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“Fish and folk”

Fisheries policy and its influence on employment and settlement in fisheries dependent societies in The Faroese Islands, Iceland and Norway

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Summary/recommendation:

The overall aim of this project is to facilitate research on the influence of fisheries policy on employment and settlement in fisheries dependent societies in Norway, Iceland and the Faroese Islands.

By combining fisheries data and population data at the municipal level in Norway, we have shown that it is possible to study whether and how strongly the development in fisheries impacts relative population growth. We find that it is the general trends of urbanization and centralization, more than the development in the fisheries industry, that influence the development.

The project has also identified data sets for Iceland and the Faroe Islands which makes it possible to carry out similar multivariate regression analyses. This will make it possible to compare results between countries.

Summary/recommendation in Norwegian:

Det overordnede målet med dette prosjektet er å legge til rette for forskning på i hvilken grad fiskeripolitikk påvirker sysselsetting og bosetting i fiskeriavhengige samfunn i Norge, Island og Færøyene.

Gjennom å kombinere fiskeridata og befolkningsdata på kommunenivå i Norge, har vi vist at det er mulig å studere om og hvor sterkt utviklingen i fiskeriene påvirker relativ folketallsutvikling. Vi finner at det er de generelle sentraliserings-trendene, mer enn utviklingen i fiskerinæringen, som påvirker utviklingen. Vi viser også at det finnes tilgjengelig tilsvarende datasett for Island og Færøyene som gjør at det også er mulig å gjennomføre tilsvarende analyser for å sammenligne resultater landene imellom.

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1 Background and project goals

1.1 Background

The design of instruments in fisheries policy is often believed to be of great importance to the settlement pattern the Faroe Islands, Iceland and coastal Norway. In the public debate on fisheries policy, developments in both the fishing industry and local communities are often compared between the countries, where differences in the use of policy instruments are used to explain differences in the profitability of the fishing industry, in employment and in the development of settlements in fisheries-dependent communities in each country. Although there are many similarities that make comparisons relevant, there are also major differences in conditions given by nature (population size, distance to fishing grounds, natural harbours, distance to market, etc.), history and macroeconomic conditions. Although the countries/regions can be characterized as small open economies, the differences are still large regarding size of population and in economic development. The oil economy has characterized developments in parts of coastal Norway. To some extent the labour market in the Faroe Islands is also under influence of the North See oil industry. Iceland has seen the growth of aluminium and tourism, to add to the role of fisheries in maintaining population in remote areas. A common trait is the role of the fisheries industry, and it's significant role in the development of economy, employment and settlement.

In small open economies, all industries are subject to efficiency pressures. This has been further strengthened by global division of labour and a high Nordic cost level. In a situation where fishery resources are fully utilized, increased productivity leads to continuously reduced employment. At the same time, it is commonly expected that the fishing industry will continue to secure settlement in fishing communities.

In this report we compare the role of the catch and processing sector in employment and settlement in fisheries-dependent regions in the Faroe Islands, Iceland and in coastal Norway in order to elucidate and foresee similarities and differences between countries. We look at whether different fisheries policies and different macroeconomic conditions have different effects on economic goals and for the importance the sector has as a regional policy instrument.

Nofima has for a long time worked on the above-mentioned issues for Norwegian conditions. This has resulted, among other things, in the book Fisken og folket ("The Fish and the People") (Iversen *et al.,* 2016) and reports on structural change in the fishing fleet (Iversen *et al.,* 2018b) and it´s consequences for processing industry and coastal societies (Iversen *et al.,* 2018a).

Comparison between countries could provide new insights into the fisheries policy debate. At a time when objectives and instruments in fisheries policy are under intense discussion, this is very relevant. The work has benefited from coordination with ongoing and already financed work on for instance the effects of structural measures for the fishing fleet.

1.2 Project goals

The project goals are the following:

1. To present comparative statistics on economic performance, employment and population

2. Hold a seminar for researchers, authorities and stakeholders
3. Initiate social science research on the combined effect of fisheries policy and general economic and societal trends on population.

Comparative statistics (goal 1) is presented in sections 2 through 4, for Norway, Iceland and the Faroes, respectively. The description includes development in the catch and processing sectors, employment development (by sector of the economy) and settlement in fisheries dependent regions in the Faroe Islands, Iceland and in coastal Norway. It will also present and compare some aspects of economic development, as well as development in important features of the fisheries policy between countries.

A presentation (goal 2) was given at Nordic Council of Ministers' ITQ conference in Stockholm, in October 2018 (ref). The presentation can be found in Appendix 2.

As for the third goal, we found that we could not just initiate research, but actually perform part of the research potential identified through the project.

The size and scope of the project does not allow for thorough comparative analysis but was meant to pave the ground for such analysis. When we started the work to map readily available sources for demographic time series at the lowest possible geographic level, we contacted "The Stein Rokkan Research Group for Quantitative Social and Political Science[1]" at the UiT - The Arctic University of Norway (Tromsø). In cooperation with them we decided to produce a paper, presenting a multilevel time-series analysis measuring the effect of fishery activity on relative population growth at municipality level in Norway. This could be done because longitudinal data sets describing fishing activity can easily be compiled with demographic data at the municipality level, and that the method had already been used to study comparable phenomena. Datasets describing the fishing industry (landings, employment (in the fleet and possessing plants) were available from other studies[2]. Our ambitions were to test this approach on Norwegian data, and then to organize similar data sets for the Faroe Islands and Iceland for use in future projects. This will provide opportunities both to test the same model as used on the Norwegian data set and to conduct comparative studies.

This work led to the publication of an article in Marine Policy: "The growth and decline of fisheries communities: Explaining relative population growth at municipality level (Iversen et al 2020). The article is based on data on population and key employment indicators of every Norwegian municipality in addition to fisheries catch, landings and employment. Methods and conclusions will be presented here and serve as an example of data sets and analytical methods that can be used to better understand the relationship between the fishing industry and settlement in developed economies. Chapter 5will thus describe an approach for future Nordic co-operation on how to be able to compare and analyse which factors have an impact on how the fishing industry performs on economic parameters and on the importance of the fisheries industry for population development and its suitability as a regional policy instrument.

[1] http://site.uit.no/rokkangruppen/

[2] "Future effects of structural changes in the fishing fleet and the processing industry": https://www.fhf.no/prosjekter/prosjektbasen/901266/

2 Norway

The fisheries industry in Norway (fishing and processing) is in transition, with one exception: fully utilized fish stocks means quite stable landings. Annual landed value in the period from 2003 to 2017 has increased, though, to close to 18 billion NOK in total, with whitefish as the largest category at close to 12 billion NOK. Prices have in general increased through, but with significant variation, as prices fluctuate from year to year. The value of landings increased quite steeply in three parts of this period. From 2003 to 2005 as prices for cod, herring and mackerel increased, from 2009 to 2011, when the quota for cod was steeply increasing, and from 2013 to 2017 with increasing prices for cod. The value in 2017 is about twice as high as in 2003, the poorest year within this window.

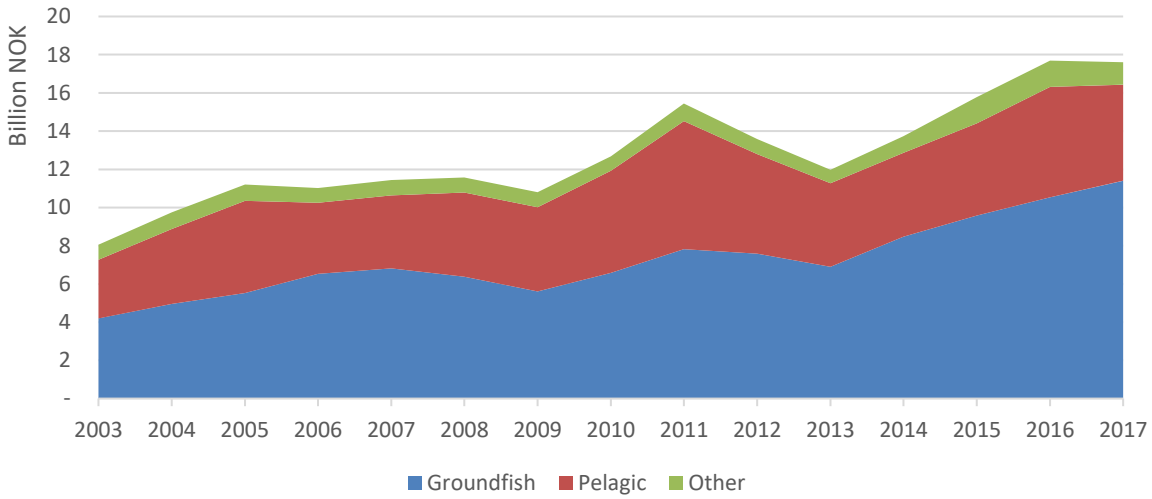

Figure 1 Value of landings in Norway (Source: Nofima/Directorate of Fisheries/SSB)

Even with increased value of landings, the number of fishing vessels has been reduced by 40% during the same period. Quotas for a large part of the fleet, coastal vessels between 15 and 28 meters, was made partly transferable from 2004, creating a process of quota consolidation as well as scrapping and renewal. The number of fishers was not as strongly reduced (but was still reduced by 30%), as many vessels with higher quotas employ more fishers, some of them running two shifts (with the added benefit of more time off and more regular work time for the fishers remaining)[3]. While the number of fishers was reduced by 30%, employment in the fish processing industry was reduced by 18% from 2003 to 2013.

[3] This is not dissimilar to the experience in several Alaska fisheries, where it seemed that a large part of the over-capacity was in terms of floating steel, but where a system with catch shares leads to a longer season (Birkenbach *et al.,* 2017), with fewer but steadier jobs (Abbott *et al.,* 2014).

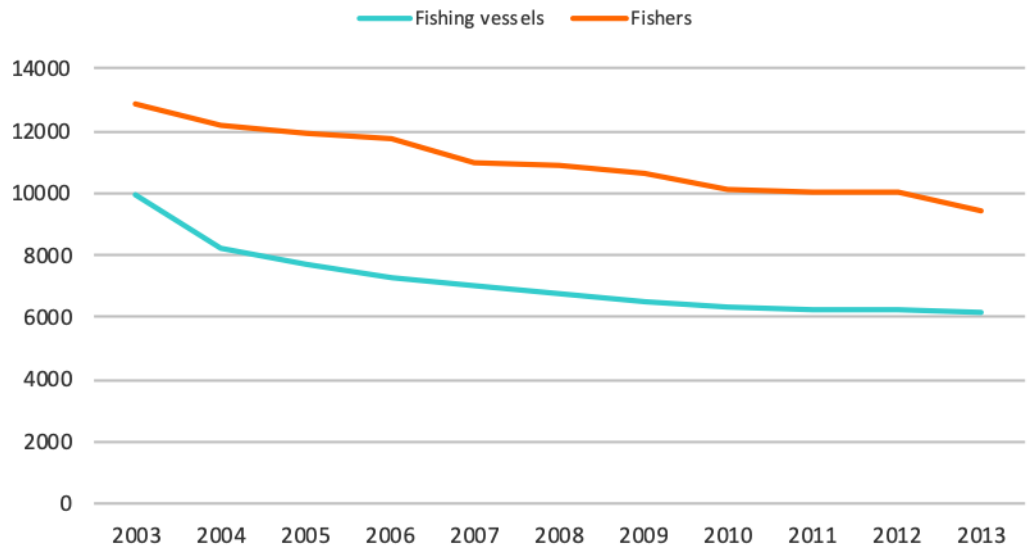

Figure 2 Fishing vessels registered and number of fishers (Sources: Fishing vessels: the Directorate of Fisheries. Fisheries: Statistics Norway[4])

The reduction of fishermen is a result of opposing trends; while young people are increasingly attracted to fisheries as crew members, as pay is very good (Nielsen *et al.,* 2018), the increased productivity from restructuring schemes and the increasing value of fishing rights leads to reduced entry from younger fishers.

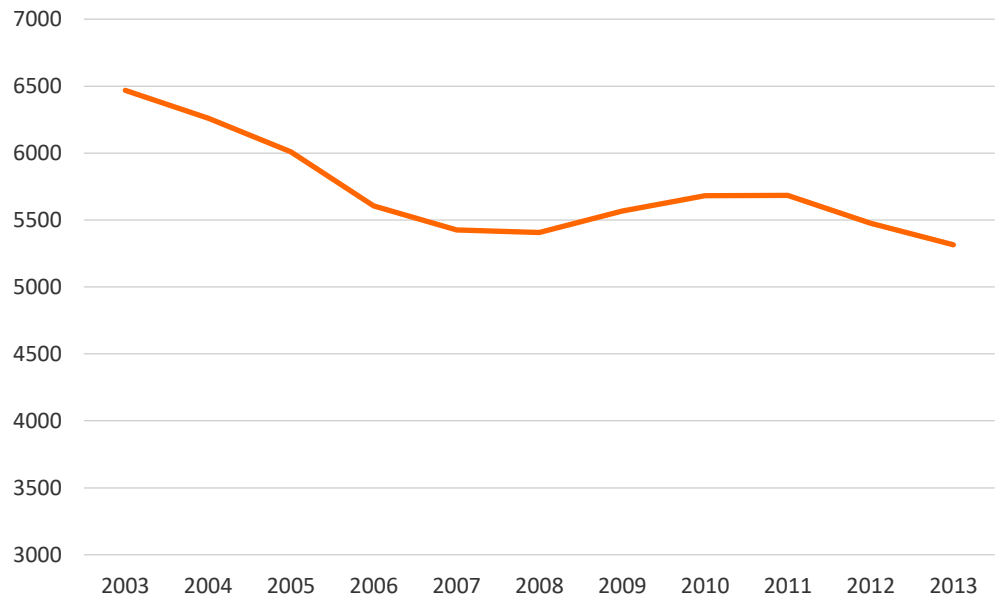

Figure 3 Employees in the Norwegian fish-processing industry (Source: Statistics Norway)

[4] The Directorate of Fisheries maintains a register showing who have fishing as main occupation as well as secondary occupation.

Even though employment in processing showed increase around 2010/2011, there is a marked reduction and a substantial change in the composition and location of the processing industry. Landing and processing of fish is concentrated to fewer and larger facilities, meaning also that some municipalities increase their activity, while some reduce or even lose activity altogether (Cojocaru *et al.,* 2018a). As shown in table 1, while the number of processing plants was almost halved, an estimated 20 municipalities lost all their processing activity in the period between 2003 and 2013.

Table 1 Number of processing plants in Norway and number of municipalities with fish-processing industry (Source: Nofima)

		2003	2005	2010	2015
Number of processing plants	Groundfish	432	418	311	288
	Pelagic	42	39	38	24
Municipalities with fish-processing industry		145*	140	128	122

* this number is from 2000, the actual number for 2003 is thus somewhere between 145 and 140

That fisheries activity is concentrated to fewer fisheries municipalities, means that some of the remaining fishing municipalities may have growing fisheries activity. On the other hand, fisheries activity also is shifted from smaller, dependent fisheries municipalities to larger municipalities or regional centers, with a more diversified economy, i.e. cities like Tromsø, Bodø and Harstad (Iversen *et al.,* 2016).

Population in Norway is steadily growing, but growth is unevenly distributed. Figure 4 below shows growth in four size-groups of municipalities. These panels show two things: 1) that growth increase with size (and that size is probably the greatest predictor of growth) and that fisheries-dependent communities grow less (or decrease more) than other communities of similar size.

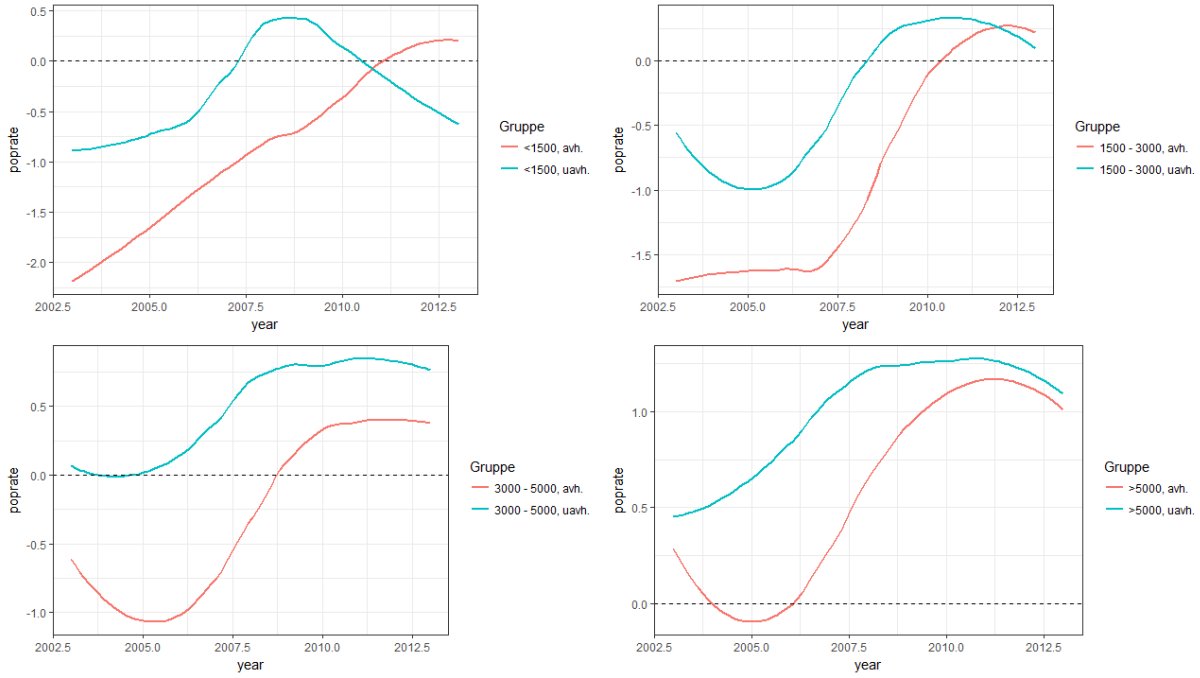

Figure 4 Population growth (net, relative growth) by municipality size

An important finding is that fisheries activity does not have a strong influence on population growth (Iversen *et al.,* 2020).

As shown by (Stein, 2019), the larger municipalities in Northern Norway has been the drivers of demographic development for the last decades. The growth is mainly fueled by natural increase (i.e. birth minus deaths) and net migration from Eastern Europe. Either way, such rapid structural changes present a good opportunity to investigate the existence and degree of influence of fisheries activities on population development.

3 Iceland

The fishing industry in Iceland (catching and processing sector) is in transition, with major investment ongoing in both sectors, as well as consolidation and optimization where companies are overall becoming fewer and bigger. The fisheries management system in place is an individual transferable quota system (ITQ) that is intended to facilitate a sustainable and profitable industry. One aspect of that is the long-term planning concept, where operators should be able to take informed decisions on their operations based on their quota share, given that stocks are relatively stable between years. The predictability has been fairly good over the last decade, as shown in Figure 5, with gradual overall increase in value. The rebuilding of the cod stock, sustainable utilization of most other stocks and good market conditions have resulted in higher landing values, with the landing value in NOK for example increasing by 50% from 2008 to 2018.

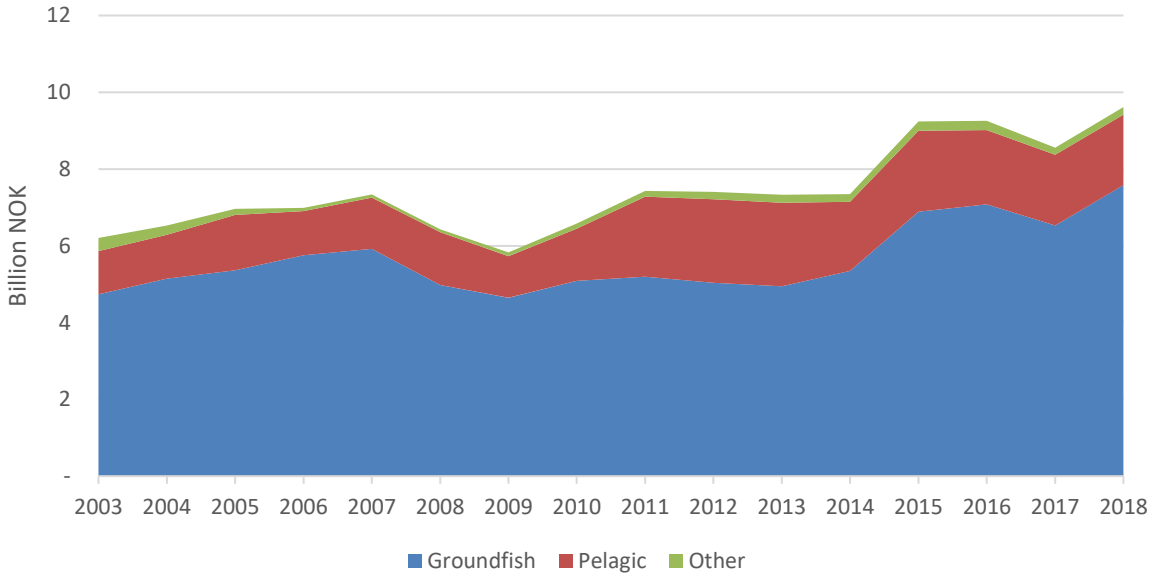

Figure 5 Value of landings in Iceland (average annual exchange rates applied)

Presenting value of landings in NOK does however not capture clearly how the landing value and operational environment has been in the Icelandic industry over the past decade, as both NOK and ISK have been rather "unstable" at times during the period in question. The highest landing values in ISK were in fact during the period 2011–2012 when the Icelandic currency was very weak, whilst capelin and mackerel were extremely strong.

Annual landing value in the period from 2003 to 2018 was on average about 11.5 billion NOK in total, with groundfish as the largest category, at about 8.5 billion NOK. The landing value of the groundfish catches have remained relatively stable over the past two decades, though with gradual increase since 2014, mostly due to higher cod catches and favourable market prices. The landing value of pelagic catches grew significantly in 2008–2011 following the arrival of mackerel into Icelandic waters. Pelagic fisheries are typically subjected to fluctuations, which are often explained by environmental factors; capelin catches in Icelandic waters have for example always been characterized by severe variability where catches can fluctuate from one million tons a year to no catch at all; herring and blue whiting catches can also fluctuate substantially, but usually not to the same extremes as capelin.

Cod is by far the most important stock in the Icelandic fishery, representing 45% of the landing value in 2018, whilst the second and third most valuable species were haddock and mackerel, representing about 8% of the total landing value, as shown in Figure 6.

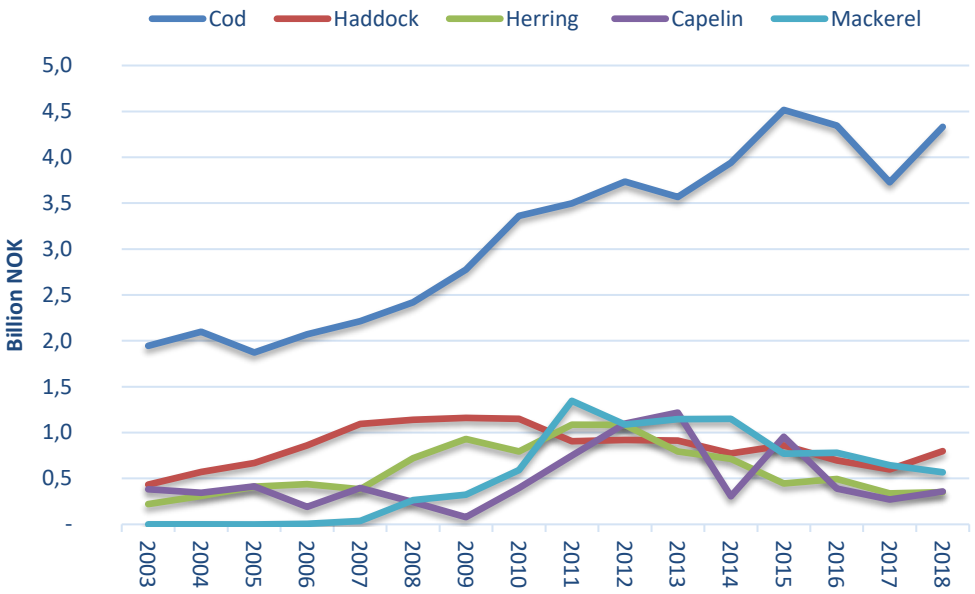

Figure 6 Landing value of the most important fish stocks in Iceland (average annual exchange rates applied)

Even though landing values have been steadily increasing, the number of fishing vessels, fishermen and fish factory workers has been decreasing. In 2003 there fishing fleet included a total of 1,872 vessels, of which 1,356 were allocated quotas. In 2018 the fleet had reduced to 1,588 registered vessels and 540 vessels with allocated quota. This in fact means that majority of fishing vessels are now operated without having permanent quotas e.g. recreational vessels; and that the commercial fleet has decreased by 60%, as shown in Figure 7.

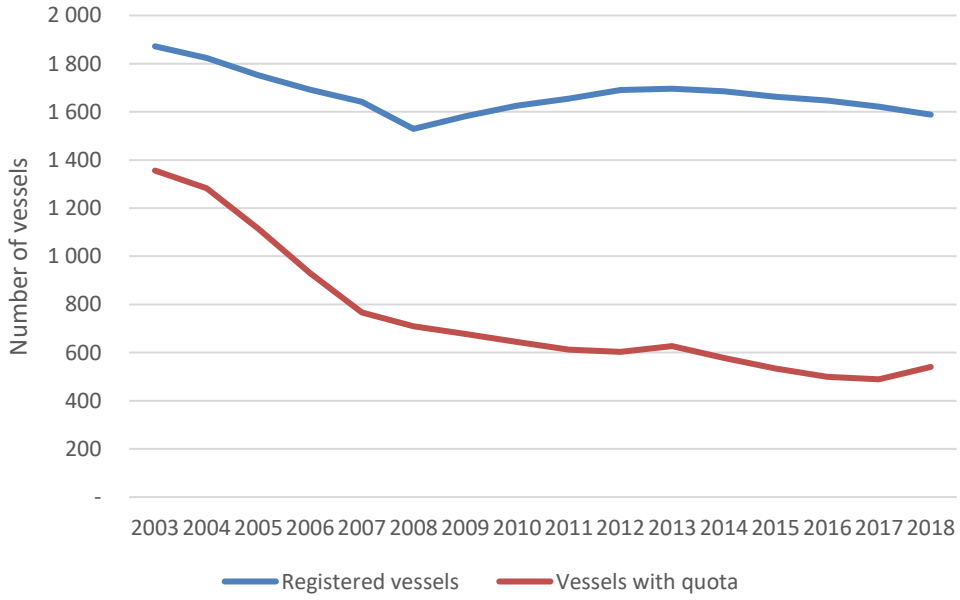

Figure 7 Number of registered fishing vessels and vessels with allocated quota 2003–2018

There has been major investment in recent years in pelagic vessels and wetfish trawlers, resulting in fewer and better equipped vessels. The factory trawlers have on the other hand been reduced by around 70%, with little investment in new vessels. The general trend seems to be that frozen-at-sea is not able to compete with land-based processing. This reduction in the number of fishing vessels does however not seem to have much effect on the number of fishermen in the fleet. The reason is that most of the vessels today have two crews, instead of one. The mentality has also changed, so fishermen are more likely to skip fishing trips, which rarely happened in the past. This has the effect that there are temporary replacement workers needed.

A similar trend has been seen in the processing sector, where smaller processors are struggling and leaving the sector, whilst the bigger operators are becoming bigger. There is significant investment taking place in atomisation in the industry, which has the effect that throughput has been increasing by over 100% with the same number of staff. In early 1990's there were over 400 processing plants (licences) in Iceland but less than 200 are operated today. The saltfish processors have declined by three-fourth and land-based freezing by 60% at the same time. But land based fresh fish production have been increasing in the ground fish fisheries, and shift from fish-meal production (animal feed) to production for human consumption have been the trend in the pelagic industry.

In the mid-1990's the total number of fishermen and fish factory workers was around 17,000, but today they are around 8,000. for the past 15 years, the number of full-time fishermen has been relatively stable between 4,000 and 5,000. Fish factory workers have however decreased from 5,400 to 2,900, which is a 45% reduction. Figure 8 shows the number of workers with fisheries or fish processing as main occupation in the period 2003–2018.

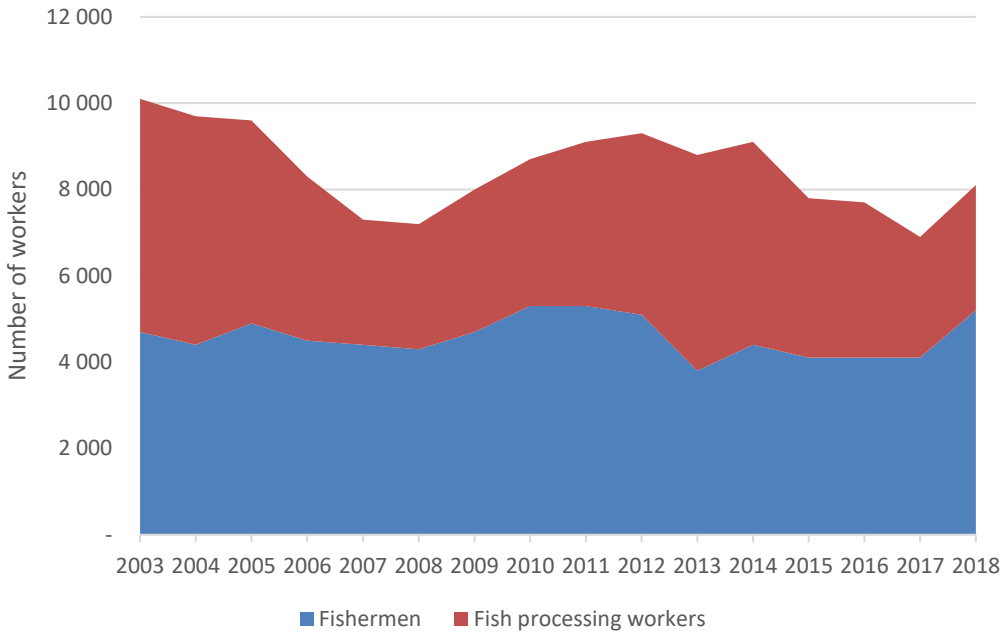

Figure 8 Number of workers with fisheries or fish processing as main occupation in the period 2003–2018

The consolidation and optimisation that has taken place in the Icelandic seafood industry has resulted in increasing profitability within the sector. Today the Icelandic fish industry is a high-tech innovative industry and one of the most profitable fishing industries in the world. In figure 5 is the

profit and EBITDA in fisheries processing in Iceland from 1997 to 2018, showing healthy operations in this period.

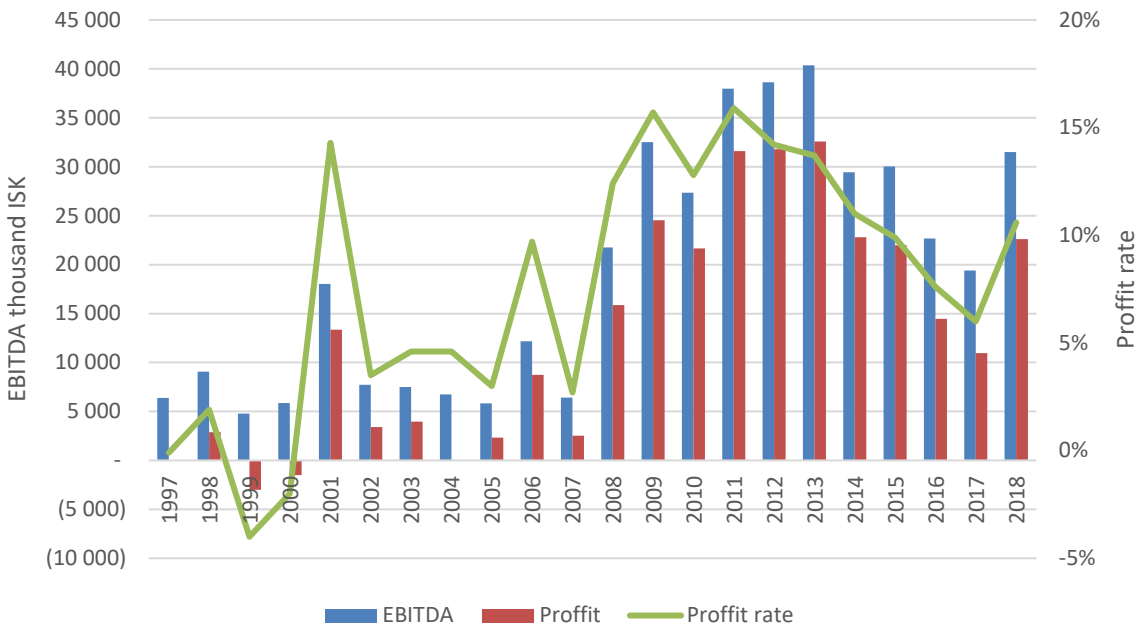

Figure 9 Profitability in the Icelandic fish processing sector 1984 to 2014

The emphasis on a market driven value chain, as opposed to resource driven value chains, is the main influencing factor for this change in value creation in Icelandic fisheries. But increased productivity and value creation takes its toll, with fewer vessels, processing factories, fishermen and fish factory workers. People must therefore look for other job opportunities. This is a development that would probably have happened anyway, though, as young people today are less likely to want to aim for a career as regular fishermen or fish factory workers. There are also some demographical effects seen with fewer fish factories in traditional fishing municipalities.

Figure 10 shows how population in four areas around Iceland has developed over the last two decades. The areas are a) the capital area, which is not at all dependent on fisheries; b) Northeast Iceland, which is dependent on fisheries but does also have other strong industries and Akureyri as the main city with a University and large service industry; c) East Iceland, which is dependent on fisheries, but does also have other strong industries, particularly the aluminium smelter in Reyðarfjörður. The seafood sector in East Iceland differs from other areas in the country, as the pelagic fishing industry has a stronghold in the area, and it has been doing extremely well for last decades; d) the Westfjords, which is almost solely dependent on the groundfish catching and processing sectors.

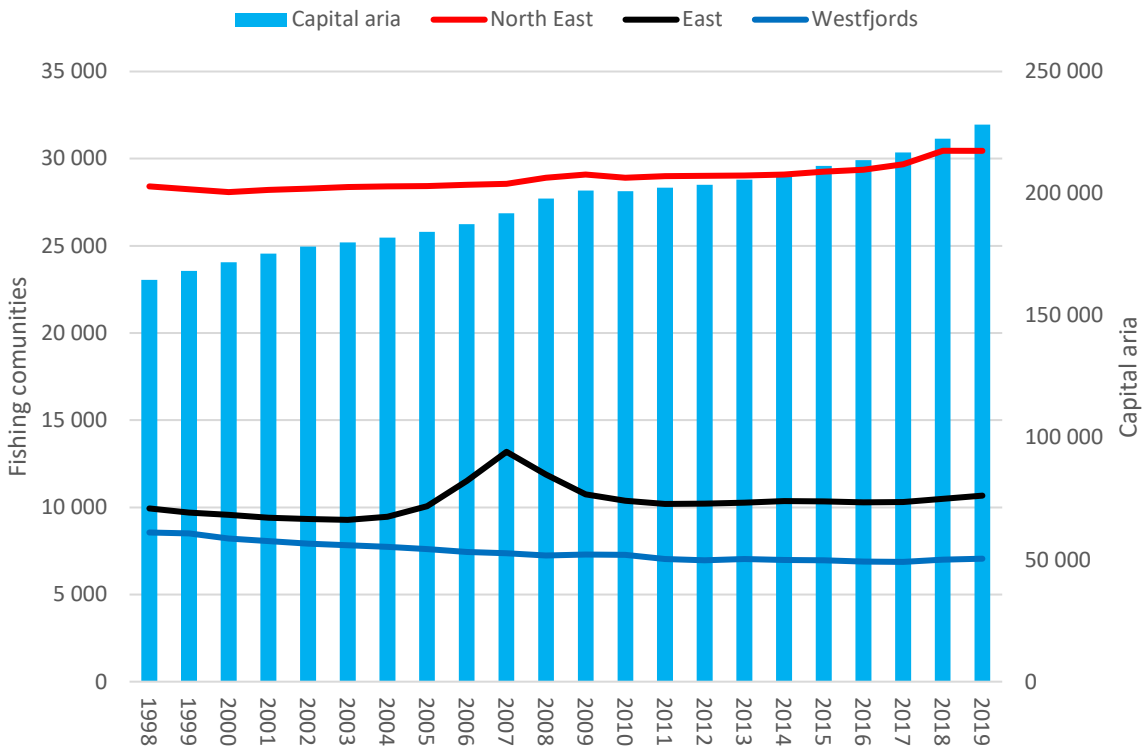

Figure 10 Number of inhabitants from 15 to 71 (working age) in four different areas of Iceland

The figure shows how population in the capital area and Northeast Iceland have been steadily increasing. Same can be said about East Iceland, which in addition had a steep influx of inhabitants during the construction of the aluminium smelter in 2005–2008. The figure also captures the downward trend of population in the Westfjords.

4 The Faroe Icelands

The Faroe Islands are highly dependent on ocean-related activities. Capture fisheries and aquaculture accounted for 96% of total exports in 2016, where pelagic species accounted for 43% and 7.5% were the main demersal species (Hagstova Føroya, 2017b). In particular, the pelagic fishery has increased substantially over time. This is also reflected in Figure 11, which shows the total quantity of catches which topped in 2017 with 700,000 tonnes. In this section, there will be some references to the aquaculture sector, as these two activities are quite related, especially when it comes to processing. Furthermore, these activities are sometimes grouped together in national statistics

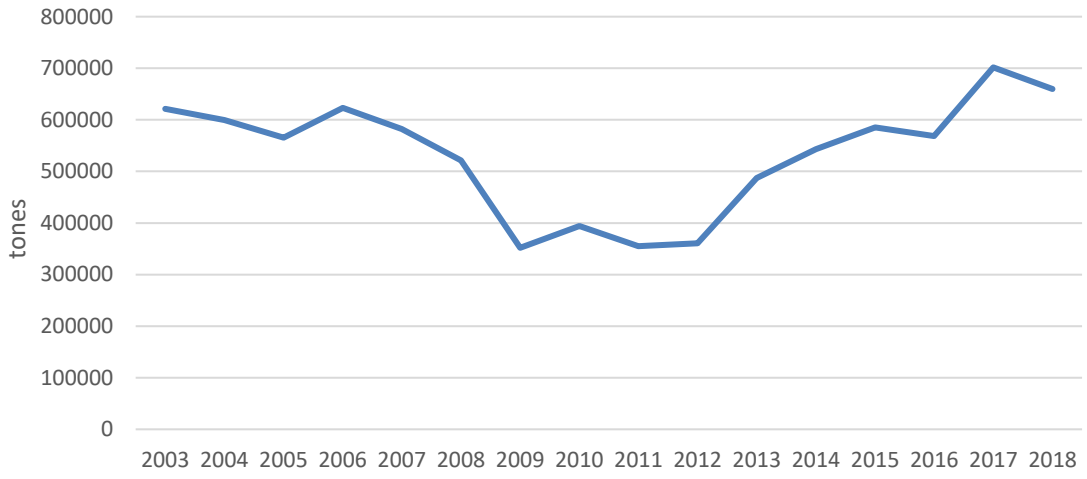

Figure 11 Quantity of catches in Faroese fisheries (Source: Statistics Faroe Islands)

The positive trend in the fishing industry is also reflected in the Gross Value Added (GVA) of the fisheries, with a GVA of about 2 billion in 2017, which has more than doubled since 2009, largely due to improved access to pelagic resources.

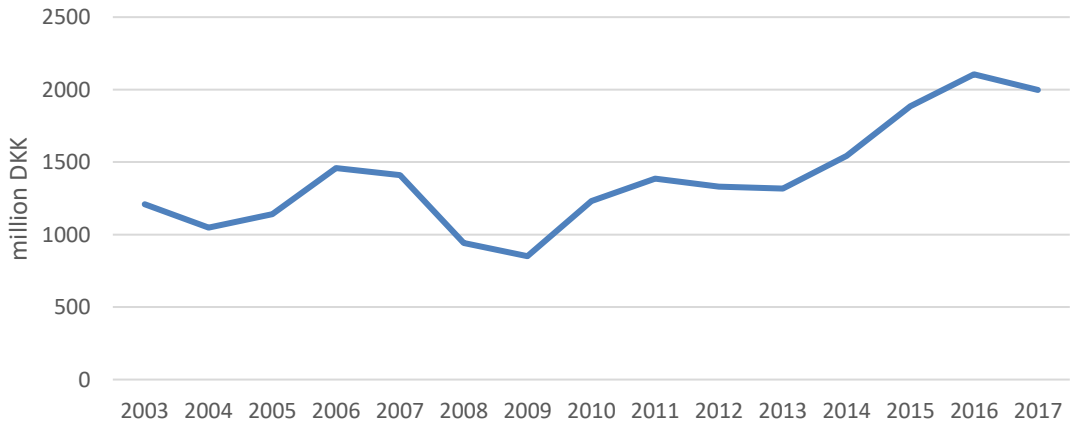

Figure 12 Gross value added in Faroese Fisheries (Source: Statistics Faroe Islands)

4.1 The Fishing Fleet

The size of the Faroese fishing fleet has been relatively stable in recent years. The number was its lowest in 2012 with 56 vessels, and was 62 in 2017.

Table 2 Number of fishing vessels in the Faroe Islands. Source: Januar 2017

Type of Vessel	2011	2012	2013	2014	2015	2016	2017
Pelagic vessels	11	1	13	13	11	10	12
Prawn vessels	2	2	2	3	2	2	2
Factory trawlers	3	3	4	4	4	4	4
Trawlers	32	34	30	30	29	29	28
Long-liners	17	16	13	14	14	13	16
Total	65	56	62	64	60	58	62

In addition to these above vessels, there are also a substantial number of vessels in the coastal fleet. These are vessels smaller than 40 GT. These are divided into three groups, large coastal vessels (4a) and small coastal vessels - 5A and 5B, where the former is commercial vessels, whilst the latter is recreational vessels. In 2019, 10 large coastal vessels reported landings, whilst the corresponding number for small commercial and recreational vessels was 83 and 441 respectively (vørn.fo). For more information on the coastal fleet, see Viðarsson *et al.* (2018).

4.2 Employment in the Fisheries Sector

As can be seen from Figure 13, the number of person working in the fishing sector has been steadily decreasing over the last 15 years, so that there are currently 1486 fishermen, whilst 1306 people were working with fish processing. At the same time, the number of people working in aquaculture has more than doubled from 500 in 2003 to 1123 people in 2019.

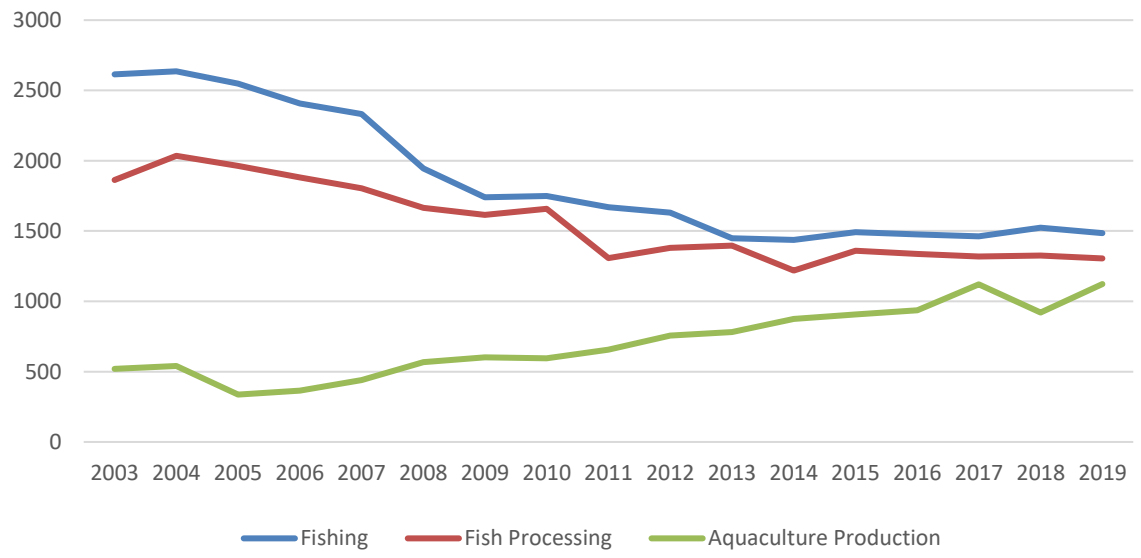

Figure 13 Number of person employed in fisheries and aquaculture in the Faroe Island (Source: Statistics Faroe Islands)

Many of the people that were working in the fishing sector have moved into the aquaculture sector, and other sectors, and the unemployment level is very low across the areas of the Faroe Islands. Howver, as illustrated in Figure 14, it should be noted that the unemployment level is the highest in the most remote of the largest islands of Sandoy and Suðuroy, where quite a large number of people work in the primary sector (mainly fisheries and aquaculture), as proportion of the population. (see **Feil! Fant ikke referansekilden.** for population by area).

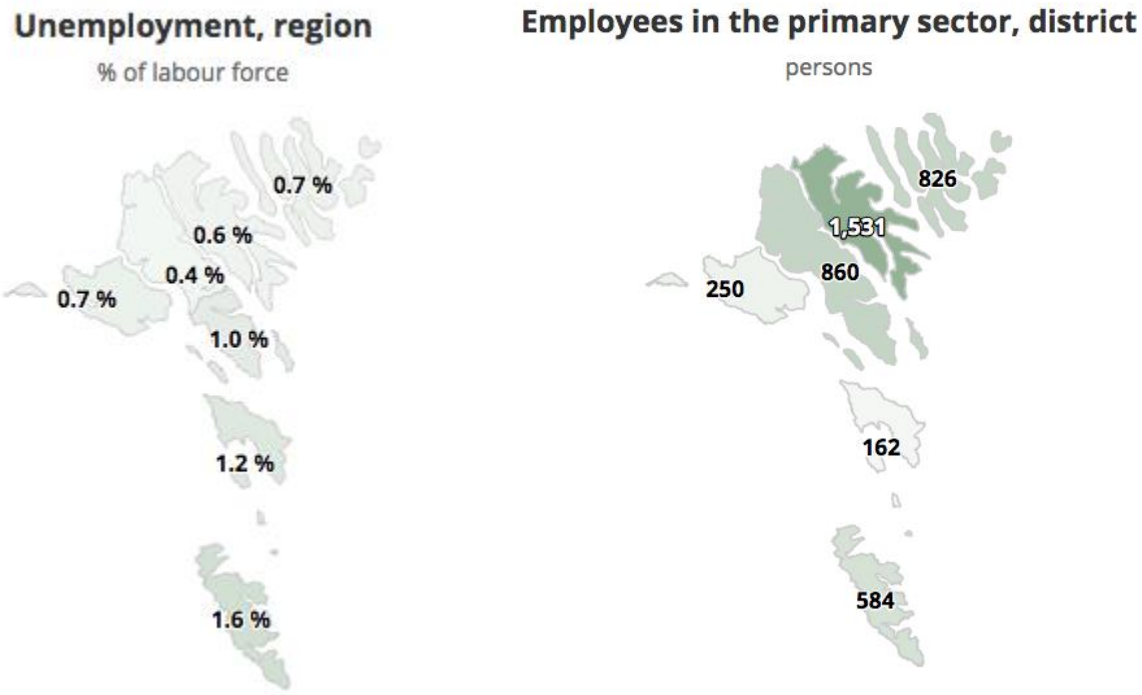

Figure 14 Unemployment and number of employees in primary sector by region in 20190 (Source: Statistics Faroe Islands)

4.3 Number of processing firms

The number of processing firms has been relatively stable in recent years. At the time of writing there are 13 demersal processing firms, 3 pelagic processing plants, as well as 1 fish meal factory and 1 drying facility. These are distributed across the islands, with active processing plants placed in 12 towns. The industry is most heavily concentrated in Eysturoy with 9 processing firms. Often Faroe Islands are considered as one region, as there are only 112 km from the most southern tip of the islands to the most northern tip and transportation links between the islands are very good. Of the 18 islands, six are connected by bridge or underwater tunnel, which means that most of the population lives within an hour's drive or so of the capital, Tórshavn, by far the largest city. Two large islands are still not connected by an underwater tunnel, Sandoy and Suðuroy, but an underwater tunnel to these islands is planned for the future. Sailing time from Suðuroy, the southernmost island, to the capital is two hours and there are several daily departures. However, Suðuroy and Sandoy could be considered more remote areas, and they have 4 and 1 processing plants respectively. As these islands are more remote, the importance of the processing activities for employment in the area is substantial.

Figure 15 Number of processing plants in each area

4.4 Demographic change

The population in the Faroe Islands has been steadily increasing in recent years, so that the population now is above 52 thousand people (see **Feil! Fant ikke referansekilden.**).

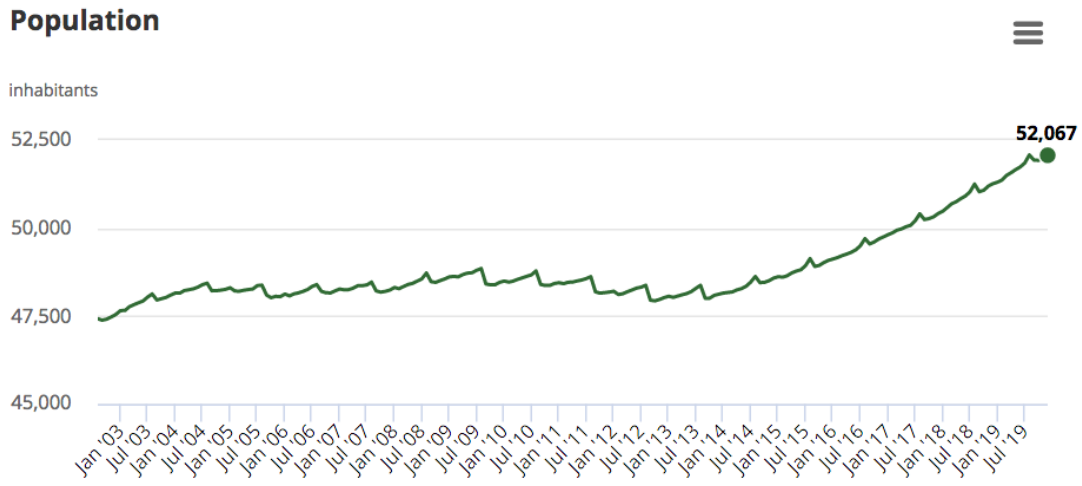

Figure 16 Population growth in the Faroe Islands from 2003–2019. (Source: Statistics Faroe Islands)

Feil! Fant ikke referansekilden. shows the current population for the different regions of the Faroe Islands. As can be seen from the figure, more than two thirds of the population live on the largest islands, Eysturoy and Streymoy.

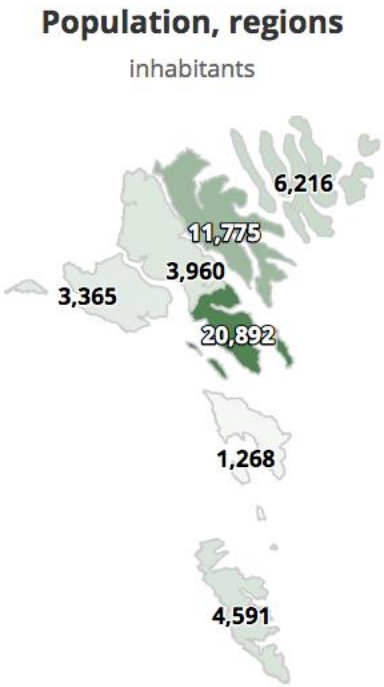

Figure 17 Population by region in the Faroe Islands. Source (Statistics Faroe Islands)

The population growth is strongest in the central areas of Streymoy and Eysturoy, but net migration is positive across the country. The only exception is Sandoyar region, which has not fluctuated greatly throughout the period.

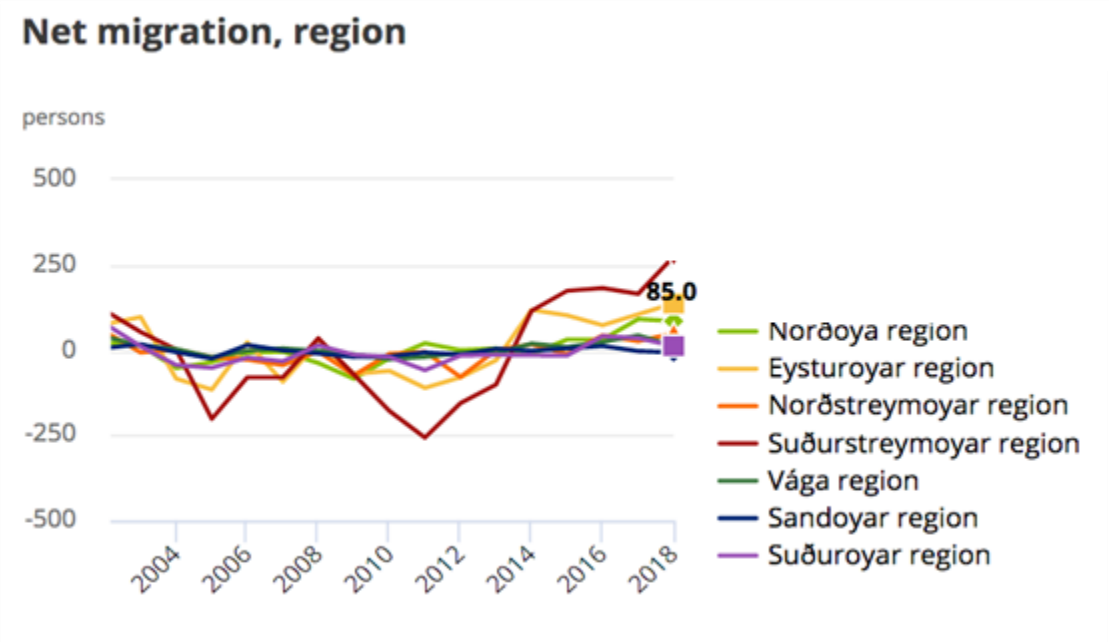

Figure 18 Net migration by region in the Faroe Islands (Source: Statistics Faroe Islands)

5 Results, methods and data sets

In this section we will report the results from the Norwegian study, present the methods applied and discuss the potential for a comparative Nordic study applying the same or similar methodology.

5.1 Results from Norwegian study

In several countries, maintaining the population of fisheries dependent communities are of major importance in the fisheries governance system. However, most studies investige the relationship between fisheries and communities with qualitative approach. As mentioned in chapter 1.2, we have published an article in the international journal Marine Policy on the importance of the fisheries industry for the development of the population in Norwegian municipalities: "*The growth and decline of fisheries communities: Explaining relative population growth at municipality level"* (Iversen *et al.,* 2019). In the following, we will briefly present conclusions, methods and relevant datasets. The purpose is to propose corresponding studies for the Faroe Islands and Iceland as well as comparative studies between West-Nordic countries. The article is based on data on population and key employment indicators of every Norwegian municipality in addition to fisheries catch, landings and employment.

The Norwegian datasets are analysed using a multi-level approach integrating micro- and macro data. Five models were estimated, and the results were reported with increased model complexity. As the model fit improves with additional variables, with the most complex model providing the best fit to the data (see below for discussion of the need to avoid omitted variable bias). The general picture is that fisheries dependent societies, all relatively small rural municipalities, have a weak development in population. Despite having a positive effect on population from fisheries activity for some municipalities, the results indicate that general national trends have a stronger influence on population growth than fisheries activities, implying that measures for increased fisheries landings are poor tools to support population growth.

5.2 Methods

When studying phenomena with complex causeality using statistical analysis, it is important to avoid omitted variable bias (Oster, 2015). A model for analysing the complex causes of population growth using only data from one sector of the economy will likely overestimate the impact of this sector. Thus, datasets that cover the complexity, and in particular complexity of the workforce development, of the communities studied are needed.

Integration of micro- and macrodata is now seen as state of the art in many subfields of political and economic sciences (Stegmueller, 2013) and has been increasingly popular the last decades (Gelman & Hill, 2006). There are good theoretical and statistical arguments for using multilevel models accounting for macro- as well as micro-level information (Duncan, Jones, & Moon, 1998; Luke, 2004).

Most studies employ pooled individual-level survey data with matched country-level information to estimate micro and macro effects. Rather than having countries as level 2 units, municipalities, or defined regions (groups of municipalities), can be used at level 2 and year at level 1. One of the critiques against multilevel modeling is that researchers analyzing countries often have too few

observations at level 2 (Stegmueller, 2013). The research strategies suggested here, where there are enough observations at level 2, attend to this critique.

The data for this kind of study must be structured as a panel data set. The multilevel time-series analysis employs a latent growth curve model because population probably has changed over the time period studied. Each municipality/region must be measured in every year t. The dependent variable, net relative population growth, is explained through a set of increasingly complex models. The most basic model contains only a constant term and a trend. This implies that individual growth curves are estimated for each municipality in relation to the overall (nation level) growth curve. This model is given as:

Level 1: $\gamma \text{poprate}_{ti} = \pi_{0i} + \pi_{1i}\text{trend}_{ti} + e_{ti}$

Level 2: $\pi_{0i} = \beta_{00} + u_{0i}$

$\pi_{1i}\text{trend}_{ti} = \beta_{10} + u_{ti}$

This base model then should be expanded by first introducing fisheries specific variables (landings, fisheries dependent, percentage fishermen), and then variables containing general information about the economic status in the municipality (public sector employment, general employment), and finally allowing the constant and trend terms to be influenced by municipality size as measured by the number of inhabitants.

The models are estimated with a Maximum Likelihood approach. To examine which model has the best the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) is used. AIC and BIC cannot be interpreted in absolute terms, but the smaller the number the better the model fit the data and better predict the actual score on the dependent variable. Both these criteria are reported together with the log likelihood function.

5.3 Future research

This project has shown that it is possible to organize similar panel data for the Faroe Islands and Iceland and to carry out similar analysis that was performed for Norway. It would probably not be appropriate to organize the datasets at the municipal level because the municipalities, especially in the Faroe Islands, are small and belong to larger labour market regions. The alternative is to organize the dataset at regional level. While the Norwegian study has shown what variables are most useful for this kind of analyses, and what results might be expected, further discussions on methodology is needed for future research. In Appendix 1 we present variables identified for comparison and tested on Norwegian data.

The team established through this project will apply for financial support for financing this research.

6 Summary and possibilities for further research

Common to the fish industry in Norway, the Faroe Islands and Iceland is that resources are well managed. The industry is exposed to international competition on both products and input factors. Most of the products are exported, and the industry must compete for labour and capital. This means that the industries are subject to continuous pressure to improve efficiency. The competition for labour, in combination with good access to capital, leads to investment in more efficient technology and increased labour productivity. When fishing must be limited for long-term resource management, the result is a steadily decreasing need for labour both in the fishing fleet and in the fish processing industry. This applies to all countries in the study and is shown in chapters 3, 4 and 5. In societies where the fishing industry is a significant part of the economy, therefore, the fisheries-related employment has declined, and given that the industry continues to improve productivity, it is unlikely that the trend will reverse.

The pressure to improve efficiency applies to all industries exposed to competition. In the case of Norway, Iversen *et al.* (2020) show that general trends have a stronger influence on population growth than do fisheries activities, implying that measures for increased fisheries landings are poor tools to support population growth. This project has shown that it is possible to organize similar panel data for the Faroe Islands and Iceland and conduct comparative analysis betwenn the three countries.

The team established through this project will apply for financial support for financing research that will contribute to a better understanding of the relationship between the development in the fishing industry and population development.

7 Literature

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Appendix 1: Data requirements

Variables identified for comparison and tested on Norwegian data:

Municipality by name or/and unique identification (in Norway municipalities can be identified both by name and number)

Region (coding)

County (coding)

- Demography
    - Total population and age and gender distribution, by municipality.
    - Must at least be divided into three groups by age: Young (0-14 years, not in working age), workforce (15-70), elderly (over 70, not in working age)

- Fisheries
    - Landings in municipality / region/ county from all vessels.
        - Spread on year and month
        - Species: Cod, haddock, saithe, other ground fish, mackerel, herring, capelin, other pelagic fish
        - Weight and value
    - Landings from vessels with homeport in municipality / region / county
        - Spread on year and month
        - Species: Cod, haddock, saithe, other ground fish, mackerel, herring, capelin, other pelagic fish
        - Weight and value

- Employment Statistics.
    - Distribution: Fishers, fish processing industry, other industries (see under), public sector (government, county, municipality).
    - If available: Detailed employment in other industries, depending on categories available.
    - Unemployment.
    - Percentage of part-time employees.

Appendix 2: Presentation

Impacts of fisheries policy on coastal employment and settlement in fisheries dependent areas in Norway, Iceland and the Faroe Islands and related projects

FISHERIES AND SOCIETY – CHALLENGES TO 2025

STOCKHOLM, SWEDEN 11.-12 OCTOBER 2018

Edgar Henriksen, Audun Iversen and Sigbjørn Svalestuen

Nofima

Content

- The projects
- The long trends
- Structuration: Objectives and effects
  - Vessels, fishers, earnings
  - Fish processing industry
- Short on regional policy
- Impacts on settlement in costal regions/municipalities
  - Are there differences in population changes in fishery dependent municipalities and same size other municipalities?
  - Which, if any variables are relevant and significant to population change
  - Comparative studies between Norway, Iceland and the Faroe Islands.

1

Nofima

Fisheries influence on employment and settlement in fisheries dependent societies in NO, IS and FO

- A cooperation between Nofima, UiT (Stein Rokkan research group), Matís and Syntesa
- Better understand if and how the instruments applied to regulate fisheries have significant effects on settlement
  - Small open and competitive economies
  - A rationalization pressure in all sectors in the economy to be competitive in product- and labor markets
  - Given that the stocks are fully exploited, a continuous reduction in employees
- Collect comparative statics
  - Collected but probably needd to be supplemented
- Develop and apply econometric models to test hypothesis
  - More complex than we anticipated

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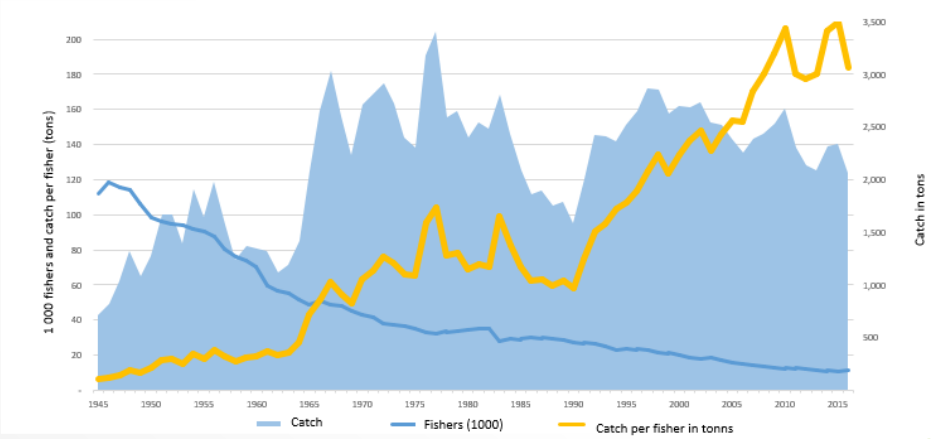
Nofima

Increasing efficiency - a continuous process



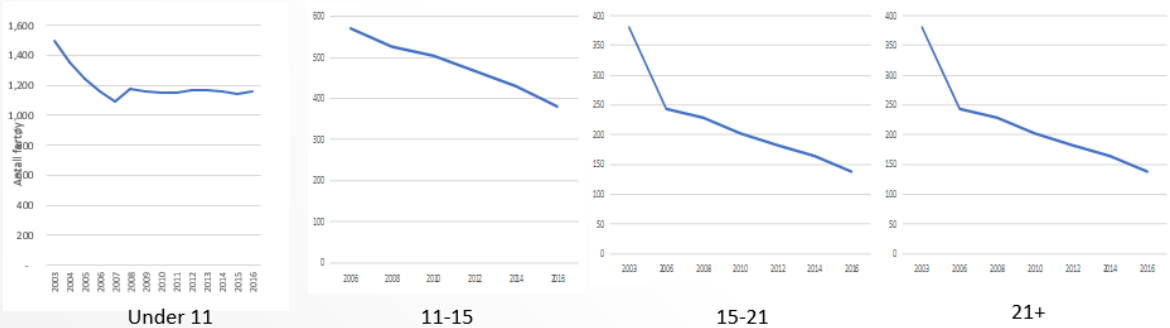
1 Kilde: F.dir.

Nofima

The coastal fleet

Reduction in all vessel groups

Market mechanisms used to reduce number of coastal vessels larger than 15 m since 2004. Expanded to >11 m in 2008. A government and industry funded decommissioning scheme for the smallest fleet (<15 m) terminated in 2009.



Under 11 11-15 15-21 21+

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Nofima

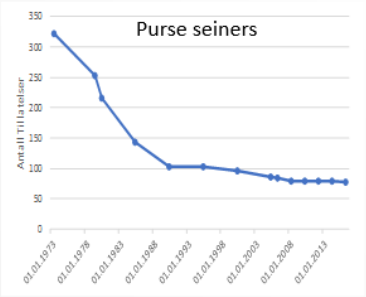
The offshore fleet

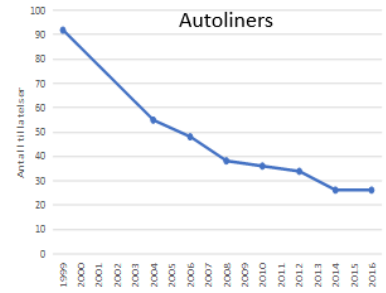
Number of vessels

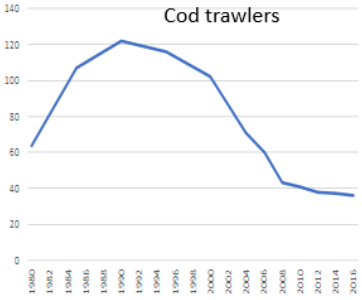
Government funded decommissioning scheme from late 70ties. Unit quotas form 1990 with possibilities to use market mechanisms to buy out vessels form 2000

Unit quotas form 2000 with possibilities to use market mechanisms to buy out vessels

Unit quotas form 1990 with possibilities to use market mechanisms to buy out vessels







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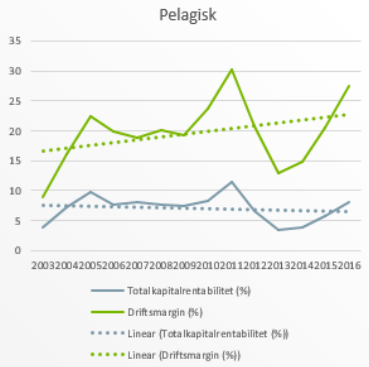
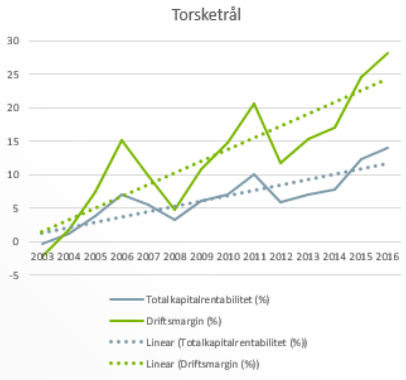
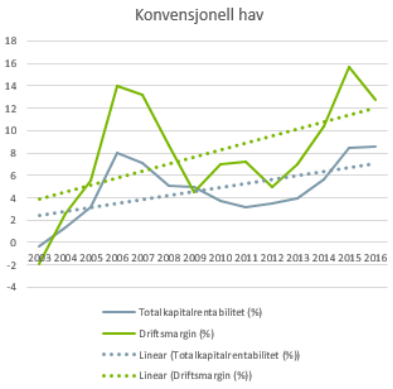
Profitability - off shore fleet







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Development in real income in Norway and for Norwegian fishers

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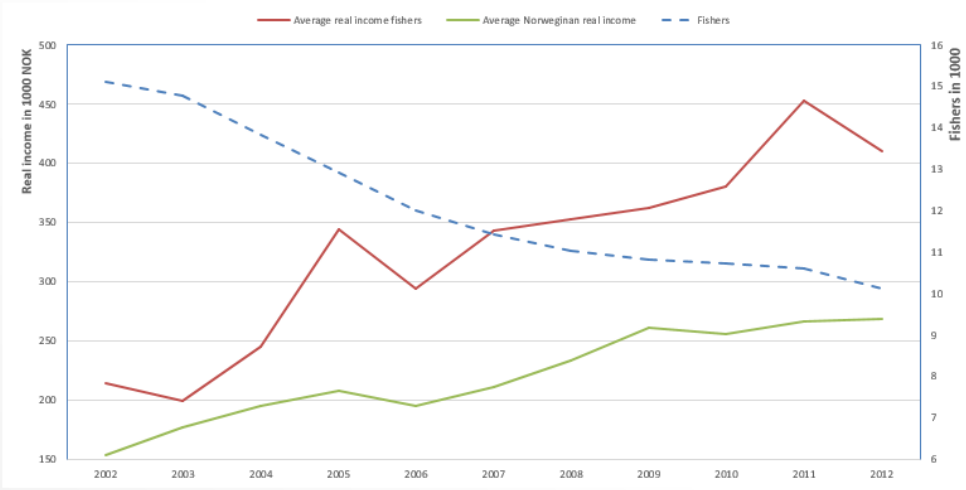

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ELSEVIER

Marine Policy

Volume 93, July 2018, Pages 186-194

The myth of the poor fisher: Evidence from the Nordic countries

Max Nielsen [a], Frank Asche [b, c], Ole Bergesen [c], Johan Blomquist [d], Edgar Henriksen [a], Ayoe Hoff [a], Rasmus Nielsen [a], Jónas R. Viðarsson [f], Staffan Waldo [d]

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https://doi.org/10.1016/j.marpol.2018.04.003

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Highlights

- Fishers are often perceived to be poor with limited empirical support.
- This study investigate this hypothesis for four Nordic countries; Denmark, Iceland, Norway and Sweden.
- Fishers are in general doing well, with a higher income than the countries average.
- Sweden is the only country where fishers make less than the average, but only marginally so.
- Coastal fishers have a lower income than both owners and crews on larger vessels.

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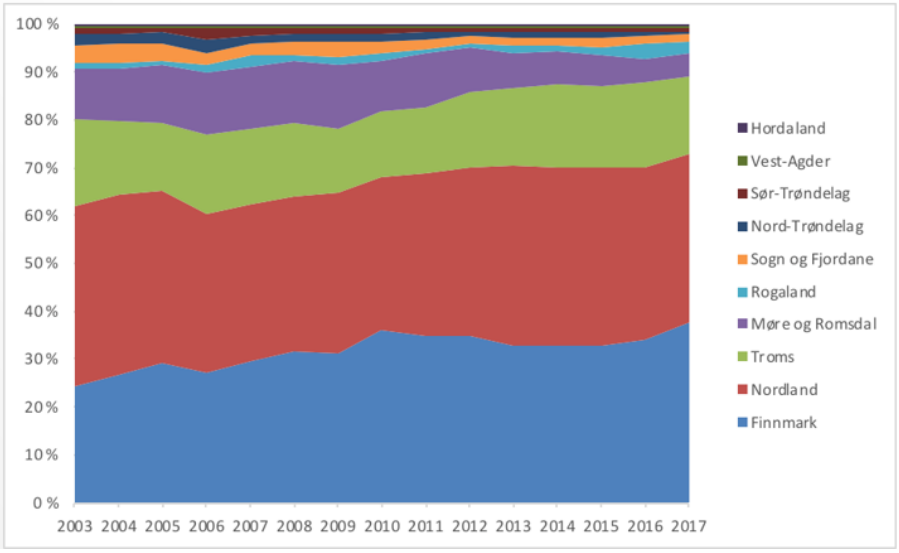
Landings divided by counties
(Ground fish, fresh)



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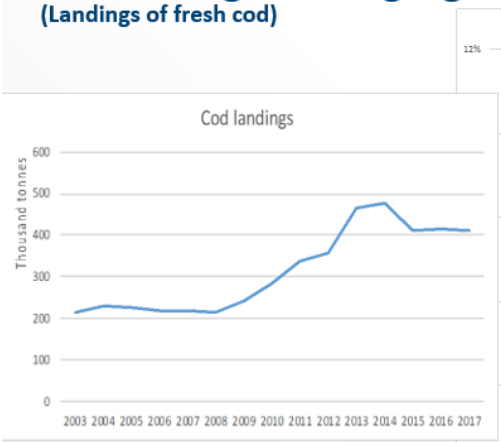
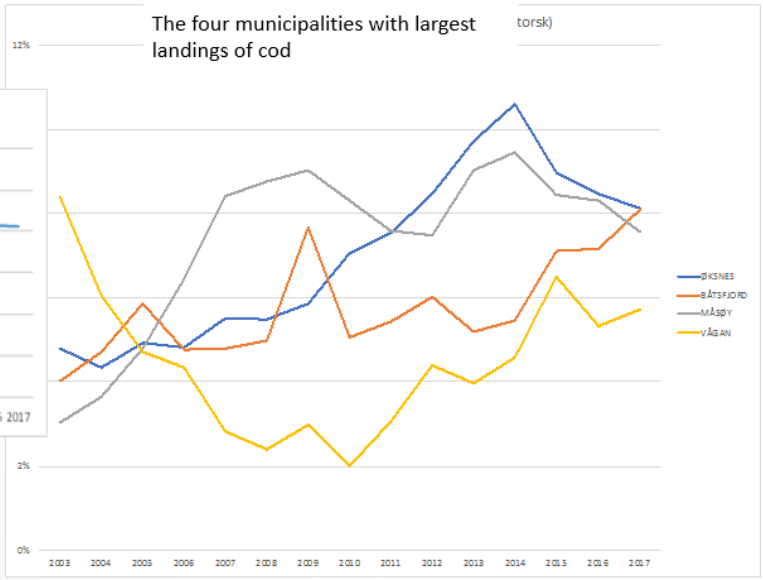
Great changes among big fishery municipalities
(Landings of fresh cod)





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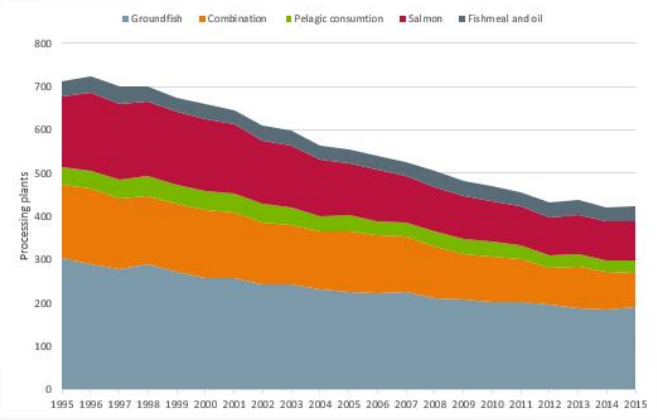
Structural changes in the fish processing industry

Reduction in number of production plants



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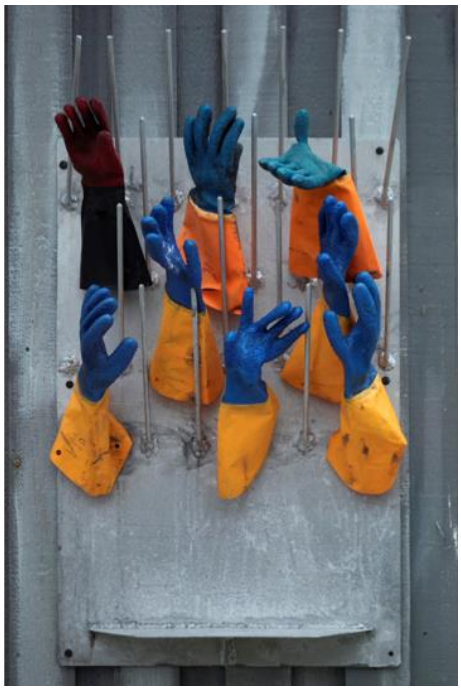
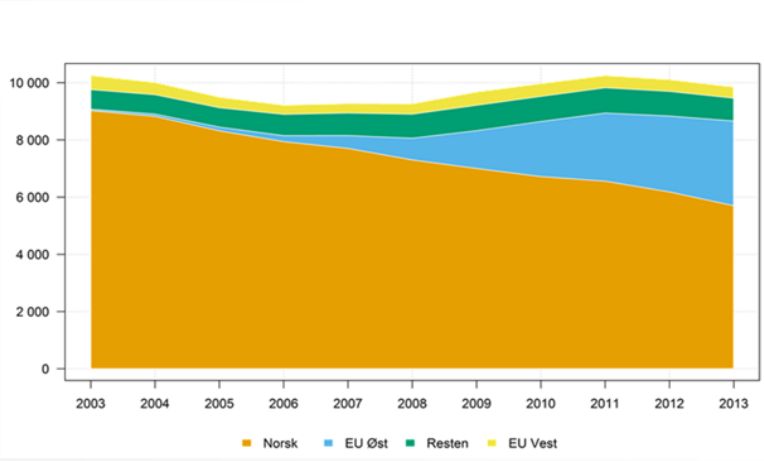


A multinational work force



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- More than 50 % of the workers are not Norwegian since 2017
- Probably 70 % during the "skrei" fishery (winter)

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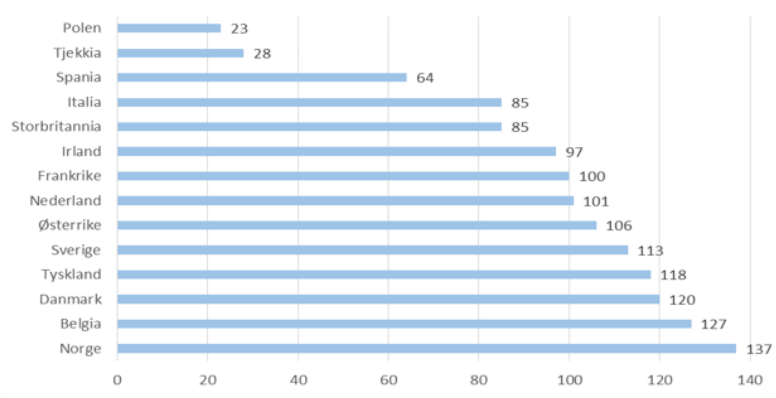
Hourly labor costs



The industry in Norway compared to EU in common currency in 2015 (TBU)

- Norwegian wages in the Norwegian fish processing industry for the entire work force
- The industry are competitive in the EU labor marked, but not in the Norwegian
- Wages in the fish processing industry are normally approximately 90 % of average wages

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Fewer communities with fish processing industry

1995: 145 communities

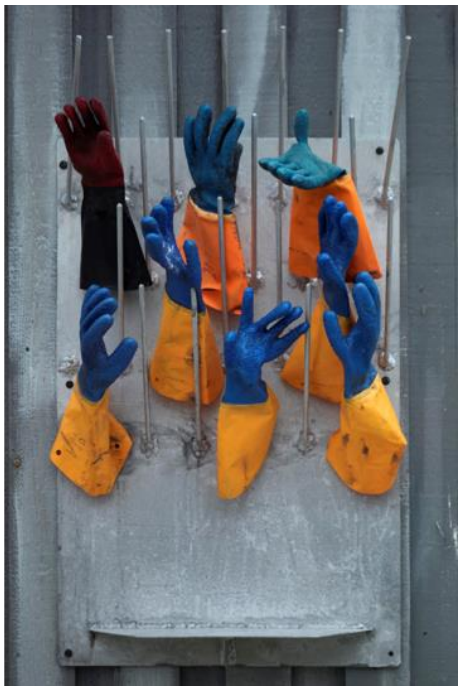
2015: 122 communities

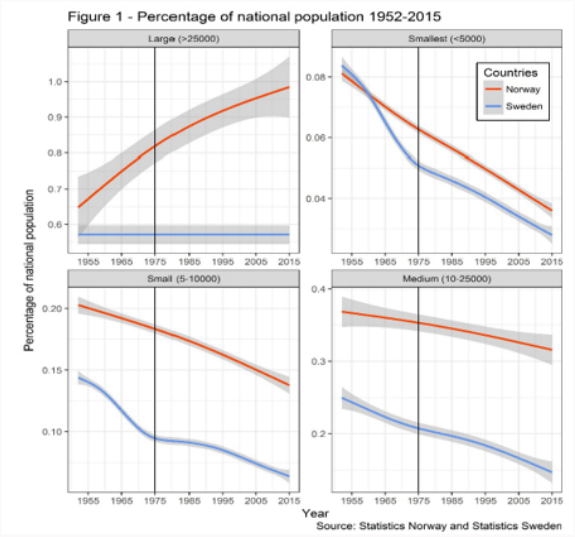
1

Reduction in numbers of employees

Ground fish processing industry

1





Short on regional policy

http://site.uit.no/rokkangruppen/files/2018/07/The-striking-similiarities.pdf

- It is often claimed that the regional policy in Norway is a success compared to Sweden
- However, the similarities in change in population between Northern Norway and Northern Sweden are striking
  - Only significant differences in the development in the largest cities
    - Universities and colleges
  - No significant differences in medium (industrial), small or the smallest municipalities.
- No significant effect on a more expansive Norwegian regional policy on demographic development.

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The Nordic economic model - main driver for changes

- The three-party cooperation (State, labor unions, organizations for employers)
- Strong collective agreements ensures that unprofitable businesses can not reduce wages
- Positive to new technology and international trade
- Strong public arrangements provide social security for the unemployed
  - Qualification schemes to stimulate work force mobility between employers and regions
- Ensure that growth in private and public wealth is based on increased productivity by allocation of the work force to the most productive industries

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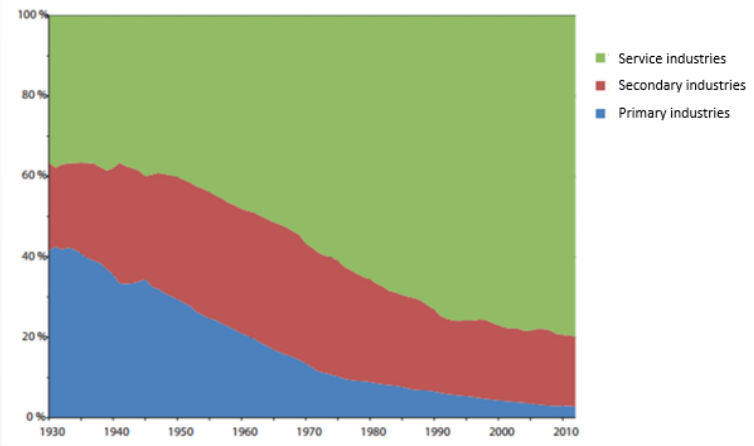
Long trends in industrial change

Percent of the workforce



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Source: Meld St 13 (2012-13) Distrikts- og regionalmeldinga

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«Fisken og folket»

In the book we classified societies after the methodology of Lindkvist (2000)

Some societies are very dependent (from 32 % and down)

Category 1: Large/dependent			Category 2: Small/dependent			Category 3: Large/independent		
Kommune	Egenfangst	Sysselsetting	Kommune	Egenfangst	Sysselsetting	Kommune	Egenfangst	Sysselsetting
Røst	20 %	32 %	Torsken*	31 %	28 %	Dønna*	36 %	5 %
Værøy	11 %	31 %	Rødøy	22 %	17 %	Haram*	13 %	5 %
Båtsfjord	29 %	30 %	Hitra	52 %	17 %	Ørland*	0 %	4 %
Træna*	4 %	29 %	Lebesby*	68 %	17 %	Hareid*	0 %	4 %
Moskenes	66 %	26 %	Herøy*	71 %	16 %	Frøna*	8 %	4 %
Gamvik	45 %	26 %	Kvalsund	0 %	9 %	Sandøy*	100 %	4 %
Hasvik	25 %	25 %	Gratangen*	100 %	9 %	Ålesund	5 %	3 %
Flakstad	51 %	24 %	Rødøy	75 %	9 %	Meløy*	92 %	3 %
Måsøy	15 %	23 %	Hjelmeland	18 %	8 %	Eigersund	2 %	3 %
Berlevåg	42 %	22 %	Kvænangen	34 %	8 %	Flora	1 %	3 %
Berg	4 %	21 %	Stranda*	100 %	8 %	Sortland*	0 %	2 %
Frøya	74 %	21 %	Vega	67 %	7 %	Os*	6 %	2 %
Karlsøy	49 %	19 %	Gildeskål	66 %	7 %	Ørsta	98 %	2 %
Øksnes	55 %	19 %	Gulen*	48 %	7 %	Karmøy	18 %	2 %
Skjervøy	49 %	18 %	Aukra*	73 %	6 %	Vadsø*	56 %	2 %
Lurøy*	55 %	18 %	Nesseby*	83 %	5 %	Alta*	100 %	1 %
Nordkapp	40 %	15 %	Osterøy*	0 %	5 %	Tromsø	7 %	1 %
Sund*	72 %	14 %				Sør-Varanger*	4 %	1 %
Selje	0 %	13 %				Bodø	38 %	1 %
Vikna	54 %	13 %				Harstad	12 %	1 %
Bø	69 %	13 %				Søgne*	0 %	1 %
Austevoll	33 %	12 %				Fjell	47 %	1 %
Giske	21 %	12 %				Hå*	0 %	1 %
Midsund	31 %	12 %				Kristiansand	40 %	0 %
Solund*	89 %	12 %				Bergen	5 %	0 %
Herøy	24 %	12 %						
Smøla	25 %	11 %						
Loppa	0 %	11 %						
Vestvågøy	63 %	11 %						
Vardø	64 %	10 %						
Hadsel	63 %	10 %						
Ibestad	100 %	9 %						
Averøy	60 %	9 %						
Bømlo	84 %	9 %						
Askvoll	29 %	8 %						
Bremanger	47 %	8 %						
Lødingen*	6 %	8 %						
Vågsøy	6 %	8 %						
Vågan	32 %	8 %						
Sula	0 %	7 %						
Andøy	76 %	7 %						
Lyngen	43 %	7 %						
Osen	100 %	5 %						
Hammerfest	23 %	5 %						
Lenvik	44 %	5 %						

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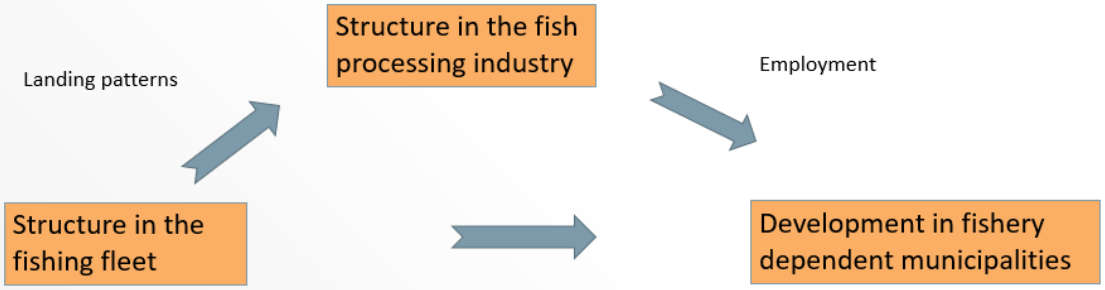
Do structural changes in the fishing fleet affect the processing industry and the fishery depended municipalities?



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Three categories of fisheries-dependent municipalities

- Number of fisheries dependent communities are reduced (Categories 1 and 2)
- Most of the reduction in the mid/west of Norway
- Still a significant number of communities with high fisheries dependence
  - Many in category 2 are probably more aquaculture dependent
- Growth in category 3: more fisheries activity in urban areas

Kategori	Category 1: Large/dependent		Category 2: Small/dependent		Kategori 3: Large/independent		Totalt	
Region/år	1990	2014	1990	2014	1990	2014	1990	2014
Nord-Norge	31	28	14	10	3	9	48	47
Norge sør for Nordland	21	17	13	7	14	16	48	40
Totalt	52	45	27	17	17	25	96	87
		- 7		- 10		+ 8		

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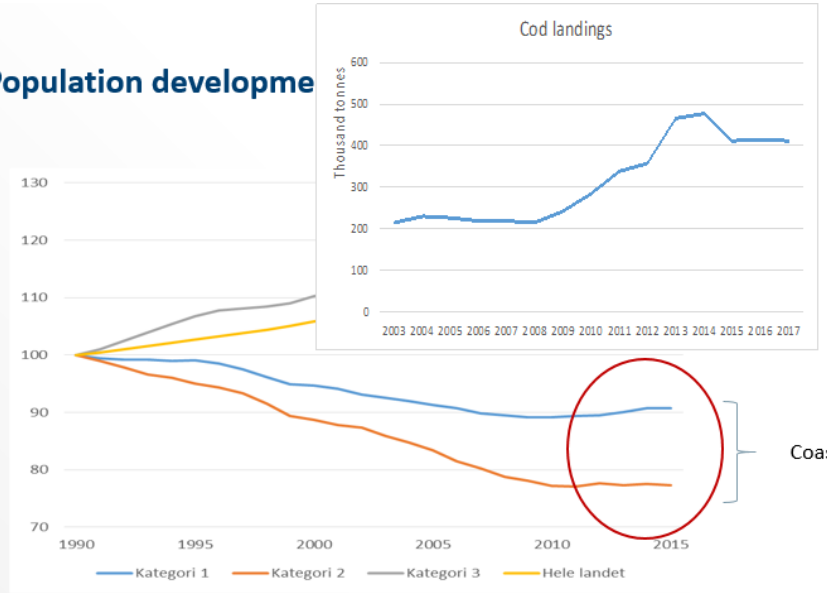
Population developme



Coastal societies i North Norway

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Our modell

- Hypothesis: Fishery dependency matters
- Compare change in population growth in fishery dependent municipalities and other municipalities
  - Divided in size groups.
    - >1500
    - 1500 – 3000
    - 3000 – 5000
    - <5000
- Hypothesis: Fishery variables can explain differences in population growth rate.
- Method: Multivariable regression on a combined longitunal population and fishery dataset on municipality level (population change as left side variable)

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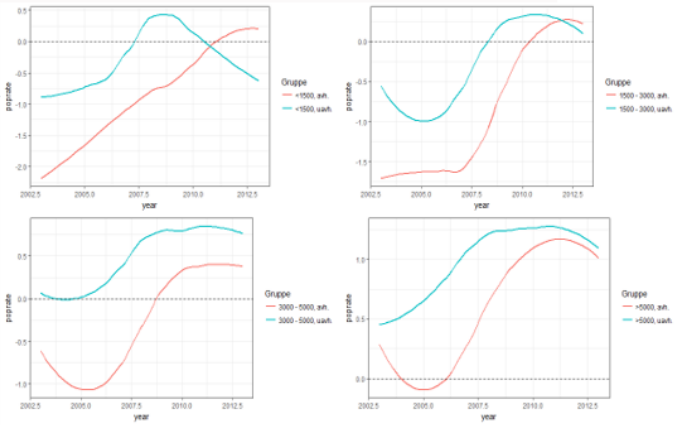
Fishery dependent municipalities develop differently



- Comparison of same size municipalities - fishery dependent versus other municipalities
- Divergent trends in the smallest municipalities
- Reduced differences between fishery dependent and other municipalities > 1500
- Size matters: Smaller municipalities have a more negative development than bigger

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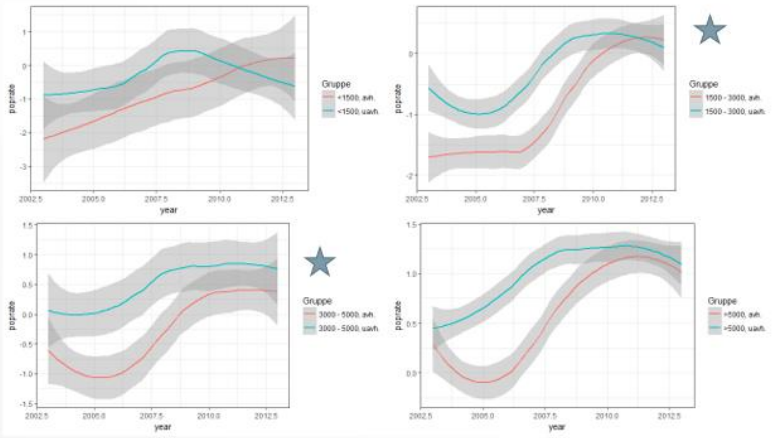
Small differences and for smallest and biggest group they are not significant (★ significant)



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The right side variables used in the model

- Landinger: Number of catches landed over a year in a municipality
- Rundvekt: Yearly amount of fish landed in a municipality
- Vekt.snitt: Average weight of landings
- Fiskere: Number of fishers
- Syarb_2: Number of workers in the fish processing industry

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No or small effects of fishery variables on development of population

	<1500	1500 - 2999	3000 - 4999	5000
(Intercept)	-1.14 *	-0.66	-0.51	0.95 ***
	(0.65)	(0.40)	(0.46)	(0.30)
landinger	-0.00	0.00	-0.00	0.00
	(0.01)	(0.00)	(0.00)	(0.00)
rundvekt	0.05 *	0.01	0.03 **	-0.01 *
	(0.03)	(0.01)	(0.01)	(0.00)
vekt.snitt	-0.10	0.01	-0.01	0.02 *
	(0.17)	(0.03)	(0.01)	(0.01)
fiskere	0.00	-0.00	-0.00	-0.00 *
	(0.01)	(0.00)	(0.00)	(0.00)
syarb_2	-0.01	0.00	-0.00	-0.00
	(0.01)	(0.00)	(0.00)	(0.00)
as.factor(komstor2)<1500, uavh.	0.43			
	(0.72)			
as.factor(komstor2)1500 - 3000, uavh.		0.43		
		(0.37)		
as.factor(komstor2)3000 - 5000, uavh.			0.82 *	
			(0.45)	
as.factor(komstor2)>5000, uavh.				-0.03
				(0.29)
AIC	761.62	1250.64	811.94	1207.91
BIC	789.47	1284.72	843.81	1245.95
Log Likelihood	-371.81	-616.32	-396.97	-594.96
Num. obs.	170	333	262	513

*** p < 0.01, ** p < 0.05, * p < 0.1

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Summary and preliminary conclusions

- The over all economic policy is the main driving force for change in populating on a municipality level
- The impact of the instruments applied to regulate fisheries have probably very limited effects
- Were the catches are landed have a small effect
- We believe that the continuous demand to increasing efficiency shape industries, also the fishing industry
- We also doubt that an industry witch have to be competitive in a global product marked and the Norwegian market is a suitable instrument in the regional policy

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Now what?

The model must be refined!

Separate employment statistics: Fishers, fish processing industry, other industries, public sector (and would love to have trade of goods and services related to fisheries)

What has the strongest effect on settlement: where the fishing vessels has their homeports or were the catches are landed?

How does seasonal patterns impact population?

Compare the development in settlement between municipalities of different sizes and different employment rate in the fishing industry (with an emphasize on the smallest municipalities)

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Planned scientific papers

- Iversen, A., Svalestuen, S. and Henriksen, E. (2018): **Explaining the growth and decline of fishery dependent communities.** Planned submitted for review spring 2019.

- Henriksen, E., Iversen, A., Svalestuen, S. Laksafoss, M., Vidarsson, J. (2019). **A comparative study of the effects of change in the fishing industry on settlement pattern in The Faroese Islands, Iceland and Norway.** Planned submitted for review late 2019.

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Thank you

Same place, different millenniums

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