Czech University of Life Sciences Prague

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Department of Economics

Master's Thesis

Assessment of the fish production in Georgia

Lasha Naveriani

CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

DIPLOMA THESIS ASSIGNMENT

Lasha Naveriani

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Thesis title

Assessment of the fish production in Georgia

Objectives of thesis

The purpose of the thesis is to investigate how fish production attitudes has changed from 2011 to 2020 years in Georgia.
Also, identify the revealed comparative advantages of fish production in Georgia to the international trade.

Methodology

The theoretical part of the Master thesis was prepared based on study and analysis of professional literature and publications of Food and Agriculture Organization of the United Nations.

The practical part was prepared based on the revealed comparative advantages indexes, Lafay and Balassa index calculations.

The proposed extent of the thesis

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The Diploma Thesis Supervisor

Ing. Pavel Kotyza, Ph.D.

Supervising department

Department of Economics

Electronic approval: 10. 3. 2022

prof. Ing. Miroslav Svatoš, CSc.

Head of department

Electronic approval: 11. 3. 2022

doc. Ing. Tomáš Šubrt, Ph.D.

Dean

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Declaration

I declare that I have worked on my master's thesis titled "Assessment of the fish production in Georgia" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the master's thesis, I declare that the thesis does not break any copyrights.

In Prague on 31.3.2022 ____________________________

Acknowledgement

I would like to thank to my supervisor, Ing. Pavel kotyza Ph.D for his advice and support during my work on thesis.

Assessment of the fish production in Georgia

Abstract

Georgian aquaculture sector has traditionally been one of the weakest in the national socio-economic system. But the fish production in Georgia has significantly increased from 2011 to 2020 years. In these ten years, commercial exchange trends have shown growing openness towards foreign countries and in particular to European Union (EU) countries.

The aims of the master thesis are to analyse fish production attitudes during the 10 years (from 2011 to 2020) in Georgia, discover the main challenges and identify the revealed comparative advantages of fish production to the international trade.

The theoretical part was prepared based on study of professional literature and publications of Food and Agriculture Organization of the United Nations.

The practical part was prepared based on the calculation of revealed comparative advantages indexes. In particular, the Balassa and the Lafay Index were used to evaluate competitive advantage to the international and regional level.

The calculations have shown that the entire analysed period can be generally characterized as the period of Georgian fish production stagnation to the international market.

This predetermined the relatively low competitiveness and disadvantages of regional and international fish production market, which were mostly confirmed by calculated values of Balassa Revealed Comparative Advantage (RCA) index and Lafay Trade Specialization index (LFI).

Keywords: Revealed comparative advantages, fish production, Lafay index, Balassa index, international trade, fish export, fish import.

Hodnocení produkce ryb v Gruzii

Abstrakt

Gruzínský sektor akvakultury je tradičně jedním z nejslabších v národním socioekonomickém systému. Produkce ryb v Gruzii se však od roku 2011 do roku 2020 výrazně zvýšila. V těchto deseti letech trendy obchodní výměny ukázaly rostoucí otevřenost vůči zahraničí a zejména vůči zemím Evropské unie (EU).

Cílem diplomové práce je analyzovat postoje k produkci ryb během 10 let (od roku 2011 do roku 2020) v Gruzii, objevit hlavní výzvy produkce ryb a identifikovat odhalené komparativní výhody produkce ryb vůči mezinárodnímu obchodu.

Teoretická část byla zpracována na základě studia odborné literatury a publikací Organizace spojených národů pro výživu a zemědělství.

Praktická část byla připravena na základě výpočtu zjištěných indexů komparativních výhod. K hodnocení konkurenční výhody na mezinárodní a regionální úrovni byly použity zejména Balassa a Lafayův index.

Výpočty ukázaly, že celé analyzované období lze obecně charakterizovat jako období stagnace gruzínské produkce ryb na mezinárodní trh.

To předurčilo relativně nízkou konkurenceschopnost a nevýhody regionálního a mezinárodního trhu s produkcí ryb, což většinou potvrdily vypočtené hodnoty indexu Balassa Revealed Comparative Advantage (RCA) a indexu Lafay Trade Specialization (LFI).

Klíčová slova: Odhalené komparativní výhody, produkce ryb, Lafayův index, Balassův index, mezinárodní obchod, export ryb, import ryb.

Contents

1. Introduction

Aquaculture is the fastest growing food supply sector in the world and it helps us with food security. Through aquaculture, oceans, seas, and inland freshwaters hold huge potential to provide us with increased amounts of healthy and nutritious food. This is needed to feed an ever growing human population so aquaculture helps us with our ‘food security’. (Seafish, 2022)

Aquaculture can massively contribute to and help secure global food supplies which are produced using methods that are good for the environment and for society. In comparison to farming land animals like cows and pigs, aquaculture is one of the most resource-efficient and least environmentally impactful ways to produce protein for us to eat. Farmed seafood can also help the United Nations Sustainable Development Goals (SDGs) become a reality. Aquaculture also supports people and communities around the world by providing business opportunities and decent jobs (Seafish, 2022)

Global trade in fish and fish products is expected to expand over the coming decade, though at a slower pace compared to the previous decade. High demand, increasing fish production, improved logistics, and globalisation of food systems should further expand international fish trade. However, the slower growth of fish production will constrain the expansion of trade. By 2029, it is projected that about 36% of production will be traded (32% if excluding intra-EU trade). (OECD, 2021)

Georgia has favourable conditions for the development of fish farming, notably the duration of the vegetation period of fish, an extensive hydrological and irrigation network, and diverse terrain and climate zones. Georgia is also rich in water resources: rivers, reservoirs, lakes, ponds.

Diploma thesis will analyse if the fish production in Georgia has revealed comparable advantage to the international and regional markets. It will explore the opportunities of fish production and look over the status of Georgia in the global trade market.

2. Objectives and Methodology

2.1 Objectives

The purpose of the thesis is to investigate how fish production attitudes has changed from 2011 to 2020 years in Georgia and discover the main challenges of fish production.

A key objective is to put the consideration of reality of fish production and analyse the opportunity of fish industry in Georgia.

Also, the objective of this study is to identify the revealed comparative advantages to the international trade and regional level.

2.2 Methodology

The theoretical part of the Master thesis was prepared based on study and analysis of professional literature and publications of Food and Agriculture Organization of the United Nations.

The practical part was processed based on the analysis international trade and revealed comparative advantages indexes analysis.

To identify the main trading partners of Georgia it was chosen comtrade data for 2 commodities H3 (fish and crustaceans, molluscs and other aquatic invertebrates) and H1604 (fish and crustaceans, molluscs and other aquatic invertebrates) for ten years, from 2011 to 2020. For it's processing were used:

- Export data from Georgia for commodity H3 and H1604
- Import data to Georgia for commodity H3 and H1604

After analysis it was discovered few the best trading partners of Georgia. They were: Ukraine, Turkey, Latvia, Kazakhstan, Armenia, and Russia.

For the calculation of revealed comparative advantages were used two indexes,

Lafay and Balassa index

For Balassa index analysis were used comtrade data from 2011 to 2020 years:

- Export data from Georgia for commodity H3 and H1604 (exclude H1604)

- Total export data from Georgia for commodities H1 –H16 (exclude H1604)
- World export data for commodity H1–H16
- Export of main trading partners (Ukraine, Turkey, Latvia, Kazakhstan, Armenia, Russia) for Commodity H1- H16

As for lafay index calculation it was considered comtrade data for all trading partners for the same commodities (H1-H16) from 2011 to 2020. For it's processing were used:

- Export data from Georgia for commodity H3 and H1604
- Import data to Georgia for commodity H3 and H1604
- Export data from Georgia for commodity H1- H16 (exclude H1604)
- Import data to Georgia for commodity H1 - H16 (exclude H1604)
- World export data for commodity H1–H16
- Export of main trading partners (Ukraine, Turkey, Latvia, Kazakhstan, Armenia, Russia) for Commodity H1- H16

Based on these two analyses, it was identified the international specialisation patterns of fish production in Georgia.

3. Literature Review

3.1 Global fish production

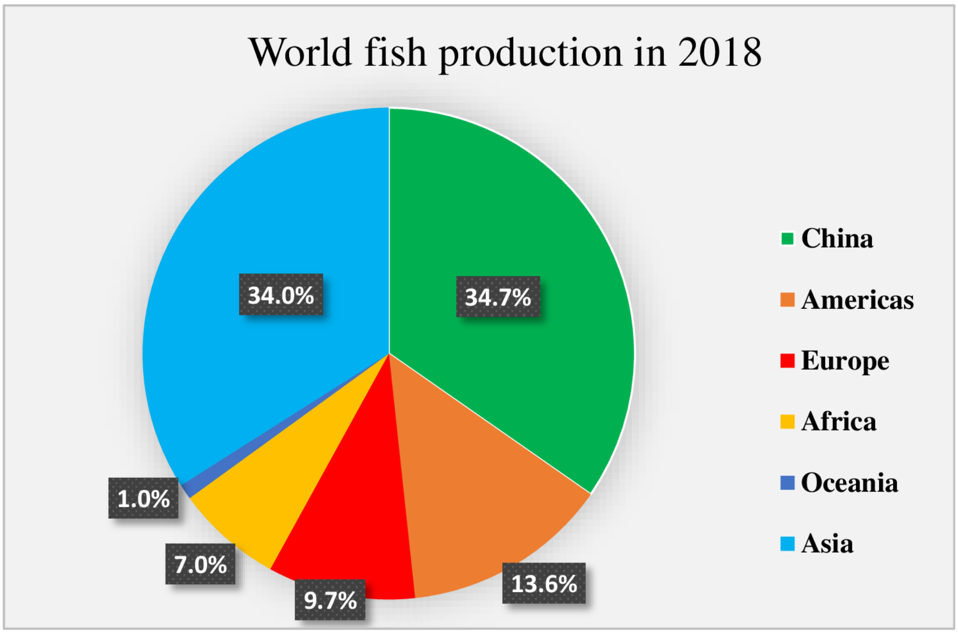
Global production of fish and seafood has quadrupled over the past 50 years. Not only has the world population more than doubled over this period, the average person now eats almost twice as much seafood as half a century ago. (Ritchie, 2021)

This has increased pressure on fish stocks across the world. Globally, the share of fish stocks which are overexploited meaning we catch them faster than they can reproduce to sustain population levels has more than doubled since the 1980s and this means that current levels of wild fish catch are unsustainable. (Ritchie, 2021)

One innovation has helped to alleviate some of the pressure on wild fish catch: aquaculture, the practice of fish and seafood farming. The distinction between farmed fish and wild catch is similar to the difference between raising livestock rather than hunting wild animals. Except that for land-based animals, farming is many thousand years old while it was very uncommon for seafood until just over 50 years ago. (Ritchie, 2021)

In the 1960s, aquaculture was relatively niche, with an output of a few million tonnes per year. Particularly since the late 1980s, annual production has increased rapidly. In 1990 the world produced only 17 million tonnes. It now produces over 100 million tonnes. (Ritchie, 2021)

Global fish1 production is estimated to have reached about 179 million tonnes in 2018, with a total first sale value estimated at USD 401 billion, of which 82 million tonnes, valued at USD 250 billion, came from aquaculture production. Of the overall total, 156 million tonnes were used for human consumption, equivalent to an estimated annual supply of 20.5 kg per capita. The remaining 22 million tonnes were destined for non-food uses, mainly to produce fishmeal and fish oil. Aquaculture accounted for 46 percent of the total production and 52 percent of fish for human consumption. (Nations, 2020)



Source: www.ourworldindata.org

China has remained a major fish producer, accounting for 35 percent of global fish production in 2018. Excluding China, a significant share of production in 2018 came from Asia (34 percent), followed by the Americas (14 percent), Europe (10 percent), Africa (7 percent) and Oceania (1 percent). (Nations, 2020)

Total fish production has seen important increases in all the continents in the last few decades, except Europe (with a gradual decrease from the late 1980s, but recovering slightly in the last few years) and the Americas (with several ups and downs since the peak of the mid-1990s, mainly due to fluctuations in catches of anchoveta), whereas it has almost doubled during the last 20 years in Africa and Asia. (Nations, 2020)

Global food fish consumption3 increased at an average annual rate of 3.1 percent from 1961 to 2017, a rate almost twice that of annual world population growth (1.6 percent) for the same period, and higher than that of all other animal protein foods (meat, dairy, milk, etc.), which increased by 2.1 percent per year. Per capita food fish consumption grew from 9.0 kg (live weight equivalent) in 1961 to 20.5 kg in 2018, by about 1.5 percent per year. Despite persistent differences in levels of fish consumption between regions and individual States, clear trends can be identified. In developed countries, apparent fish consumption increased from 17.4 kg per capita in

1961 to peak at 26.4 kg per capita in 2007, and gradually declined thereafter to reach 24.4 kg in 2017. In developing countries, apparent. (Nations, 2020)

Global capture fisheries production in 2018 reached a record 96.4 million tonnes, an increase of 5.4 percent from the average of the previous three years. The increase was mostly driven by marine capture fisheries, where production increased from 81.2 million tonnes in 2017 to 84.4 million tonnes in 2018, still below the all-time high of 86.4 million tonnes in 1996. (Nations, 2020)

The rise in marine catches resulted mainly from increased anchoveta catches (Engraulis ringens) in Peru and Chile. Catches from inland fisheries were at their highest ever in 2018 at 12.0 million tonnes. The top seven producing countries of global capture fisheries accounted for almost 50 percent of total captures, with China producing 15 percent of the total, followed by Indonesia (7 percent), Peru (7 percent), India (6 percent), the Russian Federation (5 percent), the United States of America (5 percent) and Viet Nam (3 percent). The top 20 producing countries accounted for about 74 per cent of the total capture fisheries production. (Nations, 2020)

In 2018, world aquaculture fish production reached 82.1 million tonnes, 32.4 million tonnes of aquatic algae and 26 000 tonnes of ornamental seashells and pearls, bringing the total to an all-time high of 114.5 million tonnes. In 2018, aquaculture fish production was dominated by finfish (54.3 million tonnes – 47 million tonnes from inland aquaculture and 7.3 million tonnes from marine and coastal aquaculture), molluscs, mainly bivalves (17.7 million tonnes), and crustaceans (9.4 million tonnes). (Nations, 2020)

The contribution of world aquaculture to global fish production reached 46.0 percent in 2018, up from 25.7 percent in 2000, and 29.7 percent in the rest of the world, excluding China, compared with 12.7 percent in 2000. At the regional level, aquaculture accounted for 17.9 percent of total fish production in Africa, 17.0 percent in Europe, 15.7 percent in the Americas and 12.7 percent in Oceania. The share of aquaculture in Asian fish production (excluding China) reached 42.0 percent in 2018, up from 19.3 percent in 2000. (Nations, 2020)

Inland aquaculture produced most farmed fish (51.3 million tonnes, or 62.5 percent of the world total), mainly in freshwater, compared with 57.7 percent in 2000. The share of finfish production decreased gradually from 97.2 percent in 2000 to 91.5 percent (47 million tonnes) in 2018, while production of other species groups increased, particularly through freshwater crustacean farming in Asia, including that of shrimps, crayfish and crabs. (Nations, 2020)

3.2 The importance of fisheries and aquaculture to development

Small-scale fisheries and aquaculture make critical contributions to development in the areas of employment, with over 41 million people worldwide, the vast majority of whom live in developing countries, working in fish production; food security and nutrition, with fish constituting an important source of nutrients for the poor and often being the cheapest form of animal protein; and trade, with a third of fishery commodity production in developing countries destined for export. (Finegold, 2018) With most capture fisheries worldwide considered fully exploited or overexploited, aquaculture will be central to meeting fish demand, which will continue to increase with population growth, rising incomes and increasing urbanisation. As aquaculture develops, however, governments will need to manage its potential ecological and social impacts. African aquaculture, which has grown much more slowly than in other regions, faces numerous challenges, including resource conflicts and difficulties in accessing credit, quality seed and feed, and information. (Finegold, 2018)

Also key to meeting growing demand will be improvements in postharvest processing to reduce fish losses. Both fisheries and aquaculture are often neglected in national development policy and donor priorities, as policy makers often do not have access to data which reflect the importance of fisheries and aquaculture to development. Appropriate policies and regulation remain important, however, both in managing capture fisheries and ensuring that aquaculture development is pro-poor and sustainable. (Finegold, 2018)

Despite the significant contributions that fisheries and aquaculture make to employment, nutrition, and trade in the developing world, they are rarely included in national development policy and donor priorities. This is largely due to problems with valuation of small-scale fisheries, as policy makers often do not have access to data which reflect the importance of fisheries and aquaculture to development. The stagnation or decline of capture fishery production in many parts of the world underscores the importance of fisheries policy, however, as the current state of stocks can be at least partially attributed to the difficulties of regulating fisheries and preventing their overexploitation. Even with improvements in regulation, however, pressures on capture fisheries will remain, due to continued population growth. Further development of sustainable aquaculture and improvements in the post-harvest sector to reduce losses could help to maintain fish supply and the contribution of fish to development. (Finegold, 2018)

There is a case study about importance of aquiculture in Turkey.

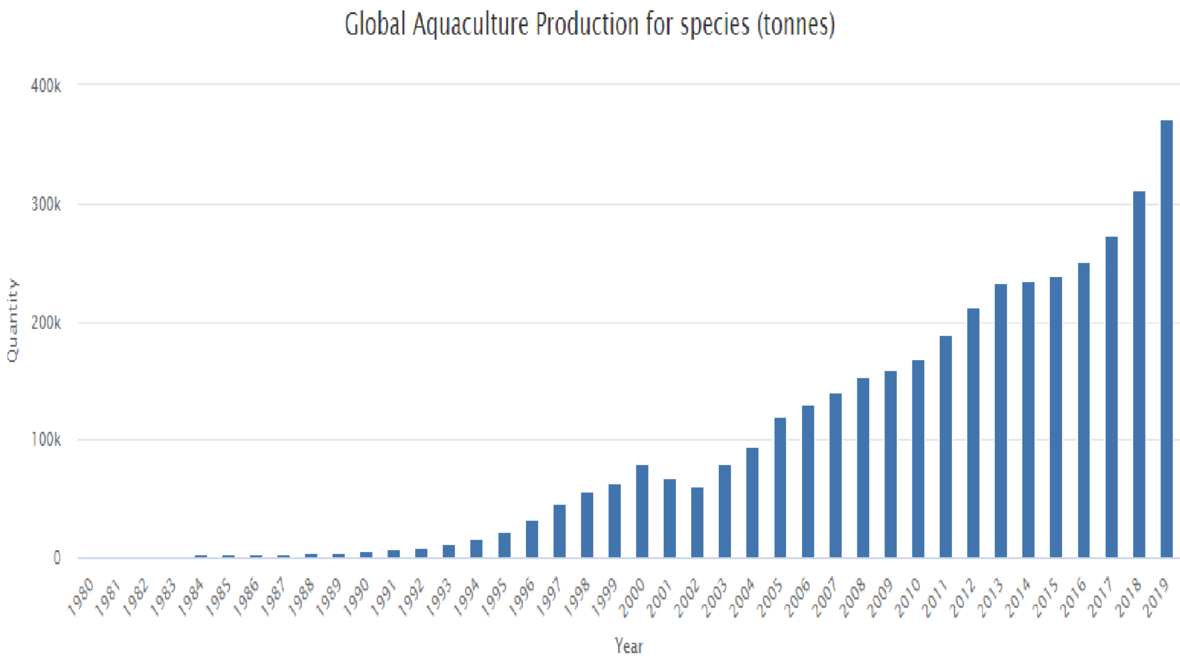
- Case study- Turkey

Turkey is a transcontinental nation that straddles both western Asia and south Eastern Europe. Its 8,333 kilometres of coast include access to four productive seas, and it also has a multitude of inland rivers and lakes – making it highly suitable for aquaculture. Commercial aquaculture started in the 1980s, when trout were grown in rivers. Over the ensuing decades, operations expanded to wooden cage culture along the coast and in reservoirs. Since then, production has increased a hundredfold from 3,075 tonnes in 1986 to 373,400 tonnes in 2019 of which 68.8 percent is produced at sea, making the country the ninth highest marine finfish producer. Aquaculture accounts for 44.6 percent of its seafood production, up from only 9 percent 20 years ago, making it the country's fastest-growing food production sector. Besides Norway, Turkey is the main driver of aquaculture production increase in Europe. (Thefishsite, 2021)

Turkey currently has 434 operational marine aquaculture facilities, mostly producing gilthead seabream (Sparus aurata) and European seabass (Dicentrarchus labrax). Production of seabream and seabass grew rapidly over the past two decades, due to technological advances and knowledge of biological requirements. Turkey is currently the world's top producer of these species, supplying 40 percent of global demand. (Thefishsite, 2021)

In 2018, Turkey produced 0.6 million tonnes of fish (including molluscs and crustaceans), with a value of USD 1481 million. 76% of this value came from aquaculture and 24% from fisheries (that is, the capture of wild resources). Between 2008 and 2018, the quantity produced decreased by 2%, while its value increased by 5%. (OECD, 2022)

Turkey is a net exporter of fish and fish products. Between 2008 and 2018, exports increased by a total of 116%, while imports increased by 124%. (OECD, 2022)



Source: www.fao.org

In 2018 Employment in the seafood sector, including processing, accounted for 52937 jobs. This represented 27% less jobs than in 2008. Over the same period, the average value of production per employee decreased by 30% in marine fisheries and increased by 24% in aquaculture. In 2018, the fleet consisted of 15352 powered vessels, down by 13% since 2008. Small-scale vessels, those below 12 meters in length, accounted for 89.8% of the total number of vessel. The total gross tonnage of the Turkish fleet in 2018 was 170793.1 tonnes, down by by 8% since 2008. Small-scale vessels accounted for 24.7% of the total gross tonnage. (OECD, 2022)

While data on fisheries in developing countries are often patchy, it is nevertheless possible to identify trends in the importance of fisheries and aquaculture for developing countries, particularly in the areas of *employment*, *consumption*, and *trade*. (Finegold, 2018)

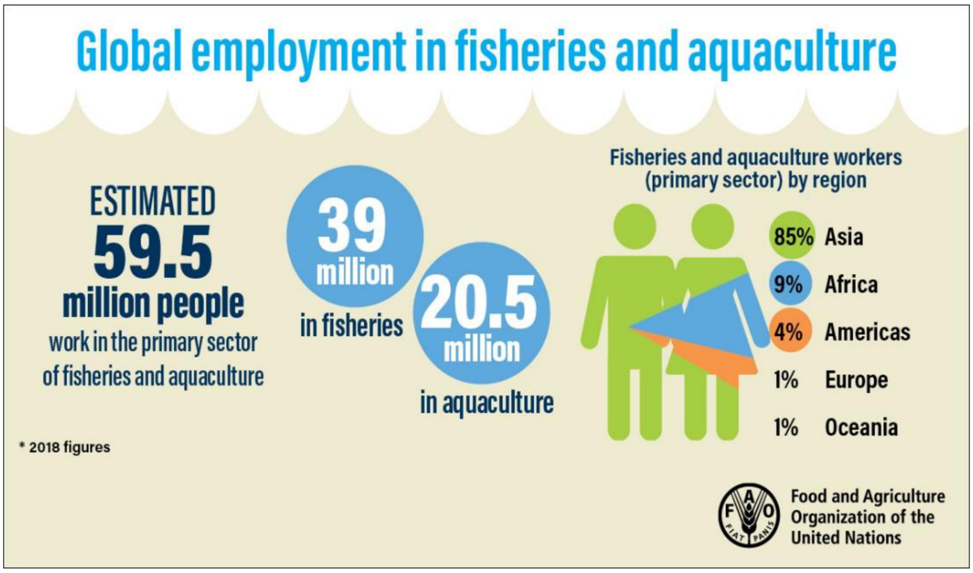
3.2.1. Employment

Estimating global employment in fisheries and aquaculture is nevertheless complex, due to the extensive number of pre-harvest, harvest and post-harvest activities associated with this sector. Jobs range from the production and sale of inputs (vessels, fishing gear, etc.) to farming and harvesting, processing, marketing and distribution of fish. Fishing and aquaculture operations can be informal and small-scale as well as highly organized and industrial in nature. (FAO, 2021)

Employment in the fisheries sector has grown more rapidly than both world population and employment in agriculture. Most of this growth is in Asia, where over 85 percent of the world's fisher folk live, and is largely due to the expansion of aquaculture in this period. While the number of people employed in fisheries and aquaculture in developing countries has been growing steadily, it has been stagnant or declining in most industrialised countries. This decline has been most pronounced in capture fisheries, while employment in aquaculture has increased in some industrialised countries. (Finegold, 2018)

Millions of women in developing countries are employed in fisheries and aquaculture, participating at all stages in both commercial and artisanal fisheries, though most heavily in fish processing and marketing. In capture fisheries, women are commonly involved in making and repairing nets, baskets and pots, baiting hooks, setting traps and nets, fishing from small boats and canoes, and collecting seaweed, bivalves, molluscs and pearls. They are rarely involved in commercial offshore and deep-water fishing. In aquaculture, women feed and harvest fish, attend to fish ponds, and collect fingerlings and prawn larvae. (Finegold, 2018)

Fish worker communities are often isolated in rural areas with little access to market information and infrastructure. High post-harvest losses of already low volumes of Production are common due to poor handling and processing, as well as a lack of proper storage facilities and distribution technologies. As a result, many small-scale fishers and aquaculture producers are poor and often depend on unpaid family labour, including that of women and sometimes children. They face numerous obstacles in raising their productivity and income levels, including limited access to credit, knowledge and inputs. Whether employed in small-scale or larger operations, fish workers are particularly prone to occupational hazards. (FAO, 2021)



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Moreover, the fisheries and aquaculture sector is characterized by a high prevalence of informal work arrangements, under-employment and seasonal and casual employment. Protection of labour rights is weak and even when regulation exists, enforcement is poor. Limited organization of the majority of fish workers in unions, associations and cooperatives also hinders their influence over decisions concerning access and use of fishery resources. Finally, practices such as illegal, unreported and unregulated (IUU) fishing and the use of flags of convenience (FOCs) are closely linked with labour abuse, including exploitation of poor migrant workers. (FAO, 2021)

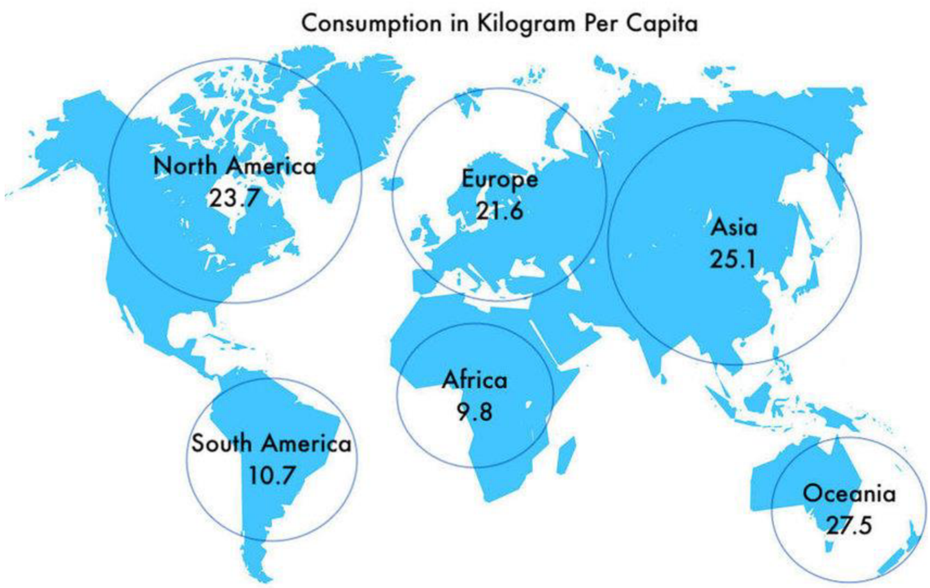
3.2.2 Fish Consumption

Global food fish consumption increased at an average annual rate of 3.1 percent from 1961 to 2017, a rate almost twice that of annual world population growth (1.6 percent) for the same period, and higher than that of all other animal protein foods (meat, dairy, milk, etc.), which increased by 2.1 percent per year. Per capita food fish consumption grew from 9.0 kg (live weight equivalent) in 1961 to 20.5 kg in 2018, by about 1.5 percent per year. (Nations, 2020)

Despite persistent differences in levels of fish consumption between regions and individual States, clear trends can be identified. In developed countries, apparent fish consumption increased from 17.4 kg per capita in 1961 to peak at 26.4 kg per capita in 2007, and gradually declined thereafter to reach 24.4 kg in 2017. (Nations, 2020)

In developing countries, apparent fish consumption significantly increased from 5.2 kg per capita in 1961 to 19.4 kg in 2017, at an average annual rate of 2.4 percent. Among these, the least developed countries (LDCs) increased their consumption from 6.1 kg in 1961 to 12.6 kg in 2017, at an average annual rate of 1.3 percent. This rate has increased significantly in the last 20 years, reaching 2.9 percent per year, because of expanding fish production and imports. In low-income food-deficit countries (LIFDCs), fish consumption increased from 4.0 kg in 1961 to 9.3 kg in 2017, at a stable annual rate of about 1.5 percent. (Nations, 2020)

Fish consumption in 2018 (kg/per capita)



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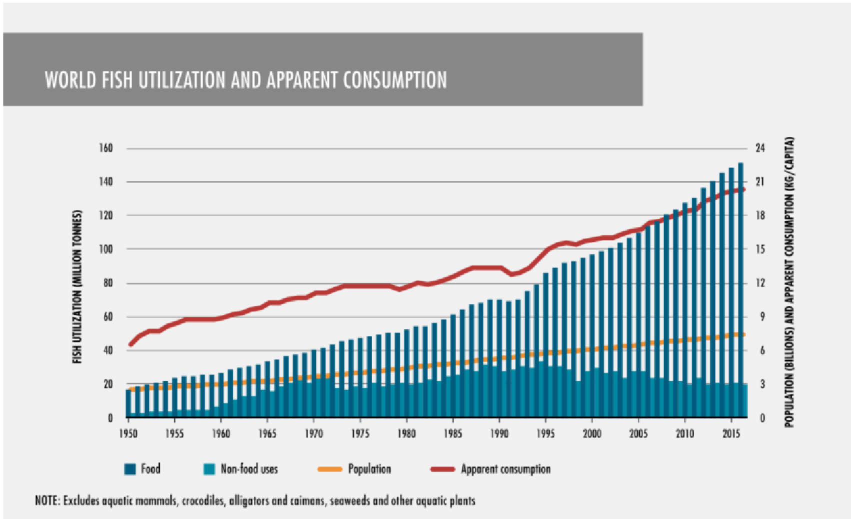
(Nations, 2020)



Source: www.fao.org

Fish and fishery products remain some of the most traded food commodities in the world. In 2018, 67 million tonnes, or 38 percent of total fisheries and aquaculture production, were traded internationally. A total of 221 States and territories reported some fish trading activity, exposing about 78 percent of fish and fishery products to competition from international trade. Following a sharp decline in 2015, trade recovered subsequently in 2016, 2017 and 2018, with respective annual growth rates of 7 percent, 9 percent and 5 percent in value terms. (Nations, 2020)

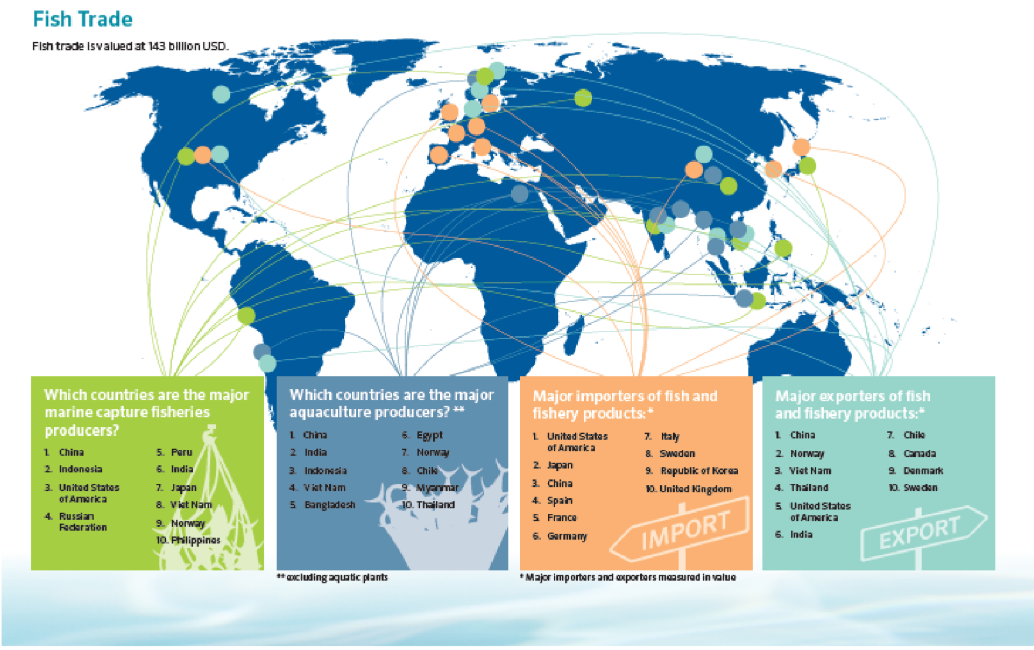
3.2.3 Fish Trade

Trade in fish is common to all societies and has taken place from time immemorial. A fisher returning with more fish than is needed to meet personal needs will tend to exchange surplus fish for other goods or services. The distribution of fish globally is very uneven. Some places enjoy abundance far beyond the needs of the local population, while others may have no direct access to fisheries resources. This means that trade has a role to play in order to achieve a more even distribution of fish around the globe where the entire marketing chain is taken into account. (FAO, 2004)

Trade has always played an important part of the fisher's livelihood, even in 'subsistence' fisheries. International fish trade has been increasing very rapidly in recent decades. An estimated 45% of the world catch is now traded internationally. The widespread use of refrigeration, and improved transportation and communications has facilitated a vast expansion of trade. (FAO, 2004)

The theory of international trade tells that through free and unhindered trade we could optimize the benefits of fisheries resources for humanity as a whole. The idea of free trade in the fisheries, however, is often vehemently contested because there are often tariff and non-tariff barriers to trade and other distorting factors, such as subsidies, present in trading relationships. Exchange of and access to information is vital to successful trade practices. (FAO, 2004)

Important frameworks relative to trade in fisheries have been established. International trade rules have developed through several rounds of trade negotiations under General Agreement on Tariffs and Trade (GATT). The last of these, the 1994 Uruguay Round, agreed to establish the World Trade Organization (WTO) and a number of important agreements with relevance to fisheries were concluded. The FAO Committee on Fisheries has a Sub-Committee on Fish Trade, which provides an intergovernmental forum for consultations on technical and economic aspects of trade in fish and fish products. (FAO, 2004)



Source: www.fao.org

International trade in fisheries products has been shown to have a positive effect on food security in many developing countries, stimulating increased production, generating foreign exchange which can be used for food imports, and enhancing the trade-based entitlements of people engaged in fishing and fish processing. Much of the discussion around the food security impact of international fish trade has focused on whether fish production for export reduces the amount of fish available for local consumption, presenting fish exports as a trade-off between foreign exchange earnings and domestic food security. (Finegold, 2018)

Such a perspective, however, fails to take into account that foreign exchange from fish exports helps to finance imports of other foods, including fish products, and that production for export helps to raise the incomes of poor fisher folk and people employed in fish processing, enabling them to achieve greater food security through enhanced purchasing power. In Thailand, for example, a decrease in rural poverty has been attributed to the export orientation of the fisheries sector and concomitant increase in the incomes of poor fishers. Fish processing for export can also generate employment, particularly among young women, though export-orientation in fisheries reduces the quantity of fish available to traditional fish processors (typically middle-aged women with little education), affecting their livelihoods. (Finegold, 2018)

3.3 Environmental Impact of Aquaculture

Aquaculture has been considered as an option to cope with the world food demand. However, criticisms have arisen around aquaculture, most of them related to the destruction of ecosystems such as mangrove forest to construct aquaculture farms, as well as the environmental impacts of the effluents on the receiving ecosystems. The inherent benefits of aquaculture such as massive food production and economical profits have led the scientific community to seek for diverse strategies to minimize the negative impacts, rather than just prohibiting the activity. Aquaculture is a possible panacea, but at present is also responsible for diverse problems related with the environmental health; however the new strategies proposed during the last decade have proven that it is possible to achieve a sustainable aquaculture, but such strategies should be supported and proclaimed by the different federal environmental agencies from all countries. (Martinez-Porchas, 2011)

The environmental impact of aquaculture is completely dependent upon the species being farmed, the intensity of production and the location of the farm. Additionally, new strategies and technologies have emerged and have proven that it is possible to have sustainable aquaculture. (Global, 2021)

Fisheries are without a doubt significant natural resources, particularly for parts of Africa and Asia. However, these areas rely heavily on fisheries for food security are places where the population is growing exponentially, meaning there are even more mouths to feed. Fish farming, when done sustainably, can be the answer to filling the gap in seafood supply that stressed fisheries are creating. (Global, 2021)

In the past, when the aquaculture industry was just getting its footing, certain factors inhibited the industry from producing fish sustainably. The intention of fish farming was never to impact the environment, but to increase food security. However, environmental problems did arise. There was no shortage of negative press, and these stories have stayed with the public. (Global, 2021)

3.3.1 The negative environmental impacts

The negative environmental impacts aquaculture has had are nuanced. Nutrient build up happens when there is a high density of fish in one area. Fish produce waste, and their waste has the potential to build up in the surrounding area. This can deplete the water of oxygen, creating algal blooms and dead zones. Farmers' usage of antibiotics to prevent disease created concern about the effect of the drugs on the ecosystem around the cages, including wild fish. Many also worried that the escape of non-native fish would cause wild fish to compete for food, potentially displacing the native fish. (Global, 2021)

These were all valid criticisms given that the industry was just beginning to learn how to cope with issues as they came up, as any new industry does. (Global, 2021)

There is also the worry that these escaped fish could mate with wild fish and have a negative impact on the species as a whole. There are some main negative impacts:

- *Nutrient build-up*

This is one of the most frequently talked about impacts of open water aquaculture. Nutrients build up in the environment surrounding the fish because there is nothing to prevent dead fish, food that isn't eaten and feces entering the water column from the cages.These additional nutrients cause algal blooms as the tiny plants make use of all the additional nutrients. (Wreg, 2021)

- Transmission of disease

Having a large number of fish kept closely together in a small area means that any diseases or parasites are likely to spread much more quickly.

Sea lice are one of these parasites causing big problems in aquaculture and because the cages are open systems there is the possibility that these lice could transfer to wild fish that pass by. This risk is higher for migrating species such as salmon which may swim past multiple cages in a Fjord system when moving from one area to another. (Wreg, 2021)

- *Energy Usage in Feed Production*

To produce large amounts of farmed fish such as salmon requires large amounts of fishmeal. Fishmeal is the fish feed which is usually made from lots of smaller fish.

There is the energy input required to produce this protein in the first place. Not only that, but these smaller fish are often caught in the wild from over-exploited fisheries, negating some of the environmental benefits seen from aquaculture. (Wreg, 2021)

❖ Use of freshwater resources

Some aquaculture facilities and hatcheries are on land. This does counter some of the concerns of housing these large numbers of fish in cages within a natural ecosystem. However, to run these facilities large amounts of freshwater are needed which have to be pumped in. Huge amounts of energy are required to pump the water and to clean and filter it. (Wreg, 2021)

❖ Destruction of mangrove forests

Aquaculture has been blamed for the destruction of millions of hectares of mangrove forests in countries such as Equador, Madagascar, Thailand and Indonesia. In Thailand this is mainly for conversion to shrimp farms where cover of mangrove forests has more than halved since 1975.

This has big environmental consequences. Mangrove forests provide nutrients and shelter for many fish species that breed and rear young, as well as providing habitat for many other animals such as birds, reptiles and amphibians. They also provide benefits to human coastal populations by acting as a physical barrier to coastal erosion and storm damage. (Wreg, 2021)

3.3.2 Positive environmental impacts

❖ Reduces the pressure on wild fisheries

Overfishing is a big environmental problem, driven by a growing global desire for fish. According to the Food and Agriculture Organization (FAO) over 70% of the world's wild fish species are either fully exploited or depleted. This disrupts ecosystems, taking away predators or prey species from the oceans. (Wreg, 2021)

Other problems from industrial scale sea fishing include:

- bycatch where large nets are cast catching unwanted species which are simply discarded;
- injuring and deaths of wildlife caught in discarded fishing nets and lines (sometimes known as ghost fishing);
- Trawling of nets along the sea bed causing damage and stirring up sediments.

Considering approximately 1 billion people on earth look to fish as a primary source of protein (World Health Organization), aquaculture reduces the drive for wild fish and the overexploitation of this highly vulnerable resource.

Although bad practices do occur it is easier to monitor the impacts of aquaculture than it is to monitor fishing in the vast open oceans. (Wreg, 2021)

- ❖ More efficient to produce than other farmed proteins

When looking from an energy efficiency point of view, and thus carbon emissions point of view, producing protein from aquaculture is much more efficient than many other forms of protein production. (Wreg, 2021)

This is referred to as the 'feed conversion ratio' (FCR) and measures the amount of feed input required compared to the weight gained by the animal. This ratio for beef ranges between 6:1 and 10:1, meaning you need up to ten times the amount of feed to produce the equivalent amount of beef. The figure is lower for pigs (2.7:1 – 5:1) and chickens (1.7:1 – 2:1). For farmed fish though, this ratio is often at 1:1 due to their cold-blooded nature they tend to be more efficient than many warm-blooded alternatives. (Wreg, 2021)

These figures have been called into question in some studies and depending on the species, the ratio does creep up to a similar range of chickens, and some argue we should look at 'calorie retention' rather than FCR.(8) It appears fish are more efficient to produce than beef, but studies are ongoing as to just how much more.

On top of this results of a study looking at full life cycle carbon emissions of farmed fish (taking into account land-use changes) was 5.07kg of CO_2 per g of trout compared to 18kg CO_2 per kg for beef. (Wreg, 2021)

- Certain farming methods have even greater positive impacts

Aquaculture extends outside of just fish and prawns and includes seaweed and similar products such as kelp.

The environmental benefits of growing these include:

- they require no fertiliser or pesticide inputs which makes them better than many land-based crops
- they require much less land
- can be harvested up to 6 times a year
- act as a carbon sink absorbing CO_2
- can be used as animal feed, reducing need to grow feed on land

Similar benefits can be seen with growing shellfish such as oysters, mussels and clams too. Oysters, for example, can filter 100 gallons of seawater a day improving water quality and removing particulates and nitrogen. Oyster beds also create an ecosystem for other sea life to use as a food source or as protection. (Wreg, 2021)

Farmed seafood is incredibly resource efficient, especially when compared with other animal proteins (beef, pork, chicken). The feed conversion ratio, which is the measurement of how much feed it takes to produce the protein, is 1.1. This means that essentially one pound of feed produces one pound of the protein. Beef, pork and chicken’s feed conversion ratios vary between 2.2-10. As a result, seafood’s protein retention, as well as energy retention are remarkably high as well. (Global, 2021)

As farmed fish are closely monitored in comparison to wild fish, farmers have more control over variables. This can positively impact the environment and the fish.

Farmed fish are generally free of environmental contaminants like mercury and heavy metals, as they exclusively eat human-processed feed. Fish feed's toxin levels are regulated. (Global, 2021)

The farming of filter-feeders, like shellfish, can improve water quality. These creatures eat excessive nutrients in the water, which, in turn, prevent the build-up of effluent. Filter-feeders are often integrated into the farming of other species, like finfish, to use uneaten feed and fish waste as food, offsetting the farm's environmental impact. This system is called polyculture, or integrated multi-trophic aquaculture (IMTA). (Global, 2021)

Sustainable fish feeds are on the rise. Fishmeal and fish oil used in feeds may come from trimmings from processing plants. Additionally, substituting plant proteins for fishmeal in feeds is also becoming more prevalent. (Global, 2021)

3.4 Value chain

A value chain is the combination of activities a business undertakes to move a product or service along its life cycle, including design, marketing, distribution, and customer support.

A company's end goal is value creation, particularly in the form of profit. By understanding each stage of the value chain, a business can create greater profit by making necessary changes to the process. With so many activities and suppliers involved, the value chain has many facets. (Thebalancesmb, 2022)

In his book *Competitive Advantage* (1985), Michael Porter explains that a value chain is a collection of activities that are performed by a company to create value for its customers. (Porter, 1985)

He identified several key steps common among all value chain analyses and determined that there are primary and supporting activities that when performed at the most optimal levels will create value for their customers, such that the value offered to the customer exceeds the cost of creating that value, resulting in higher profit. Porter's framework groups activities into primary and support categories. (Porter, 1985)

The primary activities focus on taking the inputs, converting them into outputs, and delivering the output to the customer. The support activities play an auxiliary role in primary activities. When a company is efficient in combining these activities to provide a superior product or service, then the customer is willing to pay more for the product than the cost to make and deliver the product which results in a higher profit margin. (Investopedia, 2021)

Let's work through an example of an asset management firm. The goal of the client is to achieve the highest possible return on investment within the guidelines and restrictions set forth by the client. (Investopedia, 2021)

The firm's primary activities include:

- Investment team (portfolio managers, analysts) – tasked with making the investment decisions.
- Operations and traders – tasked with ensuring the investments are in line with the guidelines set forth by the client, and the trades are at the best execution price. (Investopedia, 2021)
- Marketing and sales – responsible for procuring clients.
- Service (client relationship management) – responsible for providing all the touch points to the client.

Support activities include:

- Technology – designs a trading and client module that is efficient and effectively allows the team to provide the highest level of service and make the best investment decisions.
- Human Resources – finds and retains the highest level of talent at the firm.
- Infrastructure – includes the lawyers and risk managers whose oversight is crucial to ensuring the client's guidelines are followed, the investment risk is controlled, and the firm is operating within the regulations established by the SEC. (Investopedia, 2021)

A value chain is a business model that describes the full range of activities needed to create a product or service. For companies that produce goods, a value chain comprises the steps that involve bringing a product from conception to distribution, and everything in between such as procuring raw materials, manufacturing functions, and marketing activities.

A company conducts a value-chain analysis by evaluating the detailed procedures involved in each step of its business. The purpose of a value chain analysis is to increase production efficiency so that a company can deliver maximum value for the least possible cost.

A value chain is the sequence of activities required to make a product or provide a service. The idea of a value chain becomes useful for analytical and policy purpose, There are two reasons why the global buyers do not rely on the market and create and control value chains:

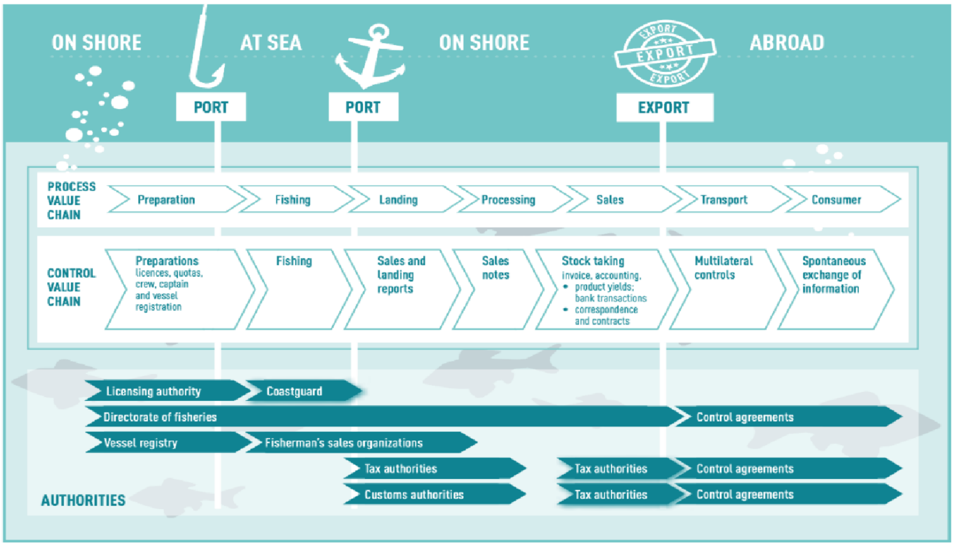
Risk of supplier failure: increase of non-price competition based on factors such as quality, response time and reliability of delivery, together with increasing concerns about safety and standards, means that buyers have become more vulnerable to shortcomings in the performance of suppliers. (Schmitz, 2005)

3.4.1 Value chain analysis

According to Porter's value chain analysis, companies can increase their profits by using value chain analysis in two different ways:

- Cost effect: Cutting production costs and streamlining processes in order to increase profitability.
- Competitive differentiation: Increasing perceived value by offering a unique or high-quality service. A differentiation advantage not only increases perceived value, but it also helps you increase brand awareness, as you'll stand out from the crowd.

A value chain analysis is conducted to identify upgrading, that is, improvements in quality and product design that enable producers to gain enhanced value or through diversification in the product lines served. However, a range of data and information of use to managing small-scale fisheries can be also be produced.



Source: www.europeansting.com

3.5 Revealed comparative advantage indexes

Measures of revealed comparative advantage (RCA) have been used to help assess a country's export potential. The RCA indicates whether a country is in the process of extending the products in which it has a trade potential, as opposed to situations in which the number of products that can be competitively exported is static. It can also provide useful information about potential trade prospects with new partners. (WorldBank, 2021)

The Revealed Comparative Advantage is defined as the ratio of two shares. The numerator is the share of a country's total exports of the commodity of interest in its total exports, and the denominator is share of world exports of the same commodity in total world exports. The RCA takes a value between 0 and (infinity). A Country is said to have a revealed comparative advantage if the value is more than one.

It is an index based on the Ricardian comparative advantage concept for calculating the relative competitiveness of a certain country in a certain class of goods or services using their trade flows as evidence. An index to indicate the advantage or disadvantage of a particular country in particular commodities or groups of commodities constructed with the help of trade flows. (Global, 2022)

In the development and evolution of international trade theory, comparative advantage has always been a core concept. Since Ricardo's classic model of comparative advantage (CA) in trade was put forward, the theory of comparative advantage has been gathered to form a theory system. An approach of comparative advantage calculation through almost two centuries' development. The most widely used application has been proposed after the Revealed Comparative Advantage (RCA) and its modification put forward by Balassa and Lafay. (Granabetter, 2016)

3.5.1 Balassa Index

Comparative advantage analysis is a useful tool in economics that can be used to compare the relative costs of production and identify sectors and markets that have the greatest likelihood of success. Balassa Index is widely used in the field to measure country-sector Revealed Comparative Advantage. (Granabetter, 2016)
The concept of revealed comparative advantage (RCA) is grounded in conventional trade theory. The original RCA index, formulated by Balassa can be written as:

$$B = (xij / xit) / (xnj / xnt)$$

Where x represents exports, i is a country, j is a commodity, t is a set of commodities and n is a set of countries. B is based on observed trade patterns; it measures a country's exports of a commodity relative to its total exports and to the corresponding export performance of a set of countries, e.g., the EU. If B>1, then a comparative advantage is revealed. (Granabetter, 2016)

The idea to determine a country's 'strong' sectors by analysing the actual export flows was pioneered by Liesner. Since the procedure was refined and popularized by Bela Balassa it is popularly known as the Balassa Index. Alternatively, as the actual export flows 'reveal' the country's strong sectors it is also known as Revealed Comparative Advantage.

Many countries are, for example, producing and exporting cars. To establish whether a country, say Japan, holds a particularly strong position in the car industry, Balassa argued that one should compare the share of car exports in Japan's total exports with the share of car exports in a group of reference country's total exports. The Balassa index is therefore essentially a normalized export share. More specifically, if BIAj is country A's Balassa index for industry j, this is defined as to:

$$BI_j^A = \frac{share\ of\ industry\ j\ in\ country\ A\ exports}{share\ of\ industry\ j\ in\ reference\ country\ exports}$$

If BIAj >1, country A is said to have a revealed comparative advantage in industry j, since this industry is more important for country A's exports than for the exports of the reference countries

Focusing on exports only is particularly relevant in situations of "one-way" trade, where countries are specialized in the export of some commodities and import those where they have no comparative advantage. (Econ, 2021)

Other indices have been proposed that apply to situations of "two-way" trade, where trade takes place in varieties of products and countries can be simultaneously exporters and importers for a given class of products. Two-way trade implies, for each product, a trade balance (Xk − Mk) that results of transactions of unequal value, a majority and a minority flow (Escaith, 2020)

When two-way trade is prevalent, as for most goods today, Lafay recalled that it becomes necessary to analyze also the symmetrical ratio of the Balassa RCA, calculated on the import side.

$$\text{BRCAm}k\ i = (\ \ i\ Mi)\ (\ Mk\ w\ Mw)]$$

World imports (when measured FOB) being notionally equal to world exports,

$$\text{Mk w} = \text{Xk w and Mw} = \text{Xw}$$

A priori, Balassa's comparative advantages must meet the condition (BRCAk i > 1 => BRCAm k i < 1) while comparative disadvantage requires (BRCAk i BRCAm k i > 1). When results are contradictory, it becomes necessary to look at the trade balance and its composition. The import approach has been criticized, among other things, for being subject to the influence of tariffs and other protectionist measures that influence the volume and composition of imports. This was particularly true when the BRCA index was created in the 1960s. It is less valid today, in particular when analysing non-agricultural imports of developed countries. (Escaith, 2020)

There are some examples of Balassa index:

- Dutch export - live trees and other plants :

The Balassa index measures the degree of specialisation of Dutch export products. If the Balassa index for a product is more than 1, it means that product involves specialisation. If it is less than 1 it means that no specialisation is involved in the product. The Dutch export of a given product is compared to the export of that product by the EU-28 (excluding the Netherlands). Up until 2017 the Balassa index was compared to the export of that product by the EU-28.

For example, the Balassa index for 06 live trees and other plants, bulbs, roots and the like; cut flowers and ornamental foliage in the year 2017 is calculated as follows.

H6 Netherlands 2017: **8.9 billion euros**
Total Netherlands 2017: **467.4 billion euros**
The Netherlands: **1.9 percent**

H6 other EU 2017: **4 billion euros**
Total Nederland 2017: **4655 billion euros**
Share: **0.085 percent**

Balassa = **1, 9/0.085 = 22.4**

The outcome is 22.4. This is more than 1, which means that the Netherlands has an export specialisation for the export products live trees and other plants, bulbs, roots and the like; cut flowers and ornamental foliage compared with the EU-28 member states. (CBS, 2020)

3.5.2 Lafay index

Lafay shows that it contains a systematic bias, stemming precisely from the existence of the minority flows in a two-way trade. He proposes an index based on a GDP weight. In practice, the Lafay index is usually modified to replace GDP by the share of trade (imports plus exports) of product "k" on total trade of "i" [(Xk i +Mk i)/ (Xi + Mi)] as the scale variable:

$$\boldsymbol{LRCAk\ i = 100\ [(Xk\ i - Mk\ i)\ /(Xk\ i + Mk\ i\ ) - (X\ i - Mi)\ (Xi + Mi)\ ] \cdot}$$
$$\boldsymbol{[\ (Xk\ i + Mk\ i/(Xi + Mi)\ ]}$$

Different indicators might measure the extent of a country's specialization in a given sector. The choice of the right index depends on many circumstances; our opinion is that in the current context of increasing intra-industry trade, a careful assessment of international comparative advantages requires to take into consideration not only exports but also imports. In fact, the process of “International fragmentation of production” (IFP), i.e. the mechanism by which foreign firms delocalize into acceding countries part of their production, both through the establishment of affiliates and subsidiaries and by outsourcing agreements with local firms, generates trade flows of parts, semi-finished and intermediate goods between foreign and Acceding countries firms. Thus, the distortion introduced in the analysis depends on the level of data disaggregation: for fairly aggregated groups of products the size of intra-industry trade flows becomes quickly significant and any evaluation of the trade performance based only on exports turns out to be a poor indicator. The Lafay index (LFI), by taking into account imports, allows to control for intra-industry trade and re-export flows.

The Lafay index takes into account these effects by considering the difference between each item’s normalized trade balance and the overall normalized trade balance. Finally, the Lafay index weights each product’s contribution according to the respective importance in trade. (ZaghiniI, 2003)

For a given country, i, and for any given product, j, the Lafay index is defined as:

$$LFI_j^i = 100\left(\frac{x_j^i - m_j^i}{x_j^i + m_j^i} - \frac{\sum_{j=1}^{N}(x_j^i - m_j^i)}{\sum_{j=1}^{N}(x_j^i + m_j^i)}\right)\frac{x_j^i + m_j^i}{\sum_{j=1}^{N}(x_j^i + m_j^i)};$$

Where i j x and i m j are exports and imports of product j of country i, towards and from the rest of the world, respectively, and N is the number of items. According to the index, the comparative advantage of country i in the production of item j is thus measured by the deviation of product j normalized trade balance from the overall normalized trade balance, multiplied by the share of trade (imports plus exports) of product j on total trade.6 Given that the index measures each group’s contribution to the overall normalized trade balance, the following relation holds: 0 1 ∑ = = N j i LFI j . Positive values of the Lafay index indicate the existence of comparative advantages in a given item; the larger the value the higher the degree of specialization. On the contrary, negative values points to de-specialization. (ZaghiniI, 2003)

- There is an example of Lafay index:

Oil seed, oleagic fruits, grain, seed, fruit industry of some countries in 2018.

This index tries to reveal comparative advantage (disadvantage) of the industry under review. Takes values between -∞ and +∞. If it takes a value of more (less) than zero, the country being reviewed has (not) a comparative advantage to world's competitors in exporting selected industry's products. (Tradecomp, 2021)

Mathematical definition:

$$\text{Lafay}_i = K * \left[\left(X_{d,i} - M_{d,i} \right) - \left(X_d - M_d \right) * \left(\frac{X_{d,i} + M_{d,i}}{X_d + M_d} \right) \right]$$

Where d is the country under study, i refers to a specific industry, X are the exports, M are the imports and K is a constant $K = \frac{1000}{X_d + M_d}$

COUNTRY	EXPORTS IN VALUE	SPECIALISATION (BALASSA INDEX)	SPECIALISATION (LAFAY INDEX)
Brazil	11,565,088	16.1	4
China	1,843,542	0.3	-1
Australia	1,159,188	1.6	0
Japan	120,262	0	-1
Sudan	76,315	2.6	0

Source: www.tradecompetitivenessmap.intracen.org

Outcome: Brazil has comparative advantages to world's competitors in exporting selected industry's products.

3.6 Fisheries and Aquaculture in Georgia

Georgia is divided into two main river basin systems. The larger one is the Black Sea river basin system which has a humid subtropical climate, while the smaller Caspian Sea river basin system has dry subtropical climate. Georgia is rich in inland water resources. The yearly average precipitation is about 1 260 mm and the annual total internal renewable water resources (TRWR) are around 58 km3. There are several thousand rivers and streams in the country, of which about 90 are considered important with an estimated total length of 5 000 km. The number of lakes is about 860, and their total area comes to almost 16 900 ha. The total length of 36 main irrigation canals is 1 296 km, while the total area of water reservoirs is about 23 000 ha. In addition to the surface waters, the total resources of fresh ground waters are 560 m3 per second. Thermal water resources of Georgia are estimated varying between 960 000 and 1 000 000 m3 per day. (Khavtasi, 2010)

The coastline of Georgia to the Black Sea is 310 km long, while maritime claims in accordance with the United Nations Convention on the Law of the Sea (UNCLOS) are 12 nm territorial sea and 200 nm exclusive economic zones (EEZ). The total Georgian territorial sea area is about 6 900 km2, while the area of its EEZ is about 115 000 km2. The main marine resource is anchovy and its annual quota is 60 000 tonnes. The most important ports for the Georgian fisheries fleet are Poti and Batumi. (Khavtasi, 2010)

National specialists list 75 marine and 68 freshwater species in Georgia, among which there are several highly valued and endangered ones, such as various indigenous sturgeons and trout. Restoration of independence in 1991 found the country in difficult economic and social situation. The marine fishing fleet virtually disappeared and catches sharply decreased. As a result, marine resources are neither fully nor properly exploited. In inland fisheries and aquaculture similar decline was experienced. At present there are about 41 more or less operating fish farms with a total area of 2 450 ha. (Khavtasi, 2010)

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disappeared and catches sharply decreased. As a result, marine resources are neither fully nor properly exploited. In inland fisheries and aquaculture similar decline was experienced. There are very low fish production results of both marine and inland capture fisheries and aquaculture. Before independence the average yearly per capita fish consumption was 19 kg. At present it is only 3.8 kg. Most of the imported fish and fish products, a total quantity of 22 600 tonnes (4.8 kg per capita), come from neighbouring countries. (Khavtasi, 2010)

Capture fisheries and aquaculture productions in 2020 were estimated at 2,464,585 tonnes and 900 tonnes respectively. The number of marine fishing vessels in Georgia is small and was estimated as 42 in 2017. In 2020 the total employment in fisheries and aquaculture was estimated at 9 370 people with fewer than 500 in aquaculture. Although aquaculture in Georgia was well established in the 1950s, the number of aquaculture farms has been gradually diminishing. (FAO, 2019)

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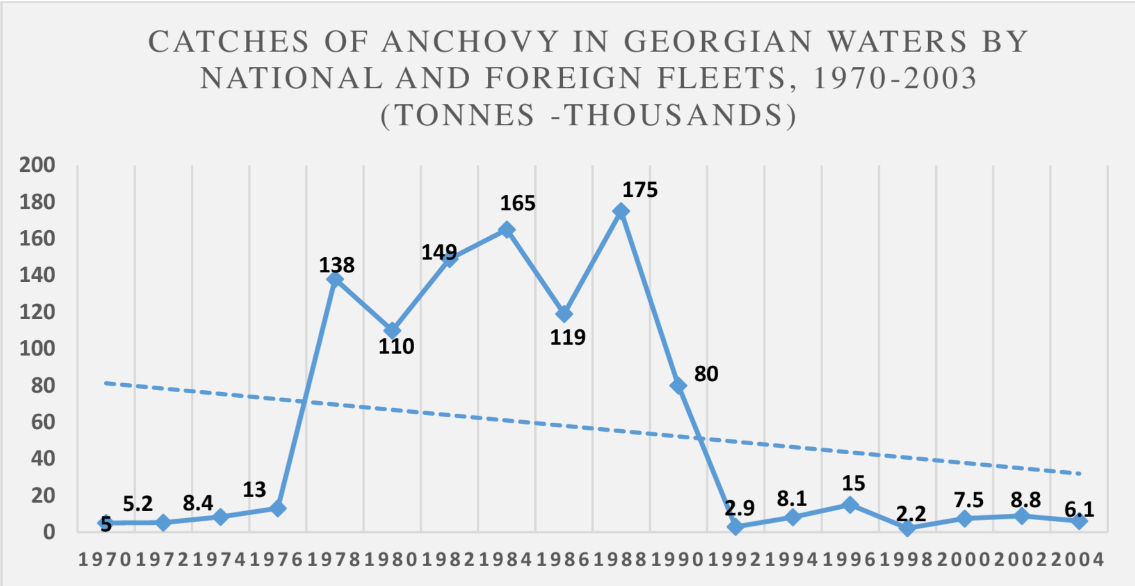
3.6.1 Fisheries and aquaculture in Georgia in the period (1970 – 1990)

Over the period 1930-1990, the highest marine capture fisheries landings were recorded in 1980. In that year a total catch of 211 889 tonnes was recorded. In Black Sea fish landing statistics, anchovy is the dominant species. It constitutes 30-40 percent of total coastal catches in Georgia. The average annual volume of anchovy caught in the 1980s was around 80 000 tonnes (Shlyakhov, Chaschin and Korkov, 1990). This volume decreased to between 2 000 and 7 000 tonnes in the 1990s (Shavlakadze, 1998). Because of the adoption in 1982 of the Law of the Sea and the establishment of 200-mile exclusive economic zones (EEZs) by many coastal states, the Government of the former Union of Soviet Socialist Republics (USSR) had to move a large part of its fishing fleet into its EEZ, including the Black Sea.

Consequently, at one point, 220 seiners were involved in anchovy fishing near the Georgian coast.

In 1988/89 anchovy landings by seiners from Turkey and the former USSR reached their peak with a catch of 488 000 tonnes. Both stocks and catch of anchovy were reduced in the early 1990s. The estimated stock in Georgian coastal waters declined from approximately 550 000 to 270 000 tonnes and the catch from about 170 000 to less than 3 000 tonnes in 1991. (FAO, 2003)



Source: www.fao.org

In the period 1980-1990 the Georgian fishing fleet incorporated 48 industrial fishing vessels belonging to state companies or to fishing cooperatives. Ten of these vessels were trawlers with an engine power of up to 2 856 HP. They had a large capacity for ocean fishing and the necessary facilities on board to stay at sea for prolonged periods. Each ocean-going vessel caught and processed on board an average of 4 000 tonnes of fish per year. Mediterranean scad (Trachurus mediterraneus), mackerel (Scomber scombrus), oil sardine (Sardinella longiceps), captain fish (Pseudotolithus brachygnathus, Pseudotolithus senegalensis) and bluefish (Pomatomus saltator) were some of the species that were landed frequently. (FAO, 2003)

In addition to the industrial fishing fleet, Georgia also had an important small-scale coastal fishing fleet in the late 1980s. This fleet included three motofelugas or motorized wooden boats (engine power 14.6 HP) and 300 small-scale fishing boats (average engine power 3.65 HP). These boats used a variety of gears - among others, fixed nets, hooks for catching spiny dogfish and seines.

As an indication of the importance of the fishing industry for the coastal economy at that time, in 1980 the state fishing companies Adjartevzi, Potitevzi and Mebaduri employed 1 200, 1000 and 254 people, respectively. Additionally, the Fishermen's Trade Union had 947 members. The total number of people employed in marine capture fisheries in 1980 was estimated at around 3 400. (FAO, 2003)

The number of people employed in these fisheries in Georgia decreased considerably in the 1980s to less than 1800 in 1990. In 1990 the fleet of Potitevzi comprised 800 fishermen. Moreover, the Trade Union of Adjarian Industrial Fishermen and Fish Processors involved 300 fishers, and 124 fishermen were members of the Georgian Trade Union of Fishermen, which included fishery enterprises in Poti, Batumi, Khobi, Gagra, Grigoleti and Sokhumi.

In the 1980s, aquaculture was considered a less important source of fish since marine production increased considerably. The number of aquaculture farms declined from the 1950s to the 1980s in particular, from around 50 to fewer than 20 farms. In the mid-1980s there were 13 fish farms in Georgia where mirror carp was cultivated in ponds. Only two fish farms were involved in rainbow trout culture. Fifteen reservoirs and 20 lakes with a total water surface of around 30 000 ha were used for the grow-out to market size of these freshwater fish (Elanidze, 1983). In the light of a huge programme of fish ranching in the former USSR, which aimed to increase the marine capture of sturgeon and salmon, the River Rioni sturgeon hatchery and River Kodori salmon hatchery were constructed in the late 1970s. These two state hatcheries released more than 2 million juvenile fish into the Black Sea over the period 1981-1991. In addition, a number of hatcheries were built in the 1980s for the restocking of inland waterbodies. (FAO, 2003)

In 1980 the then Ministry of Agriculture and Food established the GruzSelRybKhoz fisheries agency, which was responsible for inland waterbodies (rivers, lakes and reservoirs) and artificial fish ponds, with a total surface area of 700-800 ha. Average annual inland capture fisheries and aquaculture production in the 1980s fluctuated widely, between 2 700 and 5 000 tonnes. Two-thirds of the production came from aquaculture and about one-third from culture-based inland capture fisheries. (FAO, 2003)

Inland fisheries and aquaculture production in the 1980s was considerably higher than it is now. For example, Lake Tabatskuri produced between 60 and 100 tonnes annually, while currently only a production of 40 tonnes is reached; on the same lake, fisheries provided employment in the 1980s to around 40 persons but now to only eight. Similarly, annual production in Lake Paravani in the 1980s was almost 200 tonnes, compared with between 60 and 80 tonnes at present. At the end of the 1980s, the annual capture fisheries production in the Krami reservoir was estimated at 100 tonnes, while currently only 25 tonnes are being caught. (FAO, 2003)

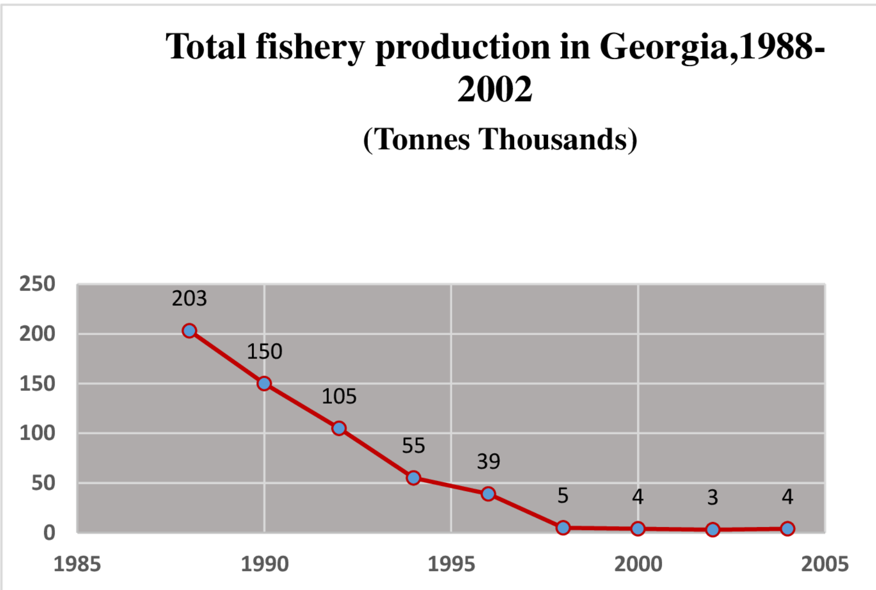
In the beginning of 1980s along the Black Sea coastal waters of Georgia the fishing activity was quite high, for example in 1980 the total catch amounted to 111389 tons (the highest ever) and in 1991 amounted to 60000 tons. For the same period the volume of aquaculture and internal reservoir products comprised 4500-5000 t. At the end of 1980s and during the 1990s Georgian marine and internal water fishing industries (pasture, pond and pool aquaculture) were considerably damaged and went bankrupt. In the second half of 1990s the catch volume has significantly decreased to an average of 2500 tons a year. (Khavtasi, et al., 2010)

3.6.2 Fisheries and aquaculture in Georgia after independence (1991-2000)

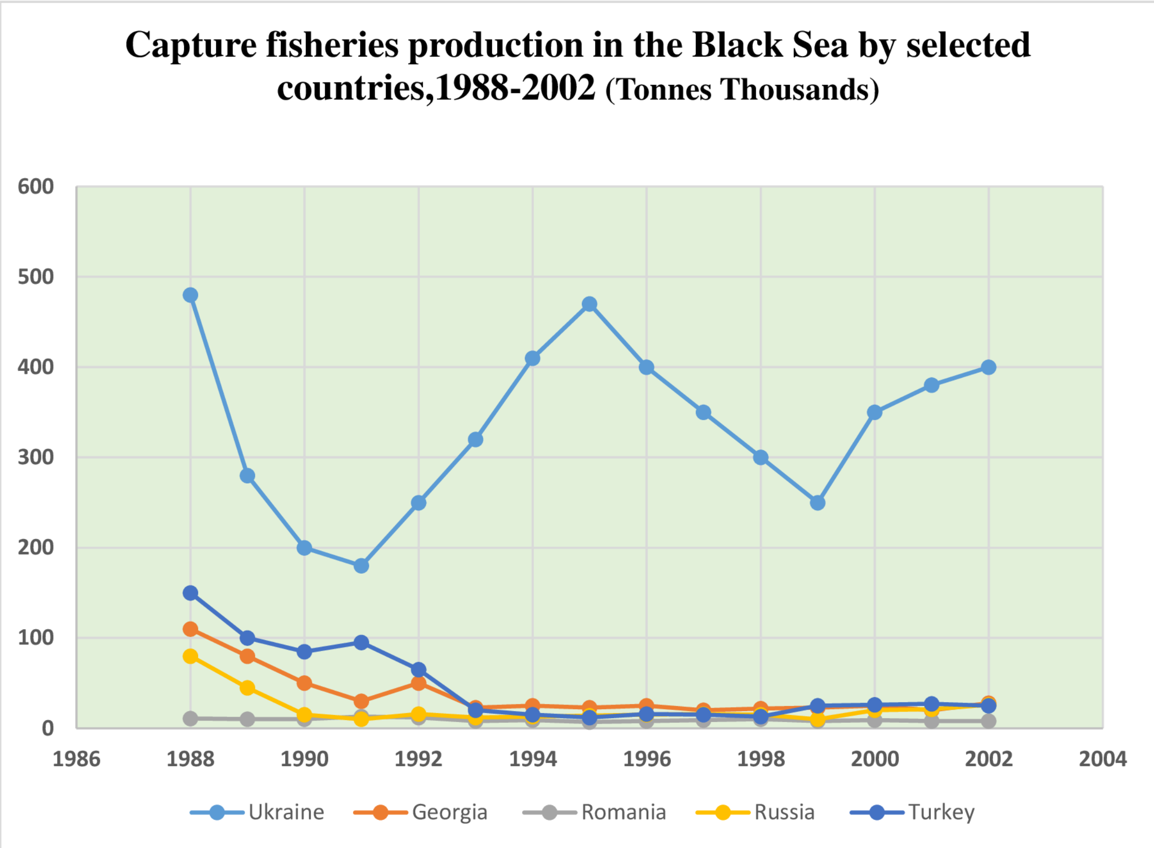
Georgia's marine fishing fleet is small. It consists of 36 medium-sized seiners, which were all constructed during the Soviet period. No significant modernization of the fleet has taken place since independence in 1991 and many of the vessels are in a bad condition because of lack of funds for maintenance and repair. There are also an estimated 324 small-scale fishing vessels involved in coastal capture fishery activities; these are equipped with seine nets, gillnets, bottom lines, cast nets and fishing rods. (FAO, 2003)

From 1991, the difficult economic and social situation in the country, lack of financial resources, inflexible banking and credit policies, and loss of the former USSR consumer market all had an extremely negative impact on the Georgian economy in general and especially on the fishery sector. The ocean-going fishing fleet was largely sold to Ukraine and the remainder of the fleet appeared to be non-profitable since access to fuel was restricted (because of high prices), as was availability. Container materials, nets and other gears and facilities for vessel maintenance were similarly limited. All fisheries production in Georgia declined rapidly between 1988 and 1995. In the year of independence (1991) production was still around 61 000 tonnes, while this figure went down to 3 800 tonnes in 1995. In 1992-1993 oceanic fishing by the Georgian fleet came to a halt. It is generally estimated that annual fisheries production between 1996 and 2002 was around 2 500 to 3 000 tonnes, although some maintain that the actual production levels were as low as 1 500 tonnes in 1999. (FAO, 2003)

The fact that not only Georgia's capture fisheries production declined in the late 1980s and early 1990s, but also that of some of its neighbouring countries, is depicted in Figure 3. The figure shows that capture fisheries production in the Black Sea decreased considerably from 1988 to 1991 from almost 796 000 to 201 000 tonnes. Over this period, catches from Turkey, Ukraine, the Russian Federation and Georgia all had a declining trend. However, from 1992 onwards it seems that Turkish catches increased again to above 250 000 tonnes annually, while those of other Black Sea countries continued to be below 50 000 tonnes. It was only in 2001 that the Ukrainian Black Sea fishing fleet achieved a catch similar to that of 1990. (FAO, 2003)



Source: *FAO FishStat*



Source: *FAO FishStat*

As the result of degradation of fish reproduction farms, the fish-breeding industry has switched from an intensive aquaculture into extensive fish-breeding, which has led to a reduction in the profitability of waterbodies and fish farms. Production of commercial fish in internal- waters was reduced from 4000-5000 t to 300-500 t annually. (Importance of the Ecosystem Approach to Fisheries in Georgia, 2014)

In turn, the decline of the fishery industry in internal waters and the reduction of fish productivity has had a major impact on marine fisheries, resulting in increasing public demand for marine bio-resources and leading to a serious deterioration of the ecosystem of the sea fishing industry. Presently the level of studies related to assessment of marine fish stocks and designation of fishing quotas has been weakened, and the trend is towards industrial/mass legal fishing with incomplete licensing, leading to a surplus consumption of sea biological resources (mostly involving expensive and rare species). Furthermore, fishing gears and fishing vessels have become outdated and illegal fishing methods have become more widespread, using various mesh-size gill.

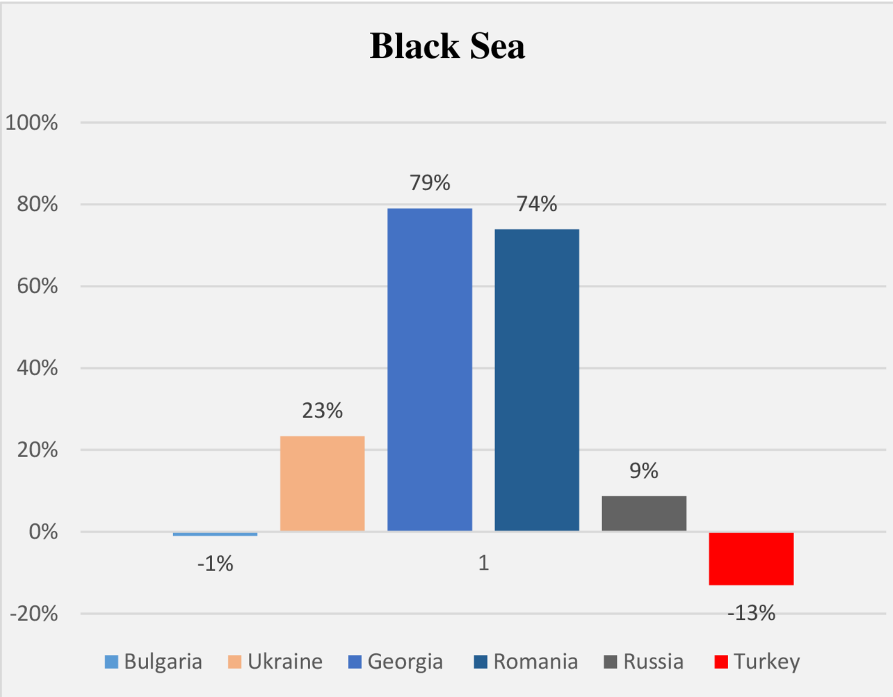
Nets, trap nets, screen-type and spider-type nets, seine and purse nets, and prohibited non-standard pelagic and bottom trawls. Along with excessive catch, the cases of abandoned nets and gears have increased, causing uncompensated damage to the ecosystem and especially to ichthyofaunal and marine mammals. (The Channel Catfish in Georgian Aquaculture, 2013)

3.7 Regional overview

Fisheries are at the heart of Black Sea life. From food security to family livelihoods, from economic growth to ecosystem services, so much in the region depends on the effective and sustainable management of its rich marine resources.

In the Black Sea, significant increases in landings from Georgia (79 percent, mostly due to fluctuations in anchovy catch) and Romania (73.9 percent) are offset by a 13 percent reduction from Turkey. (FAO, 2020)

Percentage variation between total landings recorded over 2014–2016 and total landings recorded over 2016–2018



Source: www.fao.org

The recent overall increase in catch in the Black Sea, coupled with generally stable fishing effort, reflects a modest but welcome inversion of the negative trends in the status of fishery resources in the region. For fisheries to continue playing their critical socio-economic role in the face of climate change and increasing human pressures on the marine environment, efforts toward rebuilding stocks to allow them to produce their maximum sustainable yield (MSY) are essential and require effective management.

The composition of the region's total catch has varied over time, in some cases due to reduced stock biomass, in other cases due to the adoption of management measures. This variation is evident in changing trends in the landings of priority species:

- Small pelagic: large fluctuations, well down from historical peaks of the 1980s.
- Demersal species: decreasing landings of European hake, whiting, Norway lobster, turbot, sole.
- Molluscs and crustaceans: generally increasing landings of cuttlefish, rapa whelk, spot tail mantis shrimp, deep-water rose shrimp, blue and red shrimp, giant red shrimp.

Catches of species of conservation concern, such as the European eel and the piked dogfish in the Black Sea have declined steeply to near zero in recent years, likely a reflection of both the critical state of these resources and the measures taken to minimise any further impact on them from fisheries. (FAO, 2020)

Mediterranean and Black Sea capture fisheries contribute importantly to regional economies, generating direct revenues, driving wider spending and providing crucial jobs. Over the whole region, one in every 1 000 coastal residents is a fisher. But some fisheries – particularly small-scale ones – offer uncertain livelihoods, and as the COVID-19 pandemic has shown only too clearly, the sector requires a strong social protection framework in order to ensure its resilience to shocks. Overall, 2018 revenue figures have increased by approximately USD 300 million since 2016:

- Mediterranean: USD 3.4 billion
- Black Sea: USD 251 million

Total direct fishery revenue: USD 3.6 billion. The wider economic contribution of fisheries in the region, including both direct revenue and indirect impacts, is estimated at USD 9.4 billion. (FAO, 2020)

Total European production was 3 409 288 tonnes which compares to a global total of 114 508 042 tonnes. Aquaculture activities were restricted to fish and mollusc production as aquatic plant and crustacean rearing were negligible, and production was dominated by coastal marine activities. Sub-regional differences were significant, with wide differences in the culture systems used throughout Europe while marine aquaculture was particularly underdeveloped in Eastern European countries. (FAO, 2020)

Aquacultural production 2018 in Europe

Sub-Regions	Tones	Share of Europe Total (%)	Share of World Total (%)	Share of World Fish/Shellfish Total (%)
Eastern Europe	360568	10.6%	0.31%	0.50%
Northern Europe	1756994	51.5%	1.53%	2.45%
Southern Europe	1013750	29.7%	0.80%	1.41%
Western Europe	277976	8%	0.24%	0.39%
Europe Total	**3409288**	**100%**	**2.98%**	**4.75%**

Source: www.fao.org

The European Union (EU) represented the largest single market for fish and fish products, followed by the United States of America and Japan; in 2016 these three markets together accounted for approximately 64 percent of the total value of world imports of fish and fish products. Over the course of 2016 and 2017, fish imports grew in all three markets as a result of strengthened economic fundamentals. (FAO, 2020)

Top 3 commercial species by value: Black Sea

European anchovy	$	275,784,853.00
Whiting	$	19,658,866.00
Horse mackerel	$	19,578,874.00

Source: www.fao.org

In the employment market, Black Sea fisheries provide 80 000 on-board jobs; adding other fisheries-related employment along the value chain, the estimated total reaches 785 000 jobs. All current workers are ageing: almost half are over 40, and only 17 percent are under 25. Proactive support will be needed to ensure a skilled workforce remains available in the future. (FAO, 2020)

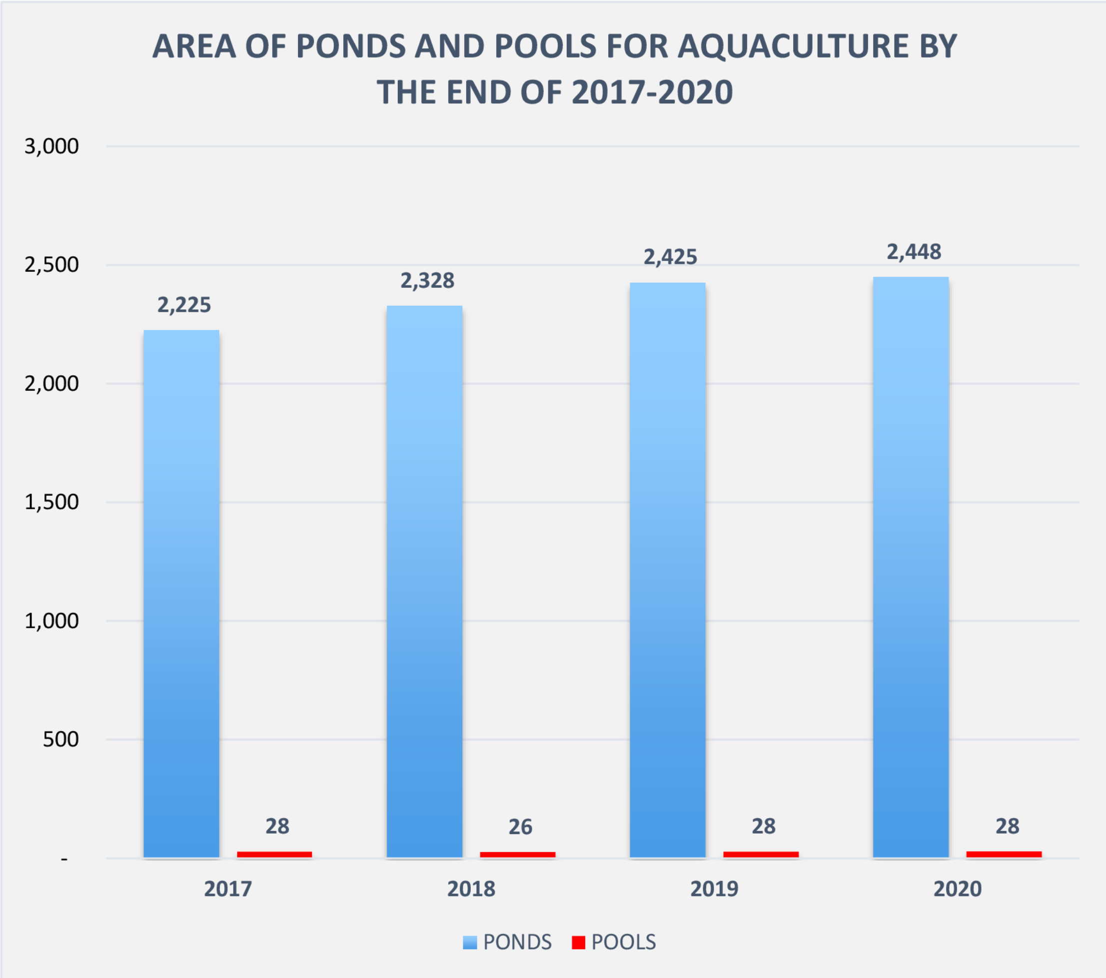
4. Practical Part

4.1 Fish production in Georgia

As a result of the nature and climate, conditions of Georgia, fresh water fisheries are mainly divided into two zones: mountains and valleys. There are cold water fish farms in mountain zones and warm water types in lowlands. The species of fish grown in warm water farms are mainly carp, silver carp, white grass carp and etc. In the highland areas, which consist of cold water-type pools, Rainbow trout are mainly used in farms. Pool farm fishing is divided into complete and incomplete systems. In complete systems the fishes are raised in full cycles - starting from spawning (reproduction) and ending with commodity fish. In case of incomplete systems the farm takes the larvae and conducts just feeding within the farms, or is producing larvae and selling it to other farms. (Economists, 2015)

There are rather contradictory data available about the physical state, number and total area of fish farms of Georgia. Almost all related reports agree that the physical state of the farms is rather poor owing to the lack of investments in maintenance and development which are explained by the shortage of financial resources and management skills of new owners. Regarding the actual number and the total area of fish farms, statistics show significant differences between present and earlier data. According to current statistics, there are 41 fish farms in the country covering a total area of 2 450 ha. (Khavtasi, et al., 2010)

In 2006 FAO reported a total of 86 fish farms, out of which 6 were specialized in fish propagation. The total area of 10 fish farms was about 3 162 ha. The significant difference may derive from the simple fact that earlier statistics also included some lakes and reservoirs where culture based fisheries were carried out. (Khavtasi, et al., 2010)



Source: www.geostat.ge

- Fish ponds

A large part of the Georgian's fish culture production relies on the use of freshwater ponds which hold and exchange water, receive fertilizer or feed, and allow for holding, rearing and harvesting of fish. The proper preparation and construction of such ponds and their associated structures are essential for successful fish farming. Some of good ponds should be inexpensive to construct, easy to maintain and efficient in allowing good water and fish management.

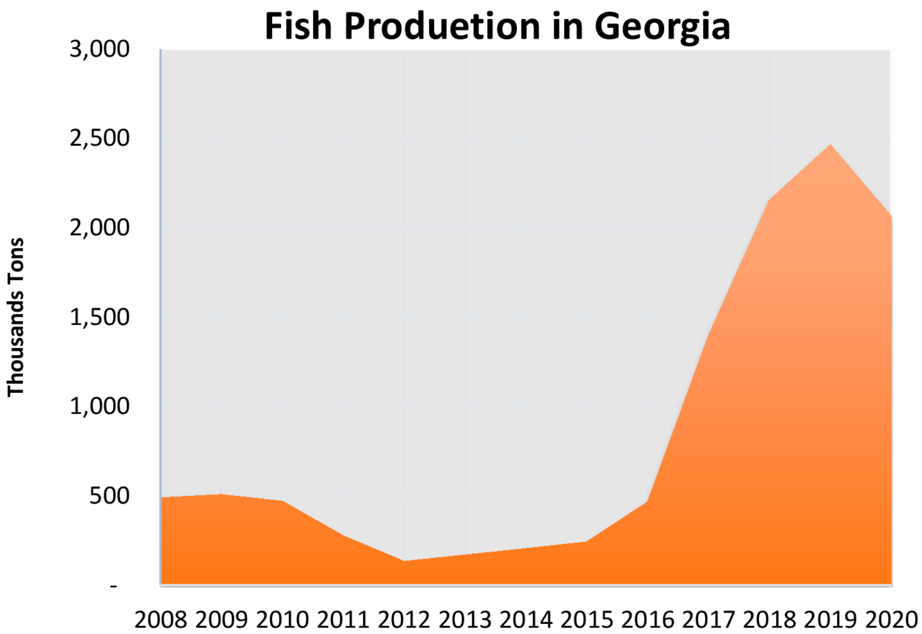
There are many kinds of fish ponds, the following are the main features and structures associated with them in general:

- **Pond walls or dikes**, which hold in the water;
- **Pipes or channels**, which carry water into or away from the ponds;
- **Water controls**, which control the level of water, the flow of water through the pond, or both;
- **Tracks and roadways** along the pond wall, for access to the pond;
- **Harvesting facilities** and other equipment for the management of water and fish.

It is important that a fish pond is defined as an artificial structure used for the farming of fish. It is filled with fresh water, is fairly shallow and is usually non-flowing. Tidal ponds, reservoirs, storage tanks, raceways and fish farm tanks are not included. (FAO, 2021)

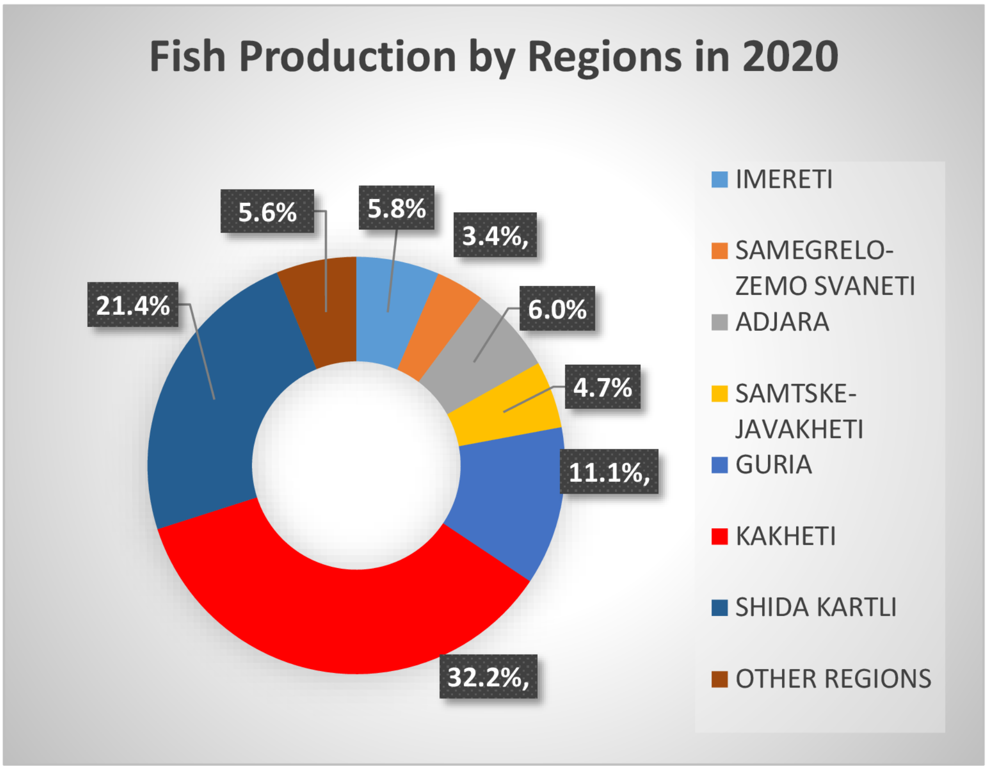
- Fish pools

It is not a large part of the Georgian's fish culture but it has also important role on Georgian aquaculture. A lot of fish farms will raise fish in pools because it is the



Source: www.geostat.ge

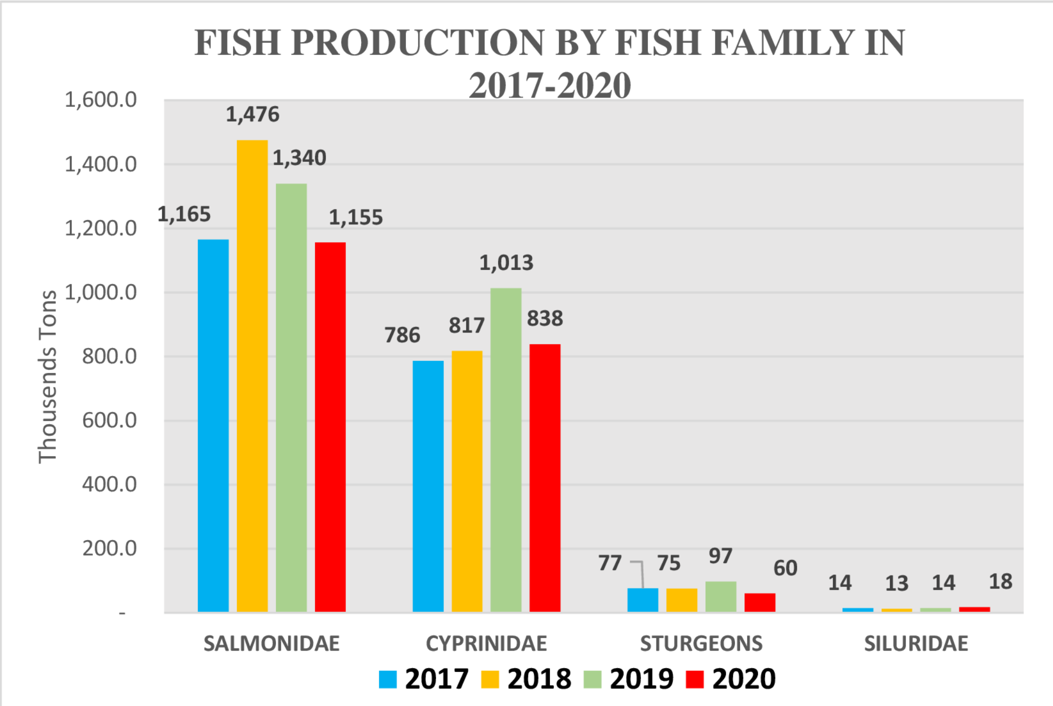
Cheapest way to create and maintain a pond environment. It has low influence of Georgian aquaculture but fish pools have an influence of fish production.



Source: [*www.geostat.ge*](http://www.geostat.ge)

The rainbow trout is the most common fish in pools and ponds, which belongs to the salmon family. It consists 61% of the total production. 44% of total rainbow trout production comes from Shida Kartli. The low rate of diversification of different species of fish produced in Georgia and the high rate of rainbow trout dominance are due to several factors. First, it should be noted that trout are cold-water fish, and Mountain Rivers creates a favourable condition for the production. Therefore, it is easier for farmers to adapt to natural conditions rather than to create a favorable environment for fish. In addition, the market demand for rainbow trout is quite high. This is evidenced on the one hand by the fact that producers have no problems with sales, and on the other hand by the fact that the share of rainbow trout in imported fish is quite high. Another important factor is that trout are easier to breed than other species of fish. (EUGEORGIA, 2021)

The second most widespread species of fish is carp, which occupies about 18% of total aquaculture production. Carp is most common in Kakheti region. (EUGEORGIA, 2021)



Source: www.geostat.ge

At the end of 2020, the percent of total volume of fish in waterbodies used for aquaculture increased by 14.7 percent compared to the previous year and amounted to 2 929.7 tons. Of which 60.2 percent was Cyprinidae, 26.1 percent - Salmonidae, 12.5 percent – Sturgeon, while 1.2 percent was Siluridae.

4.1.1 **Fish consumption in Georgia**

Fish consumption levels in Georgia are low. It is estimated by the Department of Statistics that annual per capita consumption is around 7 kg. However, other sources estimate that consumption of fishery products is less than 2 kg (live-weight equivalent) per capita per year at present. By comparison, average per capita consumption was stable at about 19 kg during the 1980s. MEFRI recently carried out some research on the demand for fishery products and subsequently estimated that current demand is between 30 and 35 kg per capita per year. Per capita consumption in coastal areas appears to be higher because of better access to fresh products and the wider availability of fish.

In Georgia there is no tradition of consumption of molluscs and aquatic plants. Before independence, most fishery products sold in Tbilisi were in frozen form. Frozen fish is still one of the main products and chosen by a sizeable proportion of the population, although preference is gradually being given to fresh products.

At present fish is sold fresh, frozen, salted and smoked and as balik (fish products) in the city markets, on the Sarpi-Psou highway and on the Red Bridge in Tbilisi. A considerable proportion is sold to consumers at landing sites in or near coastal towns.

The current domestic demand for fresh anchovy is estimated at 440 tonnes per year. This equals the catch of around 55 fishing days by the Poti fishing fleet. During the fishing season some 8 tonnes are marketed each day - about 3 tonnes in Adjara and 5 tonnes in Poti. This means that of a total catch of 9 000 tonnes of anchovy, less than 5 percent currently reaches the domestic market because of lack of demand for fresh anchovy. (FAO, 2003)

Limited landings (in terms of volume) of commercially valuable species with high market demand and the abundance of small-sized fish with low market demand create a great discrepancy between supply and demand in Georgia. The current low production levels of aquaculture and inland capture fisheries cannot supply the market with sufficient produce of carp, trout, vendace, catfish and other freshwater and brackish water species that were in high demand in earlier decades and apparently still are.

There is evidence that much of the population prefers larger-sized frozen fish, such as mackerel, scad, hake, captain fish, salmon and sturgeon, which form a considerable part of imported frozen fishery products. (FAO, 2003)

4.2 International trade

International trade allows countries to expand their markets and access goods and services that otherwise may not have been available domestically. As a result of international trade, the market is more competitive. This ultimately results in more competitive pricing and brings a cheaper product home to the consumer. There are the key takeaways:

- International trade is the exchange of goods and services between countries.
- Trading globally gives consumers and countries the opportunity to be exposed to goods and services not available in their own countries, or more expensive domestically.
- The importance of international trade was recognized early on by political economists such as Adam Smith and David Ricardo.
- Still, some argue that international trade can actually be bad for smaller nations, putting them at a greater disadvantage on the world stage.

International trade was key to the rise of the global economy. In the global economy, supply and demand and thus prices both impact and are impacted by global events. (HEAKAL, 2021)

Given the small and open nature of the Georgian economy, continuously pursuing integration with global markets through export-driven growth and the diversification of exported goods to include higher value-added products is the fastest route to increased prosperity. To fully utilise the opportunities presented by the Deep and Comprehensive Free Trade Agreement (DCFTA) with the European Union, a number of challenges must be addressed. Foreign investments could serve as facilitators for penetrating markets in the European Union and beyond if the declining trend in Greenfield investments can be reversed. Specific sectors offer diverse sets of opportunities, but face trade distinct challenges, both for potential investments and for scaling up exports. Advancing logistics and infrastructure, both physical and digital, remain crucial for boosting external competitiveness. (EIB, 2021)

Georgia's prime geographical location as a transit region in Eurasia is held back by the relatively poor transport infrastructure and quality of logistics which hamper integration with external markets as well as internal connectivity. Investment in maintenance and new projects in the transport sector, especially in rural areas, are key to accelerating growth and diversifying the private sector. Looking at domestic enabling infrastructure, needs have been detected in the water supply segment, sanitation facilities and waste management, particularly in rural areas. Access to information and communications technology infrastructure compares favourably to regional peer countries. Nonetheless, from an inclusion perspective, there are still clear differences in access to digital infrastructure according to gender and geographical location. Finally, yet importantly, healthcare access and quality need investment. (EIB, 2021)

After independence in 1991 year, Georgia had started to find other markets for their products and services. It was difficult time for country because its economy was dependant only Russian and post-soviet courtiers markets. Georgia was trying to export more and more products and services every year but since 1991 it has negative trading balance. The same problem has fish production industry. Starting from 2011 year Georgia has increased exported fish products for commodity H3 (fish and crustaceans, molluscs and other aquatic invertebrates) and H1604 (fish and crustaceans, molluscs and other aquatic invertebrates). it reached 6.8 million $ USD but it is not enough to get positive trading balance. For example, Trading balance in 2011 was -31 million $ USD, but in 2020 year it had the just the lowest difference -25 million $ USD.

Trading balance for H3 H1604 commodity in 2011 -2020 years

Years	Export	Import	Trading Balance
2011	3,261,930	35,234,264	-31,972,334
2012	2,270,209	38,117,287	-35,847,078
2013	5,370,290	40,828,000	-35,457,710
2014	8,559,564	36,669,876	-28,110,312
2015	8,522,844	34,284,174	-25,761,330
2016	11,298,908	36,609,981	-25,311,073
2017	2,784,638	37,431,784	-34,647,146
2018	2,436,166	30,070,781	-27,634,615
2019	2,992,383	34,612,995	-31,620,612
2020	6,887,219	32,122,232	-25,235,013

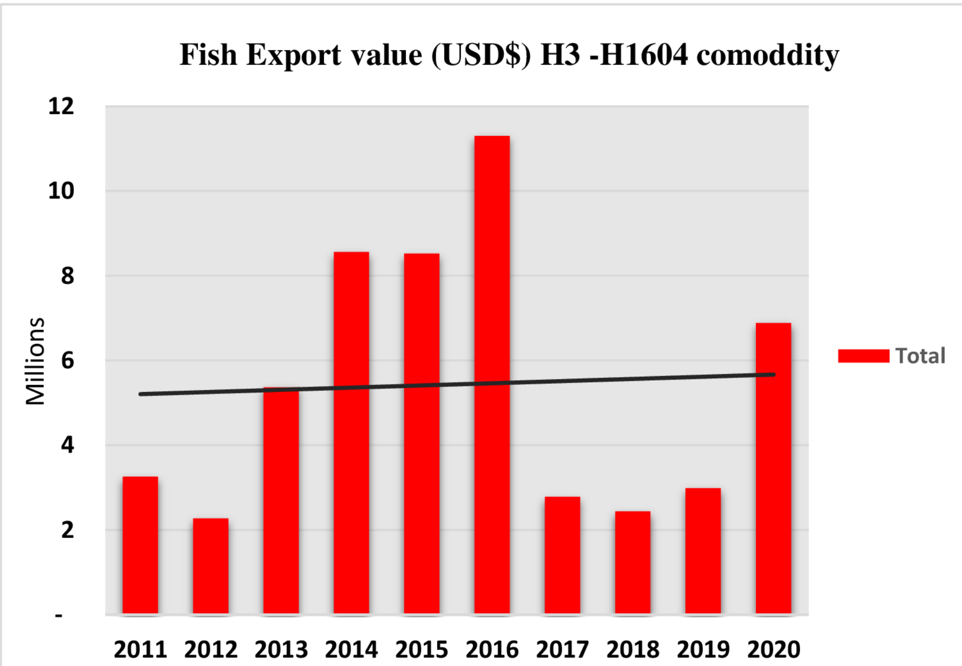
Source: own processing based on the comtrade data

4.2.1 Fish exports from Georgia

Georgia's economy expanded rapidly during 2004 to 2020 because of responsible macro policies, intensifying global integration and an attractive business environment. In 2014 Georgia signed Association agreement with EU and since then country has possibility to export more and more products and services in the European market.

Free trade agreements with global trade partners, such as the EU and China, position Georgia well to attract foreign direct investment (FDI). However, years of sustained growth had a limited impact on quality job creation, and many Georgians continue to rely on low-productivity employment, especially in agriculture and the informal sector. Export volumes have increased but exports remain unsophisticated, and firms face low growth and survival rates. These outcomes indicate an incomplete structural transformation and an economic divide among regions. (Worldbank, 2021)

Georgia fish production industry had a very positive impacts of new agreements with international trading partners. In 2016, the fish export had rapidly increased and treached the maximum value $ 11.3 million USD during 2011 to 2020. In 2017, the political instability caused huge negative impact of fish production, the value of fish export dropped by $ 8.5 million USD and it continued for 2 years.



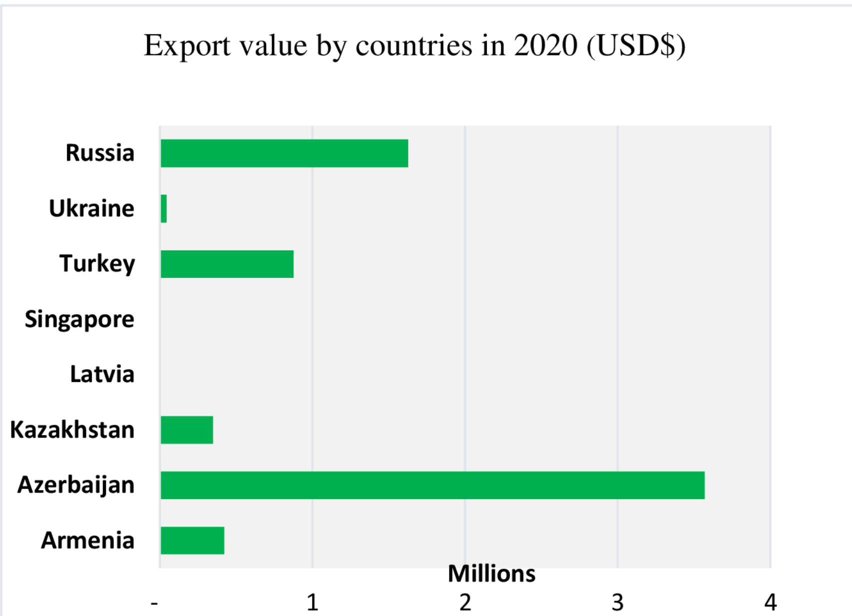
Source: own processing based on the comtrade data

According the International Trade Statistics Database the value of exports of Fish products from Georgia has reached $ 6.88 million USD in 2020. (H3 and H1604 commodities) also it was important that sales of commodity H3 increased significantly and it went up by 210% compared to 2019. In 2020 the export of commodity H3 had reached $ 4.65 million USD and the export of commodity H1604 had a value $ 2.23 million USD.

Exports of commodity group (H3 – H1604) amounted up to 0.261% of total exports from Georgia. The share of commodity group H3 in total exports from Georgia increased by 0.19% compared to 2019.

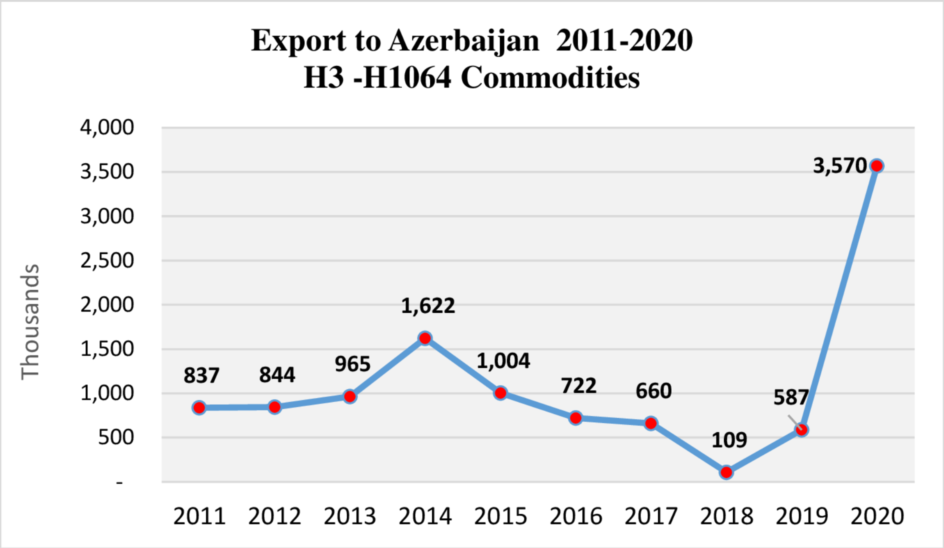
Top export destinations of Fish export commodity (H3 – H1604) :

- Azerbaijan - 51.8% (3.5 million US$)
- Russia - 23.6% (1.62 million US$)
- Turkey - 12.7% (876 thousand US$)
- Armenia - 6.1% (421 thousand US$)
- Kazakhstan - 5.05% (348 thousand US$)
- Ukraine - 1 % (44 thousand US$)



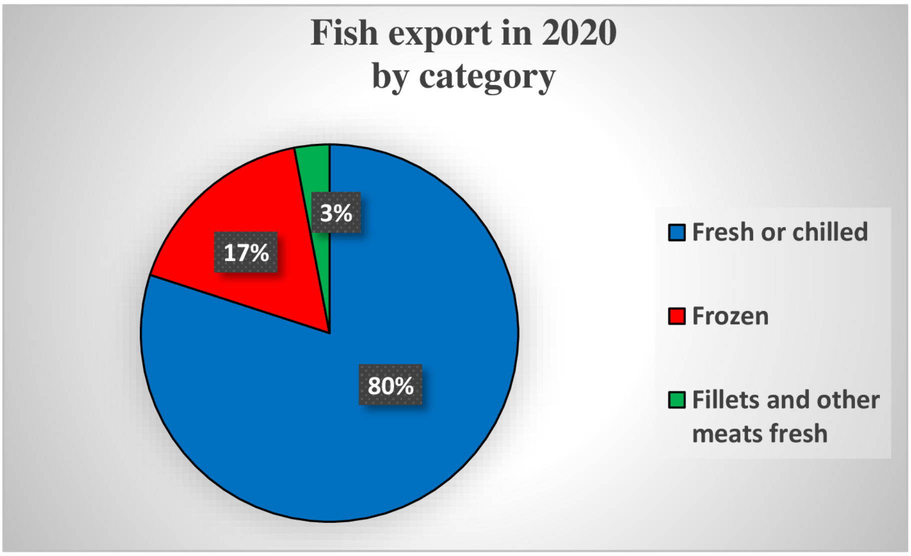
Source: own processing based on the comtrade data

Azerbaijan is the most important trading partner to Georgia. Staring from 2011 export to Azerbaijan increased more than $2.7 million and it has reached $3.5 million in 2020.



Source: own processing based on the comtrade data

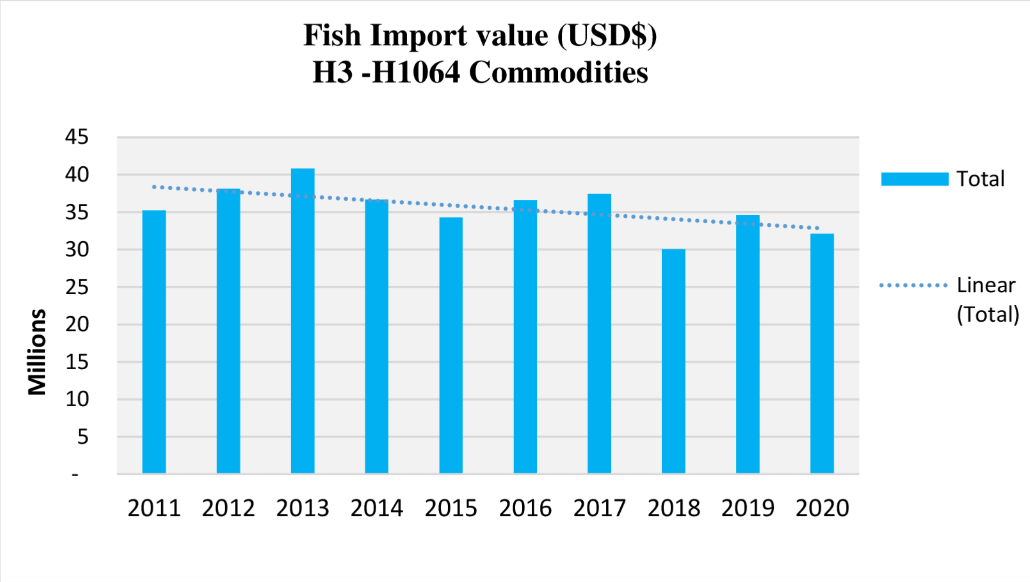
In 2020, Georgia exported 4 thousand tons of fish. The most exported category was fresh and chilled fish (3.2 thousand tons), then frozen fish (680 tons) and the last one Fillets and other meats fresh (120 tons).



Source: own processing based on the National Statistics office of Georgia data

4.2.2 Fish imports in Georgia

Fish import to Georgia has no significantly changes from 2011 to 2020. In 2020 the total value of fish imports for commodity H3 and H1604 had reached $ 32.1 million USD (H3 commodity had $ 22.1 million USD and H1604 had $ 10 million USD) in 2020. It had decreased 0.76% compare to 2019.

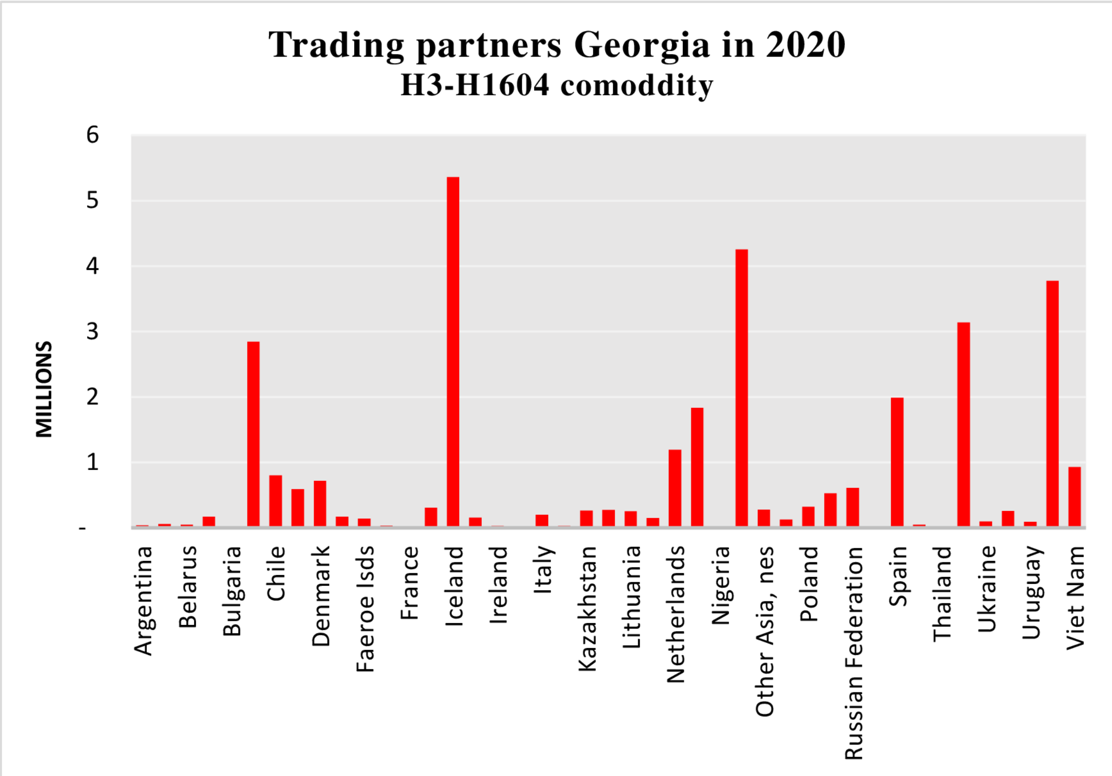


Source: own processing based on the comtrade data

The biggest value of fish import Georgia had in 2013, it was $ 40.8 million USD and the lowers in 2018 ($10 million USD). For H3 and H1604 commodities Imports accounted for 0.368% of total import flow to Georgia (in 2020, total imports to Georgia amounted to $ 8.72 billion USD) and difference had 0.004% compared to 2019 (total imports to Georgia were had $ 9.51 billion USD).

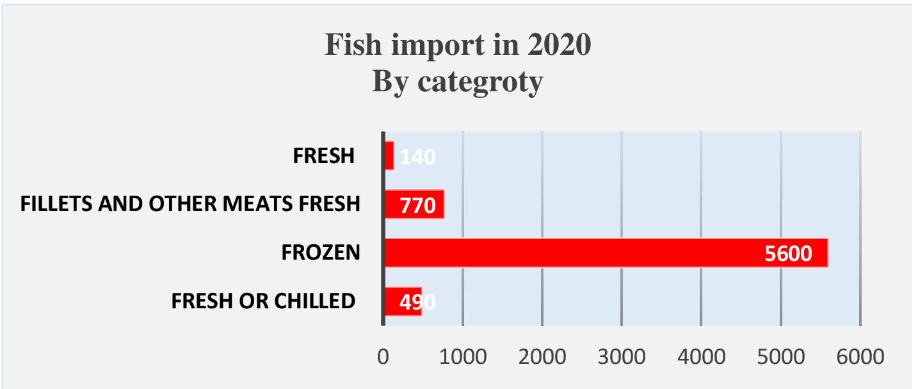
Top trading partners Georgia in 2020:

- Iceland - 16.7% (5.3 million US$)
- Norway - 13.2% (4.25 million US$)
- USA - 11.8% (3.77 million US$)
- Turkey - 9.8% (3.13 million US$)
- Canada - 8.9% (2.84 million US$)
- Spain - 6.2% (1.99 million US$)
- Netherlands - 3.7% (1.19 million US$)



Source: own processing based on the comtrade data

In 2020, Georgia exported 7 thousand tons of fish. The most imported category was frozen fish (80%), than fresh and chilled fish (11%), Fillets and other meats fresh (7%) and the last category fresh fish (2%).



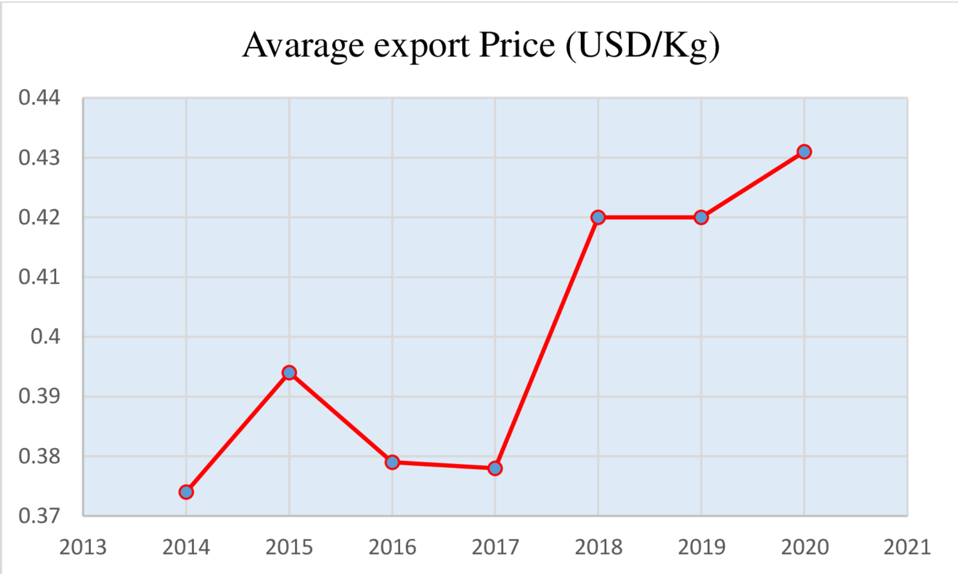
	Fresh or chilled	Frozen	Fillets and other meats fresh	Fresh
Tons	490	5600	770	140

Source: own processing based on the National Statistics office of Georgia data

4.2.3 Average export prices

In Georgia there are lots of fishe produt but some of are the most popular. For example the most popular fish products are fresh anchovies, Rainbow trout , carp.

The average export price of Georgian fresh anchovies has been quite stable, averaging $0.4 USD per kg over the five-year period with a narrow range of 0.05 cents. According to UN trade platform Comtrade, the total average export price of fresh anchovies was $2.2 per kg in 2020, which is about 5.4 times more than the Georgian price.



Source: own processing based on the comtrade data

In 2020 the average annual export price of 1 kg Rainbow trout at the gate of farm (producer price) amounted to 2.58 $USD, which is 1.5 times more than the global export price.

The average annual price of Common carp and Mirror carp equalled to 2.2 $US. The average annual price of Grass carp consisted of 1.8$ USD while the average annual price of Silver carp and Bighead carp amounted to 1.5$ USD. The average annual price of sturgeon and Siberian sturgeon amounted to 9.5 $USD and for Wels catfish – 4.1$ USD.

4.3 Balassa Index Calculation

The concept of revealed comparative advantage defined by Bela Balassa is widely in practice to determine a country's weak and strong sectors.

The Balassa formula explanation was mentioned in the theoretical part.

The Balassa Index Formula:

$$B = (xij / xit) / (xnj / xnt)$$

For the index calculation it is important to have Harmonized System (HS) codes.

For calculation fish production revealed comparative advantages by Balassa index it is necessary to take 2 commodities H3 and H16 (code 1604) in the year 2020.

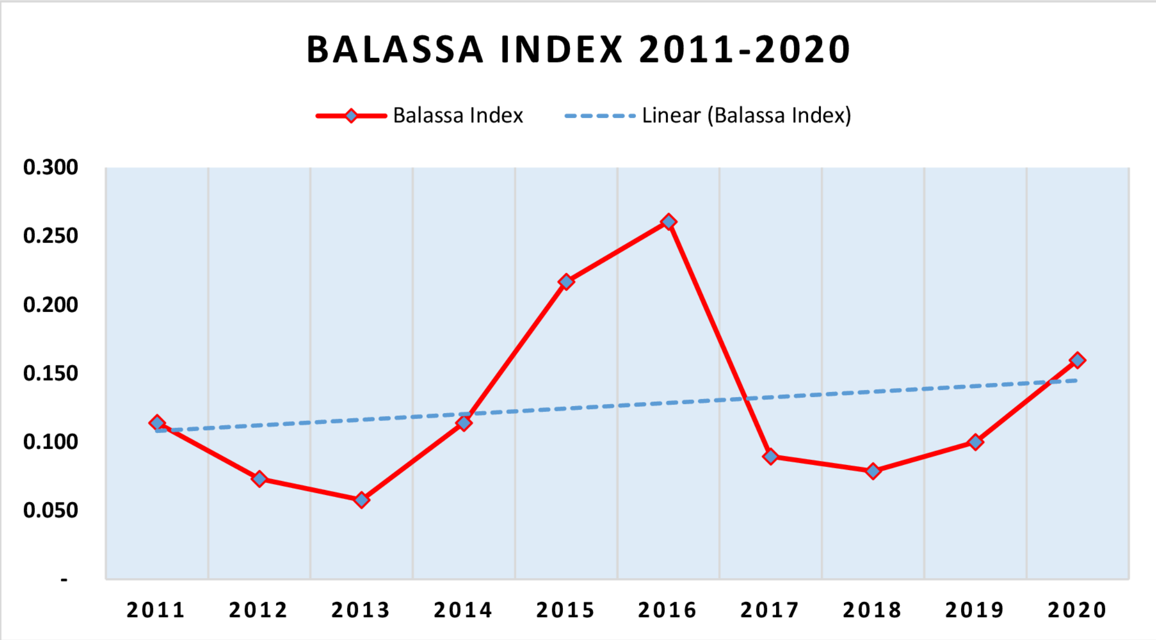
Export for commodity H3 and H1604 Georgia 2020: **6.9 million euros**
Total export for commodity H1-H16 (exclude H1604) in 2020: **318 million euros**
Percentage: **2.16%**

H3 and H1604 for global export in 2020: **124 billion euros**
Global Export in 2020: **916 billion euros**
Share: **13%**

B = (6,894,124 / 318,322,369) / (124,129,274,719 / 988,667,209,839)
B = **0.159**

The outcome is **0.159**. This is less than 1, which means that the Georgia has no an export revealed advantages for the fish production to the international trade in 2020.

Based on Balassa index analysis of fish production in Georgia has no Georgia production analysis



Source: own processing based on the comtrade data

According the calculation Georgia has revealed comparative advantages with main trading partners. For example with Armenia, Turkey, Russia Latvia, Ukraine and Kazakhstan.

COUNTRY	EXPORT (H3 and 1604)	TOTAL EXPORT	Percentage (%)	BALASSA INDEX
Armenia	54,409,693	28,311,000,969	0.1922%	11.03369
Kazakhstan	68,706,961	187,796,817,208	0.0366%	57.96012
Latvia	233,618,610	60,786,106,264	0.3843%	5.51745
Russian Federation	4,713,680,264	1,348,415,875,283	0.3496%	6.06604
Turkey	1,047,540,992	678,631,759,108	0.1544%	13.73741
Ukraine	50,587,650	196,923,195,675	0.0257%	82.54564
World	124,129,274,719	988,667,209,839	12.5552%	0.15985

Source: own processing based on the comtrade data

According the calculation Georgia has comparative disadvantages on the Global market because his index is less than 1 (0.159) (B<1).

4.3 Lafay Index Calculation

Compared with Balassa index, Lafay index can measure the comparative advantage and the intra-trade fish production sector bewtween the best trading countries. There is a formula:

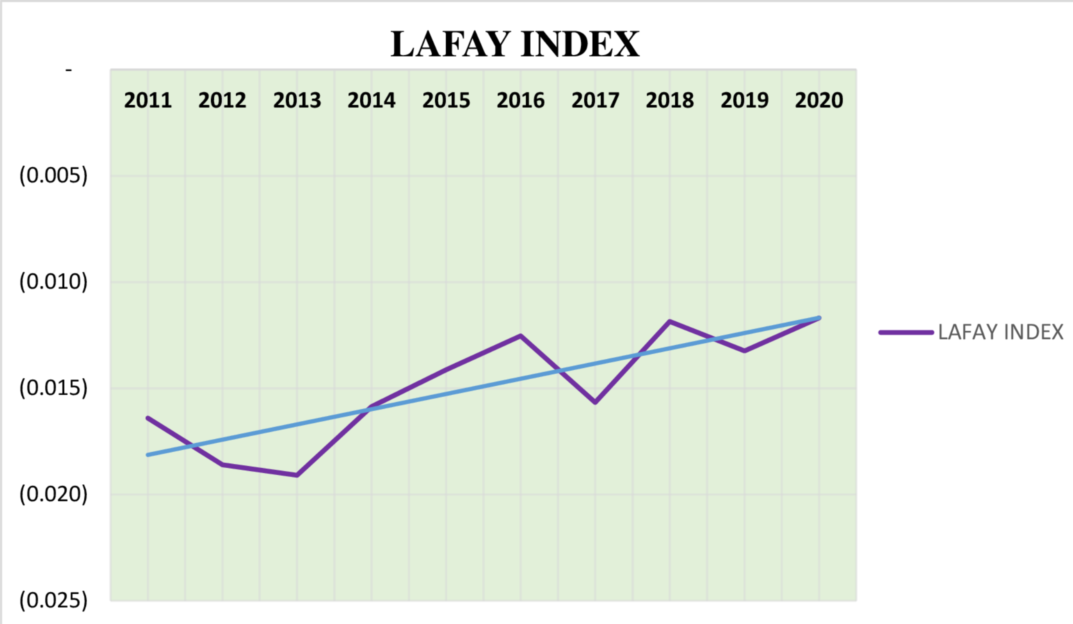
$$LFI_j^i = \left(\frac{x_j^i - m_j^i}{x_j^i + m_j^i} - \frac{\sum_{j=1}^{N}(x_j^i - m_j^i)}{\sum_{j=1}^{N}(x_j^i + m_j^i)} \right) \frac{x_j^i + m_j^i}{\sum_{j=1}^{N}(x_j^i + m_j^i)} * 100$$

xi j = exports of region i of a product in economic sector j to the rest of the world;
mi j = imports of a product in economic sector j from the rest of the world to region i;
N = is the number of traded goods.

YEARS	LAFAY INDEX
2011	-0.016
2012	-0.019
2013	-0.019
2014	-0.016
2015	-0.014
2016	-0.013
2017	-0.016
2018	-0.012
2019	-0.013
2020	-0.012

Source: own processing based on the comtrade data

Trend line from show that Georgia index value was increasing from 2013 to 2016, then it had decreased for few years. In 2020 I had small increase not it is not enough to have a revealed comparative advantages to the international market. Lafay index shows that during this period Georgia never had comparative advantages because the index was less than 1.



Source: own processing based on the comtrade data

Based on the Lafay index analysis, Georgia has no comparative advantages between the most trading partners as Ukraine, Turkey, Kazakhstan and others.

COUNTRY	EXPORT	IMPORT	BALANCE	LAFAY INDEX
Armenia	37,628,750	4,900,362	32728388.00	-1.52
Kazakhstan	5,592,581	2,688,390	2904191.00	-5.55
Latvia	1,398,283	2,034,026	-635743.00	-8.87
Russian Federation	66,529,810	223,962,513	-157432703.00	-0.10
Turkey	15,286,918	79,458,885	-64171967.00	-0.32
Ukraine	7,955,298	56,875,234	-48919936.00	-0.47
World	325,216,494	666,261,653	-341045159.00	-0.03

Source: own processing based on the comtrade data

5. Results and Discussion

Georgia have rich water resources which is one of the most important factors for the development of this sector. This is a reason why the country have opportunities to increase the fish production.

Despite the facilitating factors of natural resources, producers face lots of difficulties and challenges which is why the sector has a low development rate. The main challenges are:

- Knowledge deficit
- Laboratory studies
- Fish food
- Breeding problems

For the development of the fish production sector, it is very important to take care about all challenges which were facing producers. It is necessary to create some development long term plan to start solving problems step by step.

Georgian market is not small that's why the producers have motivation to start production just to meet local demand. Of course, this will be profitable for the private sector and will not be necessary to import such products which can be produced inside the country. This is where the role of the government is critically important. The government should actively start working on helping fish producers and attracting investments in this direction. One of the biggest issue in aquaculture sector is that there is not professional laboratories studies which is crucial for fish producers. The government should find the way to establish laboratories and equipped with the modern technologies.

Long term development plan combined with knowledge, experience and new technology will facilitate access to important resources for aquaculture producers, which will become an accelerator of the development of the sector.

5 Conclusion

Fish production in Georgia had significanlty increased from 2011 to 2020 years. Fish producers had changed their production attuide during the these ten yars but still it is not successful sector in the country. But there are lot of opportnites to develope the fish production sector.

Firstly, it is important to understand the main challangies in this sector. The first and the most importan is that there are no prfesional laboratiries studies in the country. For the development of aquaculture it is important to have a full range of laboratories, which will have the appropriate material and technical base to respond to customer requirements. Also, there are some important challangues such as missing profesional knowlidge,fish food, breeding problems, which should not be ignored. If all these problems would not be solved there is no a chance to develope the sector.

Secondly, Georgian had negative trading balance in the fish production sector. In 2020, negative trading balance reached - $25,2 million USD (for commodity H3 and H1604), which is the lowest figure from 2011 to 2020 years, but it is huge difference between fish export and import (for commodity H3 and H1604.)

Thirdly, based on the Balassa index analysis for comodity H3 and H1604 Georgia didn‘t have any reavealed coparative advantages to the internation market from 2011 to 2020. After calculation the balassa index in 2020 year, Georgia got **0.159** index. It lower than 1(B<1). It proves that georgia had comparative disadvantages to the globa market. But it is important to meantioned that Georgia had comparative advatages with the most trading partners, with Ukraine, Armenia, Kazachistan Turkey and Lativia.

In addtion, after calculation Lafay index (for commodity H3 and H1604) Georga got index -0.03, which is lower than 1 (LFI<1). It confirms that Georgia did not have any comaparative advanateges to the international and neighbourhood market.

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7 Appendix

➢ Calculation Balassa index for Georgian fish production

Years	Export (H3 and 1604)	Total (H1-H16)	Percentage (%)
2011	3,310,330	216,595,627	0.02
2012	2,359,245	241,902,032	0.01
2013	2,697,357	367,511,436	0.01
2014	4,540,885	320,910,374	0.01
2015	8,624,536	286,279,464	0.03
2016	11,331,069	314,160,806	0.04
2017	2,798,617	247,309,211	0.01
2018	2,452,759	252,295,006	0.01
2019	3,032,439	244,808,115	0.01
2020	6,894,124	318,322,369	0.02

Source: own processing based on the comtrade data

- Calculation Balassa index for World fish production

Years	Export (H3, 1604)	Export (H1-H16)	Percentage (%)
2011	108,878,734,690.00	812,578,387,223.00	0.13
2012	109,525,532,263.00	818,376,189,218.00	0.13
2013	118,438,303,842.00	857,511,478,103.00	0.13
2014	125,174,561,929.00	878,134,440,627.00	0.12
2015	112,272,221,003.00	783,473,981,520.00	0.14
2016	120,221,065,308.00	787,288,175,013.00	0.14
2017	130,739,410,537.00	861,547,536,781.00	0.13
2018	138,454,984,399.00	882,792,925,561.00	0.12
2019	135,556,023,519.00	879,845,407,038.00	0.12
2020	124,129,274,719.00	988,667,209,839.00	0.13

Source: own processing based on the comtrade data

- Calculation Lafay index for Georgia 2011-2020

Years	Part 1	Part 2	Part 3	Part 4	LAFAY INDEX
2011	-0.8497	-0.0209	-0.8287	0.0002	-0.0164
2012	-0.8988	-0.0135	-0.8853	0.0002	-0.0186
2013	-0.8924	0.0052	-0.8976	0.0002	-0.0191
2014	-0.8110	0.0085	-0.8195	0.0002	-0.0159
2015	-0.6448	0.0051	-0.6498	0.0002	-0.0141
2016	-0.5666	0.0064	-0.5729	0.0002	-0.0125
2017	-0.8782	0.0071	-0.8853	0.0002	-0.0157
2018	-0.8715	-0.0059	-0.8656	0.0001	-0.0119
2019	-0.8598	-0.0160	-0.8438	0.0002	-0.0132
2020	-0.6882	-0.0192	-0.6690	0.0002	-0.0117

Source: own processing based on the comtrade data

- Harmonized System Codes

Harmonized System Codes
01-05 Animal & Animal Products
06-14 Vegetable Products
15 -Animal, Vegetable or Microbial Fats & Oils
16-24 Foodstuffs
25-27 Mineral Products
28-38 Chemicals & Allied Industries
39-40 Plastics / Rubbers
41-43 Raw Hides, Skins, Leather, & Furs
44-49 Wood & Wood Products
50-63 Textiles
64-67 Footwear / Headgear
68-71 Stone / Glass
72-83 Metals
84-85 Machinery / Electrical
86-89 Transportation
90-97 Miscellaneous

Source: www.fao.org