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Mackerel Processing in North East Coast of Iceland

Social-, economic- and adaptability analysis of the municipality of Vopnafjörður

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ABSTRACT

Vopnafjörður is a small fisheries dependent community on the North East coast of Iceland. The community has experienced fluctuations in the fishing industry over the recent years and had to adapt. After some years of struggle, the local company Tangi was merged into a larger company, HB Grandi. The merger was a success and fish processing in the community is stable. In the recent years mackerel has been migrating more northwest into Icelandic waters and that has benefitted the town of Vopnafjörður, even though that Icelandic mackerel fisheries are of international dispute. To see what kind of effect the mackerel processing has had on the community, a social-economic analysis was structured. In the analysis the demographic changes were observed, along with social and economic effects of the processing. That included observing employment, income revenue of the municipality, social and cultural activity, along with other factors. In addition an adaptability analysis was made in order to identify the process that lead to the stable environment of the fishing industry in the community and to identify the current status. The income of HB Grandi into the community has been very positive. They have invested much in the community and are the largest employer in the municipality. The effects of the mackerel processing are also very positive, especially economically. The social effects are not as positive, for social and cultural participation decreases during seasonal work. Out migration from the municipality has leveled off but there is a housing scarcity which might have effects on future in migration. The population is getting older which results in that houses are not used up to their full capacity. In addition, the social and economic innovation is low, mainly due to high activity of the processing company. The resilience and the adaptability capacity of the community of Vopnafjörður was a key factor in securing the fisheries industry in the municipality. In the process the locals lost control of the industry which might increase their vulnerability in the long term. However, with the introduction of mackerel, the processing became more diverse and therefore stable, which decreases vulnerability. International agreement of catch quota would increase stability and decrease vulnerability in the community. Without merging the local fishing company Tangi into HB Grandi it is doubtful that the community could have benefitted so much from processing mackerel in Vopnafjörður. Without a large investor such as HB Grandi, the community might not have the capacity to engage in processing and therefore they would not have benefitted so much from the increased economic activity with the introduction of mackerel in Icelandic waters.

Key words: Mackerel, Iceland, Fisheries dependent regions, Adaptability, Resilience, Social economic analysis

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1 INTRODUCTION

The municipality of Vopnafjörður is a small village of almost 700 people and is dependent on fisheries processing. The town has experienced cutbacks in fish processing over the years. In 2002 the locals lost control of the local fishing and processing company Tangi to a neighboring company Eskja. After losing control of Tangi, the locals feared that the processing factory and the local trawler would be laid down and sold from the municipality. Municipality officials, along with other community leaders, decided to buy up the share of the company to secure processing in the town. The municipality put itself in high debt and the company became quite weak. In order to secure ongoing processing in the town the company had to merge into a large fishing company called HB Grandi, which has main base in the capital of Iceland, Reykjavík. With the merge, the processing factory in Vopnafjörður was able to develop further. HB Grandi focused on the pelagic processing in Vopnafjörður and has since 2004 invested for almost 5 billion Icelandic Krona (ISK) in the processing facilities, which is around 31 million €. This includes both freezing and fish meal processing. Today HB Grandi is the single largest employer in the municipality, employing around 17.5% of the total workforce in the town at the age of 16 – 74. This figure is higher if indirect jobs (contractors working for HB Grandi) are taken into consideration.

In the recent years mackerel has been migrating more northwest into Icelandic waters. This has benefitted the town of Vopnafjörður and has come as an addition into the processing of HB Grandi. All previous investment made by HB Grandi were mainly made for processing of herring and capelin, with addition of blue whiting and bristlemouth fish for fish meal processing. The mackerel came as addition into the previous established processing and only minor changes to the facilities were needed for to adapt the fish to the processing line. This has become a very important addition for the company and the municipality. It has resulted in a longer processing period, creating employment for the people in the municipality and enhanced stability. The mackerel processing is labor intensive and the staff doubles during the mackerel season, resulting the company having to rely on outside labor. This has led to better economic prosperity in the community as well as increasing revenue for the municipality.

Mackerel fisheries in Iceland started as bycatch with herring fisheries in 2006 but has since then grown significantly. The fishery peaked in 2011 with close to 159 thousand tons caught. The division of the catch between the coastal states (European Union, Norway, Faroe Islands and Iceland) is disagreed, where Iceland and the Faroe Islands have unilaterally issued quota for their catch against

EU and Norway consent. The fishery takes place entirely within the Icelandic Exclusive Economic Zone, allowing the states to issue a catch unilaterally, which is the reason for the dispute. The reason for the migration of the mackerel more north-west is unclear and one aspect of the dispute between the arguing partners is if the migration is permanent or not.

Disregarding the dispute, the mackerel fishing and processing has had a positive impact on the Icelandic economy. In 2011 the mackerel was the second most valuable exported species in Iceland, after cod. This is close to 10% of the export value of fish and fish related products of Iceland. The export of fish and fish related products are roughly 40% of the total export of the country. This has had positive effect on the municipality of Vopnafjörður. In 2011 the total landings of mackerel was more than 16 thousand tons with the catch value of 932 million ISK or 5.8 million €. This leaves significant value within the community in form of wages for the staff, increased tax income for the municipality, increased income through harbor fees and increased other fees related to the activity of HB Grandi.

In this study the aim is to analyze how the municipality has managed or adapted to the changes in the fisheries sector in Iceland and how they have benefitted with the introduction of mackerel. The study is to see what kind of social-and economic effects the mackerel processing has had on the municipality and how the community secured the fishing industry in the area and at what cost.

2 VOPNAFJÖRÐUR AND MACKEREL IN ICELAND

2.1 Vopnafjörður

The village of Vopnafjörður is in Northeast of Iceland and stands on a narrow peninsula in the middle the bay of Vopnafjörður. The population of the municipality, including the village and surrounding farms is 687 (Statistics Iceland, 2013a). Of this, 543 live in the village itself (Statistics Iceland, 2013b). The landscape of this municipality is diverse with mountain heaths, rivers, coastal cliffs and black beaches (Anon, 2011a). Settlement dates back to the Viking Age when the area was first settled by Viking seafarers from Norway. The name of Vopnafjörður derives from one of the original settlers, Eyvindur Vopni (Fjord of Vopni). Vopnafjörður was for a long time an important trading port for north-eastern Iceland and foreign merchants who sailed to Vopnafjörður in the early modern age (Anon, 2011a).



Figure 1. Map of Iceland, Vopnafjörður in the North East (red circle) (Iceland - Google Maps, 2013)

The history of the logo of Vopnafjörður municipality is quite interesting and goes far back. This logo is of a dragon, one of the four guardian spirits of Iceland, depicted on the Icelandic coat of arms. A Danish king had been planning on invading Iceland and sent a warlock in a shape of a whale to scout

for a good place to launch the invasion. The warlock encountered the guardian spirits at each side of the country, north, south, east and west. The dragon that appeared in Vopnafjörður is the guardian spirit of the east. The story is told in *Heimskringla* by Snorri Sturluson (2009):

Then the Danish king [Harald Gormsson] proposed to sail with his fleet to Iceland, to avenge the mockery and scorn all the Icelanders had shown towards him... King Harald told a warlock to hie to Iceland in some altered shape, and to try what he could learn there to tell him: and he set out in the shape of a whale...When he came to Vapnafjord he went in towards the land, intending to go on shore; but a huge dragon rushed down the dale against him with a train of serpents, paddocks, and toads, that blew poison towards him (Sturluson, 2009).



Figure 2. Logo of Vopnafjörður Municipality (Anon, 2011a)

Settlement gradually formed on the peninsula where the village now stands, which traces its history back to the seventeenth century. It became one of Iceland's major harbors for commerce in the eighteenth and nineteenth centuries. In the late nineteenth century, Vopnafjörður was the largest port of Icelandic emigration to North America. During the last century, the fishing industry grew considerably. Today it is the largest business sector in the area (Anon, 2011b)

Fish processing and services are the main industries in the village. HB Grandi, one of the largest fishing companies in Iceland, operates a high-tech pelagic freezing plant specializing in capelin, herring and mackerel. In addition it operates a brand new factory for the production of fishmeal. Agriculture is important in the surrounding area. Three valleys form most of the inland region which is mostly farmland and the main agricultural industry is sheep farming. Some milk production is in the area, as is horse breeding (Anon, 2011a). Tourism has grown considerably in recent years, especially regarding the salmon rivers in Vopnafjörður. They have attracted anglers from all around the world, including such celebrity anglers as the Prince of Wales and former US President George Bush Sr. (Anon, 2011c).

The nearest town and service center is Egilsstaðir, a one to one-and-a-half hour drive to the south, depending on road conditions. Flights are operated five times a week between Vopnafjörður and Akureyri in North Iceland, the largest town outside the capital area. Driving to Akureyri takes just under three hours. (Anon, 2011a)



Figure 3. Aerial view of Vopnafjörður (Anon, 2013a)

The municipality provides basic services such as a fire department, a community center, a swimming pool, a kindergarten and elementary education, a library, social services, a music school, harbor services, garbage disposal and general maintenance of the community's infrastructure facilities, such as buildings, the water supply system and roads. The municipality is one of largest employer in the community. This includes staff from the elementary school, the kindergarten, the nursing home, the harbor, the sport facilities, the municipality office and the municipality maintenance workers. The largest employer in the community is the fish processing company of HB Grandi (Anon, 2012a)

The harbor in Vopnafjörður provides all general harbor related services, such as water, garbage disposal, electricity and landing facilities. Natural harbor conditions were bad and the harbor has always been quite exposed, which has created problems for the development of the fishery sector. The harbor facilities have received extensive construction and renovation projects during recent years. The harbor was closed and narrowed by two breakwaters that were extended to two islets. This was a complete transformation of the harbor which provides good shelter now. Later, the berth and the docking area were extended along with the deepening of the harbor. The docking area was, among other things, renovated and developed in conjunction with increased activity of HB Grandi (Anon, 2012b)

2.2 The fishing industry – a story of struggle

The fishing industry has played a large role in the economy and the culture of Vopnafjörður. In the late 19th century, the fishery started to grow considerably and many people came to Vopnafjörður to fish. The fishery continued to grow in the beginning of the 20th century with introduction of motor powered boats. The proximity to good fishing grounds of cod, capelin and herring was premise for the development of the fishery. Poor natural harbor conditions were a problem for the industry and hindered development in the early years (Anon, 2012c).

The history of the fishing industry in Vopnafjörður has been a story of struggle since the establishment of the first processing facility in 1937, which was a cooperative initiative. In the beginning only a few motor boats provided the facility with fish along with some un-motorized small scale vessels. All the catch was processed as salted fish, but the processing company went bankrupt in 1941. The processing of salted fish continued with the small scale vessels but the lack of sufficient harbor and processing facilities, along with few vessels, hindered the further development of the

fishery at that time. It wasn't until 1950, when the first freezing and processing unit was established, that the industry started to develop. The freezing factory processed groundfish, such as cod and haddock. With better processing facilities, fishermen started to upgrade their fleet. The processing in the freezing facilities was more or less put on halt during the so-called herring years, from 1957 to 1966. Herring processing, both for fish meal and salting, was very labor intensive and was that one of the reasons that the freezing factory production was put on halt, along with a decrease in the landings of groundfish (Gíslason, 1990).

The landing facilities became a hinder, for as the boats got bigger, they had problem landing in Vopnafjörður. When the herring fishery collapsed, the industry put all its emphasis on groundfish and reopened the freezing and processing factory. In 1967 the local fishing and processing company Tangi was established and was mainly owned by the municipality. Later, the cooperative association of Vopnafjörður and the local union joined Tangi and established a new fish processing company under the same name. It was soon realized that without a new harbor or a new breakwater the industry would not survive. Two years later after the establishment of Tangi, the harbor was sealed off with a new breakwater, which can be said was a breakthrough for the industry (Gíslason, 1990). The newly established company increased its processing capacity and bought more vessels to supply it with fish. In 1973 the company bought a trawler, *Brettingur*, which was another breakthrough for the industry, and subsequently the processing facilities needed to be enlarged. In 1984, more or less all the fisheries related companies in Vopnafjörður were merged into the company Tangi hf. That included the freezing and processing factory (which was enlarged shortly after the merger), the fishmeal factory, and other facilities that processed fish and fish related products. Along with this, all the vessels that were previously owned by Tangi were merged into the company. The largest owner of the company was the municipality, with an 87% share. The rest of the fishing activity was privately owned, such as small scale fishing boats that fished mainly for cod (Gíslason, 1990). Another era of struggle started in 1987 when the Total Allowable Catch (TAC) of cod in Iceland was lowered. This affected the fishing industry in Vopnafjörður greatly. The reduction started in 1987, at a similar time to when renovations of the freezing factory were made, along with an investment in the fishmeal factory. The trawler *Brettingur* was also renovated and a small trawler bought. It can be said that all the investment was made at the worst possible time (Jónsson, 2013).



Figure 4. Pelagic vessel Háberg GK on its way to landing in Vopnafjörður in 1992 (Arnarsson, 2011)

In 1990 the fishmeal factory was split from the company and sold to new owners as part of a financial reform of Tangi. The municipality remained the single largest owner. From then the company was in a constant struggle. Lack of material for the processing facilities led the company to start to buy frozen cod from Russian trawlers, due to quota reductions. From 1987 the cod quota of the company had been reduced from 3000 tons to less than 1000 tons in 1996, approximately 70%. The frozen cod from Russian trawlers was the main bulk of cod processing during that time (Gíslason, 1996). During this time, several companies were established, restructured and merged for the ownership of the vessels of the company. Pelagic- and groundfish vessels with or without quotas were bought, sold and or merged into the company, leading to quite complex ownership structures at times (Morgunblaðið, 1998, Ægir, 1996; Gíslason, 1996; Jónsson, 2013). Another major reconstruction of the company occurred in 1997. All the processing facilities (groundfish and pelagic freezing and fishmeal production) and vessels were put under the hat of the company Tangi. During that period, officials of the company decided to focus further development on pelagic species, such as capelin and herring, with an emphasis on processing for human consumption. The freezing storage was increased, the pelagic processing facility was renovated and the fishmeal factory was also renovated for improved efficiency. The relative success of the pelagic sector at that time helped pay off this investment and could be said to be a reason for its development (Jónsson, 2013; Ægir, 1998, Morgunblaðið, 2004).

The processing of frozen Russian cod gave the company flexibility to stop processing and shift to pelagic species during their seasonal catch because of the storage capacity of the frozen cod. The cod processing had also been reduced during this and the working hours were shortened to only 6 hours per day. In addition the cod processing was only supported by the frozen Russian cod at that time (Ægir, 2000). The significance of the pelagic sector continued to rise, with the increased importance of capelin. The industry was reliant on the capelin and company officials stated that the company's performance was hugely dependent on this fluctuating species. "When there is a good capelin fishery, then everything goes well in Vopnafjörður" were the words of director of the company at that time (Ægir, 2002). In 1998 there were some complications about a potential merger with a neighboring processing company. This led to some ownership conflicts, but this was an attempt to secure a higher pelagic quota for the company (Morgunblaðið, 1998). A merger with another fishing company was successful in 2001 thus resulting in a significantly increased fishing quota for the company.

A year later, in 2002, the majority of the shares of Tangi were bought by the company Eskja, which is based in the East fjords of Iceland. The shares were bought after Tangi achieved record profit in the first quarter of 2002, which was mainly because of increased capelin processing (Morgunblaðið, 2002, Morgunblaðið, 2004). This was the first time that the locals lost control over the company since its establishment in 1967. The local people and municipality officials were rather skeptical about the purchase and were worried that the quota that the company had been allocating over the years would be moved away from Vopnafjörður (Vilhjálmsón, pers.comm.). A year after the sale, the locals decided to buy the shares of Tangi again from Eskja in order to secure the company, its facilities, vessels and quota in Vopnafjörður. The locals formed a partnership to buy the majority of the shares, with the municipality as one of the owners, for close to one billion Icelandic krónur at that time. This was a huge risk for such a small community. The purchase was thought to be successful, even though around 1/3 of the capelin quota of the company was lost through the transaction. During that process, the locals emphasized on the importance of controlling the company themselves (Morgunblaðið, 2003a, Morgunblaðið, 2003b, Morgunblaðið, 2004).

The municipality put itself heavily into debt by buying the share of the company back, but along with others, they managed to bring it back into local control (Vilhjálmsón, pers.comm.). The locals knew that the existence of the settlement in Vopnafjörður was largely dependent on the fishing company Tangi and therefore they were willing to take such a large risk to secure its continued existence (Morgunblaðið, 2004). These actions were not as successful as originally thought in the beginning. The large debt and difficult operating conditions of the company made it clear that further actions

were needed. The few solutions that existed at the time were either to sell the pelagic or the groundfish part of the company or to attract a large investor who could see the benefits in continuing to operate in Vopnafjörður. Shortly after, negotiations started with the fishing company HB Grandi about a merger. Their main headquarters are based in the south, in the capital of Reykjavík and they are one of the largest fishing companies in Iceland. The talks were finalized in 2004, which resulted in the merger of the local fishing company Tangi into HB Grandi (Vilhjálmsón, pers.comm.).

The merger of Tangi into HB Grandi was seen as beneficial for both partners. Tangi needed outside involvement in their business and HB Grandi was looking for a place to process and develop their pelagic catches. They only had facilities in the south of Iceland and most of the pelagic activity was taking place in the north-east and east of Iceland. Vopnafjörður was therefore an ideal place for HB Grandi to invest in. The location was in fact one of the main reasons for their decision. The willingness of the municipality, which at that time was the main owner of Tangi, to merge into HB Grandi was also an important factor in the merger process and in fact a decisive one. The infrastructure that was already established, such as the freezing and the processing facilities, along with the fish meal factory was also an important factor for the merger, along with the social capital of the workers. There had been a lot of investment made in the pelagic sector over the years and the local staff were experienced in the processing process and willing to work in fisheries (Vilhjálmsón, pers.comm.).

In a discussion with the former director of Tangi and current director of HB Grandi, he mentioned in that the merging process was relatively easy. Both partners wanted to merge and saw a benefit in it. The officials in Vopnafjörður were also satisfied and the shares of Tangi got a good value in the merging process. The officials of HB Grandi decided to focus on the pelagic sector and almost immediately after the merger, the company started to invest in the pelagic part of the facilities (Vilhjálmsón, pers.comm.).

Since the merger in 2004 there has been significant investment and development. Even today, the investment and development process is not finished. With this merger, it can be said that the struggle of securing the fishing industry in the municipality was over. Vopnafjörður got a strong actor into the community that has good access to capital for investment and has a large fleet. HB Grandi has 12 vessels, where four of them are mainly used for pelagic fisheries. The quota share of HB Grandi is around 12% of the total quota share in Iceland (cod equivalent) (Anon, 2013b). With the merger, the fishing industry was secured in Vopnafjörður, but the locals lost control.

2.3 Mackerel

Atlantic Mackerel or *Scomber scombrus* is a streamlined and fast swimming pelagic fish that is abundant in cold and temperate shelf areas. As other members of the family *Scombridae*, the Atlantic Mackerel is epipelagic and mesodemersal species. Common size for adults is from 35 cm to 45 cm and 0.3 – 0.8 kg. The fish can reach and age up to 17 years, length up to 60 cm and weight around 3 kg. The Atlantic Mackerel reaches maturity at the age of 2 to 3, around 30 cm long. The mackerel is mainly diurnal and feeds on a variety of pelagic animals, mostly crustaceans, fish juveniles and other zooplankton. Older and bigger mackerel feeds also on other small fishes. Feeding patterns of mackerel varies seasonally and spatially. Mackerel stop feeding almost completely during winter (ICES, 2013a). As they grow, they are in turn preyed upon themselves by tunas, sharks, marine mammals and birds (Ástþórsson et al., 2010).



Figure 5. Mackerel (Hlíðberg, 2011)

More distinct features of the species, according to the FAO Catalogue of *Scombrids of the world*, the Atlantic Mackerel has a:

“palatine wide, teeth in two widely spaced rows. Space between first dorsal fin groove and second dorsal fin clearly greater than length of groove; anal fin origin opposite that of second dorsal fin or nearly so; anal fin spine conspicuous, joined to the fin by a membrane but clearly independent of it. It is vertebrae with 13 precaudal plus 18 caudal; first haemal spine anterior to first interneural process; 21 to 28 interneural bones under first dorsal fin” (Collette & Nauen, 1983).

The fish has markings on back oblique to near vertical, with relatively little undulating. The belly is unmarked the fish has no swimming bladder (Ástþórsson et al., 2010).

The Atlantic Mackerel is a fast swimming and highly migratory species. It has been recorded that the maximum sustained swimming speed is up to 3.5 body lengths per second, which is approximately 4 km/h for a 30 cm fish. A tagged specimen has been reported to cover a distance of 1200 km in thirteen days (ICES, 2013a). Atlantic Mackerel forms large schools near the surface and overwinter in deeper waters. The Mackerel moves closer to shore in spring when water temperatures gets warmer, ranging between 8° and 14°C (Ástþórsson et al., 2010; Collette & Nauen, 1983). They are widespread

in the seas of the North Atlantic, from North-west Africa, to Iceland (recently) and northern Norway in the eastern North Atlantic (Northeastern population). Mackerel is also found in the Black Sea, Mediterranean and western Baltic. In western North Atlantic, it ranges from North Carolina to Labrador (Northwestern population). The Mackerel stays at depths of less than 200 meter and is a typical shoaling fish, with shoals that can be of up to 9 km long, 4 km wide, and 40 m deep (ICES, 2013a). The distribution is shown in Figure 6.

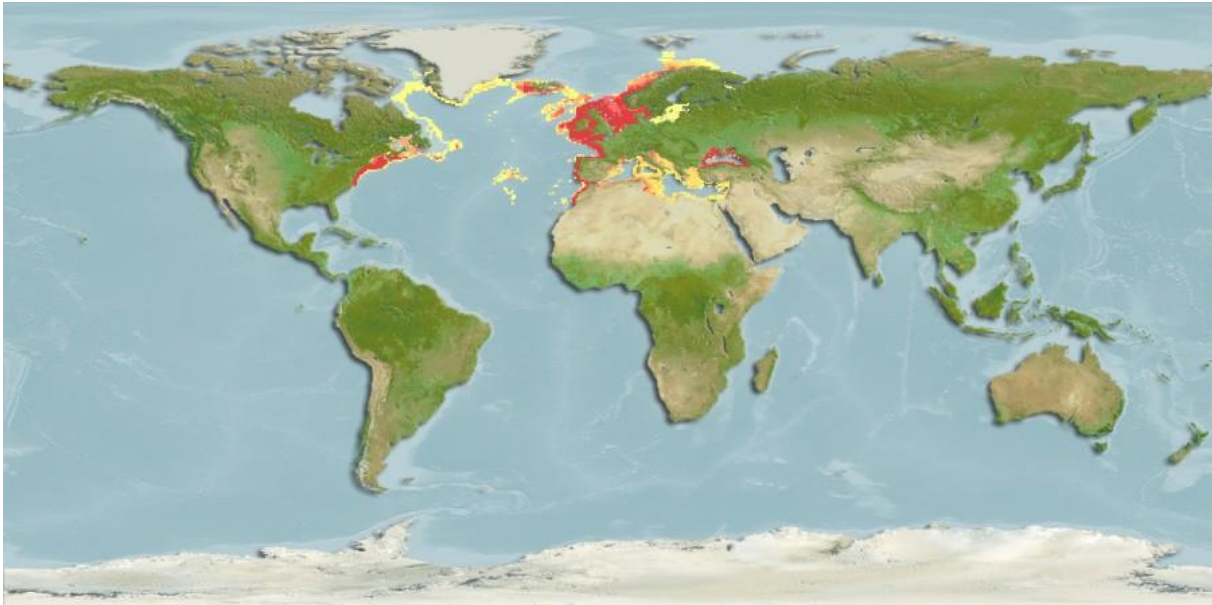


Figure 6. Distribution Map for *Scomber scombrus* (Atlantic mackerel) (Ready, 2010)

The East Atlantic Mackerel population splits into three components, the Southern, Western, and North Sea spawning components. Each component has its own migratory behaviour and is in whole considered as a Widely Distributed and Migratory Stock. Mackerel from the southern and western areas migrate to feed in the Nordic seas and the North Sea during the second half of the year and then mix with the North Sea component. The Western component is defined as mackerel spawning in the western area (ICES Divisions and Subareas VI, VII, and VIII a,b,d,e), which is located south and west of the UK and Ireland. This component is the largest, currently accounting for approximately 77% of the entire Northeast Atlantic stock. Similarly, the Southern component is defined as mackerel spawning in the southern area (ICES Divisions VIIIc and IXa), which is north of Spain and down along the Portuguese coast. The southern component is considered to be approximately 19% of the stock. The North Sea component has been at an extremely low level since the early 1970. It is considered that the North Sea component still exists at as little as 4%. This component spawns in the North Sea and Skagerrak (ICES Subarea IV and Division IIIaN) (ICES, 2012a).

2.4 Stock assessment

Methods used of assessing the East Atlantic Mackerel stock, according to ICES Advice report, are based on catch numbers at age for the period 1972-2011. Triennial mackerel egg survey estimates of SSB from 1992-2010 are also used, along with information from recruit surveys. The recruit surveys provide information on young mackerel but are thought to be unreliable due to high variability. Information obtained from the industry also contributes as input into the assessment (ICES, 2012a)

Fishing mortality was high during the early 2000s, then declined strongly and has been at a relatively stable level since 2006. SSB increased considerably from 2002 onwards and currently remains high, above the precautionary approach biomass limit (B_{PA}) and maximum sustainable yield (MSY) biomass trigger level ($B_{trigger}$), but it is showing signs of decline. The 2005 and 2006 year classes are the highest on record. The 2007 and 2008 year classes are about average (ICES, 2012a).

Catch and survey data from recent years indicate that the stock has expanded north-westwards during spawning and summer feeding migration. This distributional change may reflect changes in food availability, which is possibly linked to increased water temperature, and/or increased stock size. This expansion is supported by the latest egg survey, which was conducted in 2010 where spawning grounds of mackerel are observed to reach more north and north-west wards than usual, in addition to traditional spawning grounds. Most of the eggs are still produced in the traditional spawning area located from the west of the Celtic Sea to the west of Ireland (ICES, 2012a). In the ICES advice for 2012, it is noted that the expansion seems to be less related to changes in the environmental conditions, than to the increase in stock size. It is however noted that the north and the northwest expansion could be due to record high surface temperatures observed in the Nordic seas during in recent years, resulting in increased feeding habitat for mackerel (ICES, 2012a).

The information gathered from the egg survey 2010, along with other additional information, shows that estimation of the spawning stock biomass (SSB) is of 2,7 million tons in 2012, which is little less than the previous year, when the SSB was estimated at 2.9 million tons (Marine Research Institute, 2013).

However there are some uncertainties in estimation, for example insufficient information is available to confirm the sizes of the 2009 and 2011 year classes. Fishing mortality (F) in 2011 was estimated to be 0.31, which is above F_{MSY} of 0.22 and F_{PA} of 0.23 in 2011 (ICES, 2011, ICES, 2012a) which creates additional uncertainty. Based on this information, ICES advised that catches in 2013 should be

between 497,000 tonnes and 542,000 tonnes, with fishing mortality MSY of 0.22 (F_{MSY}), with SSB estimated at 2.546 million tonnes. As for the precautionary approach harvest rule, the fishing mortality F should be 0.23 (F_{PA}). In the light of that information in 2012, the SSB of East Atlantic Mackerel for 2014 was estimated at 2.56 million tons (ICES, 2012a). But there is constant uncertainty about the stock size as preliminary estimates of the SSB derived from egg surveys indicate an increase from 3.43 million tons in 2010 to 4.30 million tons in 2013. ICES recommendations for 2014 are therefore 889,886 tons, with a fishing mortality of F 0.21, based on the 2013 SSB (ICES, 2013b). One large uncertainty level exists for the estimation of catches and fishing mortality is due to management planning. No agreement exists in distribution of the total catches of the East Atlantic Mackerel between all nations involved in the fishery and has not been so since 2009. In addition, catches since 2008 have been significantly in excess of ICES advice. This has been a critical concern, and prevents control of the total exploitation rate. The total catch in 2012 is estimated 930,135 tonnes. Converted into fishing mortality, the rate would be of 0.36, which was above the stipulated range in the management plan (ICES, 2012a). However, with the changes in estimation due to preliminary results from the 2013 egg survey, the stock has shown steady increase and could handle such pressure (ICES, 2013b).

2.5 Mackerel – Changes in migration

Mackerel is a highly migratory species that finds its optimum distribution in cold and temperate shelf areas, temperature ranging from 8-14°C (Ástþórsson et al., 2010). The mackerel seems to be a very opportunistic species and over the recent years, it has started migrating further north and west in the Atlantic. The reasons for those changes are not known and are even disputed. Some mention that the migration is due to its stock size while others state that climate change is the main factor. The northwest migration has been a cause for dispute between the European Union (EU), Norway, Faroe Islands and Iceland in the allocation of catch of the species. Great abundance of mackerel is now in Faroese, Icelandic and even Greenlandic waters due to the northwest migration of mackerel. The reason for or the type of migration is a matter of great dispute, for the type of migration could determine the negotiating status of the disputing nations. A temporal change in migration favors, for example, the EU and Norway while a permanent change favors the Faroe Islands and especially Iceland, since Icelandic waters are at the peripheral spread of the mackerel. It is not known what is causing this new migration pattern but indications are that they are due to climatic changes and / or stock size. Other arguments are that the migration is density-dependent, where the mackerel migrates into the peripheral zones of Iceland and even Greenland only if the stock exceeds a certain size (Hannesson,

2013). This might be the case, since the stock has been in healthy condition since 2005 and been growing until 2009 and showing little decline since then. An abundant mackerel stock might possibly affect their food source. In 2012 there were historically low plankton concentrations in the Nordic Seas and the mackerel stock was large. That might have forced the stock to change its migration routes and spread more out to the peripheries of its comfort zone, into formerly unknown mackerel areas to sustain their energy needs during feeding period (ICES, 2012b). With a spawning stock biomass estimated at 3.1 million tons in 2009 and little more than 2.5 million tons in 2013, this is possible situation. Another option is that the migration might be due to the stochastic nature of the species, resulting in a temporal migration changes into the peripheral areas and are random (Hannesson, 2013). The randomness might be due to some climatic variability or other unknown factors. Those two temporary migration changes scenario arguments are more favorable by the EU and Norway, for they would strengthen their negotiating status. There is however the option that the migration is permanent and that would strengthen the negotiation status of Faroe Islands and Iceland. Permanent changes might be associated to climate change and warming oceans, therefore altering the mackerel migration route permanently. Those opinions are favored by the Faroe Islands and Iceland.

In the Arctic Climate Impact Assessment (ACIA) from 2007 it is noted that that global warming is likely to induce an ecosystem regime shift in some areas in the Arctic, including Iceland, and therefore change the species composition. Such shift was thought to affect the spatial distribution of fish stocks and change the fisheries in those areas (Vilhjálmsón et al., 2007). This has been the case with the migration of mackerel to Iceland. Moderate warming is associated with weakening of the East Icelandic current and reduction in its domain. That is thought to have positive effect on migration pattern on southern species such as mackerel would enter Icelandic waters in sufficient concentration for commercial fishing in the late summer and autumn. This has been the case and the species has taken advantage in rich supply of food over the Icelandic shelf (Vilhjálmsón et al., 2007). In the ACIA report, it was also predicted that climatic changes and altered migratory routes of fish stocks could cause conflicts among nations over distribution of fishing rights and a close cooperation should resolve such conflicts (Vilhjálmsón et al., 2007). They were right about the conflicts but not yet about the solution.

According to the Report of the Working Group on Widely Distributed Stocks (WGWIDE) (ICES, 2012b) the temperature in the Nordic seas are well above long term average. In the area west of Iceland, along with the Irminger Sea, the surface temperatures were up to 3°C higher than the long term average in the summer of 2012. In the meantime, the south western Norwegian Sea seemed to be

cooler compared with the two previous years. Sea temperature in July was highest southwest of Iceland and reached 13°C. The sea surface temperature anomalies in a 20 year average are shown in Figure 7.

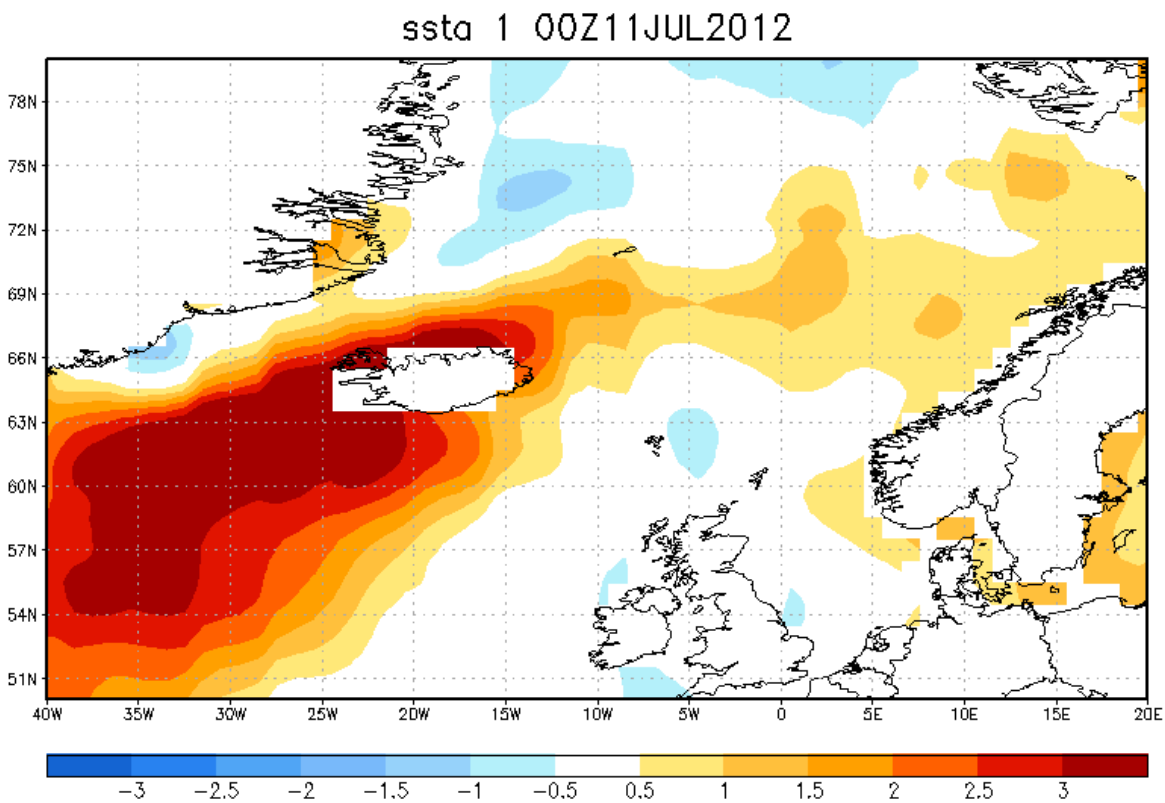


Figure 7. Sea surface anomalies (°C centered mid July 2012) showing warm and cold conditions comparison to a 20 year average (ICES, 2012b)

In the observations made in 2012 show that the front between the cold East Iceland Current and the warmer Atlantic water were clearly visible in the surface layers, even though that the front of East Iceland current is usually located the south western Norwegian sea. Warm Atlantic water extends north beyond the 70 degrees in the eastern Norwegian Sea, as well as north of Iceland. In North and northwest of Iceland the temperature was lower, reaching 4°C (ICES, 2012b). The broad geographical expansion of mackerel into the western part of the Nordic Seas, Faroe Islands, Greenland and Iceland, in the summer of 2012 were linked to those high surface temperatures in the area (ICES, 2012b). Concentrations of zooplankton are at low levels, compared to historical values according to the WGWIDE survey in 2012. Biomass is generally low, except for the westernmost area around Iceland. Zooplankton biomass has been showing a decreasing trend in the Norwegian Sea for more than a decade (ICES, 2012b). There might be several reasons for the decline and one is the size of the stocks feeding on the zooplankton. Climatic variations might also be a cause.

The reason for the changing migration of mackerel is not completely known and if the changes are permanent or not are up for a debate. There are evidences of climatic variations that affect the migration route of mackerel, but there are no proofs that those variations are permanent. The observation time has been short and predictions can vary in order to confirm those speculations. The stock size might also be the reason and therefore the changing migration pattern might be temporary. The stock size seems to affect the food source in traditional areas of mackerel, forcing the species to migrate further to their peripheral zones for feeding. Again, climate change might also affect the food abundance. Then there is the option that the migration of mackerel is just purely stochastic with no clear explanations.

Seeking for “a reason” for the migration change is perhaps not the correct point of view in this case, for there might be several reasons of change that are all dependent on each other. Nature is stochastic and is always changing. Therefore it might be concluded that all the factors or some kind of combination might influence each other causing the migration pattern of mackerel to change. Warming ocean currents, stock abundance, food availability and the stochastic nature of mackerel might all affect each other, causing the stock to change its migration behavior. Whatever the case is, the migration has changed and time will tell if it is permanent or not.

2.6 Mackerel dispute

The mackerel fisheries have been of great dispute. Since 2008 there have been no clear international agreements on the exploitation rate of the stock between the nations involved in the fishery. Since there is no consensus about the TAC of mackerel there is growing concern about the unregulated exploitation rate of the stock (ICES, 2012b). The dispute started in 2006 when mackerel started to appear as a by catch in the Icelandic summer herring fisheries out of the East coast of Iceland. The reported by catch of mackerel that year was a little over 4000 tons. The year after in 2007, the bycatch of mackerel in the herring fisheries increased dramatically and was over 36.000 tons. In the following years of 2008, 2009 and 2010 the catches increased even more and were 112, 116 and 130 thousand tons (Marine Research Institute, 2011). With such increase in catches, the mackerel was no longer considered as a by catch and regulations were issued to control the catches. In 2009 the minister of Fisheries and Agriculture issued a regulation stating that if the catch would exceed 112 thousand tons, then the minister would decide if the fisheries would continue (Matthíasson et al., 2009). This was the first regulation issued by the Icelandic government for the mackerel fisheries. For

2010 and 2011 Iceland issued a unilateral quota for mackerel and claimed 16-17% of the TAC issued by ICES, which was thought to represent their claim of the TAC in the negotiations with the other coastal states at that time. This was opposed by the other coastal states (Guðmundsson et al., 2012). The complexity of the dispute rose after the Faroe Islands issued a unilateral quota of 85.0000 tons in 2010 and 150.000 tons in 2011 and 2012 (Concern over mackerel quota, 2010, Fiskimálaráðið, 2012). In addition to this, the knot was tighten when the main actors, EU and Norway set their TAC in 2012 and now for 2013 as 90% of the recommended TAC from ICES, leaving 10% for the other Coastal States, Iceland and the Faroe Islands, as well as Russia. Faroe Islands and Iceland stated that they would not settle for the remaining 10% (Jolly, 2013; “Ministry of Industries and Innovation,” 2013)

Iceland tried somewhat to compromise the dispute by tactfully reducing their unilateral quota by 15% and recommending others to do the same for 2013. The Icelandic recommendations were rejected by Norway, stating that the reduction on their behalf would support the Icelandic claims (kystdepartementet, 2012). EU and Norway reduced though their share, from 584.000 tons to 490.000 tons for 2013, which has been around 90% of the recommended TAC of ICES (Guðmundsson et al., 2012; “Ministry of Industries and Innovation,” 2013)

The dispute is at a stalemate, where EU and Norway accuse Faroe Islands and Iceland of high demands, while Faroe Islands and Iceland accuse EU and Norway of unwillingness of sharing the stock in comparison to their claims. It seems that the nature of the dispute has reached a point of a waiting game, where the nature of the migration change are in forefront. EU and Norway perhaps see their interest of waiting to see if the migration is temporal, due to stock size, climate change or stochasticity of the stock. It seems to even benefit EU and Norway if the changes are stock size related, for it would benefit those actors to overfish the resource to keep it in traditional migratory areas (Hannesson, 2013). Faroe Islands and Iceland could therefore loose from delayed negotiations if the changes are temporal but could however gain a better bargaining position if the changes turn out to be permanent and independent from the stock. Preliminary estimates indicate that the stock is growing and that might perhaps affect the negotiations (ICES, 2013b)

The Icelandic point of view is that the mackerel is on a feeding migration into Icelandic waters and some evidence show that the species are taking food from other species such as herring. Further concerns are about that mackerel feeds on pelagic larvae and could affect the recruitment of other commercial valuable species such as cod (Guðmundsson et al., 2012; Mackerel Q&A, n.d.). In joint survey in 2012 there was recorded species overlap, as presented in Figure 8, which is the cause of the concern.

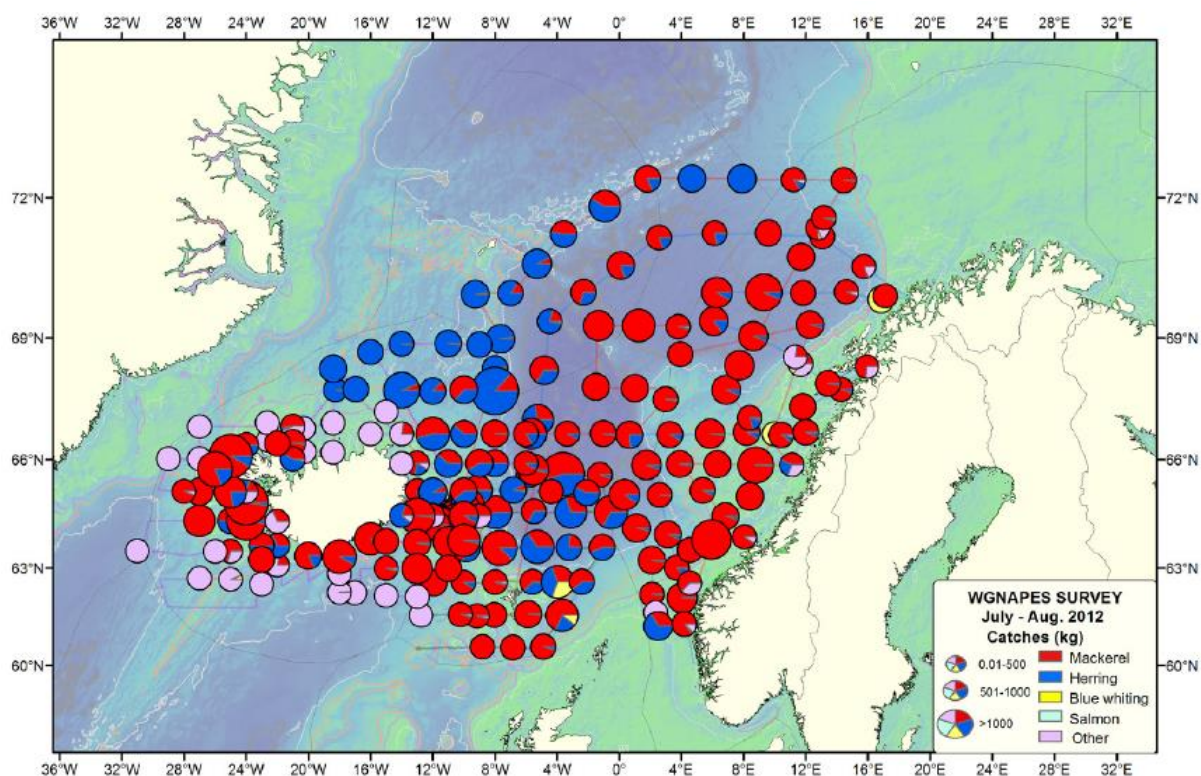


Figure 8. Distribution and spatial overlap between mackerel (red), herring (blue), blue whiting (yellow) and salmon (violet) from joint ecosystem surveys between 1st of July and 10th of August 2012 (ICES, 2012b).

Evidence indicates that mackerel is gaining up to 50% in weight while in Icelandic waters. In 2012 around 1.5 million tons of mackerel were estimated to be in Icelandic EEZ or around 30% of the total estimated biomass of 5 million tons in 2012. Weight gain would therefore be around 3 million tons (Sigurjónsson, 2012). Therefore Iceland is claiming composition for their stay in the Icelandic EEZ in form of a quota share of the recommended TAC. Or as in the words of the minister of Industry and Innovations of Iceland stated in an interview “the mackerel can’t stay here and get a free lunch” (Steingrímur, n.d.). Icelandic claims of the mackerel share are thought to be around 15% of the TAC issued by ICES (Fiskifrétir, 2012; Jolly, 2013).

2.7 Mackerel in Iceland

Migration of mackerel into Icelandic waters is not a new phenomenon. Reports of mackerel in Icelandic waters date as far back to 1640-1644. It is believed mackerel was found at the North-West part of Iceland, but it cannot be confirmed. The first confirmed report of mackerel in Icelandic waters dates back to 1895, where the fish was found at the South-West part of the country. Further reports date in the beginning of the 19th century and correlate with periods of warmer waters around

Iceland(Ástþórsson et al., 2010; Friðriksson, 1944). During those years the mackerel was not utilized due to lack of knowledge and technology of catching. Today, the knowledge and the technology are well established for mackerel fisheries in Iceland and the fisheries are fully exploited and could even be more when looking at the fleet capacity (Ástþórsson et al., 2010).

The Icelandic Marine Institute (MRI) has over the recent years monitored the changes of the migration of East Atlantic Mackerel into Icelandic waters. This is both done with direct observations and with reports from the Icelandic fishing industry. From 2009 MRI has participated in an international research expedition about pelagic species in the Norwegian Sea, Faroese and Icelandic waters. In addition, MRI participated in 2010 for the first time in an international egg survey that is conducted every three years. The next survey will be in 2013 (Marine Research Institute, 2013). Surveys in Icelandic waters in 2010 estimated the total biomass to be 1,1 million tons, or around 23% of the total biomass of 4.85 million tons. In 2011, the biomass was estimated the same or 1.1 million tons out of 2.7 million tons, or around 43%. The 2011 numbers are though inaccurate since some areas were not included in the survey. For 2012 the mackerel biomass in Icelandic waters seemed to have increased, from 1.1 million tons up to 1.5 million tons or around 30% out of the total biomass of 5 million tons surveyed in the whole research area (Guðmundsson et al., 2012; Sigurjónsson, 2012). Figure 9 shows research vessels track and density of mackerel in catches in the 2012 survey.

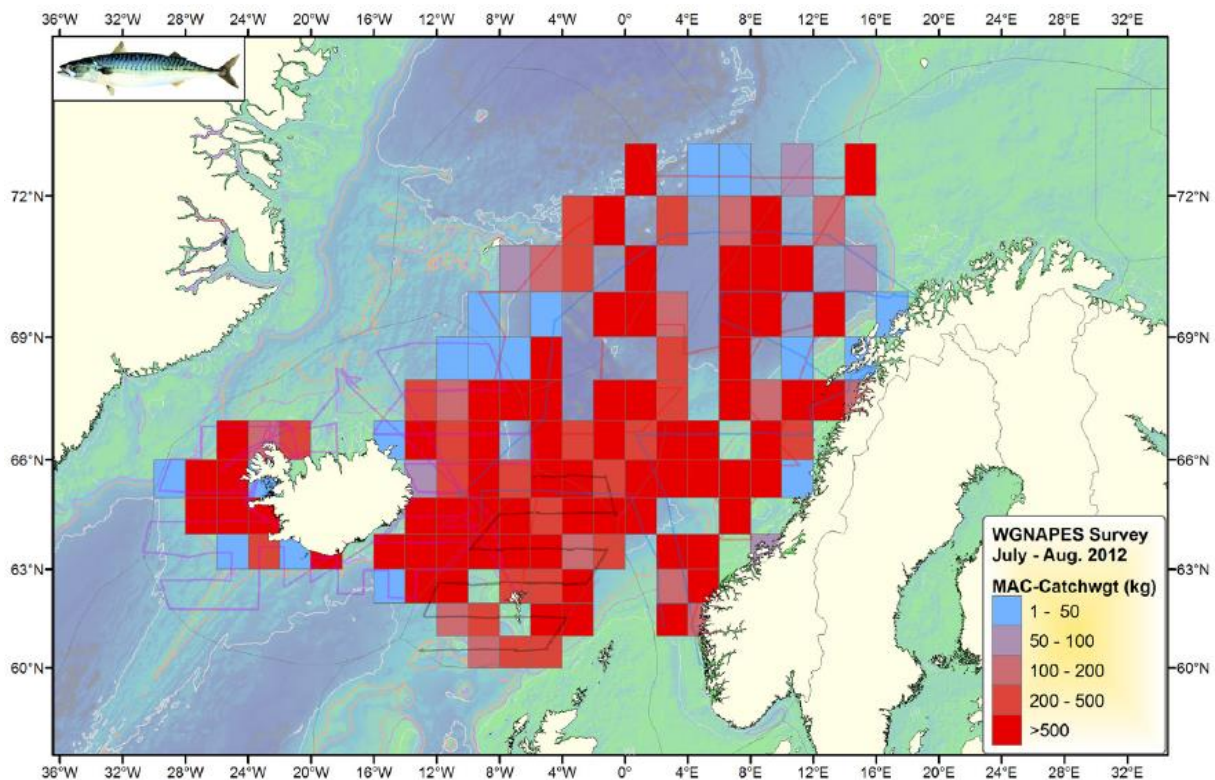


Figure 9. Catches of mackerel in kg represented in standardized rectangles. Light blue represents small catches (1-50 kg), while dark red represents catches of more than 500 kg mackerel. Vessel tracks are shown as continuous lines (ICES, 2012b).

As mentioned before, mackerel started as a by catch in the Icelandic summer herring fisheries at the East coast of Iceland. The reported by catch of mackerel that year was a little over 4000 tons which came as by catch in mid water trawls. The catch increased dramatically over the next years and was no longer considered as by catch. The minister of Fisheries and Agriculture imposed a catch limit in 2009 and in 2010 the first unilateral quota was issued. Iceland has issued herself quota of around 15 – 17% of the TAC recommended by ICES (Guðmundsson et al., 2012). In 2013 Iceland issued a quota of 123.182 tons or around 23% of the total recommendation of 542.000 tons from ICES. This is a 16% or a 24.000 tons reduction from previous year where the quota issued was 146.818 (Guðmundsson et al., 2012; ICES, 2012a, Stjórn makrílveiða, 2013)

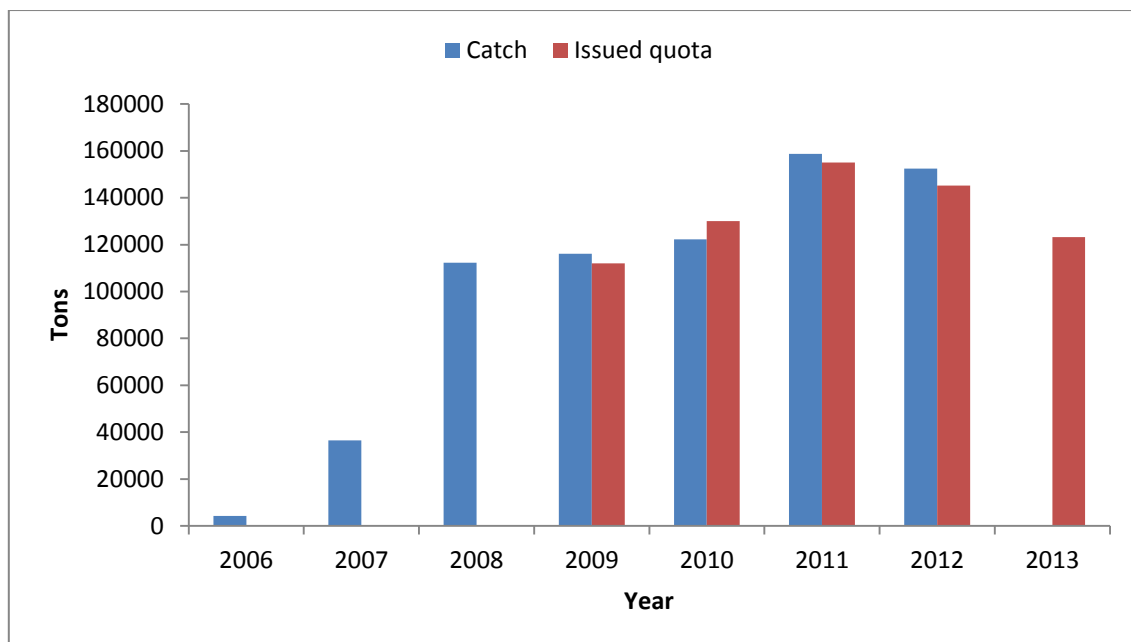


Figure 10. Total catch and quota issued (note that in 2009 no quota was issued, only catch limit) (Guðmundsson et al., 2012; “Stjórn makrílveiða,” 2013; Statistics Iceland, 2013c)

As mackerel is new species in Icelandic waters, special regulations were adopted in order to control the fisheries. During the years 2007, 2008 and 2009, no regulations were in place, only a recommendation from the Ministry of Fisheries and Agriculture of Iceland, except when the minister of Fisheries and Agriculture stopped the fishery in 2009. On the following years, Iceland has set a limit for the catch of mackerel and distributed quota between vessels in Iceland. Bulk of the distribution allocated to vessels that have fishing experience acquired in the previous years, prior to the quota allocation. Those are vessels that used pelagic trawls and purse seines to gain the fishing experience. Quota is distributed proportionally depending on previous fishing experience from 2007 – 2008 and is around 71% allocated to this group. Around 21% is allocated to factory vessels that

process and freeze the catch on board. Roughly 5% go to medium sized and large vessels without previous fishing experience and 3% is allocated to small scale vessels. The regulation takes aim from the fact that mackerel is limited time within Icelandic waters. Vessels that have not begun or have not reached 50% their quota before 20th of august will lose their share and it will be redistributed. All catches are to be landed in Icelandic ports and at least 70% of the catch shall be processed for human consumption (Stjórn makrílveiða, 2013). Mackerel is most commonly caught by pelagic trawls and purse seines, operated by large vessels. Less effective fishing gear is also used, such as long line and hand-line (Valtýsson, 2013a).

2.8 Economic significance

Even though the significance of fisheries in Iceland relatively has been decreasing, they are still important for the economy. In 1999 marine products represented almost 70% of the total export value of Iceland. Today it has been reduced to roughly 40% of the total export value (Figure 11) and the main cause is due to diversification of the Icelandic economy.

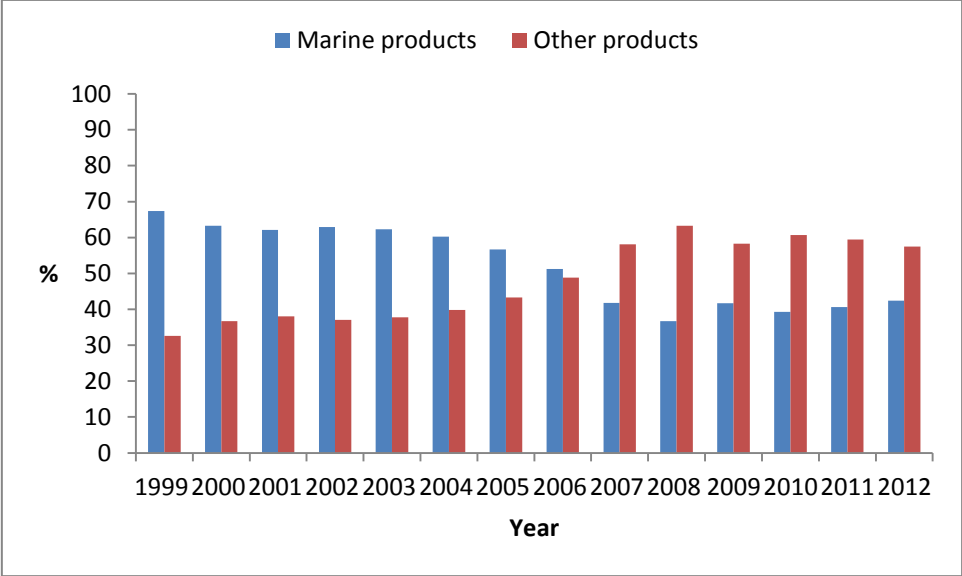


Figure 11. Exports by commodities 1999-2011 (Statistics Iceland, 2012)

The direct input of fisheries to the Icelandic GDP has ranged from 6.1% in 2007 to 12.3% in 2001.

Statistics Iceland has calculated temporary direct input for 2012 to be 11.5% (Figure 12).

In a recent study made by the Iceland Ocean Cluster the total contribution of the fisheries sector is estimated to be 27.1%. The fisheries sector is defined as a primary industry for the Icelandic economy. The GDP is therefore calculated by adding indirect contributions, supporting sector's exports and demand effect to the direct contribution (Sigfússon & Gestsson, 2012).

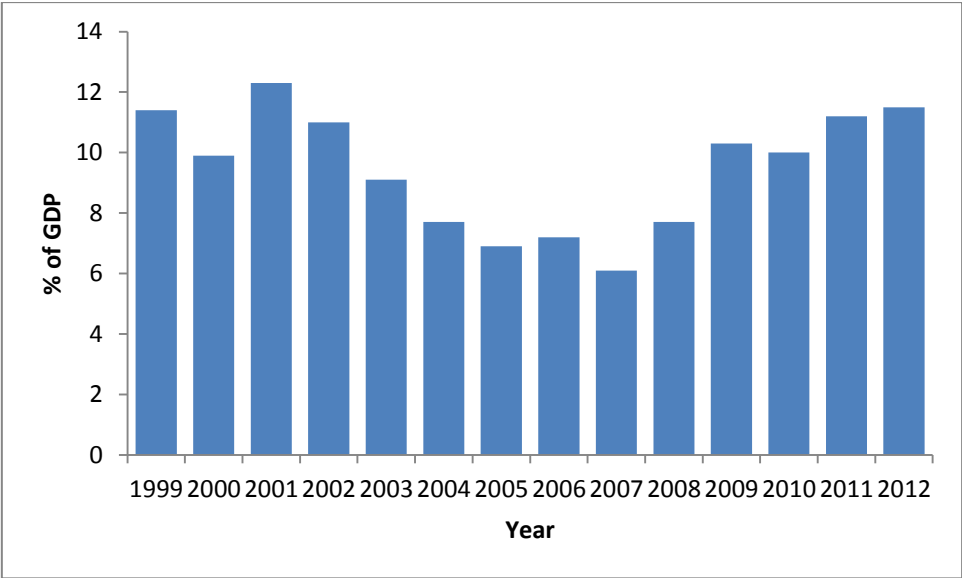


Figure 12. Direct contribution of fisheries to GDP (2011 and 2012 numbers are temporary) (Statistics Iceland, 2013d)

In 2009, mackerel accounted for 0.5% of total exports of Iceland, 1.5% in 2010 and 3.9% in 2011. Of the total fisheries export, mackerel accounted for 9.6% in 2011 and had the second highest export value after cod of 31%. In 2012, mackerel accounted for 7.3% of the total fisheries export, fourth after cod, capelin and herring (Statistics Iceland, 2012). The importance of mackerel in the Icelandic economy is therefore significant and increases when regions and communities that process mackerel are scrutinized.

3 MATERIAL AND METHODS

3.1 Method

The aim of this study is to create a socio-economic analysis of the newly established mackerel processing in the town of Vopnafjörður. This socio-economic analysis will also emphasize on the adaptability process of the municipality to adapt to the changing environments in the fisheries sector in Iceland. The social- and economic analysis will help describing the current adaptability, resilience and vulnerability in the society.

The study is split into two periods; before and after establishment of the processing company HB Grandi in Vopnafjörður. The adaptability process before the establishment of HB Grandi will be analyzed along with social and economic effects after the establishment. In addition a new adaptability and resilience assessment of the municipality will be made, in order to identify the current adaptability and resilience abilities.

Resource-dependent communities, such as Vopnafjörður have been of interest of social studies because of how development for economic gain or other purposes can have dramatic effects upon them (Rickson et al., 1995). Such studies usually look at the impacts to the human environment, at various social actors and the opportunities and threats affected by an activity or impact (Gramling & Freudenburg, 1992). Social assessments focus on community, which is distinguished as set of social relations, shared values, a sense of mutual destiny, common bonds and obligations (Rickson et al., 1995). There is though a linkage between the social and the economic, or the socio-economic (Burdge & Vanclay, 1996) and the linkage could give a good overview on social systems with adequate analysis. Socioeconomic impact assessments aim to refer to interdisciplinary social science efforts, focusing on sociological variables that have specific implications for a social group's quality of life. Such assessments are relevant in areas that some changes occur. That especially applies to rural areas (Freudenburg, 1986).

Several key factors are identified in the literature on how to conduct socio-economic analyses. Burdge & Vanclay (1996) suggest a wide definition of socio-economic factors and include *“all social, cultural and economic consequences to human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organize to meet their needs, and generally cope as members of society”*.

Gramling and Freudenburg (1992) identify those factors as, physical (Buildings, constructions), cultural (identity, knowledge, traditions), social (organisations, population, human capital), political, legal, economic (property values, investment, labor, economic flexibility, specialization) and psychological (Anxiety, stress, anger, etc).

According to the Food and Agriculture Organization of the United Nations (FAO) report on Quantitative Socio-Economic Policy Impact Analysis by Bellù, & Pansini (2009), socio-economic systems include set of elements that are linked together by the flow of goods and services, including payments (Bellù, & Pansini, 2009). Those elements include commodities produced, economic and market activities, consumption, wages, rents, interests, profits, labor, land and capital services. Economic agents such as households, enterprises and the government are also considered as socio-economic factors, including private institutions, taxes, social and demographic characteristic.

In the Environmental Impact Assessment and Strategic Environmental Assessment report by the United Nations Environment Program (UNEP) by Hussein et al. (2004) the social and economic factors are defined separately when it comes to assessments. Social factors include occupation, socio-economic status, demographic changes such as population changes, age structures, in and out migration, social structures, social organizations, social relationships and accompanying cultural and value systems that affect quality- of or way of life. This includes cultural values, which are identified as language, dress, religious beliefs and ritual systems. The report identifies economic factors as duration of construction and operational periods, workforce, workforce skills, earnings, capital investment and the characteristics of the local economy. Changes in employment, development of local firms, investment, demographic changes, infrastructure capacity and demographic changes are also included as economic impacts. In addition, fiscal factors are identified. They include size of investment and workforce requirements, capacity of existing service delivery and infrastructure systems, tax systems and demographic changes (Hussein et al., 2004). In a manual for socio-economic study, compiled by Abdrabo & Hassaan (2003), similar aspects were identified. The socio-economic factors are defined as the community structure, institution, infrastructure, demographic conditions, community resources and gender. That included migration trends, age structure, land values and housing conditions. Economic factors are defined as income levels, job opportunities, employment composition, unemployment rate and availability of job opportunities. According to socio-economic impact assessment guidelines, made by the Mackenzie Valley Environmental Impact Review Board (2007), a social-economic impact assessment can identify and distinguish impacts of a proposed development or a change. It is noted that the people who are impacted have a say of what is significant in a social-economic impact assessment and refer to that each assessment is case

specific. The importance of relationships between people, culture, economic activities and the biophysical environment is though stressed. Examples of valued socio-economic components and associated issues are, in- and out-migration effects, Local and regional cost of living, effects of increased disposable income, overall amount of money in a community, housing pressures – affordability, availability, and appropriateness. Changes in social and cultural makeup of affected communities, along with employment opportunities for local, regional and territorial residents are also examples of socio-economic components.

Social impact assessment focuses on the impact of development proposals on people. Each Social Impact Assessment is case specific and is depending on the institutional arrangements that are in place. Any proposed action that changes the live, work or cultural live has a social impact. That can affect people's values attitudes, perceptions, how people relate to one another, organise themselves and function as individuals and members of society. According to a UNEP Environmental Impact Assessment Training Resource Manual (UNEP, 2002) there are several key aspects that have social impact. Those include demographic change, economic change, environmental change and institutional change. Social impacts are often connected to a change in one or more of those key aspects. Those changes can be natural or human induced. Social impact can in many cases be of significant aspects in many types of projects or changes. Such projects do not only include large development for they vary with the setting and the characteristics of the community affected. Resource dependent communities or groups are usually more affected by proposals or changes that affect their resource use (UNEP, 2002).

In this study, the socio-economic analysis will use similar factors as described in the literature above but take into consideration the situation in Vopnafjörður. The main aim is to analyze and detect changes that the mackerel processing has made. In addition, the adaptability process of the municipality will also be included in the analysis. A socio-economic analysis can offer a wide range of instruments and approaches. However, the feasibility and effectiveness of a socio-economic analysis depends on the context in which it has to take place and on the choice of the analytical approach (Bellù, & Pansini, 2009). In other words, each analysis is case specific. In this study, the main emphasis will be on demographic changes, economic effects and social effects, which are thought to be the main factors that have affected the community of Vopnafjörður. The data available also suggests that those factors are the most appropriate ones to analyze. The factors are further elaborated in Table 1.

Table 1. Socio-economic indicators

Factors	Indicators
Demographic changes	Age structure Gender structure In and out migration
Economic effects	Employment Housing prices Income Innovation Investment in the municipality Municipality income revenue
Social effects	Community activity Future perceptions Innovation Social and cultural life Social perception

Those factors will be used to analyze the effects of the mackerel processing on the socio-economic environment in Vopnafjörður municipality. Both quantitative and qualitative data will be used in this analysis. Therefore a triangulation strategy will be used to link together the data. The triangulation approach assumes that looking at an object from more from more than one standpoint provides more comprehensive knowledge about the object (Miller & Fox, 2004). Linking together the quantitative and qualitative data will therefore elaborate the analysis of the project. The results of the quantitative will help understanding of the qualitative and vice versa (Miles & Huberman, 1994).

The idea of triangulation acknowledges that various methods can have their advantages and disadvantages. A research, study or an analysis should therefore use several methods and then try to merge the different findings (Hughes & Sharrock, 2007).

3.2 Adaptability analysis

The adaptability analysis will take aim from the process of securing the fisheries industry in Vopnafjörður and thereby securing the settlement in the municipality. This is in a way a historical analysis and is largely based on interviews with the municipality officials along with leaders of the processing company. Information from newspapers and other media is also used to support the analysis. The results from the social- and economic analysis will be used to identify the effects of the adaptability procedure and aim. The theoretical approach is explained in the theoretical framework.

3.3 Data collection

The analysis will use data from the municipality of Vopnafjörður, the statistical bureau of Iceland and the HB Grandi fish processing company. The data is both statistical and with descriptive (qualitative and quantitative) about the effects of the mackerel processing. Official statistical data includes employment rates, municipality revenue, tax income, housing prices, profit of landings and investment, along with demographic information, such as population, age and sex structure of the municipality. The data used mainly consists of the period 2004 – 2012 or during the impact period of the study. Older data will also be used in cases when appropriate.

Data from HB Grandi includes information about the processing facilities, the processing procedure and other relevant information, number of permanent positions on a year basis, number of positions in mackerel processing season, salary, salary payment on mackerel season, number of annual job applications, cost of investment in Vopnafjörður, cost of investment directly connected to mackerel processing, processing quantities numbers of mackerel, processing capacity per day and revenue of mackerel processing.

In addition, extensive interviews were made with leaders of the community and the fish processing company. The interviews were semi structured where specific questions were set as a foundation for the interviews (Hughes & Sharrock, 2007). That gave the option of further examination of interesting answers that were given by the respondents. People that were interviewed are the director of the municipality, the leader of the municipality council, a municipality representative, municipality tourism specialist, the principal of the elementary school and former municipality council leader and the local priest. Within HB Grandi, the director of the company was interviewed and the processing manager in Vopnafjörður. Along with those scheduled and planned interviews, other smaller and unorganized interviews were made. Those were generally in the form of small talks with people

within the community and the staff of HB Grandi. They were meant to give further insight into the study and the perception of the people in the community about the effect of the mackerel processing and their general perception about HB Grandi. The interviewers will not be identified in the text of the study unless necessary, such as when talking to municipality officials or HB Grandi representatives.

A survey was made among the staff of HB Grandi for additional information about the perception of the effect of the mackerel processing and the establishment of the company in Vopnafjörður. The staff was encouraged to answer a short questionnaire during their breaks. The sample of the questionnaire was therefore selected by convenience sampling (statistics, 2013), where the staff of HB Grandi was the population and the only ones that were directed to the survey. The questionnaire was constructed with the help of the University of Akureyri Research Centre, which has extensive experience in constructing such questionnaires. All numbers that are displayed in the study are presented in Icelandic Krona (ISK) and currency exchange from € is based on the mean exchange rate of 2012 (1€ = 160.7 ISK) (Central Bank of Iceland, 2013b).

4 ADAPTABILITY - THEORETICAL FRAMEWORK

The theoretical framework is to define the adaptability process of the municipality towards securing the fishing industry in the area and therefore settlement. Adaptability will be defined along with other factors that affect the adaptability process. The additional factors are resilience, vulnerability, path dependency and a definition of fisheries dependent regions. Rural development and climate change will be linked to the analysis.

4.1 Social Adaptability: Definition

To adapt is to make something suitable for a new use or purpose. It also means to become adjusted to new conditions. Being adaptable means to be able to adjust to or be altered for new conditions or uses (Soanes & Hawker, 2006a). Adaptation is related to resilience. It is the capacity of actors in a system to manage and influence resilience in the face of uncertainty and surprise. Adaptability is the capacity to affect the recovery or the resilience from a difficult condition. Adaptive systems are able to reconstruct themselves in the face of change without a significant decline in the crucial functions of the system (Folke et al., 2005; Walker et al., 2004).

Adaptation and adaptability in social sciences, as summarized by Smith et al. (2000) has been referred to as adjustments by individuals and collective behavior of social-economic systems. Human, social and economic sectors and activities are those which can adapt, along with natural systems that are either managed or not. Other practices, processes or structures of systems can also be included. The adaptation process of those who can adapt can be passive, reactive, or anticipatory. They can also be spontaneous or planned.

Adaptation is made up of actions throughout society, by individuals, groups and governments. Adaptation motivation includes many factors, such as economic well-being, cultural values or improvement of safety. The adaptation process can be through market exchange, the government, social networks and individual actions. Individuals, governments and public bodies can all take adaptive action. Adaptation involves both building an adaptive capacity and implementing adaptation decisions. That includes increasing the adaptability capacity of individuals, groups or organizations to adapt to changes and transforming the capacity into action. The adaptation process is non-stop and involves a stream of activities, actions, decisions and attitudes. Those factors inform decisions about all aspects of life, which reflects existing social norms and processes. It is dependent on the context of demographic, cultural and economic change. This includes information transformation, technologies, global governance, social conventions and flows of capital and labor (Adger et al., 2005). Adaptation can be both intentional and unintentional and is the outcome of an action or inaction, both of which can generate short-term or long-term benefits. The process can be either reactive to a given situation or anticipated. This depends on the timing of the adaptation response and is usually based on costs, benefits, equity, efficiency, urgency and implementation criteria (Smith et al., 2000).

The adaptation strategy and its success, depends on how the action meets the goals and how others are affected by it. Successful adaptation needs to include multiple factors, for success at one level could produce negative externalities. Success depends on the scale of implementation and the criteria used to evaluate it. Individual adaptation actions are therefore not independent. They are constrained by institutional processes, regulatory structures, property rights and social norms (Adger et al., 2005).

Adaptability can be used to increase the resilience of a system. This can be done through comprehensive actions which aim to enhance well-being and increase access to resources and insurance. The process enables specific populations to recover in the system. Issues that arise in the

adaptation process are defined by society and dealt with at an appropriate level. How a problem or issue is handled is a reflection of the interests of the actors who are in control or have the power to define the problem. Adaptation actions are therefore undertaken with different objectives. The success of an adaptation process can be defined by the objectives set. However, it is important to note if any negative externalities emerge from the adaptation process. Short term success might for example be less successful in the future and therefore cause negative external effects. The definition of success should be defined in both time and space. Adaptation can have positive effects in one location or at a certain time, but negative effects in another location or at another time. In addition, an adaptation action can create unintended impacts on other natural and social systems to better or for worse (Adger et al., 2005).

The private sector usually emphasizes more on economic efficiency when adaptation measures are decided. Public bodies also focus on economic efficiency, but not to the same extent. Their aims and decisions should be for the well-being of the community, with an emphasis on the distribution of the success, equity and legitimacy of their decisions. Equal distribution of “goods” or equity of the adaptation process and the legitimacy of decision making are central to the resilience and ultimately the perceived success of the action. In that sense, the assessment of adaptation is not purely economic, for there are some values that cannot be expressed by the market. Such values could be cultural and / or ethical. The capacity of an adaptation action determines the effectiveness in order to achieve the expressed objectives. The effectiveness might depend on the unknown future state of the world. In some cases it can be directly measured, such as by the number of jobs created, migration pattern or revenue created by the adaptation action. Robustness to uncertainty and flexibility are indicators of the effectiveness of an adaptation action (Adger et al., 2005). The speed or the rate of change related to adaptation and the duration can influence the nature of the adaptation. That can also be influenced by the risks and the opportunities of the adaptation process, which serve as an incentive for action (Smith et al., 2000).

The resilience, adaptability and transformation ability affect the stability of a system, which is dominated by individual human actors. In other words, the adaptability of social-ecological systems are primarily a function of the social component in the systems (Walker et al., 2004). This involves individuals and groups acting to manage the system. This influences the resilience, either intentionally or unintentionally. Their collective capacities determine the success of the adaptation to disturbances and changes. The dynamics of the social systems are dominated by human action and are therefore a function of the social component. Disturbances and fluctuations are part of the real world and therefore the adaptive process is constant. The natural and human processes, along with

inside and outside processes, affect the stability of the current state of the system which needs to constantly adapt (Walker et al., 2004). Social capital is therefore important in the adaptation process, for it increases the flexibility of management organizations and institutions. This applies to the adaptive governance process where individuals are an essential factor. They supply the system with leadership, trust building, vision and meaning. Their social relations and networks serve as a web that ties together the adaptive governance system (Folke et al., 2005).

Adaptive governance can also be important in the adaptation process. It is engaged through adaptive co-management which focuses on networks, leadership and trust. Leadership is crucial in shaping change and reorganization by providing innovation. That is done to gain the flexibility needed to deal with systems dynamics. Leaders can provide the system with important functions for adaptive governance. This includes managing conflict, linking actors together, connecting and initiating partnerships between actors, providing knowledge and mobilizing support (Folke et al., 2005).

If a system does not adapt, there is a danger that the system could become locked in and unable to transform. A tension could also arise between the current state and the adaptation process to the new state. The system might refuse to change. Therefore adaptability has to make the desirable state more attractive than the undesirable state. That might be done by creating an attractive path by changing the current state of the system. However, the adaptation might want to stay in the current state, for example when undesirable shocks affect the system and show resilience (Walker et al., 2004). Homogenous economies, with ignorant and incapable actors are suggested to have a weak adaptive capacity. Diversified and heterogeneous economies that have knowledge and capable actors are considered to have a strong adaptive capacity (Pike et al., 2010).

Climate change is one factor that affects adaptation. The term implies a change and this is central to the adaptation process. Adaptation objectives in relation to climate change are to reduce cumulative impacts and to ensure adaptive measures do not adversely impact others. This includes avoiding anticipated adverse impacts of climate change. An integrated approach of adaptation actions and policies are a key factor to achieve an effective adaptation in practice (Adger et al., 2005). Adger et al. (2005) define adaptation to climate change as *“an adjustment in ecological, social or economic systems in response to observed or expected changes in climatic stimuli and their effects and impacts in order to alleviate adverse impacts if change or take advantage of new opportunities”*

It can be difficult to separate climate change adaptation decisions or actions from actions triggered by other social or economic events for they might be closely related. Adaptation in the light of

climate change can also arise as a result of other non-climate related changes. Reactive non-climatic adjustments measures can have negative effects on the success of climate related adaptation actions. They can produce externalities from measures taken by economic actors, governments and individuals that are adjusting to social and ecological change that does not serve climatic adaptations (Adger et al., 2005). Another aspect of climate change adaptation is the timing. An adaptation action towards climate change may affect the economic efficiency of the action. Where the planning horizons are short, or less than a year, capital turnovers are high and the system can adjust easily and quickly. This could for example reflect the investment flexibility of individuals and private investors. When the planning horizons are long term, capital turnovers are low and the system cannot adjust quickly and the process is more rigid. Such perspectives could for example apply to municipalities, where investment can be expensive and long term (Adger et al., 2005).

Climate conditions are not stable and can vary in time and space. Variability is an integral part of the concept of climate change. Climatic changes imply a change in mean climatic conditions, including extremes highs and lows. Adaptation is needed in order for systems to adjust to the changing climatic conditions that affect them, in both positive and negative ways. Adaptation to climate change is an adaptation to variability (Smith et al., 2000)

4.2 Adaptation and fisheries dependent communities in the north

Fishing communities are usually characterized by a close relationship to the environment on which they base their livelihood. They are in many cases very dependent on fisheries and are defined as such. Such communities have often shown remarkable ability to adapt to social and ecological change, where social agency and social capital of the communities play a central role. (Einarsson, 2009). This can be applied for example to Arctic and northern societies and cultures, which can be considered as highly adaptive and resilient. They have been defined as well equipped for integrating changes that occur, both social and ecological. Those societies have shown that they integrate modern solutions which are positive for their adaptation capacity. Modern solutions often entails loss of traditions, but traditions should not hinder development (Csonka & Schweitzer, 2004). Residents in the area are regarded as creative actors when it comes to their personal and communal fate. They respond to changes and are not held down by rigid cultural traditions (Einarsson, 2009).

In modernized capital intensive fisheries management systems, resources usually become tied up due to regulative systems such as catch quotas or fishing licenses (Einarsson, 2009). This means that

the exclusive access or the user rights to the fishing stock becomes an asset or a property that implies value and that can be bought and sold. Therefore fisheries resources can become tied up as an investment (Charles, 2001). This can result in a decreased flexibility of the fisheries system but it also can increase responsiveness to external changes in social and ecological systems. External social influences such as global politics and resource regime shifts can act as triggers to change. They can even have more effect than natural changes. In such cases, communities can show their capacity to absorb any disturbances and undergo change, while essentially retaining the same structure, identity and function. In other words, they can adapt to change. Local systems can show a level of adaptability that allows continuity through cultural change which is usually on a case by case process. The adaptation might differ in many ways, such as cultural, economic and geographical aspects. A lot can be learned about adaptability capacity building and community viability by examining case studies (Einarsson, 2009).

When it comes to climatic changes, societies, organizations and individuals have in the past adjusted their behavior in response to such changes and many are planning future adaptation (Adger et al., 2005; Smith et al., 2000). The social adaptation to climate change is a process to reduce the negative effects of climate on people's health and well-being. Adaption also takes advantages of opportunities that might arise with climatic change and involves adjustments to enhance the viability of social and economic activities. It reduces vulnerability to climate and enhances resilience by adapting to the present variability and extreme events as well to long term climate change. The adaption process can be passive, spontaneous, reactive or anticipatory and refer to adjustments in a system in response to climatic stimuli. Climate change adaptation includes responses to extremes, to variability from year to year and long-term changes. The sensitivity and vulnerability of systems and their adaptations occur in social, economic and ecological systems. Climate change impacts are currently being observed. The adaptation process should also be apparent in societies that are or could be affected, for the impacts of climate change can be modified with adaptation (Adger et al., 2005). Adaptation aims to reduce the sensitivity of the system to climate change and to alter the exposure of the system to climate change. This is done to increase the resilience of the system. The systems that are the most vulnerable to climate change are those that have the greatest sensitivity and the least adaptability capacity (Watson et al. 1996). The adaptive capacity needs to be built to decrease vulnerability to climate change. That can include information distribution, awareness building of potential impacts, maintaining well-being, protecting property or land and maintaining economic growth, or exploiting new opportunities that might arise. The adaptation process usually entails costs but it might also entail benefits, for example utilizing a new resource or producing public goods such as infrastructure improvements (Adger et al., 2005).

The adaptation ability of the social system depends on its jurisdictional and political scale. Municipalities, cities, firms, markets and groups adapt within their level of capacity, which depends on available technologies, regulatory systems and knowledge (Adger et al., 2005). Northern fishing villages have long shared the vulnerabilities and narrow economic base of other northern resource-dependent settlements. Economic diversification such as the development of other sectors has become more and more appealing to communities that suffer from external shocks from the fishing industry, but not all can adapt (Einarsson, 2009). Many fisheries dependent communities are facing anthropogenic and natural changes in their traditional livelihoods and for community survival and they need to adapt. The adaptation process can be in a form of transformation from traditional livelihoods to something new or by showing resilience to the changes that are occurring and staying in the same path. Depending on their capacity, some can adapt, but some cannot.

4.3 Resilience: Social-ecological systems

To be resilient is to be able to recover quickly from difficult conditions (Soanes & Hawker, 2006b) or in other words, resilience is the capacity to adapt to change (Magis, 2010). An ecosystem is resilient if it maintains its functional integrity in the face of outside disturbances (Perman et al., 2003). In social-ecological terms, resilience is defined as the magnitude of shock or disturbance a system can absorb without changing the system in a fundamental way. This refers to the capability of the system to absorb or buffer disturbance and self-organize without adverse effects. It also refers to how the system can build capacity for adaptation and learn to emerge from disturbances or shocks. A resilient social-ecological system is able to adapt to change and maintain its basic structure and function. When a change is inevitable, resilient systems contain the components needed to cope, adapt or reorganize, without changing the fundamentals in the systems and to retain essentially the same function, structure, identity, and feedbacks. Resilient systems strive to stabilize (Adger, 2000, 2006; Berkes et al., 1998; Folke et al., 1996, 2002; Hill et al., 2008; Walker et al., 2004; Österblom et al., 2011). Most definitions of social ecological resilience come originally from C.S. Holling who in 1973 defined ecological resilience as:

Resilience determines the persistence of relationships within a system and is a measure of the ability of these systems to absorb changes of state variables, driving variables, and parameters, and still persist. In this definition resilience is the property of the system and persistence or probability of extinction is the result. Stability, on the other hand, is the ability of a system to return to an equilibrium state after a temporary disturbance. The more rapidly it returns, and with the least fluctuation, the more stable it is. In this definition stability is the property of the system and the degree of fluctuation around specific states the result (Holling, 1973).

Resilience of a system increases its capacity to cope with stresses, shocks and disturbances and could be defined as an opposite to vulnerability. With increasing resilience, vulnerability decreases and vice versa (Adger, 2000). Loss of resilience will increase the vulnerability of a system and cause it to flip from one equilibrium state to another (Berkes et al., 1998). Resilience is the ability to make a system sustainable through adaptation and transformation (Magis, 2010)

When it comes to social resilience and resilience of groups and communities, the concept of resilience is generally the same. The main difference is the geographical area which is usually confined to communities or economies. The difference of regional resilience is connected to the regions ability to return to its previous level and/or growth rate of output, employment, or population in case of a shock (Hill et al., 2008). The regional resilience is an understanding of how power relations are within a community or a region. Such relations entail politics and the uneven dispute and cooperation between capital, labor, the state and civil society (Pike et al., 2010). Social resilience is the capacity of groups or communities to cope with stresses, shocks and disturbances as a result of social, political and environmental change to their social infrastructure (Adger, 2000). Those stresses, shocks and disturbances could be economical, political or ecological. There is however a clear link between social and ecological resilience, especially for social groups or communities that are dependent on environmental (ecological) resources for their livelihoods (Adger, 2000).

The resilience of an ecosystem affects the resilience of the social system. Community resilience is the development, and engagement of community resources by community members to thrive in a changing environment, uncertainty, unpredictability and surprise. Members of resilient communities develop personal and collective capacity to respond and to influence change, to sustain and renew the community, and to develop new trajectories for a communities' future (Magis, 2010). Collective action needs participation and leadership from the whole community. External forces can impact the community but the community can take action and influence its well-being and take matters in their own hand. Communities are important in economic, social and the environmental resource management. They need be recognized as key stakeholders and have to participate in the resource management issues that affect communities (Magis, 2010). Culture and the belief of a community member's ability to protect the well-being of their community is important to community resilience. This includes their ability to survive and thrive when changes occur, and their belief in the ability to develop the necessary capacity to become resilient (Magis, 2010). Institutions and individuals at smaller regions and organizations should be expected to respond much more quickly to challenges

(Pendall et al., 2010). If a region or a community is able to recover successfully from shocks to its economy or its structure, then it is resilient (Hill et al., 2008)

Management is important when it comes to resilience building. Management that helps build up resilience can sustain systems that face surprise, unpredictability, and complexity. Such management is flexible and open to learning (Folke et al., 2002). One way to do so is through intelligent institutional leadership. Such leadership is capable of understanding the nature of a shock, disturbance or surprise to form a strategic adaptation. Regional and local actors are important in such process (Pike et al., 2010). Individual actors play a crucial role in providing the system with leadership, trust, vision and meaning. They form social relations in the form of actor groups, knowledge systems and social memory. Such social networks serve as a web that ties the adaptive governance system together (Folke, 2006).

Management should aim through its policy to make use of economic incentives to enhance resilience. In addition, the development of monotonous systems should be avoided (Folke et al., 2002). Management can create a resilient system that could in the long term become vulnerable. If a system is too resistant and monotonous then it can affect its adaptability negatively (Derissen et al., 2011). Systems need to be able to change and adapt for flexible livelihoods and governance plans support resilient systems (Perry & Ommer, 2010). However, a key concept in social resilience is stability. Instability in systems can lead to decreasing resilience. For example a significant population movement can be evidence of instability, especially if there is high out migration in the system (Adger, 2000)

Resilient systems are often associated with diversity. Such diversity includes diversity of species / resources, human opportunity, and economic options. The diversity maintains and encourages both adaptation and learning (Folke et al., 2002). Dependency on a few natural sources decreases stability, especially in resource dependent systems. Instability of some types of resources, such as fish stocks, and the instability of markets can decrease the resilience. Technical innovation can also contribute to loss of resilience in such systems by threatening the sustainability of economy (Adger, 2000). Coastal communities are usually dependent on coastal resources for their livelihood. These resources include tourism, fishing and other extractive uses and transport. It has been argued that coastal communities are more resilient or more stable than non-coastal communities since they have access to the resources mentioned. The economy is however still reliant on a single coastal system. Resilience depends on the diversity of the system, which lies within the natural and the social system (Adger, 2000).

Communities that learn to live with change and uncertainties while being able to actively build a capacity to thrive are resilient. Communities can develop resilience through strategic planning, collective action, innovation and learning. Resilience can also be facilitated if diverse resources available in the communities are engaged and put into action. Such resources exist in the natural world and in the people who live in the community. Resources are in the culture of the people and in the connections between the people and in the political processes in which the community engages. Resources are also in the economy and infrastructure of the community (Magis, 2010). Resilience is developed through engagement of the resources available within the community by taking action. A community's resources are dynamic and can be developed, expanded, depleted or destroyed. The development of these resources contributes to the capacity to respond to shocks, stress, crises and opportunities (Magis, 2010).

According to Magis (2010) community resilience is *“developed through conscious deliberation, planning, implementation, and learning. The community develops itself intentionally and moves toward specific strategic visions and objectives”*. In order to do so, a community looks for examples outside its area to find resources that can help them.

There are constant changes facing communities and they are from multiple sources. Changes are inevitable and communities can not anticipate a future without change. Changes and their impact are not known and cannot therefore be anticipated. A resilient community will influence its ability to successfully respond to change. This makes resilience critically important to the community and its social sustainability. Communities are well served to strategically develop resilience (Magis, 2010). In short, community resilience is built and formulated through the engagement of all capitals available within the community (Magis, 2010)

4.4 Community and Social Vulnerability

The definition of being vulnerable is to be exposed to the possibility and threat of harm (Soanes & Hawker, 2006c). The general description of being vulnerable applies to communities and is defined as social vulnerability, where weaknesses of the communities or the social system are explained. Vulnerability describes for example weaknesses that affect the viability of small and or peripheral communities. In this context, the concept of a social-ecological system is also used.

Adger (2006) talks about the social-ecological system when it comes to vulnerability. The vulnerability of social-ecological systems is according to him, influenced by the resilience level of the society. Vulnerability and resilience are closely linked, for they address the shocks and the stresses experienced by the social-ecological system, the response of the system, and the adaptability capacity.

Causes of social vulnerability can though vary in time and space. Most research indicates that certain demographic and housing conditions, such as age, income levels, gender, building quality and general infrastructure either increase or decrease vulnerability. Other factors include a lack of access to resources (i.e. knowledge, information and technology), access to political power and representation, the level of the social capital, beliefs and customs and individual power (Cutter et al., 2003).

Socio-economic status is an important factor when it comes to vulnerability. It is the ability to absorb losses and to enhance resilience when impacts occur in a society. The term includes the income level, the political power in a society and prestige. Wealth is a factor that enables communities to recover up to a certain level if negative impacts affect its society. Wealth entails insurance, social safety and entitlement. The socio-economic status is closely linked to the education level where it is positively correlated to income and knowledge levels (Cutter et al., 2003).

Gender and age can also influence vulnerability in a society. Women are, for example, considered more vulnerable due to sector specific employment, lower income and family care responsibilities. Age composition in the society can increase vulnerability, especially if the composition concentrates on the either side of the age spectrum. An old demographic composition has mobility constraints while a young composition reduces participation in the workforce due to child care. Population changes, growth or decline can affect vulnerability. High population growth can result in lack of housing and worse social services while population decline results in less ability to cope with changes due a to loss of social capital (Cutter et al., 2003) The most qualified individuals also tend to be the most mobile ones. In addition to this, rural areas are in general more vulnerable due to their lower income, service levels and more limited economy. Rural areas are often dependent on some kind of resource extraction that can be unstable, such as fisheries (Cutter et al., 2003). Social institutions play a role when dealing with vulnerability. They are often discrete, however, and change the state the vulnerability (Adger, 2006). This would undoubtedly depend on the strength on the social institutions.

The type of employment, and or lack of economic diversity also affect vulnerability. If employment is dependent on fluctuating factors, such as fluctuating fishing stocks, then it makes the society more vulnerable. If a shock would occur, then it could lead to a potential loss of employment due to a lack of diversity, contributing to a slower recovery of its society. This usually increases vulnerability (Cutter et al., 2003). The type of employment corresponds to commercial and industrial development. The value and the quality of commercial and industrial buildings is an indicator of the economic health of a society (Cutter et al., 2003).

The level, type and the quality of infrastructure coincide with the vulnerability. Sewers, bridges, water, communications, transportation etc. are important factors in every society. Infrastructure affects economic activity and the wellbeing of the residents. If weakened, it can increase vulnerability. This includes health care as hospitals and nursing homes contribute to the quality of life. If health care is absent or weak, then it can result in increased vulnerability (Cutter et al., 2003)

Climate change is a factor that affects vulnerability in societies. The Intergovernmental Panel on Climate Change (IPCC) defines vulnerability as “the extent to which a natural or social system is susceptible to sustaining damage from climate change” (McCarthy et al., 2001). Vulnerability refers to the sensitivity of a system to changes in climate, or to the degree of the response of a system to a change in climate. This includes both beneficial and detrimental effects. Vulnerability to climate change relates to the degree of exposure of system to the climatic effects (McCarthy et al., 2001). Vulnerability to climate change refers to the tendency of the social and ecological systems to suffer harm and the ability to respond to the stresses caused by climate change (Parry et al., 2007). As summarized in the IPCC Climate Change 2007, “the vulnerability of a society is influenced by its development path, physical exposures, the distribution of resources, prior stresses and social and government institutions” (Parry et al., 2007).

It is suspected that the climate change impacts will affect populations that are already vulnerable to climate change. Marginalized groups, both in developed countries and in the developing world, will bear the most burden of climate impacts (Adger, 2006).

Marginalized or peripheral communities are usually more vulnerable than more centralized communities. This goes in hand with the definitions made by Cutter (Cutter et al., 2003), for marginalized communities have a lesser capacity to deal with changes and are more vulnerable. Marginalized communities also have less access to centralized political power; rely on primary industry that is often dependent on natural fluctuations, fewer social institutions, lower service levels

and often less social capital due to their size and position. All this leads to more vulnerable societies and communities. Fisheries dependent regions and communities could in many cases be described as marginalized, due to their dependency on nearby resources (Symes, 2000).

4.5 Path dependency definition:

Path dependency is defined as an act in the past that defines a future path. This means that decisions made in the past define the options that can be made in the future. This is a self-reinforcing sequence of increasing return, meaning that the probability of further steps being taken down a given path increases with each step taken until some kind of equilibrium point is reached. The concept of increasing returns has been used to explain the persistence of several potentially inefficient technologies. A decision was made in the beginning and the path was set and stayed upon, even though more efficient paths were available later (Mahoney, 2000). In that sense, path dependency can be used to trace a given outcome back to a particular set of events that set the path in the beginning. In this situation, an investment in a process has been made, making it hard to change the path. This reflects decisions that were made that shape the current state; a sequence of events has determined current values. Changing from the initial path is not impossible, but incentives to do so might carry less weight than continuing on the same path. All investment in the current path has made future changes too costly to implement. The path might then be reinforced again by increasing the legitimacy of the current path, even if other ways are more legitimate. The reinforcement is done through the positive feedback cycle as the initial decision enforces the path, based on the initial decision. This results in a lock-in, where the system locked in a path that it hard to break out of. There is no knowledge about other paths and because other paths are not taken, then there is no other knowledge than the original path (Liebowitz & Margolis, 1995; Mahoney, 2000).

4.6 Regional path dependency

Path dependence can shape the economic development of regions and at the same time the regions shape the processes of path dependence. Geographical endowments and transport possibilities are important, along with the role of localized learning and knowledge spillovers in the development of regional innovation systems. Those features are important contributors to the path dependency of a region. In addition, economic landscapes and regions inherit the history of past industrial and institutional development, and this history can have a major effect on future development and evolution (Martin & Sunley, 2006).

The regional economy might develop into a positive lock-in which turns into a negative one, due to lack of adaptability. All the development of the positive lock-in might become a source of increasing rigidity and inflexibility. That undermines the adaptability, competitiveness and productivity of a region. Once locked in a certain path, the system might become trapped and cannot escape except through the intervention of some external force or shock that shakes the system into a new configuration or path (Martin & Sunley, 2006).

Different industries within a region may be subject to different sources of path dependence. Some are resource based while others are subject to particular externalities of localization, such a physical or infrastructural capital and or a technological. Place dependence is an important dimension of path dependence. This implies that interactions and feedbacks between firms and other institutions are to some degree place-specific, and that these interactions occur across different scales. However, the more economically diverse a region is, the more flexible the region is and can show several paths of dependence (Martin & Sunley, 2006)

A regional economy can become locked into growth path that might turn out undesirable as a result of decisions made over a long period. To break out of this path a region has to show the resilience ability to avoid becoming locked into a low-level equilibrium or to be able to adapt into a better equilibrium (Hill et al., 2008). It is hard to leave the path for all the knowledge and the infrastructure exist in the region towards the path chosen. The locked in pathway needs a radical shock or stress, positive or negative, to motivate changes in the path (Pendall et al., 2010). Collective understanding and strategies can enhance the adaptive capacities to recognize and overcome the lock-ins that decrease the adaptability of the region to disruptive changes (Pike et al., 2010)

There are examples of regions that become locked in and are unable to transform. Then the question arises of how society can develop transformability and avoid such lock-ins? Increased adaptability and resilience capacity can make a desirable state more attractive than the undesirable state. Therefore the enhancement of adaptability and resilience could be a solution to break from current paths by creating an attractive path by changing the current state of the system (Walker et al., 2004). That is perhaps easier said than done.

4.7 Fisheries dependent regions and communities

The definition of what a fishing village or area is often easy to notice. If there are fishing boats visible in the harbor it is a clear sign of an established fishing village. It is harder to identify if the same village or area is dependent on fisheries. There are, however, some general terms that can make such definition. In short it can be said that a fisheries dependent region or a community is an area where fisheries and related activity is significant for the area. Many tools and definitions can be used to define it, for example economic criteria, employment and landings (Symes, 2000). A fisheries dependent region or a community is a region where the fishing industry provides an essential foundation to the economical or the social structure (Phillipson, 2000).

The term of fisheries dependency is not only considered as economic dependence, but also social and cultural dependence (Urquhart et al., 2011). But what is it to be dependent? To be dependent is to be reliant upon someone or something, such as fisheries (Brookfield et al., 2005). An area that is dependent on fisheries is defined as an employment area where fisheries contribute to the economic activity to such level that when difficulties in the sector occur, they can seriously undermine the socio-economic fabric when jobs are lost (Phillipson, 2000). Furthermore, the fishing industry is central to the community way of life and the community perspective is dominated by the fisheries. Fishery is the glue that holds the community together (Brookfield et al., 2005). Fishing activity within fisheries dependent regions and communities refers to both onshore and offshore operations (fishing, processing etc.) and on inshore and offshore grounds. The population within such area is in a specific territorial location, which relies on the fishing industry for economic, social and cultural survival (Brookfield et al., 2005).

The dependency on fisheries can be due to the inter connectedness of the social-economic system in relation to the biophysical marine environment. Changes in the marine environment affect then the socioeconomic system. (Perry & Ommer, 2010). Dependency on fisheries implies reliance on employment from fishing activities and processing. That includes cultural ideology of fisheries that maintain cultural functions as a support for the fishing industry (Lindkvist, 2000). A more precise definition of a fisheries dependent community, as referred by Lindkvist (2000) states that municipalities are regarded as dependent on fisheries if 5% or more of the workforce is participating in fishing or processing.

The location of fisheries dependent communities is often marginalized or peripheral because they need to be close to fishing grounds, which might be in peripheral areas. Fishing industry is the backbone of the economy in these areas and communities and the structural characteristics of fisheries dependent regions and communities are often derived from their peripheral location (Symes, 2000).

The economic structure in the communities is usually characterized of small and medium sized enterprises with narrow based employment structure, based on fisheries. In addition, the labor force is geographically restrictive (Symes, 2000). This is however changing, for fishing industry has become more capital dependent. This has replaced parts of the traditional labor. Specialization has increased and companies have become bigger. In a traditional peripheral fisheries dependent region or community, the demography has been strongly affected by out migration of young people and an aging population. This might be a result of increased capital in fisheries (Symes, 2000) Capital becomes cheaper and labor more expensive, which could cause this migration pattern (Perman et al., 2003). Processing companies and, in many cases, ships in the areas, are owned by companies based outside the communities or municipalities where the activity takes place (Lindkvist, 2000). Economic constraints on fisheries dependent communities have been identified as a globalization of the fish food industry, capital penetration and mobility of labor (Brookfield et al., 2005). Political constraints entail common policies on fleet reduction, licenses and quotas, economics of scale in favor of large scale industrialized fisheries and processing (Symes, 2000). The emphasis on large scale industries within fisheries are usually at the expense of small scale fishing industries, which could be said are of importance to peripheral fisheries dependent communities. In spite of such constraints, communities that are fisheries dependent usually show a clear political commitment at local level to support the industry and dedicate considerable political energy and economic funds to secure the industry for the future (Brookfield et al., 2005).

5 MACKEREL PROCESSING IN VOPNAFJÖRÐUR

5.1 Development and build up process

The pelagic sector is of great importance for HB Grandi. The importance is stressed in the staff handbook at the Vopnafjörður pelagic processing facilities, as it states that the closeness to the fishing grounds makes the processing facilities of Vopnafjörður the center for pelagic processing of HB Grandi (Vilhjálmsson, 2012). The company decided on build up the pelagic processing facilities in Vopnafjörður in 2004 and the process has been since then quite substantial.

Shortly after the merger of HB Grandi and Tangi, or in 2006, a decision was made to move the groundfish processing from Vopnafjörður and sell the largest trawler, *Brettingur*. Municipality officials in Vopnafjörður and the general public were not pleased with this action. They feared that this was the start of a shut-down process in Vopnafjörður (Vilhjálmsson, pers.comm.). Fortunately for the municipality this was not the case and the development and investment process continued in the pelagic sector.

Extensive investment has been made in filleting and whole freezing of pelagic species and for fish meal production, which lead to a long term development process in the municipality. From 2006 to 2012 the investment has been around 5 billion ISK and thereof 1 billion ISK from 2009 to 2012 that are directly linked to improvements in pelagic processing (Andrésson, 2013). The existing infrastructure and the housing facilities was good and investment and development was somewhat based on that, even though that current facilities are quite different from the beginning of the investment processing.

New premises were built to the existing structures and investment was made in purchasing new processing equipment, especially for herring and capelin. There is new equipment in every area and housing has been expanded. The fishmeal factory was for example more or less completely renovated, where old parts of the factory are unrecognizable. In 2008 it was decided to increase the processing capacity and renovate the fish meal factory. Two fish meal factories of HB Grandi in the south were shut down and parts from those two factories were used to upgrade the Vopnafjörður factory. The factory was modernized and made more environmental friendly by powering the fish meal processing with electricity instead of oil. This both increases quality and decreases cost. New office facilities were built, lab and staff facilities (HB Grandi, n.d.). These upgrades to the fish meal factory were in fact necessary in their terms for the previous facilities did not meet the standards of

the company. The timing of the constructions and the investment were quite suitable for the company, even though that was discovered afterwards. Poor capelin seasons were in fact positive for the company, as they were simultaneous to the construction process (Vilhjálmsson, pers.comm.). The construction process is ongoing and there are even more future plans for development in Vopnafjörður.



Figure 13. Processing facilities at HB Grandi: Little hard labor (Arnarsson, 2013)

The facilities in Vopnafjörður are quite capital intensive and there is a strong focus on automatic processing and the treatment of the raw material that comes in to the processing facilities. Direct human contact to the fish that comes in is minimized and the processing process has been made as automatic as possible. Therefore the role of the staff is more of an observational role than anything else, with little or none physical labor in the process. This technological investment has increased the quality of the product of the company. Still, the processing is quite labor intensive. HB Grandi employs 82 persons on a yearly basis in full positions, thereof 12 in the fishmeal factory. This number doubles in a mackerel season, where the company needs around 160 employees in order to be able to keep the processing going. In addition to that, there is estimated on the behalf of HB Grandi that 20 – 25 full positions on a yearly basis work on projects for HB Grandi through contractors. From that, it can be estimated that direct and indirect jobs for HB Grandi can be around 107 positions on a yearly basis (Andrésson, 2013). The total payment of salaries of HB Grandi on a yearly basis, according to 2012 payroll, was around almost 740 million ISK. Out of that, almost 354 million were during mackerel and autumn herring season, which accounts to close to half of the salaries payments in 2012.

HB Grandi did not receive any special assistance from the municipality in the development process, such as lowering fees etc. In addition there was no assistance from the government, this was HB Grandi own initiative and investment. The harbor constructions that the municipality made in 2001 are though seen as assistance to the company, for if those constructions would not have been made, then the company would not have decided on settling in the municipality. Neither the director nor the pelagic processing manager feel that the municipality is granting them any favors or priorities when it comes to the communications of those two, such as when it comes to constructions matters. They generally feel that there are good communications between them. HB Grandi officials mention that they want to go through right procedure when it comes to the development process. In addition they want things done properly and emphasis to have everything in right order. This applies to the appearance of the company for they want to have a good image with clean surroundings of their facilities (Róbertsson, pers.comm.; Vilhjálmsón, pers.comm.).

5.2 Mackerel Processing

In 2010 the mackerel processing for human consumption started. There had been some experiments with the processing in 2009 and it was discovered then that the current facilities at that time was not suited for mackerel processing. When that was discovered, the company started to make improvements for processing mackerel. That included investment in new equipment, adjusting existing one and with staff training. This included in adjusting the existing sorting system, which was made for capelin and herring, for mackerel. The main factor was to establish a new cooling system. The fishing season for mackerel in Icelandic waters is when the fish is feeding and gaining weight. When catching mackerel while it is feeding, there is a chance of damages or tainting of the fish due to the enzymatic breakdown of the feed inside the mackerel, which is mainly krill along with other species. Cooling slows down this process and is therefore important in the processing of mackerel (Guðmundsson et al., 2012). The cooling procedure starts in the vessels, which is important when it comes to the quality of the catch. The ships of HB Grandi use Refrigerated Sea Water (RSW) and Chilled Sea Water (CSW) systems. The RSW is better for it keeps more stable temperature that results in higher quality raw material making the fish to remain firmer (HB Grandi, 2011b). The company had also to install a new cooling system for the land based processing in order to keep the quality during the processing. In addition to the cooling system, the freezing system was upgraded and modernized. The cooling system helps with the freezing process, which decreases the freezing time. A good cooling system can for example shorten the freezing time by 2-3 hours in a blow

freezer. Freezing of mackerel can be a challenge due to the high fatty contents and the shape of the fish. Good cooling and freezing system are therefore important in order to maintain good quality of the product (Guðmundsson et al., 2012). HB Grandi uses two freezing methods, plate freezer and blast freezer. The traditional plate freezer freezes mackerel that has been headed, gutted and eviscerated. The plate freezer has size limitations, where the largest mackerel does not fit so easily into the plate system. The blast freezer solved that problem where the mackerel is frozen whole in boxes in a short time. This is a quite efficient method of freezing and takes shorter time than plate freezing. The blast freezer was installed in 2011 and upgraded in 2012 in order to be able to increase processing capacity. The blast freezer was seen as a success as it allows the company to process large mackerel for human consumption in a fairly easy way. Without the blast freezing system the company would have had troubles of reaching the 70% limit of mackerel processing for human consumption that was imposed by the ministry of fisheries in 2011. In addition the market responded quite well to the product. (HB Grandi, 2011a). As for the rest of the mackerel, offcuts, evisceration (intestines) and fish that has been separated out from the processing is used for fishmeal production.



Figure 14. Processing facilities at HB Grandi: Direct human contact is minimized (Arnarsson, 2013)

The social capital of the local staff was an important factor in the development process as they adapted quickly to the changes that were made in the processing factory. There was huge investment made to adjust the current facilities to mackerel and the adaptation process was short. Before the investment and the changes of the facilities, all mackerel that the company received was more or less put into fishmeal production (Róbertsson, pers.comm.). The mackerel processing for human consumption was a success and HB Grandi got good quality from the processing along with a positive response from the market about their product. The company was pleased with that (Róbertsson, pers.comm.).

For the mackerel season of 2011 a new regulation was imposed for the mackerel processing. The regulation states that it is required to allocate 70% of the monthly mackerel catches of individual vessels for processing. This regulation has been enforced since 2011 (Stjórn makrílveiða, 2013). For HB Grandi this was not a problem and they met the requirements that year, especially due to the newly installed blast freezer the same year. The following years have been even better where almost all of the mackerel is processed for human consumption, with exception of offcuts of mackerel and fish that have been separated out of the process (Róbertsson, pers.comm.). The profit maximizing behavior of the company controlled this development, for they got higher price for mackerel processed for human consumption than mackerel processed for fish meal and oil.

Table 2. Mackerel processing of HB Grandi (Andrésson, 2013)

Year	2010	2011	2012
Freezing - Tons	4,860	11,530	9,477
Fish meal - Tons	10,241	4,642	6,281
Medium price (ISK)	85	174	146
Total revenue (ISK)	1.286.167.271	2.806.747.632	2.304.402.646

As it shows in Table 2, the mean price is higher with more processing for human consumption. Since 2011 all mackerel has been processed for human consumption (freezing) and the cutoffs go to fishmeal production. The increase in fishmeal production in 2012 is due to the fact that less mackerel was frozen whole, leaving more cutoffs going to fishmeal production. The company has a freezing production capacity of 400 tons per 24 hours and 300 tons when the mackerel is headed and eviscerated. The fishmeal factory has a production capacity up to 800 tons per 24 hours(Andrésson, 2013; HB Grandi, n.d.).

With the introduction of mackerel, the processing pattern of the company changed. Other pelagic species are usually processed through autumn to spring. With the income of the mackerel, the processing was expanded into the summer time (Róbertsson, pers.comm.). The mackerel came as a direct addition to the current processing in Vopnafjörður (Figure 15).

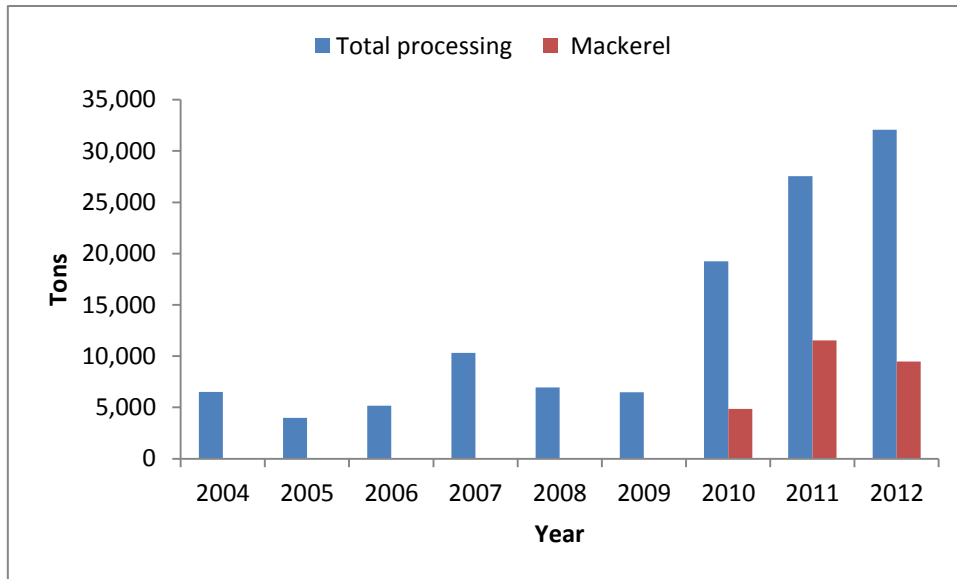


Figure 15. Pelagic processing (freezing) in Vopnafjörður (Andrésson, 2013)

HB Grandi has gained extensive experience in the mackerel fisheries and processing. Their main goal is to maximize profit at each time. Their key to do that is to focus on the quality of the product, for better quality gives better price. The cooling system that they applied to both in their vessels and in the land based processing has been the key to ensure good quality. In addition, experienced staff contributes a lot to the process (Róbertsson, pers.comm.).

All the investments made for mackerel processing were long term investments. They have though paid up already; it only took two seasons to do that. Mackerel was very valuable addition for the company. HB Grandi has been successful in marketing and selling mackerel. They get around 85% of the maximum price for mackerel (mackerel caught in October outside the Norwegian coast). They think that this is acceptable price (Vilhjálmsón, pers.comm.).

The director of the company, Vilhjálmur Vilhjálmsón stated that the introduction of the mackerel to the company was like winning the lottery. It was a pure addition to their existing production and gave good revenue. Mackerel processing is therefore a positive addition to their production (pers.comm.).

5.3 Quality standards of the processing

When HB Grandi was established in Vopnafjörður, one aim was to increase quality of their production. One step in doing so was to limit access around their premises. This meant that people in the community were not allowed any longer to “drop in for a visit”. This was a change from the previous practice when the processing facilities were more or less open to everyone. In addition they have limited staff access to the supervising offices. People felt that the company was isolating itself from the community and they felt that they were perhaps hiding something. That is not the case. The requirements for the quality standards that the company wants to fulfill states that they need to limit access to the processing facilities. HB Grandi tries though to be open towards the community, such as having special days when people can come and visit the facilities (Róbertsson, pers.comm.).



Figure 16. Processing facilities at HB Grandi: Strict quality standards (Arnarsson, 2013)

The company stresses that they are producing food for human consumption and they need to have high quality and hygienic levels. The staff is well aware of that and they follow those standards quite well, the opposite it can lead to discharge. This is important to the company for they need to have high standards in order to be able to maximize profit from their production (Róbertsson, pers.comm.).

The fish meal factory follows different standards but they do also focus on quality. The fish meal factory is in secondary food processing (feed production for animals for human consumption) and they have also a strict policy about quality and hygiene. The fishmeal factory is quite automatic and they do not many people when it is running. Most of the work is monitoring the procedure (Róbertsson, pers.comm.).

5.4 Mackerel dispute and processing in Vopnafjörður

In general the mackerel dispute does not have any effect on the company. They have already invested in the processing facilities for mackerel and the investment has been paid up. They do though realize that their mackerel quota will be reduced when there will be an agreement in the dispute. HB Grandi wants though that an agreement will be made between the coastal states about the distribution of the mackerel catch. In their mind, the coastal states have an obligation to reach an agreement. This is important for the company for they would like to have some stability in the management system so they can make future plans about further utilization of the species (Vilhjálmsón, pers.comm.).

The current fisheries season suits the company quite well, fishing from July to September. At that time the mackerel is relatively close to the processing facility, which minimizes fuel cost of the fishing vessels. Fisheries that take place in October – November might not be very suitable for the company, especially regarding the processing in Vopnafjörður. At that time the mackerel is off the coast of Norway and far away from the processing facilities. Therefore the company might chose to land the catch at the nearest port instead of in its own processing plant. The distance and the fuel cost would have too large impact in the profit maximizing procedure. In addition, the mackerel fisheries might be in conflict with fishing season of other pelagic species, such as herring. The Norwegian spring spawning herring season is in September and October, followed by a season of Icelandic summer spawning herring in October – November (Vilhjálmsón, pers.comm.).

As the company sees it, with current situation, the optimal fishing season for them is during the summer, from June to September, even though they get lower prices. They have managed to get good prices for mackerel caught at this time, or 85% of the maximum price of mackerel caught in October off the Norwegian coast and they are satisfied with that price. They have managed to get such a good price in markets in Eastern Europe (Vilhjálmsón, pers.comm.).

There are however some considerations about the effects of the mackerel migration into Icelandic ecosystem. It is not known what kind of effects mackerel has but it is known that it is on a feeding migration and that might have negative effects on other economically significant species (Vilhjálmsón, pers.comm.).

5.5 HB Grandi and Vopnafjörður municipality

Communication between the municipality and HB Grandi is in general good. There might be some personal disagreements between some workers within the municipality and HB Grandi, but nothing of importance. The company wants to have as good communication with the municipality as possible. They want to reach conclusion in matters that concern them in collaboration with the municipality. They want to maintain positive relations (Vilhjálmsón, pers.comm.).

There are some rumors in the town that HB Grandi is in fact controlling everything in the municipality and they get what they demand. Both the company and the municipality deny this (Steinsson, pers.comm.). The company does need assistance from the municipality in some matters, such as issuing land for their activity and servicing infrastructure around their facilities, such as roads and water supply. HB Grandi and the municipality need therefore to work together to find optimal solution that suit both partners. According to HB Grandi they get good service from the municipality (Róbertsson, pers.comm.).

In 2010 there was a malfunction with the cleaning system of HB Grandi and fat and other biological waste went into the waters around the processing facilities. People of Vopnafjörður were not happy about this incident and subsequently communication with the municipality became rigid. The company solved the problem in collaboration with the municipality. They try to collaborate as much as they can and they try to meet each other needs whenever possible (Róbertsson, pers.comm.). The municipality wants to strengthen their relations with the company and they have done so, by making some investments and constructions in the municipality that benefit the company

6 DEMOGRAPHICAL CHANGES IN VOPNAFJÖRÐUR

Vopnafjörður can be defined as a fisheries dependent village. It is close to the fishing grounds and there has been a focus on building up the fisheries sector in the area. Today 17.5% of the total workforce works directly in fisheries through HB Grandi. People came to the village to work and they did that largely in the fishing sector. But there have been some changes in population of the municipality during the last 15 years. From 1998 to 2013 there has been a decrease in the population, from 852 in 1998 down to 687 in 2013, or by 165 people. This is a 19% reduction over this period (Statistics Iceland, 2013a). For such small community the change is significant, for every person in the community is important.

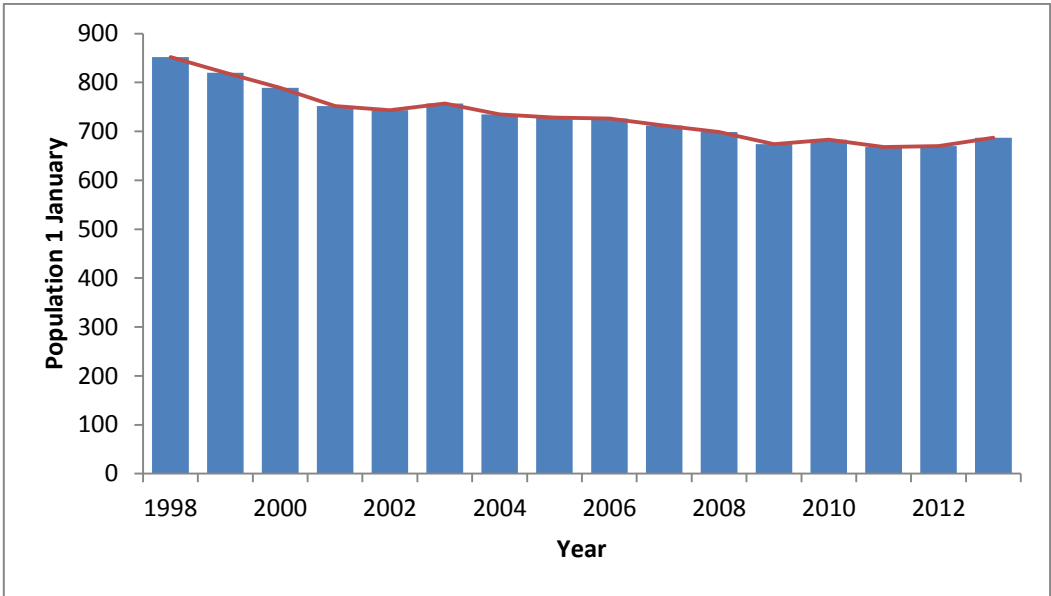


Figure 17. Population development in Vopnafjörður municipality from 1998 - 2013

There has been a reduction almost every year in the municipality over this period, with a few exceptions. In 2003 there was an increase of 14 people but a year later or in 2004 there was a reduction of 22 people. In 2010 there was an increase of 9 people and that was followed by a reduction of 15 people in 2011. There was an increase by two persons in 2012 and that was followed by increase of 17 people in 2013, making this the only period where there is an increase two years in a row since 1998. This shows that the population decrease is stabilizing.

The composition of the demography has also been changing. In 1998 the age and gender composition was quite traditional, with an age and gender population pyramid with a wide bottom and narrow top. But in 1998 there are some indicators that a generation gap is forming due to a gap from the age 18 – 35 in the pyramid.

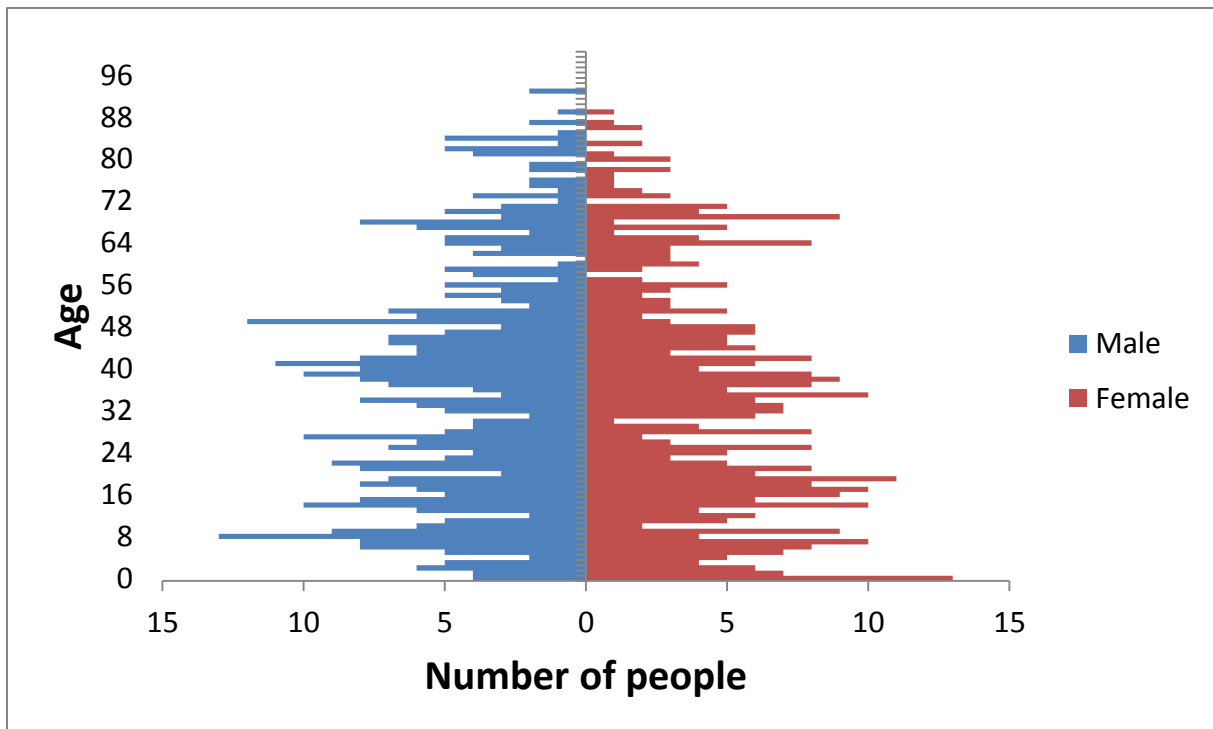


Figure 18. Vopnafjörður municipaity 1998 age pyramid

Already in 2004 the population pyramid began to show some changes. There is a gap forming in the age of 18 to 40, showing that young people are moving away from the municipality. In 2013 the population pyramid has changed considerable. The population is growing older and there is a large gap in the age from around 24 to 40, which can be considered as a child bearing age. The lack of young women might also be of concern for the community. There are also few children in the community from age zero to age of ten, where the number of children in each of those year class does not exceed ten. Majority of the population is above middle age, which is another concern for a growing age. The pyramid in 2013 is also thinner than in 1998 and that is an indicator of decreasing population (Statistics Iceland, 2013a).

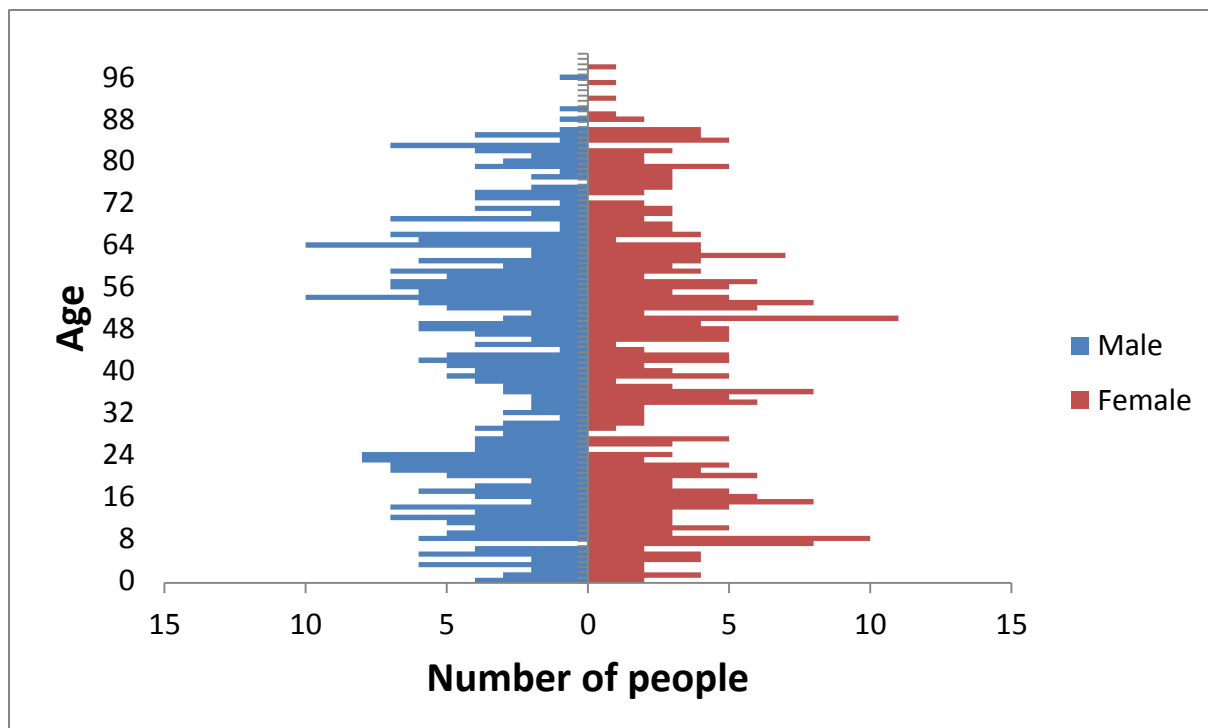


Figure 19. Vopnafjörður municipaity 2013 age pyramid

There are currently more males in the community than females. There are more females in the age group from 0 – 18 and in the age group of 68 – 100 but in others there are more males. In the age group of 19 – 36 the difference is 11 more males than females. This age group can be considered as the main child bearing age.

Table 3. Vopnafjörður municipaity 2013 age groups

Age	Male	Female
0-18	81	82
19-36	72	59
37-50	58	57
51-67	92	71
68-100	57	58
Total	360	327

The reason for population and demographic change is not known and reasons for people migrating away from smaller settlements can vary. The main reason is however usually considered to be economical. People move away in the pursuit of better job opportunities into more diversified economies. If there is a lack of job opportunities in the smaller communities and people simply move away. Another issue is that young people move away in pursuit of higher education, e.g. high school and college and don't come back. In the recent years the economy has been changing, moving away

from primary industry into more service orientated economy. That affects smaller communities that do not have diversified or service orientated economy. There are also social factors that affect the migration pattern. Larger towns often have more to offer than small societies, such as in terms of cultural life, services, transportation and education. Housing prices can affect people's decision to move. Housing prices are usually lower in smaller communities than in larger towns and cities. A large house in a small place might only be as valuable as a small apartment in larger towns. This could discourage people to move. Low housing prices in the smaller settlements are however not strong enough incentive to make people move from the larger communities (Herbertsson & Eypórssón, 2003)

Vopnafjörður does not have rich cultural life or good variety of services. The village is quite isolated and only has elementary school. People want to enjoy modern standards of living and in many cases such standards are not available in a small community as Vopnafjörður. Theater, cinema, regular concerts, shops, cafés and so on, is not available in the community. Closeness to nature and the society is though a benefit that attracts many, but might not overweigh the other factors. Closeness to nature might also affect males more than females, where hunting and fishing is seen as a more positive factor for males than females. The housing prices in Vopnafjörður are below national average and almost the half of the average in the capital area (Registers Iceland, 2013). It seems therefore that the main incentive to live in Vopnafjörður is job opportunity. From 1987 there had been difficulties in the fishing industry at Vopnafjörður and several attempts were made to stabilize industry. That was succeeded in 2004 but till then the industry did fluctuate quite much. This instability might be one of the reasons for the population decrease. But as the population pyramid shows for 2013, the population is growing older. Increasing age might be an indicator of that young people is not interested in living in Vopnafjörður. The service level is low and the economy is undiversified. Young people move away for seeking education and do not come back, since there are no or few jobs that fit their education. The population pyramid for 2013 shows this, where young people are missing, creating a gap from teen age to middle age. Those that stay might see themselves better of working rather getting education, but it can be assumed that the only stay if there are jobs available in the community. In addition the pyramid might also be skewed, for young people often move from the age 16 – 20 for high school, but are still registered as residents at the municipality. After the high school, they tend to register away from the municipality in order to get housing benefits from their actual place of stay.

As for the generation gap, there was an anecdote told by one male in his thirties in the town. He announced that he came second in a beauty competition for his year class in the municipality. This would usually be good news, but not in this case, as he was the only male in his year class living in the municipality. This shows that the people understand that there are missing year classes in the municipality.

From 2004 the population kept on decreasing until 2009, even though that HB Grandi had established them in Vopnafjörður and announced that they would build up the pelagic processing. From 2009 the population in the community has somewhat leveled off. That could be correlated with the fact that HB Grandi had kind of confirmed their established in Vopnafjörður and built up the local trust. It might even be correlated to the start of the mackerel processing. Another reason could be due to all excess workforce had migrated away making access to work better for the rest and therefore reducing the incentive to move away.

Some people in the community mention that they are witnessing some changes in the demographic pattern. They mention that that young people are moving back with increased job opportunities. People in the community know though that this is a slow process but they believe that young people want to live in the town. But still, young people are reluctant to move due to the isolation of the town. Other mention that there is no change and that the population has more or less remained unchanged over the recent years, with perhaps a minor decrease. There are always the same people that are staying in Vopnafjörður and therefore little demographic changes. The main reason is thought to be the monotonous employment in the society.

The community officials hope that this demand for labor will lead to people will move to Vopnafjörður but they understand though that it takes time for the population to grow. Most of the people that move to Vopnafjörður do it temporarily during seasonal work, such as at mackerel season. But there is an understanding that there is a need for an population growth in the society, but they know that this is a slow process. HB Grandi is more or less fully manned when it comes to permanent positions but the demand for labor increases during seasons, such as the mackerel season. The problem is that the season is temporary and that does not give enough incentive for people to move to Vopnafjörður.

7 SOCIAL CHANGES

Social life is important in every community, not least in small peripheral communities like Vopnafjörður, which is dependent on fisheries. In order to understand the social life and the perception of the changes with the increased activities of HB Grandi, several interviews were made in order to gain further understanding into the community life. In addition, some aspects of the HB Grandi staff were used in order to gain some quantitative perception. Those that were interviewed were community officials and key persons within the community. In addition were several small interviews with various people in the community in form of small talks, where some kind of snow ball technique was used to gain further insight into the community. Names or status of people are not mentioned in this part in order to protect their identity.

7.1 People's Perception of HB Grandi

With the establishment of HB Grandi in the municipality of Vopnafjörður and increased activity with mackerel processing, there have been some social changes in the community. The company is without a doubt a big actor in the community and people do notice their effect. The general perception of the people towards the company is usually positive and people appreciate what HB Grandi has done for the community. People do though perceive that the company has a lot of power. Both company and municipality officials deny that HB Grandi is using their size in the local economy to get what they want. There is however an understanding between the municipality and the company that collaboration is needed and they both want to solve matters that arise mutually. The company size might though affect the municipality decisions unconsciously, and that might seem to the locals that they are using their size to get what they want. HB Grandi wants to stay in Vopnafjörður and the municipality officials, along with the people, want them to stay.

People felt that there were some significant changes when HB Grandi was established in the community. It took some time for the company to work its way into the culture of the society and there is a perception that they are perhaps still working their way into the culture of the society. People know that the company takes good care of its employees and workers are happy at HB Grandi. The staff gets adequate training and goes on various seminars which is seen as a positive. The company puts in return strong demands towards its staff. People get fired if they do not fulfill the company's requirements, but there is flexibility for improvement. The staff has a responsibility feeling towards the company. Supervisors in the company are more or less local persons, which is positive and makes perhaps communications to the staff perhaps easier. People do also notice that

the company is managed from Reykjavík, therefore the social perception of the company is not the same as if the company is managed from Vopnafjörður.

The society is in general positive towards HB Grandi. It is also a belief that the more HB Grandi builds up and invests in the municipality the longer the company will stay. In peoples belief the company is there to stay and they do not believe that the company will move away from the municipality, even though that might be the case in the future. Some are more aware of this than others, especially those that are not closely tied towards the company. People are in a way codependent with HB Grandi, for they feel the need to support the company. They feel a need to support them in order to keep the company happy, keep them happy so they won't leave. This might be the case for there was a serious threat that the fishing industry would disappear in Vopnafjörður in 2002 and therefore risking settlement in the municipality, people might therefore want to show their support. People care for the community and want to secure settlement, for they want to live in Vopnafjörður, it is where they come from.



Figure 20. Overview of Vopnafjörður: The processing and the fish meal factory are the heart of the town (Arnarsson, 2013)

HB Grandi does many things for the society and they want to maintain a positive image in the community. For example they emphasize on having everything clean and nice around their facilities and that is appreciated in the community. The company does also support several social and cultural events in the municipality and pay for the local gym, making it free for everybody to train. In addition they educate their employees during off seasons, which is positive for the community. They have introduced healthier lifestyle to their employees and that has shown in the community, as the owners of the local store have mention that sales of unhealthy products have reduced.

The staff has a lot of empathy towards the company. When the pollution accident occurred in 2010, the town was split into two divisions; those that supported the company and those that criticized them. The workers were those that supported the company while people outside of the company

and with no relation towards it criticized it, meaning that they do not rely on it in any way. They do not work at the company, do not service them or have relatives associated to HB Grandi. There was some perception in the community that HB Grandi wanted to silence the accident and to cover over it. People felt that the incident was supposed to be silenced and not talked about. Some people were not happy about how the municipality handled the matter, since the company did not receive any fines or warnings after the accident. Some speculations were made about the relations of the company towards the community, for members of the environmental committee of Vopnafjörður municipality were also working at HB Grandi at that time. There might have been some conflicting interests and people concerned about their job security. The company did make a small formal apology but some felt that it was not enough; the matter was in some people minds poorly represented. Some felt that the company showed some disrespect towards the people of the community.

The majority seems to be positive towards HB Grandi. People understand what the company has done for the society. There is also this belief that the more the company invests in the municipality the longer they will stay there. Many also assume that the company has established itself in Vopnafjörður permanently. People do not believe that the company will go away, even though there could be possibility in the future.

The company officials feel this empathy from their workers and they feel that the local staff in Vopnafjörður is very good and that is important for the processing. They employ many locals and do in fact prefer to employ locals and that is seen as a benefit that the locals want to work in fisheries. The company understands that they need to be flexible towards some of their workers, especially those that have families. Single mothers in the community do though struggle, since the 24 hour seasonal shift system does not fit them well. The company tries to be flexible and show understanding towards their situation. HB Grandi are very happy with the processing and it is easy to fill in the positions, people from Vopnafjörður want to work in fisheries. For example, they were quick to adapt to a new quality standard system, and that would be impossible without good staff. In turn the company takes good care of its employees. People like working at HB Grandi. The staff gets adequate training and goes on various seminars which is quite positive

When the staff in HB Grandi was asked about their general perception of the company, then all that answered the staff survey, except one, said that they were positive towards HB Grandi. One person was neutral, 23 were positive towards the company while 31 persons were very positive. This is seen in Figure 21.

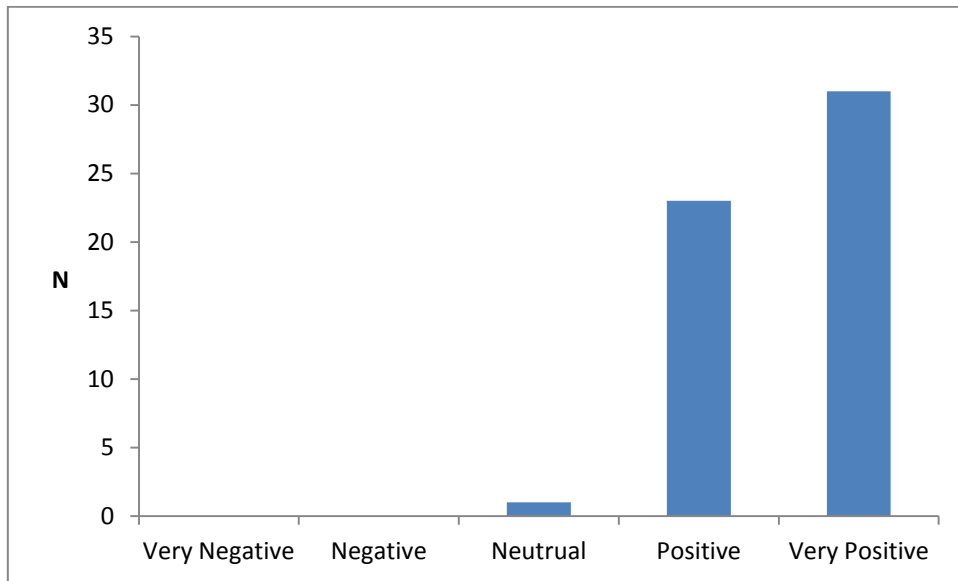


Figure 21. Staff survey: General perception towards HB Grandi

In addition the survey showed that the staff thinks that HB Grandi has had quite positive effects on the municipality. When asked about how the company has affected the municipality, then 9 persons felt that they had positive effects, while 45 felt that they had very positive effects. Some mentioned that they had some negative effects or 13 persons, most of them, or 11, mentioned little or very little negative effects. This is displayed in Figure 22. People were allowed to mention both positive and negative effects.

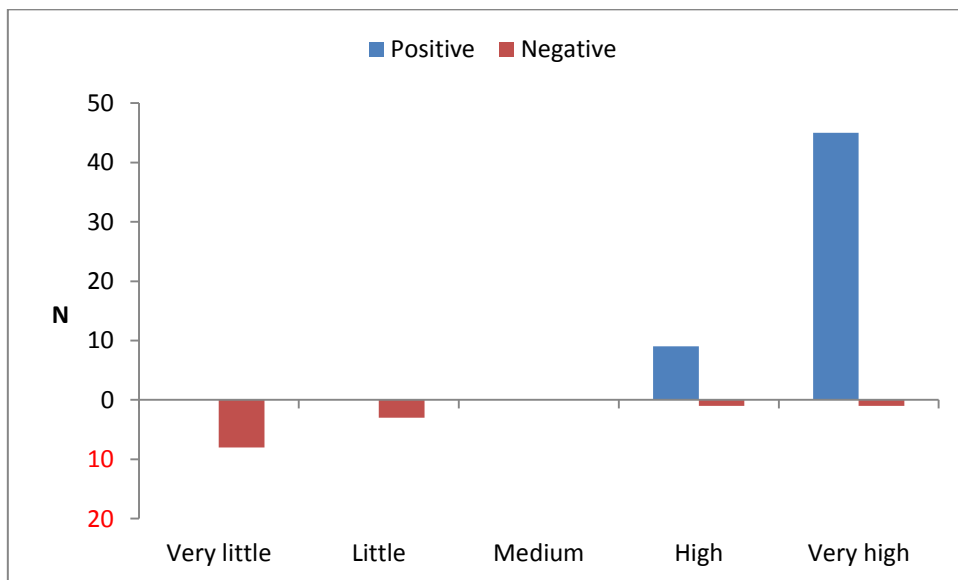


Figure 22. Staff survey: HB Grandi effects on the municipality

The staff perceives HB Grandi as important for the municipality. In the survey, 50 out of the 55 that answered the survey said that the company was of very high importance, as shown in Figure 23.

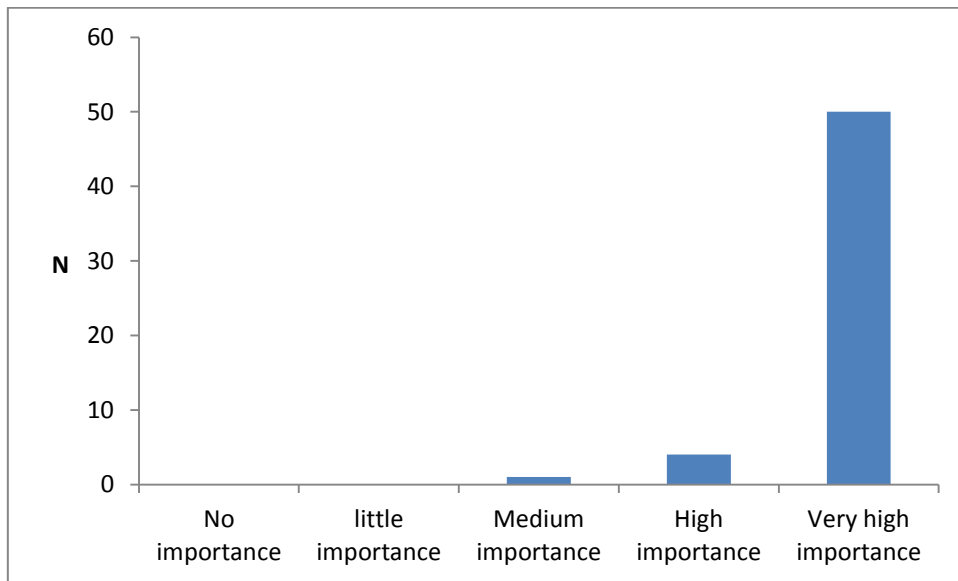


Figure 23. Staff survey: Importance of HB Grandi for the municipality

The staff had similar perception towards the mackerel processing when asked about its importance for the company. All, except one, mention that the mackerel processing was either of high or a very high importance for the company. This is displayed in Figure 24.

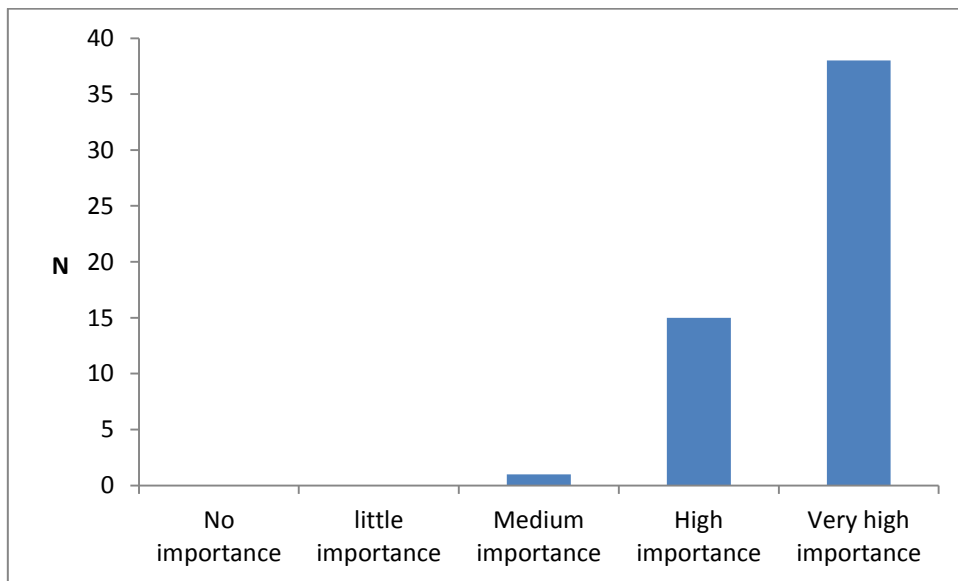


Figure 24. Staff survey: importance of mackerel processing for HB Grandi

When asked about the importance of the mackerel processing for the municipality, then the answers were quite similar. Out of the 54 that answered, 51 said that the mackerel processing was of high or very high importance for the municipality, as seen in Figure 25.

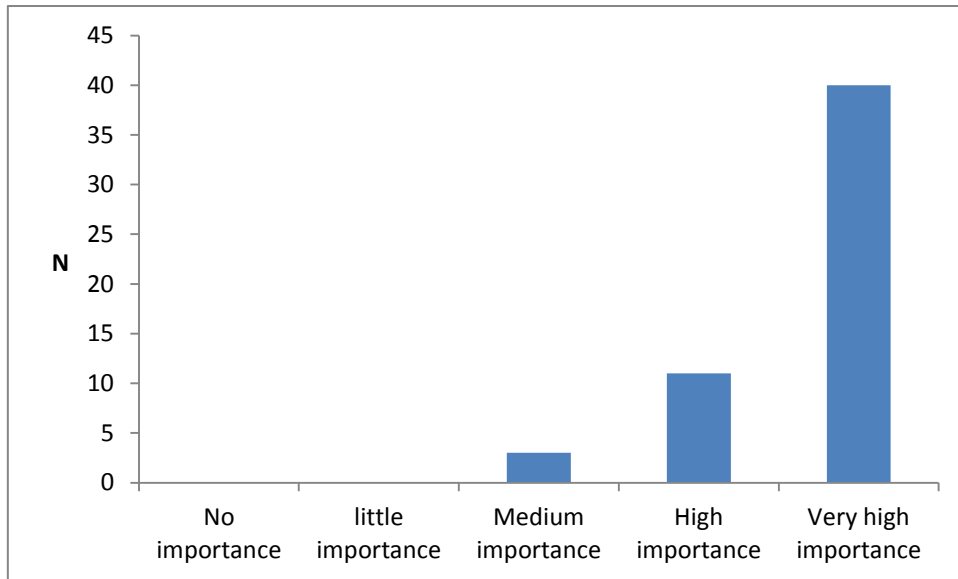


Figure 25. Staff survey: importance of mackerel processing for Vopnafjörður municipality

In addition, the staff feels that HB Grandi has had positive effects on general living conditions in the municipality. The majority felt that they had positive effects on the living condition, where 48 out of 53 answered positively said they had high or very high positive effects. Only six persons said that the company had negative effect, and only little or very little negative effects. This is displayed in Figure 26.

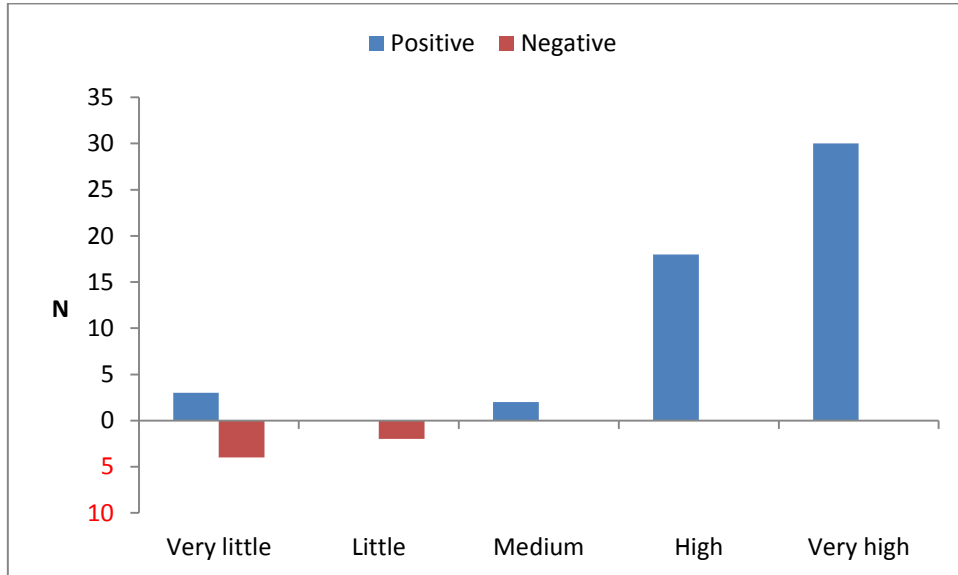


Figure 26. Staff survey: Effects of HB Grandi on living conditions in Vopnafjörður

The staff of HB Grandi seems to have positive perception towards their employer and the also acknowledge to importance of the company for the municipality.

7.2 Community activity

There are indicators in that the community activity is less after the establishment of HB Grandi in Vopnafjörður and especially during mackerel season. People mention that there is too much work which decreases social innovation. Social and cultural events in the community suffer from too much work since people rather chose to work or rest from work than attend to such events. It has been noticed that young people that come again to village during summer breaks are too busy working that they do not participate in the social and the cultural life. There is little interest when there is so much work. There is little initiative to participate and to be innovative, since there is no interest in the events. People get a perception that the community looks like labor camps rather than anything else. In addition it was mentioned that social and cultural events were best organized by the schedule of vessels coming to Vopnafjörður, for if there is work, then people do not participate. The town might though be full of people during seasonal work, especially during mackerel season, but they are not visible in the community, they just go to and from work. When there is something going on at the same time, such as cultural or social events, then people choose work over socializing. This somewhat changed when HB Grandi introduced new shift system in the processing, where people need to take four days off for every twelve days working. But there is only a fraction of the staff not working at each time. The company introduced this system because they feared that too much work during seasons might have negative effects on the workers. Some were skeptical towards this new system, but that might explain the mentality in the community during this time, especially in the beginning of the processing. In the beginning there was some kind of gold rush in the municipality, for there was a belief that the mackerel processing was temporal; people wanted work at that time and a lot of it. Now, people know that the work is relatively stable and do not demand so much work as before, they are happy to get days off. Before people simply did not want days off, they just wanted to work.

During off seasons there are various seminars hosted by HB Grandi for their staff. Those seminars are thought to be uplifting and inspiring for the community. The seminars are held to make the staff them more valuable and are focused towards the processing. But there have been other seminars, such as cooking classes and seminar about a healthy lifestyle, which was a great success. The whole community noticed the seminar and some are perhaps a bit envious that the staff has such interesting seminars, and the whole community is interesting in participating. In general the social life is much more prominent during off seasons in the community.

Mackerel processing has also affected the local sports club, Einherji, which has a football team in the third division in Iceland. Young people choose work over playing football, making it hard to establish a team. The team has negotiated with HB Grandi, letting players work only on night shifts so they can have some time for practice and matches during daytime. But those two do not necessarily go so well together. But all this work in the municipality allows the football team to attract players with good work during mackerel season in the town. Even due to this controversy of work and play, the football team managed to get promoted to the third division in the summer of 2013. All except one player were working at HB Grandi during the football and the mackerel season. The work attracted players to join the team which did very well during the first part of the summer. During the second part, when there was more activity in the mackerel processing, the team did not so well. It was mentioned that all the work did almost ruin the teams chance to get promoted into the third division. The importance of the activity of HB Grandi has therefore effect to the sport life, both in positive and negative way. The players that were playing well with Einherji were noticed by clubs in higher divisions, but those clubs could not offer as well paid job as Einherji, through HB Grandi, resulting in that the players stayed at Vopnafjörður. The work is an important factor for the sports life in the amateur league in Iceland and not at least in Vopnafjörður.



Figure 27. Einherji football team celebrating their promotion (Þorvaldsson, 2013a)

7.3 Social Innovation

During the interviews, people mentioned that social initiative has decreased in the community with the introduction of the mackerel processing in Vopnafjörður. There is little to do when there is mackerel season and it seems that HB Grandi drains all innovation and initiative from the society. It was mentioned that there was not much social and cultural life before HB Grandi came, but it has still decreased. People are not interested in participating and therefore it is hard to be innovative to start something new due to lack of interest. The people feel that it is easier to do nothing than to start something new. This does not only apply to workers at HB Grandi, for this lack of social innovation spreads into the community. The workers at HB Grandi are a big part of the society, so if they are not participating then there is a large gap in the social events and gatherings. That decreases the will of others to participate and to be initiative. There is little encouragement to start something new since there are so few that participate. Too much work is probably one explanation to this lack of interest. The generation gap probably affects the social life as well. It was for example mentioned that there are always the same people attending the social and cultural events. Those are often above the average age and do not have strong ties to HB Grandi.

It was mentioned that there are some indicators that this is changing. The society is more positive than before and that has good impact on the service industry, especially regarding tourism. There is much to do for kids and adolescents and there is some cultural life. Some speculations are that if more people migrate into the community then the social life will prosper. The reliance on HB Grandi is though strong. They support various cultural and social events, along with supporting the local sports team. Even though they do support in this way, there are strong demands towards them and people want them to support even more. This is perhaps one indicator of the lack of the social innovation in the society. There is a feeling that HB Grandi should support more and the conception towards the company is that it is a direct source of funds. HB Grandi has done many positive things for the community, especially in terms of work and people appreciate that, but there are strong demands towards them.

The society is in kind of transition and it might take some time for it to be accustomed to this new system. People are always working but they might realize that there is more to live than work and want to do something. That depends on people that take initiative to do something and motivate people to participate. It might be hard when there are also so many temporary workers that only come to work, they don't want to participate, they just want to collect their paycheck and leave.

8 ECONOMIC EFFECTS

The municipality officials that were interviewed said that there is without a doubt that the mackerel processing has had good economic effect on the society. They feel that there is a lot of employment and little unemployment. The tax revenue from the employees registered at Vopnafjörður has increased which has had a good effect to the society. In addition the mackerel season lengthens the seasonal work in the municipality and there are more options for jobs throughout the year, creating more job security. This has though led to some problems for the municipality and other local businesses of hiring people. There is much competition for labor and HB Grandi takes the bulk of it. In total there are 82 full positions on a yearly basis at HB Grandi in Vopnafjörður. Majority of those positions are at the processing factory or 70. The fishmeal factory employs 12 full positions on a yearly basis. Those 82 positions add up to 17.5% of the total workforce in the municipality of 468 persons at the age from 16 – 74 (Statistics Iceland, 2013e). This number grows considerable higher if indirect jobs from contractors that work mainly for HB Grandi are taken into consideration. It is estimated that 20 – 25 full positions on a yearly basis are worked by contractors for HB Grandi, totaling up to 107 positions, or close to 23% of the total workforce, which is a significant proportion of the workforce in Vopnafjörður. During mackerel season the need for labor doubles. The processing needs around 160 person's during the season, which is almost the double the amount of workers on a yearly basis. In comparison, the Vopnafjörður municipality has only 71 employees on their payroll, in 47 yearly positions. Those 71 employees make up for 15% of the total workforce (Jónsson, 2012).

There have been problems in hiring people to the municipality summer work (gardening and maintenance in the municipality surroundings) due to HB Grandi activities. People prefer to work at the mackerel season than at the municipality for they get better wages. The municipality can't compete with HB Grandi in the terms of wages and therefore has difficulties in finding people to work. There are no problems in employing people to the elementary school, especially the permanent positions. There is however difficulties in hiring people to assistant positions, since they are not as well paid and require no education. People prefer then to work at HB Grandi if possible. But the municipality officials see this more of a luxury problem than anything else.

HB Grandi is fully manned when it comes to permanent positions but the demand for labor increases during mackerel season. The problem is that the season is temporary and that does not give enough incentive for people to move to Vopnafjörður. Therefore the municipality loses tax income from those workers, since they are not registered residents in Vopnafjörður. In addition the revenue from the company goes away from the municipality for their headquarters are in the south. Strong

employment, established by HB Grandi has probably stopped out migration in the community. The population has not started growing yet, but the migration pattern has leveled off.



Figure 28. The harbor can be a busy place (Arnarsson, 2013)

Since the merger there has been constant development in the municipality and that is mainly because of increased activity of HB Grandi. There is much work for industrial workers, such as metal workers, carpenters, mechanics and other specialized workers. This is a change from before, where there was little activity and investment made by the processing company prior to the merger. Many companies are servicing HB Grandi and that leads to more employment in the society. Those companies in fact rely on HB Grandi for work. Those include the local carpentry, machinery and the auto workshop. The servicing industry has also benefitted from their increased activity, such as the local hotel, which relies strongly on doing business with HB Grandi (Steinsson, pers. comm.).

The municipality officials realize that it would be a hard blow for the community if HB Grandi would shut down their operations. The community is very dependent on HB Grandi, for the company establishes employment, both directly and indirectly and with them gone, then they would suffer, but in their minds they would survive (Steinsson, pers. comm.).

The establishment of HB Grandi has had in general positive effects, a lot of work since they came, even during the Icelandic economic crisis. The crisis did not have so much effect in Vopnafjörður since there was so much work in the municipality. If HB Grandi and their processing facilities would not be in Vopnafjörður, then there would be very little activity in the municipality. They are in fact very dependent on the company (Steinsson, pers. comm.).

The directors of HB Grandi have stated that they want to use local services as much as they can. In addition they want to employ local people and they have priority in seasonal work, such as the mackerel. They are flexible towards their staff, especially regarding family life and for people that can't work a full time job, such as workers that are old. There is a very low staff turnover rate at HB Grandi and they are very happy about that. The company officials are well aware that too much work can have negative effect in the community. Therefore they introduced a new shift system during seasonal work so people would get some days off during seasons. This was especially the case in the mackerel season. They aim to keep the staff as happy as possible and to keep current staff. They have invested in the staff and they think it is very valuable for the processing to have skilled workers (Róbertsson, pers.comm.; Vilhjálmsón, pers.comm.).

They feel that people from Vopnafjörður can have job at HB Grandi if they want, especially during seasons. In that manner the mackerel season is very important. Teenagers that are seeking education away from the municipality can have work at the mackerel season and that is very important for them. They like to employ young people from the municipality. When school starts and the school kids leave in the autumn, the company has to find new staff. They mean that the "B" type or second class workers come in after that. They would prefer to have the young locals but the need to settle with the other workers due to the length of the season. There are also more problems associated with the "B" type staff. They know that the work at HB Grandi does not suit everybody, especially during seasonal work when processing is ongoing 24 hours. This is for example a problem for single mothers that don't have anybody to watch over their children, but they try to be flexible (Róbertsson, pers.comm.).

While interviewing people in the community, it came clear that they also notice a big difference in the municipality since HB Grandi was established in Vopnafjörður. They have had positive effect on the community, especially regarding jobs and people are happy about that. It is also noticed that it is hard for other businesses to compete with HB Grandi for staff. This especially applies for summer jobs in the service sector. Some businesses have had to increase the wages in order to secure people in the positions. There is in fact high demand and competition for local labor. The perception in the society seems to be that HB Grandi is the only workplace that can offer good salaries. People mentioned however that the company might not offer high time wages, but they do offer a lot of work, which accumulates in a high salary in the end. It is though hard to get a permanent position at the company but the seasonal work, as the mackerel processing, gives young uneducated people a chance to come to Vopnafjörður and work and earn good money. There is a lack of jobs for educated people, since most of the positions in HB Grandi are already manned. People feel that there is a need

for more innovation in the society and people need to be creative, which they seem not to be at the moment.

The economic value and total landings of mackerel in Vopnafjörður is showed in Figure 29. The figure shows the value from the processing in Vopnafjörður. The value is from the statistics Iceland definition, where they gather information about the value from landing reports, allocation (processing method) of the catch and sales (Benónisdóttir, 2012).

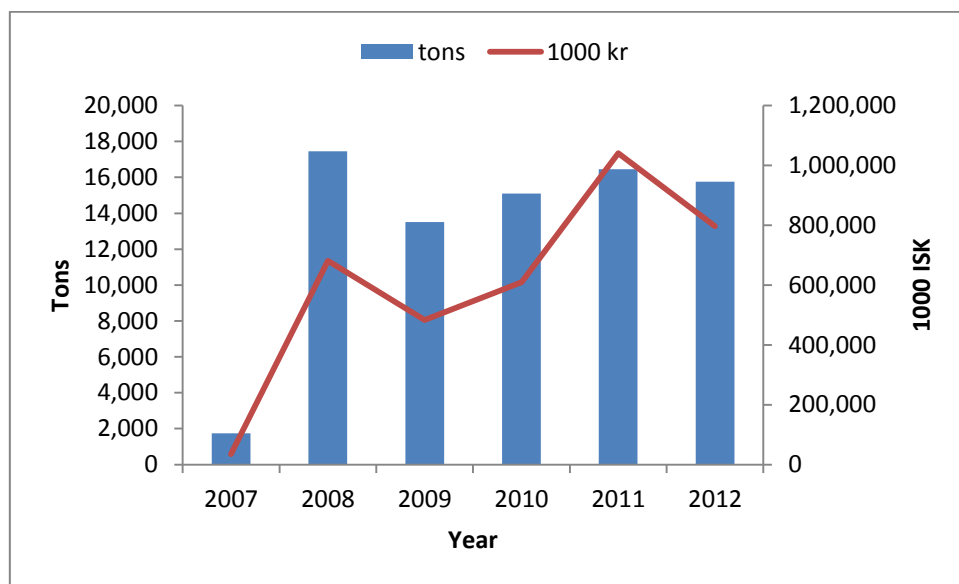


Figure 29. Total landings and value (2012 prices) of mackerel in Vopnafjörður (Benónisdóttir, 2013)

The processing creates a considerable value, especially in such small community and it generates additional value into the community, such as increased salary to the workers and increased tax income revenue for the municipality.

The results from the staff survey show that people working at HB Grandi feel that the economic effects of the mackerel processing are positive. Of those 54 that answered the survey said that the mackerel processing had high or very high economic effects. Some negative effects were felt, but only six persons experienced little or very little negative economic effects. This is displayed in Figure 30.

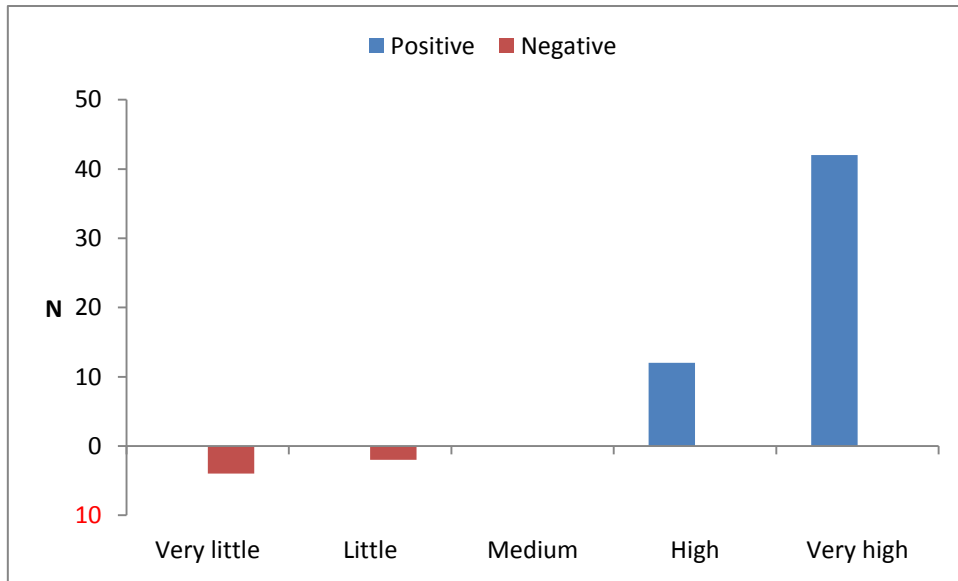


Figure 30. Staff survey: Economic effects from mackerel processing

There were similar results in the staff survey when asked about the effects of mackerel processing on employment in the municipality. 53 said that the mackerel processing had high or very high positive effect on employment, while one person said it had only medium effect. Six persons said that it had very little negative effects. The results are shown in Figure 31.

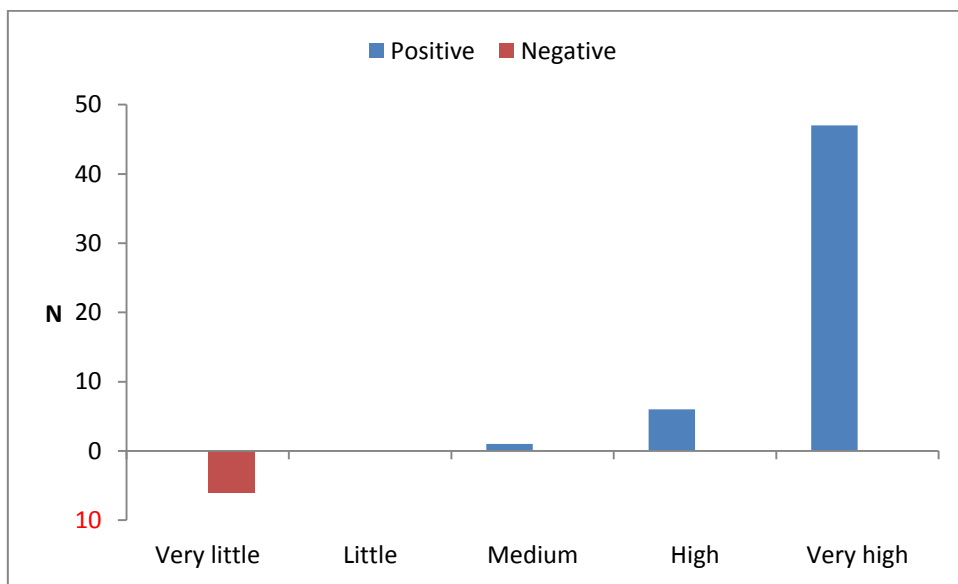


Figure 31. Staff survey: Effects of mackerel processing on employment

8.1 Employment

The effects of the increased processing in Vopnafjörður are though not very clear when looking at the actual unemployment rate, as shown in Figure 32 (Directorate of Labor, 2013). The numbers are somewhat skewed due to the economic crisis in Iceland in 2008. The economic upswing till that time might also explain the downswing in the unemployment rate. The effect of the crisis seemed not to affect Vopnafjörður as much as the national average and that might be explained due to the level of economic activity in the municipality during that time. People and municipality officials mentioned several times that the economic upswing never reached Vopnafjörður and therefore they did not experience as much downswing.

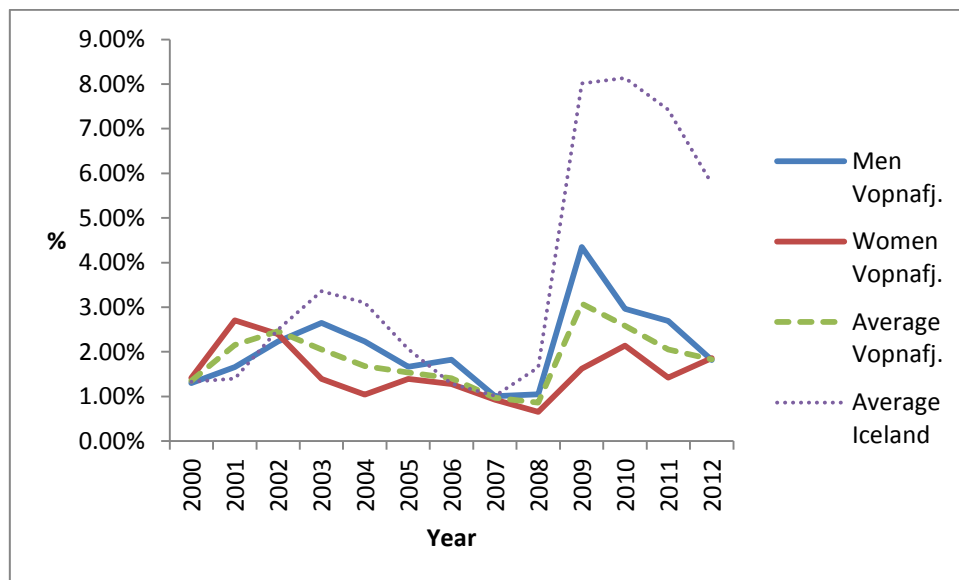


Figure 32. Unemployment rate in Vopnafjörður and Iceland (Directorate of Labor, 2013)

The unemployment rate has been going down during the years after the crisis, moving from 3,08% to 1,83% on average for both men and women. The low unemployment rates in places as Vopnafjörður can also be due to out migration, since people do not find work in the community and move therefore away. There was decrease of people in from 2003 to 2010, from then, the populatio increased slightly without increasing the unemployment rate, which is an indicator of increased economic activity. The numbers are based on a year average. The figures could be lower during the seasonal work, such as during mackerel season.

8.2 Housing

Establishment of HB Grandi and the increased activity with mackerel processing have had some effects on housing in the municipality. Municipality officials say that the processing has had positive effects on housing prices in the municipality. Demand for housing has also increased and for the first time since 1995 a construction for new residential housing started in the autumn of 2013 (Porvaldsson, 2013b). Rent has also risen in the community, due to housing scarcity. It is quite interesting fact that there is a housing scarcity in Vopnafjörður, since there has been so much out migration over the years. It is expensive to build new houses and the investment does not pay off since the market price is lower than the building cost. This creates reluctance to build new houses, both for individuals and construction companies. The municipality’s role is to help as much as possible, for example by providing inexpensive plots for future constructors.

The main reason for the housing scarcity is that many houses are not used to their full capacity. Since the population is growing older, there are fewer people living in each house. People that migrated away from Vopnafjörður might want to come back to the town but find it hard to settle down due to the housing scarcity. The housing scarcity in the municipality has made difficulties to find places for the seasonal workers during the mackerel season. Therefore workers that can provide themselves with accommodation during the season are prioritized. This suits very well for example for young people that have relatives in the community The scarcity lead HB Grandi to rent out rooms in private houses in the community and some saw opportunity in doing so and overpriced their accommodation for the company, which had no chance except to accept the offer out of necessity.

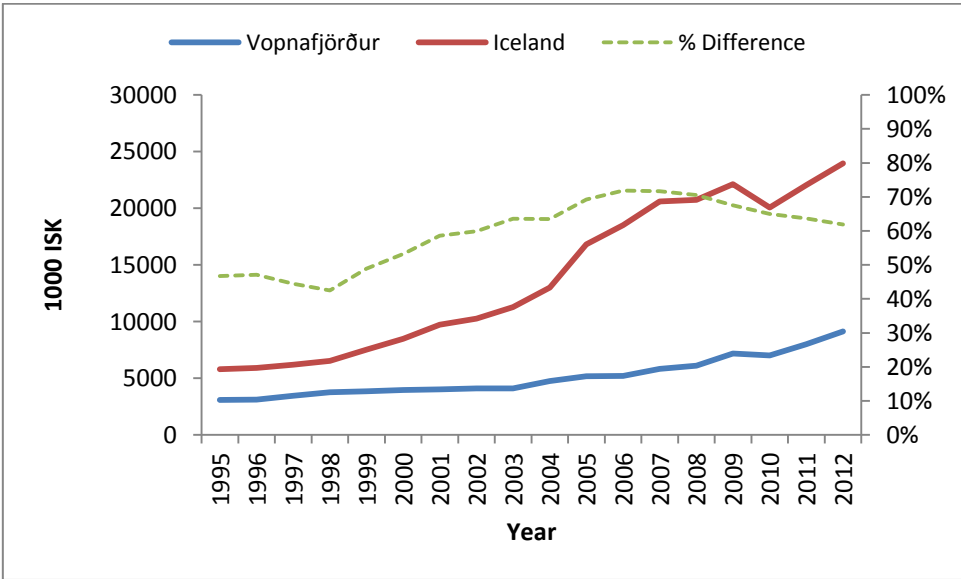


Figure 33. Average housing prices in Vopnafjörður and Iceland, with % difference - inflation regulated for 2012 prices (Freysdóttir, 2013)

The housing prices in Vopnafjörður are considerably lower than the national average. The average housing prices in Vopnafjörður are from 42% lower in 1998 to 72% lower in 2007. In 2012 the housing prices were 62% lower than the national average, but it seems that the price development in Vopnafjörður will follow the national average. That might partly be explained due the economic crisis in Iceland that started in 2008 which affected the housing prices negatively on national level. The price fall did not have as much effect in Vopnafjörður, probably due to already low housing prices and little demand. Percentage change in housing prices in Vopnafjörður, as shown in Figure 34 is higher than the national average from the year 2007 and does not drop below the national average change. The data is gathered from Register Iceland and are at 2012 price level / value (Freysdóttir, 2013).

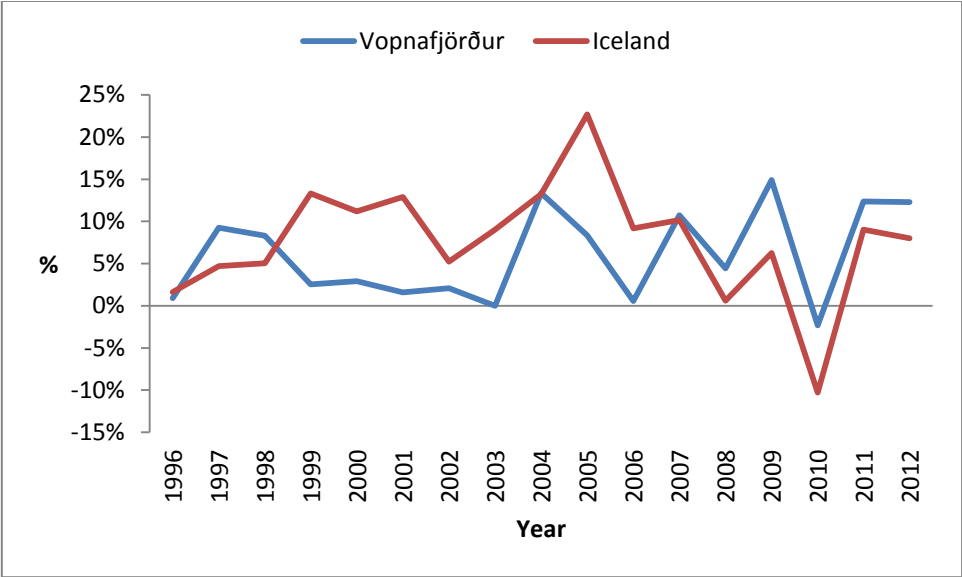


Figure 34. Percentage changes in housing prices, Vopnafjörður and national average - inflation regulated for 2012 prices (Freysdóttir, 2013)

The number of sales agreements has though not risen during the recent years. That might perhaps be explained by the changing demography in the community. As mentioned before, the demography is getting older, meaning that the people are quite settled in and little changes are in the housing market.

The housing situation issue was raised several times when speaking to the locals. They all noticed that there is scarcity but did also mention that this would be resolved with the course of time due to the aging of the demography. The reluctance in the market value increase in the community might perhaps be explained by the patience of the people, as they wait for the “houses to become available”.

8.3 Private income

There have been positive effects on increased activity of HB Grandi in Vopnafjörður. Signs of prosperity are in the community where people, especially those that work at HB Grandi, go abroad quite often, take good care of their properties, and are buying new cars and other luxury goods, such as televisions etc. This is noticed in the community and workers at HB Grandi do not keep their earnings a secret. This creates some jealousy in the society. People feel that the average worker at HB Grandi is one of the highest paid worker in the country. It was mentioned that the average worker at HB Grandi in Vopnafjörður is a high paid employee and on level and or even above income with some positions that require high education. They can even earn more monthly during a mackerel season than a university teacher. There though are many hours, during day and night, behind their earnings. The general effect is that people are getting more income and more stable work throughout the seasons. This has also positive effect on the municipality since they get income tax from wages. As mentioned before the total payment of salaries of HB Grandi in 2012 were around 740 million ISK. Half of this amount is due to the mackerel and autumn herring season. It can be assumed that the amount for 2011 was similar. In comparison, the municipality of Vopnafjörður paid 210 million ISK in wages in 2011.



Figure 35. HB Grandi is the largest employer in Vopnafjörður (Arnarsson, 2013)

In the staff survey, all except 2 persons said that they had worked in mackerel processing in Vopnafjörður before. That was in total 53 persons, and 52 of them had experienced change in their financial status due to the mackerel processing and 51 answered what kind of change. Vast majority experienced positive change or 48 persons. 40 persons of those 48 answered that they experienced high or very high positive financial change. Four persons experienced medium positive financial change and four experienced little positive change. Three persons mentioned that they had experienced negative financial change with the introduction of mackerel processing in Vopnafjörður. Two of them experienced very little negative financial change and one experienced little.

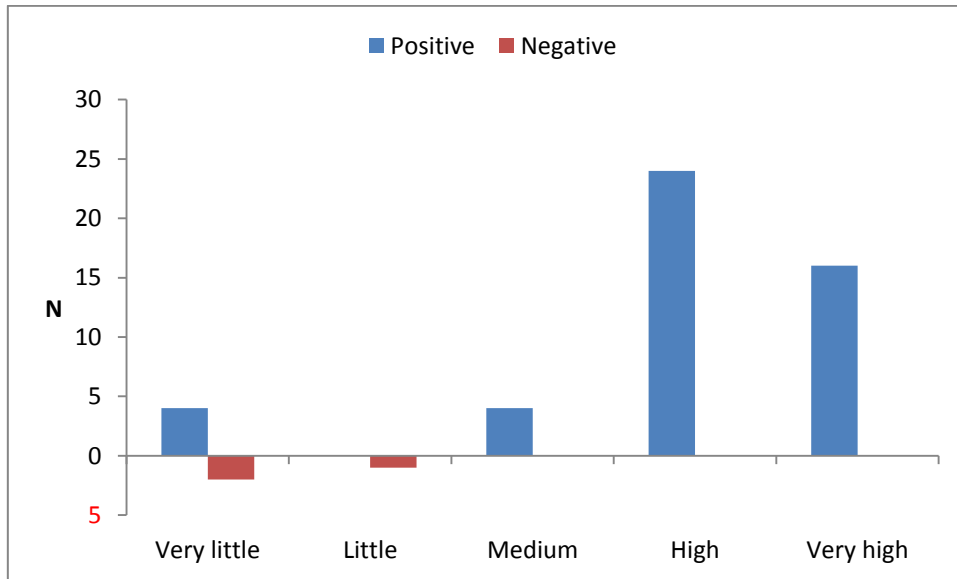


Figure 36. Staff survey: Personal financial change with introduction of mackerel processing in Vopnafjörður

There is perhaps no surprise that the staff of HB Grandi is gaining from their increased activity. The prosperity that follows seems though to spread into the community. In addition, increased personal income is also positive for the municipality, as they collect income tax from salaries of residents registered in Vopnafjörður municipality.

8.4 Innovation

Economic Innovation in the community seems to have decreased with increased activity of HB Grandi, according to discussions that were made with people in the community. It seems that people are starting to rely more and more on HB Grandi as a stable source of income, either as an employer or as a purchaser of service. There is in fact no need for people to start new things as they have plenty to do. It was noticed in the service industry in the town that there was a lack of effort in providing good service. That might be due to the fact that there is no need to make any extra effort. Business is perhaps good enough without providing any extra effort into it.

The local hotel was taken as an example. The property is owned by the municipality which rents the facilities to those running the hotel. The quality is however very low and there seems to be little ambition to improve quality. As it seems, the hotel does not need to show any ambitions to improve quality. They get much business from HB Grandi, which is a secure client that they rely on and therefore they do not need to do anything extra. HB Grandi is large client and they have become reliant on them. Their initiative is in fact not needed; they are doing fine without any extra work.

Those that are within the service sector see HB Grandi as a stable source of income and they try get as much from them as they can. People are perhaps innovative when it comes to finding ways to make money out of HB Grandi. One story mentions that someone grabbed the opportunity of renting out rooms in a house for extremely large sum, well above average rent price in Vopnafjörður and even in the capital, Reykjavík. HB Grandi needed accommodation for their staff and this was opportunity to make some profit from it. It was mentioned few times in the interviews that there is a need for more diversity in the local economy, especially for educated people. But in order to do that, people need to be innovative, which they seem not to be. People understand that diversity is good for the local economy and that would attract younger people. The innovation seems to be too low to engage in such action; there is enough economic activity at the moment in the community.

8.5 Investment

The facilities in Vopnafjörður are quite capital intensive and there has been a lot of investment since the company was established in the municipality. They have been constructing or renovating more or less since their establishment in Vopnafjörður in 2004. The fishmeal factory was completely renovated, new office facilities built along with staff facilities and cafeteria. The processing facilities were enlarged and a new freezing storage was expanded. A new cooling system was installed along with a new blast freezer and gutting and eviscerating lines installed. In addition various other smaller investments were made. This has totaled to 31 million € since 2006 to 2012, where 6 million € are directly linked to mackerel processing. This totals to almost 5 billion Icelandic kronur (4,982,762,680 ISK) and thereof almost 1 billion for direct investment for the mackerel processing (964,405,680 ISK) (1€ = 160.7 ISK on a 2012 mean rate (“Central Bank of Iceland,” 2013b)). Those numbers are not at 2012 price level.



Figure 37. Water pipe installation to HB Grandi facilities (Arnarsson, 2013)

The municipality has also invested quite a bit over the recent years in order to strengthen the status of the fishing industry in the community. The main problem for the municipality was poor natural harbor conditions that were a hindrance for further development of the industry.



Figure 38. Overview of the harbor and the new and the old breakwater – Facing west (Arnarsson, 2013)

In 1999 the municipality decided to go into extensive harbor construction by sheltering the harbor with two breakwaters that were connected to two inlets just outside of the harbor. The berth and the docking area was extended and renovated and other minor developments have been made during the more recent years. That includes preparation of the surrounding sites of the harbor area. The municipality director said that those constructions totaled up to 2 billion ISK (2013a). According to the director the constructions for the harbor area are more or less over and they are quite satisfied with current results.

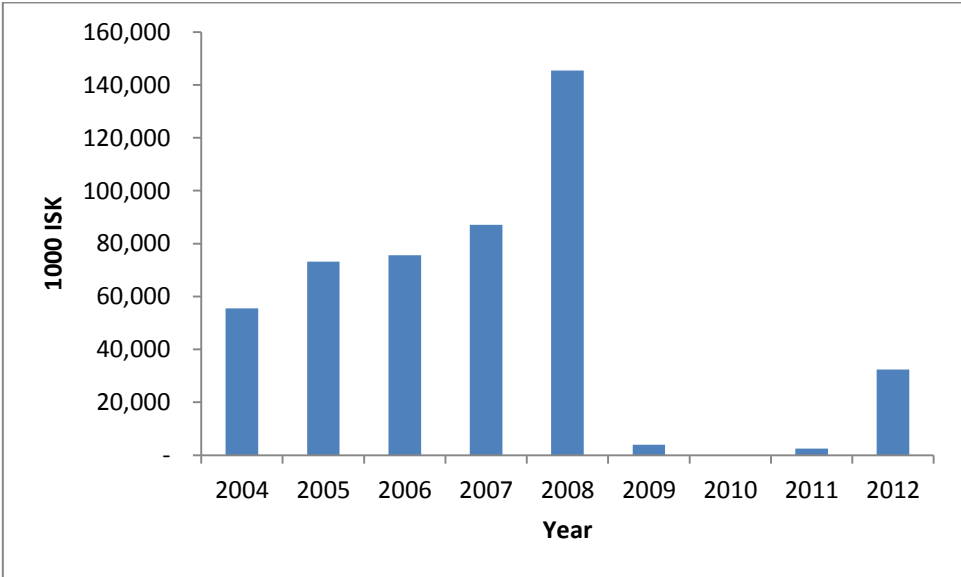


Figure 39. Harbor related constructions expenditure 2004 - 2012

The construction cost from 2004 to 2012 is close to 500 million ISK and is shown in Figure 39. This includes improvements in the landing and the docking area around HB Grandi, deepening of the

harbor and other harbor related constructions. In addition to harbor construction the municipality has engaged in other infrastructure construction around the HB Grandi facilities, such as renewal of water and sewage pipes. The renewal was needed in order to meet the water consumption needs of the company. In conjunction with those constructions, the Iceland State Electricity laid down 6 electric cables that were connected to HB Grandi facilities (Þorvaldsson, 2012). That was done due to the renewal of the new electrically powered system at the fishmeal production with the installation of the electric/steam boiler.



Figure 40. The main street of Vopnafjörður under construction

8.6 Municipality finances

All the work that has been created by HB Grandi has had positive effects on the income of the municipality. Harbor fees, income tax and property taxes have all increased since HB Grandi started in Vopnafjörður. They feel that they have a problem with the seasonal workers since they do not pay income tax to the municipality, they are not happy with that since everything counts in such a small community. It is some peoples mind that that the company contributes more to the society than it does. But it is without peoples doubt that the mackerel processing has had good effect on the society. There is a lot of employment and almost no unemployment. The municipality officials mention that tax revenue from the employees registered ad Vopnafjörður has increased and that there is in general good effect to the society from the processing.

HB Grandi is fully manned when it comes to permanent positions but the demand for labor increases during seasons, such as the mackerel season. The problem is that the season is temporary and that does not give enough incentive for people to move to Vopnafjörður. Therefore the municipality loses tax income from those workers, since they are not registered residents in Vopnafjörður. In addition the revenue from the company goes away from the municipality for their headquarters are in the south. There is however an increase in the municipality income from each year, since 2004 or the

year when HB Grandi was established in Vopnafjörður. The income increases from 147 - 150 million ISK in 2004 and 2005 to 258 million ISK in 2012 (Steinsson, 2013a). This is a clear increase as seen in Figure 41.

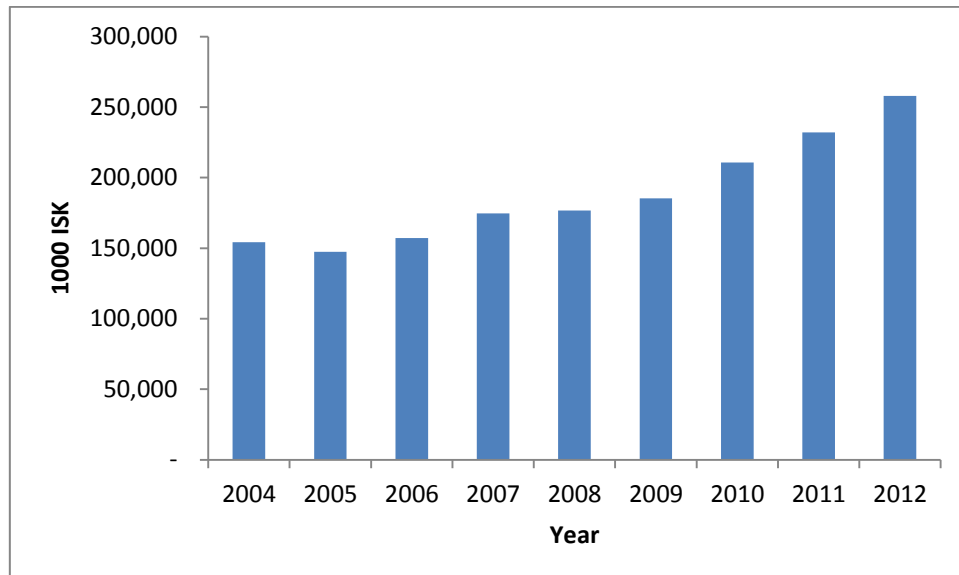


Figure 41. Municipality of Vopnafjörður income tax revenue each year 2004 – 2012 (Steinsson, 2013a)

When the income of the tax revenue of the municipality is corrected for inflation to 2012 values, then there is not so clear difference. Still, there is an increase in 2012. The inflation in Iceland has been quite high during the recent years, especially during the first years of the financial crisis that started in 2008, where inflation reached its highest point of 13% the same year. Average yearly inflation for this period is 6% (Central Bank of Iceland, 2013a).

The income of the municipality when corrected for inflation is presented in Figure 42. The income is relatively stable over the years. A decrease can be detected in the years after the financial crisis, but from 2009 there is a stable increase and that is the same period as when the mackerel processing started in the municipality. In 2012, the municipality received the highest revenue from income taxes in the period of 2004 – 2012.

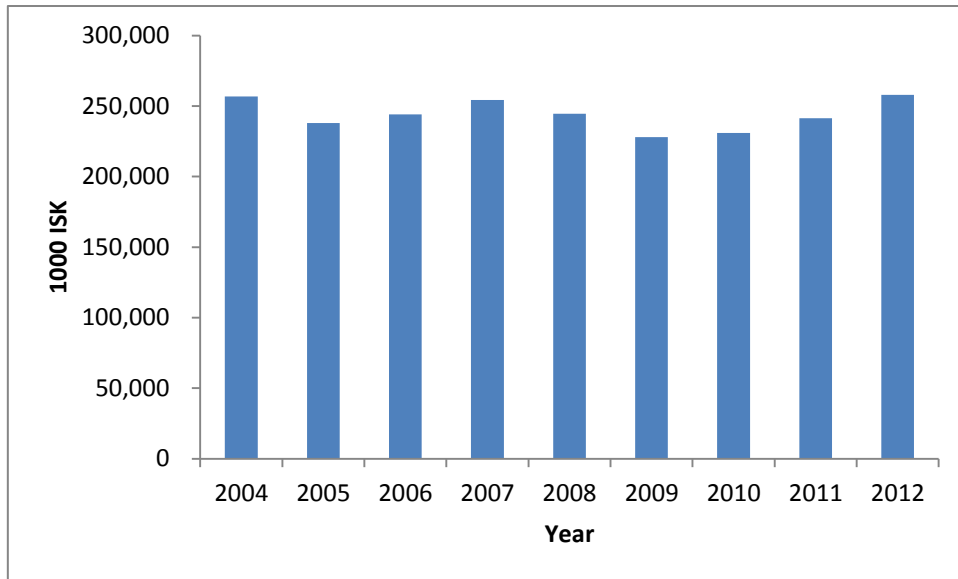


Figure 42. Vopnafjörður municipality income tax revenue - inflation regulated for 2012 prices (Steinsson, 2013a)

The municipality also gains from increased harbor activity, such as from docking and landings. The more ships come, then the more the municipality gains from docking fees. The same applies to landing fees. The harbor activity in Vopnafjörður has been relatively stable over the years and that is also due to the introduction of mackerel, as it has decreased fluctuation. Vopnafjörður has a good geographical location in terms for pelagic processing and the landings represent that as displayed in Figure 43 (Statistics Iceland, 2013f). The same figure shows that groundfish landings are almost nonexistent in 2012.

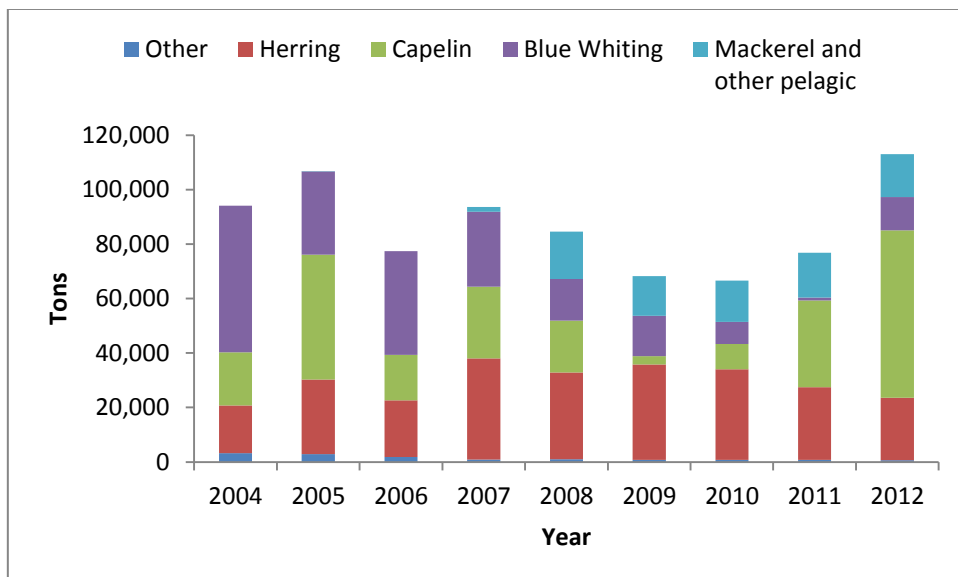


Figure 43. Total landings in Vopnafjörður 2004 – 2012 (Statistics Iceland, 2013f)

There is a noticeable increase in the income from harbor activities from 2004 – 2012. From the year 2008, when mackerel landings started in Vopnafjörður, it is also noticeable increase in income, except for a decrease between 2008 and 2009. The income is depicted in Figure 44. The income from

the harbor activities correlate with the total landings as seen in Figure 44. The year 2012 has the highest number for landings and therefore it has also highest revenue.

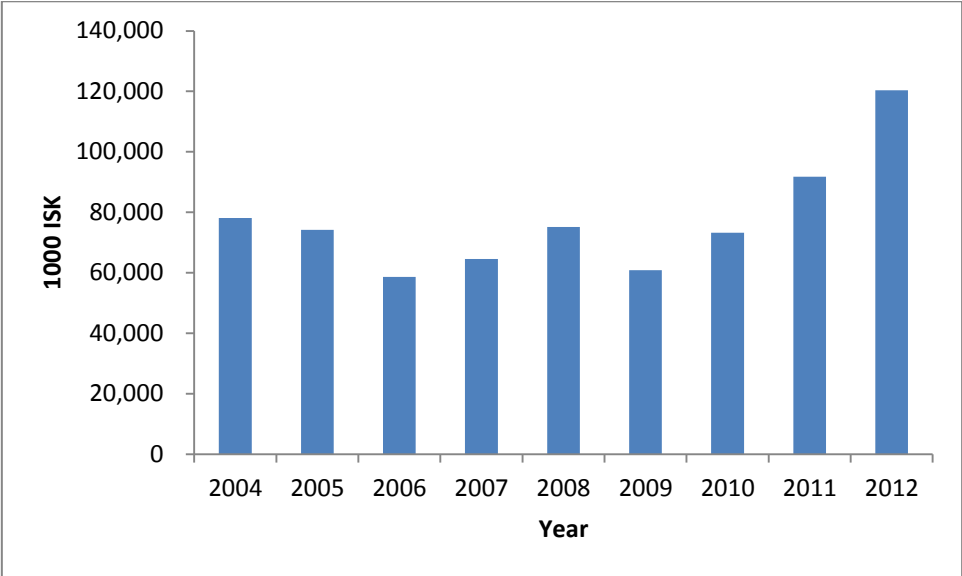


Figure 44. Income from harbor activite in Vopnafjörður (inflation regulated for 2012 prices) (Steinsson, 2013a)

This increase in the harbor activities has also had positive effect on the general operation of the harbor in Vopnafjörður Figure 45. The huge downswing in 2008 is due to the financial crisis in Iceland, where capital cost increased significantly. In addition, the municipality had invested quite a bit the same year in harbor constructions, as can be seen in Figure 39. The capital cost has decreased as the inflation has decreased. In addition, the municipality paid down debts in 2010.

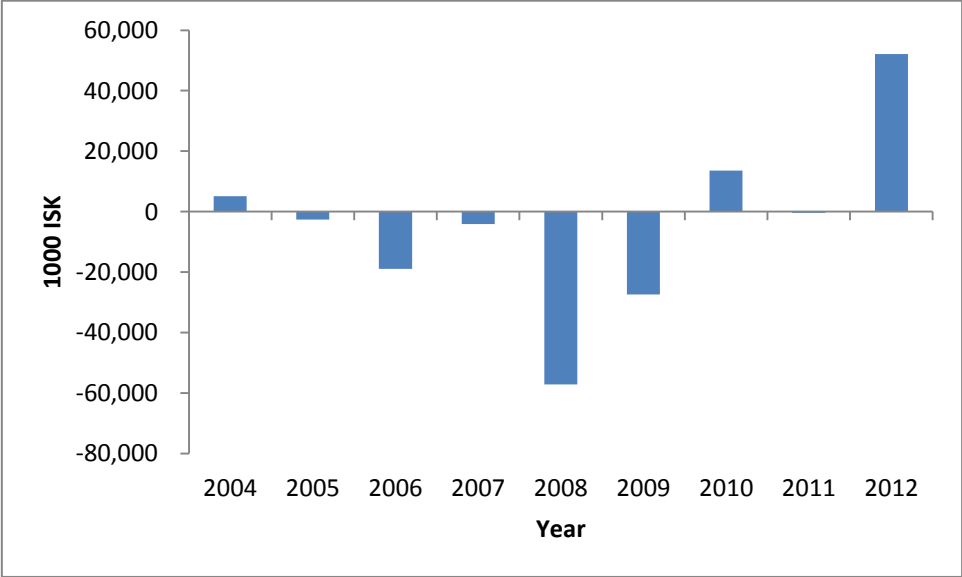


Figure 45. Financial outcome of Vopnafjörður harbor operation (inflation regulated for 2012 prices) (Steinsson, 2013a)

The general outcome of the municipality operations has had a great deal of fluctuations during the period of 2004 – 2012. The municipality has been in large debt for quite some time, especially after securing the fishing industry in the community. On top of that a financial crisis increased the capital cost of the municipality considerably. The financial outcome for the municipality is displayed in Figure 46.

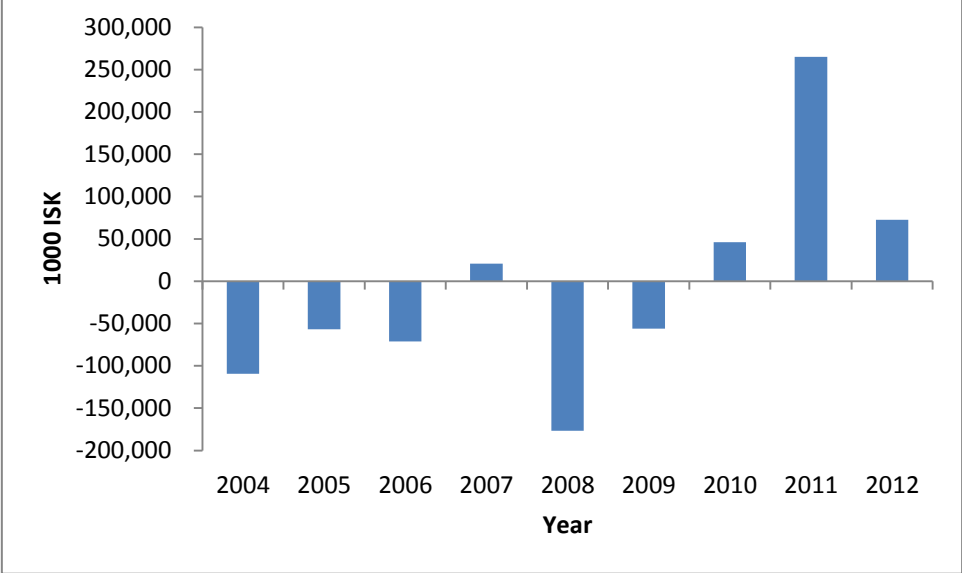


Figure 46. Financial outcome of Vopnafjörður municipality (inflation regulated for 2012 prices) (Steinsson, 2013a)

Even though there had been increased economic activity in the community, the municipality was still operated at a loss. It was not until 2010 when the municipality turned their operations around and that was mainly due to the fact that they sold their shares in HB Grandi which they got after the merger in 2004. With the sale, the municipality was able to pay down loans and therefore decrease capital cost. From 2010 to 2012 the municipality has generated profit.

9 ADAPTABILITY OF THE COMMUNITY

The story of the fisheries industry in Vopnafjörður has been a story of struggle over the years. The municipality is quite isolated and can be defined as a fisheries dependent community for the fisheries and related activity is significant for the area. The closeness to resources was an important factor in the development of settlement in Iceland as in other countries. The establishment of the municipality of Vopnafjörður was largely based on the closeness to the fishing grounds, which was important for the development of the fishing industry as it became the main industry in the municipality (Brookfield et al., 2005; Phillipson, 2000; Symes, 2000). Due to technological changes the importance of the closeness has decreased. Vessels have been more capital intensive and high tech, making land processing in some cases obsolete. The vessels can also stay on sea for long time making them less dependent to specific harbors that are close to the fishing grounds (Herbertsson & Eypórssón, 2003). For Vopnafjörður this was the case but has somewhat changed. Closeness to the fishing grounds for pelagic fisheries is seen as a benefit, as the quality of the catch largely depends on its freshness. This is for example the case for mackerel. Small pelagic species start to decompose quite quickly due to their feeding habits (feeding of krill). Shorter time from the fishing grounds to the processing is therefore a benefit. New technology such as cooling systems can though reduce such dependency (Guðmundsson et al., 2012).

The municipality of Vopnafjörður is a fisheries dependent community. The settlement started to grow during the last century due to increased activity in the fishing industry. The location to the fishing grounds was the major reason that the community settled for fisheries, even though that harbor conditions were not good. It might be said that this was a logical reason, since the community was able to utilize the resources in the area. The path for the community was set and they have ever since been quite reliant on fisheries, especially those living in the village. Decisions were made that shape the current state of the community, making it hard to change the path (Mahoney, 2000). This results in a lock-in, for the community is locked in a path that it hard to break out of, Vopnafjörður has relied on fisheries and will probably will do so further on (Liebowitz & Margolis, 1995; Mahoney, 2000). The path dependency of Vopnafjörður has shaped the economic development the region, at the same time the regions shape the processes of path dependence (Martin & Sunley, 2006). The development has been a positive lock in during the development of the industry and at the same time negative when the community experienced reduction in the fishing industry. That undermined the adaptability, competitiveness and productivity of the community. They managed though to turn the negative development around and today, the lock in has turned

out to be positive. The system might though become trapped, such as if a shock or a crisis appears in the industry. That might lead to that they cannot escape except through the intervention of some external force or shock that shakes the system into a new configuration or path (Martin & Sunley, 2006). Such external force might be an introduction of new industry in the area that would make the community more economically diverse and therefore more flexible to change the path of dependence and find a new equilibrium. Collective understanding and strategies can enhance the adaptive capacities to recognize and overcome the lock-ins (Hill et al., 2008; Pendall et al., 2010; Pike et al., 2010). Enhancement of adaptability and resilience could be a solution to break from current paths (Walker et al., 2004), creating more options of development for a community such as Vopnafjörður. Still, their path chosen seems to be quite beneficial for the community, especially due to positive impact of mackerel processing, something that came as an addition in the already established, path dependent, fishing community. It could be said that the mackerel processing locks the community even further in their current path.

Fisheries are essential foundation to the economic and the social structure. The community relies on the industry and difficulties in the sector can seriously undermine the socio-economic fabric. The fishing industry, and the company of HB Grandi is the largest employer in the community with 17,5% of the total workforce on their payroll. In addition the industry in Vopnafjörður is quite capital intensive (Lindkvist, 2000; Phillipson, 2000; Symes, 2000). Without employment, which the fishery industry provides, there is a possibility of out migration which affects the social life in the community (Urquhart et al., 2011). The fishing industry in Vopnafjörður is central to the community way of life and the community perspective is dominated by the fisheries. The fishing industry is the glue that holds the community together; it relies on the fishing industry for economic, social and cultural survival (Brookfield et al., 2005). Over the years there have been changes in the natural environment that have affected the industry and the socioeconomic system in the community (Perry & Ommer, 2010) Those changes might correlate with the decreasing of population in the community, as when there is less work, then people move away (Herbertsson & Eypórsson, 2003). In addition there have been changes in the fisheries industry, where it has been more capital intensive and more specialized (Perman et al., 2003). The changes in the fisheries sector in Vopnafjörður might somewhat be explained by the dynamics of economics of scale, where large scale industrialized fisheries and processing have replaced the mixed fisheries and processing from before. And now, the industry is owned by company based outside the community (Brookfield et al., 2005; Lindkvist, 2000; Symes, 2000)

In the modernized capital intensive fisheries management system in Iceland, resources became tied up in the regulative system as investment in the form of catch quotas (Charles, 2001; Einarsson, 2009). The community had to adapt to the system and be resilient enough to compete in the capital intensive environment, in which they failed. The industry became too capital intensive for the community to handle. They took risks that did not pay off. The company was bought by a neighboring company Eskja, which had not the best intentions for Vopnafjörður in mind, according to the local leaders at that time. Measures were taken to save the company and huge risk was taken when it was bought again from Eskja, weakening the position of the company, the municipality and the community in whole. Next steps were though successful and Tangi merged into HB Grandi. The side effect is though that the locals lost control of the company that had more or less been in their hands since its establishment.

The natural environment usually characterizes fishing communities such as Vopnafjörður. They base their livelihood on the resources available and do often show remarkable ability to adapt to social and ecological change, where social agency and social capital of the communities play a central role. The same applies to arctic and northern societies, and they have been identified as highly adaptive, resilient and with residents that are creative actors when it comes to their personal and communal fate (Csonka & Schweitzer, 2004; Einarsson, 2009). With that in mind, the community of Vopnafjörður could be defined as such as well, a northern fishing village that has little economic diversification and is reliant on fluctuating fish stocks

The community has experienced both social and ecological changes during the recent years. It is though debatable if the natural changes are induced by climate change or not. Still, there are changes and the community of Vopnafjörður, with the help of HB Grandi, have adjusted their behavior in response to such changes. They grabbed the opportunity that arose with those current positive changes, climatic or not. They have started processing mackerel, due to its migrating changes, benefitting the community. This is an adaptation that takes advantages of opportunities that might arise with climatic change and involves adjustments to enhance the viability of social and economic activities, such as with utilizing a new species like mackerel. As for the case of Vopnafjörður, then the adaptation has been reactive for the changes were not anticipated (Adger et al., 2005; Einarsson, 2009). The response to the natural changes was rapid and it took the processing company short time to adapt their processing to mackerel. They showed a great deal of adaptive capacity. The same could be said about the community, for the people working in the processing company were quick to pick up new processing methods and people were willing to work during the mackerel season. Young people came back during summer time in order to help and to get a well-

paid summer job. The municipality has also aided the company by assisting them with infrastructure changes that were necessary for the production, such as by replacing and updating the water system to the processing. There has been a strong collective action in the community in order to respond to the changes and to take as much benefit as possible from them. The community adapted to change (Adger et al., 2005; Einarsson, 2009; Watson, et al., 1996)

9.1 Vulnerability

The fluctuations in the fishing industry in Vopnafjörður have affected its vulnerability. The reason for this vulnerability might be due to lack of access to resources, natural and anthropogenic (Cutter et al., 2003). In this case, the resources could be described as fish and capital. The society of Vopnafjörður has been getting more vulnerable in demographic terms. The population has reduced the recent years but seems to be leveling off. Additional problem is that the most qualified individuals tend to be the most mobile ones. They might already have left due to lack of appropriate opportunities, and that might have affected the municipality of Vopnafjörður. The population is getting older which is an indicator of more vulnerability and the population is not properly gender balanced. Rural and resource extraction dependent areas, such as Vopnafjörður are also often described as more vulnerable than central, non-resource extraction communities or areas. Infrastructure and social institutions do also affect vulnerability, but they seem to be strong in Vopnafjörður (Cutter et al., 2003).

The vulnerability is also affected by the type of employment or economic diversity in the community. If employment is dependent on fluctuating factors, such as fluctuating fishing stocks, then it makes the society more vulnerable. This might be the case for Vopnafjörður, as they are hugely dependent on fluctuating pelagic stocks for their main industry. However, with the introduction of mackerel the vulnerability might be reduced since the processing is more diverse; downswing in one species might result with an upswing of another, or in other terms, the fluctuations become more stable since more species are utilized (Valtýsson, 2013b). But there is a difference between processing species such as mackerel or blue whiting, where mackerel is more valuable and labor intensive. Such fluctuations might be influenced by some natural changes, such as increased water temperature.

This has already happened with the introduction of the mackerel into the area and the changes turned to be positive. This meant increased access of natural resources for processing company. But, those natural changes can also increase the vulnerability of Vopnafjörður as they might be reversed.

It is not known if the changes are permanent or not and if the community becomes dependent on the processing and the species migrates back southeast, then it could have negative effects. In addition, the long term biological effects of the introduction of mackerel into Icelandic waters are not known. Therefore the system might still be quite sensitive to natural changes. That kind of vulnerability refers to the sensitivity of a social-ecological system to natural changes in climate, or to the degree of the response of a system to a change in climate (McCarthy et al., 2001). Vulnerability to climate change refers to the tendency of the social and ecological systems to suffer harm and the ability to respond to the stresses caused by climate change (Parry et al., 2007). In addition, it is suspected that the climate change impacts will affect populations that are already vulnerable to climate change. That includes marginalized groups or communities, such as fisheries dependent communities as Vopnafjörður, for they are usually seen as more vulnerable than more centralized communities. They are seen more vulnerable due to less capacity to deal with changes (Adger, 2006; Cutter et al., 2003; Symes, 2000). Reaching an international agreement about division of the mackerel catch would lead to more stability in the fisheries and benefit the community of Vopnafjörður and decrease natural induced vulnerability of the fluctuating stocks, such as mackerel.

In the case of Vopnafjörður, they have been able to respond positively to the changes, by engaging in mackerel processing. But the changes in the migrating pattern of mackerel are positive for the community. They have though been affected negatively before by changes in the natural environment, with the reduction of cod quota in 1987, but managed to cope. That might be largely due to the fact that the municipality was flexible to deal with such changes as the main owner of the fishing industry in the community, which they are not any more. Loosing ownership of the fishing industry in the community means that they cannot control their fate any more, they are reliant on outside anthropogenic factors, which leave them more vulnerable than before.

9.2 Resilience

The community of Vopnafjörður has over the years shown that it is quite resilient. It has been able to adapt to changes and maintain basic structure and functional integrity in face of outside disturbances (Magis, 2010; Perman et al., 2003). Resilient system, such as Vopnafjörður, contains the components needed to cope, adapt or reorganize, without changing the fundamentals in the system and to retain essentially the same function, structure, identity, and feedbacks. In short, resilient systems strive to stability (Adger, 2000, 2006; Berkes et al., 1998; Folke et al., 1996, 2002; Hill et al., 2008; Holling, 1973; Walker et al., 2004; Österblom et al., 2011).

The municipality of Vopnafjörður has shown resilience in times of trouble and they have managed over the years to secure the fishing industry in the community. This process has not been easy and they have suffered shocks on the way. There has been decrease in the population in the community and now they have lost control of the processing company, having to rely on outside actor, HB Grandi. They have though been lucky for HB Grandi has invested significantly in the community in order to establish a modern, automatic and capital intensive processing. This has led to positive development in the community, where out migration has leveled off and the municipality income has increased and their operations are run with profit.

This kind of resilience could be defined as regional resilience, which is connected to the regions or the community's ability to return to its previous level and/or growth rate of output, employment, or population in case of a shock. The regional resilience is an understanding of how power relations are within a community or a region. As for Vopnafjörður, the power relations are well combined, since the municipality had control over the largest employer in the community. The capacity of the municipality to react was high, since all the groups in the community agreed to secure the industry. The community developed a collective capacity to face the challenges and the small size of the community made it easier to do so (Adger, 2000; Hill et al., 2008; Magis, 2010; Pike et al., 2010).

The leadership of the municipality was strong in the time of change and they made correct decisions when faced with the threat of losing the industry from the community. Strong management and leadership helped build up the resilience capacity. Individual actors played a crucial role in providing the system with leadership, trust, vision and meaning (Folke et al., 2002; Folke, 2006; Pike et al., 2010). This was the case in Vopnafjörður when crucial local actors, along with the municipality officials, formed cohesion in order to save the industry. They served as a web that tied the adaptive governance system of the community together (Folke, 2006). The main problem is that with further reliance of the fisheries sector the social-economic system might become monotonous and therefore less resilient. The system needs to be able to adapt and be flexible in order to increase its resilience (Derissen et al., 2011; Folke et al., 2002; Perry & Ommer, 2010). Every system should though strive for stability and that is something that Vopnafjörður has been aiming for. Due to the reliance to the fisheries sector, that has natural and anthropogenic fluctuations, the municipality has had problems achieving stability. Coastal communities are usually dependent on coastal resources for their livelihood and dependency on a few natural sources decreases stability. That applies to in resource dependent systems such as Vopnafjörður (Adger, 2000; Folke et al., 2002).

Communities that are facing constant changes and challenges learn to develop resilience over time. They learn to use of resources that are available within the community by taking action. A community's resources are dynamic and can be developed, expanded, depleted or destroyed. This is the case for Vopnafjörður, as they have had to adapt to changes in the fishing industry more or less during the last century, and especially the last decades. A resilient community such as Vopnafjörður will influence its ability to successfully respond to change. This makes resilience critically important to the community and its social sustainability (Magis, 2010).

9.3 Adaptability

The story of the fisheries industry in Vopnafjörður has been a story of struggle. However the industry in Vopnafjörður has been able to face of change without a significant decline in the crucial functions (Folke et al., 2005; Walker et al., 2004). The fishing industry, processing and fishing, started as a cooperative but was later owned largely by the municipality. In 1984 the ownership of all the processing facilities and the vessels was merged into one local company, Tangi, where the majority of the company was owned by the municipality. By this action the municipality had full control of the majority of the fishing industry in Vopnafjörður, which was both pelagic and groundfish processing. From 1983 to 1987 there was a constant growth in the industry, until the TAC of cod was lowered. The TAC reduction came right after major investment in the company, both in the pelagic and the groundfish sector, along with some renovations of the local trawler. This was the first major shock that faced the company. The company, which was owned by the municipality, had to adapt to these changes in order to secure the industry in the community.

Since 1987 to 2004 the industry has been facing challenges and most of them have not been anticipated. From then, the community has been going through a reactive adaptation process (Smith et al., 2000). There has been a strong consensus in the community to secure the fishing industry, and in the way, the economic wellbeing. The adaptation process has been a collective action, non-stop throughout the years, consisting individuals in the community and the local municipality government, where the role of the community leaders has been important (Adger et al., 2005). The municipality was closely tied to the private sector as the major owner of the fishing industry in the community. The adaptation measures of the community focused on economic efficiency along with objectives to secure the industry and therefore livelihood in the community (Smith et al., 2000).

The adaptation strategy taken and its success, depends on how the action meets the goals and how others are affected by it (Adger et al., 2005). The Vopnafjörður adaptation strategy has been securing the settlement in the community and the goal for that is securing the fishing industry. The community took a high risk in order to secure ongoing processing in the community and they succeeded, but with a cost. The municipality lost control of the industry and now relies on an actor that is outside of the municipality which does not necessarily act with Vopnafjörður best intentions in mind. HB Grandi does what is best for them and does not have to take consideration the needs of the community. This could be identified as a negative externality in the adaptation process (Adger et al., 2005).

The aims and the decisions of the municipality in the adaptation process were in favor of the well-being of the community. In that sense, the assessment of adaptation is not purely economic, for there are some values that cannot be expressed by the market. Such values could be cultural and / or ethical (Adger et al., 2005). In the case of Vopnafjörður, the emphasis was on securing the settlement by being able to provide the people with job opportunities. They took action and risk to do so, for, as the director of the municipality stated “there was a thin line between make it or break it for the community”(Steinsson, pers. comm.). The action was collective, as the majority of the community leaders agreed upon what needed to be done. The social capital of those leaders were important in the adaptation process, as they knew what needed to be done and took action (Folke et al., 2005; Pike et al., 2010; Walker et al., 2004).

The effectiveness of adaptation can in some cases it can be directly measured, such as by the number of jobs created, migration pattern or revenue created by the adaptation action (Adger et al., 2005). As seen in the social an economic analysis, the adaptive action was a success. The municipality took a chance by buying up their shares in the company from Eskja, that resulted in a merger with HB Grandi. The introduction of the mackerel processing came as an addition and has been very positive for the community, something that might not have happened without a merger to HB Grandi.

The community has experienced both social and ecological changes during the recent years. It is debatable if the natural changes are induced by climate change or not. Still, there are changes and the community of Vopnafjörður, with the help of HB Grandi, have adjusted their behavior in response to the changes. They grabbed the opportunity that arose with those current positive changes, climatic or not. They have started processing mackerel that has changed its migration for the benefit of the community. This is an adaption that takes advantages of opportunities that might arise with climatic change and involves adjustments to enhance the viability of social and economic

activities, such as with utilizing a new species like mackerel. As for the case of Vopnafjörður, then the adaptation has been reactive for the changes were not anticipated. The planning horizons were short and the capital turnovers were high. HB Grandi adjusted relatively easily and quickly, which reflects the investment flexibility of the private sector, something that the municipality might not been able to do (Adger et al., 2005; Einarsson, 2009). The response to the natural changes was rapid and it took the processing company short time to adapt their processing to mackerel. They showed a great deal of adaptive capacity. The same could be said about the community, for the people working in the processing company were fast to pick up new processing methods and people were willing to work during the mackerel season. Young people came back during summer time in order to help and to get a well-paid summer job. The municipality has also aided the company by assisting them with infrastructure changes that were necessary for the production, such as by replacing and updating the water system to the processing. There has been a strong collective action in the community in order to respond to the changes and to take as much benefit as possible from them. The community adapted to change (Adger et al., 2005; Einarsson, 2009; Watson, et al., 1996)

The adaptation process can somewhat be explained in Figure 47. The community was facing changes and needed to react. From 1987 the municipality and the local fishing company had been striving to stability, which they managed not to do. The company of Tangi was weakened, but it had the municipality as a backup. Tangi and the municipality got weaker over the years and in the end lost control of the company to a neighbouring company, Eskja. Soon after they lost control they realized that there was a possibility that Eskja would split up Tangi and leaving little activity in Vopnafjörður. The locals responded to this threat, even though they were in quite weak to do so. They took a chance by taking loans and giving up quota in exchange of gaining control of Tangi again. This chance paid off in the end, as it led to a stabile situation where they merged into HB Grandi.

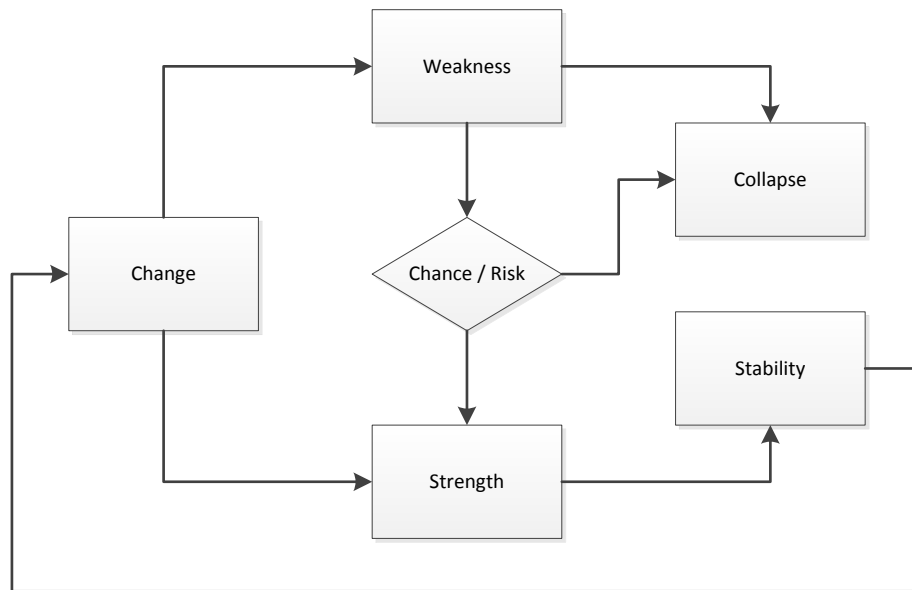


Figure 47. Adaptation process in face of change where strength leads to stability and weakness to collapse. Taking a chance in a weak situation can turn it into strength and therefore stability. Chance can also lead to collapse (Arnarsson, 2013)

HB Grandi has in turn invested hugely in the processing facilities of Vopnafjörður. Currently the processing is doing well and both municipality and HB Grandi officials are satisfied. But with a changing environment this might not become the case, as the municipality and the community has no bargaining power anymore. They have lost control of the fishing industry, which at the moment is prospering. If a similar shock would occur again, then the community would perhaps be too weak to face the change.

9.4 Adapting to mackerel

As mentioned before, the community and HB Grandi adapted to the mackerel processing quite easily. HB Grandi had already made decisions of investing in Vopnafjörður and the processing facilities, both for freezing and fish meal production were up to date. HB Grandi officials saw an opportunity in mackerel processing and they responded. They adapted their processing quite fast to mackerel and minor adjustments were needed in order to process the mackerel for human consumption. The fish meal factory could process the species right away, as it did in the beginning. All investment that has been directed at mackerel has already paid off and it did so in two seasons. HB Grandi had (and has) in addition control over a pelagic fleet with a high fishing capacity. The company has also good access to markets and the director has mentioned that they get good prices for their product. HB Grandi had in fact all that was needed to start the processing; fleet, processing facilities, capital and access to markets.

10 DISCUSSION

The story of the fishing industry in Vopnafjörður has been a story of struggle over the years. The industry has been facing challenges since its establishment, both natural and anthropogenic. In the beginning it was harbor facilities that hindered development of the industry. Later on the quota reduction of cod was a challenge for the community, which had to find alternative ways to secure fish processing. Later, market related challenges rose, which might have been long term results of the natural challenges that the industry faced. The market related, or anthropogenic challenges have been the most challenging for the industry. The municipality was in threat of losing the industry from the community because the locals lost control of the local company Tangi. Tangi was bought by a neighboring fish processing company and the locals were rather skeptical about the purchase and were worried that the quota, that Tangi had been allocating over the years, would be moved away from Vopnafjörður and therefore ruin the industry and threaten settlement in the area. The locals took a collective action where the community leader and the municipality officials decided to buy the shares of Tangi again from Eskja in order to secure the company, its facilities, vessels and quota in Vopnafjörður. The community managed to bring the company back into local control, but at cost. The municipality put itself heavily into debt by buying the share of the company back and lost 1/3 of their capelin quota. The locals knew that the existence of the settlement in Vopnafjörður was largely dependent on the fishing company Tangi and therefore they were willing to take such a large risk to secure its continued existence. The risk that the community took led to operating troubles in the company. Two alternatives were in the position for securing the industry; either sell the groundfish or the pelagic processing away from the company or to get a large investor with mutual interests of the community to operate in Vopnafjörður. They were fortunate enough that fishing company HB Grandi was seeking for a location for their pelagic operations and saw their interests in building up the sector in Vopnafjörður. This resulted in a merger of the two companies, which was a successful and easy process, where both partners were satisfied.

This was a huge challenge for the community and there was a thin line between making or breaking it. Fortunately for Vopnafjörður, they made it, but with a cost. In this process they lost control over the fishing industry for the second time. Vopnafjörður is a fisheries dependent community and they took action to secure their dependent resource. The fishing industry had been facing many challenges and they needed to adapt. The adaptation had always been reactive, except when the company was bought again from Eskja, where they took an anticipated action. The community took its path towards the fishing industry and it has been adapting towards it ever since, with direct help of the municipality. Now the municipality is free in way to focus on other matters and might perhaps

work on diversifying the economy. But losing control over the industry might increase the vulnerability of the community since they cannot control the fate of the industry anymore. The company is run from Reykjavík and it can only be assumed that they run it in their best interests, not for the sake of Vopnafjörður. The social perception will be quite different, where access to company was easier before. The community is however resilient. They have managed to adapt to changes and maintained basic structure and functional integrity in face of outside disturbances. The community seems to be resourceful and has strong leadership.

Mackerel has had positive social and economic impact on the community of Vopnafjörður. More jobs are available and out migration seems to have leveled off. This has though led to housing scarcity in the community which is probably temporal. Mackerel processing has led to general positive economic effects and people seem to notice that, and future perceptions in the community are bright. Not many negative aspects rise, except for less interest of the community to participate in social events. There is some competition for labor and innovation seems to be low. Those issues could though only be temporal since the mackerel processing has not been ongoing for long and the community might be in some kind of transition. The introduction of mackerel will increase the stability in the community since it lengthens the processing season. In addition, more species available for processing will result in a better stability for HB Grandi due to the fluctuating nature of pelagic species. Mackerel will also decrease the vulnerability of the community, since it promotes stability. Mackerel processing will also strengthen the status of HB Grandi in Vopnafjörður where it comes as an addition into their operations. With that, the company has more reason to stay in the area. The processing of mackerel is lucrative and creates revenue for the company. HB Grandi adapted relatively easy to the processing.

If the new migration pattern of mackerel is permanent then it will have positive effects on the processing in Vopnafjörður. The community could start to prepare itself better for the season in order to face the massive inflow of workers during that time. It would promote more stability in the operations of the company and better planning could be done, such as for marketing. The same stability could be reached if division of quota between the coastal states could be agreed upon. With an agreement, a long term planning could be made. That would promote stability, both in the community and for the processing company, even if the migration patterns changes. Reaching an agreement would therefore be very positive for a community such as Vopnafjörður.

In general the establishment of HB Grandi and the start of mackerel processing in Vopnafjörður are seen as positive. Without the establishment of HB Grandi in the community there might have been a

possibility that Vopnafjörður would not have been able to participate in mackerel processing. As the situation was at Tangi after the buy of the company from Eskja, it can be doubted that the mackerel processing in Vopnafjörður would have started, at least not at the same capacity as with the support HB Grandi. The municipality put itself heavily into debt by buying the share of the company back from Eskja and the actions were not as successful as originally thought. The large debt and difficult operating conditions of the company made it clear that further actions were needed. The financial capacity of the company of that time was extremely low and all the local benefactors had already put themselves in huge debt. The only solution without outside investment was some kind of reformation of the company, where either the groundfish or the pelagic part would have been sold. Even after such action it is doubtful that Tangi would be able to adapt their processing facilities to mackerel processing. They would have been able to process the fish into meal in the start, but in 2011 a new regulation was imposed that states that at least 70% of all mackerel landed should be processed for human consumption. They might have been able to adapt their facilities, but it is hard to say if it would be up to the same capacity as HB Grandi did. Without any radical changes, there might not have been as significant mackerel processing in the municipality. It can therefore be speculated that the adaptation process of securing the fishing industry in the community, with the income of HB Grandi has therefore been a long going process to adapt to mackerel processing in Vopnafjörður. Without changes, there might not have been any mackerel processing and therefore not the same positive social and economic effects.

The important issue is to gain more stability in fisheries dependent communities such as Vopnafjörður. Therefore it is important to be able reach agreement on utilization of species that become available, such as with the mackerel. The impact of processing the newly established species of mackerel in Vopnafjörður has been positive and it would be interesting to see if similar communities share the same experience. There might be different cases and situations in other places but further research would give better insight of the changing environment for fisheries dependent regions and communizes.

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12 APPENDIX

Staff survey

Kæri starfsmaður HB Granda á Vopnafirði

Sigmar Arnarsson heiti ég og er nemandi við Háskólann í Tromsø í Noregi og er að skrifa meistararitgerð um áhrif makrílvinnslu á samfélagið á Vopnafirði. Í því samhengi er ég að athuga viðhorf starfsfólks landvinnslu HB Granda í garð ýmissa málefna tengdum makrílvinnslunni. Mig langar því að biðja þig um að hjálpa mér og svara eftirfarandi spurningalista. Þú þarft ekki að svara einstökum spurningum eða spurningalistanum í heild.

Fullum trúnaði er heitið og ekki verður hægt að rekja svör til svarenda.

Almennar spurningar.

1. Kyn

Karl Kona

2. Fæðingarár

3. Núverandi búseta (póstnúmer)

Eftirfarandi eru almennar spurningar um upplifun þína gagnvart HB Granda. Spurningarnar eru á skalanum 1 – 10, þar sem 1 er lægst og 10 er hæst. Vinsamlegast dragðu hring utan um viðeigandi svar.

4. Á skalanum 1 – 10, hver er almenn upplifun þín gagnvart fyrirtækinu HB Granda?

Mjög neikvæð 1 2 3 4 5 6 7 8 9 10 *Mjög jákvæð*

5. Á skalanum 1 -10, hversu lítil eða mikil áhrif telur þú að HB Grandi hafi haft áhrif á sveitarfélagið?

Jákvæð

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Neikvæð

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Engin áhrif

6. Á skalanum 1 -10, hversu mikilvægt telur þú að fyrirtækið HB Grandi sé fyrir sveitarfélagið?

Ekki mikilvægt 1 2 3 4 5 6 7 8 9 10 *Mjög mikilvægt*

Eftirfarandi spurningar eru almennt um makrívinnslu á Vopnafirði. Spurningarnar eru á skalanum 1 – 10, þar sem 1 er lægst og 10 er hæst. Vinsamlegast dragðu hring utan um viðeigandi svar.

7. Á skalanum 1 -10, hversu mikilvæga telur þú makrívinnsluna vera fyrir HB Granda?

Ekki mikilvæga 1 2 3 4 5 6 7 8 9 10 *Mjög mikilvæga*

8. Á skalanum 1 -10, hversu lítil eða mikil áhrif telur þú að makrívinnsla á Vopnafirði hafi haft á eftirfarandi atriði fyrir sveitarfélagið?

Efnahagsleg?

Jákvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Neikvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Engin áhrif

Atvinnu?

Jákvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Neikvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Engin áhrif

Önnur fyrirtæki?

Jákvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Neikvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Engin áhrif

Húsnæði?

Jákvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Neikvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Engin áhrif

Íbúafjöldi?

Jákvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Neikvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Engin áhrif

Lífsskilyrði?

Jákvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Neikvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Engin áhrif

Annað, hvað?

Jákvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Neikvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Engin áhrif

9. Á skalanum 1 – 10, hversu mikilvæga telur þú makrívinnsluna vera fyrir sveitarfélagið?

Ekki mikilvæga 1 2 3 4 5 6 7 8 9 10 *Mjög mikilvæga*

10. Á skalanum 1 – 10, hversu lítil eða mikil áhrif telur þú að eftirfarandi atriði geti haft áhrif á makrívinnslu á Vopnafirði?

Breytingar á fiskveiðistjórnunarkerfi?

Jákvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Neikvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Engin áhrif

Samningastaða Íslands í makríldeilu?

Jákvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Neikvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Engin áhrif

Innganga í Evrópusambandið?

Jákvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Neikvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Engin áhrif

Núverandi efnahagsástand?

Jákvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Neikvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Engin áhrif

Breytingar á göngumynstri makríls?

Jákvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Neikvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Engin áhrif

Loftslagsbreytingar?

Jákvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Neikvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Engin áhrif

Veiði umfram ráðgjöf Alþjóðahafrannsóknaráðsins (ICES)?

Jákvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Neikvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Engin áhrif

11. Telur þú að sveitarfélagið hafi haft áhrif á makrívinnslu á Vopnafirði?

Já

Nei

12. Ef já við spurningu 11, á skalanum 1 – 10 hversu lítil eða mikil áhrif telur þú að sveitarfélagið hafi haft á makrívinnslu á Vopnafirði?

Jákvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Neikvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Einhver sérstök jákvæð eða neikvæð áhrif, hver?

13. Á skalanum 1 -10, hversu mikið eða lítið telur þú að aðkoma stjórnvalda að makrívleiðum hafi hjálpað makrívinnslu á Vopnafirði?

Mjög lítið 1 2 3 4 5 6 7 8 9 10 *Mjög mikið*

14. Hversu mikið telur þú að aðkoma stjórnvalda að makrívleiðum hafi hjálpað makrívinnslu á Íslandi?

Mjög lítið 1 2 3 4 5 6 7 8 9 10 *Mjög mikið*

Persónuleg og almenn fjárhagsleg áhrif makrívinnslu á Vopnafirði. Spurningarnar eru á skalanum 1 – 10, þar sem 1 er lægst og 10 er hæst. Vinsamlegast dragðu hring utan um viðeigandi svar.

15. Hefur þú unnið við makrívinnslu á Vopnafirði

Já

Nei

16. Hefur fjárhagsleg staða þín breyst með tilkomu makrívinnslu á Vopnafirði

Já

Nei

17. Ef já við spurningu 16, á skalanum 1 – 10, hversu lítið eða mikið hefur fjárhagslega staða þín breyst með tilkomu makrívinnslu á Vopnafirði

Jákvæð breyting

Mjög lítið 1 2 3 4 5 6 7 8 9 10 *Mjög mikið*

Neikvæð breyting

Mjög lítið 1 2 3 4 5 6 7 8 9 10 *Mjög mikið*

18. Hver er fjárhagsstaða Vopnafjarðarhrepps á Íslandi að þínu mati?

Mjög slæm 1 2 3 4 5 6 7 8 9 10 *Mjög góð*

19. Hver er staða efnahagsmála á Íslandi að þínu mati?

Mjög slæm 1 2 3 4 5 6 7 8 9 10 *Mjög góð*

Eftirfarandi eru spurningar um loftslagsbreytingar og áhrif þeirra. Spurningarnar eru á skalanum 1 – 10, þar sem 1 er lægst og 10 er hæst. Vinsamlegast dragðu hring utan um viðeigandi svar.

20. Á skalanum 1 – 10, hversu meðvituð/aður ert þú almennt um loftslagsbreytingar?

Mjög lítið 1 2 3 4 5 6 7 8 9 10 *Mjög mikið*

21. Á skalanum 1 – 10, hversu lítil eða mikil eru að þínu mati áhrif loftslagsbreytinga?

Jákvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Neikvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Engin áhrif

Einhver sérstök jákvæð eða neikvæð áhrif, hver?

22. Hversu mikil áhrif telur þú að loftslagsbreytingar geti haft áhrif afkomu þína í framtíðinni?

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

23. Á skalanum 1 – 10, hversu lítil eða mikil áhrif telur þú að loftslagsbreytingar hafi á eftirfarandi atriði á Vopnafirði?

Atvinnu?

Jákvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Neikvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Engin áhrif

Lífsskilyrði?

Jákvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Neikvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Engin áhrif

Búsetuskilyrði?

Jákvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Neikvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Engin áhrif

Veðurfar?

Jákvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Neikvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Engin áhrif

Önnur áhrif, hver?

Jákvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Neikvæð áhrif

Mjög lítil áhrif 1 2 3 4 5 6 7 8 9 10 *Mjög mikil áhrif*

Engin áhrif

24. Eitthvað að lokum?

Kærar þakkir fyrir þátttökuna