UiT The Arctic University of Norway

Faculty of Biosciences, Fisheries and Economics (BFE)

Is fisheries policy driving rural depopulation?

Exploring how the implementation of the quota management system has affected rural settlement structures in Iceland

Magnús Víðisson

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Takk kærlega fyrir Tromsø, þetta hefur verið ævintýri.

Magnús Víðisson

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Abstract

Iceland has been dependent on the ocean and the resources found within it for centuries. With greater technology and fishing effort in the past decades, overfishing had become a serious threat to the nation's largest commercial stocks. This development led to restrictions on the fisheries which later led to the implementation of the ITQ system. Fisheries in Iceland are conducted with sustainability in mind but there have been general assumptions that the social dimension has not gained from Iceland's current fisheries management system. As in, due to its structure it has led to depopulation within rural settlements.

This study will examine if there is a link between the implementation of the quota management system in the 1980s and depopulation in rural settlements in Iceland. This study will examine how landing patterns and quota share developments have changed regionally and how it could be linked to changes in fisheries policies. And it will attempt to answer if these factors link when it comes to depopulation in rural settlements in Iceland.

Keywords: Population development, ITQ, fisheries management, settlement structures, fisheries policy, depopulation, Iceland,

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1 Introduction

In Iceland, it is generally assumed that the population of rural areas have been decreasing since the quota management system was implemented in Iceland in the 1980s (Kristjánsson, 2020). The assumption is that people have been forced to move to larger settlements in Iceland after limitations were put on the commercial stocks. Fishermen could not fish as much as they wanted anymore, which lead to less employment security in many of Iceland's smaller settlements. Throughout history, fisheries have been important for Icelanders. This does not only apply when it comes to workers who are directly involved in the sector, such as fishermen and employees in fish processing plants, but also those who work indirectly in the sector. Indirect jobs include for example repairs of fishing gear, machinery repairs, landings of fish and transportation. This also extends to general community services like health care, police, postal service, education, accommodation, etc. These sectors often depend on people living in the settlements and those people are mostly directly or indirectly employed by the fisheries located there.

The countries involved North Atlantic fishing have been known to have effective quota management systems (Pitcher, Kalikoski, & Parmod, 2006). There have been though some exceptions to that; for example the mackerel dispute which is occurring as this is written (Spijkers, J., & Boonstra, W., 2017). These countries have similar quota systems which share the same goals. There are three key factors that the quota management systems in the North Atlantic focus on to be sustainable. That are the environmental, economic and social dimensions. Maximizing sustainability ensures that the commercial stocks being utilized should not be overfished to ensure healthy stocks for the future of fisheries. After being limited with quota management systems, fisheries have had to figure out how to maintain profits while fishing less of the stock they formerly relied on. This has resulted in better utilization of resources when it comes to byproducts and fresher products. Before the implementations of quota management systems fish was mostly caught for their fillets and the exact method of harvesting and processing was not a vital factor. But because of the quota management systems, fisheries products have become more valuable and due to that efficiency and profits have improved. Countries in the Northern Atlantic are known for quality seafood products. But according to some (Einarsson, 2016) the social factor has not been that lucky after the limitations were put on the commercial fish stocks. The social factor being geographical

distribution of landings, quota shares and population developments in rural coastal settlements in Iceland. Before the quota management system fishers could fish as much as they could carry in their vessels. After the limitations fishers were not able to fish the same amount they were used to before and therefore were not making sufficient amount to thrive anymore and therefor had to either look into alternative employment were they were located or relocate to find work elsewhere.

Fisheries have been vital for Iceland since settlement and are still very important for Iceland's economy today. Though the country has historically gone through periods of difficulty, fish has always been an available resource. But in recent times, with better technology, a more modernized fishing fleet and greater access to the resource, overfishing became inevitable. This applies not only in Iceland but also around the world. Limitation systems towards the exploitation or the resource had to be implemented if Iceland wanted to keep the commercial stocks healthy.

This research paper will attempt to discover if there is a link between depopulation in rural settlements in Iceland and the implementation of the fisheries quota management system. Most of the population in Iceland lives by the coast, and many of them live in coastal settlements. Throughout history, many of these towns have been dependent on fisheries. Of the three sustainability dimensions this research paper will examine how the social dimension has been affected by the limitations that were put on the fisheries by the quota management system. Later after the implementation the quota management system was made transferable without any geographical limitations. Quota can therefore be easily traded from settlements and regions.

This thesis will examine population development of settlements and regions before and after the implementation of the quota management system. The end goal is to discover if there is a link between the implementation and population development. Population development of settlements and regions data will be traced as far back as possible. This is to see if the population was increasing or decreasing before the implementation and see how development has afterwards progressed in settlements and regions, to clarify whether restrictions were the cause of migration. This research paper will investigate landings in regions, to visualize changes in where the fish has been landed throughout time. This is important to look into to see if there is a link between the implementation and geographical changes in landings by regions. The data

can tell if regions are increasing, decreasing or stable when it comes to flow of marine resources into the regions. It is also important to investigate how the distribution of quota shares has been developing regionally since the quota was made transferable. By examining how it has developed through time, relationships between population developments in different regions could be shown to exist.

This thesis will also try to answer the question if there are other factors driving depopulation of smaller settlements in Iceland. Those other factors would then be most likely linked to the general global trend towards urbanization. There are many causes for urbanization for example migration, commercialization, industrial growth, etc. People migrate from more rural areas to larger settlements and industrial areas because the chances of better employment prospects located there. Larger settlements offer better commercial returns and opportunities to the more rural settlements. Growth in industrialization is often the main reason for urbanization. There are also social factors of larger settlements that attract people to migrate there; a better standard of living, need for status, educational services, etc. For many there are a lot of social benefits living in larger settlements (Pawan, 2016).

1.1 Research questions

In recent years there has been depopulation in some rural settlements in Iceland. The population development of towns have shown that there is a rise in population in many settlements until up the 1980s but afterwards declined in size. Limitations on fisheries in Iceland has not been around for a long time. Not until in the last quarter of 20th century were limitations put on the fisheries. The implementation of the limitation systems in Iceland came around at a similar time smaller rural settlements started to decrease in population.

The questions that this research paper is going to attempt to answer is if the implementation of the ITQ system caused depopulation in rural settlements in Iceland. If by putting limitations on the commercial stocks and making the quota shares transferable affected regions and settlements with the result of depopulation within them. This research paper will attempt to answer if the ITQ system has affected regional changes in fisheries when it comes to landing patterns and quota share allocations regionally. The research paper will then examine if these factors link in anyway, was it caused by the implementation of the ITQ system that regional

fisheries changed and led to depopulation in rural settlements or can it be explained by some other factors.

The thesis will analyze if there is a link to be found between these factors. Population changes in rural settlements before and after the implementation of the quota management system will be studied and to understand geographical distribution of fisheries, development of regional quota shares and landing patterns will be examined. The landings will be examined how they've changed before and after the implementation and how quota shares have developed after they were made transferable.

Though the main focus of this paper is on the possible link between depopulation in rural settlement structures and the implementation of the quota management system, there are other factors which could have driven it. When analyzing the data, it is important to examine the Icelandic population as a whole and other factors that influence urbanization. For example the Route 1, which runs around the island and connects most of the inhabited places in the country, wasn't completed until the year 1974 (Iceland on the web, n.d.).

1.2 Methodology

To facilitate this research, data on population development in regions and settlements has to be collected and information on changes in geographical distribution of fisheries has to be gathered.

This thesis in is mostly quantitative in nature and the thesis is based mostly on statistical data. A lot of the data is retrieved from Statistics Iceland. Statistics Iceland is part of the National Statistical Institute of Iceland and was established in 1914. Statistics Iceland is an independent institution that answers under the Prime Minister's office. Statistics Iceland is the center of official statistics in Iceland and has a leading part in the organization, coordination and conduct of official statistics. Statistics Iceland collect statistical data about Icelandic society, process them and distribute back to the society. The dissemination of the statistical data contributes to an informed social debate and is a basis of democratic decisions in Iceland (Statistics Iceland, n.d.).

The data that was acquired from the website of Statistics Iceland where all their published data is released. Their population census data has been published in many parts, or each data set has

data from different years. There isn't any master data set which could show population developments from the first census to the most recent ones. So to be able to retrieve the population data needed for the research, the data sets had to be retrieved individually and put carefully together town to town and region to region. The population data used in the thesis is from 1911 to 2019. The period is chosen because the data available from Statistics Iceland starts to show population data for most settlements around 1911. The data goes further back but population data is quite arbitrary before 1911 as in not all settlements that are included have information before that time.

The statistics about landings in each region were though in one place and more easily accessible. But all data had to be put into visualized format and in this research there are graphs to make the data more understandable. The data for the landing statistics are available from 1982 to 2018. This is vital information because there is data available right before the implementation of the quota management systems and after.

The data for quota shares in regions was retrieved from the Directorate of Fisheries. The data for quota shares is published every fishing year or season in Iceland, which is from the 1st of September to the 31st of August. The first year of data, or the 1991 season, is though only from 1st of January to 31st of August. The data is though not published specifically for each region but for each settlement on Iceland. The data had to be put together by hand for each region by combining the quota shares in the settlements.

Correlation analyzes was not chosen for this research due to different time series in the data used and because of the differences in the variables used. While there could be ways to solve this, time constrains did not allow that.

The settlements covered in this thesis do all share the same geographical characteristics, or being located by the coast and located outside of the Capital region. There were 57 coastal settlements covered in this thesis out of 59. The coastal settlements of Hnífsdalur, and Borgarnes were not included. Population data for Hnífsdalur was limited and Borgarnes's location makes it hard for boats to land (Faxaflóahafnir, 2013).

The background of the thesis uses various information from published material from trusted sources. The background consists of the history of fisheries in Iceland, major events in fisheries

in Iceland, historical catches between both Icelandic and foreign fleets, fisheries management systems, important institutions, important fisheries figures today, current stakeholders and their quota share allotment.

It is important to look into these factors in the background to get an idea of the development of the fisheries in the country to understand why limitations were put on the fisheries. It is also vital to dig deep down into the fisheries to be get a better understanding for the reader to know more about the fisheries this research is about.

The data collected in the research will then be compared to tell if there is a link between the implementation of the quota management systems and depopulation in settlement structures in Iceland. The data between population developments, landings and quota shares are compared before and after the period of implementation.

1.3 Structure of thesis

Chapter two contains a brief discussion of the current status of Icelandic fisheries. In chapter three we will examine why Iceland needed a management system in the fisheries sector, justify its existence and explain fisheries management in Iceland. Chapter four contains developments of quota share allotment, landing patterns by regions and development of amount of workers in the sector. Chapter five will cover population developments by regions and settlements in Iceland. Chapter six will cover a brief discussion of other sectors in Iceland. Chapter seven contains a discussion of the above research and summarize its findings.

2 Icelandic Fisheries

This chapter goes briefly over Icelandic fisheries today and will discuss important institutions that are essential to conduct efficient and effective fishers, important commercial species in Icelandic waters, export of Icelandic fisheries and largest stakeholders today and etc. This is to demonstrate the importance of the fisheries sector in Iceland today.

2.1 Important institutions

To maintain a successful fisheries management system it is important to ensure that it has scientific grounding. Extensive information and knowledge about the ocean and the ecosystem found in the waters around Iceland establishes the groundwork for making decisions on how sustainable fisheries are conducted and how to efficiently utilize natural resources found in Icelandic waters. The institutions that provide and make decisions based upon the research are the Marine Research Institute of Iceland, the Ministry of Industries and Innovation and the Directorate of Fisheries.

The Directorate of Fisheries monitors Icelandic fisheries and takes care of everyday administration of the management system. The Directorate of Fisheries issues fishing permits, quota allocations and oversees the daily process of the individually transferable quota system. They have the power to revoke fishing licenses and permits and can enforce sanctions in cases of over fishing and on those who do not comply with the regulations. The Directorate of Fisheries gathers information on all landings from ports in the country in real time and has also information on processing and exportation of marine products. The Directorate also observers how fishing vessels are operating, the weighing of landed catch and the processing of fish. They do it both on site and through electronic surveillance. That includes vessel monitoring systems which the Directorate operates in a collaboration with the Coast Guard of Iceland (Directorate of Fisheries, n.d.a).

The Marine Research Institute of Iceland is responsible for carrying out extensive research on the status and the productivity of commercial stocks found in Icelandic waters, and are also responsible for carrying out more long-term research on the ecosystem and the marine environment. This important research is the foundation of the advice that the Marine Research Institute gives on sustainable catches of the commercial fish stocks each fishing year (Ministry of Industries and Innovation, n.d.a).

The Ministry of Industries and Innovation are a part of the decision making process when it comes to the allocation of the total allowable catch for each year. The Ministry bases its policy on the total allowable catch on the recommendation that has been made by the Marine Research Institute but also consults with relevant stakeholders in the fisheries (Ministry of Industries and Innovation, n.d.a).

2.2 Commercially important species

There are currently around 25 species in Iceland at the moment that have catch quotas. The catch quota categories are around 59. This difference is because many species are sorted separately by domestic areas and international fisheries and some subcategories (Directorate of Fisheries, n.d.b). There around 340 species of fish that have been found in Icelandic waters, of which 30 are commercial stocks (Valtýsson, H, 2016a, pp. 3). Other species that are utilized are Norway lobster, northern prawn, and Iceland scallop. This changes however throughout the years due to stock conditions. The species that have catch quotas in Iceland in 2018 are listed below in table 1. Although only the species that have catch quotas all catches must be reported to port. Therefore the total amount of catch in Iceland also includes non-catch quota species.

Table 1 Catch quota species in Icelandic fisheries (Directorate of Fisheries, n.d.b)

Cod	*Gadus morhua*
Haddock	*Melanogrammus aeglefinus*
Saithe	*Pollachius virens*
Rose fish	*Sebastes norvegicus*
Deepwater redfish	*Sebastes mentella*
Norway redfish	*Sebastes viviparus*
Common ling	*Molva molva*
Blue ling	*Molva dypterygia*
Cusk	*Brosme brosme*

Atlantic wolffish/catfish	*Anarhichas lupus*
Spotted wolffish	*Anarhichas minor*
Angler	*Lophius piscatorius*
Greater argentine	*Argentina silus*
Greenland halibut	*Reinhardtius hippoglossoides*
European plaice	*Pleuronectes platessa*
Lemon sole	*Microstomus kitt*
Witch	*Glyptocephalus cynoglossus*
Common dab	*Limanda limanda*
American plaice	*Hippoglossoides platessoides*
Atlantic herring	*Clupea harengus*
Blue whiting	*Micromesistius poutassou*
Atlantic mackerel	*Scomber scombrus*
Norway lobster	*Nephrops norvegicus*
Northern prawn	*Pandalus borealis*
Iceland scallop	*Chlamys islandica*

In the year 2018 1.258.548 metric tons of marine resources were reported to have been caught. The table 2 below displays the 9 most caught species and the amount caught. The table displays that most of the catches are from pelagic species as in blue whiting, capelin, mackerel, and herring. Other species in the table are all demersal. Also note that all Sebastes species are often

consolidated into species in some databases and therefore “Redfish” can refer to all species of Sebastes.

Table 2 Amount of species caught in Iceland in metric tons in 2018 (Statistics of Iceland, 2018a).

Blue whiting	292.949	Saithe	66.250
Cod	275.017	Redfish	57.989
Capelin	178.128	Haddock	48.459
Mackerel	135.559	Other	80.292
Herring	123.905		

Figure 1 below puts the 2018 catches into a more visual context. It displays proportionally how much of the most caught species in relation to the total catch in 2018. The figure displays that blue whiting is the most caught species followed by cod, capelin, mackerel, herring, saithe, redfish, and haddock. The category “Other” includes all other catches.

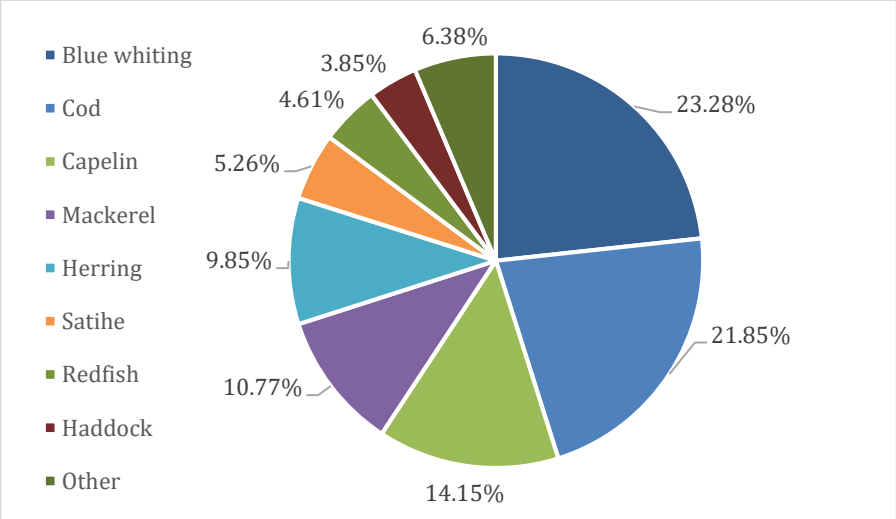


Figure 1 Most caught species in 2018 in proportions to the total catch (Statistics of Iceland, 2018a).

Though most of the most caught species in Icelandic fisheries are pelagic it does not follow that they are the most valuable species. Figure 2 below displays the most valuable catches in the year 2018.

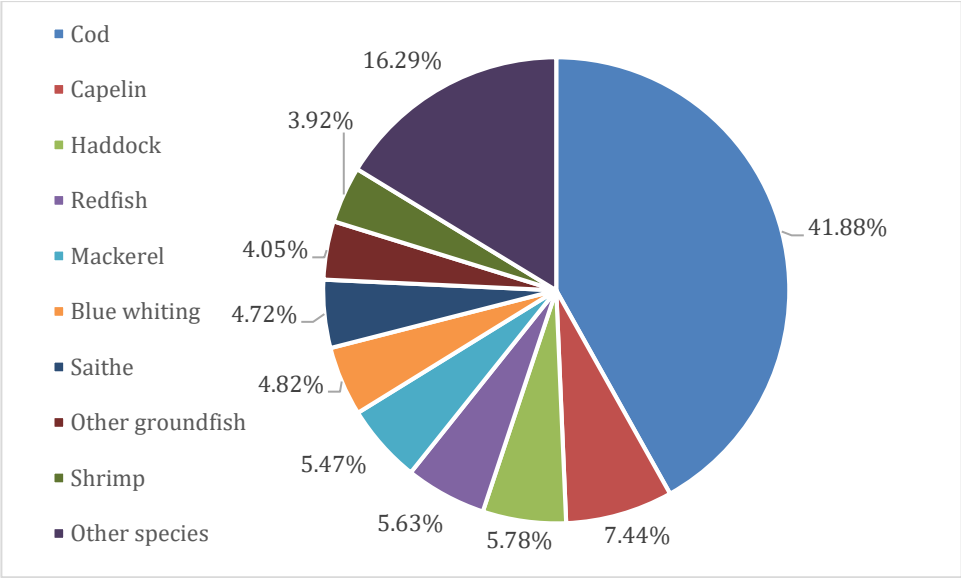


Figure 2 Value of the nine most caught species in 2018 (Statistics of Iceland, 2018b).

Figures 1 and 2 display that though cod is only 21.85% of the total catch in Iceland, it is the far most valuable species in the Icelandic fisheries. The cod is responsible for the majority of the value of all the catches in Iceland or 41.88% of the total value. As displayed in figure 1 there were four pelagic species in the top five most caught species in Icelandic fisheries but as displayed in figure 2 above they do not appear as valuable.

2.3 Export from Icelandic fisheries

Fisheries products from Iceland were exported to 96 countries in 2018 and Icelandic fisheries products were exported to every continent except Antarctica. As has been mentioned cod is the most valuable species in Icelandic fisheries and there is no exception when it comes to export. Figure 3 below represents the 10 most exported species from Iceland and their value in 2018. The figure displays that there is a relation between amount and value. Pelagic fish has less value while demersal fish are more valuable.

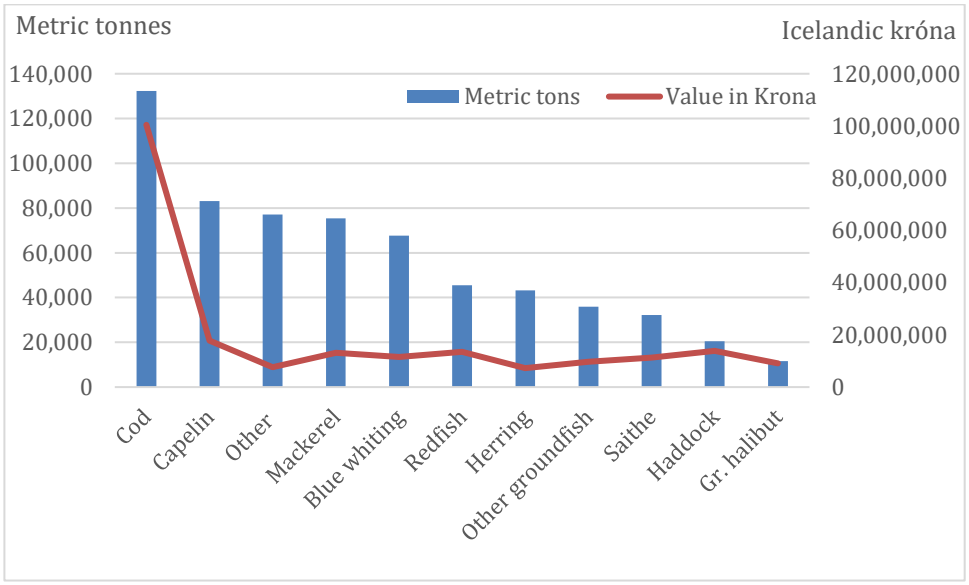


Figure 3 Most exported species in 2018 and their value (Statistics of Iceland, 2019c).

Figure 4 below displays the top ten countries that Icelandic fisheries products were exported to in 2018. The blue columns represents the amount exported and the orange line represents value in Icelandic krona. The figure displays that Iceland exports the greatest portion to Norway which might be considered strange since Iceland and Norway are big competitors in the fisheries. This comes about because Iceland exports a lot of fish meal and oil to Norway due to their fish farming. This also explains why the value for the Norwegian market does not correlate to the amount, since fish meal and oil do not hold much value as products that are meant for human consumption. The value spikes when it comes to the UK, France and Spain, since the most valuable products are sent there which are frozen and chilled.

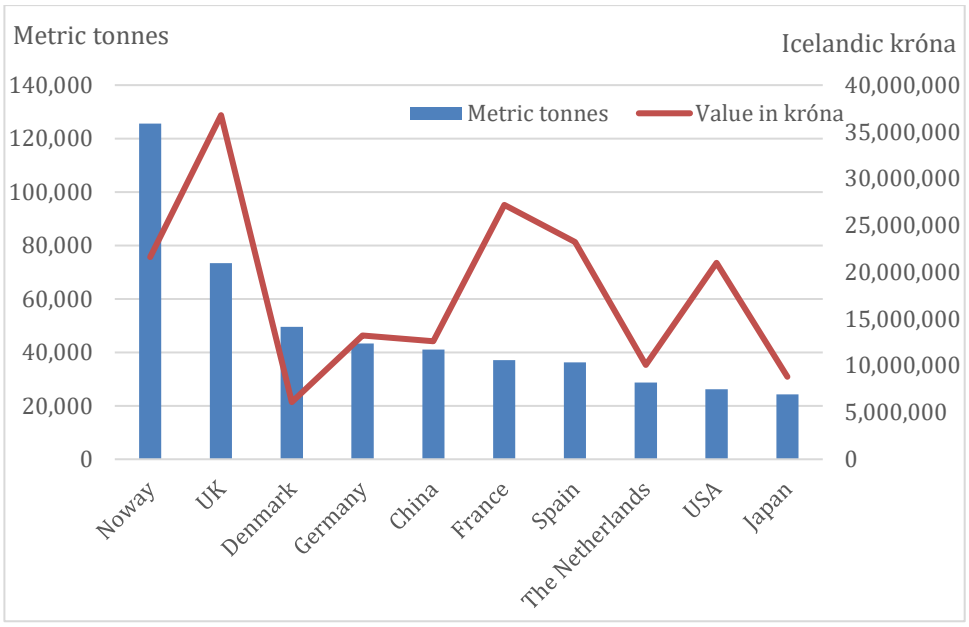


Figure 4 Top ten countries when it comes to exports in 2018 (Statistics of Iceland, 2018b).

Figure 5 below displays product categories that fish is exported by from the Icelandic fisheries in 2018. The blue columns represent the amount in metric tons and the orange line represents their total value. There five categories are frozen, fish meal/oil, chilled, salted, dried fish and other. Like the figure displays, most of fish products that are exported are frozen but that can be explained by the location of Iceland, as distances are long because of geographical positioning.

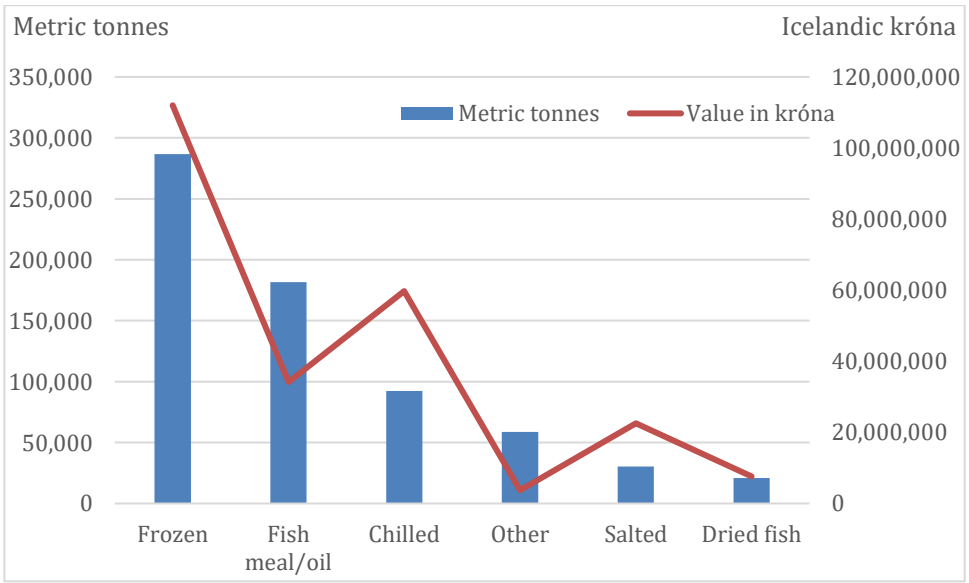


Figure 5 Exports in fisheries in Iceland by product categories in 2018 (Statistics of Iceland, 2018b).

2.4 Largest stakeholders

The fisheries in Iceland are mostly vertically integrated which means that individuals or fisheries companies own the vessels that have been allocated the quota shares. (Gissurarson & Arnarson, 1999 pp. 104) There are none the less quota limits imposed on the fisheries and the limits can differ for each species. For example, no one can own more than 20% of the quota shares of haddock, 12% of the quota shares of cod and 20% of the quota shares of saithe, haddock and etc. Complicating the picture, individuals or fisheries companies also cannot exceed 12% of the total amount of the quota shares of all species. Which means that individuals or fisheries companies have mixed quotas when it comes to species, but the total amount of the total allowable catch cannot not exceed 12% in the total quota shares (Lög um stjórn fiskveiða nr. 116/2006). Table 3 below lists the 10 biggest quota share owners in Icelandic fisheries for the year 2018 and how much they possess proportionally.

Table 3 Top ten largest quota share owners in Iceland in 2018 (Directorate of Fisheries, 2018)

HB Grandi hf.	9.76%
Samherji Ísland ehf.	6.58%
FISK-Seafood ehf.	5.27%
Þorbjörn hf.	5.06%
Síldarvinnslan hf.	4.90%
Skinney-Þinganes hf	4.10%
Útgerðarfélag Reykjavíkur hf.	4.04%
Vinnslutöðin hf.	4.02%
Vísir hf.	4.01%
Rammi hf.	3.71%

3 Fisheries Management in Iceland

To determine if there is a link between the implementation of the quota management system and depopulation, it is important to look into why a management system was needed in the first place. This chapter contains an overview of the history of fisheries in Iceland, the history of fisheries management and current management system today. The chapter will briefly look into fisheries in Iceland in historic time and its importance. Furthermore, the chapter will detail the events that led to the imposition of fisheries management systems in Iceland in order to justify their implementation. The current fisheries management system is also discussed and explained how it functions.

3.1 Historical importance of fisheries

Because of the position of Iceland, being located in the North Atlantic Ocean surrounded by cold sea, its climate and its topography, the result has been that the Icelandic nation has had to rely greatly on the ocean and its resources since settlement in the year 874. Pastoralism has of course been practiced since settlement and according to sources, the first two or three centuries after settlement were rather good for agriculture. After that period the climate became colder in Iceland. Average temperature dropped approximately 1.5°C for one and a half century and the next six centuries were quite cold in Iceland. The average year temperature was rarely higher than approximately 3.3°C and went below 3°C in the beginning of the 17th century this situation remained during in the 18th and 19th century. While some of these figures may be based on projections, the overall picture is clear and the conclusion is that Iceland was in no way deemed as fertile or suitable country for agriculture. However according to the government's definitions and general parlance most landlords in Iceland were defined as "farmers". But in recent times and last decades, scholars who have written about Icelandic society and taught it have called these people the "farmer's community". This definition is though misleading and could indicate that Icelanders lived off agriculture for centuries and other industry sectors, like fisheries, only been additional ways of living. However that was not the case. When compared to other nations in Northern Europe, Iceland's agriculture was rarely sustainable. The available farming land was almost destroyed from vegetation damage and overuse. But though Iceland's farmland was meager and its nature sensitive, Icelanders had another resource that kept the nation alive for centuries. In the 19th and 20th century fisheries became a pillar in reconstruction and development of Icelandic society (Þór, 2002, pp. 11).

Iceland was one of the poorest countries in Europe in the world in the beginning of the 20th century (Jakobsson & Hálfdánarson, 2006, pp. 55). Some of the richest fishing grounds in the entire North Atlantic are in the ocean around Iceland. For centuries the fishing grounds around Iceland seemed like a bottomless storehouse. People sought resources from the sea, although it could be harsh. From experience people have agreed that fisheries have been far more trustworthy food source than agriculture. It is also known that in the older days when farming was not doing well, people flocked to the coast from the farms. That was because there was more hope for a stable food source there. But if there was a collapse in the fisheries or circumstances were bad at the same time and agriculture failed, which could happen, famine could occur in the country. Cold years could both destroy crops and cause ocean cooling around the country which resulted in more sea ice than usual. That resulted in less fish migrating closer to land and therefore no stable food source either in fisheries or from agriculture (Þór, 2002, pp. 11 - 12).

Fisheries in Iceland had a major effect on the development of settlements and where people chose to build their habitats. Centuries ago, the best lands to build on where mostly those lands that were close to rich fishing grounds, had a good and nutritious soil for farming and where livestock could thrive. But other ocean subsidies were also important resources like birds and eggs, resources found on beaches like clams, kelp, drift wood and more. Examples of areas like that in Iceland are the South West part of Iceland and the Westfjords region. People migrated to these areas centuries after centuries from all over the country for seasonal fishing which implicates how fisheries were an important factor for livelihoods in Iceland. It is also reasonable to say that the nation would probably not have been able to thrive without resources found in the ocean around Iceland. The national economy of Iceland in the past centuries were mostly between two sectors, fisheries and agriculture. But these two sectors were so interlaced that it is hard to distinguish between them two. Landlords sent their workers to the coast for fishing and to buy stockfish. No home in the country could be without seafood, and stockfish, dried fish, wasn't only an important for export but also an important food source. In the same way, fishers who lived on the seafront and lived mostly of fisheries while maintaining some agriculture bought agriculture products from farmers in exchange for fishery commodities (Þór, 2002, pp. 12).

3.2 The Herring case: The uprising and the collapse

The Atlanto-Scandian herring stock (*Clupea harengus*) consists of numerous main stocks and is the Norwegian spring-spawning stock the largest. Throughout the early and middle of the 20th century the stock trailed the same yearly migration pattern around the Northeast Atlantic Ocean. Characteristically the stock spawned around the Faroe Islands and alongside the coast of Norway. After spawning the herring larvae drifted north towards the Barents Sea and fish that had reached maturity and younger recruits went to the west migrating to the feeding grounds in the east and north of Iceland. The herring stock then stayed over the winter in a small area in the east of Iceland before migrating back to their spawning grounds in the east. But in the 1950s to the 1960s the migration pattern changed radically as one of the one of the largest herring stock almost completely vanished. Throughout the next decades the stock maintained at low levels, then after the 1980's the stock considerably started to recover, mainly though in Norwegian waters (Hamilton, Otterstad & Ögmundardóttir H, 2006).

For centuries the Atlanto-Scandian stock had been fished along the coast of Norway where it spawned. It was then in the mid-19th century fishermen form Norway discovered that the same herring stock was abundant and migrating to Iceland towards its feeding grounds in east and north of Iceland in the summer and autumn. Norwegians arrived in Iceland and initiated a herring fishery in towns in east of Iceland, such as the town of Seyðisfjörður. They provided jobs for locals in herring salting and built wooded houses, which was an improvement because in Iceland at the time many lived in turf houses. Icelanders quickly learned from the foreigners how to conduct the fisheries themselves and in 1890 Icelanders begun their own herring fishing company in Siglufjörður on the north coast. In the beginning of the fishery, the efforts were mostly practiced inside the fjords in the area. But the herring fishery in Iceland did not start well in the end of the 19th century as the climate worsened and the prices for herring on European markets fell (Hamilton et. al, 2006).

Due to warmer climate conditions on the early part of the 20th century the herring fishery recovered. The catches were also a lot larger than before because of the use of larger vessels and the usage of new purse seine technology. In the beginning of the 20th century, both the foreign and domestic fisheries were catching between 10 thousand and 25 thousand metric tons. In the beginning the Icelandic fleet accounted only for a small part of the total catches but after 1915 they became the larger participant. The total amount of catches continued to grow over

the years and reached peaks larger than 200 thousand metric tons in the 1930s and 1940s. The herring fishery, because of good herring season, contributed the Iceland's economic rise and its political independence in the 1940s (Hamilton et. al, 2006).

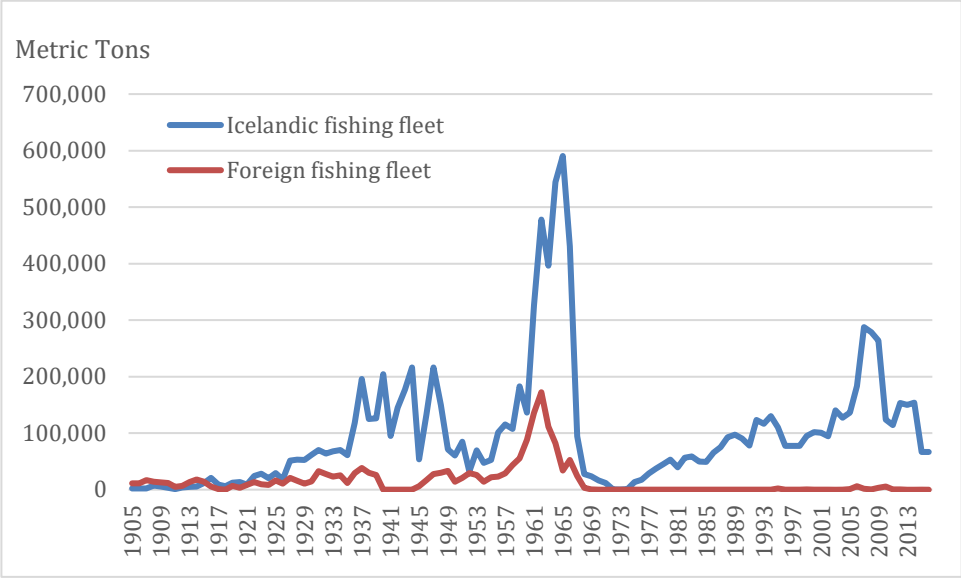


Figure 6 Herring catches of Icelandic and foreign fishing fleets.in Icelandic waters between 1905 and 2016. (Statistics Iceland, 2019a)

During the 1930s and 1940s markets became stronger, technologies in the fisheries had developed and increased effort led to augmented exploitation of the herring stock in the Northeast Atlantic. In the Northeast Atlantic the total catches of the herring stock oscillated in a general upwards trend and during the 1950's the total amount surpassed over one million metric tonnes. In the 1950's markets had expanded and there had been a rise in technological innovation in the fishery. Innovations were for example sonar that was used to locate schools of herring, power block assisted purse seines were also a big improvement to make the fisheries more efficient and nylon mesh seines to catch the herring. With these new improvements the total amount of catches reached almost two million metric tonnes in the Northeast Atlantic throughout the mid-1960s. Quickly afterwards the amount of catches went below 100 thousand metric tonnes in 1969 and in 1973 the amount was only around 10 thousand metric tonnes. It was clear that when the fisheries were at its peak, it was because of overfishing. The estimating spawning biomass of the Atlanto-Scandian herring stock was around 14 million metric tonnes in 1950 but in 1972 that number had declined down to only 500 thousand metric tonnes. When the catches in the 1960 reached its peaks it is estimated the biomass had already decreased by 74 percent. The rise of the catches and the falling population size effetely killed of the resource.

There was only a coastal remnant of the stock that survived around Norway (Hamilton et. al, 2006).

3.3 The Cod Wars – The expand of territorial waters

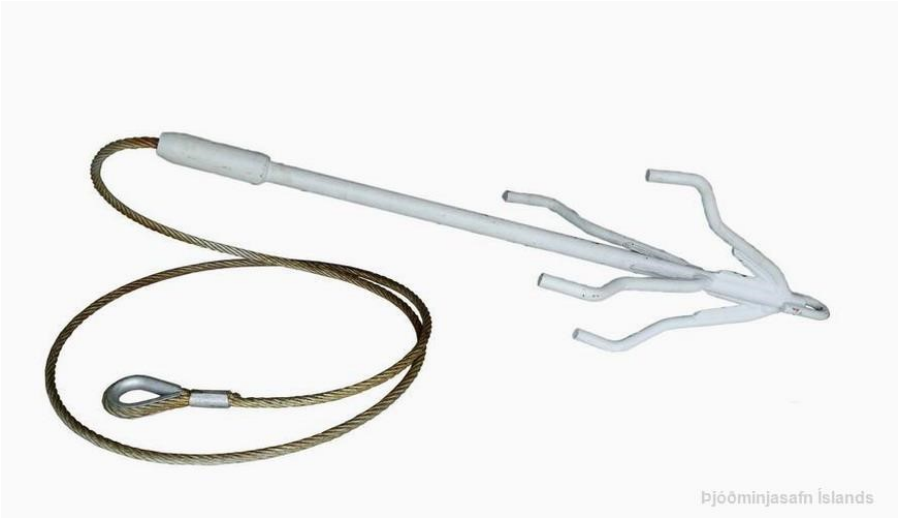
The Cod Wars were a dispute between Iceland and the United Kingdom over fishing rights in the waters around Iceland. The cod wars were four in total and all resulted with Iceland being the victor.

The first Cod War began in May 1952 when Iceland decided to extend their territorial waters from 3 to 4 nautical miles. The lines were drawn extensively to include all fjords and bays. The dispute began when the British did not comply with the Icelandic guidelines. Icelandic statesmen pointed out that if Iceland would not get favorable results from these disputes it could result in Iceland withdrawing from NATO, the North Atlantic Treaty Organization, which meant USA forces that were stationary in Iceland would have to leave. In the first Cod War, the Icelandic coast guard clashed with British vessels in attempts to stop the British to fish in the waters then were inside the 4 nautical mile line. Because of this the UK trawling industry imposed sanctions on the Icelandic economy and put on landing bans on Icelandic trawlers in the UK. Banning Icelandic trawlers to land at British ports was effectively closing off the largest export market for Iceland's main commodity. The landing ban started a competition between the two powerhouses the Soviet Union and the USA, the states relieved Iceland of most of its commodities that was initially meant for the British market. In November 1956 the disputes came to an end which was highly satisfactory for Icelanders as the UK accepted the 4 nautical mile limit set by Iceland. (Steinsson, 2016)

The second Cod War begun in September 1958 when Iceland extended their territorial waters unilaterally from 4 to 12 nautical miles. This was the first Cod War where the UK sent the Royal Navy to Icelandic waters to protect their vessels from the Icelandic coast guard vessels. These disputes led to highly covered conflicts at sea by the media which led British media to call the dispute as a "Cod War". These conflicts at sea resulted in serious nationalist repercussion in Iceland. Again Icelandic officials threatened to withdraw Iceland from NATO and send the US forces home unless the dispute would end in a favorable conclusions for Iceland. Between February and March in 1961 the second Cod War ended with highly

satisfactory results for Iceland when the British acknowledged the 12 nautical mile extensions of the Icelandic territorial waters. (Steinsson, 2016)

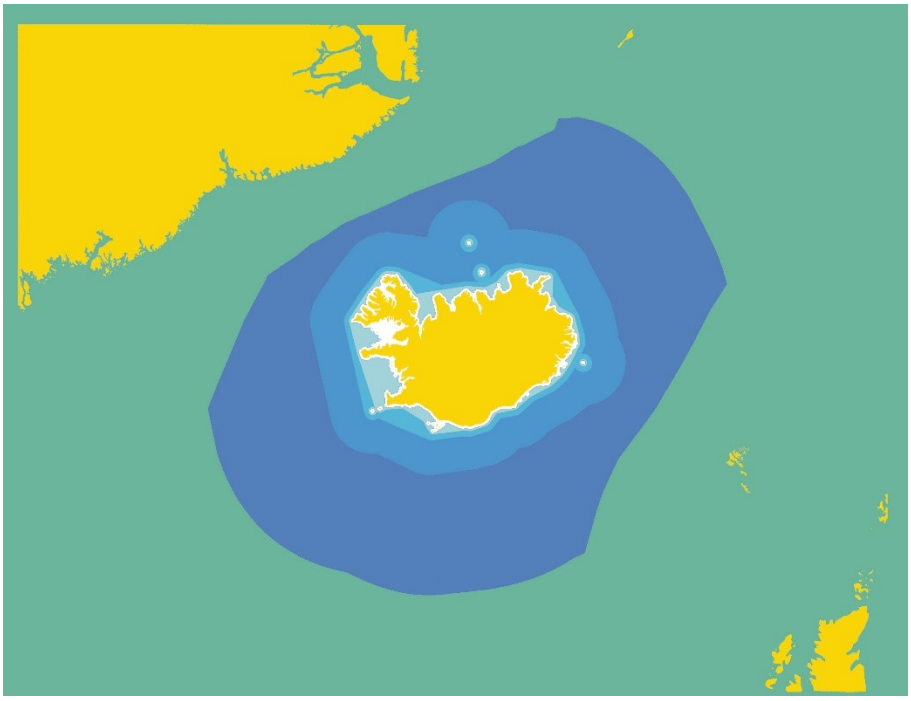
The third Cod War started in September 1972 when Iceland extended its territorial waters from 12 to 50 nautical miles. Throughout the third Cod War the Icelandic coast guard started using net cutters for the first time. The net cutters cut the wires of the trawls that the British vessels had out, the net cutters ruined their nets and sabotaged their fishing. The net cutters were pulled by the coast guard vessel that sailed behind the British vessels and the cutter that was under water cut the wires connected to the trawls. The UK subsequently sent the Royal Navy into the contested Icelandic waters to protect their vessels. That resulted in numerous clashes at sea between the Royal Navy and Icelandic vessels. The International Court of Justice also ruled against in Iceland in a verdict which Iceland refused to comply. Just like in the former Cod Wars, Iceland threatened again to withdraw their membership from NATO and expel the US army from Iceland. But it was in this Cod War that it came closest to that the US army would be expelled from Iceland but it did not go through. The third Cod War ended in November 1973 with favorable temporary agreement for Iceland. The UK agreed to the 50 nautical mile expansion limit. But the agreement did also include a temporary fishing rights for British trawlers in Icelandic waters (Steinsson, 2016).



Picture 1 Net wire cutters used to cut nets of foreign vessels (Þjóðminjsasafn Íslands, n.d.)

The fourth and the last Cod War begun in November 1975 when the temporary agreement made in the third Cod War ran out. Iceland expanded their territorial waters from 50 to 200 nautical miles. The clashes at sea begun again between the Icelandic coast guard vessels, the British

trawlers and the Royal Navy. These clashes created another nationalist backlash in Iceland. Iceland, after have been threating political actions in the previous Cod Wars, consequently took the most serious action in all of the Cod Wars and it went through with one of their threats and cut all diplomatic relations with the UK. In addition to these actions the Icelandic government threatened that Iceland's continuing membership in NATO would be linked to the result of the Cod War dispute. The Fourth Cod War ended in June 1976 when the UK agreed to Iceland's 200 nautical mile exclusive economic zone. The British fleet did though get a very restricted fishing rights in Icelandic waters (Steinsson, 2016).



Picture 2 The expansion of the Icelandic EEZ zone between 1952 and 1976 from 4 nautical miles to 200 nautical miles (Ívarsson, H, n.d.).

3.4 Catches between foreign and Icelandic vessels

Though Icelanders have been fishing since settlement in the rich oceans around the island they've not been the only ones utilizing it. Foreign vessels fished in Icelandic waters for centuries and the first ones to do so were English when they arrived on sailboats in the 15th century. That era in Iceland is called the English century. Later other nations started to show up to. For example The Hanseatic League, German merchant guilds, followed closely and

started both fishing and trading around Iceland. This was good for the Icelandic economy as in fish price was high and many profited from the situation.

The English and Germans ended up though conflicting and started fighting between each other. The Germans ended up victorious from the conflicts and the 16th century in Icelandic history is often called the German century. Iceland was under Danish rule at these times and with some craftiness the Danish king managed to drive both the English and Germans away. This resulted in the fish trading ended up in the hands of Danish merchants which lead to Danish monopoly on fish trading in Iceland. From the mid-16th century to the 18th century it appears that there were mostly Icelanders fishing around Iceland except for Basque whalers.

In the 18th century many foreign vessels started to fish around Iceland. These were the Dutch. The Dutch was then one of the biggest maritime nations in the world. In the 19th century the French arrived while the Dutch mostly left and had the biggest fleet around Iceland.

In the end of the 19th century a lot of changes happened and many nations started to arrive to fish in Icelandic waters again. This can be explained because of great technological changes in fisheries with motorisation. The first trawler that was seen in Icelandic waters was in 1891, it was English. Around the start of the 20th century French, Belgian and Faroese ships were fishing for cod, American vessels fishing for halibut, English, Dutch and German vessels fishing for flatfishes and cod and Norwegian boats fishing herring and whale.

In the 20th century it were the British and Germans who fished the most of all foreign fleets around Iceland. But there were also quite a bit of Faroese and French sailboats and fishing and some herring and whaling boats from Norway. These were though not the only nations fishing around Iceland at that time. It is not known how much the foreign fleets were fishing in Icelandic waters until 1905 but it can be assumed that the foreign fleets were catching a lot more than the Icelandic fleet (Valtýsson, 2017b pp. 7-8).

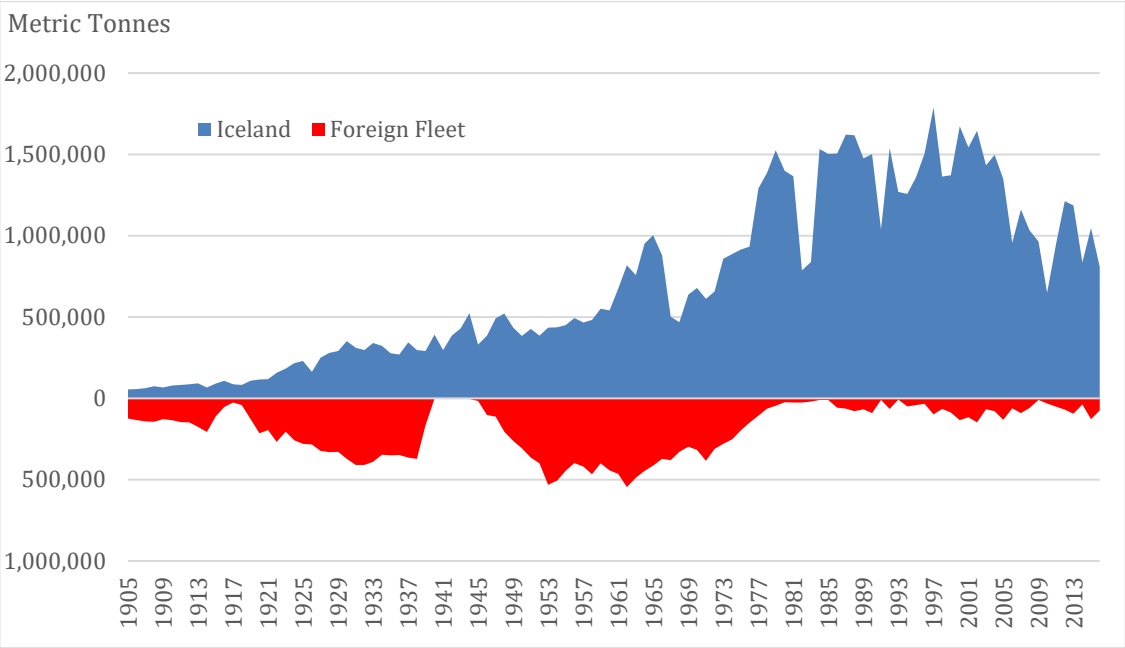


Figure 7 Amount of caught fish between Icelandic and foreign vessels (Statistics Iceland, 2019a)

Figure 7 above displays the amount of caught fish around Iceland from 1905 to 2016 between both Icelandic and Foreign fishing vessels. To understand better how much Icelandic and foreign vessels have been fishing the Icelandic catches are displayed above the x axis while the foreign catches are displayed beneath it.

Figure 7 displays that catches by foreign fishing fleet were larger than the Icelandic for a while in the 20th century. From 1905 until the start of World War 1 the foreign fleet fished more. During the World War 1 catches by the foreign fishing fleet decreased drastically but after the war foreign fleets again fished more than the Icelandic fleet. This kept going until World War 2 where almost no one other than Icelanders were fishing in Icelandic waters. Icelanders increased fishing during those years. After World War 2 the foreign fleet re-entered Icelandic waters and kept on going. It wasn't until the final Cod War in 1976 that fishing in Icelandic waters by foreign fleets almost stopped. As Iceland had gained a 200 mile EEZ zone Iceland were for the first time since the 15th century the only ones allowed to fish in Icelandic waters. (Valtýsson, 2017b, pp. 7-8). There are though some foreign catches in Iceland but that can be linked to bilateral treaties.

3.5 History of Fisheries Management in Iceland

Closures on fishing grounds and regulations on fishing gear have been in use for a long time in management of Icelandic fisheries, and are still used today. Direct fisheries management regulating effort or catches can be dated to the year 1965. In that year scallop and inshore shrimp were subjected to effort restrictions, licenses and quotas on catch (Danielsson, 1997). In 1969, because of the distressing collapse of the herring stock in Iceland, a quota was imposed on herring fisheries. This did not bear the desired results, and therefore a complete moratorium was announced on herring fisheries in 1972. Herring fishing was resumed in 1975, but it was obvious that due to the state of the stock the whole fleet could not participate in the industry. Therefore, an individual vessel quota system (IVQ), with limited eligibility for quotas was implemented on the fisheries. The vessel quotas, nevertheless, were quite small, and in spite of no clear permissions being given and certain bureaucratic obstacles, informal exchanges of these vessel quotas soon began. In 1979, fairly unhindered trade of quotas between vessels was permitted by a ministerial verdict supported by the industry. This was the first instance of an individual transferable quota system (ITQ) in a major fishery in the world (Arnarson, 1996).

The capelin fishing industry in Iceland, which became very important in the 1970s, was subjected to limited entry and IVQs in 1980 for license holders at a time when the capelin stock began to decrease. The justifications for doing so were that the stock was thought to be extremely vulnerable to overfishing. The arguments were similar as in the herring fisheries, that it was clear that the harvesting power of the Icelandic fishing fleet was significantly in excess of the capelin stock's biological reproduction capacity. With the capelin crisis, it was similarly argued that if limits had to be put on the fishery, the most effective outcome would be if it were to be done though individual quotas. The implementation of the ITQs had been showing positive results in the herring fishery and therefore proved a convincing argument for implementing the same kind of system for the considerably more important capelin fishery. In 1986, the capelin vessel quotas became partly transferable in conjunction with the increased transferability of demersal vessel quotas. Both capelin and herring vessel quotas became part of the general fisheries management system in 1991 (Arnarson, 1996)

After the exclusive economic zone was extended to 200 nautical miles, the most valuable commercial fish stock, the cod fishery, was subjected to an overall catch quota (Arnarson, 1996). In the autumn of 1975 the Marine Research Institute of Iceland published a report that

the most valuable commercial stocks in Iceland were being overfished and fisheries should be heavily restricted. The institute estimated that the cod catch would only be 230 thousand metric tons in 1976, but it had been 375 thousand metric tons in 1974 (Runolfsson, 1999). Annual quotas which were recommended by marine biologists were quite restrictive and therefore challenging to maintain. Consequently, in 1977, a day effort based system was put in use on the cod fishery. That system worked as instead of allocating IVQ on boats, fishers were allocated allowable fishing days for each vessel. But due to technological progress however and the continuous growth of the demersal fleet, the amount of annual allowable fishing days had to be reduced from year to year. At the beginning of the day effort based system in 1977, deep sea trawlers were only allowed to fish for 323 days in the cod fishery. In 1981 or four year later the numbers of days that vessels were allowed to catch cod had reduced to 215 days. The day effort based system became noticeably economically wasteful (Arnarson, 1996). In 1983 the parliament suggested a change in Icelandic fisheries management. The Marine Research Institute had published a new report which was nicknamed a "black report". The report highlighted that the there was a serious risk of cod and other important species being overfished and they would have to respond promptly with increased fishing restrictions the next year (Runolfsson, 1999). So it was clear that the fisheries management methods that had been set between 1976 and 1983 were not working. Therefore, in 1984, following a quite a steep drop in the commercial demersal catch levels and stocks, a new system was introduced or a system of IVQs. It is though imperative, at that point, to mention that boats that were under 10 gross registered tonnage were relatively plentiful, but catching relatively small portion of the demersal catch, were exempted from the IVQ system. Alþingi, the legislature in Iceland, originally passed the IVQ regulation for only one year. However in 1985, because of largely favorable outcomes of the individual quotas, the IVQ system was extended for one more year. An important provision in the system was though added, vessels that preferred the effort based system could select that arrangement instead of the individual quota restrictions. For the next two years, the system was extended but was largely unchanged for the next two years. Alþingi passed a general vessel quota legislation in 1988 for all fisheries in Iceland which became effective for the period 1988 to 1990. In 1990 the Fisheries Management Act was enacted which was a complete uniform vessel quota system for all fisheries. This act became effective in 1991. The act is of unspecified duration and eliminates the limited effort based system in the demersal fisheries. Besides in the act, vessels that were between 6 and GRT were merged into the ITQ

system. Vessels under 6 GRT were not incorporated into the system with the provision they could only use “hooks and line” as fishing gear, for example any kind of nets were forbidden (Arnarsson, 1996).

When individual quota system was introduced in 1984 the allocation of the TAC-shares varied somewhat between different fisheries. In the deep sea shrimp, lobster and demersal fisheries the allocated TAC were fundamentally based on the historical catch of vessels during certain base years. When it came to the demersal fishery this equalled to the vessel’s average share of the total catch during the three years prior the implementation or the years 1981 – 1983. There were though some notable special cases to this regulation. Examples of that were e.g. if a vessel was not operating usually between the years 1981 – 1983. This could’ve been due to major repairments or having entered the fleet in 1981, the calculated TAC share was also adjusted upwards. Furthermore, throughout the years of 1985 – 1987, it was also feasible to adjust the TAC shares by temporarily choosing the effort based system instead of the vessel quotas and demonstrating large amount of catches during that period. In the inshore shrimp and herring fisheries the original TAC shares were equivalent for all vessels that were qualified. Vessels that were qualified were usually those vessels that had recent participation history in the fisheries. Same rules were applied to the capelin fishery in Iceland apart from for one third of the TAC shares were originally assigned on the basis of the capacity hold of the vessel (Arnarson, 1996).

3.6 The ITQ system in Iceland

Iceland was one of the first fisheries countries in the world to implement the ITQ system or individual transferable management system in fisheries. The earliest IQ or ITQ systems in the fisheries were implemented in the latter part of the 1970s after Iceland has expanded their territorial waters to two hundred nautical miles. After that, the quota system in Iceland expanded in numerous steps to cover all commercial fisheries stocks in Icelandic waters. The most significant step in the development of the quota management system was taken in 1984 when demersal fisheries were included in the IQ system. Later in 1991 a uniform and fairly comprehensive ITQ system was adopted for all fisheries in Iceland. In 1991, the quota was also made transferable without any restrictions. It is significant to mention that before 1991, various fisheries management systems had been tried out other than the ITQ and those include, overall catch quotas, fishery access licenses, fishing effort restrictions and investment controls and

vessel buyback programs. But from Iceland's experiences throughout all these numerous fisheries management systems, it has all led to all fisheries in Iceland becoming an ITQ system. (Arnarson, 1996)

3.7 The Icelandic ITQ system today

The present fisheries management system in Iceland is the ITQ system which was specified in the Fisheries Management Act of 1990. The system consists of many important features and all fisheries that are subjected to a TAC are managed on the basis of catch quotas, the quotas that have been distributed to vessels are assets of unlimited period and can be divided and transferred between vessels with minor retractions. All commercial fishing is subjected to these quotas except for a subgroup of the small vessel fleet. The quotas were originally distributed on the basis of catch history of vessels prior to the implementation of the quota system and the allocated quotas are subjected to a fee (Directorate of Fisheries, n.d.d).

The objective of the Icelandic government when it comes to fisheries management is to act in accordance with the aim of protection and effective utilization of commercial stocks in Icelandic waters, and thereby ensure dependable employment and stability in settlements around the country. When it comes to fisheries management there are various methods used to manage the Icelandic fleet. These methods include, for example, fishing permits, catch quotas, regulations on the type of equipment used, and the closing of certain fishing areas, for multiple reasons. When it comes to fishing permits, all vessels that conduct commercial fishing in Iceland need a license issued by the Directorate of Fisheries. On average, there are around 1300 vessels and boats that are licensed by the Directorate of Fisheries for commercial fishing. In addition to the general fishing licenses, special licenses are also issued for niche fisheries like lumpfish and Danish seine. The Directorate of Fisheries also allocates catch quotas in metric tonnes for certain species for one fishing year at a time. Each fishing year in Iceland starts on the 1st of September and ends on the 31st of August. The allocation of the quota is also based on the quota share of each vessel and in cooperation with the Ministry of Industry and Innovation regarding the total allowable catch for individual species during the fishing year. The quota share of each vessel refers to the proportion, in percentages, of the total allowable catch of the whole stock of a quota based species that fishing vessels may catch by the total allowable catch of the whole stock a fishing vessel may catch. The total allowable catch of all

species are based on the fishing year. Most of the commercial fish stocks in Iceland are quota based and make up around 98% of the total catch value (Directorate of Fisheries, n.d.d).

As has been mentioned the fisheries management in Iceland is an ITQ system and stands for individual transferable quota. That means catch quotas are transferable between fishing vessels without geographical boundaries. But catch quotas must though, according to law, always be restricted to each fishing vessel. But if certain conditions are met and with certain restrictions, catch quotas can be transferred between different fishing vessels. But the transfer of catch quotas between vessels cannot take effect until the Directorate of Fisheries confirms the transfer. It is though important to mention that according to law the possession, of individuals or other stakeholders, over catch quotas in general in certain special species may not exceed certain limits. The ITQ system can though be quite flexible as flexibility is built into the system. The main objective of the flexibility is to facilitate fishermen and others in the industry to adhere to the set rules and endorse responsible utilization of commercial fish stock in Iceland. For context it can be mentioned that up to 15% of the catch quota of most commercial stocks can be transferred from one year to another and vessels are able to catch 5% in excess of the allocated catch quota in one fishing year but the amount that a vessel exceeds will then be deducted from their allocated quota next fishing year. Another type of transfer in the fisheries is a species transfer. A species transfer is a regulation where vessels are permitted to deduct a catch quota from a certain stock of fish and fish more of another. This regulation does though not apply however to the cod stock. Catches that are below certain length limits, "undirmálsafli", of certain species like cod, haddock, saithe and redfish are not fully deducted from the catch quota of vessels. That is if the catch that is under the length limits is separated from other catches and weighed and recorded separately. Up to 5% in excess catch quota of a fishing vessel can be, if certain conditions are met, be landed as so called VS catch and the amount is not deducted from the catch quota of the vessel. VS stands for "Verkefnasjóður Sjávarútvegsins" and is the Fisheries Project Fund. Most of the profit of the catch, or 80%, goes to the Fisheries Project Fund and the rest goes to the fishery company and the crew of the vessel (Directorate of Fisheries, n.d.d).

The Fisheries Project Fund has two departments that allocate grants, a general department and a department of marine research. The general department provides grants for tasks that fall within the projects sector of the Icelandic government and tasks that are under the auspices of

the Marine Research Institute, the Fisheries Control Authority of the Directorate of Fisheries and the Icelandic Food and Veterinary Authority, the Institute of Freshwater Fisheries, Institution of Food and Safety and as well the Research Fund on Increased Value of Seafood. The department of marine research provides grants for projects that are made by individuals, companies, research-, development and university institutions and allocates grants to projects that strengthen research and development projects that focus on the marine environment in the Icelandic waters and promote long term sustainable utilization of marine resources and competitiveness in the Icelandic fisheries sector (Ministry of Industries and Innovation, n.d.b)

Recreational fishing is permitted in Iceland but only for personal consumption. Fishers can only use non automatic hand line equipment; fishing rods, for example. It is prohibited to sell any catches that have been obtained by recreational fishing or use them for financial gain (Directorate of Fisheries, n.d.d).

When it comes to catch quotas in the Icelandic ITQ system, there are two types. There are general catch quotas that can be fished with all permissible fishing gear, and then there are hook catch quotas where the quotas can only be fished with fishing gear operated with hooks, i.e. hand line and longline fishing. Vessels that are fishing in the hook catch quota system are called "hook boats." Boats that the system applies to have to be smaller than 15 gross tonnes and are only permitted to pursue fishing with hand lines and longlines. Catch quotas in the system cannot be transferred into the general catch quota system. Around 700 vessels have licenses to fish within the hook catch quota system today (Directorate of Fisheries, n.d.d).

Every catch in Iceland has to be weighted and registered. It is a ubiquitous principle in Icelandic fisheries management that all landings must be weighed in their port of landing. Certified weighers handle all weighing of catches landed in accordance with detailed regulations applicable to weighing and recording of all marine catches. Fish processing plants and fish markets can, if they subject themselves to certain conditions, be granted a permission to reweigh fish that has been chilled with ice due to weight difference between frozen and melted ice during transportation. Immediately after each landing, the port authorities record the results of each weighing and report it to the Landing Ports database, which is maintained by the Directorate of Fisheries. By this process the Directorate of Fisheries always has the most recent information on landings and individual fishing vessels' quota catch status, and that of the fishing fleet as a

whole. This information is also published immediately on the website of the Directorate of Fisheries. It is a very important principle of the Icelandic fisheries management system that all catches that are caught are brought ashore and weighed at a port of landing. Discarding catches is prohibited and the fishing must be conducted in such a way that the catches are not damaged in fishing gear (Directorate of Fisheries, n.d.d).

When it comes to registering catch on products from vessels that process the catch on board, for example freezing trawlers, the catch is calculated from the vessels' catch quota according to special individual utilization coefficients. The utilization coefficients are based on measurements that are taken on board vessels that process the catch in accordance with certain regulations and methods and are done with regular intervals. The Directorate of Fisheries does regular reviews of the utilization coefficients of individual vessels (Directorate of Fisheries, n.d.d).

As has been mentioned the managing of the fisheries in Icelandic waters is also conducted with closure of fishing grounds and ban on fishing gears. If the proportion of small fish in catches exceeds a certain limits, fishing areas may be closed. The closures can be a short term, sudden closures, or long time closures, when areas are closed through regulations. Specific regulations apply about fishing gear equipment, for example about mesh sizes and small fish separators, and these regulations are primarily intended to prevent fishing of small fish or other harmful fisheries (Directorate of Fisheries, n.d.d).

There is also a strict monitoring in the fisheries sector in Iceland. Fisheries inspectors from the Directorate of Fisheries carry out surveillance all the way from fisheries that happen at sea to what happens on land. The inspectors uphold laws and regulations relating to fishing, catches and catch quotas, and provide guidance to ship owners, fishermen and representatives of fish processing companies about regulations and their interpretation. There is precise monitoring on each amount a vessel catches and the species composition of the catches and if something is out of order the Directorate of Fisheries takes action if necessary. Furthermore, there are various types of electronic surveillance carried out by the Directorate of Fisheries, for example the Directorate of Fisheries is able to compare information on catches landed at ports and the information obtained according to reports from fish buyers (Directorate of Fisheries, n.d.d).

Violations of the fishing regulations are in a form of fines and are applied to the perpetrators whether the laws and regulations were broken intentionally or because of negligence. Large scale offences are though more serious and those who commit those could be imprisoned for up to 6 years. Furthermore, the Directorate of Fisheries has a legal authority to apply administrative penalties towards stakeholder, for example they can revoke fishing licenses and revoke fish weighing permits because of certain offenses (Directorate of Fisheries, n.d.d).

If a vessel fishes more than their catch quota is, the Director of Fisheries allows the parties involved to adjust their catch quotas of the vessel by transferring sufficient catch quotas within a specific time frame. If a vessel fails to do so, the vessel will be deprived of their fishing permits until its catch quotas have been corrected. If the catch quotas of a vessel have not been adjusted before of the end of the fishing year in Iceland, the Directorate of Fisheries charges the vessel with a fee that is equal to the value of the illegal catch on the fishing vessel concerned (Directorate of Fisheries, n.d.d).

3.7.1 Regional Quotas in Iceland

Annually, the Ministry of Industry and Innovation allocates certain catch quotas to support settlement structures in Iceland. The amount is a part of 5.3% which is subtracted from the annual TAC. (Ministry of Industries and Innovation, 2020). The settlement structures that qualify for the regional quotas are settlements that have been adversely affected by contractions in the fishing industry and are dependent on fishing and processing of demersal fish, as well as settlements that have suffered unexpected reductions in the catch quotas of fishing vessels operational in the area which have been landing catches locally in cases where the reduction has had a negative impact on local employment. The Ministry sets regulations on the allocation to the settlements and allocation to fishing vessels. Municipalities may request special exemptions from the general regulations if needed, but the Minister must approve them. The Directorate of Fisheries is then responsible for allocating the catch quotas to the fishing vessels according to regulations that are in effect at each given time. Information about the allocation of the regional catch quotas can be found in statistics for each fishing year at the Directorate of Fisheries. The catch quotas that are allocated this way may be used for up to three years at a time (Directorate of Fisheries, n.d.c).

3.7.2 The Coastal Fisheries

In the year 2009 the then government of Iceland implemented a new type of fisheries management system. This was supposed to replace the regional quotas mentioned above, but both are still in effect today. The new program was supposed to strengthen and stimulate employment in settlements that survive on fisheries and revive small scale fisheries. It is referred to as "Strandveiðar," which is roughly translates to coastal fisheries. Coastal fisheries allow "carte blanche" hand line fishing by the coast. The fisheries are limited in the form of total catch quotas that are allocated for the program as well as the size of vessels that can enter into it. The aim of the program is to utilize the marine resources in Icelandic waters on a new basis, which will make it possible for people to engage in fisheries by the coast in a sustainable and responsible manner. The government that was in power when the coastal fisheries was implemented had been criticised because of how hard it was for new parties to ender into commercial fishing in Iceland. The aim of the government was to find a way to make fishing more accessible for those who do not have fishing licenses and cannot gain financially from fishing (Ministry of Industries and Innovation, 2009, April 16)

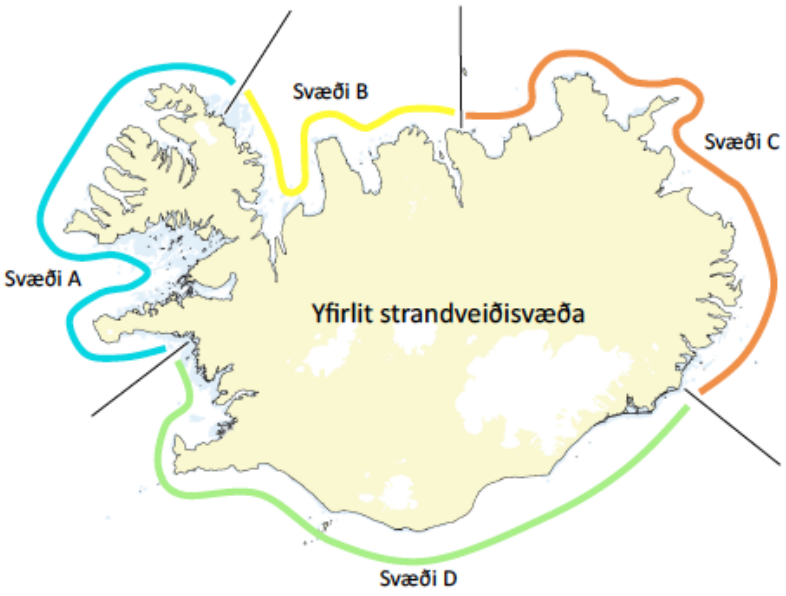
The coastal fisheries are conducted over the summer and are in full effect in the months of May, June, July and August. The country is split up into four regions and each region is allocated a total catch quota for each month. Fishers then have 12 days each month to go out to sea and fish in each region. The fishers can choose the fishing days themselves. For the coastal fisheries in the fishing year between 2018 and 2019 the fisheries were allocated 11.1 thousand metric tonnes of ungutted demersal fish in quota. This amount comes from the 5.3% like in the regional quotas (Ministry of Industries and Innovation, 2020). The Minister of Fisheries is allowed to increase the amount of total catch quota in the fisheries if necessary. When the total catch quota is finished for a particular month in a region, fishers in the region have to wait until the next month starts to be to start fishing again.

The four regions that the country is divided into are called regions A to D. Picture 11 below displays how Iceland is divided into four regions and where they are. They are divided as follows.

A. Eyja- og Miklaholtshreppur to Súðarvíkurhreppur
B. Strandabyggð to Grýtubakkahreppur

C. Þingeyjarsveit to Djúpavogshreppur

D. Sveitarfélagið Hornafjörður to Borgarbyggð



Picture 3 Regions for the coastal fisheries system in Iceland (Alþingi, 2018).

There are many regulations in the coastal fisheries though they are "carte blanche". For example it is prohibited to go fishing on Fridays, Saturdays and Sundays and days that are so called "red letter days" which are for example Ascension Day, Independence Day and on the merchant's holidays. Each fishing trip in the fisheries cannot exceed 14 hours. These 14 hours are based on the time that the vessel leaves from port to go fishing until it returns to port for landing. Fishers are not allowed to go on more than one fishing trip per day. If vessels fail to reach port for some uncontrollable reasons like for example because of an engine failure, the Directorate of Fisheries still expects these regulations to be met. Vessels can have up to four automatic hand line machines on board, all other fishing gear is forbidden to be on board while these fisheries are conducted. Vessels cannot fish more than 650 kilograms per fishing trip of species that are considered a commercial stock. The number is though measured in cod equivalents. That means cod has the coefficient 1 and other commercial species can have a coefficient below or over that. That means you have time the coefficient with the 650 to figure out how much of each species you can fish. Saithe is though excluded from the cod equivalent and vessels are able to catch up to 1 metric tonnes of saithe each trip (Directorate of Fisheries, n.d.d)

3.8 Concentration due to transferability of quotas

After the quota management system implementation in 1984, vessels were allocated quota shares. In 1991 the quota was then made transferable, with trading of quota now explicitly permitted. As expected, that lead to some concentration of quota. There are no regulations for maximum quota concentration by settlement or regions, but, as has been stated, companies, individuals or legal entities cannot exceed more than 12% of total quota shares in Iceland. It differs by species how much quota shares single entities may possess. For example, the maximum is 12% of total cod catch, 20% of saithe and haddock, and 35% of redfish. But combined, the total quota share cannot exceed 12% in total (Lög um stjórn fiskveiða nr. 116/2006).

Table 4 Development of quota shares by fisheries companies (Auðlindanefnd, 2000)

	1984	1990	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00
Largest fisheries company	4.1	4.3	3.6	3.4	3.5	4.0	3.6	4.1	5.8	6.5
5 largest fisheries companies	13.4	14.0	15.8	15.9	15.5	16.5	16.1	16.7	21.2	22.5
10 largest fisheries companies	21.4	21.9	25.1	25.0	25.3	26.4	26.6	27.1	32.8	34.8
25 largest fisheries companies	38.2	39.2	40.2	40.6	41.3	43.2	43.5	45.1	50.5	56.1
50 largest fisheries companies	-	-	54.0	54.9	56.0	58.7	59.0	61.5	66.0	70.3

Table 4 above displays the development of quota shares by the largest companies. In 1984 when quotas were implemented there were only 5 commercial stocks subjected to quotas. Therefor table 4 above is only based on the quota shares of cod, haddock, greenland halibut, redfish and saithe to make the numbers comparable. The table includes the first year 1984, the last year before transferability and then the seasons from 1992/93 to 1999/00. The table includes the first year 1984, the last year before transferability and then the seasons from 1992/93 to 1999/00. The table displays that there was a small change between 1984 and 1990, which can be connected to changes in company ownership (Auðlindanefnd, 2000). After 1991, when the quota was made transferable, changes can be seen in the amount of quota shares owned by the largest companies. The table shows that the concentration of quota shares increased quite rapidly in the period. The 5 largest fisheries companies went from owning 13.4% in 1984 to 22.5% in the 1999/00 season, the 10 largest fisheries companies went from 21.4% to 34.8%, the 25 largest fisheries companies went from 38.2% to 56.1% and the 50 largest fisheries companies went from 54% in the 1992/93 season to 70.3% in the 1999/00 season. This indicates

that shortly after the quota was made transferable, concentration of quota had begun to increase rapidly.

The legislation fundamentally changed the operating conditions of the fisheries industry and began a new phase, characterized by a high degree of optimization and concentration of fishing and processing. Therefore, the number of companies in the industry has decreased, and the largest companies have grown and their profitability greatly increased. Increased leeway for the larger companies for investment and technological development has improved the performance of fishing vessels and fish processing plants and has led to further consolidation within individual companies and areas. The quota shares of the 10 largest companies in 1984 went from 21% to 53% in 2015. At the same time, landings of demersal fish decreased on average in 45 ports and increased by 75% in 19 ports. Similarly, landings of pelagic fish decreased on average by 77% in 27 ports while it increased by 117% in 12 ports. The share of the largest 10 demersal landing ports increased from 49% in 1984 to 64% in 2015 and the share of the 10 largest pelagic ports increased from 79% to 94% over the same period (Ministry of Industries and Innovation, 2017).

4 Landings and Quota Shares by Regions in Iceland

This chapter contains landings and quota shares by regions in Iceland. The data in this chapter displays the landings and quota shares proportionally to visualize how the two have changed throughout the years. This information is vital to look into to understand if there is a link between implementation of the quota management system in Iceland and how landing patterns have changed after the quota was made transferable.

When the quota was made transferable, quota shares were able to be sold and traded without geographical boundaries, so it is important to examine how quota shares have developed regionally. By examining this information it can give an idea if there are linkages with population development in Iceland.

Amount of workers in the fisheries sector in Iceland will also be examined in this chapter. This is to display the development of how the amount of workers in the sector has changed before and after the implementation of the quota management system. This information important to examine to see if the implementation has affected the amount of workers in the sector.

4.1 Landings by regions

This section contains landings in Iceland by regions from 1982 to 2018. This range of years is an ideal range to look at because the quota management system was implemented in 1984. This information is also important to examine to display how landings have developed regionally and if the development can be linked to the ITQ system. The numbers that are included in the figures below do not include landings that have been landed abroad. Each figure displays landings in proportion to the whole country for each year. This is to put in context how each region has been performing on a scale of whole Iceland.

4.1.1 Landings in the Southern Peninsula region

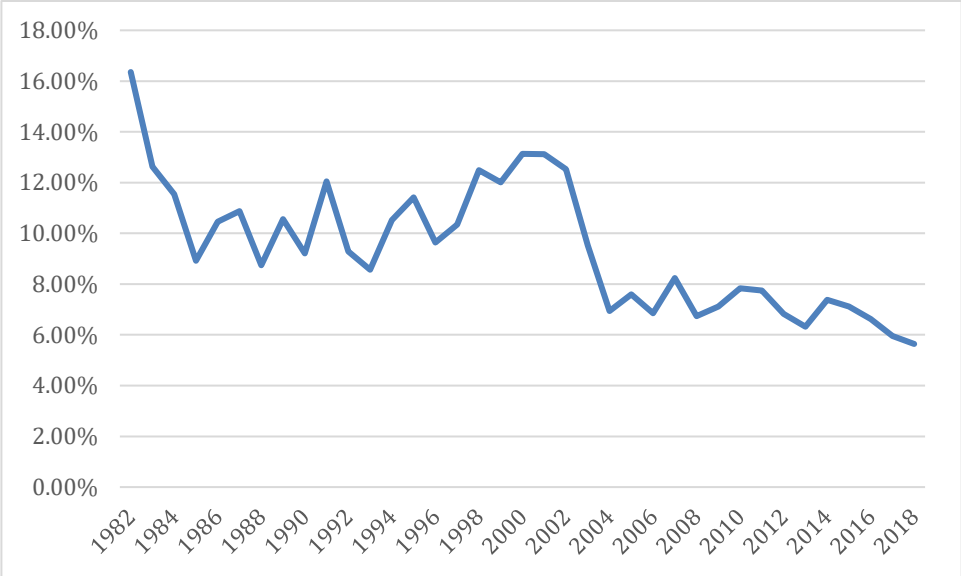


Figure 8 Amount of landings in the Southern Peninsula region from 1982 to 2018 (Statistics Iceland, 2018c)

Figure 8 above displays how much has been landed proportionally in the Southern Peninsula region from 1982 to the year 2018. As the figure displays, landings in the region decreased from 1982 until it hit a bit of a fluctuating but stable period between 1984 and 1998. Then the landings increase a bit around 2001 and reached around 13%. Afterwards landings decrease. In 2004 landings went down to around 7% and has slowly be decreasing since. Landings in the region hit 6% in 2018 which is an all-time low.

4.1.2 Landings in the Southern region

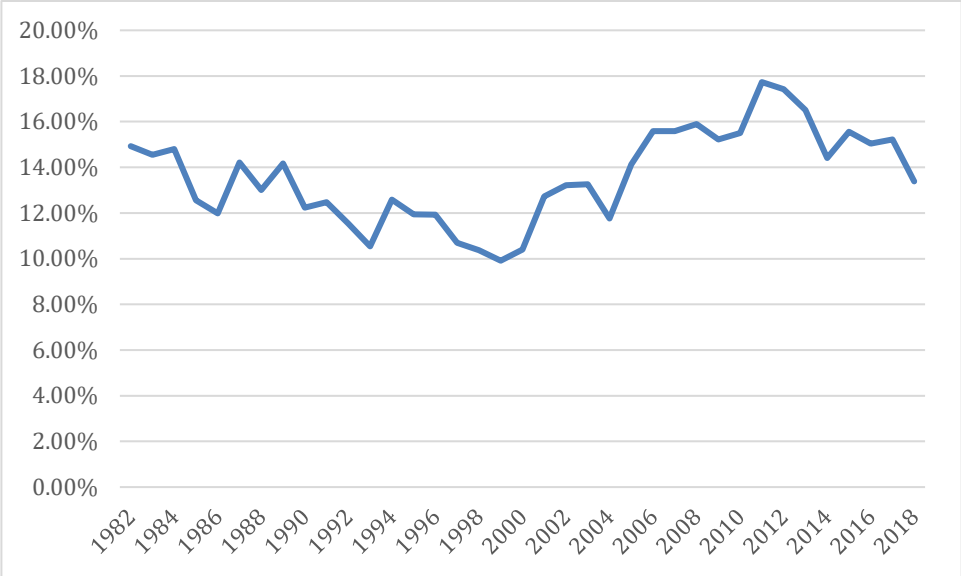


Figure 9 Amount of landings in the Southern region from 1982 to 2018 (Statistics Iceland, 2018c)

Figure 9 above displays landings proportionally in the Southern region between 1982 and 2018. The figure displays that the amount has fluctuated a bit throughout the years. Between 1982 and 1999 there was a bit of a downwards slope where landings went from around 15% to less than 10%. But then landings started to increase and hit an all-time high of 18% in 2011. Then it decreased again and were around 13% in 2018.

4.1.3 Landings in the Eastern region

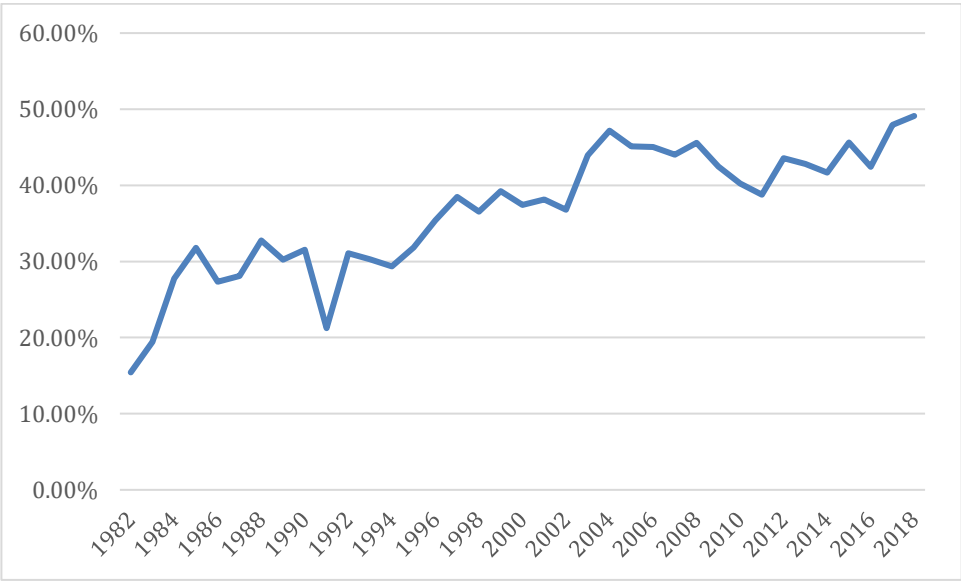


Figure 10 Amount of landings in the Eastern region from 1982 to 2018 (Statistics Iceland, 2018c)

Figure 10 above displays landings in the Eastern region in Iceland from 1982 to 2018. The figure displays an increase throughout the period from around 15% to almost 50%. This can explained by in the Eastern region a lot of pelagic species are landed such as mackerel, herring and capelin (FAO, 2010). Pelagic catches are usually a lot larger than other species like demersal catches.

4.1.4 Landings in the North Eastern region

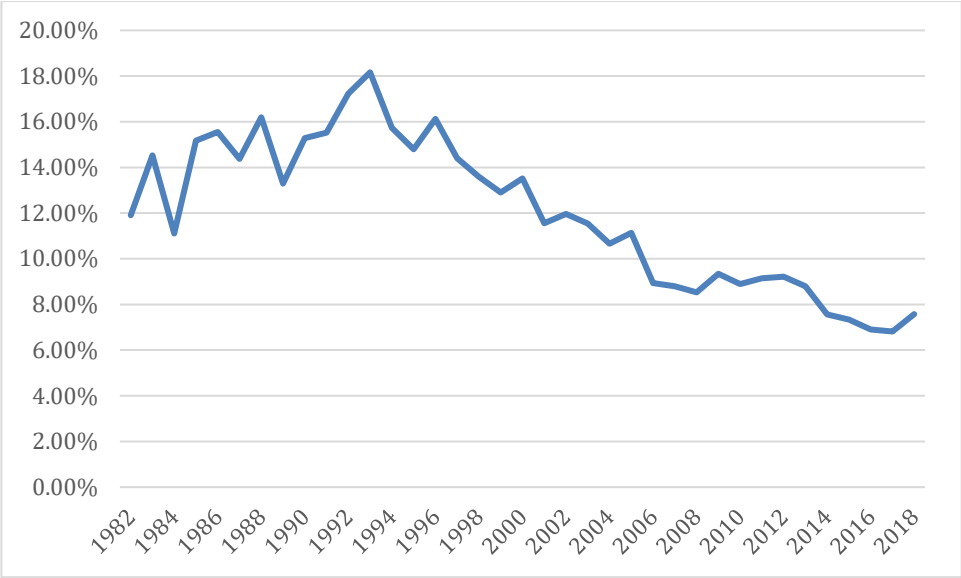


Figure 11 Amount of landings in the North Eastern region from 1982 to 2018 (Statistics Iceland, 2018c)

Figure 11 above displays landings in the North Eastern region in Iceland from 1982 to 2018. The figure displays that landings have proportionally been decreasing throughout the period. The began to increase up until 1993 where it rose from around 12% to around 18% but after that landings have been decreasing, going from almost 18% down to around 7.5% in 2018.

4.1.5 Landings in the North Western region

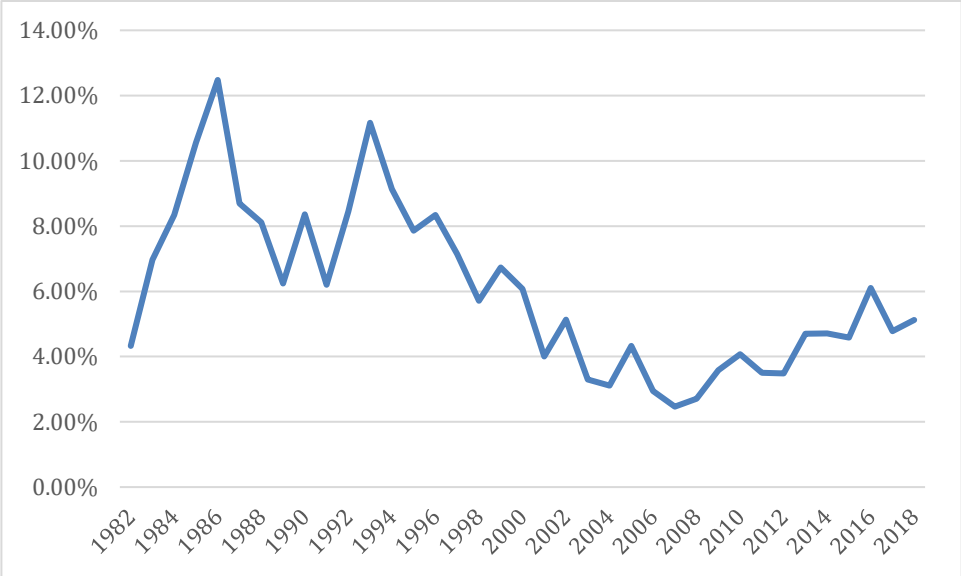


Figure 12 Amount of landings in the North Western region from 1982 to 2018 (Statistics Iceland, 2018c)

Figure 12 above displays landings in the North Western region from 1982 to 2018. The landings in the region fluctuated a lot between 1982 and 1994 where the catches went from around 4% up to almost 12.5% in 1986. Afterwards landings decreased quite a lot and then in 1995 it increases again to around 11%. Since then landings have decreased and in 2007 landings were only 2.5% in the region. Landings increased gradually afterwards but in 2018 they were far from what they were when they the landings were at its peak.

4.1.6 Landings in the Westfjords

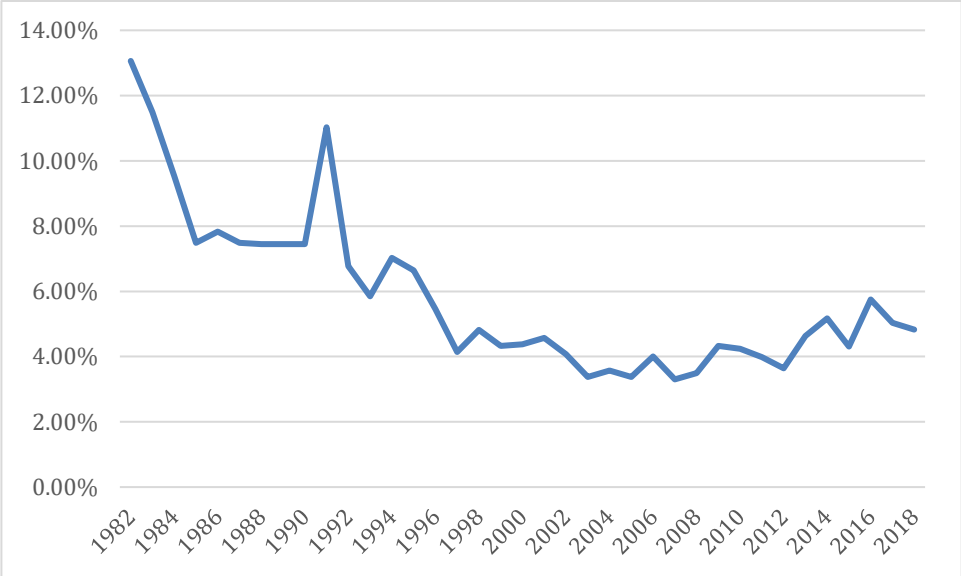


Figure 13 Amount of landings in the Westfjords from 1982 to 2018 (Statistics Iceland, 2018c)

Figure 13 above displays the amount of landings in the Westfjords in Iceland from 1982 to 2018. Landings decreased proportionally in this period except for a major spike in 1992. In 1982 almost 13% of landings took place in the Westfjords but went down to less than 3.5% in 2003. Since then landings have increased a little bit and in 2018 were around 5%.

4.1.7 Landings in the Western region

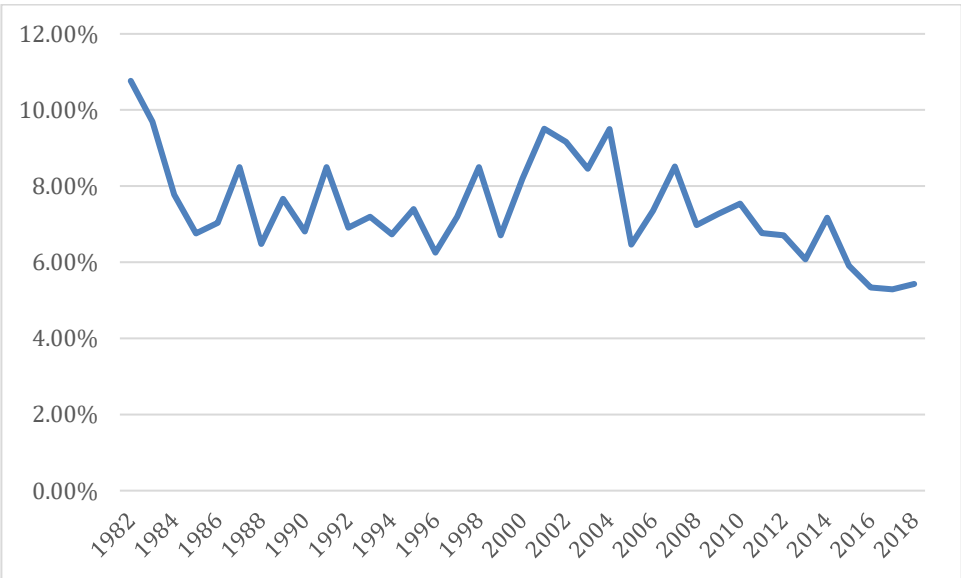


Figure 14 Amount of landings in the Western region from 1982 to 2018 (Statistics Iceland, 2018c)

Figure 14 above displays the amount of landings in the Western region in Iceland from 1982 to 2018. The figure displays that landings in the region fluctuated quite a bit in the period. In 1982 the landings were around 11% but decreased a bit in the following years. From 1984 to 2014 the landings fluctuated between around 6.5% and 9.5% in that period. But in recent years the amount has decreased gradually and were around 5.5% in 2018.

4.1.8 Landings in the Capital region

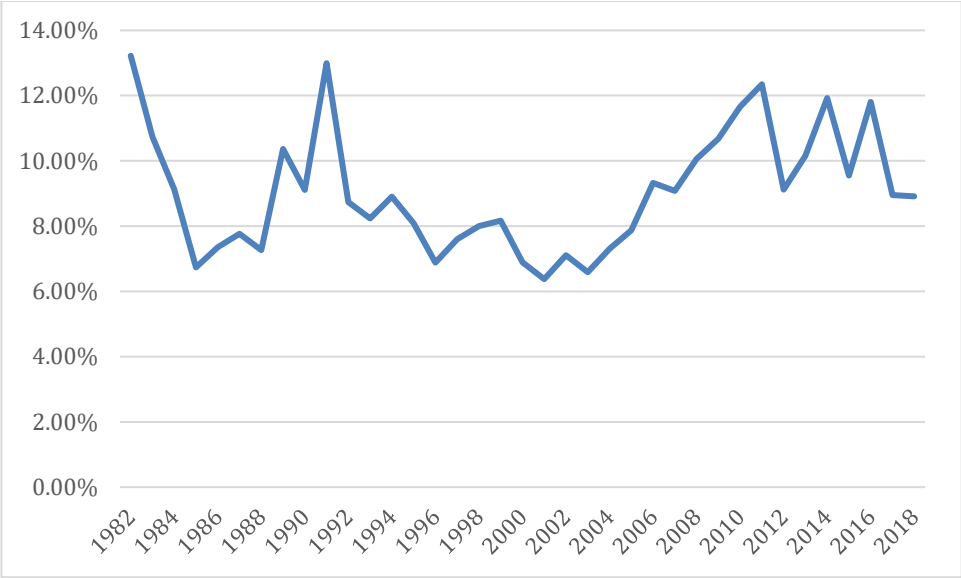


Figure 15 Amount of landings in the Capital region from 1982 to 2018 (Statistics Iceland, 2018c)

Figure 15 above displays the amount landed proportionally in the Capital region in Iceland between 1982 and 2018. The amount has varied quite a bit and hard to determine a certain trend happening. Landings decrease in the beginning between 1982 and 1986 but increase again in 1991. Landings drop again in 1992 and are quite stable until 2004. After that landings increase again and since 2010 landings has been between around 9% and 12%.

4.1.9 Summary of landings by regions

Landings have changed quite a bit throughout the years like the figures above display. Landings have decreased the most in the Westfjords, the North Eastern region and the North Western region. The regions show a similar characteristics where all of them show a decrease after 1993. The Westfjords and North Western region take a larger dive than the North Eastern region but those two regions have though bounced back a bit in recent times while the North Eastern region still displays a decrease in landings. Landings in the Western region and the Southern Peninsula region have also decreased but not as drastically as the three regions mentioned. The Southern

region and Capital region have fluctuated throughout the period but been stable to some extent. The Eastern region is the only one that displays a large increase in landings but that can be explained due to pelagic fisheries in the region.

The period the figures display is from 1982 to 2018. The quota management system was implemented in 1984, right after the data of landings by regions was made available. Regions like the Southern Peninsula region, Western region, Capital region and the Westfjords all show a steep drop in landings in the beginning of the period and which could possibly be linked to the bad status of commercial stocks. After 1990 when the quota was made transferable it can be seen in the figures that landings in regions either drop or increase. This can possibly be explained by when the quota shares were made transferable stakeholders in regions traded their quota as soon as it was possible.

4.2 Quota share developments in Icelandic regions

This section contains development of quota shares in regions in Iceland from 1991 to 2018. The period is from when quota became transferable, or in 1991, to latest available information published. Looking at the development of how the quota shares have been proportionally allocated to each region for each fishing year could tell if there is a link between quota share allocations and demographic changes in Iceland. The x axis in the figures displayed below is fishing years, which are from 1. September to the 31. August. The y axis shows the amount of allocated quota shares in Iceland in a proportion of the whole country. Quota shares are allocated to vessels each fishing year and each vessel is operating in a certain region. The fisheries in Iceland are mostly vertically integrated where vessels are often owned by stakeholders which also own a processing facility. This is important to have in mind because there is a possibility that if quota shares leave regions, people employed by the quota owners might lose work.

4.2.1 Development of quota shares in the Southern Peninsula region

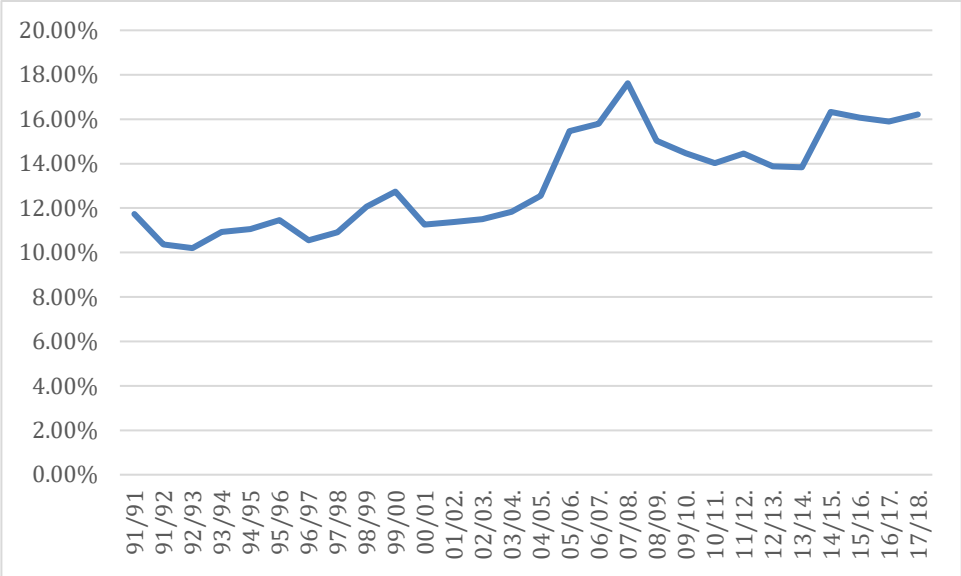


Figure 16 Development of quota shares in the Southern Peninsula region from 1991 to 2018 (Directorate of Fisheries, 2018)

Figure 16 displays the development of how much quota shares are allocated to the Southern Peninsula region in Iceland from 1991 to 2018. The figure displays that quota shares in the region has increased throughout the years. In the beginning quota shares in the region where a little less than 12% but peaked in the 07/08 season where they went up to almost 18%. In recent years the quota shares have been around 16% in the region.

4.2.2 Development of quota shares in the Southern region

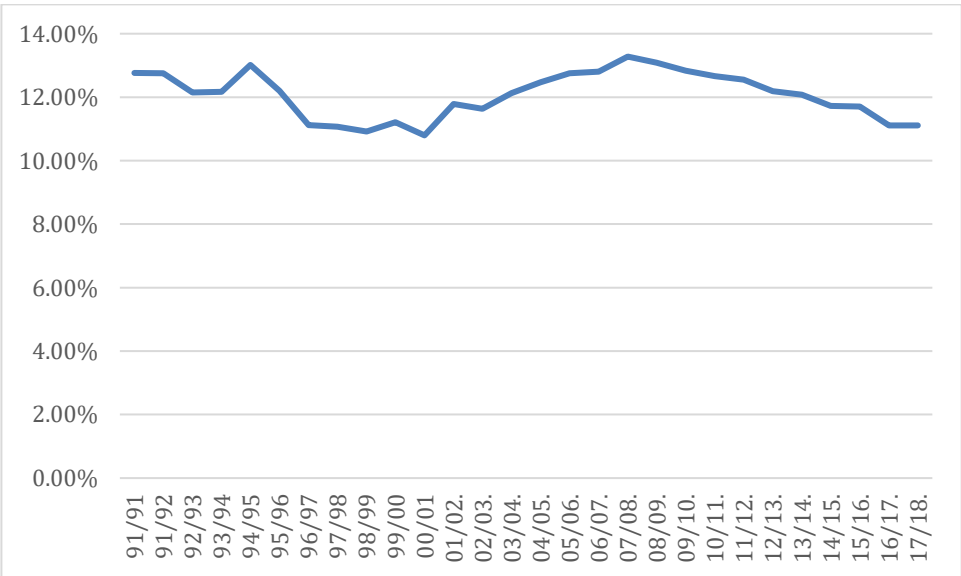


Figure 17 Development of quota shares in the Southern region from 1991 to 2018 (Directorate of Fisheries, 2018)

Figure 17 displays the development of how much quota shares are allocated to the Southern region in Iceland from 1991 to 2018. The figure displays that the amount of quota shares in the region has been quite stable throughout the years and fluctuated around 12%.

4.2.3 Development of quota shares in the Eastern region

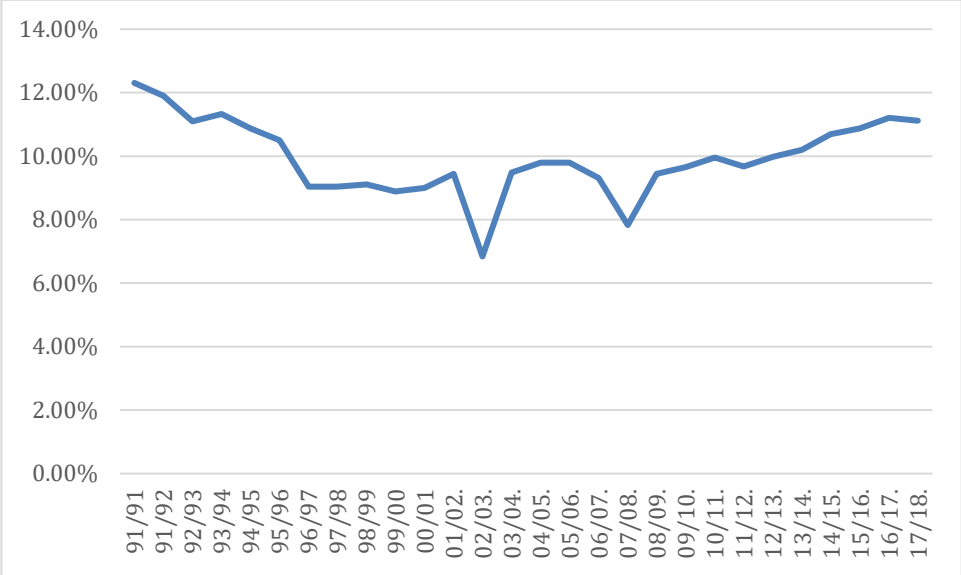


Figure 18 Development of quota shares in the Eastern region from 1991 to 2018 (Directorate of Fisheries, 2018)

Figure 18 above displays the development of how much quota shares are allocated to the Eastern region in Iceland from 1991 to 2018. The figure displays that the quota shares dropped quite a bit in the beginning of the period from around 12.3% in the 1991/1991 season to 9% in the 1996/1997 season. The amount of quota shares have though been increasing gradually since then except for two bad years in the 2002/2003 season and 2008/2009 season. The quota shares were around 11% in the 2017/2018 season.

4.2.4 Development of quota shares in the North Eastern region

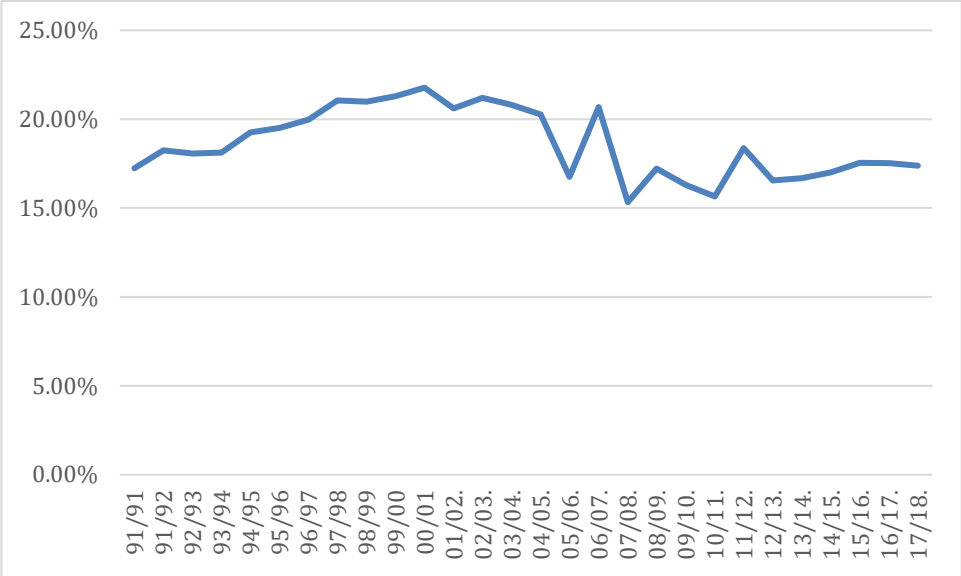


Figure 19 Development of quota shares in the North Eastern region from 1991 to 2018 (Directorate of Fisheries, 2018)

Figure 19 above displays the development of how much quota shares are allocated to the North Eastern region in Iceland from 1991 to 2018. The figure displays that after 1991 the amount of quota shares increased from around 17% to almost 22% in the 00/01 season. Afterwards the amount decreased a bit but with a spike in the 06/07 season. But afterwards the amount of quota shares decreased again and has since then between around 15% and 18%.

4.2.5 Development of quota shares in the North Western region

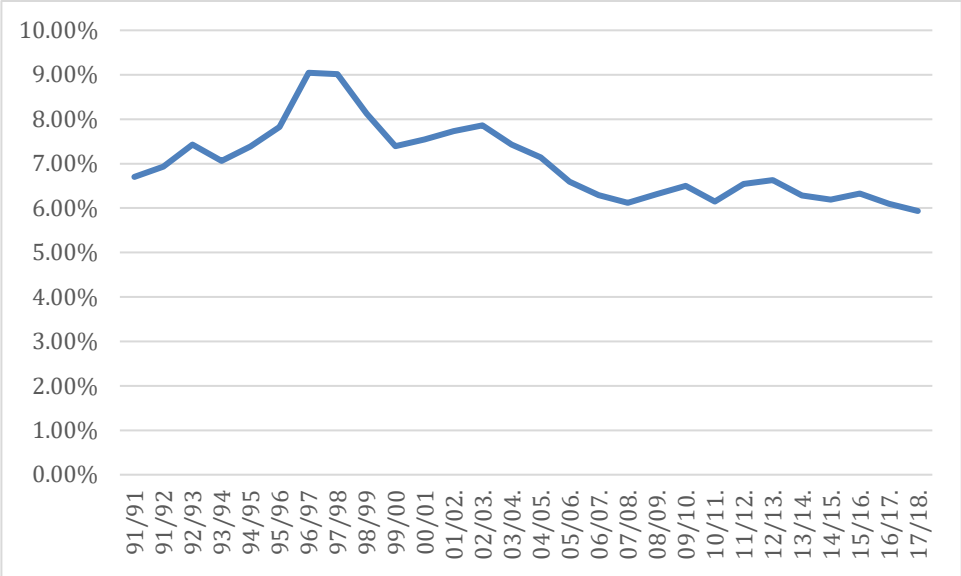


Figure 20 Development of quota shares in the North Western region from 1991 to 2018 (Directorate of Fisheries, 2018)

Figure 20 above displays the development of how much quota shares are allocated to the North Western region in Iceland from 1991 to 2018. The figure displays an increase in the quota share allocations from 1991 to the 98/99 season where it increased to 9%. Afterwards the amount of quota shares decreased gradually and is today around 6%.

4.2.6 Development of quota shares in the Westfjords

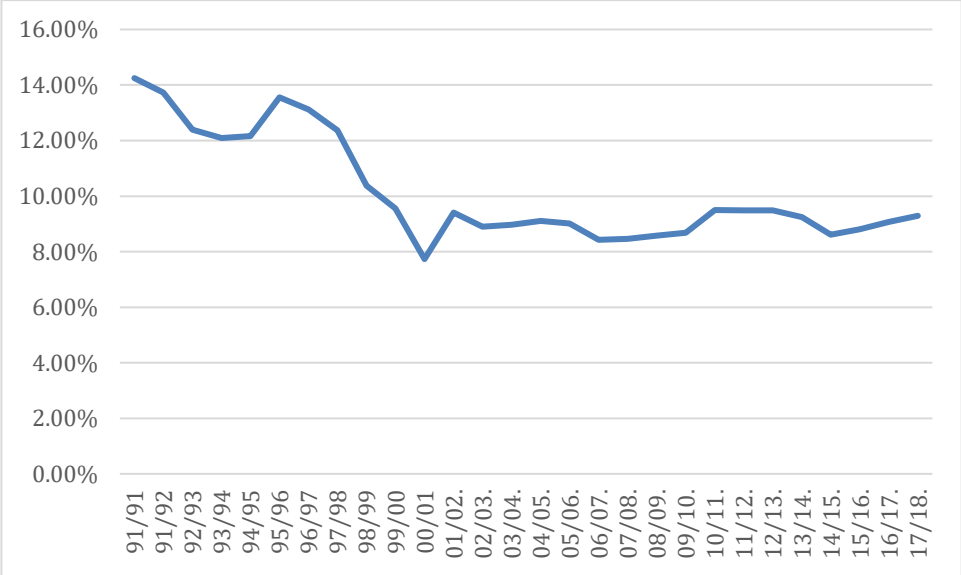


Figure 21 Development of quota shares in the Westfjords from 1991 to 2018 (Directorate of Fisheries, 2018)

Figure 21 above displays the development of how much quota shares are allocated to the Westfjords in Iceland from 1991 to 2018. The figures displays that the amount of quota shares have dropped quite a lot since quota was made transferable. In the start is was a bit more than 14% but dropped a bit until it increased again in the 96/97 season. Afterwards the amount of quota shares decreased gradually and got to an all-time low in the 00/01 season where it went under 8%. Since then the quota shares have been quite stable in the region around 9%.

4.2.7 Development of quota shares in the Western region

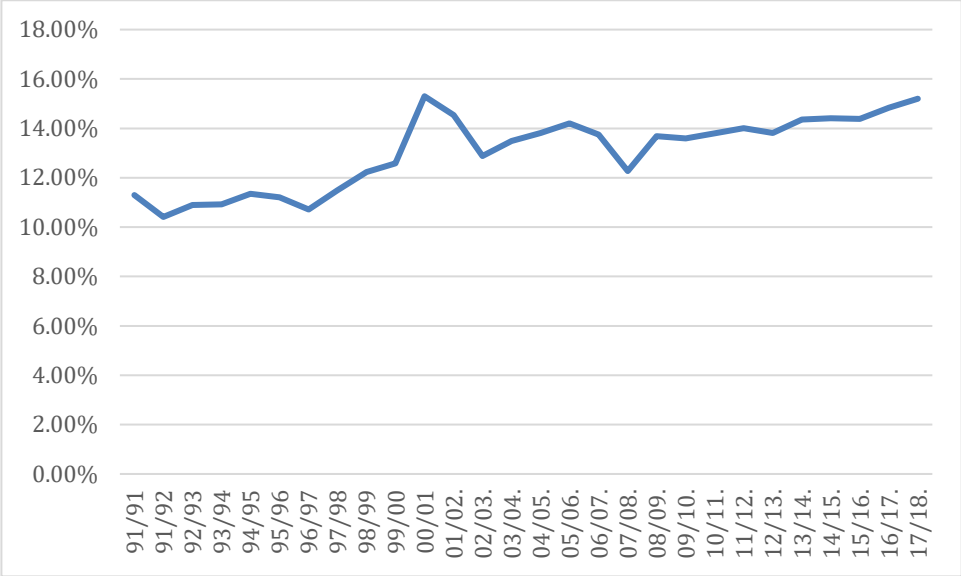


Figure 22 Development of quota shares in the Western region from 1991 to 2018 (Directorate of Fisheries, 2018)

Figure 22 above displays the development of how much quota shares are allocated to the Western region in Iceland from 1991 to 2018. As the figure displays, the amount of quota shares have been progressively increasing since the start of the transferable quota era. In 1991 the amount was around 11% and went to 15.3% in the 00/01 season. Shortly afterwards the amount decreased but has gradually increased to the same amount or around 15% in 2018.

4.2.8 Development of quota shares in the Capital region

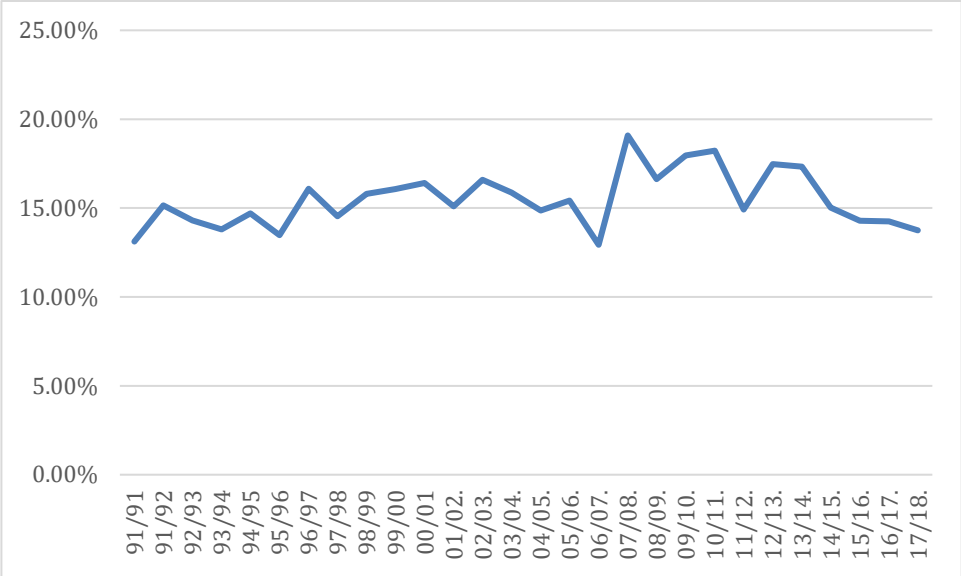


Figure 23 Development of quota shares in the Capital region from 1991 to 2018 (Directorate of Fisheries, 2018)

Figure 23 above displays the development of how much quota shares are allocated to the Capital region in Iceland from 1991 to 2018. The amount of quota shares in the Capital region has fluctuated bit but at the same time been quite stable. From 1991 to the 07/08 season the amount was around 14% and 16%. Then it increased to around 19% in the 08/09 season. Afterwards the amount has decreased and is was around 14% in 2018.

4.2.9 Summary of quota shares

The quota shares by regions have changed quite a lot since the quota was made transferable. There are three regions that have been quite stable during the course of the period. Those are the Capital region, the North Eastern region and Southern region. The Southern Peninsula has been gradually increasing in the amount of quota shares. The Eastern region had a bit of a downwards spike throughout the period but bounced back. There are only two regions that show a decrease in quota shares, those are the Westfjords and North Western region. The quota shares in the North Western region increased in the beginning of the period but decreased again but has been stable since the 07/08 season. The Westfjords decreased in quota shares a bit more drastically where they lost almost half of their quota shares in only a decade. It increased though a little bit afterwards but has been more of less the same since the start of the century. As the figures above display, the quota shares by regions have fluctuated. As the quota was made transferable some regions lost quotas while others have gained. It seems by limiting access to

the resource in the 1980s and allocating quotas to vessels from their 3 years fishing experience, some vessels had it better than others. Because of the input of the transferability stakeholders could trade their quota to possibly those who had had it better because of the allocations.

4.3 Development of amount of workers in the fisheries sector

With limitations being implemented on the fisheries it is important to examine the development of the amount of people working in the sector. Figures 24 and 25 below display the development of amount of workers in the sector. Figure 24 displays the development from 1963 to 2019 while figure 25 displays the development from 1991 to 2019. This is because the data between 1991 and 2019 also includes data of if the workers were located in the Capital region or outside of the Capital region. The data includes workers that are both fishermen and workers that are processing the fish on land. The period 1963 to 2019 chosen because that is how far back the data goes.

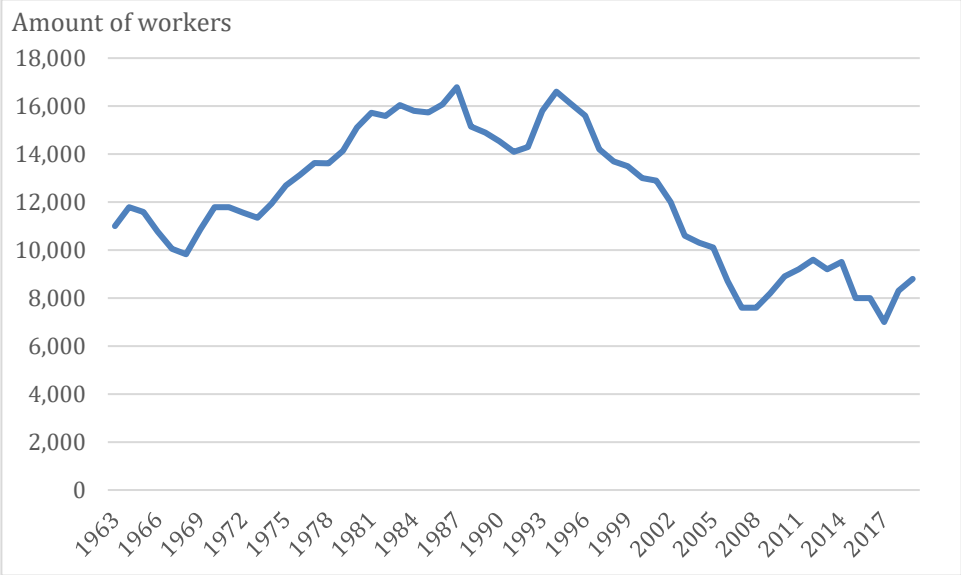


Figure 24 Development of amount of workers in the fisheries sector between 1963 and 2019 (Statistics Iceland, 2003, 2020a).

Figure 24 above displays the development of the amount of workers in the fisheries sector between 1963 and 2019. The figure displays that the amount of workers in the sector took a steep drop where the amount went from almost 12 thousand workers in 1964 to less than 10 thousand workers in 1968. Afterwards, the amount of workers in the sector began to increase quite considerably. From 1968 to 1987 the amount of workers in the sector went from being little less than 10 thousand to around 16.7 thousand. After that the numbers dropped to 14.1

thousand workers in 1991. But it increased again and reached 16.6 thousand people in 1994. Afterwards the amount of workers in the sector dropped considerably and went down to 7.6 thousand workers in 2007. That is a decrease of around 9 thousand workers in a span of 13 years. It increased though in the following years and was little less than 10 thousand workers between 2012 and 2014 but decreased again and hit an all-time low in 2007 when only 7 thousand people worked in the sector. The amount increased a bit afterwards and the amount of workers were around 8.8 thousand in 2019.

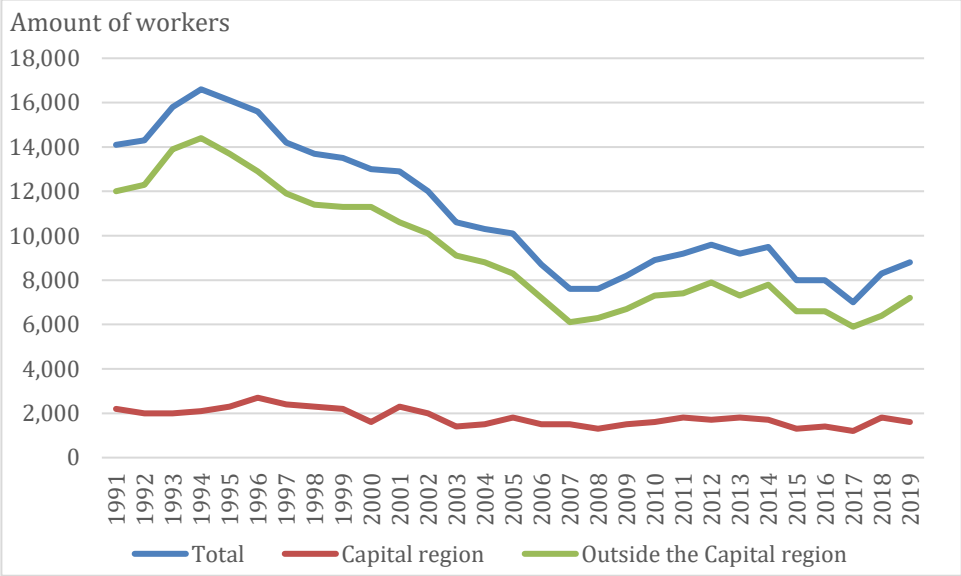


Figure 25 Development of amount of workers in the fisheries sector in the Capital region and outside the Capital region between 1991 and 2019 (Statistics Iceland, 2020a)

Figure 25 above displays the development of amount of workers in the fisheries sector in the capital regions and outside of the Capital region from 1991 to 2019. The figure displays that the amount of workers in the Capital region has not changed a lot and has been around 2 thousand workers. What the figure displays is that it is the regions outside of the capital region that have been experiencing the decrease of workers in the sector, at least during the period between 1991 and 2019. As the figure displays there is a high correlation between the total decrease and decrease outside the Capital region.

Changes in population development might have something to do with the decrease of workers in the sector but it cannot be forgotten that it is hard to estimate it due to technological innovations in fisheries over the years. Fisheries Iceland has stated that the decrease of workers does not tell the whole story because at the same time jobs in fishing and fish processing plants,

workers in indirect jobs related to fisheries have increased. Because of technological innovations in fisheries less people are required to do fisheries related jobs, and that calls for jobs in other sectors. Those sector today find ways to improve the quality of raw materials and make the products more valuable. The people who work in these high-tech industries, developing solutions for the fishery industry, are not directly working in the fisheries sector but indirectly. Thus it can be a little misleading solely looking into those who are directly employed by the fisheries sector (Þorsteinsson, H, 2017). The technological innovations have also been noticeable in the fishing as vessels have larger capacity today to fish. In the 1960 around 350 fishers were needed to catch around 2.5 thousand metric tons of herring, 20 years later in the 1980s that number had decreased to only 100 fishers to catch the same amount, but of capelin as the herring stock was depleted, today to catch the same amount only one ship is needed and only around 10 fishers to operate (Herbertsson, 2005).

As the amount of workers has decreased in both fishing and fish processing plants, there has been an interesting development when it comes to value and total catch. In 1982 the total catch in Iceland was around 812 thousand metric tonnes, which 388 thousand metric tonnes were cod. In 2011 about 170 thousand metric tonnes of cod was caught. Though there is less amount caught between these years, each kilogram of fish is utilized better and more value made from it. From 1982 to 1991 the catch value went from 76 billion ISK up to 129 billion ISK. In 2011 the catch value was 170 billion ISK. So it is clear that there has been a great success in increasing the value of catches in Iceland. Similarly if only demersal catches are counted, the catch value in 1982 was 65 billion ISK but in 2015 it was over 100 billion ISK. The key of increasing the catch value lies in product development, higher market prices, better utilization of products and technological innovations in fisheries. It is also clear that sustainable fisheries has a major impact on how value creation has developed. By having limitations on the fisheries, companies are always looking for new ways to maximize their catch values (Þorsteinsson, H, 2017).

5 Population development in regions and coastal settlements in Iceland

This chapter contains population development in regions and coastal settlements in Iceland. The information in this chapter is vital to examine to see how population in regions and settlements have been changing before and after the implementation of the quota management system. The quota management system was implemented in 1984 and it was made transferable in 1991. By examining that information, the data could give and idea if there is a possible link between population developments and the implementation which possibly led to geographical changes in the fisheries.

5.1 Population development of Iceland

Population of Iceland has been growing quite rapidly for the last one hundred years. One hundred years ago the population of Iceland was only around 92 thousand people but in 2019 it had grown to almost 357 thousand people as displayed on figure 26 below. That means the population is 3.9 times larger today than it was one hundred years ago.

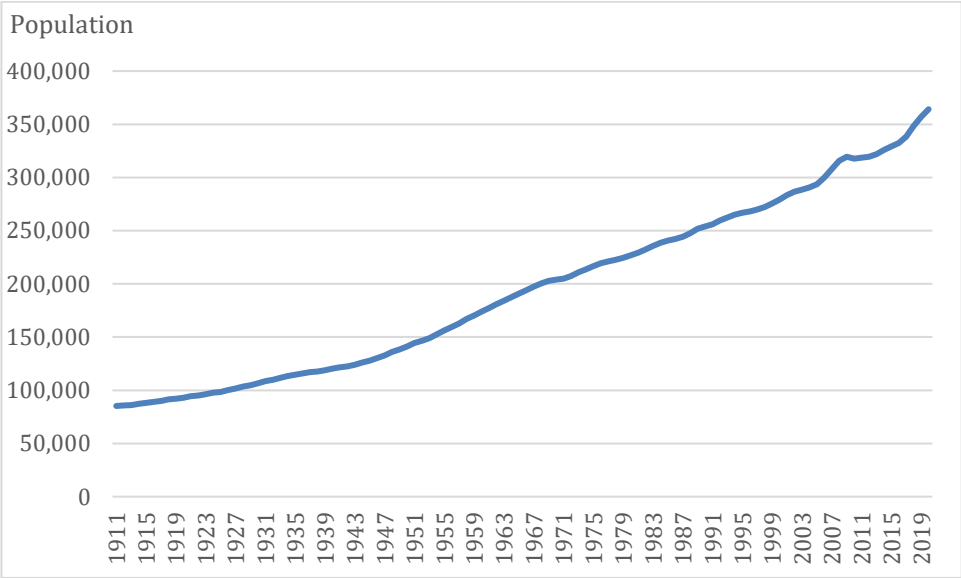


Figure 26 Population development in Iceland between 1911 and 2019 (Statistics Iceland, 2019f).

As has been mentioned before, this thesis focuses on the topic if there has been a decrease in smaller settlement structures in Iceland due to the implementation of the quota system. The quota system was implemented in 1984 and therefore we will look into data gathered from the Statistics of Iceland from 1911 to modern days or 2019. Figure 27 below displays the population

growth in Iceland from 1980 to 2019. The figure displays that the population has been increasing quite rapidly in that period. In 1980 there were around 227 thousand people in Iceland and like has been mentioned above the population in 2019 was 357 thousand. That is an increase of 130 thousand people only in 28 years or a little more than 57% in increase. In figure 27 below the only down spike in the population development is between 2009 and 2010.

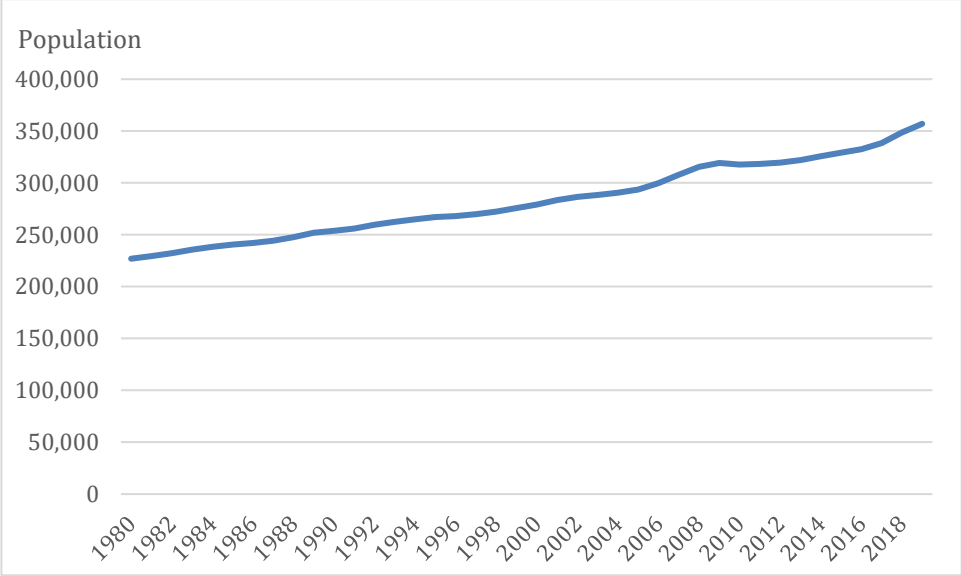


Figure 27 Population development in Iceland between 1980 and 2019 (Statistics Iceland, 2019f).

5.2 Population development by regions

Iceland is split into eight regions which are:

1. Capital region
2. Southern Peninsula region
3. Western region
4. Westfjords region
5. North Western region
6. North Eastern region
7. Eastern region
8. Southern region

Their locations are displayed in picture 12 below. Population developments in each region will be examined and coastal settlements within them except for the capital region due to its size and density between municipalities. Many municipalities within the Capital region are located

adjacent to each other. The period of 1911 to 2019 has been chosen because 1911 is the furthest year back the data goes with data from majority of settlements in Iceland. It is also important to look into the population development in the settlements before the ITQ system was implemented in the 1980s.

Picture 4 Regions of Iceland (Lögreglan, 2020)

5.2.1 The Capital region

The Capital region in by far the largest region in Iceland. The population in the Capital region has grown rapidly throughout the last century as displayed on figure 28 below. The figure displays the population in the region was around 15.4 thousand people in 1911. In 2019 around 228 thousand people lived in the region. The Capital region is responsible for 63.8% of the whole population of Iceland. The capital region has eight municipalities within it, Reykjavík which is by far the largest municipality with around 127 thousand inhabitants and the other 7, Hafnarfjörður, Garðabær, Mosfellsbær, Seltjarnarnes, Kópavogur, Álftanes and Kjósárhreppur.

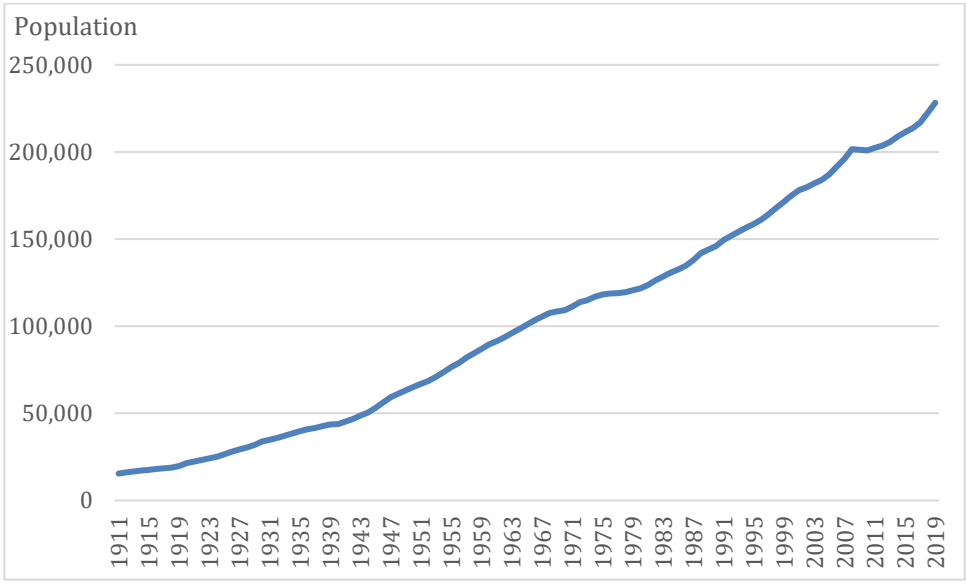


Figure 28 Population development in the Capital region between 1911 and 2019 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

5.2.2 The Southern Peninsula region

The Southern Peninsula region is located west of the Capital region. Like the Capital Region the Southern Peninsula region has been increasing quite rapidly in population as figure 29 displays. In 1911 the population of the region was only around 2.5 thousand people. The figure displays the growth wasn't that rapid until around 1950. After that the population in the region goes from about 5 thousand people to around 17 thousand in 2004. The population grows increases even more after that with a slight decrease between 2009 and 2016. In 2019 the population of the region was little more than 27 thousand people. That means over the period the population has increased by around 24.5 thousand people in that time.

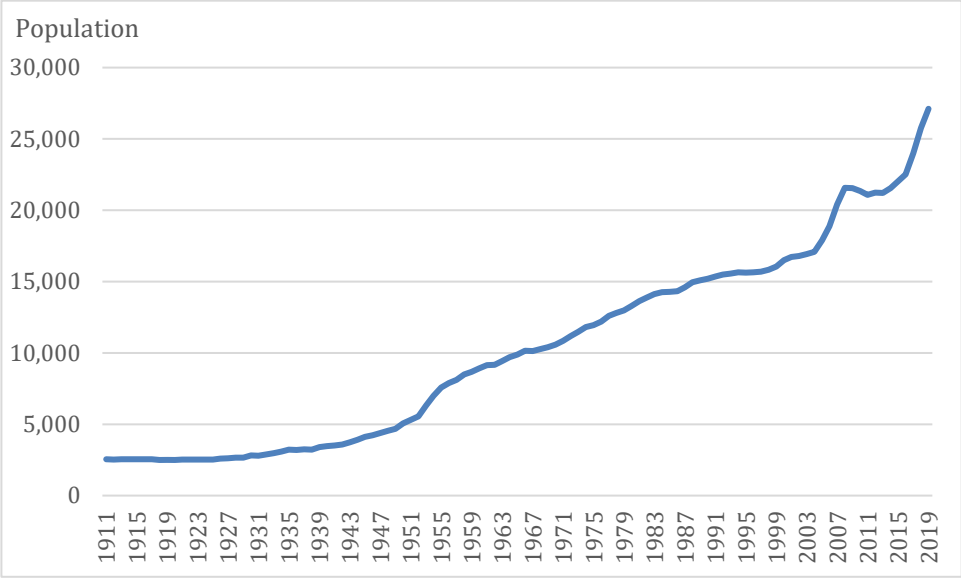


Figure 29 Population development in the Southern Peninsula region between 1911 and 2019 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

The coastal settlements found in the Southern Peninsula region are Grindavík, Garður, Sandgerði, Reykjanesbær (former known as the two municipalities of Keflavík and Njarðvík) and Vogar. Figures 30 and 31 below display that the population has been on the rise since the year 1911 to the year 2019 in all coastal settlements. Figure 30 displays the population development in Grindavík, Sandgerði, Garður and Vogar while figure 31 displays the population development only in Reykjanesbær. This is due because of the population difference between these towns. Reykjanesbær is a lot larger in size than the other coastal settlements as figures 30 and 31 display.

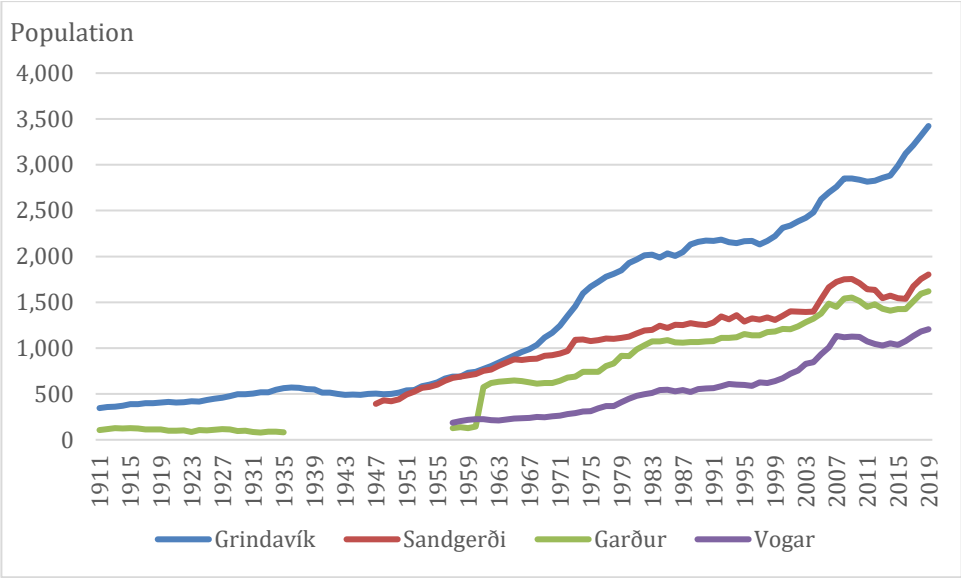


Figure 30 Population development in Grindavík, Sandgerði, Garður and Vogar between 1911 and 2019 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

Figure 30 above displays the population development in Grindavík, Sandgerði, Garður and Vogar from 1911 to 2019. Grindavík is the only settlement that has data for the whole period. From 1911 to 1947 there is little growth in the towns but after that all settlements displayed in the figure show increase in population. Grindavík increased a lot more in size than the other settlements as displayed. After 2009 all settlements display a small decrease in population development but after that they all increased in size.

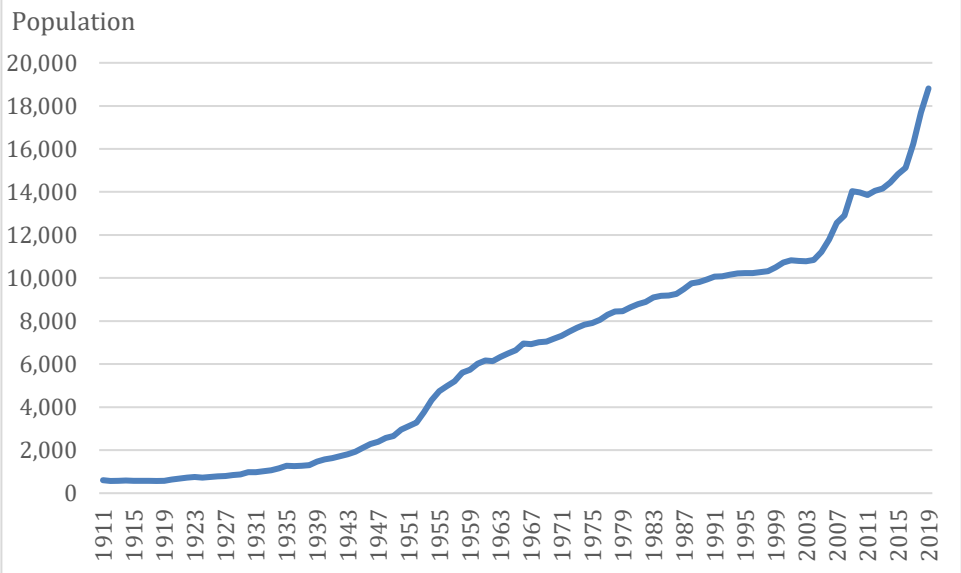


Figure 31 Population development in Reykjanesbær (former Keflavík and Njarðvík) between 1911 and 2019 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

Figure 31 above displays the population development of Reykjanesbær, formerly known as the two separate towns of Keflavík and Njarðvík. In the beginning of the period from 1911 to 1938 the population grew gradually, from around 600 to little more than 1300 people, but in 1939 the population begun to increase quite rapidly. This development kept on going until 2004 where the town had around 11 thousand inhabitants. After 2004 the population increased even quicker and in 2019 around 18.8 thousand people lived in Reykjanesbær.

5.2.3 The Western region

Figure 32 below displays the population development in the Western region of Iceland between 1911 and 2019. As can be seen on figure 32, the population in the region was quite stable from 1911 to 1951. After that the population in the region started to increase and in 1983 the population had grown from around 10.2 thousand people in 1951 to about 15.1 thousand people. Afterwards there was gradual depopulation and in 1997 the population had gone down to around 13.9 thousand people. After 1997 the population started to increase again and in 2019 there were around 16.5 thousand people in the region.

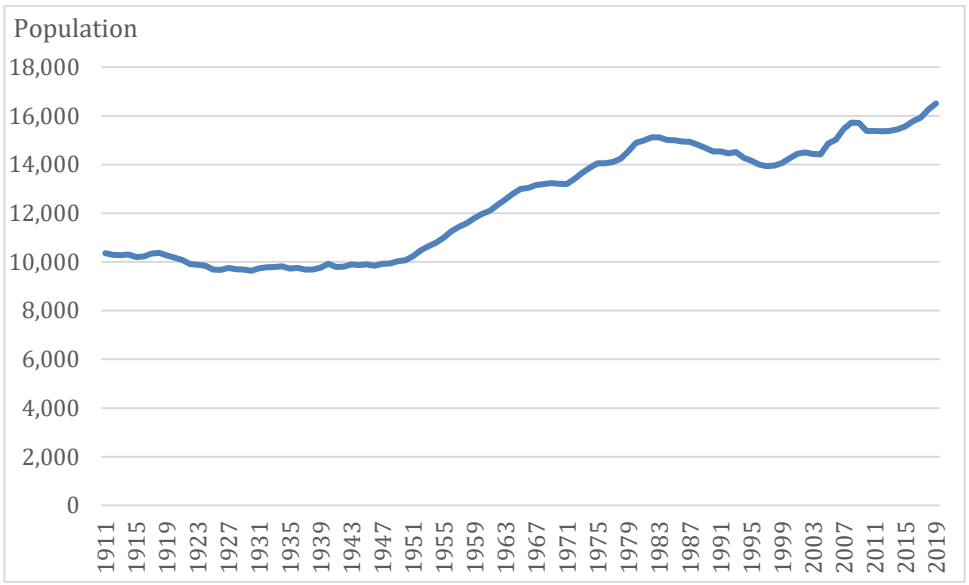


Figure 32 Population development in the Western region between 1911 and 2019 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

The region has seven coastal settlements within it which are displayed on figures 33 and 34. The settlements are Stykkishólmur, Ólafsvík, Grundarfjörður, Hellissandur, Búðardalur, Rif and Akranes. The figures are split due to major population differences between Akranes and other coastal settlements in the region.

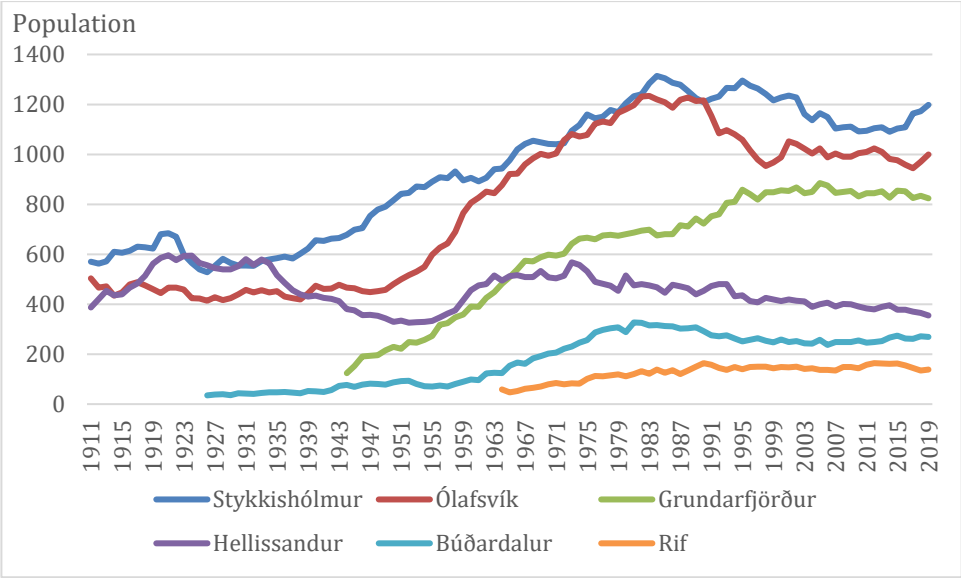


Figure 33 Population development in Stykkishómur, Ólafsvík, Grundarfjörður, Hellissandur, Búðardalur and Rif between 1911 and 2019 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

Figure 33 above displays the population trend in Stykkishómur, Ólafsvík, Grundarfjörður, Hellissandur, Búðardalur and Rif. The figure displays that from the start of the data all towns increase their population until the 1980s except for Hellissandur which had been gradually decreasing in size for decades. After the 1980s Stykkishólmur Búðardalur and Ólafsvík reduce in size while Grundafjörður goes against the trend and increases in size. The data for Rif starts in 1965 when 47 people lived there, in 2019 the population had grown to 138 inhabitants.

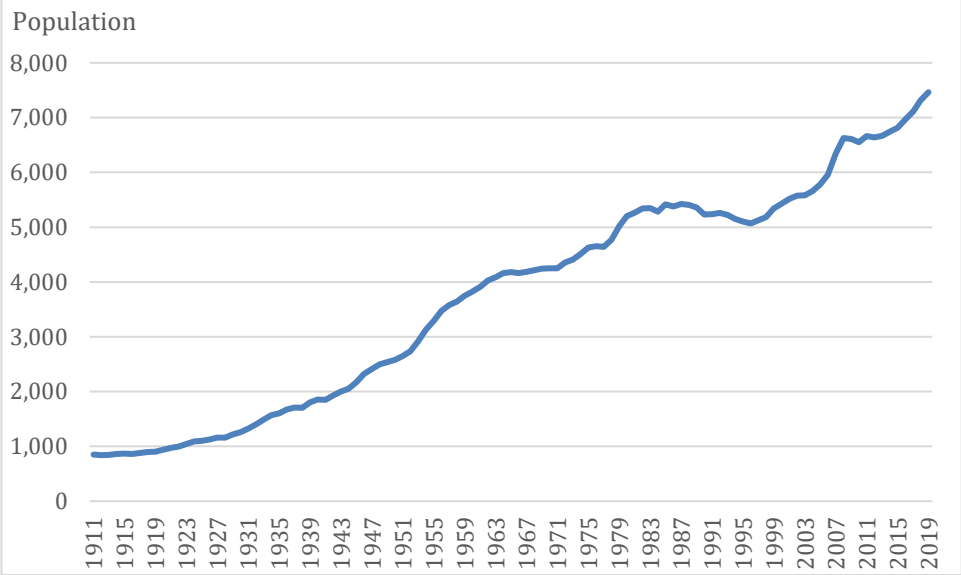


Figure 34 Population development in Akranes between 1911 and 2019 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

Figure 34 above displays the population development of Akranes. The population has increased quite a lot though out the period like the figure displays. From 1911 to 1986 the population grew from around 850 people to around 5.3 thousand. A small decrease is detected after that where the population decreased to around 5 thousand in 1996. After 1996 the population increases again and in 2019 it was around 7.5 thousand people.

5.2.4 Westfjords region

The Westfjords region is the least populous region in Iceland and had only around 7 thousand inhabitants in 2019. Figure 35 below displays the population development of the region from 1911 to 2019. The figure displays that the population has been declining for a while. From 1911 to the beginning of the 1940s the population was stable around 13 thousand people. After the 1940s the population decreases to around 10.5 thousand people in 1956. From 1956 to 1981 the population in the region was stable around 10 to 10.5 thousand people. After 1981 the population begun to decrease again and like has been mentioned was around 7 thousand people in 2019.

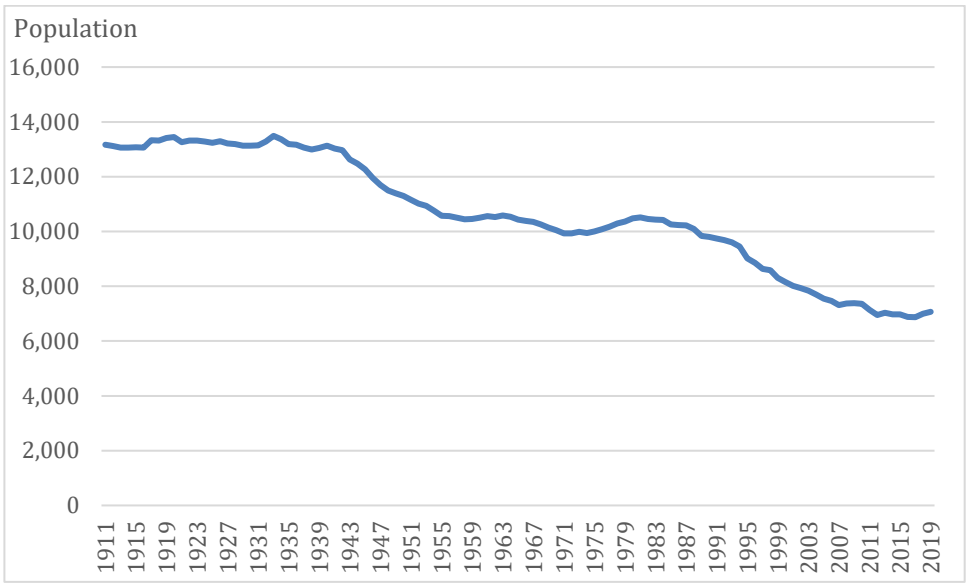


Figure 35 Population development in the Westfjords region between 1911 and 2019 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

The Westfjords region has many coastal settlements within it or a total of eleven. Figures 36 and 37 below display the population trends in the 11 coastal settlements. The settlements are split in two figures due to different in population size. The coastal settlements in the figures are Ísafjörður, Bolungarvík, Tálknafjörður, Flateyri, Suðureyri, Bíldudalur, Þingeyri, Súðavík,

Drangsnes, Hólmavík, Ísafjörður, Bolungarvík and Patreksfjörður. The last three are displayed on a different figure due to size differences.

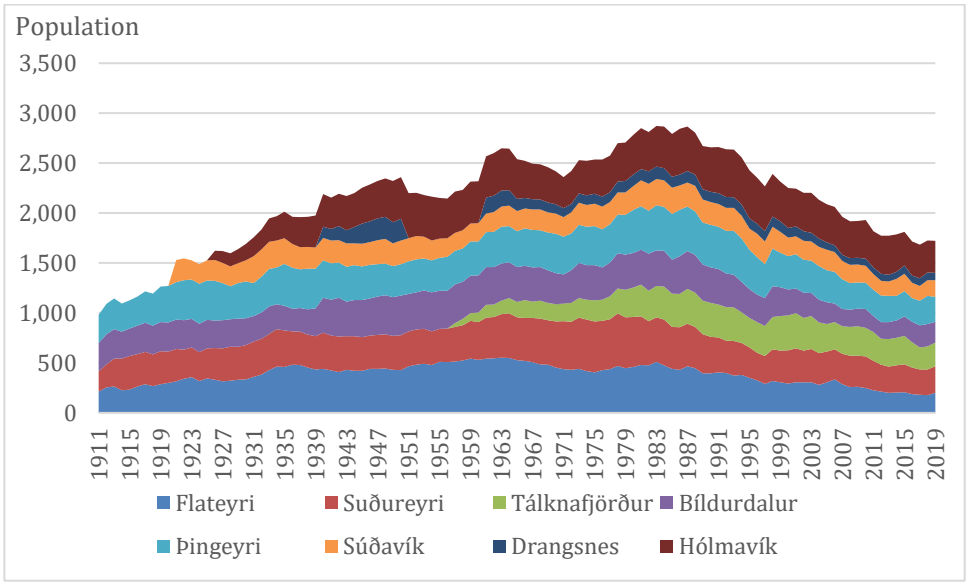


Figure 36 Population development in Flateyri, Suðureyri, Tálknafjörður, Bíldudalur, Þingeyri, Súðavík, Drangsnes and Hólmavík between 1911 and 2019 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

Figure 36 above displays the population development in Flateyri, Suðureyri, Tálknafjörður, Bíldudalur, Þingeyri, Súðavík, Drangsnes and Hólmavík. Like the figure displays, all the towns display an increase in population in the period until the 1980s except for Flateyri that had been stable. After the 1980s all towns show a decrease in population.

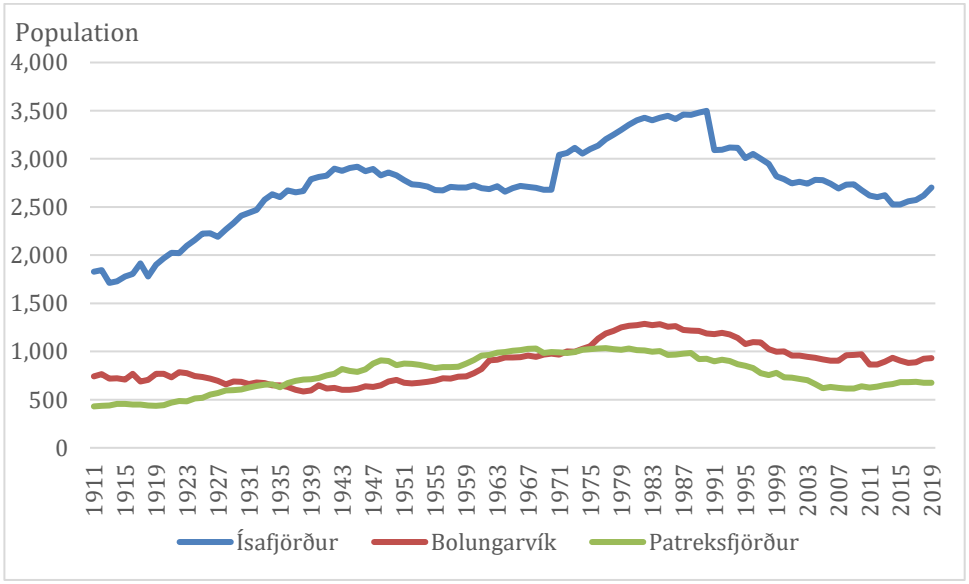


Figure 37 Population development in Ísafjörður, Bolungarvík and Patreksfjörður between 1911 and 2019 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

Figure 37 above displays the population development in Ísafjörður, Bolungarvík and Patreksfjörður. The figure displays that in Ísafjörður, which is the largest settlement in the region, the population increased from 1911 until the 1940s by about 1 thousand people. The population stayed between 2.9 thousand and around 2.7 thousand people until 1970. After that it increased in 1990 had a population of around 3.5 thousand. After that it decreased quite a bit and in 2015 the population was around 2.5 thousand people. In 2019 it was around 2.7 thousand people. The population of Bolungarvík went from around 740 in 1911 to around 600 people in 1944. After that the population increased to almost 1300 people in 1982. After that the population decreased again and in 2019 it was around 930 people. The population of Patreksfjörður increased from around 430 people in 1911 to little more than 1000 in 1975. After that it gradually decreased to around 620 people in 2005. 675 people lived there in 2019.

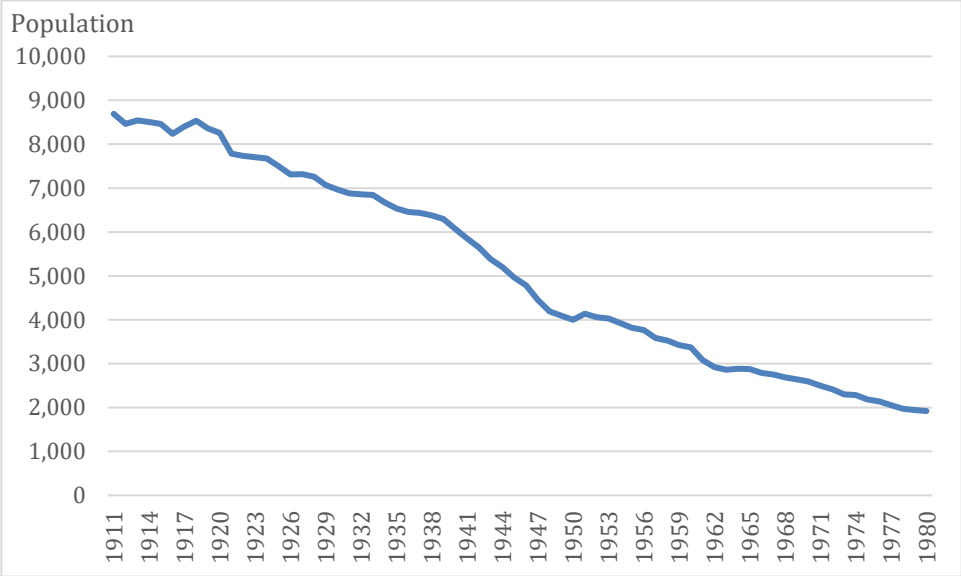


Figure 38 Population development in sparsely populated areas in the Westfjords from 1911 to 1980 (Statistics Iceland, 2006)

While the population in the Westfjords region decreased throughout the period of 1911 to 1980, coastal settlements grew larger. This can though be partly traced to rural areas or sparsely populated areas in the Westfjords decreasing in size. Figure 38 above displays the population development of sparsely populated areas in the Westfjords from 1911 to 1980. The figure displays that in 1911 around 8.7 thousand people lived in sparsely populated areas in the Westfjords but decreased quite a lot throughout the period. In 1980 less than 2000 people lived in sparsely populated areas in the Westfjords.

5.2.5 North Western region

The North Western region is the second least populated region in Iceland. There are around 8.4 thousand people that live in the region. The region, like the Westfjords Region, has been experiencing depopulation, but not as rapidly. The population development is displayed on figure 39 below. In 1911 there were around 9.1 thousand people living in the region. The population varied around the 10 thousand mark from 1920 to 1972. Afterwards was a small increase and in 1985 the region increased to its peak of 10.8 thousand people. After that the population decreased gradually and in 2019 it was little more than 8.4 thousand people. The coastal settlements in the region are Sauðárkrókur, Siglufjörður, Blönduós, Hvammstangi, Skagaströnd and Hofsós.

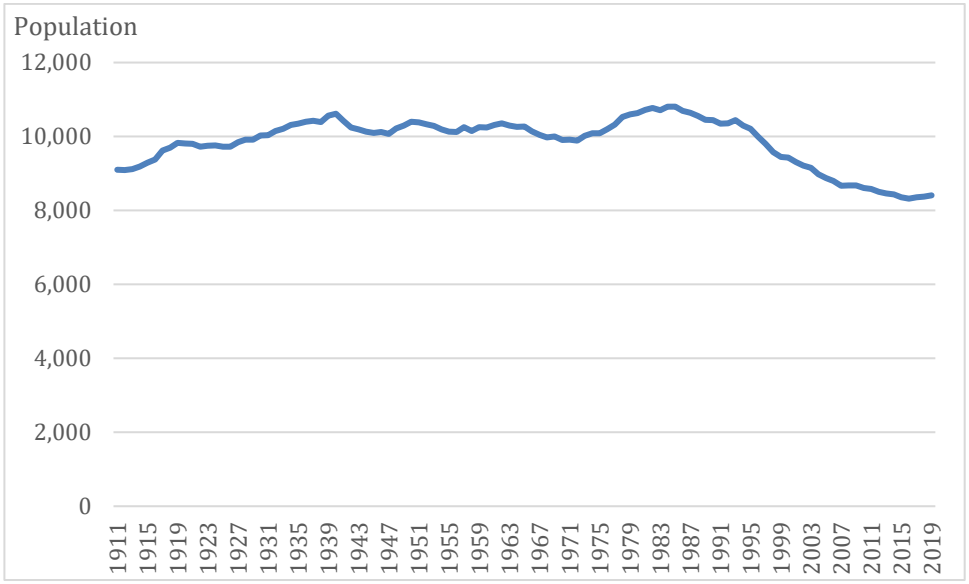


Figure 39 Population development in the North Western region between 1911 and 2019 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

The population development in these six coastal settlements are displayed on figures 40 and 41 below. Sauðárkrókur, Siglufjörður and Blönduós are displayed on a different figure due to the size differences.

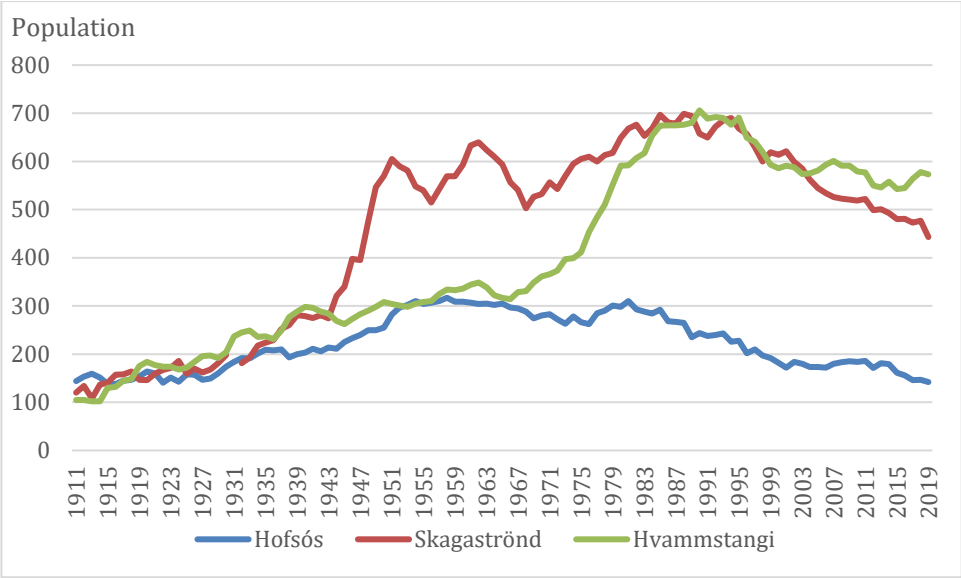


Figure 40 Population development in Skagaströnd, Hvammstangi and Hofsós between 1911 and 2019 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

Figure 40 above displays the population development in Skagaströnd, Hvammstangi and Hofsós. The figure displays that the population in the towns grew in a similarly trend from 1911 to 1937. After that Hvammstangi and Skagastönd grew quite rapidly after that and both towns topped around the same time in the start of the 1990s when the population of both towns was around 700 people. After that both towns decreased gradually and in 2019 around 570 people lived in Hvammstangi and 440 in Skagaströnd. Hofsós increased from 144 people in 1911 to around 300 people in 1953. The population was around 300 people until 1985 when the population began to decrease. In 2019, only 149 people lived in Hofsós.

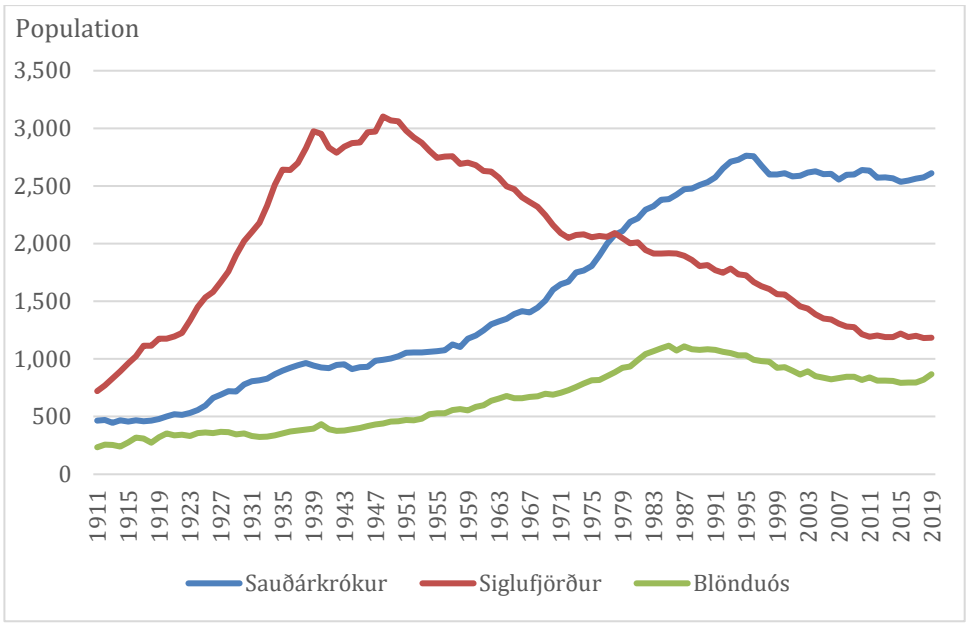


Figure 41 Population development in Sauðárkrókur, Siglufjörður and Blönduós between 1911 and 2019 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

Figure 41 above displays the population development in Sauðárkrókur, Siglufjörður and Blönduós. Siglufjörður grew quite rapidly from 1911 to 1940 where the population went from around 720 people to almost 3000 people. The population decreased a bit after that but went over 3000 in 1949. The population has gradually decreased since and in 2019 a little less than 1200 people lived in Siglufjörður. Blönduós displays a population growth from 1911 to 1986 where the population went from around 230 people to over 1.1 thousand. Afterwards the population decreased and is to day around 860 people. Sauðárkrókur on the other hand grew gradually from 1911 to 1997 where it went from around 500 people to around 2.7 thousand people. The population decreased a little bit between 1997 and 1999 but has been around 2.6 thousand people since then.

5.2.6 North Eastern region

Figure 42 below displays the population development in the North Eastern region. As the figure displays, the population in the region has been increasing. In 1911 around 12 thousand people lived in the region and in 2019 there were around 29.2 thousand people in the region. There are many coastal settlements found in the region and the settlements in the region are Grímsey, Dalvík, Ólafsfjörður, Hrísey, Árskógssandur, Hauganes, Akureyri, Grenivík, Húsavík, Kópasker, Raufarhöfn and Þórshöfn.

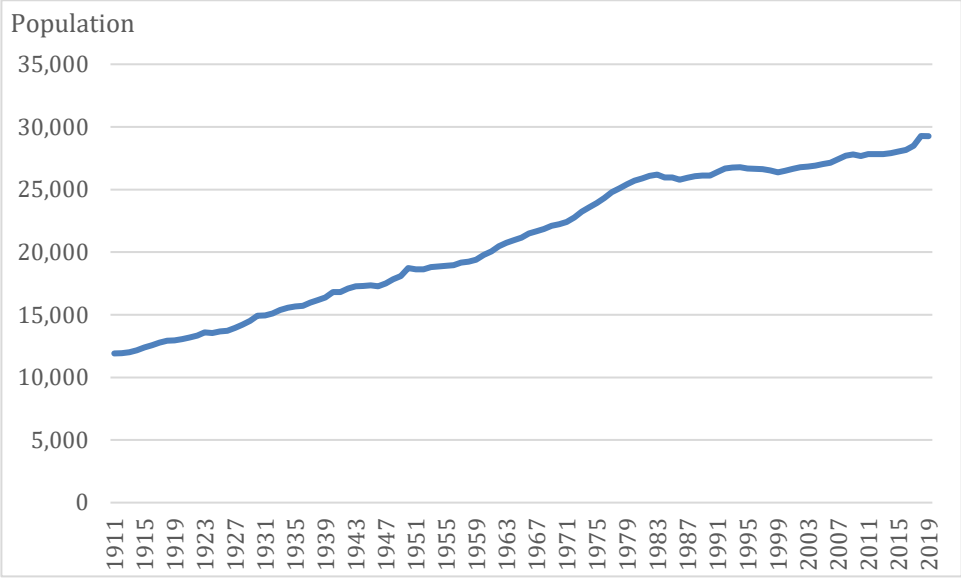


Figure 42 Population development in the North Eastern region between 1911 and 2019 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

In the region, the settlement of Akureyri is by far the largest. Akureyri has also been growing quite rapidly in population since the 1911 so having the town in the number could display distorted numbers for the whole region. Figure 43 below displays the population development in the region without Akureyri. The figure displays that if Akureyri is taken out of the equation the population development is different. The population was around 10 thousand in 1911 and increased to its peak in 1984 where the population was around 12.2 thousand. After that there was gradual decrease in the region and in 2014 less than 10 thousand people lived there. In 2019 the number had increased a bit and was around 10.5 thousand people.

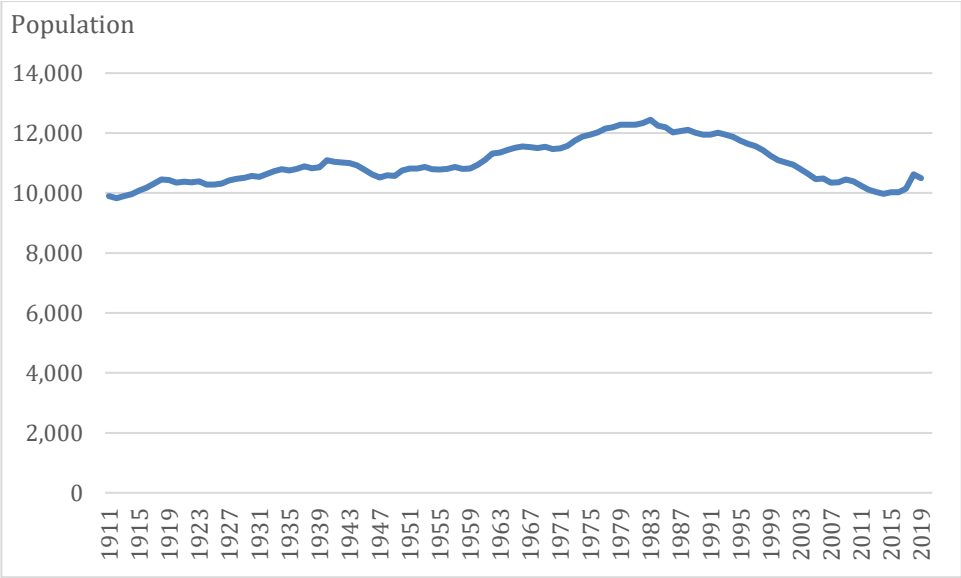


Figure 43 Population development in the North Eastern region without Akureyri between 1911 and 2019 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

Figures 44, 45 and 46 below show the population development of coastal settlements in the region between 1911 and 2019. The figures are separated into three figure due to amount of settlements and their size differences.

Figure 44 displays the population development of Akureyri which, as has been mentioned, is by far the largest settlement in the region. As the figure displays, the population has increased immensely over the period. In 1911 there were only around 2000 people in Akureyri and in 2019 the population was little less than 19 thousand people.

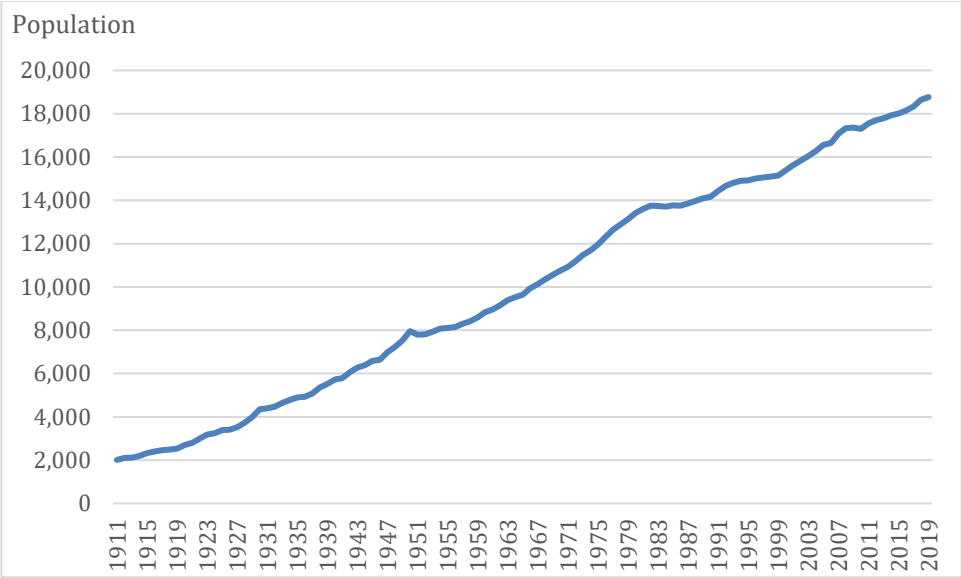


Figure 44 Population development in Akureyri between 1911 and 2019 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

Figures 45 and 46 below display the population development in the rest of the coastal settlements in the region. Figure 45 below displays the population development in Húsavík, Dalvík and Ólafsfjörður. The figure displays that Húsavík grew in the beginning and went from around 600 people in 1911 to little more than 2.5 thousand people in 1983. The population was stable until 1997 when it began to decrease. It went down to around 2.2 thousand people in 2017. In 2019 around 2.3 thousand people lived in Húsavík. Dalvík had around 500 inhabitants in 1911 and grew to little more than 1.5 thousand people in 1992. The population was stable afterwards but has decreased a little bit in recent years. In 2019 little less than 1.4 thousand people lived in Dalvík. In 1911, Ólafsfjörður had a population of 500 people. The population increased gradually and was around 1.2 thousand people in 1980. The population was stable until 1995 when it began to decrease. In 2019, less than 800 people lived in Ólafsfjörður.

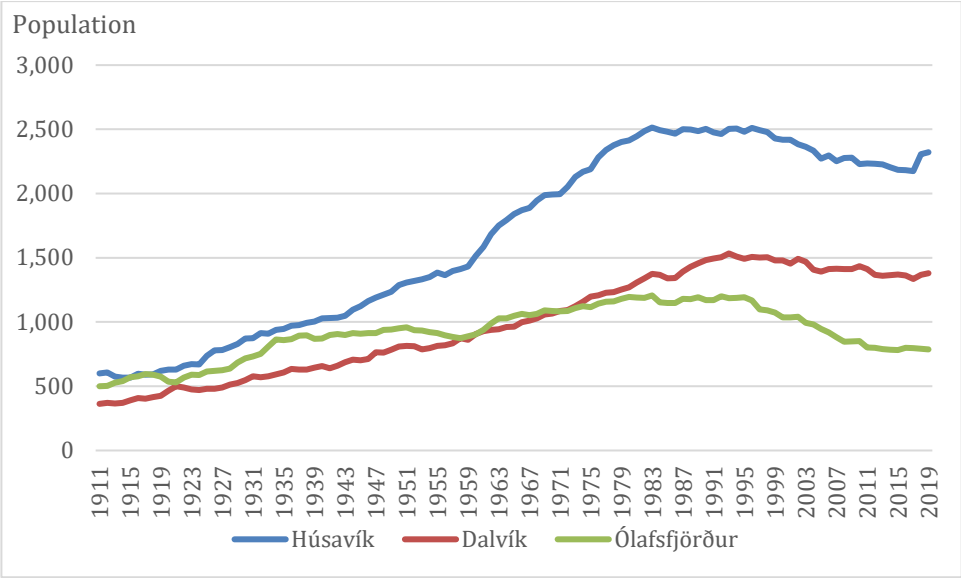


Figure 45 Population development in Húsavík, Dalvík and Ólafsfjörður between 1911 and 2019 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

Figure 46 below displays the population development in the coastal settlements of Grímsey, Hrísey, Árskógssandur, Hauganes, Grenivík, Kópasker, Raufarhöfn and Þórshöfn. The figure displays a similar development for most of the settlements. In the period all of them display growth until the 1980s, some more than others. After that most of the settlements show a trend of decrease in population.

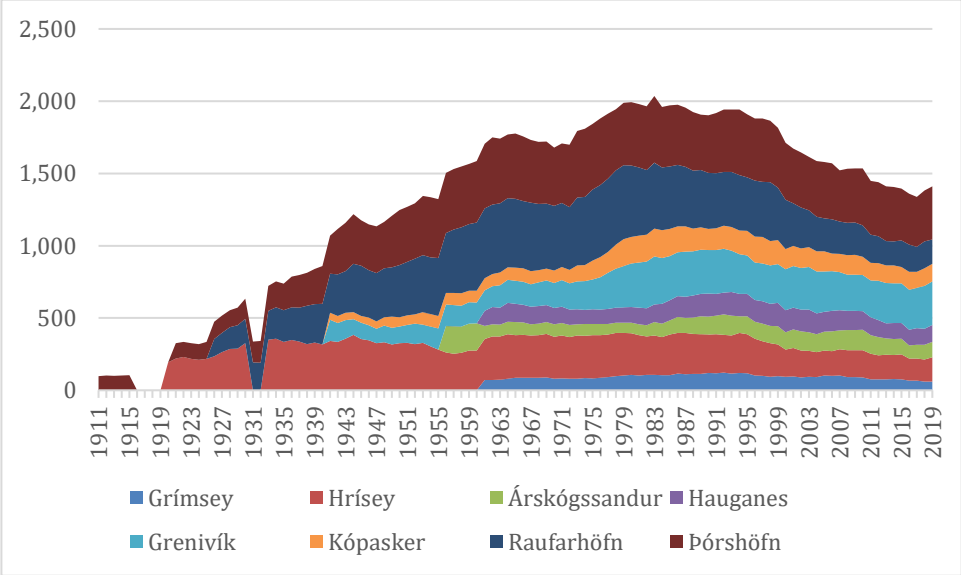


Figure 46 Population development in Þórshöfn, Grenivík, Raufarhöfn, Hrísey, Kópasker, Hauganes, Árskógssandur and Grímsey between 1911 and 2019 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

5.2.7 Eastern region

Figure 47 below displays the population development of the Eastern Region from 1911 to 2019. The figure displays that between 1911 and 1957 the population in the region was stable around 9.5 thousand to 10 thousand people. Afterwards it started in increase and in 1991 the population had increased to more than 13.1 thousand people. After that a gradual decline in population began and in 2003 the population had decreased to 11.8 thousand people. In 2005 was large increase in population in the region but this can be linked to a building of a large dam called Kárahnjúkavirkjun in the region and an aluminum processing plant which is located between Eskifjörður and Reyðarfjörður (Jónsson, K, 2007 December 22). After the construction of those two the population went down again and has been stable since. After that the population has been around 12.3 and 13 thousand people.

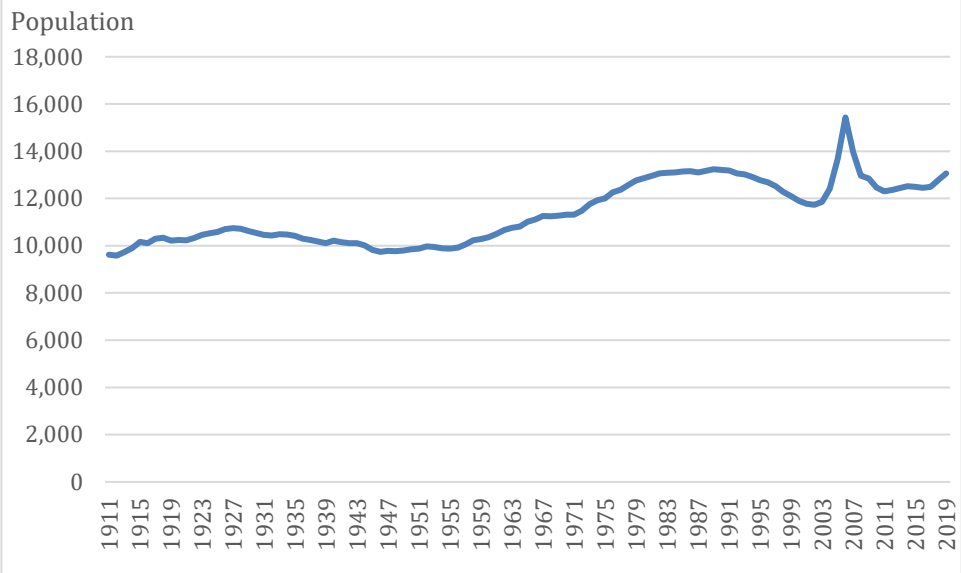


Figure 47 Population development in the Eastern region between 1980 and 2019 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

The coastal settlements in the region are Höfn í Hornafirði, Eskifjörður, Reyðarfjörður, Nesakupstaður, Fáskrúðsfjörður, Seyðisfjörður, Vopnafjörður, Djúpivogur, Stöðvarfjörður, Breiðdalsvík, Borgarfjörður Eyrstri and Bakkafjörður. Figures 48 and 49 below display their population development between 1911 and 2019. The figures are two because of population differences.

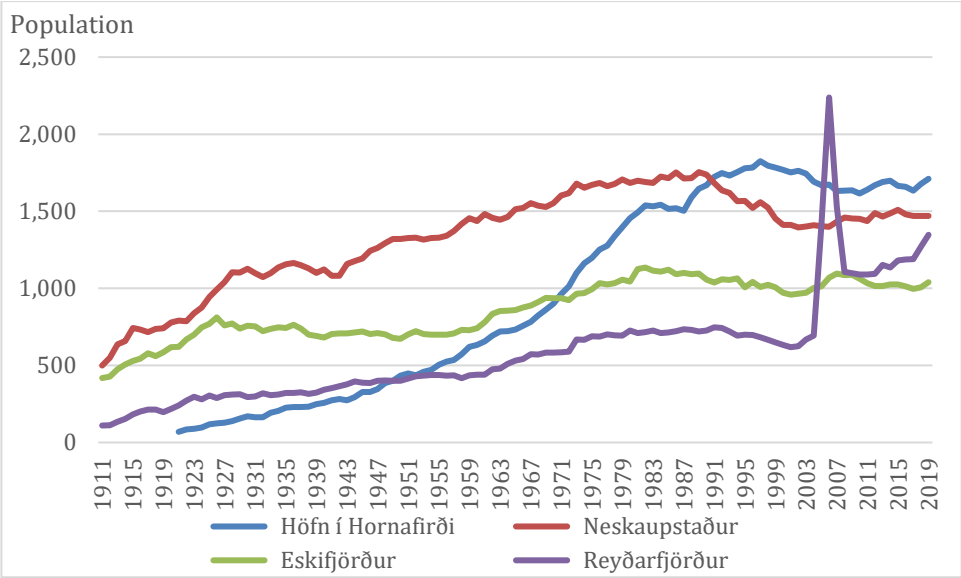


Figure 48 Population development in Höfn í Hornafirði, Neskaupstaður, Reyðarfjörður and Eskifjörður between 1911 and 2019 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

Figure 48 above displays the population development in the four towns of Höfn í Hornafirði, Neskaupstaður, Reyðarfjörður and Eskifjörður from 1911 to 2019. The figure displays that most of the towns have been increasing in population throughout the period. Höfn í Hornafirði had the population of 69 in 1921 and in 2019 around 1.7 thousand people lived there. Neskaupstaður had a population around 500 people in 1911 and in 1989 the population was around 1.8 thousand people. After that the population decreased and was around 1.5 thousand in 2019. Eskifjörður had a population of 418 people in 1911 and has grown gradually until 1982 where the population was around 1.1 thousand. A small decrease occurred afterwards and in 2003 less than one thousand people lived there. The population increased again in 2007 to around 1.1 thousand people but decreased again and has been around one thousand since then. Reyðarfjörður grew from 110 people in 1911 to 720 people in 1993. The population decreased a little bit and in 2002 only 625 people lived there. Shortly afterwards there was a large increase in population where it increased to 2238 people in 2006. This can be linked to construction of the aluminum processing plant located between Reyðarfjörður and Eskifjörður. After its construction the population decreased to around 1.1 thousand people but has risen since and in 2019 the population was around 1.35 thousand people.

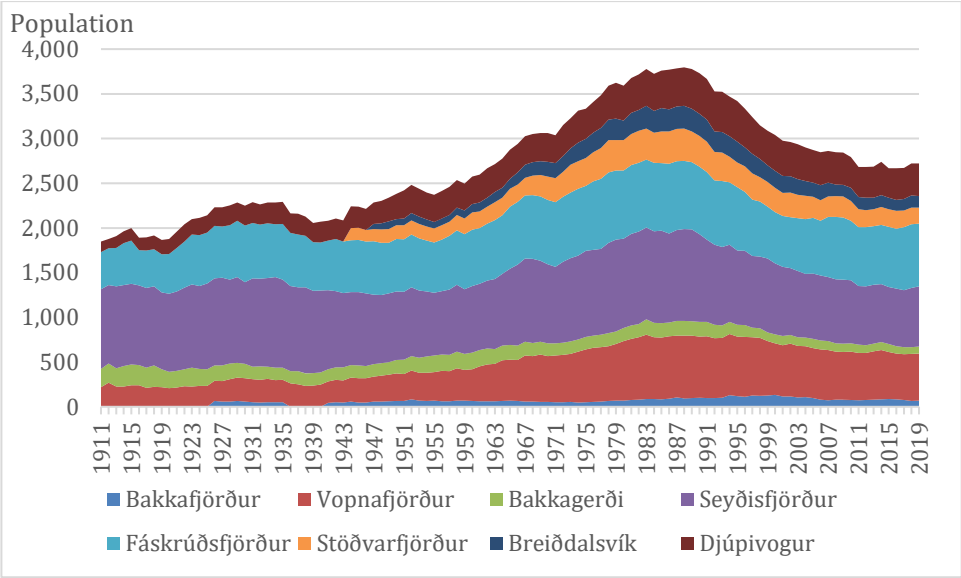


Figure 49 Population development in Fáskrúðsfjörður, Seyðisfjörður, Vopnafjörður, Djúpivogur, Stöðvarfjörður, Breiðdalsvík, Borgarfjörður Eystri and Bakkafjörður between 1911 and 2019 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

Figure 49 above displays the population development in the rest of the coastal settlemetns in the Eastern region which are Bakkafjörður, Vopnafjörður, Bakkagerði, Seyðisfjörður, Fáskrúðsfjörður, Stöðvarfjörður, Breiðdalsvík and Djúpivogur. The figure displays a similar population trend in the settlements where they all display increase in population until a similar time period between the 1980s and beginning of the 1990s. Afterwards all settlements begin to decrease in size.

5.2.8 Southern region

The Southern region displays growth in population between 1911 and 2019 as displayed in figure 50 below. The Southern region is a quite populous region though there are only 4 coastal settlements within it. In 1911 the population of the region was 13.5 thousand people. The population was quite similar until 1949 when it began to increase. In 2019 the population of the region was around 27.3 thousand people.

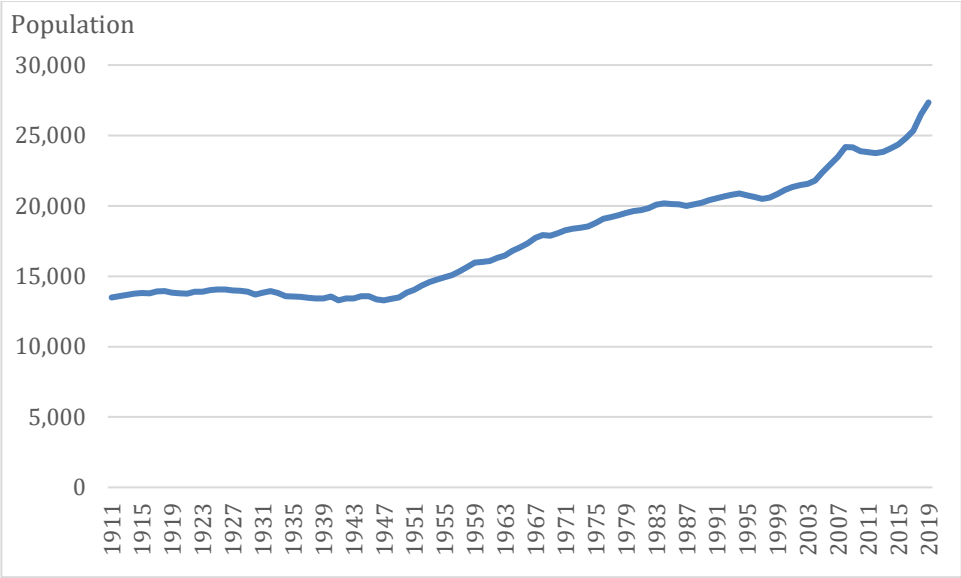


Figure 50 Population development in the Southern region between 1911 and 2019 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

There are only four coastal settlements in the region and they are Vestmannaeyjar, Þorlákshöfn, Stokkseyri and Eyrarbakki. The region has larger landlocked settlements and quite a lot of rural farms which explains why the area is so populous. Figures 51 and 52 below display the population development in the coastal settlements in the region. There are two figures due to size differences.

Figure 51 below displays the population development in Vestmannaeyjar and Þorlákshöfn. In 1911 the population of Vestmannaeyjar was around 1.5 thousand people but grew quite rapidly to around 3.3 thousand people in 1926. The population was more off less the same until it grew from around 3.5 thousand people in 1948 to about 5.3 thousand people in 1972. Between 1972 and 1974 was a big drop in the population where it went down to around 4.4 thousand people. After that the population grew to almost 5 thousand people in 1990. Afterwards the population decreased slightly and was round 4 thousand in 2007. In 2019 the population was around 4.3

thousand people. Þorlákshöfn had a population of 91 people in 1956, since then the town has grown progressively and in 2019 the population was 1654 people.

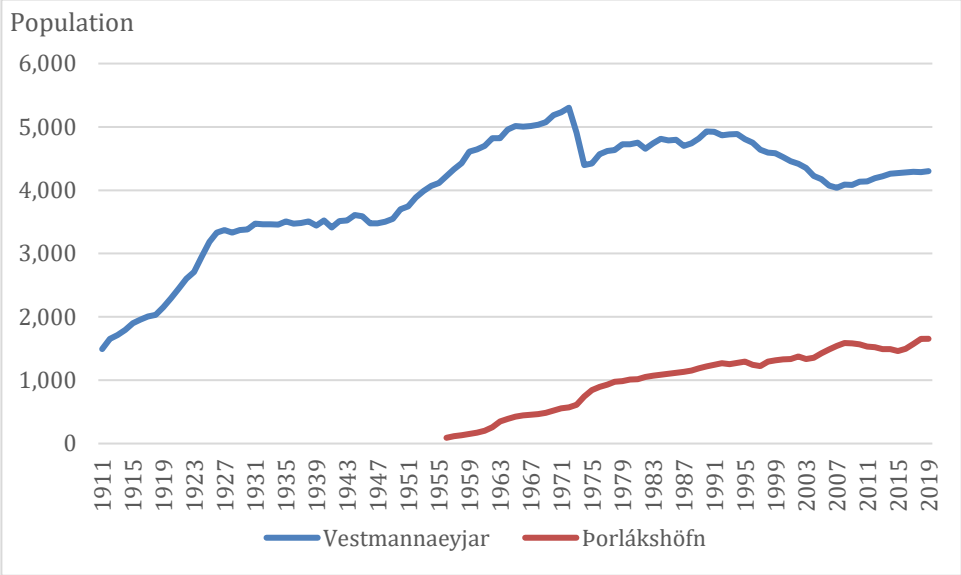


Figure 51 Population development in Vestmannaeyjar and Þorlákshöfn between 1911 and 2019 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

Figure 52 below displays the population development Stokkseyri and Eyrarbakki. The settlements show a very similar population developments like figure 52 below displays. Both settlements increased in population from 1911 to 1922 but after that the population dropped for both settlements. The population in the settlements were between 525 and 540 inhabitants in 2019.

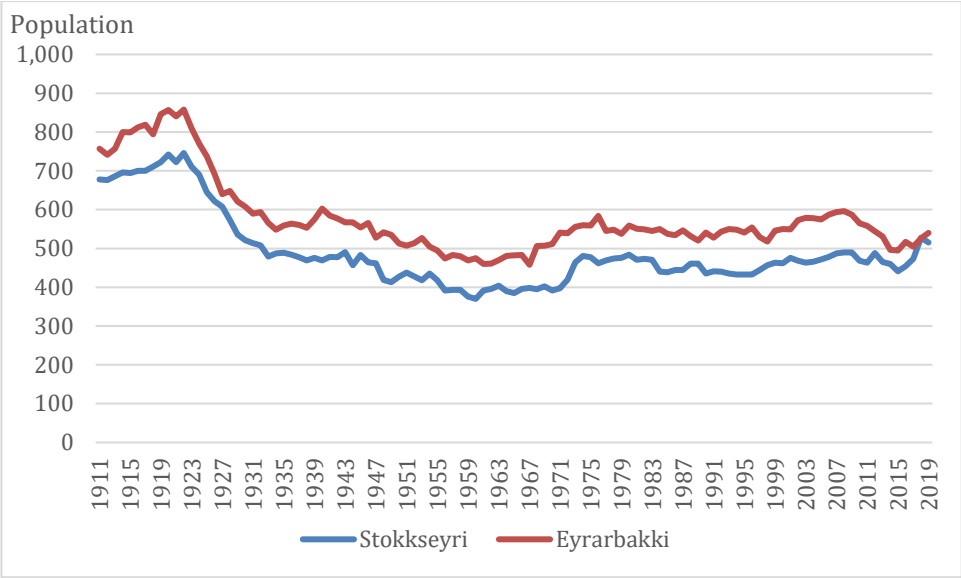


Figure 52 Population development in Stokkseyri and Eyrarbakki between 1911 and 2019 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

5.3 Summary

Population developments in the 8 regions of Iceland are quite diverse throughout the period displayed. Some regions and settlements have increased in size during the period, both before and after the 1980s while some regions and settlements have decreased in size before or after the 1980s or during the whole period.

There are regions that display depopulation in the period examined and that are the Westfjords, North Western region, North Eastern region (without Akureyri), the Eastern region and the Western region. The Westfjords displays a depopulation throughout the whole period, but does it twice. The five regions all though share a similar population development when it comes to depopulation. All regions begin to display depopulation between 1981 and 1991. In a similar period, many settlements within the regions have developed in a similar way. In the Westfjords, all the coastal settlements within the region decreased in size in a similar period. In the Eastern region, smaller settlements have decreased in size in a similar period while the larger once have been more stable or increased in size. Except for Neskaupstaður which similarly decreased in a similar period. Most of the coastal settlements within the North Western region display a depopulation in a similar period as the region itself but at the same time the largest one, Sauðárkrókur, went in an opposite direction and in the time period increased quite rapidly in size. Coastal settlements within the North Eastern region display some similarities too. Most of them begin to decrease in size in a similar time period though there are some anomalies within

like for example Húsavík and Dalvík. Húsavík decreases in size though, but not until the end of the 1990s. The Western Region displays a gradual depopulation and some of the coastal settlements within it. Akranes the largest settlement within the region displays depopulation in a similar timing. Many other smaller settlements do too but not all of them. The settlements within the region did though not display any long term depopulation and most of them stabilized quite quickly afterwards. Akranes on the other hand has increased quite a lot at the same time.

The other regions the Capital region, Southern region and Southern Peninsula region do not display depopulation. The settlements within the Southern Peninsula region show no sign of depopulation and all increase in population over the period. The Southern Region displays though a depopulation in Vestmannaeyjar, the largest settlement after 1991 while others increase or stay stable.

6 Brief overview of other sectors of the Icelandic economy

Fisheries is not the only sector today in Iceland that is highly profitable for the Icelandic economy. The economy of Iceland today is mainly based on three factors which are smelting aluminium, fisheries and tourism (Iceland-Market Overview, 2018). Unfortunately comparable numbers between these sectors do not go far back in time. Figure 53 below displays how much quarterly each sector has been making from 2013 to 2019. Aluminium products are a part of industrial products, it is included to show how big part of the industrial sector it is.

Figure 53 displays that between 2013 and 2019 the industrial and fisheries sectors have been quite stable between 68.000 and 81.000 million kr. The tourism on the other hand has risen quite a bit. As the figure displays the amount that comes from tourism is quite irregular but can be explained by differences by visitors by seasons. The income from tourism has been steadily increasing from year to year but decreased a bit between 2018 and 2019. The figure displays, the tourist season tops every year in the third quarter or from the beginning of July to the end of September. Least amount of tourists visit Iceland over the winter time or from the beginning of October to the end of December.

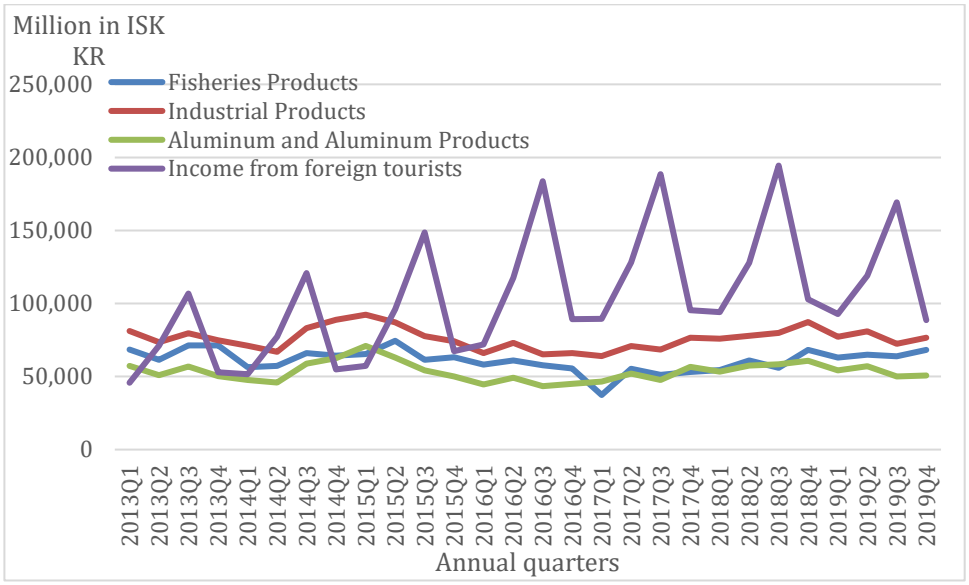


Figure 53 Export of goods and services of Fisheries Products, Industrial Products, Aluminium Products and Income for foreign tourists between 2013 and 2019 (Statistics Iceland, 2020b)

6.1 Tourism

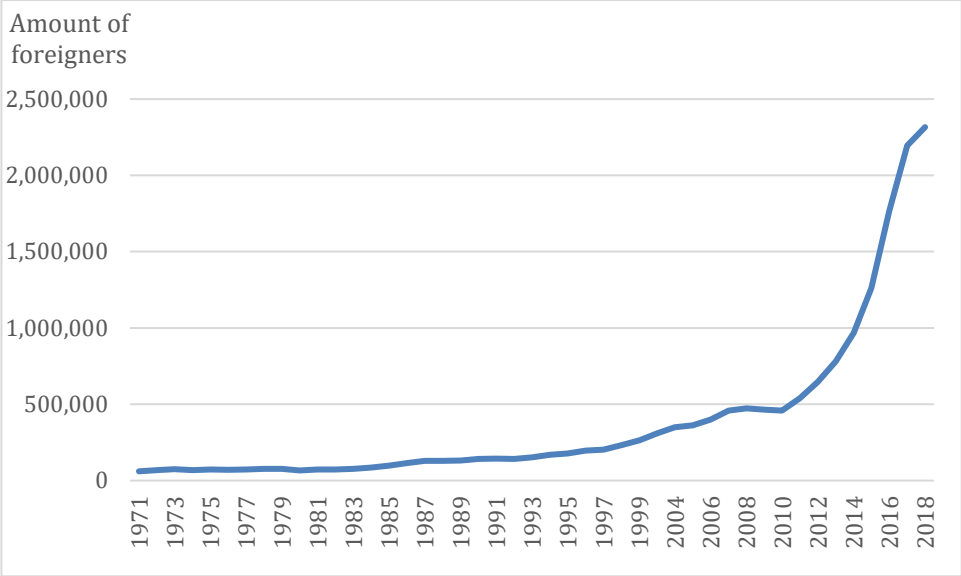


Figure 54 Amount of foreigners visiting Iceland from 1971 to 2019 (Statistics Iceland, 2004, 2019e).

Figure 54 above displays how many foreigners visited Iceland between 1971 and 2019. Data for the years 2000 and 2003 wasn't available. The years from 1971 to 1999 show all foreign visitors coming to Iceland while 2003 to 2019 only display those travelled via Keflavík International Airport.

Figure 54 displays tourism wasn't a big economical factor for Iceland until recently. The figure displays between 1971 and 2010 the amount of foreign visitors never surpassed 500 thousand people. After 2010 the amount of tourists in Iceland grew immensely. Every year after another has been a record year in amount of foreign visitors. This can be linked to Iceland being covered quite a lot in the world media because of the financial crisis in 2008 and the eruption of Eyjafjallajökull volcano in 2010. Iceland had gotten a worldwide media coverage and because of the financial crisis it was cheap to visit (Sheivachman, 2019). This made Iceland a popular tourist attraction and since 2010 the amount of visitors have increased rapidly and in 2019 around 2.3 million people went through Keflavík International Airport.

6.2 Aluminium

Aluminium production began in Iceland in the year 1969 when the first aluminium plant smelter was built in Straumsvík in the capital area. Today there are 3 aluminium smelters found in Iceland. One in Grundartangi, one hour away from the capital area and one in Reyðarfjörður

located in the east of the country. Grundartangi smelter opened in 1997 and the one in Reyðarfjörður 2007 (Samál, 2015).

Figure 55 below displays the export value of produced aluminium in Iceland since 1981 to 2015. The period 1981 to 2015 is chosen because of currency changes in 1980, therefore the amounts before 1981 were not viable. The figure displays how much aluminium production has increased in value over time and it displays it doesn't become a large part of the Icelandic economy until after the aluminium smelter in Reyðarfjörður started producing in 2007. As figure 53 above displays between 2013 and 2019 it is now exporting for a similar amount as the fisheries sector is doing today.

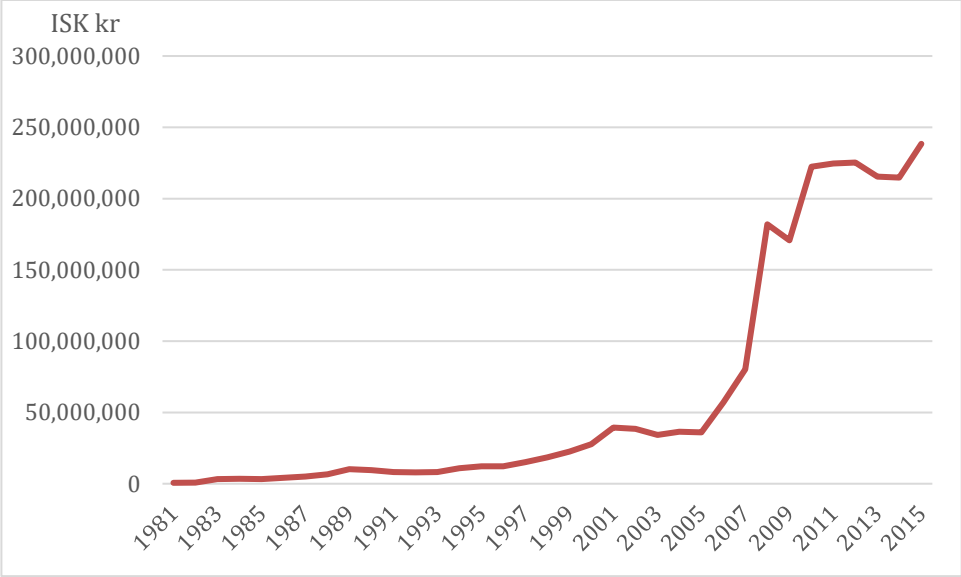


Figure 55 Export value of Aluminium from 1981 to 2015 (Statistics Iceland, 2019b).

Figure 56 below displays the amount produced since the first aluminium smelter was established in 1969. Figures 55 and 56 display that it wasn't until 2007 when the aluminium smelter in Reyðarfjörður came to be that Iceland started to produce quite high amount of aluminium. Before that the numbers were quite stable around 100 thousand metric tonnes until 1997 when the aluminium smelter in Grundartangi was established. Then production increased to around 300 thousand metric tonnes a year. Since then the number have risen to be around 750 thousand to almost 900 thousand metric tonnes produced per year.

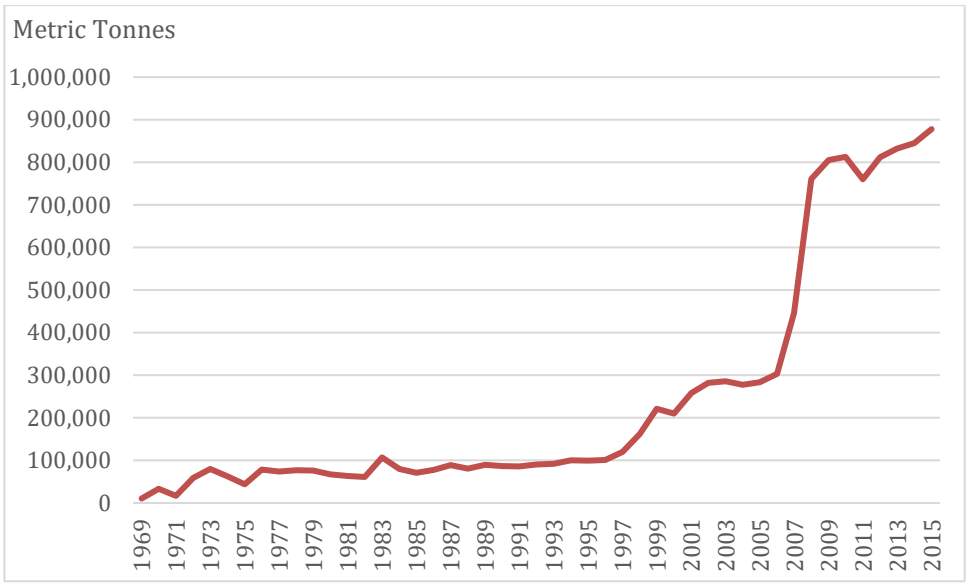


Figure 56 Amount of produced Aluminium in metric tonnes from 1969 to 2015 (Statistics Iceland, 2019b).

6.3 Amount of workers between the sectors

Figure 57 below displays how many people have been working in the fisheries sector, producing of aluminium and tourism. These numbers do though only cover people who are working directly in the sectors, and not those who are linked to it indirectly. The fisheries numbers include those who work in both fish processing plants and fishermen. The data for workers in these sectors covers 1991 to 2019.

The amount of workers in the aluminium sector doesn't change much and was around 900 and 1100 workers from 1991 to 2006. After 2007, the year Reyðarfjörður aluminium smelter began production, the number increased quite a bit and has been between 1900 and 2200 workers in the field since then.

Tourism has been on a rise since 1991 and that is clearly shown in the figure 57 below. In 1991 there were a little less than 10 thousand people working in the sector but the amount of workers have increasing quite a lot after that. In 2010, the year of the Eyjafjallajökull volcano eruption amount of workers had increased to 17.6 thousand workers. Afterwards there is a steep yearly rise until 2017 where the amount had risen to 28 thousand workers. It has been stable since with a bit of a decrease between 2018 and 2019.

In a similar period the amount of workers in the fisheries sector has decreased like has been discussed in chapter 4.

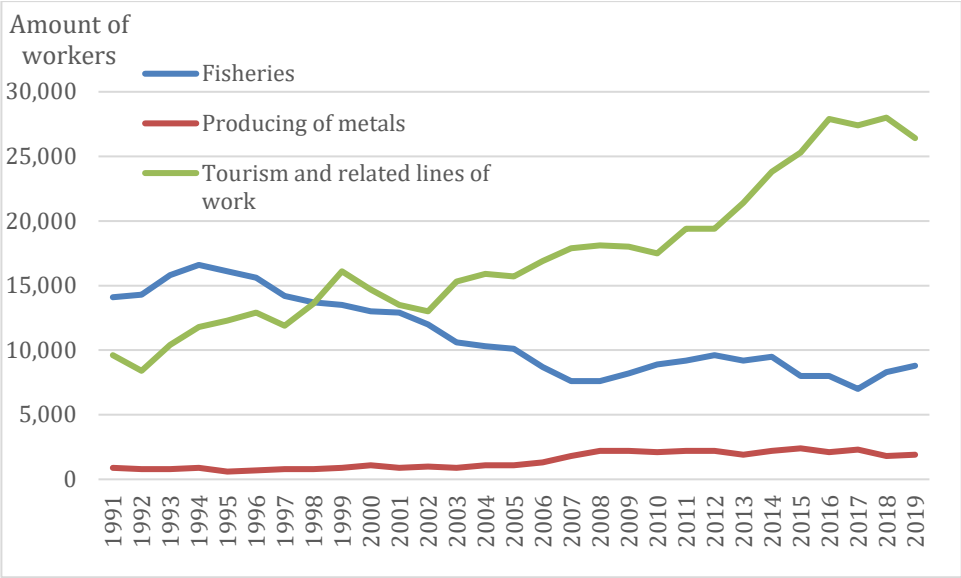


Figure 57 Amount of workers in Fisheries, Producing of metals and Tourism and related line of work from 1991 to 2019 Statistics Iceland, 2020a)

7 Discussion

The intention and objective of this thesis is to try to find out if there is a link between the implementation of the ITQ system in 1984 and depopulation in rural settlement structures in Iceland, and if the implementation has affected geographical changes in the fisheries via quota share and landing developments. Because of the implementation of the quota management system, some have argued that it has caused depopulation in rural settlement because it has limited access towards the resource. The data this research has observed is how landings patterns and allocations of quota shares have developed throughout time regionally. The data on landing development being examined from 1982 to 2018 and quota shares development data from the 1991/1991 fishing season to the 2017/2018 fishing season. The research has also analyzed patterns in population developments by regions and coastal settlements within them, and how they have developed from before and after the implementation. The thesis also looked into the development of the amount of workers in the fisheries sector and briefly discussed other large economy factors in Iceland.

7.1 Results

The data that has been examined in the chapter 5 in this thesis displays that some regions decreased in population size and some not around the timing of the implementation of the ITQ system. The regions that decreased in population are the Westfjords, the North Western region, the North Eastern region, the Western Region and the Eastern Region. It has to be noted that the North Eastern region only displayed depopulation if Akureyri, which is by far the largest settlement in the region, is not included in the numbers for the region. The five regions share the same characteristics that depopulation begun in a similar time period or between 1981 and 1991.

If the data for development of landings, development of quota shares and population development in the Westfjords is examined, it displays a certain trend. As can be seen on figure 35 the population in the region has been decreasing since the 1940s. The population stabilized but in the 1980s depopulation continued in the region. As figure 35 displays the population decreased from around 10.5 thousand people in the beginning of the 1980s to around 7 thousand people in 2019. That is a decrease of about 33%. The coastal settlements in the region all display

a similar trend when it comes to population development. As displayed on figures 36 and 37 all settlements in the region decreased in size after the 1980s and the beginning of 1990s.

In a similar time period, or from 1982 to 2018, the amount of landings in the region decreased proportionally too. As figure 13 displays between 1982 and 1985 the landings decreased from 13% to 7.5%. The landings were stable until 1991 when they increased rapidly to 11%. After that, the landings in the region began to decrease and did for a long time. In 2003 the amount had dropped to around 3.3%.

The quota shares in the region also show a decrease as displayed on figure 21. The quota shares in the region corresponded 12% to 14% in the country between the 1991/1991 and 1996/1997 seasons. After that the amount of quota shares in the region decreased progressively and went under 8% in the 2000/2001 season. Since then the quota shares in the region have been stable and have corresponded for around 9% in the country.

As displayed in Figure 39 the population in the North Western region decreased a bit but not as substantially as in the Westfjords. The figure displays that after 1985 the population in the region decreased. In 1985 the population was little less than 11 thousand people but in 2019 it had decreased to around 8.4 thousand people. The coastal settlements in the region displayed in figures 40 and 41 also display a depopulation which around the same time period, except for Sauðárkrókur which is also the largest coastal settlement.

Landings in the North Western region have also decreased proportionally as figure 12 displays. From 1982 to 1993 the landings fluctuated a lot. But in 1993 the amount of landings in the region corresponded for around 11% of the whole country. After that the amount of landings decreased quite rapidly and hit an all-time low of 2.5% in 2007. The amount has gradually risen since then and was around 5.1% in 2018.

The quota shares in the North Western region as displayed in figure 20 decreased a bit. But not until after the 1996/1997 season. The quota shares increased from the 1991/1991 season to the 1996/1997 season where it went to around 9% but after that it decreased gradually. In the 2017/2018 season the quota shares on the region corresponded only for around 6% of the country.

Figure 43 displays the population development in the North Eastern region without Akureyri included. The figure displays that there was an increase in region up until the 1980s. After 1983 the population in the region started to decrease gradually. In 1983 there were around 12.4 thousand people in the region but went below 10 thousand people in 2014. It has increased slightly since and is around 10.5 thousand today. Figures 45 and 46 display the population development of coastal settlements in the region. Most of the settlements in the region display the same trend, as they increase in size until the 1980s to decrease in size later. This is found within most of the smaller settlements but larger settlements like Dalvík and Húsavík. They both decrease in size but not until in the late 1990s.

The amount of landings in the North Eastern region are displayed in figure 11. The figure displays that the amount of landings have fluctuated. The amount of landings increased from around 12% in 1982 to more than 18% in 1993. But afterwards the landings in the region decreased substantially and in 2018 the amount of landings in the North Eastern region corresponded only for around 7.5% in the country.

The amount of quota shares is displayed on figure 19. Between the 1991/1991 season and 2000/2001 season the quota shares in the region increased from around 17% to almost 22%. After that the amount of quota shares decreased a bit and hit around 15.3% in the 2007/2008. In the 2017/2018 season the amount of quota shares in the region were 17.3%.

As displayed on figure 47, the population development in the Eastern region began to decrease after 1991. The population gradually went from 13.1 thousand people in 1991 to 11.8 thousand in 2003. When it comes to coastal settlements in the region there are some similar trends to be found within the smaller once as displayed on figures 48 and 49. The settlements increase in size until the 1980s and the beginning of the 1990s but afterwards they begin to decrease in size. The larger once display a little correlation to this except for Neskaupstaður which also decreases in size around the same time.

The landings in the region are displays on figure 10 and display that they have increased tremendously from 1982 to 2018. The landings in the region were around 15% in 1982 but in 2018 they corresponded almost for 50% of the whole country. This can though be linked to the fact that most of the pelagic fisheries in Iceland are conducted in the region.

The quota shares for the region displayed on figure 18 display that the amount of quota shares in the region has been decreasing. The quota shares were around 12.3% in the 1991/1991 season but had decreased to around 9% in the 1996/1997 season. After that the quota shares increase gradually except for two bad season. The quota shares in the region were around 11% in the 2017/2018 season.

The Western region displayed an increase in population as displayed on figure 32 until 1983 where there were around 15.1 thousand people in the region. Afterwards the population decreased gradually and in 1997 the population was around 13.9 thousand. The coastal settlements in the region are displayed on figures 33 and 34. The largest settlement, Akranes, decreases in size in a similar period but the smaller settlements vary. Some of them display depopulation at the same time but others are more stable or decrease later. But there are no long term depopulation trends within the region as most of the smaller settlements become quite stable and Akranes increase in size again shortly afterwards.

Figure 14 displays that the landings in the region have fluctuated quite a bit in the Western region. In 1982 around 11% was landed in the region but shortly afterwards the number had decreased down to around 6.8% in 1985. From 1985 to 2007 landings vary quite a lot between 6.25% and 9.5%. After 2007 the landings decrease and in 2018 they were around 5.4%.

Quota shares in the region displayed on figure 22 display that they've been increasing gradually since the 1991/1991 season until the 2017/2018 season. They've fluctuated a bit but in that period, quota shares in the region went from 11.3% to 15.2%.

Other regions in Iceland, the Capital region, Southern region and the Southern Peninsula region do not display depopulation as displayed in chapter 5 and out of all the coastal settlements located within them three only one displays depopulation. That is Vestmannaeyjar in the Southern region as displayed on figure 51.

Figure 16 displays that the amount of quota shares have increased in the Southern Peninsula region from the 1991/1991 season to the 2017/2018 season. The amount of landings, displayed on figure 8, decreased substantially from 1982 to 1985 where they decreased from around 16.3% to 8.9%. Afterwards they fluctuated but increased gradually until the 2001 season where the amount had risen to around 13%. After that the amount decreased substantially down to less

than 7% in 2004. The amount of landings have been decreasing gradually since and in 2018 they were around 5.6%.

Figure 17 displays that the quota shares in the Southern region have been quite stable fluctuating around 12% from the beginning to the 2017/2018 season, but landings in the region decreased from 15% to around 10% between 1982 and 1999 as displayed on figure 9. Afterwards the landings in the region increased quite rapidly and were almost 18% in 2011 but decreased quite a bit afterwards and were around 13% in 2018.

To visualize population development of coastal settlements better in whole, figures 58, 59 and 60 below display the settlements listed chapter 5 by their population size in 1984, when the quota management system was implemented, regardless from their location. Figure 58 displays settlements that had less than 500 inhabitants in 1984, figure 59 displays settlements that had 500 to 2000 inhabitants in 1984 and figure 60 displays settlements with settlements with more than 2000 inhabitants in 1984. The graphs are adapted from (Ministry of Industries and Innovation, 2017).

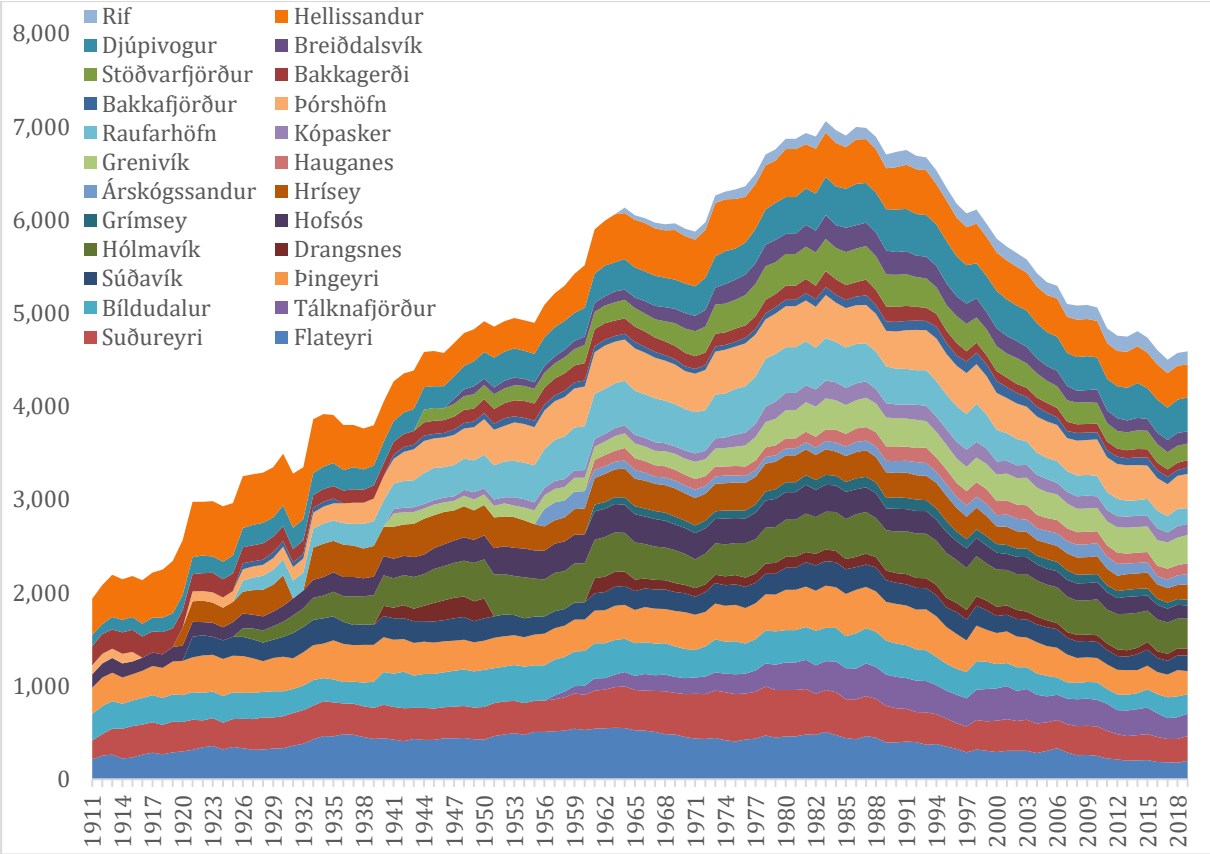


Figure 58 Population development of settlements with less than 500 inhabitants in the beginning of the quota management system in 1984 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

Figure 58 above displays population development in settlements with less than 500 inhabitants in 1984. The settlements all display similarities in their population development. The settlements display increase in population up until the 1980s where they reach their peak in population size. But in the end of 1980s the settlements decrease in size. Between 1984 and 2019 the population in total of these settlements decreased by around 34%. The total population in 2019 is around the same as it was in 1945.

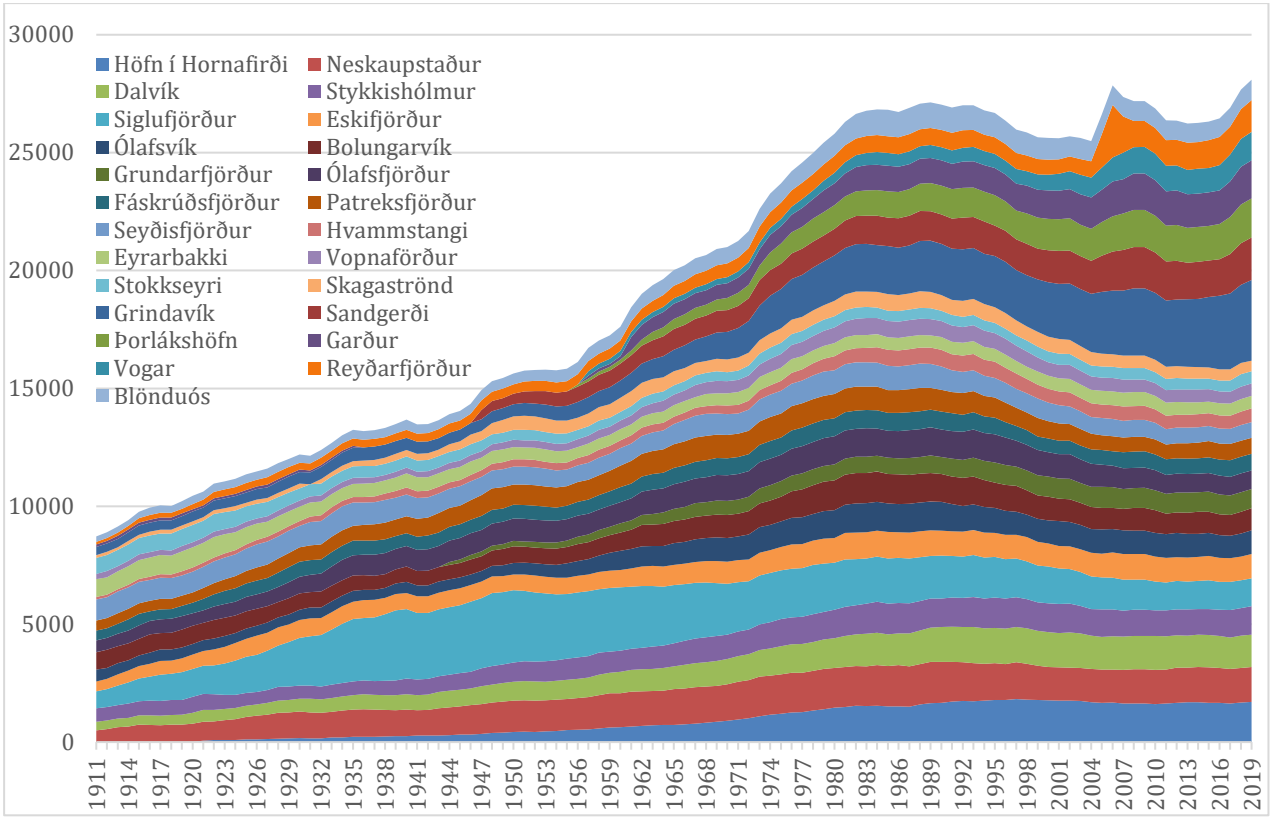


Figure 59 Population development of settlements with 500 to 2000 inhabitants in the beginning of the quota management system in 1984 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

Figure 59 above displays population development in settlements with 500 to 2000 inhabitants in 1984. Though settlements within these size limits have developed differently as can be noticed, the figure displays that settlements within these size limits have been quite stable since the implementation in 1984.

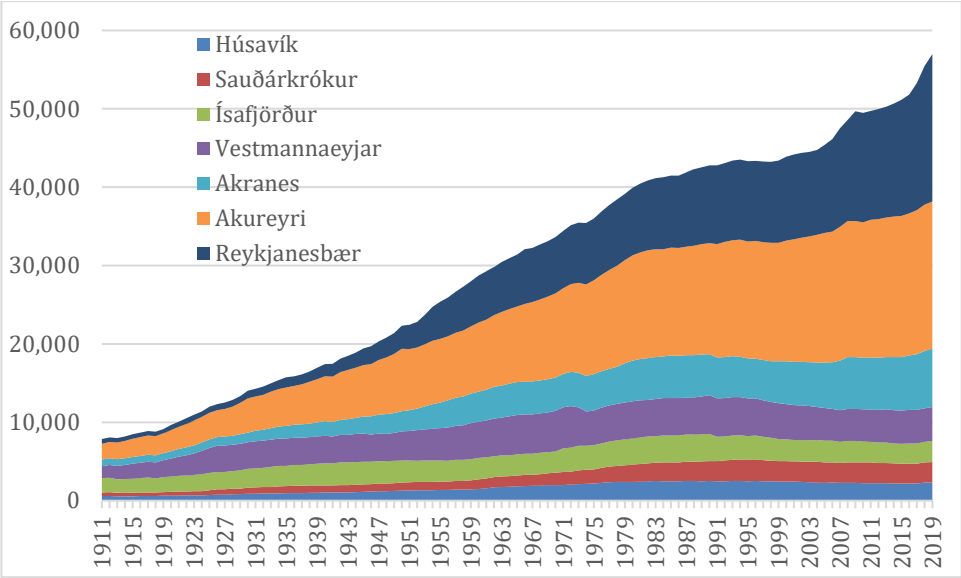


Figure 60 Population development of settlements with more than 2000 inhabitants in the beginning of the quota management system in 1984 (Statistics Iceland, 2006, 2008, 2011a, 2011b, 2019d).

Figure 60 above displays population development in settlements more than 2000 inhabitants in 1984. The figure displays that the settlements that had more than 2000 inhabitants have increased by quite a lot since the implementation. In total going from around 40 thousand to around 66 thousand inhabitants.

There seems to be a link to be found between changes in geographical fisheries patterns and population developments in some places. The best example of that being the region of Westfjords. When the system was implemented and later when the quota was made transferable, all settlements within the region began to decrease. When the quota became transferable, the quota shares in the region decreased shortly afterwards. Landings in the region displays a similar trend and have dropped substantially after 1991. So it can be at least presumed from the gathered data that there is a link between the ITQ system and the population development in coastal settlements in the Westfjords.

The North Western region displays link between population development and the landing numbers. As discussed the population started to decrease in the mid-1980s, the amount of landings in the region fluctuated in the beginning but shortly after, when the quota was made transferrable the amount of landings in the region decreased substantially. The quota shares increased however from 1991/1991 season to the 1997/1998 season in the region but decreased gradually afterwards. The explanation behind that could possibly be concentration of quota

somewhere in the region as in one settlement doing better than others. If the figures for the population developments of settlements within the region are looked at it displays that regions have been decreasing in size except for Sauðárkrókur. So it can be assumed from the gathered data that some settlements within the region have been affected by the implementation of the ITQ system.

The North Eastern region doesn't show clear patterns between the three factors. The population in the region started to decrease around the mid-1980s, but the landings don't start to go down until 1993. The quota shares in the region increase until the 2000/2001 season. All the settlements in the region, except for Akureyri, begin to decrease in a similar period the system in implemented. That can also be possibly explained by that while settlements within the region are experiencing depopulation but the quota shares and landings going up that some concentration within the region is happening. Akureyri is by far the largest settlement in the region and displays an opposite population development to the whole region. So while the factors of quota shares, landings and population development do not link it is hard to estimate if the ITQ system and depopulation in the region are linked. The timing of the implementation matches for most of the smaller settlements but at the same time it is hard to estimate a linkage because of the possible anomaly Akureyri is due to its size.

The Eastern region displays depopulation after 1991. Smaller settlements in the region decrease in size in a similar time period while the larger once do not display the same except for one. Quota shares in the region decrease too after the 1991/1991 season for few years. But at the same time landings in the region increase tremendously. But that can be linked to the pelagic fisheries in the region. So it can be assumed that the implementation of the ITQ system has affected smaller settlements in the region from the three factors.

The Western region displays depopulation in the mid-1980s and few of the settlements in the region do too. The landings and quota shares do though not display a similar pattern. The quota shares increase gradually the whole period and the landings do not display any visible correlation to the population development either. So based on the factors examined, linking the depopulation in the region and settlements to the implementation of the ITQ system is not viable.

Figures 59, 58 and 60 display an interesting development of settlements when they're grouped together by their population, figure 59 especially. The figure displays that settlements that had less than 500 inhabitants in 1984 have decreased in size, all in a very similar time period or in the 1980s or the beginning of the 1990s. Of course it is hard to generalize only from examining population development and timing but many of the settlements in figure 59 are located in the regions that have been established that ITQ system might have caused depopulation. So there is a possible link between coastal settlements that were small before the implementation have been hit the hardest.

But as has been demonstrated, from the data examined in this thesis it does not necessarily give all of the answers if the implementation of the ITQ system and its effects on depopulation. In 2001 Haraldsson (2001), an economist, made a report for the Icelandic Regional Development Institute where he looked into changes in debts of fisheries companies after the changes in the fisheries management system. He touched upon population development by regions and takes examples with few companies in settlements that have decreased in size over the period. He states that costs of running companies in the sector increases, salary, costs of raw material, etc. in 1995 around the same time there are major changes in development of quota shares by region. He states there is a correlation between there. His results were that it was clear that with the changes in 1991 when the quota was made transferable it had has far reached consequences for the development of settlements in Iceland through the transfer of quotas between regions and individual communities. He states in his findings that when it comes to development of population and quota shares there might be a partial link there to be observed but at the same time but other factors also affect the changes. Also Kokorsch and Benediktsson (2018) wrote a paper on the development of Icelandic fishing villages after the privatisation of fishing rights. They did cluster and correlation analyses of fisheries performance, socio-economic performance and demographic performance. They conclude that small and remote settlements have been particularly strongly affected by the changes but stated also that demographic challenges cannot be explained solely by loss of quota.

Other large sectors in Icelandic economy do not display a necessary influence on these developments mostly because both tourism and aluminum processing are quite new, both sectors grew immensely around the start of last decade as displayed in chapter 6. That doesn't

mean it cannot have influence for the rural settlements but if they would it would probably be a change for the better as it could lead to new opportunities.

The development of the amount of workers displayed on figures 24 and 25 in chapter 4 displays that amount of workers has decreased in the sector. From 1963 to 1987 the amount increased from less than 10 thousand workers to 16.7 thousand workers. The amount decreased to 14 thousand afterwards but reached 16.6 thousand in 1994. After that the amount decreased quite rapidly and has been around 7.6 thousand to 9.8 thousand from 2007 and 2019. The decrease is also almost entirely happening outside the Capital region. The changes link to changes in settlement structure quite a bit, especially due to the fact these changes are happening outside of the Capital region. But it is hard to estimate because the data for each region is not available and as has been discussed in chapter 4, because of technological advances and innovation in the fisheries sector, less workers are required today to work on boats and processing fish.

Rural development in Iceland is in many ways similar to the regional developments found in other western countries. The boundaries between urban and rural areas have become increasingly complex and obscure in recent decades. Improved transportation, advances in communication and more flexible working practices have created various new opportunities for employment and residence as labour market specialization has increased and jobs in fisheries have decreased significantly. Increased demands for access to health care, education, culture, commerce and services has led to more widespread activities and the growth of smaller service centres in many places. Therefore it can be said that outside of the metropolitan areas, traditional urban communities and traditional rural communities are now mixing to varying degrees when it comes to the vast employment and service areas in suburbs, smaller cities, towns, villages and rural areas. In many western countries, a significant depopulation is often connected to more remote settlements that thrive on monotonous job sectors and limited access to services that characterizes modern societies today (Bjarnason, 2015, November 18)

Conclusion

As has been demonstrated in this thesis, the implementation of the ITQ system in 1984 and its effects on geographical changes in fisheries can be linked by some extent to depopulation in rural settlements in Iceland. Settlements in some parts of Iceland, i.e. in the Westfjords, display a strong link between the implementation and depopulation of rural settlements. It also seems like that smaller settlements are more likley to display links between depopulation rather than larger settlements. By limiting access to the fisheries and implementing transferabilty on the quota, some regions displayed a decrease in amount of quota shares and amount of landings which can be linked to depopulation of some rural settlements. But it is diffucult to blame the ITQ system solely on depopulation in Iceland. There some other factors that that could‘ve possibly led to depopulation of certain regions and settlements. General trend towards centralization and concentration of settlement stuctures is something that possibly drove some of the depopulation. People looking for services in larger settlements that were not available to them. Also less people are needed today to conduct fisheries due to technological advances and innovation in the sector. Perhaps because of that, people needed to seek job opportunities elsewhere. But it has to be mentioned that regarless of if the ITQ system would‘ve been implemented or some other management system technilogical advances could‘ve and probably would‘ve happened anyways. Limitations on the commercial stocks in Icelandic waters were however necessary to implement. As history has displayed overfishing was becoming inevitable from increased efforts in fishing and larger area to exploit. If the current fisheries management system was the best way to go is difficult to say. Mainly because it is hard to estimate how other management systems would’ve performed in the same settings in the 1980s. Maybe if the quota would not have been made transferable or at least made transferable within some boundaries to prevent quota shares leaving settlements or regions the population development could have developed differently. However it has to be said, if no limitations would’ve been implemented the demographic changes would’ve most likely developed in the same direction or even worse. If no limitations would’ve been put on the fisheries, stocks could’ve been easily depleted and led to no fisheries sector at all. That could’ve resulted in even greater demographic changes than have been observed in this thesis.

In this thesis three factors were examined to determine if the ITQ system and depopulation in rural settlements are linked. They were development of quota shares and development of

landings by regions and population development in regions and settlements. I suggest to be able to be conduct a more accurate study on these matters a more rigorous statistical analysis would be done. Also, I believe that to be get more accurate data a larger team of specialists from different academic fields is needed to analyze various different factors on rural development. When I say that I mean i.e. anthropologists, historians, economists, etc. That is to dig deeper how rural settlements have been affected individually. Look into their history, how fisheries within the settlements have developed, and what kind of major changes the settlements have gone through that could explain depopulation. I also suggest that in a more accurate study, the development of quota shares would be investigated by examining how their development has been in individual settlements and find out what mechanisms drove the changes. In a vertically integrated fisheries a loss of quota can also mean a loss of a workplace for example. It would also be important to look into how settlements have developed when it comes to urbanization. If settlements that display depopulation have decreased in size because of lack of services that are vital for settlements to thrive i.e. health care, education, commerce, etc. Or was it maybe because of the implementation of the ITQ system which led to services like that dissapear becasue of lack of people.

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