries such as France, Italy or Spain. However, the aquaculture sector is expanding rapidly in the non-EU countries thanks to their competitive advantages such as cheap labor and easier licensing processes of new production facilities (Llorente et al., 2020). The constant depreciation of the Turkish lira has helped Turkish companies remain competitive, which has contributed to a slowdown of the EU production (Llorente et al., 2020; European Bass and Bream Sector to Benefit From EU Investment | GLOBEFISH | FAO, n.d.). Yet, the potential impact of the Turkish aquaculture on the sustainability of aquaculture value chains has not been investigated in depth so far.

Opportunity for growth leads the capital to actively seek new marine commodity frontiers with more cost-effective raw materials through further deployment of commodity-widening strategies. Similarly, aquaculture firms in Turkey have relocated some segments of their operations to Mauritania by establishing their own fishing fleets there, harvesting small pelagic wild fish to be processed as fishmeal, establishing fish feed factories in new geographies with lower production costs. These are all examples for widening frontiers of the Turkish aquaculture sector (Ertör & Ortega-Cerdà, 2018). When initial high profitability attracted investors, the expansion of the fishmeal processing business in Mauritania gained steam, and considerable growth occured from 2011 onwards with the designation of a new industrial fishing area in Mauritania (Corten, 2017). Most catches were small pelagic species such as *Trachurus trachurus, Sardinella aurita, Sardinella maderensis, Sardina pilchardus, Scomber japonicus* and *Engraulis encrasicolus* (Ozturk, 2017). As of March 2017, 22 purse-seiner and two trawler vessels were actively fishing in Mauritania, and this number then steadily increased to 51 (Öztürk, 2017; Öztürk, 2018). However, fish catches started to decline after one decade, and the recent regulations of the Mauritanian government made this extractivist fishing activity in Mauritania less profitable (Partner Africa, 2023). Indeed, industrial fishers demanded officially from the central government of Turkey opening up of new fishing frontiers for them overseas, as they admitted drying up the fish resources in Mauritania, stating explicitly: “Did you think that Turkish [industrial] fishers would comply with any quotas? We dry up the fish wherever we go” (Diken, 2023). Emiroğlu İşgören et al. (2019) reported that there were 23 fish feed facilities in Turkey as of 2018. They anticipated that the feed industry will grow together with the aquaculture sector and that the demand for feed will rise, driving up the demand for both plant- and animal-based raw materials, including corn, soy, barley, wheat and sunflower, as well as for fishmeal and oil (ibid).

Modern intensive aquaculture is often characterized by a power concentration within the industry, with large, well-capitalized firms controlling the whole value chain (Gereffi, 1994). For instance, large companies began integrating the three primary phases of the Chilean salmon value chain—hatching, growing, and harvesting—in the 1990s as part of a vertical integration process (Rainbird & Raminez, 2012). Similarly, Ertör and Ortega-Cerdà (2018) highlighted that currently the top aquaculture organizations oversee every production phase in Turkish aquaculture. This power extends to managing hatcheries for breeding, adaptation units, raising farms, harvesting fleets, and sea vessels for juvenile transit. It also includes owning fleets for raw material collection, fishmeal and fish oil (FMFO) factories, and fish feed manufacturing facilities. Remarkably, these

companies also manage internal marketing, logistics, packaging, shipping, and processing. The vertical integration of different activities within one organization represents a paradigm change in the aquaculture industry, which calls for a more thorough analysis of its effects on ecological concerns and sustainability.

In the context of the aquaculture industry, a comprehensive global value chain (GVC) perspective can reveal the interconnected processes and activities involved in the production and exports of seabass and sea bream from Turkey to Europe and the UK. While the wealth of literature concentrates on the global value chain of farmed salmon and shrimp with a specific focus on South America and Asia (Tran et al., 2013; Saidul Islam, 2008; Y. Gudbrandsdottir et al., 2021, Belton et al., 2018), studies adopting a social sciences perspective on the Mediterranean aquaculture products, particularly on seabass and sea bream, are by and large missing. Therefore, in the present thesis, I apply the GVC framework to better understand the governance of the seabass and sea bream farming industries in Turkey starting from Africa and ending up as a final consumer product in Europe and the UK, drawing upon earlier critical research on aquaculture (Phyne & Mansilla, 2003; Rainbird & Ramirez, 2012; Bush et al., 2019) and leveraging the GVC theoretical lens (Gereffi & Humphrey, Sturgeon, 2005; Gereffi, 1999). This is crucial for a comprehensive understanding of how intensive marine aquaculture shapes the sustainability landscape of the global aquaculture value chains. In the following section, I will first discuss the methodology I employed in this study and then I will resent the study's findings in Section 4.

3. METHODOLOGY

This study adopted a qualitative research design. I carried out 10 in-depth, semi-structured interviews over an online communication software with the key aquaculture sector representatives (aquaculture firm owners, fish feed facilities representatives, and aquaculture consultants) in Turkey, and reviewed published secondary materials, including government documents and International Trade Center (ITC) Trade Map dataset to explore the dynamics of the Turkish aquaculture sector and its role in the global value chain of the farmed seabass and sea bream sector.

I reached these key interviewees using the snowball sampling method in order to maximize the depth and diversity of the diverse aspects regarding the sector. The interviews were undertaken between September 2023 and January 2024. Representatives of the sector were first asked to describe their position regarding how they acquire raw materials for seabass and sea bream production. They were also asked about the production, processing, and export stages of farmed seabass and sea bream to understand the flow of fishmeal within this global value chain. Table 3.1 provides a complete list of all ten interviewers who participated in this study. The respondents were given participant ID numbers in order to keep their identities anonymous. The interviewed sector representatives are in charge for managing nearly 54 percent of Turkey's total farmed seabass and sea bream production in 2023 and approximately 86% of the fish feed production industry. The interviews took around 40 to 60 minutes.

Second, relevant published materials, such as government documents, international fishing agreements, international trade data, and industry reports were analyzed to provide a contextual understanding of the aquaculture sector and validate interview information obtained through interviews.

Third, the Trade Map for seabass and sea bream production data was reviewed, which serves as a valuable resource for analyzing global trade patterns. Trade Map, developed by the International Trade Centre (ITC), is a comprehensive database, offering detailed information on global trade patterns, including commodities, import/export quantities, values, partner countries, and relevant trade variables. I used Trade Map to retrieve specific trade data, focusing on the commodity code 230120 (“flours, meals, and pellets of fish”) to analyze fish flour imports to Turkey. Additionally, I

examined the commodities with codes 1504 referring to “fats and oils and their fractions of fish or marine mammals, whether or not refined (excluding chemically modified)” and 2304 indicating “oilcake and other solid residues, whether or not ground or in the form of pellets, resulting from the extraction of soya-bean oil”) to estimate fish oil and soybean flour imports, respectively, for fish feed production. To investigate the aquaculture fish value chain in Turkey, particularly seabass and sea bream, I utilized the specific codes of 030284 for seabass and 030285 for sea bream for accurate tracking of trade activities and market dynamics. These data sources were used to analyze the seabass and sea bream global value chain.

Table 3.1. List of interviewees.

Intervewee ID	Role	Business	Annual Production Volume (SBSB) in tonnes	Annual Production Volume (Feed) in tonnes
#1	Aquaculture Sector Representative	Aquaculture & Feed Factory	45,000	150,000
#2	Aquaculture Sector Representative	Aquaculture & Feed Factory	65,000	200,000
#3	Feed Sector Representative	Feed Factory	-	45,000
#4	Feed Sector Representative	Feed Factory	-	50,000
#5	Feed Sector Representative	Aquaculture & Feed Factory	15,000	100,000
#6	Fishing Vessel Owner	Industrial Fishing	-	-
#7	Aquaculture Sector Representative	Aquaculture & Feed Factory	5,000	-
#8	Aquaculture Sector Representative	Aquaculture & Feed Factory	30,000	60,000
#9	Aquaculture Sector Representative	Aquaculture	3,350	-
#10	Consultant	Seafood Consultancy	-	-
Total coverage in the interviews of the study			**163,350**	**605,000**
Total production volume in Turkey			**309,071** (TURKSTAT, 2023)	**700,000** (based on interviews)

I used the following semi-structured interview questions in the interviews in order to understand the company's operations, the role and the sourcing strategies of fishmeal in aquaculture, export markets, government support, sustainability efforts, and an overview of the sea bream and seabass value chain:

1. Can you briefly describe the primary products and services your company offers in the fisheries sector?
2. Could you explain the importance of fishmeal as a feed ingredient, particularly in the context of seabass and sea bream production? If you have a fish feed factory, what is its annual production capacity in tons?
3. What are the main components used in fish feed formulations? What percentage of these formulations consists of fishmeal and fish oil? Where do you source these materials, and are any of them produced locally?
4. What is the ratio of your seabass and sea bream sales in the domestic and export markets? Which countries stand out in your exports?
5. Are there any government subsidies, grants, or incentives in Turkey to support fish feed production or aquaculture? How do these subsidies impact your factory's operations and pricing?
6. Do you have relationships with fish farmers from whom you purchase or to whom you export?
7. What sustainability initiatives, both environmental and social, does your company undertake?
8. Can you describe the value chain in seabass and sea bream farming?

While these represented the perspectives of the fish feed and aquaculture quite well, the views of governmental authorities such as Ministry of Agriculture and Forestry and Türkiye Exporters Assembly, as well as marine scientists could have provided additional insights into the regulatory frameworks and policy implications relevant to the aquaculture sector. Therefore, it has to be noted that further studies can incorporate the views of a broader set of stakeholders into the analysis.

4. RESULTS

4.1 The Global Value Chain of Farmed Seabass and Sea Bream from Africa to Europe and the UK

In this section, I will present the findings regarding the value chain of the farmed seabass and sea bream based on the in-depth interviews I conducted with the sector representatives as well as a review of the primary and secondary literature on aquaculture, and the Trade Map database. An important first observation emerging from this analysis is that the sea bream and seabass aquaculture sector in Turkey has experienced rapid growth since mid-1980s (WWF, 2021). In 2022, the two most significant farmed fish species produced in Turkish waters were seabass with 156,602 tons and sea bream with 152,469 tons (TURKSTAT, 2023).

According to the data from the Eastern Black Sea Exporters Association (DKİB), in 2022, 245,760 tons of seafood were exported from Turkey to 96 countries, generating a revenue of 1.6 billion dollars (Dünya Gazetesi, 2023). Sea bream, seabass, and Turkish salmon had the highest contribution to these seafood exports. Sea bream yielded 372,063,694 dollars from 70,974 tons of exports, seabass contributed with 503,229,970 dollars for 64,662 tons of exports, and the Turkish salmon brought 363,175,116 dollars for 49,215 tons of exports. The Ministry of Agriculture and Forestry has a target of 2 billion dollars in seafood exports by the end of the year 2023 (NTV, 2023).

Table 4.1. Fishery exports over the years (billion dollars), (Source: TURKSTAT).

Year	Total amount of seafood exports
2018	0.88
2019	0.96
2020	1
2021	1.3
2022	1.5

In 2017, Turkey became the primary supplier of European seabass and sea bream consumption: 51,208 tonnes of seabass and sea bream were imported to the EU, of which an astonishing 98% came from Turkey, marking an "unprecedented peak" in import volumes (European Commission, 2018). Sector representatives see this as a consequence of lower costs of production, particularly, the cost of labor, and the presence of vertical integration in the value chain:

> "As Turkish companies, we act as subcontractors for Europe. The demand for seabass and sea bream is very high in EU countries, while fish consumption is quite low in Turkey. One in three fish in Europe is Turkish." (Interviewee #5, feed sector representative)

> "Turkish companies have cost efficiency due to their integrated facilities, we control production from hatching of fish eggs to the table. Abundant know-how contributes significantly, but the key factor is the low cost of labor in Turkey, boosting our competitive advantage." (Interviewee #2, aquaculture sector representative)

The leading companies in Turkey engaged in seabass and sea bream farming are Kılıç, Sagun, and Gümüşdoğa (based on interviews conducted by the author). These have farming facilities in İzmir, Antalya, Aydın, Muğla, and Mersin (MoAF, 2023). Sea bream and seabass have a significant market share in the Mediterranean countries. One of the main physical reasons for this is that the water temperature along the coasts of the Aegean and Mediterranean regions of Turkey is suitable for the aquaculture of these fish species. While seabass farming is predominantly practiced in the Izmir-Aydin region, gilthead sea bream is primarily cultivated in the warmer waters of the Muğla and Antalya regions. Izmir and Muğla are the top two cities for production, with sea bream and seabass being the prominent species produced. The production in the Black Sea mainly consists of Turkish salmon, but during the summer months when the cages are empty, some seabass farming is also carried out (Yigit et al., 2023). The steady increase in the seabass and sea bream production can be seen in Figure 4.1, and the main cities of production in Figure 4.2 below.

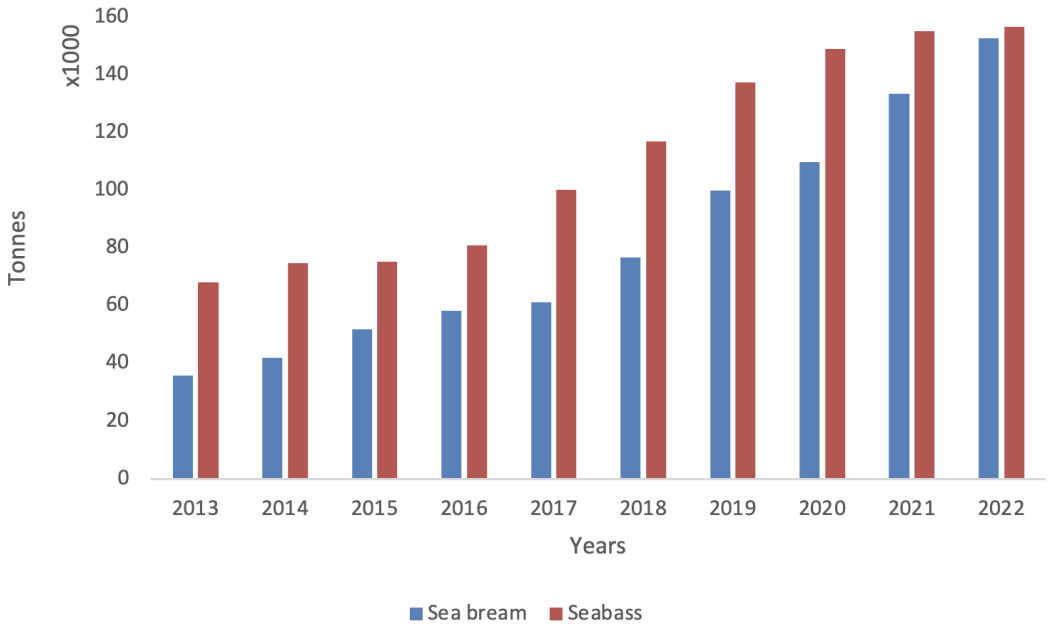


Figure 4.1. Seabass and sea bream production in Turkey (Source: TURKSTAT).

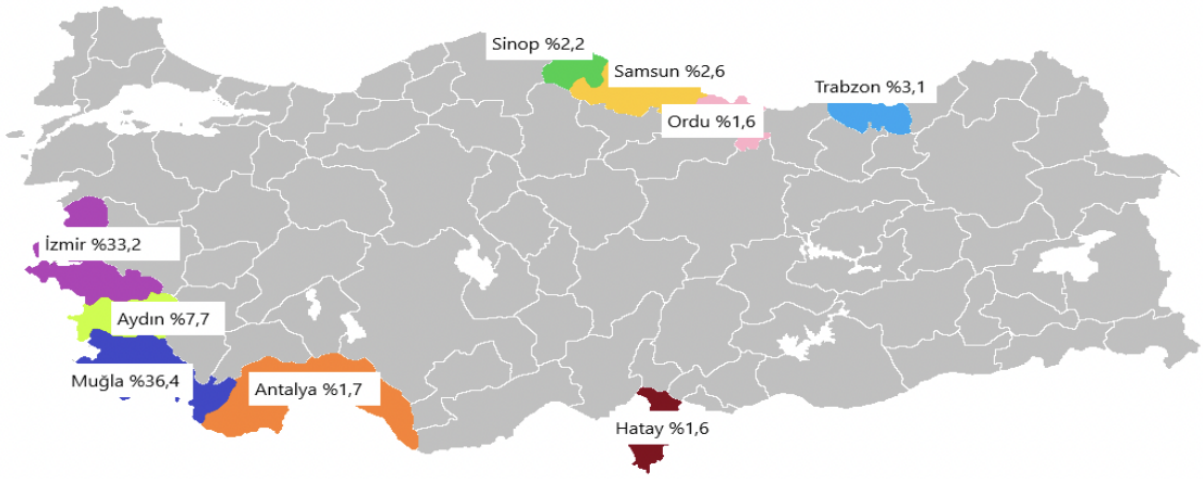


Figure 4.2. Fish farming facilities in Turkey by provinces, Source: Çöteli (2022).

4.1.1 Exports of Farmed Seabass

Based on the Trade Map dataset, the Table 4.2 below presents a list of the countries to which Turkey exported farmed seabass (*levrek*, in Turkish) in 2022, in the descending order: The first country in the list received the largest amount of seabass exports from Turkey. The "Value exported" column indicates the exported quantity in thousand USD. "Share in Turkey's exports" represents the share of these amounts (in thousand USD) within the total export value. Additionally, the "Quantity exported" and "Unit value (USD/unit)" are provided in this table.

Accordingly, nearly half (45.5% in terms of thousand USD) of the seabass exports went to the EU and the UK (TradeMap). The United Kingdom stands as the largest market for the Turkish seabass exports, accounting for 13.18% of the total monetary value. The strong demand from the UK market suggests a significant trade relationship between Turkey and the UK in this sector. Italy follows closely as the second-largest market for the Turkish seabass, with an 11.06% share. The United States holds a notable share of 10.63% in Turkey's seabass exports. The Netherlands represents another significant market for Turkish seabass, with a share of 9.61%. Greece and Spain both account for a 8.66% share each in Turkey's seabass exports. These countries are key destinations for Turkish seabass, indicating strong trade ties in the Mediterranean region.

Table 4.2. Seabass export data for 2022 via ITC Trade Map,www.trademap.org (*Accessed 30th October, 2023)*

Importers	Value exported in 2022 (USD thousand) ▼	Trade balance 2022 (USD thousand)	Share in Türkiye's exports (%)	Quantity exported in 2022	Quantity unit	Unit value (USD/unit)
World	248,078	247,872	100	40,861	Tons	6,071
United Kingdom	32,686	32,619	13.2	5,489	Tons	5,955
Italy	27,439	27,439	11.1	5,141	Tons	5,337
United States of America	26,382	26,382	10.6	3,585	Tons	7,359
Netherlands	23,852	23,852	9.6	3,987	Tons	5,982
Greece	21,482	21,482	8.7	4,090	Tons	5,252
Spain	21,479	21,479	8.7	3,730	Tons	5,758
Israel	15,137	15,137	6.1	2,158	Tons	7,014
Russian Federation	14,773	14,717	6	2,388	Tons	6,186
Kuwait	14,733	14,733	5.9	1,924	Tons	7,657
United Arab Emirates	13,103	13,103	5.3	2,039	Tons	6,426
Qatar	9,177	9,177	3.7	1,568	Tons	5,853
Portugal	8,520	8,520	3.4	1,291	Tons	6,600
Romania	3,435	3,435	1.4	571	Tons	6,016
France	3,084	3,084	1.2	520	Tons	5,931
Ukraine	2,609	2,609	1.1	438	Tons	5,957
Canada	2,046	2,046	0.8	334	Tons	6,126
Lebanon	1,698	1,698	0.7	390	Tons	4,354
Germany	933	933	0.4	176	Tons	5,301
Bulgaria	904	904	0.4	159	Tons	5,686
Georgia	898	897	0.4	168	Tons	5,345
Syrian Arab Republic	700	700	0.3	178	Tons	3,933
Cyprus	647	575	0.3	140	Tons	4,621
Jordan	534	534	0.2	87	Tons	6,138
Kazakhstan	410	410	0.2	62	Tons	6,613

4.1.2 Exports of Farmed Sea Bream

Table 4.3 provides the same information this time for the case of farmed gilthead sea bream (*çipura*, in Turkish) based on the Trade Map database. Accordingly, more than half (76.5% in terms of thousand USD) of the farmed sea bream was exported to the EU countries and the UK (TradeMap). Italy holds the largest share in Turkey's sea bream exports, with a significant 17.3%. Greece follows closely as the second-largest market for the Turkish sea bream, with a share of 14.74%. The Netherlands represents an important market for Turkish sea bream, with a share of 10.52%.

Table 4.3. Seabass export data available via ITC Trade Map, www.trademap.org, *Accessed 30thOctober,2023.*

Importers	Value exported in 2022 (USD thousand)	Trade balance 2022 (USD thousand)	Share in Türkiye's exports (%)	Quantity exported in 2022	Quantity unit	Unit value (USD/unit)
World	238,162	238,058	100	53,101	Tons	4,485
Italy	41,202	41,202	17.3	9,582	Tons	4,300
Greece	35,103	35,103	14.7	8,631	Tons	4,067
Netherlands	25,046	25,046	10.5	5,423	Tons	4,618
Spain	20,894	20,894	8.8	4,869	Tons	4,291
Portugal	17,363	17,363	7.3	3,415	Tons	5,084
United Kingdom	16,674	16,645	7	3,473	Tons	4,801
Russian Federation	15,098	15,032	6.3	3,138	Tons	4,811
Lebanon	11,737	11,737	4.9	3,153	Tons	3,722
United Arab Emirates	8,350	8,350	3.5	1,679	Tons	4,973
Romania	7,131	7,131	3	1,446	Tons	4,932
Israel	6,741	6,741	2.8	1,166	Tons	5,781
Germany	5,865	5,865	2.5	1,448	Tons	4,050
France	4,529	4,529	1.9	992	Tons	4,566
Ukraine	4,522	4,522	1.9	950	Tons	4,760
Kuwait	2,626	2,626	1.1	473	Tons	5,552
Lithuania	2,580	2,580	1.1	552	Tons	4,674
United States of America	2,073	2,073	0.9	323	Tons	6,418
Jordan	2,042	2,042	0.9	431	Tons	4,738
Qatar	1,780	1,780	0.7	365	Tons	4,877
Cyprus	1,302	1,302	0.5	361	Tons	3,607
Syrian Arab Republic	1,184	1,184	0.5	346	Tons	3,422
Georgia	1,149	1,146	0.5	237	Tons	4,848
Canada	804	804	0.3	143	Tons	5,622
Azerbaijan	592	592	0.2	131	Tons	4,519

These strong ties to the European and the UK market for both farmed sea bream and seabass are seen as a result of their own marketing and distribution companies by the interviewed sector representatives:

> "In European countries, there is high demand for seabass and sea bream. We have a distribution company in Greece that operates in the form of a mobile app to deliver our products to our customers. The customers are not end-users, but businesses like restaurants, hotels, and fish markets from EU countries. The company has been in operation since 2015.'' (Interviewee #1, aquaculture sector representative)

Indeed, the leading firms in the sector (Gümüşdoğa, Kılıç and Sagun) have established their own trading companies in Greece, Italy and the Netherlands to enable marketing and distribution of their products. Gümüşdoğa's European trade is facilitated through Dalga Seafood, an Athens-based trading company. Dalga Seafood boasts exports to 400 locations across 20 European countries, serving wholesalers and supermarkets[4]. Kılıç Holding, on the other hand, has a marketing company, Spador SRL, located in the city of Rimini, Italy, which handles the distribution to Europe[5]. Sagun EU was established in 2015 in Yerseke, the Netherlands, as a group of companies with 100% ownership and capital of Group Sagun[6]. The goal of Sagun EU is to facilitate the sale of aquaculture products produced in Turkey, including seabass and sea bream, to fish markets, retailers, and wholesalers in every European country on a partial basis, while also providing logistics and storage services. This is why the Netherlands holds a prominent position in the export of seabass and sea bream from Turkey according to the Trade Map database. This is clarified by the sector representative as follows:

> "You observe the Netherlands taking the lead in exports, yet it functions as the distribution center for Europe." (Interviewee #7, aquaculture sector representative)

4.1.3 Fishmeal: The Crucial Input for the Aquaculture Sector

Typically, fishmeal of superior quality should have a crude protein content ranging from 60% to 72% by weight (Cho & Kim, 2010). For farmed carnivore species, the feeds are comprised of a combination of fish oils and proteins, plant-based proteins, minerals, and vitamins such that this

[4] https://dalgaseafood.eu/
[5] https://www.kilicdeniz.com.tr/kilometre-taslari/
[6] https://www.sagun.com/grup-sirketlerimiz/sagun-eu/

combination meets the nutritional requirements of the fish. While traditional diets for carnivorous farmed fish contained 30 to 50 percent fishmeal and oil, these percentages are not a must[7]. The interviewees of the present study confirmed that currently the most significant portion of expenditures in aquaculture, roughly 60%-80% of the total, is associated with the acquisition of raw materials to be used in feed.

According to the latest figures published by the Ministry of Agriculture and Forestry, in Turkey, as of 2022, there were 30 facilities engaged in fish feed production; 14 of these were located in the Aegean region (MoAF, 2022). This overlaps significantly with the distribution of aquaculture facilities in Turkey, where the Aegean region stands out as the biggest producer of both aquaculture and fish feed.

Table 4.4. Fishmeal producers in Turkey (Source: MoAF).

Adana	Metin KILINÇLI-Balık Yemi Fabrikası
Aydın	Biomar Sagun Yem Sanayi Ticaret Anonim Şirketi Yem Fabrikası
Aydın	Halil Gençsoy Makina Sanayi ve Ticaret Ltd. Şti. -Yem Üretimi
Aydın	Noordzee Su Ürünleri İhracat Sanayi ve Ticaret Anonim Şirketi Yem ve Kedi Köpek Maması Fabrikası
Aydın	Uğurlu Balık Üretim Sanayi ve Ticaret A.Ş. Yem Fabrikası
Bilecik	Mersu Su Ürünleri Ve Yem Sanayii Ticaret Anonim Şirketi-Yem İşletmesi
Bilecik	Serhat Alabalık Üretim Nakliye İnşaat Sanayi ve Ticaret Limited Şirketi Bozüyük Yem İşletmesi
Denizli	Özpekler İnşaat Taahhüt Dayanıklı Tüketim Malları Su Ürünleri San. ve Tic. Ltd. Şti. Yem Fabrikası
Gaziantep	Beşyem Tarım Hayvancılık Gıda Sanayi ve Ticaret A. Ş.Yem Fabrikası
Gaziantep	Hemaks Makina Sanayi Ticaret Anonim Şirketi
Gaziantep	İpek Yem ve Gıda San. Tic. A.Ş.-Yem Fabrikası
İzmir	Agromey Gıda ve Yem San. Tic. A.Ş.Torbalı Yem Fabrikası
İzmir	Nektar Yem ve Yem Katkı Maddeleri Gıda Hayvancılık Sanayi Ticaret Limited Şirketi-Tire
İzmir	Normfeed Su Ürünleri Yem San. Tic. A.Ş.
İzmir	Turkuaz Marin Deniz Ürünleri Anonim Şirketi
İzmir	Çamlı Yem Besicilik San. ve Tic. A.Ş.
Manisa	Abalıoğlu Balık ve Gıda Ürünleri Anonim Şirketi-Balık yemi
Kahramanmaraş	Gürdal Yem Enerji Tarım Gıda Hayvancılık Sanayi ve Ticaret A.Ş. Yem Fabrikası
Mardin	Serhan Company Tar. Gıda İnş. Pet. Kuyumculuk San. ve Tic. Ltd. Şti-Yem Üretimi
Muğla	Gümüşdoğa Su Ürünleri Üretim İhr. ve İth. A.Ş.Yem Fabrikası
Muğla	Kılıç Deniz Ürünleri Üretimi İhr.İth. ve Tic. A.Ş. Karma Yem Fabrikası
Muğla	Skretting Yem Üretim Ticaret A.Ş.Yem Fabrikası
Sakarya	Mahdumlar Alabalık-Mehmet PİLAVCI
Samsun	Dostlar Su Ür.Pz.Tic.Ltd.Şti. Yem İşletmesi
Samsun	Samsun Balıkçılık Su Ürünleri San. Tic. Ltd. Şti.- Yem Fabrikası
Samsun	Sürsan Su Ürünleri San. ve Tic. A.Ş. Yem Fabrikası
Sinop	Sibal Plastik ve Su Ürünleri Değerl. San. ve Tic. A.Ş. Yem Fabrikası
Sivas	MARSİS SU ÜRÜN.İŞL.TURZ.VE NAK.SAN.TİC.LTD.ŞTİ.-Yem Fabrikası
Şanlıurfa	Birecik Yem Ambalaj Pak.Ltd.Şti.-Yem
Tekirdağ	Karyem Gıda San. İth. İhr. Tic. A.Ş. Yem Fabrikası

One of our interviewees indicated that the raw materials used in the feed for the sea bream and seabass production mainly include fishmeal, genetically modified soybean meal, fish oil, corn gluten, wheat and by-products, and special vitamin and mineral premixes for extruded feeds. The nutritional values were indicated roughly as follows: crude protein 45%, crude fat 20%, crude ash

[7] https://www.fisheries.noaa.gov/insight/feeds-aquaculture

9%, crude fiber 1.8%, calcium 2.3%, phosphorus 1.5%, and sodium 0.3%. Indeed, the formulation of the appropriate feed mixture to meet the specific needs of the cultivated fish is crucial, as a representative from an interviewed fish feed company confirmed:

> "We have special formulations for fish feed. We produce feed specific to each species, utilizing fishmeal, fish oil, terrestrial animal proteins, and plant-based animal proteins. The feed has a specified protein value; for example, we set it at 45 percent. We derive this protein from both plant and animal sources, as well as from the sea. High-value products like shrimp meal and squid meal can be included, and we predominantly provide these high-quality feeds to juvenile fish. We also incorporate soybean meal, soy protein concentrate, corn gluten meal, wheat gluten meal, sunflower seeds, guar (a plant native to India), pea protein, rice protein, poultry by-product meal, and others. Foreigners add blood meals from pigs, but we do not use them according to Turkish regulations." (Interviewee #3, feed sector representative)

This formulation takes into consideration a variety of factors, such as the nutritional requirements of the fish species and specific preferences of the customer or the fish farm. The composition of these feeds is of utmost importance to ensure the proper growth and development of the farmed fish. In terms of nutritional composition, protein is the most significant and expensive component in fish feed. The key components found in fish feed can be summarized as follows:

Fishmeal and Fish Oil: Since many aquaculture species, including seabass and sea bream, are carnivores, proteins, primarily sourced from fishmeal, are crucial in their diet. Furthermore, fish oil is unique for fulfilling essential fatty acid requirements. These marine-derived components, abundant in nutrients, play a pivotal role in meeting the dietary needs of farmed fish. According to a 2019 study, fish feed for producing seabass and sea bream in Turkey typically comprises 30-65% fishmeal, 8-14% fish oil, and other protein sources (Ulukan, 2019). However, interviews that I conducted revealed that currently, the fish feed for seabass and sea bream production in Turkey consists of 10-30% fishmeal, 8-20% fish oil, and other protein sources. The interview findings indicate a decline in the feed's proportion of fishmeal and fish oil over the past few years:

> "In the past, the fishmeal to oil ratio was 45%. But it's down to about 15% now that sustainability is becoming more and more important. Companies in the European Union are working to lower this ratio, and we have done so as well. This standard is enforced by certification organizations such as Marin Source, who put pressure on aquaculture companies via inspections like raw material scores.'' (Interviewee #2, aquaculture sector representative)

Land Animal Proteins: Land animal proteins contribute to the protein content of the feed as well. Poultry by-product meal proteins are employed as a substitute for fishmeal protein. Blood meal is a commonly utilized ingredient in the production of fish feed.

High-Value Ingredients: In some cases, specialized ingredients like shrimp meal and squid meal are integrated to enhance the nutritional value of the feed. These high-value ingredients are particularly favored for feeding fry fish, as they provide crucial nutrients for their rapid growth.

Variety of Plant-Based Components: The plant-based constituents of fish feed can encompass soybean meal, soy protein concentrates, corn gluten meal, wheat gluten meal, sunflower seeds, guar gum, pea protein, rice protein, and various other sources of plant-based protein. The plant-based constituents mentioned are also often imported from abroad as raw materials for fish feed production in Turkey. The reliance on imports for these sources highlights the presence of a global value chain in fish feed manufacturing. In particular, soybean meal is an important ingredient used for the feed production. It is obtained by grinding the residue left after extracting oil from soybeans, an important nutrient source in the feeding of livestock and poultry animals as well. Turkey imports high quantities of soybeans as it cannot meet its domestic demand through local production (Özcan, 2022). According to the Trade Map database, as of 2022, Argentina was a large supplier of soybean meal to Turkey. Argentina is followed by the Russian Federation and Brazil. However, because soybean meal is widely used in multiple farming sectors, identifying the particular proportion consumed by the aquaculture poses a challenge.

Vitamins, Minerals, and Bonkalit: A well-balanced mix of fish feed should also include vitamins, minerals, and bonkalit. These components are essential to the general well-being and development of farmed fish. Vitamins support a number of physiological processes, including immunity, metabolism, and general health. Minerals like calcium and phosphorus are essential for the growth of bones and the health of the skeleton. By adding bonkalit, the mineral content is further improved and complete nutrition is provided for the best possible growth, development, and health of the fish, according to the interviews carried out in the present study.

As a variety of ingredients, including soybean, corn, fishmeal, fish oil, and wheat, are used in the aquaculture and the majority of these raw materials are imported (Çoban et al., 2020), the prices of these primary ingredients of fish feed are directly correlated with the price of commodities and energy globally (Rana, K.J. et al., 2009). Thus, one can expect that feed costs for the aquaculture

sector are likely to increase in the future (Yıldırım & Çantaş, 2021). However, the aquaculture sector requires a consistent and continuous supply of high-quality protein to sustain the growth and development of farmed fish. Therefore, anchovy (*hamsi* in Turkish) caught in Turkish waters is often processed in fishmeal and fish oil factories for consumption in aquaculture. However, currently the anchovy stocks overfished in The Black Sea and the Sea of Marmara (Ulman et al., 2020). Since 2019, the quantity of anchovies caught in Turkey has decreased by 52%, reaching 125,980 tons in 2022 (TURKSTAT, 2023). That made the Turkish industrial fishers search for raw materials in foreign seas, particularly, in African waters (Öztürk, 2017). Several major Turkish aquaculture companies, involved in fish feed manufacturing as a form of vertical integration in the value chain, have made strategic acquisitions of fishmeal and fish oil factories in Mauritania to enhance the accessibility of high-quality fishmeal for local fish feed production (European Bass and Bream Sector to Benefit from EU Investment | GLOBEFISH | FAO, n.d.). Some of them also engage in offshore fishing as they bought fishing licenses and quotas form the Mauritanian government:

> "The decision to explore African waters, particularly those around Mauritania, was driven by the aim to gather insights into local fishing dynamics and fishing quotas. Mauritania, for instance, has implemented fishing quotas.'' (Interviewee #2, aquaculture sector representative)

Turkish industrial fishers capture the pelagic fish, a crucial component for producing fishmeal[8], a key ingredient in fish feed. Fishmeal companies then process these pelagic fish into flour at their factories in Mauritania and import it to Turkey. Offshore fishing regulations are less restrictive here as an industry representative noted:

> "In Mauritania, we have permission for offshore fishing. Our fishmeal factory in Mauritania covers 10% of our fishmeal needs, and we source the rest from various parts of the world. The fishing areas vary based on the size of the vessels, extending up to 5 miles from the coast. Our fishing crew is Turkish, we manage the operations, and there are also local workers among the crew." (Interviewee #1, aquaculture sector representative)

One of the aquaculture sector representatives stated that:

> "We categorize fish into pelagic and commercial types and carry out an eco-transformation process [through aquaculture practices and technologies]. We're dealing with a substantial fish population in

[8] https://www.fao.org/3/x5926e/x5926e01.htm

> Mauritanian waters, almost like a national wealth, from which we extract fishmeal at a ratio of 1 to 5 [referring to the pelagic catches]. We also obtain farm-raised fish in an amount half of that. To clarify, this translates to a 1-to-10 ratio, representing the transformation of pelagic fish into commercially farmed fish species." (Interviewee #2, aquaculture sector representative)

The indicated 1:10 ratio mentioned here is distinct from the FCR. FCR refers to the converting feed into farmed fish. In the context provided here, the interviewee is referring to the ratio between pelagic catches and commercially farmed fish, describing it as an eco-transformation process, emphasizing the conversion of wild-caught fish into farmed fish through aquaculture practices. According to the interviews I conducted, concerns about cost increases and sustainability have driven the fishmeal content in fish feed down to as low as 10-30% today. The rise in fishmeal prices triggers a shift towards alternative protein sources. Overcapacity and overfishing by the industrial fishers worldwide increased the pressure on fish stocks, making fishmeal a costly commodity over the years. International audits and regulations focusing on the conservation of marine resources also drive companies toward alternative protein sources. A representative from one of the feed companies explains the situation as follows:

> "The fishmeal resources are depleting, and with the increasing population, aquaculture needs to expand. Therefore, it is necessary to continue to procure raw materials of the same quality. Therefore, research and development efforts are required. You should achieve optimum cost for maximum aquaculture yield." (Interviewee #5, feed sector representative)

Another representative from one of the aquaculture companies highlights the search of alternative raw materials:

> "We usually source plant-based protein from abroad as it's not widely available in Turkey. We keep an eye on alternative raw materials. For instance, concentrated soy protein has emerged as an alternative, and we plan to import it from the United States. You can achieve the same effect by using 4% instead of 15%, feeding the fish without causing stress. All producers are compelled to shift to alternative raw materials." (Interviewee #7, aquaculture sector representative)

Turkish industrial fishing vessels operate in the waters of the West African coast of the Atlantic Ocean as well as on the shores of Oman in the Indian Ocean, harvesting fish that are then processed and sent to fishmeal and fish oil factories in those countries (NTV, 2023b). Table 4.6 below is the list of suppliers of the fishmeal to Turkey in 2022 based on Trade Map data. Accordingly, Morocco is a significant supplier: Morocco's share in Turkey's fishmeal imports

stands at 48.7%. Georgia and Uman follow Morocco with 11.5 and 10.2 percent, respectively. Predominantly owned by Turkish entrepreneurs, fishmeal and fish oil factories in Georgia process around 85-90% of the caught anchovies, with all produced fishmeal and oil exported to Turkey under licenses issued annually since 2006 (Zengin et al., 2012). About 6.8% of Turkish fishmeal imports are sourced from Mauritania (SFP, 2020).

Table 4.5. Fishmeal import data is available via ITC Trade Map, www.trademap.org, *Accessed 30th October, 2023.*

Exporters	Value imported in 2022 (USD thousand)	Trade balance 2022 (USD thousand)	Share in Türkiye's imports (%)	Quantity imported in 2022	Quantity unit	Unit value (USD/unit)
World	311,285	-306,294	100	198,987	Tons	1,564
Morocco	151,711	-151,711	48.7	99,591	Tons	1,523
Georgia	35,840	-35,840	11.5	20,479	Tons	1,750
Oman	31,888	-31,888	10.2	20,297	Tons	1,571
Mauritania	21,123	-21,123	6.8	13,625	Tons	1,550
South Africa	16,475	-16,475	5.3	9,791	Tons	1,683
Guinea	15,513	-15,513	5	9,563	Tons	1,622
Russian Federation	7,084	-7,084	2.3	4,230	Tons	1,675
Spain	6,807	-6,807	2.2	4,972	Tons	1,369
Senegal	5,550	-5,550	1.8	3,529	Tons	1,573
Ecuador	3,385	-3,385	1.1	3,316	Tons	1,021
Gambia	3,320	-3,320	1.1	2,098	Tons	1,582
Côte d'Ivoire	2,888	-2,888	0.9	1,800	Tons	1,604
Finland	1,981	-1,981	0.6	1,031	Tons	1,921
Norway	1,659	-1,659	0.5	792	Tons	2,095
Iran, Islamic Republic of	1,614	-1,614	0.5	1,213	Tons	1,331
Peru	1,386	-1,386	0.4	882	Tons	1,571

Table 4.7 below presents the list of suppliers of fish oil to Turkey in 2022. Notably, Norway emerges as a major contributor, with a share of 46.3% according to the latest available data. Chile, Georgia, and Oman follow Norway in terms of Turkish fish oil imports. However, determining the exact proportion of fish oil used for industrial purposes as a dietary supplement for human consumption versus its utilization in fish feed is a challenge.

Table 4.6. Fish oil import data available via ITC Trade Map, www.trademap.org, *Accessed 28th November, 2023.*

Exporters	Value imported in 2022 (USD thousand)	Trade balance 2022 (USD thousand)	Share in Türkiye's imports (%)	Quantity imported in 2022	Quantity unit	Unit value (USD/unit)
World	150,703	-111,065	100	81,323	Tons	1,853
Norway	69,756	-65,256	46.3	41,337	Tons	1,687
Chile	27,821	-22,329	18.5	15,483	Tons	1,797
Georgia	24,498	-24,493	16.3	11,786	Tons	2,079
Oman	8,234	-8,234	5.5	3,962	Tons	2,078
Russian Federation	5,155	-4,968	3.4	2,398	Tons	2,150
India	3,432	-3,432	2.3	995	Tons	3,449
Guinea	2,445	-2,445	1.6	1,021	Tons	2,395
Mauritania	1,875	-1,875	1.2	1,448	Tons	1,295
Iceland	1,405	-1,405	0.9	211	Tons	6,659
Peru	1,268	11,009	0.8	213	Tons	5,953
Finland	1,051	-1,051	0.7	607	Tons	1,731
Germany	1,014	-1,014	0.7	598	Tons	1,696
Morocco	799	629	0.5	440	Tons	1,816
Latvia	720	-720	0.5	483	Tons	1,491
China	437	-437	0.3	38	Tons	11,500
Faroe Islands	197	-197	0.1	132	Tons	1,492

Figure 4.3 below represents the geographical location of Mauritania, Western Sahara and Morocco. Why Morocco has a very big share in terms of fishmeal imports to Turkey is a question mark. According to the Western Sahara Resource Watch (WSRW) data, the majority of the fishmeal labeled as “Moroccan” in Turkey actually originated from the Western Sahara occupied by Morocco (WSRW, 2020). Some interviewees also mentioned during the interviews that their current fishing operations are located in Western Sahara. Indeed, WSRW has tracked the movement of fishmeal shipments from occupied Western Sahara for three consecutive years and found that in 2021, all 17 identified shipments were destined for Güllük, a coastal town on the Aegean coast of Turkey. WSRW also observed some fishmeal cargo being transported by a truck to a Turkish aquaculture company (WSRW, 2022).



Figure 4.3. Map of Mauritania. (Source: BBC News, 2023)

Apart from the major aquaculture companies engaged in fishing activities in Mauritania, fish feed producers also procure it from West Africa. A high-volume fishmeal producer interviewed highlighted the following regarding their supplies:

> "The company from which we purchase fishmeal has been the same over the years; we've been sourcing fishmeal from the same producer in Morocco for the last 22 years. However, the supply of fish oil is quite variable; using anchovy oil results in a high-quality feed, and adding a certain amount of sardine achieves optimal quality. We have quality departments responsible for these matters. The protein content in fishmeal also varies by country; the protein content in Turkish fish is around 72-74%, in Morocco 66%, and Peru between 71-73%." (Interviewee #5, feed sector representative)

For fish feed production, the supply of anchovy from Georgia and Abkhazia is also very important as the high protein content of anchovies compared to other fish enhances the quality of the fed fish. This is explained by a aquaculture company representative as follows:

> "The protein value of anchovies is around 74-75%. Anchovy meal is more valuable compared to fishmeals coming from Mauritania and Chile. In the last few years, there has been a shortage of raw materials. This is why there is a shift towards plant-based proteins. Unfortunately, plant-based protein causes fish to become undesirably fattier due to soy and corn additives. Fishmeal mostly comes from Abkhazia to us, and we also procure from Morocco and Chile. We prefer anchovy as much as possible for fish oil. There are intermediaries; they bring the products into the country, and we purchase from

them. The products undergo quality testing, and if the analysis results are satisfactory, we proceed with the purchase." (Interviewee #8, aquaculture sector representative)

4.1.4 Turkish Fishing Fleet in Africa

While initially, the fishing operations of Turkish fishing vessels included Georgia and Abkhazia, these operations were expanded physically to West Africa and to Oman on the Indian Ocean. Turkey has signed several fishing agreements with countries in Africa including Mauritania[9], Somali[10], Senegal[11], Algeria[12], Guinea[13], the Gambia[14], Tunisia[15] and Oman[16]. The agreements usually involve a requirement that the fish caught is supplied to a fish processing enterprise in the respective country (NTV, 2023).

Turkish industrial fishing vessels in West Africa can be considered as constituting the first nod in the global value chain of farmed seabass and sea bream. However, to the best of my knowledge, there is not much scientific attention to the Turkish fishing operations there, apart from Mauritania. The fishing agreement signed with Mauritania was crucial in terms of expanding frontiers of the industrial fishing fleet in Turkey, which was already operating overseas in Georgia and Abkhazia. The Cooperation Agreement in the Field of Fisheries and Marine Economy between the Government of the Republic of Turkey and the Government of the Islamic Republic of Mauritania was signed on February 28, 2018, in Nouakchott. The agreement was announced officially in *Resmi Gazete* on November 5, 2021, and number 31650[17] and enabled the Turkish vessels to buy fishing licences and quotas involving pelagic fish species (Türk Balıkçıları Afrika-Moritanya'da Balık Avlıyor | TÜDAV, n.d.) issued by Mauritanian fishing authorities, estimated to lead to yearly catches of 1,500,000 tons (Ulukan, 2019). A representative from the sector I interviewed explained the Turkish access to Mauritania's rich ocean resources as follows:

"Our initial reason for going to Africa was to learn about what is happening there, how quotas are determined. Mauritania has very generous fishing quotas. The fishing quota is updated every year, and

[9] https://www.resmigazete.gov.tr/eskiler/2021/03/20210311-5.htm
[10] https://www.tarimorman.gov.tr/Sayfalar/VideoGaleri.aspx?OgeId=1467&Kategori=38270ea5-ced8-42b3-8d3f-2f37921b2309
[11] https://www.iletisim.gov.tr/turkce/haberler/detay/turkiye-ile-senegal-arasinda-5-anlasma-imzalandi
[12] https://www.resmigazete.gov.tr/fihrist?tarih=2023-07-22
[13] https://www.resmigazete.gov.tr/fihrist?tarih=2019-07-26
[14] https://www.resmigazete.gov.tr/eskiler/2018/02/20180227.htm
[15] https://www.resmigazete.gov.tr/eskiler/2017/11/20171111.htm
[16] https://www.resmigazete.gov.tr/eskiler/2009/12/20091216-7.htm
[17] https://www.resmigazete.gov.tr/eskiler/2021/11/20211105-1.pdf

> to obtain a quota, you must establish a local company, and it is granted to that company." (Interviewee #2, aquaculture sector representative)

In Mauritania, the length of operating fishing vessels usually ranges from 26 to 40 meters, typically with a crew of approximately 30 individuals, as one of the sector representatives noted in the interviews. Several Turkish fishing vessels also supply the fish they catch to Chinese fishmeal companies in Mauritania (Ozturk, 2017). However, in addition to Turkish vessels, European, Chinese and Russian industrial fishing fleet have a heavy presence in West Africa as well (Corten, 2014; Corten et al., 2017; Ozturk, 2017; Bocoum et al., 2023). Reports by environmental NGOs emphasize that they substantially exacerbate overfishing in West African waters, detrimental for local coastal livelihoods (Greenpeace, 2021).

> "There are zones designated by Mauritania based on the length of the vessel. There are [Turkish] vessels ranging from 300 to 700 tons, with lengths between 26-40 meters. As for sardines caught, they mostly go to fishmeal factories, owned mainly by the Chinese. I catch 300 tons daily via purse-seine fishing and sell it to Chinese fishmeal processing factories." (Interviewee #6, fishing vessel representative)

There are three distinct categories of fishing regimes in Mauritania. These include artisanal fisheries, national coastal fisheries subject to national rules and regulations, and industrial offshore fisheries. The second category is dominated by Chinese and Turkish fishing vessels, whereas the third category is dominated by the biggest European vessels which buy fishing quotas in line with their bilateral fishing agreements with Mauritania. Turkish fishing vessels are provided with right concessions categorized under (national) coastal fisheries of Mauritania. They buy fishing licences if they sign contracts with fish processing and marketing enterprises in Mauritania and have an obligation to land the fish they catch in Mauritania. The duration of the concession rights is evaluated by the Ministry of Fisheries and Maritime of Mauritania based on the level of contribution to the Mauritanian economy. This is related with the level of the investment into the processing and storing of fresh or frozen products, the production of processed or semi-finished goods (cooked meals, canned products, etc.), the level of waste recycling, and the generated employment (Moritanya İslam Cumhuriyeti Balıkçılık Sektör Raporu, n.d.). Turkish and Chinese vessels dominate this sector. 90 percent of the catch of the national (second category) and industrial fishers /third category) are pelagic fish (ibid).

Typically, fishmeal should be produced from fish remnants that are unsuitable for human consumption; however, the Western Sahara Resource Watch implies that most of the fish caught in the region is directly processed into meal and oil for export (WSRW, 2020) which endangers local food security in the region and leads to protests by local people. Other news articles by environmental NGOs confirm this for other countries of West Africa (Mauritania, Senegal and the Difficult Path Towards Good Fisheries Management | World Ocean Review, n.d.; Greenpeace, 2021)

According to the Turkish Marine Research Foundation's (TÜDAV) 2018 report, Turkish fishers were operating 52 purse-seiners and four fishmeal and fish oil factories in West Africa (Türk Balıkçıları Afrika-Moritanya'da Balık Avlıyor | TÜDAV, n.d.). However, recently, there has been a noticeable decline in the number of Turkish vessels operating in Mauritanian waters. This trend suggests a shift or reduction in Turkish fishing effort in this region. Changing regulations of the Mauritanian government in terms of limiting quotas have likely contributed to this observed decrease:

> "Mauritanian government supports canned products, for example, due to their added value, but there is little sympathy for fishmeal. In recent years, those with fishmeal factories have been told to set up freezing and packaging facilities. Consequently, we resisted for 3-4 years. Now, with the pressure from the government, the business has reached an impasse. We are slowing down operations there since we have already achieved our goal." (Interviewee #2, aquaculture sector representative)

> "The new directive of the Mauritanian government involves a requirement of creating value-added to the fish catches; they require processing of fish into value-added products like canned or frozen fish, only the remaining 40% is can be allocated to fishmeal production. The government has limited the quotas on factories for FMFO. There were 50 Turkish ships in Mauritania, which has now been reduced to 25. There are policies for downsizing." (Interviewee #6, fishing vessel representative)

While Turkish fishers operating in Mauritania complained in a parliamentary meeting in Turkey that they have exhausted the fishing resources in Mauritania, not complying with their assigned quotas there (Yeşil Gazete, 2023), the Turkish Embassy in Nouakchott issued a press release on its Twitter account, refuting the allegations and stating that the Turkish fleet in Mauritania is well-respected because they comply with the regulations regarding the vessel size (tonnage) limitations and areas closed for fishing (Akşam Gazetesi, 2023). The official statement is as follows:

> “Turkish fishermen contribute significantly to the industry and local economy by supplying fish, caught in Mauritania, frozen and transferred to factories, especially in Nouadhibou, for distribution worldwide. The competence of Turkish fishermen in their profession is acknowledged by Mauritanian authorities, and it is observed that Mauritanian ship owners in the capital, Nouakchott, prefer to collaborate with Turkish fishermen, supplying fish to the factories located in Tanit Port. Additionally, nearly 40 Turkish fishing vessels create employment opportunities for numerous Mauritanians, providing substantial salaries. Moreover, as a social responsibility, Turkish captains teach Mauritanian citizens ship navigation and management on every Turkish fishing vessel along the Mauritanian coasts, contributing to the development of the fishing industry in the country. Turkish fishermen in Mauritania play a significant role in various aspects of the fishing sector, such as supply, agency, translation, creating income sources for many individuals in Nouadhibou. They have established themselves as respected members of Mauritanian society through their social interactions.”

4.1.5 A Sketch of the Global Value Chain of the SBSB from Africa to Europe and the UK

Based on the interviews that I carried out with sector representatives and other primary and secondary sources I attempted to sketch a first global value chain figure for farmed seabass and sea bream below. Figure 4.4 below represents the fishing operations of Turkish fishers in Africa which catch small pelagic fish in the coastal areas of each country, which is then often supplied to fishmeal factories in each respective country. The fishmeal is then exported to Turkey to be used as fish feed in the intensive aquaculture industry producing seabass and sea bream, exported mainly to Europe and the UK.

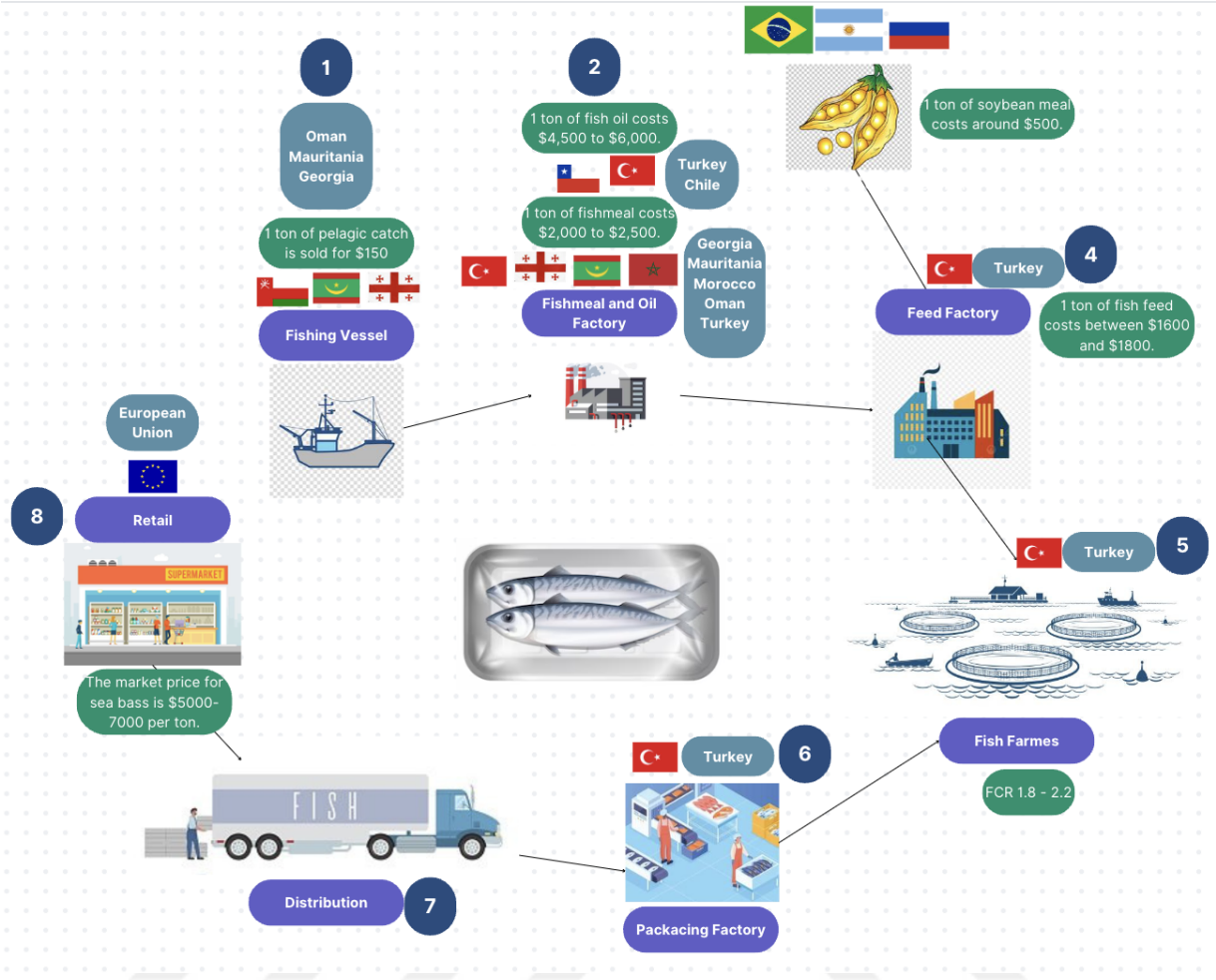


Figure 4.4. The value chain of seabass and sea bream.

More particularly, as my interviews reveal, the Turkish fishing fleet predominantly operates in the waters of Black Sea, Mauritania, Georgia, and Oman. Turkish fishers sell the fish caught to fishmeal factories, including those owned by both Chinese and Turkish enterprises. The sales price is currently approximately $150 per ton of pelagic fish caught. The catch is directed to fishmeal and fish oil factories, ultimately becoming fishmeal. Turkey imports fishmeal mainly from Mauritania, Georgia, Morocco, and Oman, and produces in its own factories. In addition, Turkish aquaculture companies import fish oil mainly from Chile and also procure it locally in Turkey based on locally caught fish in the Black Sea, for instance.

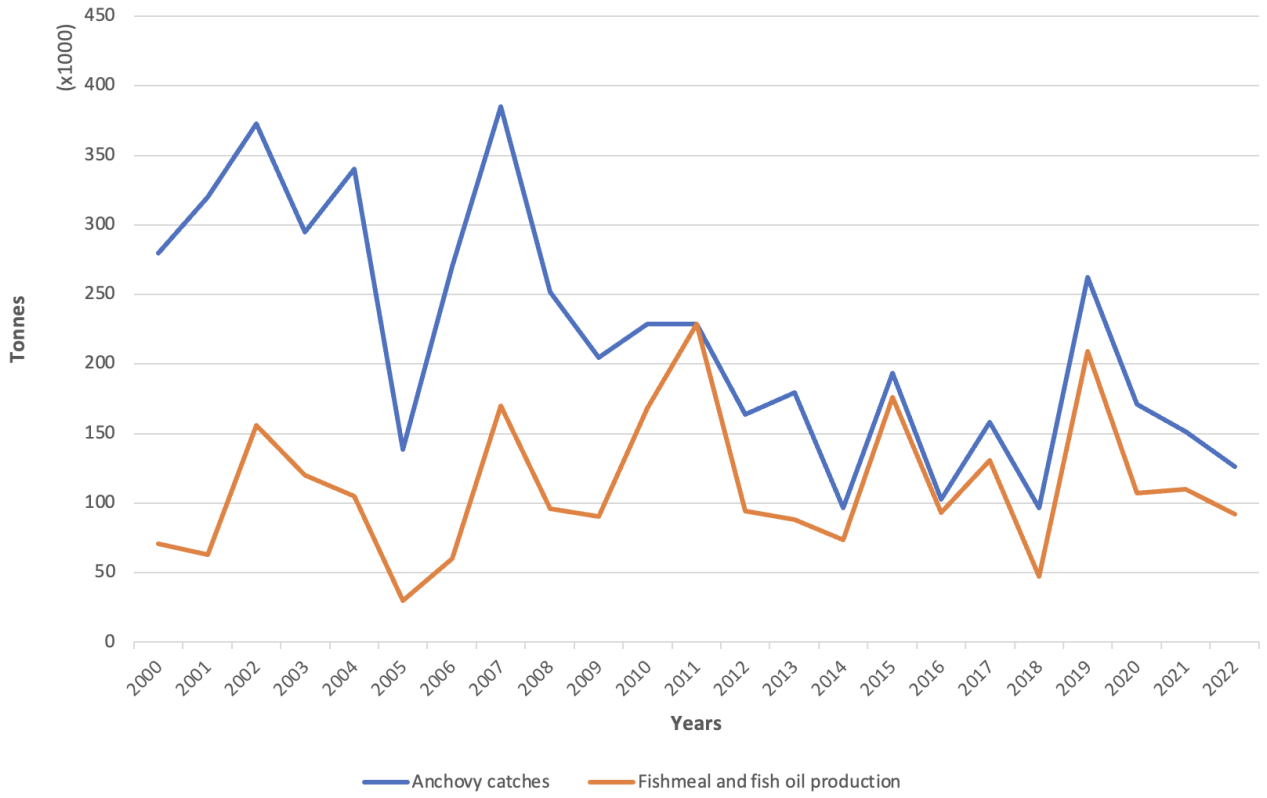


Figure 4.5. Anchovy catches and fishmeal and fish oil production in Turkey. (Source: General Directorate of Fisheries and Aquaculture, 2023)

Figure 4.5 illustrates anchovy catches and fishmeal and fish oil production in Turkey. The graph demonstrates that fishmeal production closely follows anchovy catches over the years from 2000-2023. According to our interviewees, anchovy oil is regarded as the highest quality fish oil, and companies prioritize its use whenever feasible. For instance, in 2022, 126,000 tons of anchovies were caught domestically, and production in fish feed and meal factories amounted to 92,000 tons. In the same year, only 2,000 tons of anchovies were imported, indicating that the majority of anchovy was used as feed raw material in the Turkish market. On the other hand, the demand for nearly 200,000 tons of fishmeal was met through imports from other countries.

Returning to Figure 4.4, the cost of inputs for aquaculture is around $2000-$2500 per ton of fishmeal and approximately $4500-$6000 per ton of fish oil. Another crucial ingredient in fish feed, soybean meal, is imported to Turkey as soybean production in Turkey cannot cover the demand here. The main countries from which Turkey imported soybean meal in 2022 were Argentina, Russia, and Brazil, with a sales price of $500-$600 per ton. These imported raw materials are processed into fish feed in the 30 fish feed factories in Turkey as of 2022. The ton price of fish feed is around $1600-$1800, and these feeds nourish fish in aquaculture farms. Most fish feed companies are vertically integrated, operating feed factories, fish farms, and fish

processing/packaging facilities. According to information gathered in interviews, the Feed Conversion Ratio (FCR) for farmed seabass in Turkey is approximately 2.2, and for sea bream, it is around 1.8. Similarly, literature from other Mediterranean countries, such as Zoli et al. (2023), suggests FCR values of 2.4 for European seabass and 1.9 for gilthead sea bream. This ratio indicates the amount of feed needed to grow the fish, and the industry conducts research and development to lower this ratio because feed costs represent a significant portion of aquaculture expenses. The harvested fish, typically in 3 different sizes, namely, 400-600 grams, 600-800 grams, 800-1000 grams, are sent to processing and packaging facilities. They are processed and packaged as fresh fish or fillets according to customer expectations in the trade destination. Logistics are managed either through agreements with third-party companies or in some cases where vertical integration is stronger, through distribution companies abroad owned and operated by the aquaculture companies, facilitating marketing to various European countries. The average price for 1 kilogram of seabass is around $5-$7, with Israel, Kuwait, and the US paying more and European countries paying closer to $5. The average price for 1 kilogram of sea bream is $4-$6.



Figure 4.6. The map of the global value chain of seabass and sea bream.

Finally, Figure 4.6 illustrates the global value chain of seabass and sea bream on mapping. It includes fishing vessels, FMFO factories, feed factories, fish farming sites, processing and packaging facilities, and export destinations. Green arrows signify imports, except the green arrow represents the Turkish Black Sea region FMFO production used as input for feed factories. On the other hand, orange arrows denote exports.

4.2 Financial Support and Licencing for the Aquaculture

4.2.1 Financial Support

Governmental support for the aquaculture sector in Turkey takes diverse forms, encompassing international agreements like the Turkey-Mauritania fishing deal and other government-supported initiatives aimed at fostering industry development. Between 2003-2019 total subsidies provided to the aquaculture sector amounted to US$743 million (Atalay & Maltaş, 2020), leading to a 510% increase in aquaculture production and a rise in its share from 9% to 44.6% in total fisheries and aquaculture production (Çoban et al., 2020). Direct support payments were allocated to aquaculture producers who were registered in the aquaculture system. The support was provided based on the output produced (in kilogram). For instance, in 2013, the Decision Number 2013/4463 on agricultural support in 2013 was passed[18]. Accordingly, seabass and sea bream production would benefit from governmental subsidies of 0.85 TL/kg.

The government actively provided support to aquaculture companies through export subsidies as well (Ertör & Ortega-Cerdà, 2018), which led to the initiation of an EU seabass and sea bream subsidy investigation, but the investigation was closed with no countervailing required[19]. However, the subsidy payment to seabass and gilthead sea bream was discontinued in 2016 in order to adapt to international trade rules (Çoban et al., 2020). Current legislation does not mention seabass and sea bream anymore and instead refers to subsidies for trout, carp, mussel, and new species[20]. Yet, the Turkish aquaculture sector still enjoys substantial advantages due to a continuous devaluation of the Turkish lira against the Euro and offers a substantially affordable price for European retailers and consumers (Seabass prices hold firm in 2016 but bream prices suffer due to Turkish volumes | GLOBEFISH | FAO, n.d.)

Some aquaculture sector representatives I interviewed expressed their dissatisfaction about the absence of subsidies:

> "There is no direct government subsidy to support the aquaculture sector. The government used to offer them, but those were discontinued. We only have the support of the Turkey Exporters Assembly

[18] https://www.resmigazete.gov.tr/eskiler/2013/04/20130408-5.htm
[19] https://suymerbir.org.tr/ab-cipura-ve-levrek-subvansiyon-sorusturmasi-kapatildi/
[20] https://www.resmigazete.gov.tr/eskiler/2023/09/20230915-3.pdf

> (TIM), where they cover the costs if we participate in trade fairs and support us for market research and analyses. TIM covers the expenses for quality certifications we need to receive. And since we are exporting our products, we do not pay any value-added taxes." (Interviewee #9, aquaculture sector representative)

The Turkey Exporters Assembly (TIM) plays a pivotal role in supporting the Turkish seafood industry engaged in export activities. According to the feedback from industry representatives, the government's direct subsidy has been discontinued, but companies find support through entities like TIM. TIM covers expenses related to participation in trade fairs and market research Additionally, TIM supports exporters by covering the costs associated with quality certifications. Quality certifications refer to standardized assessments and approvals granted to products that meet a specific predetermined variety of criteria related to production processes, environmental responsibility, traceability, labeling, and product quality, ensuring compliance with industry standards and regulations (Ababouch, 2012). This indirect support becomes even more critical as it enables companies to compete in the international market effectively. Furthermore, one of the sector representatives highlighted the role of Eximbank for supporting the sector as follows:

> "We work with Eximbank (insurance company). You send the exports insured; your money is guaranteed if the customer doesn't pay. Eximbank takes a certain amount of commission in each batch. They insure your goods. Let's say you've sent the goods, and you told the customer to pay after 45 days. If they don't pay, Eximbank pays you after about 6 months. Sell a product to someone in Turkey, and you won't sleep at night." (Interviewee #9, aquaculture sector representative)

Türk Eximbank is a fully state-owned bank to support Turkish exports. Its primary objectives include enhancing export activities, diversifying exported goods and services, exploring new markets, increasing the share of exporters in international trade, providing necessary support for their endeavors, and ensuring competitiveness and security for exporters and international contractors and investors[21]. This multifaceted support is crucial for encouraging investments, promoting the production and sale of investment goods, and ultimately contributing to export and foreign currency earnings. The support provided by the Turkey Exporters Assembly and Turk Eximbank significantly enhances the appeal of engaging in export activities over domestic business relations.

[21] https://eximbank.gov.tr/tr/hakkimizda/kurumsal/bankamiz-hakkinda

Moreover, according to the Article 13(ı) of Law No. 3065, the delivery of certain animal feed items, including fishmeal, became exempt from VAT starting from January 1, 2016[22]. The VAT exemption on fish feed is vital, serving as a substantial form of support to the Turkish aquaculture sector. By relieving the financial pressures related to VAT, the government created a favorable atmosphere for the advancement and expansion of the aquaculture industry.

While fish feed is a product exempt from VAT, the global prices of raw materials used in producing the fish feed is the main source of concern among sector representatives (TAGEM, 2019).

> "We source only 15% of the fish feed raw materials domestically, while the remaining, particularly fishmeal and fish oil, is procured from abroad. We make purchases from countries such as South Africa, Morocco, Tunisia, Peru, and Chile. Our overseas supplier has been the same for years, we have been sourcing fish flour from Morocco for 22 years." (interviewee #5, feed sector representative)

However, tax exemptions for importing fish feed inputs is supporting the aquaculture industry substantially. The system providing an 18% rebate on declared expenditures is a crucial component of the export-oriented support mechanism for the aquaculture industry in Turkey that facilitates the global market presence of Turkish fishery products:

> "Importers acquiring essential raw materials for fish feed in Turkey have the opportunity to receive a notable 18% tax refund on declared expenses, if they are engaged in exporting goods. This becomes particularly significant for integrated facilities involved in both feed production and fish exports. For instance, with an export volume of 5,000 tons of fishmeal, such tax refunds play a pivotal role in alleviating financial burdens for the company." (Interviewee #3, feed sector representative)

4.2.2 Licensing

The industry representatives believe these financial supports are not sufficient. For instance, one representative complained about the phase of the establishment of fish farm facilities as follows:

> "There is little to no state support, and in fact, we are striving to pursue these endeavours against the government's will. For instance, the Fisheries Department under the Ministry of Agriculture says that

[22] https://www.resmigazete.gov.tr/eskiler/2016/10/20161004-31.htm

> they have identified a potential area of 100,000 m2 off the coast of Dikili in Izmir for fish farming; they ask us to proceed with production. We apply, we get the project approved. Then, all ministries must provide their approval. Once we obtain our approval of the project, we have to revisit all the units. But when we mention that tourism department does not approve our project, other departments say there's nothing they can do; they won't permit it." (interviewee #7, aquaculture sector representative)

The sector representatives are therefore discouraged by the legislation, lengthy licensing procedures, and the separate laws and regulations created by various ministries (TAGEM, 2019). Specifically, the redirection of facility establishment to a designated region by the Ministry of Agriculture and Forestry, can face rejection from the Ministry of Tourism in the final stages to protect tourism-related activities in the region. A notable conflict unfolds involving the Ministry of Tourism, Ministry of Environment, Urbanization and Climate Change, and Ministry of Agriculture and Forestry. This discord revolves around the environmental repercussions of fish cages, acknowledged as sources of pollution and undesirable odors. The tension is particularly evident in the Aegean and Mediterranean regions, renowned for being tourism destinations and summer vacation spots. The clash of interest emerges as these areas, housing hotels, restaurants, and fish cages, grapple with conflicting demands and priorities. To address these concerns, a pivotal industry move occurred in 2008—onshore aquaculture facilities were shifted to offshore areas (WWF, 2021; Çoban et al., 2020).

Fishing activities often involve high operational costs, and fuel constitutes a significant component of these costs. Fuel support provided by the government (fuel tax concessions) enables fishers to sail farther offshore, however, it is seen as a harmful capacity-enhancing subsidy category (Sumaila et al., 2021; OECD, 2021)[23]. As such, these subsidies can be considered as an important factor to have led to the emergence of over-capacity of industrial fishers in Turkey, which then gave rise to the expansion of their fishing operations overseas, closely linked with the growth of the aquaculture sector.

Upon review of the Investment Incentive Certificates issued by the Ministry of Industry and Technology between March 1, 2022, and March 31, 2022, and published in Resmi Gazete on May 8, 2022, and number 31829[24] several direct and indirect benefits for the aquaculture sector have been identified. Black Sea salmon production with a capacity of 100 tons annually in Sinop, for

[23] https://www.tarimorman.gov.tr/BSGM/Belgeler/Duyurular/2021/UluslararasiSular-OTVsizYakit.pdf
[24] https://www.resmigazete.gov.tr/eskiler/2022/05/20220508-2.pdf

instance, these support categories included support for the operation of fish production and breeding farms, and related fishery services: Interest Support, VAT Exemption, Employer Share of Insurance Premium for 10 years, Tax Reduction by 90%, and 50% support for YKO (Public Economic Enterprise). In Samsun, for the manufacturing of fish feeds with a capacity of 150 tons per day, interest Support, Customs Duty Exemption, VAT Exemption, Employer Share of Insurance Premium for 7 years, Tax Reduction by 80%, and 40% support for YKO.

The Agriculture and Rural Development Support Institution (TKDK) provides a 50% grant support for Fishery Products Processing and Marketing-Related Physical Asset Investments and a 60% grant support for Aquatic Products Projects to producer organizations. Within the project scope, new enterprises can be established, and existing facilities can undergo modernization, acquire new machinery and equipment, and receive support for information technologies[25]. Furthermore, the IPARD (Instrument for Pre-Accession Assistance Rural Development) project aims to ensure minimal production losses by supporting the establishment of cold chains, construction of cold storage, production and processing lines, Fresh Chilled Aquatic Products, Fresh Frozen Aquatic Products, Smoked Fish Products, Fillet Products, Canned Products, Cephalopods and Bivalve Aquatic Products, and installing packaging and canning systems, all of which are eligible for grant support. The total project budget ranges from €30,000 to €1,500,000. In addition to the grant rate, an extra 10% rate is applied for investments related to waste management. The project provides Value Added Tax, Special Consumption Tax (SCT), Customs Duty, import taxes, and similar exemptions. Additionally, facilities can engage in renewable energy production equivalent to its electricity needs and benefit from grant support. The supported provinces include Ankara, Giresun, Çankırı, Yozgat, Sivas, Ordu, Amasya, Tokat, Trabzon, Burdur, Erzincan, Samsun, Aksaray, Aydın, Balıkesir, Bursa, Çanakkale, Çorum, Denizli, Hatay, Isparta, Karaman, Kastamonu, Konya, Kütahya, Manisa, Mersin, Nevşehir, Uşak, Afyonkarahisar, Kahramanmaraş, Kars, Ardahan, Elazığ, Malatya, Erzurum, Ağrı, Van, Mardin, Diyarbakır, Muş, Şanlıurfa, which are not the main production areas of seabass and sea bream. The requirement is to have a minimum production capacity of 100 tons/year and a maximum of 2,000 tons/year for aquatic products, fish oil, cephalopods, bivalve mollusks, and shellfish[26].

The investment incentives provided by the Ministry of Industry and Technology, known as "*yatırım teşvikleri*" in Turkish and those provided by the TKDK, did not appear prominently in the insights gathered in our interviews. This could be attributed to the fact that these supports are

[25] https://www.tkdk.gov.tr/Content/File/BasvuruFiles/BrosurBilgiKartlari/SektorBilgiKitapcigi103.pdf
[26] https://www.tkdk.gov.tr/Content/File/BasvuruFiles/BrosurBilgiKartlari/SektorBilgiKitapcigi103.pdf

notably geared towards newly established farms and factories, whereas our interviewed sector representatives, with production capacities ranging from 3,350 to 65,000 tons annually, may not have found them applicable to their more established operations.

4.3 Environmental Sustainability of The Seabass and Sea Bream Value Chain

In the dynamic landscape of the aquaculture sector, the acquisition of certificates, both on a national and international level, is crucial. The global trade network demands a diverse array of certificates, with customs audits being notably stringent. Despite such challenges, Turkish aquaculture entities diligently secure a multitude of certificates required for product imports. An industry representative, having served in the sector for over 15 years notes as follows:

> "The seafood sector is more advanced in terms of sustainability compared to other sectors because it is an EU exporter. The use of certifications is very high, with widespread certifications like ASC and Best Aquaculture Practices, even though they incur costs. There is not much serious work going on to comply with the Green Deal at the moment. It is expected to come later." (Interviewee #10, aquaculture sector consultant)

These certificates aim to serve as safeguards for safety and quality of products, and have evolved to address different environmental sustainability criteria as well. The sector's pursuit of sustainability has been notably influenced by its commercial ties with the EU. Key EU initiatives, including the EU Green Deal, the Farm to Fork strategy, and the Common Fisheries Policy (CFP), have played pivotal roles in shaping the sustainability landscape[27]. The stringent standards set by these initiatives have not only impacted the quality assurance measures but have also prompted a growing emphasis on seeking specific sustainability certifications. Recent research investigating the sustainability claims of fisheries and aquaculture products concluded that the share of fishery and aquaculture products launched in the market with sustainability claims was increasing across Europe in all countries (Lucas et al., 2021).

The expansion of aquaculture has substantial environmental impacts such as overfishing, effluents on the receiving ecosystems and ecosystem destruction (Martinez-Porchas & Martinez-Cordova, 2012). Therefore, it is crucial for the aquaculture sector to demonstrate that they meet certain environmental standards by obtaining relevant certifications. Various certification schemes exist that demonstrate the sustainable production and processing of fisheries products. These

[27] https://food.ec.europa.eu/system/files/2020-05/f2f_action-plan_2020_strategy-info_en.pdf

certifications offer assurance to consumers, industrial buyers, and retailers that the products meet ethical, environmental, and social standards. Additionally, by endorsing sustainability initiatives in fishing and aquaculture, these certifications aim to have a role in safeguarding marine resources and fostering a sustainable fishing industry for the future (Bush et al., 2013; Amundsen & Osmundsen, 2020).

The export-oriented nature of the Turkish seabass and sea bream production imposes stringent requirements on food quality and traceability. Meeting international standards has become imperative for the sustainability and competitiveness of the industry. As EU markets increasingly demand transparency in the production process, adherence to high-quality standards, and a commitment to traceability, Turkish producers are compelled to adopt practices that ensure the integrity and safety of their seafood products. A representative from the industry characterizes the circumstances as follows:

> "We are transitioning to green energy by enhancing solar-power capacity, and our carbon footprint scores are projected to reach zero by around 2027. Our fishing vessels will be electric-powered. Other major companies are also undergoing a green transformation, and taxes will increase if renewable energy and environmental standards are not met." (Interviewee #1, aquaculture sector representative)

The TIM (Turkish Exporters Assembly) and Exporter Unions Sustainability Activities Information Note highlights a substantial emphasis on energy and carbon measurements as critical factors of the sustainability of the aquaculture sector[28]. This strategy objective aligns with the EU Green Deal's environmental goals and aims to protect the market presence in the EU markets. As part of this commitment, a project has been launched to calculate the carbon emissions of the Aegean Region's Aquatic Products Sector, thereby contributing to a better knowledge of and monitoring of the sector's impact on climate change. However, there appears to be a lack of awareness within the industry about the sustainability of raw material sourcing and the potential effects of overfishing:

> "In the UK, we have a lot of obstacles to overcome, particularly when it comes to fulfilling standards like sustainability and quality. Tesco conducts audits on us and explains the regulations that they update annually. Our purchase quality certifications are reviewed closely, and they report it as inappropriate raw material if they find that we are not producing appropriately." (Interviewee #2, aquaculture sector representative)

[28] https://ticaret.gov.tr/data/643ffd6a13b8767b208ca8e4/Ek-4%20T%C4%B0M.pdf

The aquaculture industry is heavily dependent on wild marine fish catches, which can only exist if marine health is conserved. However, increasing pressure on marine resources raises questions about overexploitation, biodiversity loss, and the industry's sustainability. Therefore, the industry representative state that they must look into sustainable alternatives for supplying the sector's needs:

> "We have certifications like Global GAP and ASC, and we are constantly under inspection. The UK, for instance, is a country that sent an entire shipment to destruction due to a minor lettering error on the label at customs; this happened to us once. There is pressure to shift towards plant-based alternatives in fish feed." (Interviewee #8, aquaculture sector representative)

Modern processes and quality management systems like BRC, IFS, Global GAP, and HACCP are easily adopted by the Turkish aquaculture industry (Tolan, 2017). According to a WWF survey (2021), key certification schemes are Aquaculture Stewardship Council (ASC), Best Aquaculture Practices (BAP) and Global Good Agricultural Practice (GLOBALG.A.P.). This report emphasized that participation in global certification schemes such as ASC and GLOBALG.A.P., as well as the government's recognition of different national regulatory frameworks, have assisted Turkey's SBSB companies in becoming a significant global exporter of farmed SBSB, notably to European markets. The most widely used certification schemes employed by Turkish firms, based on a simple inspection of aquaculture company web pages revealed that BRC, IFS, Marine Stewardship Council certification, Friend of the Sea, ASC, Best Aquaculture Practices, Global G.A.P. are the certification schemes adopted by the Turkish aquaculture sector. Below, I provide a brief review of these certification schemes based on Rector et al (2022).



Figure 4.7. Certifications for food quality & safety and sustainability in aquaculture.

Table 4.7. Certifications schemes and their objectives.

Certification scheme (Osmundsen et al., 2020) (Rector et al., 2022)	**Objective/Purpose**
BRC Global Standards (BRC)	Food safety, quality and operational criteria in food manufacturing
International Featured Standards (IFS)	Quality assurance and food safety
Marine Stewardship Council (MSC)	Responsible fishing
Friend of the Sea (FOS)	Conservation of the marine environment while ensuring sustainable fish stocks for generations to come
Aquaculture Stewardship Council (ASC)	Minimization or elimination of the key negative environmental and social impacts of farming, while permitting the industry to remain economically viable
Best Aquaculture Practices (BAP)	Safe, responsible and ethical farm-raised seafood
Global G.A.P.	Agricultural (and aquacultural) practices that are economically, ecologically, socially, and culturally responsible

Certifications can provide a degree of trust. However, there are several instances where, for instance, MSC and Marin Trust routinely certified fisheries that are unsustainable, as demonstrated in multiple peer reviewed papers (Le Manach et al., 2020).

Reducing the consumption of fishmeal and oil is actually the industry's largest sustainability initiative in Turkey, as the interviews reveal. Fish supplies are gradually declining, which suggests that in the upcoming years, it will become harder to obtain these raw materials. One of the aquaculture sector representatives stated the following:

> "Until this year, we were growing by 200-300% annually, but due to global conflicts and the crisis in China, we won't take major steps; we'll stay in the same place for 2-3 years. We've stockpiled fishmeal for several years." (Interviewee #1, aquaculture sector representative)

Because algal oil has an omega-3 content, the industry is working to develop it as a substitute for fish oil, and some corporations have programs aimed at achieving this goal. One of the major participants in the global feed industry, Skretting, has effectively substituted algal oil for fish oil, contributing to the reduction of overfishing and introducing premium fish projects. Other notable companies in this industry include the retail giant Metro Market and Turkish seabass and sea bream grower Hatco Aquaculture:

> "Anchovy and sprat are used to produce fishmeal. As they are natural (wild) stocks, we are trying to preserve them. We are working on developing alternative raw materials. We use plant-based alternatives such as soybean meal, corn bran, and instead of fish oil, we used algae oil, which has higher omega-3 content." (Interviewee #4, feed sector representative)

Retailer Metro Turkey, in collaboration with Skretting Turkey and leading local fish producer Hatko Aquaculture, has introduced Turkish consumers to seabass and sea bream fed with a feed solution containing algae oil, providing double the amount of omega-3 while reducing the reliance on wild fish. In the initial phase of the initiative, 150 tons of fish have been fed with algae oil, marking a decrease of 180 tons in marine ingredients. This reduction is equivalent to the annual fish needs of 30,000 people[29] (Metro Turkey, Skretting Turkey, & Hatko Aquaculture, [2021]).

> "New fishing grounds are emerging in the Arabian Peninsula and geographical diversity increases as the amount of catches decreases. Habitats are being destroyed as a result of overfishing. Due to challenges such as overfishing and climate change, the sector is compelled to utilize plant-based raw materials." (Interviewee #10, aquaculture sector consultant)

The report by WWF Turkey (2021) presents a thorough overview of the supply chain involved in the Turkish SBSB exports to Europe, involving key stakeholders in Turkey, the EU, and the UK, along with recommendations for advancing environmental sustainability and social responsibility. Surveys were carried out to discover the social and environmental aspects of SBSB production in Turkey as well as the requirements set by European markets. Three findings are essential for this thesis. First, the Turkish SBSB sector showcases advanced adherence to third-party certification,

[29]https://www.skretting.com/tr-tr/news-and-stories/daha-fazla-omega-3-ceren-daha-surdurulebilir-metro-premium-balklarnn-srr-skrettingin-veramaris-alg-ya-ceren-yenilikci-yem-cozumu/

surpassing European counterparts according to our interviewees, yet certification is obtained only partially in certain facilities just to meet whatever is demanded by the EU and the UK markets. Second, feed manufacturers heavily depend on overexploited European anchovies or other pelagics imported from Mauritania or Peru, raising sustainability concerns. Third, while climate change awareness is currently limited, major producers in the sector are proactively addressing energy efficiency and carbon emissions reduction with certification bodies like ASC and GLOBALG.A.P.

The following remarks on sustainable practices were made by an industry representative from the city of İzmir, indicating that the sector has now moved farther offshore:

> "We [fish farms] utilize unused areas of the sea. We are utilizing regions that are not on the route, far from the coast. The remnants of fish are processed in factories to contribute them back to the economy, which can help reduce fishmeal imports. These leftover parts are also sold for generating extra monetary gain." (Interviewee #9, aquaculture sector representative)

Yet, there is discontent from local coastal communities because fish farming sites often damage marine ecosystems and have a negative impact on tourism and small-scale fisheries. According to Akyol et al. (2019), for instance, small-scale fishers on the Aegean coast encountered issues with sea-cage fish farms. The main complaints centered around water pollution, space limitations for fishing, and the attraction of dolphins to the area. Furthermore, intensive aquaculture production in Turkey has escalated the use of feed additives to prevent fish outbreaks, consequently intensifying environmental pressures on marine ecosystems (Yılmaz et al., 2021). Yet, the EU prohibition of antibiotics is being implemented in Turkey, instead, the sector tries to use natural ingredients to diminish environmental harm (Yılmaz et al., 2021; Yılmaz & Tan, 2022). News articles also report that after years of conflict between fish farms and local communities: For instance, pollution in Güllük Bay negatively impacted tourism, prompting significant backlash against fish farms until they were moved offshore (Gazete Vatan, 2021). The local coastal communities continue to express discontent due to perceived dispossession, claiming that the farms are polluting the seas, coastlines, harming marine life, Blue Flag beaches, tourism, and coastal fishing activities in the region (Gazete Duvar, 2017; Deniz Atlası, 2014).

The Fishery Improvement Project (FIP) began in 2017 and aims to transform Mauritania's fishery into a sustainable one by improving food security and respecting human rights. This multi-party project is designed to raise and improve the sustainability, management, and fishing practices

to the level expected by the MarinTrust and Marine Stewardship Council (MSC) certifications[30]. However, the FIP receives substantial criticism from the Coalition For Fair Fisheries Arrangements because it legitimizes unsustainable fishing practices that hurt local communities and the environment by certifying the fishmeal operations as sustainable (Standing, 2022). Positive ratings provided to businesses in West Africa's fishmeal and fish oil industries highlight the vulnerability of seafood labeling to corporate influence, legitimizing ecologically destructive activities and imposing undue political influence, which again raises questions about the credibility of these certificates (Bush et al., 2013). Improving governance in small-pelagic fisheries is critical to addressing the region's environmental and social concerns (Greenpeace, 2021; Bocoum et al., 2023). Numerous actors are involved in the socio-ecological exploitation of Mauritanian marine resources by both legal and illegal fishing practices. EU and Chinese presence exacerbated overfishing along Mauritania's abundant coastline (EJAtlas, 2014), before Turkish fleet’s presence. Industrial fishing operations limit access to fish for local populations and intensifies overfishing in the region. In this regard, the most notable example was the authorization given by the Mauritanian government to a 40-meter Turkish purse-seiner to fish for small pelagics in shallow seas, swhich was typically reserved for artisanal fishing and this amplified conflicts with local fisheries (CFFA, 2021).

[30] https://www.fip-petitspelagiques-mauritanie.org/home

5. DISCUSSION

The findings of this study imply that the production of the farmed seabass and sea bream industry can be analysed through the lens of the GVC framework, rather than the GCC approach, as the end products can be seen as differentiated products rather than homogenous commodities. The fishing industry in Turkey has strategically shifted from economically less valuable, homogenous supplies of pelagic fish to the domestic market, such as fresh sardines and anchovies, to economically valuable fish like seabass and sea bream with higher export value. Recently, the aquaculture sector in Turkey started to engage in additional value-added creation, going beyond the production of fresh-frozen seabass and sea bream products, to include the production of fish fillets. Fish farmed in cages are cleaned, sized, and packaged in processing and packaging facilities according to specific needs, consumer behaviour and the demands of the customers, such as wholesalers, retailers and distributors in Europe and the UK, where consumers prefer ready-to-use end products. Producers can sell value-added products at a higher price to consumers who want to avoid dealing with cleaning fish. Another recent product differentiation leading to higher value-added involves "extra practical" products prepared in serving-size bags along with their sauce, which can be quickly consumed with minimal cooking or heating at homes of the consumers. The situation was also articulated by one of the interviewees as follows:

> "We mainly produce fillets. Once processed, it becomes more expensive due to the added value. Moreover, in the EU, there is no fish cleaning culture." (Interviewee #8, aquaculture sector representative)

The expansion of the Turkish aquaculture industry to meet the demand for raw materials, especially fishmeal, on the other hand, is likely to lead to regional conflicts. It is crucial to note these pelagic fish caught in the seas of Mauritania and other African countries are a vital source of nutrition and livelihood for local coastal communities, and their exploitation as a cheap commodity essentially amounts to dispossession of the local communities (Philippe, 2022). Mauritania became an important source of fishmeal for the Turkish aquaculture sector for the last several years, with large amounts of pelagic wild fish catches. Even though the Mauritanian government has received licence fees for the quotas and required that the fish caught should be supplied to the fishmeal factories in Mauritania to capture some of the gains locally, in practice, this did not hinder that the biggest portion of value added was indeed produced in countries like Turkey and China, as they had

the opportunity to process these wild fish catches into more differentiated products with higher price premiums. For the case of seabass and sea bream, while raw materials were extracted in Mauritania in an almost open-access regime, the actual value creation and gain occurred in Turkey. This is in line with previous studies analysing the power asymmetries, rent dynamics and income distribution in the global commodity chain literature (Kaplinsky, 2000). The interviews revealed that more recently, Mauritanian government requires the Turkish companies to invest in processing facilities in the country to create more value-added, for instance by producing canned fish products (Ozturk, 2018). As a response, however, the number of Turkish fishing boats in Mauritania has halved, and some Turkish companies have decided to cease their operations there. Therefore, we observe Mauritania transitioning away from a "mature" commodity frontier (Ertör & Ortega, 2018) towards a "closing" frontier for Turkish fishers (Nolan, 2019). In this context, Oman now emerges as a new commodity frontier, where Turkish fishers and fishing capital can continually expand to, seeking and providing raw materials from a new ocean.

However, in the global value chain of the seabass and sea bream industry, Turkish aquaculture producers are subject to a buyer-driven global chain, where large retailers such as Tesco, Carrefour, Marks & Spencer serve as the "lead firms" in the chain and capture most of the value generated (Gereffi, 1994). These lead firms have the power to transform chains, ultimately carry out the final product sales to consumers, and production is shaped based on the demand of these retailers. To the contrary, the Norwegian salmon industry is considered as a producer-driven GVC where vertically-integrated companies possess strong bargaining power (Olafsdottir et al., 2019). An important characteristic of buyer-driven chains is the utilization of cheap labor, which still stands out as a crucial enabling factor for the Turkish SBSB production. In Turkey, nature comes at a lower cost compared to Europe, which is evident in fish farm tenders and farming license fees and why production has shifted to Turkey. Nevertheless, similar to the Chilean salmon chain (Phyne & Mansilla, 2003), operation costs and entry costs are rising substantially due to the surge in the prices of inputs such as fish oil and plant-based sources of fish feed, coupled with the rising costs associated with establishing fish farms. One of the interviewees mentioned the high costs in the following manner:

> "Seventy-five percent of the cost is feed, and 10-12% is for buying juvenile fish. The investment cost to establish a farm is also very high. For a farm with a production capacity of 2,000 tons (you can only sell to the domestic market with this capacity), you need 10 million euros, and you would spend only about 7-8 thousand euros to grow the fish. Approximately 20 million euros are required to start a farm." (Interviewee #7, aquaculture sector representative)

The Turkish SBSB GVC underwent a vertical integration process (Ertör & Ortega, 2018), similar to salmon farming in Chile. Chilean aquaculture firms integrated the three primary stages of the value chain, including hatching, growing, and harvesting processes in the 1990s (Rainbird & Ramirez, 2012). In parallel to Chilean practices, some Turkish aquaculture firms with the biggest capital also engage in egg production activities in the SBSB production. These companies manage every node in this chain, which begins with hatcheries and juvenile fish production and often finishes on the tables of consumers in the EU and the UK—representatives of the Turkish aquaculture sector interviewed point to this vertically integrated business model as a source of industry success. In addition, companies with substantial capital have acquired FMFO facilities in countries like Georgia and Mauritania to control a certain extent of the FMFO segment of the chain.

When it comes to evaluating the types of governance for the global SBSB value chain, a nuanced analysis reveals a distinctive landscape shaped by inter-firm linkages (Gereffi et al., 2005). Gereffi et al. (2005) presented five distinct governance types -market, modular, relational, captive and hierarchy- within a GVC that range from high to low levels of power asymmetry and "explicit coordination", which refers to effective planning and communication between lead firms and suppliers. As discussed in the Literature Review section of this thesis, market governance involves simple transactions with easily transmitted product specifications in which producers can make products with minimal buyer input. In modular governance, suppliers create products or deliver services to client requirements and bear full responsibility for process technology. Relational governance involves mutual reliance and is regulated through reputation and social and spatial proximity. Captive governance features small suppliers dependent on powerful buyers, marked by a high degree of monitoring and control, and finally, on the other extreme to the market type, the hierarchical type is characterized by vertical integration and managerial control within a set of lead firms that develop and manufacture products in-house.

Given these five types of governance, one can argue that the value chain of the farmed seabass and sea bream exhibits mostly the relational, hierarchical, market and captive types of governance. In response to a complex regulatory environment concerning food safety, environmental impact, and labor standards, the transactions of Turkish aquaculture firms with European and UK supermarkets have increased in complexity. This escalation in complexity has prompted a notable increase in explicit coordination among various actors in these chains. The Turkish SBSB sector heavily exports to the EU and UK, fostering a significant level of explicit coordination between

Turkish suppliers and importers in the EU and UK. This implies the presence of relational governance between these nodes.

In raw material sourcing within the SBSB production chain, Turkish producers predominantly acquire their raw materials from West Africa, with some aquaculture firms possessing their own fishing vessels and FMFO factories in Mauritania. The relationship between the nodes of FMFO factories or fishing vessels and Turkish aquaculture producers can be characterized as a hierarchy type of governance. This is a sign of the pressure on Turkish aquaculture producers to control their own raw material supply base due to rising costs of fish feed. The interactions between soybean meal and other plant-based ingredient suppliers and the Turkish feed industry operates under a market-type governance. Notably, some feed companies are also operating within a market-type governance by selling feed to small-scale aquaculture producers in Turkey, and certain standalone feed producers engage in captive-type governance by tailoring feed for specific farm conditions. Moreover, other feed producers acquire raw materials through distributors sourcing FMFO from Morocco, Peru, Georgia, Oman, and Mauritania, operating again under a market-type governance.

In fish processing as a final product, the integration between fish farms and fish processing facilities is predominantly governed by a hierarchy type, especially in larger companies that encompass juvenile fish production, fish farming, and processing within a unified operation. However, small-scale aquaculture producers, unable to afford certification schemes, often adopt a relational type of governance by selling their fresh fish to larger processing entities, establishing close-knit relations with the fish processing companies.

The relations with the EU and UK retailers operate under a relational type of governance rooted in mutual dependence and relational coordination. Contracts in this domain often hinge on the reputation and reliability of the Turkish aquaculture suppliers. As a non-EU SBSB producer, Turkey maintains spatial proximity with the EU, facilitated by the fact that it is a neighbor to Greece, which was a significant European SBSB producer before Turkey dominated the market. Long-term relations, knowledge-sharing with lead firms, adherence to quality and safety standards, and a relatively high degree of explicit coordination are critical features of this relationship. Interviews indicate that UK importers impose increased audit scrutiny on products from Turkey. The influence of large UK and EU retailers and chain restaurants is pivotal in shaping seafood processing companies' business strategies and conduct. This is underscored by the prevalence of

various certifications among Turkish SBSB processors, highlighting the significant impact of EU and UK buyers on steering the value chain dynamics.

According to Olafsdottir et al. (2019), the salmon value chain exhibits a set of diverse governance types as well. Market governance thrives in the dynamic exchanges between producers and buyers, prevailing in the sales of the commodity spot markets. Suppliers can make products there based on technical standards without any inputs from buyers. Additionally, large integrated companies reflect the hierarchy governance type emphasizing centralized control and strategic investments for high-end retail targets (ibid). Similarly, Olafsdottir et al. (2019) highlighted that there's a growing trend of long-term relational contracts in the Norwegian salmon chain, particularly between large integrated companies and retail or large secondary processors.

The governance structure within the Turkish SBSB value chain involves state intervention through spatial licenses subject to the Environmental Impact Assessments (ÇED), and food safety inspections are required to be carried out based on government regulations. As discussed in the literature (Ponte & Gibbon, 2005), the primary governance mechanism in the EU and the UK is based on quality safety standards. Adherence to these standards is demonstrated through specific certification processes and inspections. These certifications emerge as private governance tools, and Turkish companies possess several diverse sets of certifications. These certifications are imperative for accessing key markets despite inducing additional costs for the Turkish aquaculture companies, yet, there are support mechanisms such as that of Turkish Exporters' Association (TIM) that supports obtaining the required certification financially. However, it is essential to acknowledge that small-scale aquaculture producers face challenges accessing these markets if they cannot bear the certification costs. This aligns with the observations made by Bush et al. (2013), implying that certification schemes create additional costs for small-scale producers and might exclude them from certain markets.

The aquaculture sector underwent substantial expansion in the early 2000s, initially catalyzed by direct government subsidies. However, it has since then evolved to operate more independently, and has reduced its reliance on state support. The “upgrading” trajectories it has undertaken are critical to understanding the sector's current production and export figures. While there is a clear pressure on quality, safety, and sustainability standards by lead firms, the upgrading has occurred in all three types, namely process, product, and functional upgrading, leading to improved productivity and enhanced production and export volumes. Turkish SBSB cultivators develop value-added

products by freezing, creating fillets in desired weights, or sauced them as a form of product upgrading. Improving the quality and optimal use of fishmeal, a key input and basic cost in aquaculture, is essential for productivity, making it a key objective for process upgrading. The industry focuses on decreasing FCR, utilizing new technologies to screen cages, and minimizing feed waste. Research and development efforts aim to minimize fish escapes, fry deaths, and outbreaks of diseases, contributing to process upgrading. An example of functional upgrading is the establishment of distribution centers in Europe by companies, and even acquisitions of fishmeal factories in Mauritania can be cited as an example of functional upgrading. Similarly in Zambia, the aquaculture sector has significantly expanded in the last decade due to upgrading processes (Kaminski et al., 2018). Vertical integration appears to be a critical strategy for many firms to exert greater control over the value chain and for upgrading possibilities (ibid).

However, global value chains often bring along ecological and social conflicts (Ponte, 2020). Utilizing a vertically integrated approach and leveraging substantial capital, major aquaculture companies in Turkey expanded by acquiring smaller firms, especially after they moved their operations farther offshore on the coastal areas of Turkey in 2008. This shift in 2008 led well-capitalized and technologically advanced large companies to grow further. Similar to Chilean salmon farming, Turkey also grapples with ecological contradictions such as spatial concentration issues. In Chile, farms were initially located close to the shore for cost-effectiveness, but due to the spread of the ISA virus which is an Atlantic salmon viral illness that results in high death rates in salmon farms, they shifted operations to open seas (Irarrázaval & Bustos-Gallardo, 2018). In contrast to Chile, where the move was driven by lower costs, in Turkey, the relocation was required due to the environmental pollution concerns of the public and negative impacts of intensive aquaculture on tourism. The aquaculture sector tried to navigate these socio-ecological contradictions through various means while continuing its expansion.

The primary export markets for Turkish SBSB are the EU and the UK; therefore, the aquaculture sector in Turkey is attempting to be proactive in terms of aligning with the quality and sustainability standards mandated by these markets. This is mostly acknowledged ahead of other industries in Turkey, as the interviews revealed. Certifications cover various criteria related to quality and sustainability standards, including health and safety, renewable energy consumption, greenhouse gas emissions, and waste. These fall mainly under the category of environmental sustainability. However, the sector also needs to pay strong attention to ensuring sustainable feed supply since the operations are heavily dependent on the affordable availability of fish feed

(Gudbrandsdottir et al., 2021). Turkish aquaculture industry efforts to boost aquaculture production and exports through expanding into international waters for feed production purposes resulted in overfishing in the West African waters and the natural resources seized from local communities. However, for the GVC of the Turkish SBSB industry, the metrics specified by European and UK certifications fall short of providing a holistic view of socio-ecological sustainability throughout the entire GVC. This is in line with the findings of Gudbrandsdottir et al. (2021) who showed that diverse sustainability challenges within the farmed salmon value chain are not being effectively addressed. Furthermore, the predominant focus remains on site production policies such as renewable energy and waste management for both salmon and SBSB farming, and this prevents addressing broader sustainability issues across the entire value chain (ibid). In fact, the Norwegian salmon business hides its adverse impacts on West African communities and fish populations under voluntary initiatives and certification programs (Feedback Global, 2024). Indeed, interview findings in the present study confirm that these certification schemes have a relatively narrow definition of sustainability and tend to prioritize narrowly defined environmental indicators (Osmundsen et al., 2020), while neglecting overfishing, local communities' welfare in West Africa, marine pollution both near aquaculture sites and FMFO facilities (Bush et al., 2013), and negative impacts on tourism and local culture. However, these are important aspects from the point of environmental justice. Promoting a more holistic and inclusive approach is imperative for the long-term sustainability of Turkey's aquaculture sector and the broader marine ecosystem. However, this should not diminish the significance of the certification schemes' efforts in promoting sustainable aquaculture and ensuring access to food for a growing population.

Furthermore, the interviews revealed a substantial decrease in the FMFO content in the feed composition compared to the past. The increase in FMFO prices was mostly cited as a reason, and sustainability was stated as another rationale by the interviewees in the present study. Global feed companies are trying to reduce FMFO in the feed content for carnivorous fish species, to increase plant-based ingredients through various R&D activities as they anticipate future challenges in terms of diminishing fish populations, possibly leading to a potential shortage of raw materials in the near future. On the other hand, despite public commitments to sustainability, Norwegian salmon producers have not effectively transitioned to alternative ingredients that could reduce the reliance on wild-caught West African fish in feed formulations (Feedback Global, 2024).

Last but not least, despite the Turkish fleet's dominance in the Black Sea and the Mediterranean, they ventured to African waters and Arabian Peninsula due to the heavy overexploitation of Black Sea and Mediterranean fish stocks (SoMFI, 2023). Aquaculture will face

economic, biophysical, and technological limitations and these challenges prevent significant contributions to global food and nutrition security (Belton et al., 2020). The industry faces challenges in sourcing raw materials, such as fishmeal and fish oil, which are becoming scarcer and more expensive over time. While expanding its search for raw materials overseas, it encounters exploitation in those regions as well. As a result, some companies have stockpiled fishmeal in anticipation of potential difficulties. The industry aims to increase the plant-based ratio of feed to sustain carnivorous species, but this system is likely unsustainable given the declining fish stocks. Consequently, they are hoping for a technocratic miracle to avert a collapse.

6. CONCLUSION

In this thesis, I tried to systematically analyse Turkey's seabass and sea bream production relying on a Global Value Chain approach, while also shedding some light on its sustainability dimension. More specifically, I focused on the different nodes and stages for the production of the fish feed, production of seabass and sea bream and their processing and exports to Europe and the UK, for which I tried to identify the different types of governance between the two extremes of market and hierarchical governance, and found that, in line with the literature (Jespersen et al., 2014; Olafsdottir et al., 2019), different types of governance are at work throughout the seabass and sea bream value chain, even though lead firms in the EU and the UK are quite strong in terms of their bargaining power. Despite their power, some of the Turkish aquaculture companies could achieve a substantial level of vertical integration spanning the stages of wild fish catches (both in the Black Sea and Africa), processing of fish feed, the actual production stage of farmed fish, processing this fish into more consumer-friendly forms such as ready-to-cook filets via distribution companies they opened up abroad such as the Netherlands and Greece. However, whether this type of integration really can ensure that they receive much of the value added generated is debatable, given that they are strongly dependent on fish feed ingredients, such as imported plant-based proteins, fish oil and wild pelagic fish that they cannot themselves catch and hence import from Peru, for instance. Gereffi et al. (2005) noted that "access to developed country markets has become increasingly dependent on participating in global production networks led by firms based in developed countries" (Gereffi et al., 2005, p. 99). Thus, studying the governance of the seabass and sea bream GVC can contribute to a better understanding of how firms in developing countries access global markets and how they can enhance their net gains from participating in these chains. Furthermore, there is evidence for upgrading mechanisms in the Turkish aquaculture sector (such as upgrading in products, processes, and functions), yet, it is not clear whether these will be sufficient to capture a greater share of the total value generated in the chain in the near future, or whether they will merely continue to serve as subcontractors to the EU and the UK.

Another important dimension that has been investigated in this thesis were the sustainability impacts of this global value chain. Here, sustainability should be understood not only in terms of environmental impacts, but also in terms of social and environmental justice. As a net seafood exporter, Turkey's seafood production footprint is quite remarkable: There are environmental and

social impacts beyond the fish farming facilities in Turkey. The initial growth in the aquaculture industry was primarily driven by the governmental subsidies and export-based economic growth ideals of the government. This redirected Turkish fishing fleets to international waters in the Black Sea and Africa for raw materials, causing various socio-ecological conflicts there, especially along the West African coastal communities and fish populations. Even though a new comer to these African seas –European, Russian and Chinese large-scale industrial fleets with enormous capital and fishing capacity were already operating in the West African Seas when the Turkish fleet arrived— the Turkish fleet was quite quick to exhaust marine resources there, as industrial fishers themselves admitted in a parliamentary commission meeting in Ankara, possibly with severe consequences for local livelihoods and marine health. Even though different certification systems are in place to be able to access the European markets, which the Turkish aquaculture firms are quite successfully adhering to, the system of seafood certification itself is problematic because it does not really address the socio-ecological challenges in the entire value chain of the seafood industry. Replacing the traditionally government-regulated quality and sustainability inspections of the past, the emergence of third-party assessments and certifications systems continue to be controversial for achieving environmental sustainability and social justice for any global value chain (Bush et al 2013; Bitzer & Glasbergen, 2015). However, the changing market conditions (rising prices of fish feed and plant-based sources of proteins) are shaped by the ecological impacts due to the declining fish stocks and overfishing, and these changes will likely shape the sustainability concerns in the near future even more strongly. Future research could delve into in-depth analysis of individual aquaculture companies, examining the dynamics of large versus small enterprises and their relationships with buyers in diverse markets such as the US, Russia, and Kuwait, which have different quality and sustainability standards than the EU and UK markets. Such focused investigations could provide valuable insights into the decision-making dynamics and socio-ecological impacts within the seabass and sea bream business in the future.

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