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**The Collapse of the Norwegian Herring
Fisheries in the Late 1950s and 60s
Crisis, Adaptation, and Recovery**

by

**Torbjørn Lorentzen
Rögnvaldur Hannesson**

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The Collapse of the Norwegian Herring Fisheries in the Late 1950s and 60s Crisis, Adaptation, and Recovery

Abstract

This paper deals with the economic effects of the collapse of the Atlanto-Scandian and the North Sea herring stocks on the Norwegian fisheries. In the late 1950s the Norwegian winter herring fishery failed, and in the 1960s the entire stock of the Atlanto-Scandian herring collapsed. A few years later the North Sea herring stock suffered the same fate.

Prior to these events, the herring fishery was the single most important fishery in Norway in terms of employment and landings. It was particularly important in western Norway, not least in the county of Hordaland, on which this paper focuses in particular.

The immediate consequence of the collapse of the herring stocks was a severe decline in income and raw material for the processing industry. These difficulties were, however, overcome relatively quickly. The fishing fleet found substitute stocks, such as mackerel and capelin. The government took some measures for immediate employment relief, but over time redundant fishermen were absorbed into other industries, not least the emerging petroleum and fish farming industries. The time of the herring collapse was also a time of transition to a greater specialization in the labour market. Earlier, people had combined fishing with other occupations (farming, carpentry, etc.), but specialization on a single occupation became more and more common. This is likely to have made the adjustment to the herring collapse easier.

The demise of the herring stocks in the 1960s and 70s is generally believed to have been the result of overfishing, which in turn was caused by major technological leaps (the power block, the asdic) enabling the fishing fleet to increase its catches by an order of magnitude. At the time there was no framework in place for international fisheries management to limit catches to what the fish stocks could bear. The herring collapses did, however, coincide with a change in ocean climate, so the causal relationship may have been more complicated. The technological changes which contributed to the herring collapse also made it easier to adjust to this event; the bigger and more powerful boats could be directed to fish stocks previously only lightly exploited due to distance and other factors making them less easily accessible.

1. Introduction

Over the past 10-15 years, research on climate change and its consequences has moved to the top of the research agenda world wide. Some of this research has dealt with the economic consequences of climate change, such as how crop growth will be affected, what will happen to the need to heat or to cool buildings, etc. But global warming will not just affect the atmosphere and plants and animals on land, it will also affect ocean temperature and currents and thereby plant and animal life in the sea. This, in turn, will affect growth and yield of fish stocks, both in capture fisheries and those that are raised in fish farms. Whether the economic impacts will be negative or positive depends on what kind of changes will take place in the ecosystem. Generally speaking, a change in climate is expected to affect growth rates, recruitment, geographic location and distribution of wild fish stocks, and growth conditions in places suitable for fish farms (for detailed discussion, see Stenevik and Sundby 2004).

The effects of climate change on fish stocks will have direct or indirect consequences for the economic outcome in fisheries and aquaculture. Climate change in the sea is not a new phenomenon, however. In various parts of the world changes in ocean temperature have been observed on time scales of various lengths, from year to year variability such as the El Niño to decadal variations such as have occurred in the North Atlantic (see Stenevik and Sundby, 2004). The latter changes are associated with variability of fish stocks such as the herring, even if they need not be the sole cause of the collapses in such stocks (see Stenevik and Sundby, 2004).

In times past, people have had to cope with major changes in fish stocks associated with climate variability in the ocean. Some of these changes, in particular the herring collapses in the 1960s and 1970s, have been of a magnitude which is probably comparable to what might result from global warming and its impacts in the oceans. As a prelude to a study of how global warming might affect Norway's fisheries, it seems to us reasonable to investigate the impacts of the collapses of the Atlanto-Scandian and the North Sea herring stocks in, respectively, the early 1960s and 1970s. This case study will therefore serve as a useful backdrop to an analysis of expected socio-economic effects from a significant climate change.

In this paper we will describe the most important socio-economic impacts the disappearance of the Atlanto-Scandian herring brought about. We will also comment on some of the effects of the overexploitation of the North Sea herring. We will review the changes that took place in the wake of the collapse of these stocks, in particular the changes in catches, production, exports, and fleet and industry structure. We will also try to shed some light on how local communities were affected, and how economic agents adapted to the sudden and dramatic change in income that took place.

The remainder of the paper consists of six parts. In the next section we briefly discuss the development of the Norwegian fish landings in the 20th century. This development shows the volatility of the herring fishery and how it came to be replaced by other species. Section Three describes the fishing industry along the Norwegian coast in the period between the two world wars, and in particular the herring fishery. We have limited the description to the west coast, mainly because the herring fishery was concentrated on that part of the coast. Section Four focuses on the changes that took place in the herring fishery after the Second World War. In Section Five we deal with the crisis in the herring fishery, which started in the late 1950s, the effects and possible explanations of the crisis, and, last but not least, how the fishing industry adapted to the collapse in the herring fishery. In Section Six we describe briefly how two

small fishing communities, Bømlo and Fedje, evolved after the collapse in the herring fishery. The last section concludes.

2. The Norwegian fisheries in the 20th century: the impact of herring

The total landings of fish and crustaceans in Norway increased about fivefold in the 20th century, from about half a million tonnes to 2.5 million tonnes (Figure 1). In constant value of money (2003-kroner) the increase was even greater, or about sixfold (Figure 2). This has not been a smooth development, on the contrary there have been major fluctuations, more so in terms of quantity than in terms of value. As we can see from the figures, fluctuations in the catches of herring have been a major, if not the major, source of fluctuations in the total catch. Herring has always been a capricious fish, a source of legends and of shifting economic fortunes. There was an enormous increase in the catches of herring from the end of the Second World War and to the mid-1950s. Then there was a steep decline, followed by a rapid increase again in the 1960s. In the late 1960s the Atlanto-Scandian herring stock collapsed, and the North Sea stock met a similar fate a few years later. After that the herring fishery was a shadow of its former self until the late 1980s when the Atlanto-Scandian stock recovered, and has trended upwards since then.

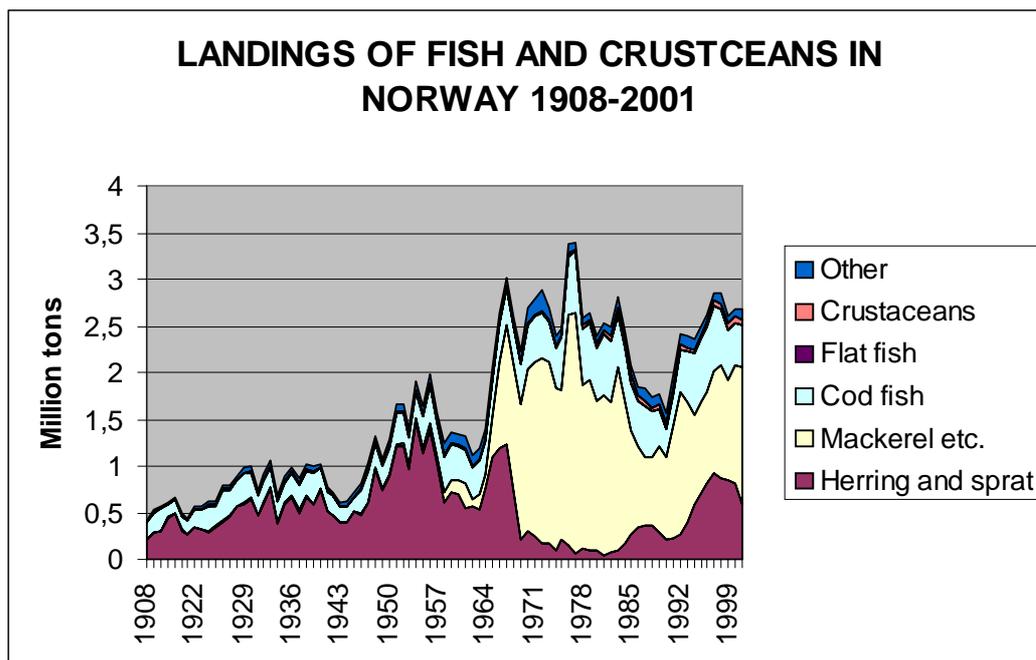


Figure 1: Quantity of fish landed in Norway 1908-2001. (For a further explanation of these categories, see Appendix.)

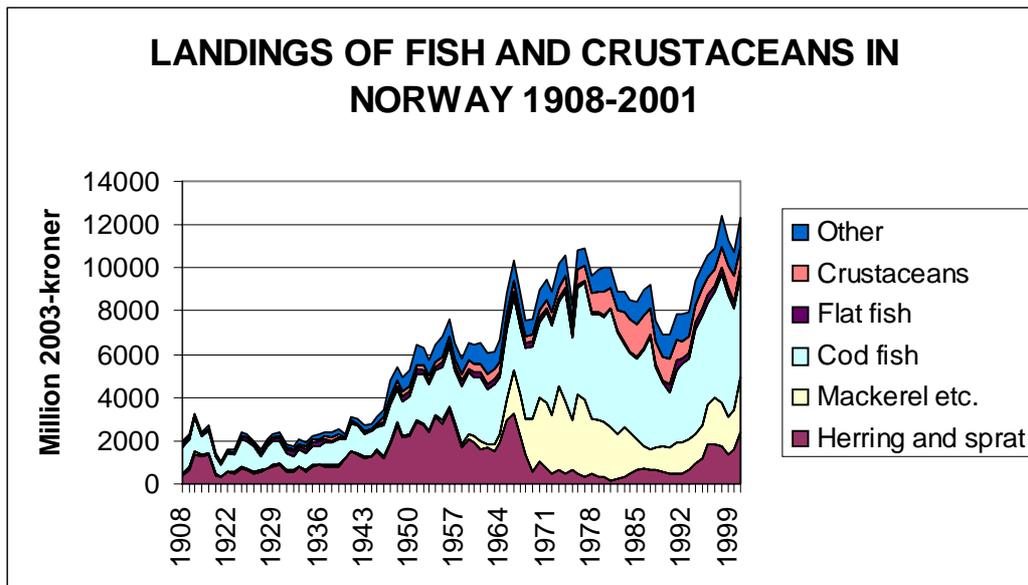


Figure 2: Value of fish landed in Norway 1908-2001

The rise in the herring catches in the 1960s was caused by a technological leap. A mechanical winch, the so-called power block, came to be applied to pulling the purse seine, a gear used for catching herring by encircling a shoal with a net, closing the bottom and then hauling in the net until the fish are trapped in a small sack as it were. This replaced a technology where a small boat was put on the water in order to encircle the shoal, the net being pulled by hand. Another important development was the introduction of fish finding equipment, the so-called asdic, which enabled the fishermen to see the herring shoals under water instead of observing them by ripples on the sea. These innovations increased the fishing power of the fleet enormously over a short period of time and are generally alleged to have brought the herring stocks to a collapse. The shoaling behaviour makes it relatively easy to catch herring even though the stock has been severely depleted, so that a diminishing profitability does not provide a strong enough feedback mechanism to halt an ongoing depletion until it is, perhaps, too late. While the herring stocks did not vanish totally the fishery was actually brought to a halt in the 1970s. This may possibly have saved the stocks.

Not only have there been large fluctuations in the total catch, there have also been major changes in the composition of the catch. After the herring collapse in the late 1960s there was an enormous increase in the catches of mackerel and capelin, so large in fact that the total catch volume held up well and even increased despite the collapse of the herring. Since capelin and mackerel were mainly used for low-paying meal and oil, the value of the total catches would have fallen had it not been for an increase in the landings of the more highly valued cod. As we will return to, decline in one fishery spurs the development of another. The North Sea mackerel met a fate not dissimilar to the herring, but new mackerel stocks came on the scene, and the capelin stock held up well until the late 1980s.

3. The herring fishery in the inter-war period

The labour market in Norway in the inter-war period was still dominated by primary industries, even though the secondary and service industries were expanding. In the coastal areas of Norway people employed in fisheries usually also pursued other occupations, for example farming, carpentry, and in some areas factory work. Nevertheless, many small communities along the coast were more or less completely dependent on the fisheries. Figure 3 shows Norway and the counties along the coast.

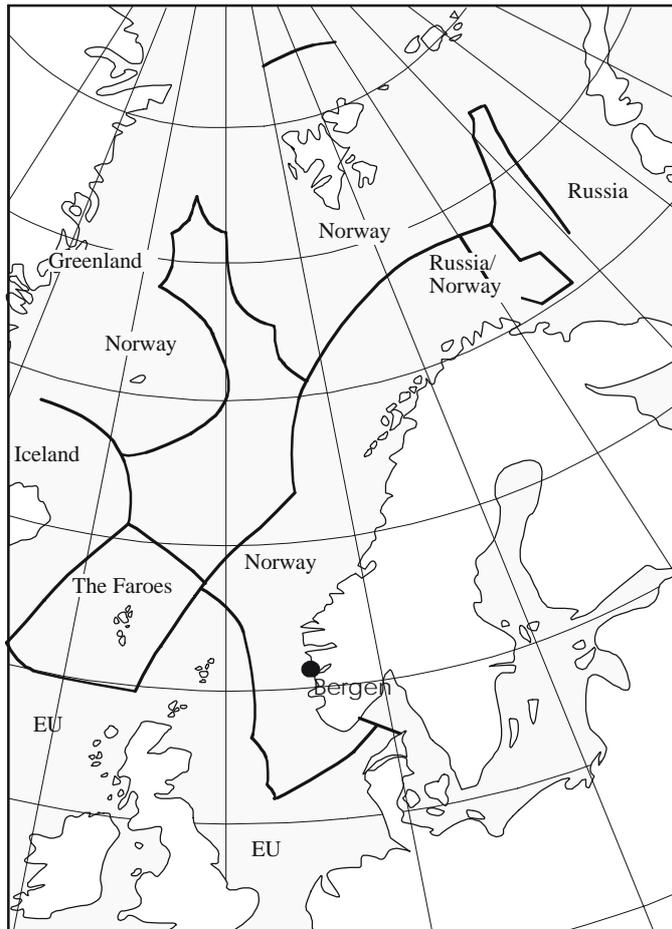


Figure 3: The location of the winter herring fisheries was north, south and west of Bergen in Hordaland county.

The herring fisheries dominated the fishing industry in Hordaland county, and it was also the most important fishery in Norway as a whole in terms of employment, as well as the quantity and value of landings. Many municipalities along the coast of Hordaland were based on fisheries – first and foremost the herring fisheries, more precisely the so-called “winter-herring” fishery, which is the sum of the big and the spring herring fishery. Table 1 shows the share of fishermen in the working population in typical fishery-dependent municipalities.

Table 1 Fishery-dependent municipalities in Hordaland county in the inter-war period

Fishermen as a share of the total number of people working	Municipality
Over 60%	Bømlo, Bremnes, Austevoll, Sund, Fjell, Herdla, Hjelme, Fedje
20 to 60%	Austrheim, Fitjar, Moster, Fjelberg, Valestrand, Sveio
5 to 20%	Skånevik, Kvinnherad, Tysnes, Strandvik, Os, Askøy, Manger, Hordabø, Lindås

Source: Johansen (1989).

In eight municipalities over 60% of the work force was employed in the fishing industry. It is certainly to be expected that changes or fluctuations in the fish stocks and landings will have significant effects on such single-industry communities. Note that these figures only cover people directly employed in the fishing industry. Many people were employed in subcontracting activities, for example as crew on pilot boats involved in the herring fishery, as fish buyers, workers in the fish processing industry, in box and barrel making factories, shipyards, boat yards, engine factories, and engineering workshops.

Askøy is an example of a municipality that has few fishermen (se Table 1). On the other hand, the indirect economic activities derived from the herring fishery were essential for the economic activity in Askøy during the first part of the 20th century.

The winter-herring fishery

The fishing communities in Hordaland definitely depended primarily on the herring fishery in the winter months. In the period 1920 to 1940 the (winter) herring fishery amounted to about 50% of the total sales value of fish in the county. About 5-6000 fishermen took part in this fishery. If we also include sprat and other herring fisheries the herring amounted to about 70% of the total first hand value.

The west coast has had two rich herring periods; the first from 1808 to 1870 and the second from 1890 to about 1960. If we include the fishing activity north of Stadt, the latter period can be prolonged to about 1967. After the rich herring period was over in 1870, the rural districts in the inner parts of the coastal area dropped more or less out of the fishery. When the herring fishery expanded two decades later they did not resume their fishing activity.

In the latter period the herring fishery “Storsildfisket” (the “Big-herring” fishery) began along the coast of Møre/Romsdal county in November – December. Some decades later this fishery began immediately after the turn of the year. Later in the season the fishery moved further south along the coast of Sunnhordaland and Ryfylke as the centre of the “Vårsildfiske” (the “Spring-herring” fishery) in February and March. The winter-herring fishery is the sum of the big-herring and the spring-herring fishery. The quantity caught by the fishermen in Hordaland amounted to 22-23% of the total landings of herring during the period 1920 to 1940. Typically, when the fishery was good with high volumes, the price was low, and when the volume was low – the price was high. Hence it may be said that the market mechanism partially, but far from totally, internalised the income risk by reducing the variance in the aggregated income.

Geographical differences in the use of fishing gear

In the late 1930s about 6000 fishermen from Hordaland county took part in the (winter) herring fishery. The most common fishing gear in Hordaland was seine – more precisely land-seine. In Rogaland and Møre/Romsdal counties, the counties south and north, respectively, of Hordaland, purse seine was most commonly used. The use of land seines implied that the catch of the herring took place close to shore. When using this gear the fishermen have to wait for the fish and catch it when it becomes available. This is a passive gear compared to a mobile gear technology which enables the fishermen to detect and chase the herring.

It is to be expected that land-seine fishing is less flexible and economically more risky, compared to the more mobile purse seine technology. After all, the herring may not show up close to the shore. During the 1930s fishermen started to upgrade the seine-boats by installing engines. Gradually the land-seine was replaced by purse-seine technology.

The land-seine gear was risky to rely on because of its inflexibility and its dependence on good weather conditions. Most of the land seine fishery was organized by a seine-group. This form of organization reduced the income risk fishermen were exposed to, because investment in seines was divided among a group of fishermen, and the income was generated from a number of seines, which increased the probability to have a share of the catch. This form of organizing the fishery also contributed to equalizing the incomes of the participants.

The fishing technology evolved in a direction which became more and more capital intensive. The high capital intensity and fixed costs involved external investors from the towns on the west coast; Stavanger, Haugesund, Bergen, Florø, Måløy, and Ålesund. This development was especially typical for Møre/Romsdal and Rogaland counties.

The average net income from the herring fishery in the inter-war period was 200-300 kroner per fisherman during the three months harvesting period. In the best seasons the average income was 500-600 kroner per fisherman. As a comparison, the average taxable annual income was 1400-1500 kroner per taxpayer in Hordaland in the late 1930s.

The different types of herring

Depending on size, migration pattern, and spawning area, the herring is classified into different main groups. These groups are, furthermore, divided into different subgroups.

The herring caught outside and along the coast of Hordaland county in the winter months is classified as Norwegian Spring Spawning herring, which is a part of the Atlanto-Scandian herring. The North Sea herring is another group and does not belong to the Atlanto Scandian herring class.

As mentioned before, the winter herring fishery is the sum of the big herring and spring herring fisheries. The “small herring” fishery took place along most of the Norwegian coast (i.e., from Rogaland to Finnmark counties) from July to September. The “fat herring” fishery took place from north of Stadt to Finnmark county and started late in the summer or in the beginning of the autumn. The main areas for these last mentioned fisheries were outside Troms and Nordland counties. The herring fishery off Iceland started in July and ended in the beginning of September. Norwegian fishermen initiated this fishery right after 1900. Fishermen from Norway used land-seine, drift net, and later purse seine, to catch the fish.

The North Sea herring fishery

The North Sea herring fishery has a long history. Fishermen from Holland were engaged in an extensive herring fishery as early as the 1600s. If we look at the twentieth century, the herring fishery in the North Sea began to decline after 1907. In the period 1920 to 1933 there was hardly any herring fishery in the North Sea. Norwegian fishermen using drift nets took part in this fishery from 1934. In the late 1930s about 500 fishermen were engaged in this fishery. The bulk of the catch was landed in Hordaland county. During the 1960s the North Sea herring fishery was completely changed – mainly because of a significant increase in efficiency by the application of purse seine technology.

Data on aggregate landings from the different herring fisheries show how the fisheries have fluctuated over the years (see figure 1, 2 and 5). If we look at the data from the inter-war period we can see that the “small-herring” fishery accounted for 4% of the total landed value in Hordaland county, the share of sprat was 13%, and the winter herring fishery amounted to about 49%. The numbers indicate clearly that the herring and sprat fisheries were important for the fishing sector and for the communities along the coast of Hordaland county.

The sprat fishery

The fishing fleet that caught sprat also caught herring – especially small or juvenile herring. The fishing of sprat increased after 1900, among other factors because of technical improvements in the canning industry. The export of canned, smoked sprat in oil virtually exploded in the period from 1903 to 1915 (Johansen 1989).

The volatility in income, i.e. variation in price and quantity, was high in the sprat fishery, higher even than in the herring fishery. One important reason for this is the short lifetime of sprat, and it is also sensitive to changes in ocean currents, temperature, and the supply or inflow of forage fish.

In 1934 there were 194 factories for canning of sprat in Norway, and 31 of these were located in Hordaland county. The sprat was caught with land-seine. The development in the sprat-fishery was similar to the herring fishery – i.e. the purse-seine technology gradually took over. On average about 2500 and 3500 fishermen took part in this fishery in the late 1930s.

Fishing and other occupations

It was mentioned above that most of the income from fishing was based on seasonal fisheries. The income from the fishery was not high enough to cover the cost of living for a whole year. Before the Second World War, and also in the immediate post-war years, fishermen typically engaged in various occupations besides fishing. But the historical development was towards more and more specialization of the labour force, and fishing became more or less a full year occupation.

In the interwar period it was normal that fishermen combined three or four occupations, for example farmer, carpenter, mason and other craftsman jobs. After the war the fishing boats were relatively well equipped and in such a way that they could be used for transportation in the off-fishing season. In Hordaland county about 1500 fishermen were engaged in transportation in the late 1940s.

Table 2: Estimated income per taxpayer in Hordaland county 1937-1939. Fishermen, small farmers, farmers and average for all groups

	Fishermen (full time)	Small farmers	Farmers	Average in the county
1937	636	965	1373	1481
1938	732	1005	1427	1580
1939	735	1079	1487	1668

Source: Johansen 1989 and Norway's Official Statistics (NOS): Tax-statistics for budget year 1937/1938-1939/1940, table: A, p. 8.

Table 2 shows the gross income for different full time occupations in Hordaland county in the period 1937-1939. From the table we can see that the fishermen's average income was smaller than for small farmers and farmers.

4. A time of change

The years between 1940 and 1960 were a period of change for the fisheries on the West Coast of Norway. First there were the problems resulting from war and occupation, and then the reconstruction and investment in a new fishing fleet – among other factors investment in new fishing technology and bigger boats. Finally there was the sudden collapse of the winter herring fishery in the late 1950s and the Atlanto-Scandian stock about ten years later.

The years around 1960 can be regarded as a crossroad for the fishing industry on the west coast of Norway – and more or less also for the rest of the coast. Until 1960 the fisheries can be characterized as a typical coastal fishery. Most of the landed fish was caught close to the coast near the archipelago. The crisis in the herring fishery in the late 1950s forced more and more boats out of the archipelago and into the open sea to look for alternative fishing grounds. It should also be mentioned that the technical development and improvement in the fishing technology which took place at the same time made it possible to begin distant water fishing.

We will not go any further in describing the situation in the fisheries during the war 1940-45, except mentioning that the price of fish in general increased during the war, and that the income received by the fishermen also increased. Figure 4 shows how the average income evolved 1939-1945.

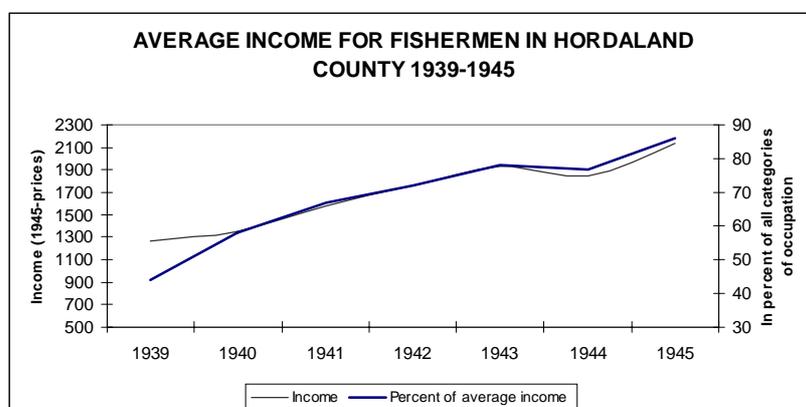


Figure 4: Average income for fishermen in Hordaland (based on data from Johansen (1989), p. 98).

The winter herring fishery after World War II

In the immediate post war years (1946-1947), 17-18000 fishermen took part in the winter herring fishery. In 1950 the total participation was 24600 fishermen, increasing to about 28000 in 1957. About 4000-4500 fishermen from Hordaland county directly took part in this fishery. If we also include crew on freight boats, the winter herring fishery probably employed 1000 more men in Hordaland. It may be added that the winter herring fishery employed more fishermen in Møre/Romsdal county, Rogaland county, and Sogn/Fjordane county than in Hordaland county. Figure 5 shows how the volumes of the catches have developed over time. While the landing record before the war was 5.3 million hectolitres in 1938, the landed volume in 1948 was 9 million hectolitres. The winter herring fishery culminated with 12.6 million hectolitres in 1956.

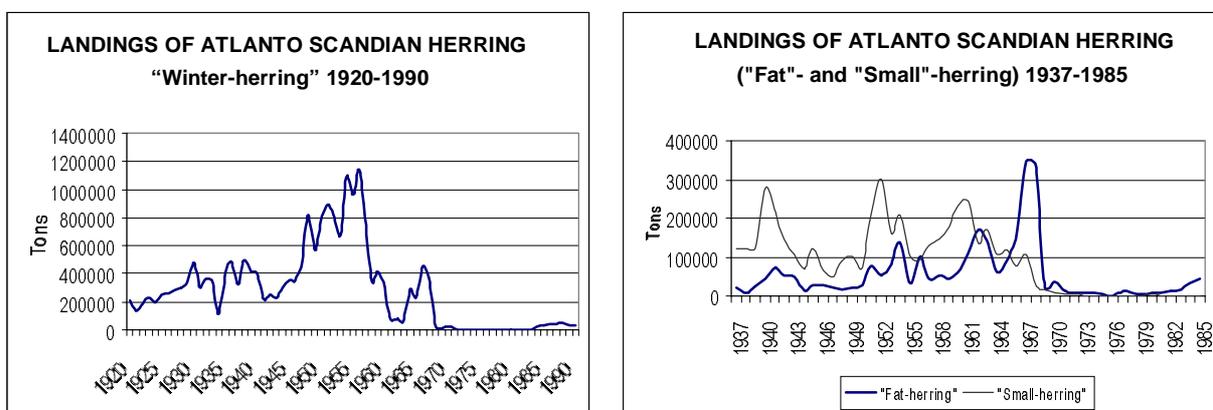


Figure 5: Landings of herring (source: Statistics Norway).

The fishery moves north

During the period 1945-1956 the concentration of the winter herring fishery moved north along the coast from Rogaland and Hordaland counties to Møre/Romsdal and Sogn/Fjordane counties. Fishermen from Rogaland and Hordaland caught first and foremost the "spring herring". As a consequence of the change in the migration pattern of the herring, the fishermen from Hordaland began catching the "big" herring later.

The fishermen from Rogaland and Hordaland caught and landed on average about 1.6 million hectolitres a year, but the total landed volume was 4.7 million hectolitres in Hordaland. This can be explained by the fact that the production capacity in the industry located in the other counties was too small to absorb the whole catch.

After the war the importance of the land-seine and the set-net diminished, but the use of purse seine increased. Table 3 shows landed volume and fishing gear in the period 1945-1956 (percentage distribution, and for the whole country). The shift in the fishing gear implied also a shift toward more capital-intensive gear, and the need for labour per ton of catch decreased.

Table 3: Landings of winter herring according to fishing gear 1945-1956 (percent)

Year	Purse seine	Land seine	Drift net	Fishing net
1945-1947	42	4	25	29
1948-1950	47	9	24	20
1951-1953	61	1	29	9
1954-1956	68	1	27	5

Source: Johansen (1989), p. 104.

Before the war and immediately thereafter there was optimism, and investment increased. The increase in landings created optimism and expectation of more prosperity. The fishing production process became more capital intensive, and the risk of being inflexible and economically vulnerable to negative shocks such as lower fish prices and less catch increased. High capital intensity implies high fixed costs, and positive profits demand high volumes. But no tree reaches the sky – and neither do fish landings.

5. The crisis in the herring fishery: consequences, adaptation, causes

The decline of the winter herring fishery started in the 1957-season – after ten years with steady growth and expansion in the herring fisheries. That year the purse seine fishery failed. The following year the drift net fishing also failed. As we can see from the figures for landed quantity, the lowest landed quantity was reached in 1961. This was a preliminary bottom; later (1964-1967) there was a substantial recovery in the herring fishery – as we also can see from Figure 5 (remember that winter herring is the sum of “spring” herring and “big” herring).

On average a purse seine had to catch between 9-10 000 hectolitres herring to break even in the late 1950s. The break-even catch gave the crew an income of 7-8000 kroner per fisherman. The duration of the fishery was two to two and a half months work. The average salary for an industrial worker at that time was about 1000 kroner per month. Under these economic conditions, getting a crew for the purse seines was not a problem.

After the collapse in the herring fishery in 1957, the income was dramatically reduced, and many fishermen had to be satisfied with 75 kroner per week, or about 300 kroner per month. This amounted to about ten percent of the income in the heydays (Johansen 1989).

Economic statistics show that the average operating result was about 43000 kroner per purse seiner in 1956, while the result was reduced to respectively – 32000 kroner in 1957 and – 77000 kroner in 1958. The combination of decreasing landings of herring, bad weather, and a boom in investment that increased the capacity and participation in the fishery, made the herring fishery unprofitable. The crisis stimulated rethinking, and affected fishermen and politicians began asking what would have to be done to make the fishery profitable. We do not anticipate too much by arguing that the series of crises – economic crises – laid the foundation for the changes in behaviour and regulation of the fisheries that came later.

Multiplier effects

It is to be expected that a dramatic and sudden change in income at the top of the value chain will be quickly transmitted to the lower levels. The sudden reduction in herring landings affected respectively the oil and fishmeal industry, the industry which made salted products of herring, exporters of fresh and frozen herring, the canning industry, the barrel industry, and boatyards. No less than three quarters of the raw material for the oil and fishmeal industry came from the winter herring fishery. It should also be mentioned that the tax income and activity in many fish-dependent municipalities were negatively affected by the crisis.

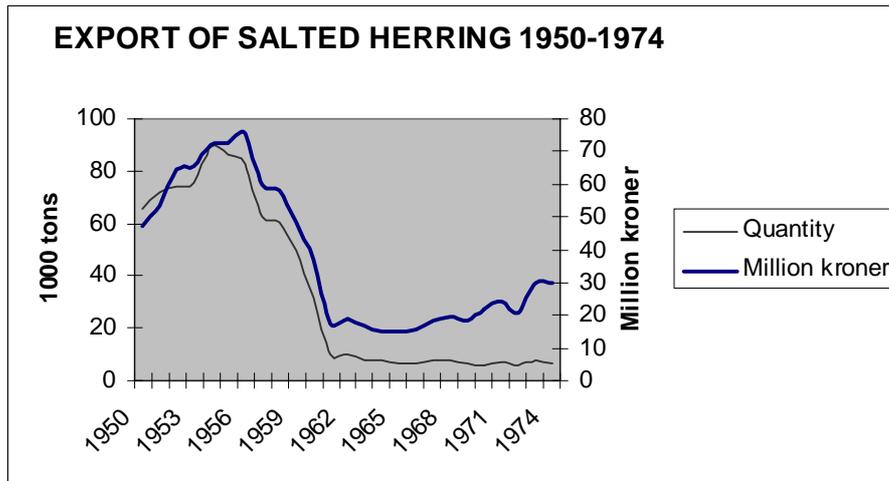


Figure 6: Export of frozen herring (source: Statistics Norway).

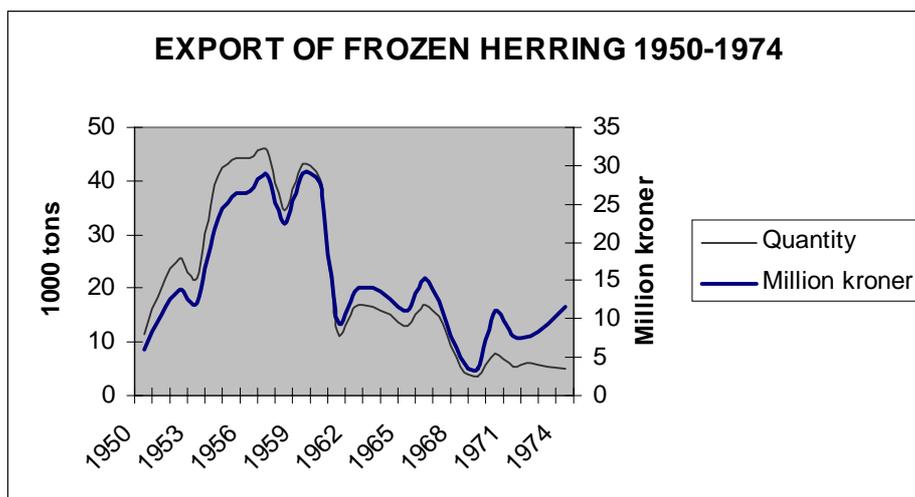


Figure 7: Export of salted herring (source: Statistics Norway).

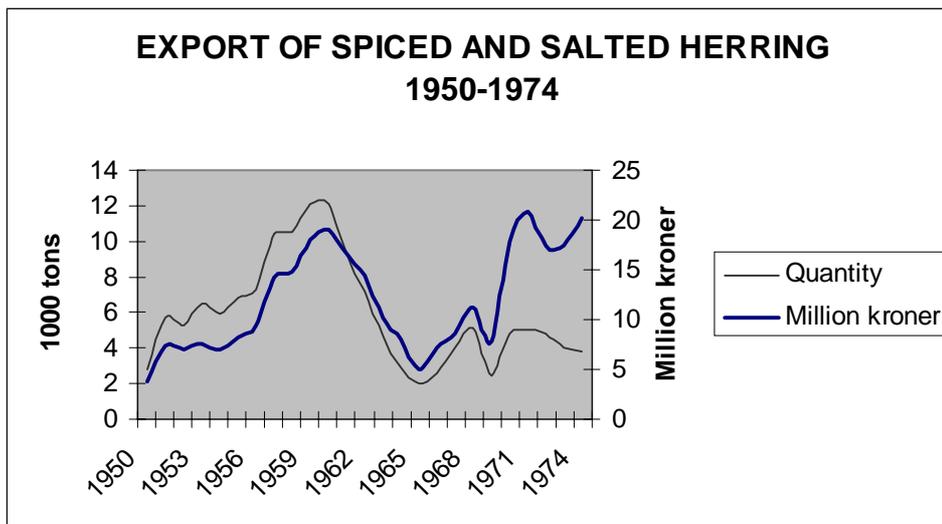


Figure 8: Export of spiced and salted herring (source: Statistics Norway).

To illustrate how the collapse in the winter herring was transmitted to the rest of the value chain, we can look at the export value and quantity for some relatively important products of herring during the period 1950-74. The products are export of frozen herring (Figure 6), export of salted herring (Figure 7) and export of spiced and salted herring (Figure 8). In addition the total export of fish is also presented for the same time period (Figure 9).

The reduction in landings of winter herring started about 1957, and it is to be expected that exports of products of herring began to fall the same year. We must, however, take into consideration that some of these products are salted or frozen so that they can be kept in stock. Therefore, some minor time lag between landings and export figures is to be expected. The years before the collapse the export value and quantity increased. The turning point was about 1958-60 – depending on product. During two to four years after the decline started, the volume and export value were reduced significantly. The decline was slightly compensated by a positive price effect, probably because of the reduction in the supply. The slight increase in the export in the early 1970s is due to the landings of herring from the North Sea.

The collapse of the North Sea herring fishery started about 1966-67, and the effect on export is vaguely mapped in the export figures of frozen herring and spiced and salted herring. Note also the slightly increase in export value and volume about 1966-67. This can be explained by the temporary increase in the landings of winter herring – before it faded out. It is probably also possible to note the collapse of the winter herring fishery in the figures for total export of fish. Figure 9 shows a reduction in value and volume in the period 1956/57-1962. It is probably also possible to note the effects of the collapse of the North Sea herring in the aggregated export figures in the period 1967-1971.

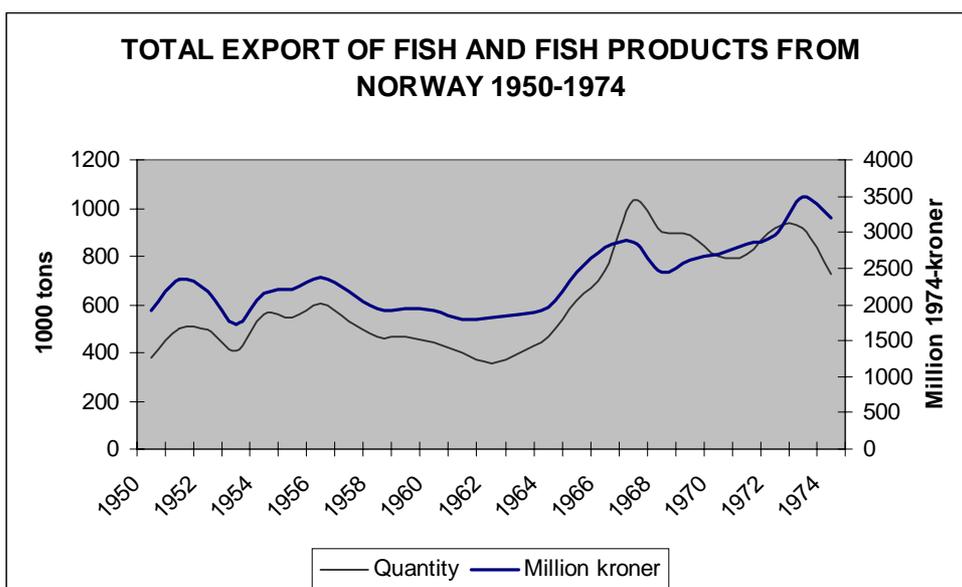


Figure 9: Total export of fish and fish products (source: Statistics Norway).

What caused the crisis?

In the season 1952-53 fishermen observed that there was less herring in the sea compared with the years before. Furthermore, an article in the newspaper *Fiskaren* in 1954 indicated that the increase in total landings was less than the increase in the efficiency and capacity of the fishing fleet. These improvements tend to squeeze the profitability in the fishery. Besides, the probability for overexploitation of the fish resources also increases.

In the period 1950-1959 no good or strong age groups of herring were found. About 60% of the catch in 1959 was fish from the 1950-year class. It was also argued that the nutrition and spawning conditions were aggravated in the same period. Nowadays the oceanographers explain these changes in the eco-system by changes in ocean temperature and currents (Johansen 1989). Not only were the year classes recruited in the period 1950-1959 weak, one and two year old herring were also heavily exploited by the Norwegian fleet in that period [see *Fiskaren* May 16th 1954 and the article by T. Aas May 12th 1954, and *Fiskaren*, November 11th 1969].

During the 1960s, researchers on herring at the Institute of Marine Research in Norway came to the conclusion that it was necessary to protect juvenile herring and simultaneously reduce the exploitation of so called “fat herring” between three and four years old. Some of the researchers on herring concluded that the collapse in the herring fishery in the late 1950s could mainly be explained by the overexploitation of the juvenile herring. The overexploitation hypothesis has come to be widely accepted, but oceanographers have pointed out that the demise of the herring stocks coincided with declining temperatures in the Northeast Atlantic (see, e.g., Stenevik and Sundby [2004]). The causal relationships may therefore be more complicated. Herring stocks have been known to fluctuate and to periodically disappear long before the technological advances in fishing that put them under an unprecedented strain in the 1960s.

How did the fishing industry adapt to the crisis?

The winter herring fishery was pivotal for most of the fishermen on the west coast of Norway, both in the interwar period and after the war until the collapse in 1957. Half of their income was based on that particular fishery. Fishermen's allocation of time and resources between fisheries depended first and foremost on the size of the boat. The fishing boats that took part in the winter herring fishery can be roughly divided into two groups, (1) boats 80-90 feet long or more, and (2) smaller boats. In June and July the large boats were engaged in the herring fishery off Iceland and in the North Sea. They were also often engaged in transportation. The small boats took part in the "fat herring fishery", "small herring fishery", and sprat fishery in the fjords and in the archipelago. North of Stadt the combination of fat herring and small herring (juvenile) fishery was typical, while south of Stadt it was the combination small herring (juvenile) and sprat.

When an important fishery fails, it is to be expected that the fishermen will look for alternatives. When the winter herring fishery failed in the late 1950s the fishing on juvenile herring intensified. Some characterized this fishery that went on in the fjords in the North of Norway as "vacuum cleaning". The fish was delivered to the oil and fishmeal industry (Source: Johansen (1989), p. 113). South of Stadt the juvenile fishery was also increased, but the fish was sold to the canning industry.

Hordaland was the most important sprat-fishing county in Norway in the period 1940-1960. The sprat fishery also became more efficient and more capital intensive, for example through the development from land seine to purse seine. The herring caught in the summer months (July to September) off Iceland belongs to the Atlanto-Skandian herring ("fat" and "big" herring) as the winter-herring, the so-called "spring spawning" herring caught along the coast of Norway in the winter months. The Norwegian herring fishery off Iceland in the period 1945-1962 is illustrated in Figure 10.

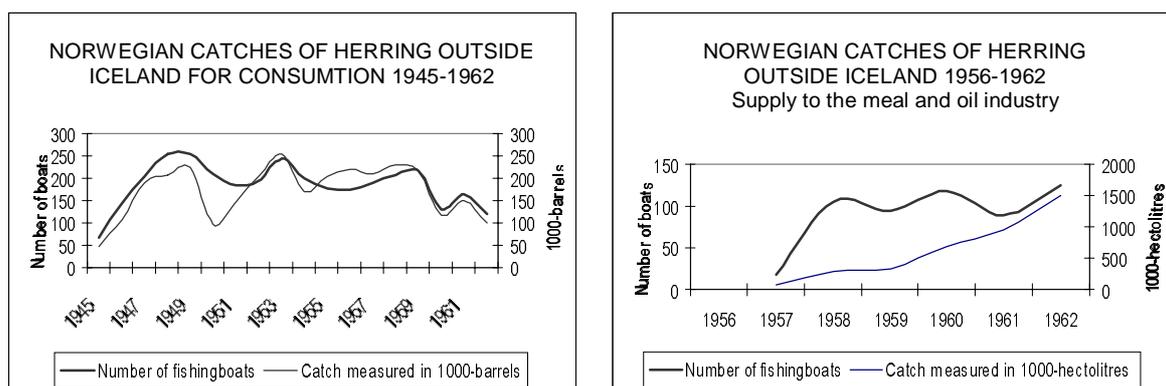


Figure 10: Norwegian catches of Icelandic herring (source: Statistics Norway).

The location of the herring fishery off Iceland changed over years. Until about 1960 it was located along the coast north of Iceland. Later the fishery took place east of Island, partly in the open Atlantic north of the Faeroe Islands up to Jan Mayen. The season was also prolonged from July-September to the period July-November/December.

During the heydays in the herring fishery the supply of herring to the oil and fishmeal factories was satisfactory. After the collapse we can observe a change in the demand for raw fish. The shortage of herring to the oil and fishmeal industry during the late 1950s and 60s was compensated by increased supply of herring caught off Iceland. Figure 10 above also shows the increase in the importance of this particular fishery for the oil and fishmeal industry.

The North Sea herring fishery

The North Sea herring fishery has long traditions, in particular for the fishing industry in Holland, Sweden, Denmark and Germany. The Norwegian fishermen applied drift nets to catch herring in the North Sea in the period 1900-1935. The Norwegian share of the catch was marginal compared to the other nations' landings. The Norwegian fishermen could not use trawl in the North Sea, as this was forbidden by the "Trawler Law" of 1939. In 1946 the Norwegian government began giving concessions for trawling in the North Sea. Because of the rich winter herring fishery and full capacity utilisation there was no incentive to increase the effort in the North Sea. After the collapse in the late 1950s and with the introduction of the "power block" and purse seine technology it became technologically possible and profitable to exploit the herring resources in the North Sea. Hence the fishery in the North Sea expanded dramatically during the 1960s.

Herring is gone – tuna is gone

During the 1950s the tuna fishery expanded along the coast of Norway. Since tuna chase herring, they tend to follow the migration pattern of herring. When the tuna fishery was at its highest it employed 4-5000 fishermen in total. Figure 11 shows how this fishery evolved over time.

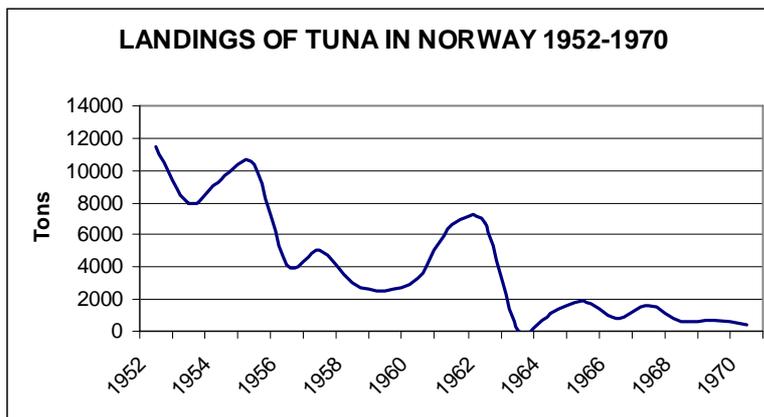


Figure 11: Landings of tuna. Source: Statistics Norway.

As we can see from the figure, the tuna fishery disappeared when the herring disappeared in the late 1950s and early 1960s. Fisheries biologists have explained the disappearance of the tuna partly by the high exploitation by both the Norwegian fleet and fishermen in Biscaya, and partly by the collapse of the Atlanto-Scandian herring. As a consequence of the drop in the seasonal fisheries in Norway, the Institute of Marine Research in Norway sent a research vessel in 1959 to remote fishing grounds to investigate whether it would be possible for

Norwegian fishing vessels to exploit tuna resources in distant areas such as Biscaya. Some attempts were made, but it was not profitable.

Table 4: Participation in different fisheries by fishermen from Hordaland county 1947/48 and 1959/60

Fishery	1947/48	1959/60	Change
Saithe	811	260	- 551
Mackerel	1064	660	- 404
Salmon	588	395	- 193
Lobster	2035	983	- 1052
Crabs	829	328	- 501
Fjord cod	196	184	- 12
Mackerel shark	192	60	- 132
Basking shark	56	151	+ 95
Eel	172	135	- 37
Small whale	115	71	- 44
Bream, ling, whiting, flatfish, haddock, etc.	2049	1216	- 833
Total reduction in number of fishermen			- 3664

Source: Johansen (1989), p. 125.

The saithe fishery along the coast of Hordaland

The saithe fishery was an important fishery for the fishermen in Hordaland county. The saithe forage both on herring and herring roe, so when the herring disappeared in the late 1950s it brought decline on the saithe fishery.

The fishermen in Hordaland county also took part in other fisheries. Table 4 shows the number of fishermen who took part in the different fisheries in Hordaland county in 1947-48 and 1959-60.

Local differences in Hordaland county

As already stated, Hordaland county was a typical herring county and a seine county. These characteristics in fact are most appropriate for the municipalities in the middle of the county; Austevoll, Sund and Fjell. Most of the purse seines were located there, and their prosperity was founded on the winter herring fishery, the tuna fishery, and the herring fishery off Iceland. On the other hand the sprat fishery showed a decreasing share of the total fishing activity.

The fishery was more fragmented in the municipalities in the northern part of Hordaland county. These municipalities, for example Herdla, Hjelme, Fedje and Austrheim, had fewer large fishing boats but more medium sized and small boats. Nets were typically used to catch the herring. Fishermen in these places also caught other species such as saithe, pollack (whiting), cod, haddock, bream, small whales, and ling.

Typical characteristics of the municipalities in the south were diversity of to fishing gear and the size of the fishing boats. The most important fisheries were the mackerel and lobster fisheries. The fishing in these areas was based on local resources, close to the coast.

In general we can conclude that the coastal fishery was based on relatively local resources, mainly on sprat, mackerel, lobster, crab, saithe and young year-classes of saithe. On the other hand the herring fishery was pursued more and more by the purse seine fleet, which was continuously improving and increased its area of activity and the distance from its home base.

In a historical perspective, society was evolving toward a greater specialization and industrialization, that is, away from a subsistence economy. At the same time the fish resources started to decline in the late 1950s. The combination of being a fisherman and a peasant gradually became less and less important.

A coast in crisis – major problems in the fishing industry about 1960

It has been mentioned that the Norwegian fishing industry had a growth period from 1930 and into the 1950s. It was a period characterized by a positive development, and the income earned by the fishermen was increasing relative to many other occupational groups. Needless to say, the optimism turned to pessimism when the winter-herring fishery collapsed in 1957, and the situation got worse in the coming years. In addition we must also take into consideration that the situation was getting severe because other fisheries as well more or less collapsed at the same time, among others the lobster, saithe and tuna fisheries. Earlier it was briefly described how the fisheries and the fishermen were affected by the crisis in the late 1950s. Local public finances are another indicator of how the collapse in the herring fishery affected the people in the fishing communities.

Table 5 shows the economic condition in a sample of affected municipalities, and how much the tax income was reduced because of the collapse in the herring fishery. The dramatic reduction in income tax from private persons and tax income from firms affected the supply of public services and public investment. The situation in many municipalities can be characterized as a situation of emergency. Many people experienced the situation as a natural catastrophe (Johansen 1989, p. 149).

Table 5: Overview over the shortfalls in tax revenues in different municipalities in Hordaland county in 1957-1958

Municipality	Number of inhabitants	Number employed in the winter-herring fishery	Percent shortfall in tax
Fedje	934	400	-21,4
Austrheim	2313	250	-15,9
Hjelme	1046	400	-48,8
Herdla	5274	800	-41,1
Fjell	5316	800	-30,9
Sund	3130	500	-40,6
Austevoll	3400	800	-57,6
Fitjar	3157	250	-22,5
Bremnes	4732	400	-14,7
Moster	1755	200	-13,0
Bømlo	1466	400	-34,5
Sum	32523	5200	-31,4%

Source: Johansen 1989, p. 148. The situation in municipalities after the collapse in the winter herring fishery. Archive in Hordaland county courthouse.

Government response to the crisis

The government granted loans to equip the fishing fleet and money for price subsidies to fishermen who were hardest hit. Many gave up being fishermen, especially those who came from the inner parts of the fjords and who combined fishing and farming. A peasant who also was a fisherman only took part in the herring fishery.

Table 6 shows the number of people who were full time fisherman and those who combined fishing and farming. Besides farming, people combined occupations like building and construction, marine transport and work in the manufacturing industry. The fact that the income from the herring fishery amounted to such a large share of the total income meant that the collapse in the herring fishery pushed the peasant-fisherman “system” out of balance. The decline of the combination farmer-fisherman was also promoted by the general development in society, among other factors increased specialization of the labour force, industrialization, increased education, urbanization, and increased opportunities for career choices.

It should also be mentioned that in the short run, right after the crisis in 1957 and the first part of the 1960s, the government granted money to employ people in road construction. Some persons who were pushed out of the fishery were employed in international shipping. In Austevoll, for example, the number of sailors increased from 157 in 1956 to 307 in 1959 (ibid p. 151).

Table 6 Number of fishermen in Hordaland county 1948 and 1960.

Year	Total number of fishermen	Number of full time fishermen	Number of fishermen combining small scale farming*
1948	7959	1197	4496
1960	4650	1344	1532
Change in the categories	-3309	+147	-2964

* Besides small scale farming, part time fishermen combined fishing with working in the building and construction industries, manufacturing industry, and the marine transport industry.

Source: Statistics Norway: Fishery survey (Fiskeritellingen) 1948. Part 1, p. 2 and Fishery survey (Fiskeritellingen) 1960. Part 1, p. 14 and pp. 174-175.

In addition to the short run responses to the crisis, industry and commerce and local government tried to implement a long run policy, which partly focused on establishing a more all-round or versatile economic activity, and partly on increasing the efficiency and developing the fishing industry in general. The relatively fast technological development implied that the fishing industry did not have to be entirely based on seasonal fisheries. The main goal was to implement instruments that would increase efficiency and provide year round activity and greater profitability in the fisheries.

Technological changes in the fishing industry

Up to the late 1950s the Norwegian fishing industry was still a seasonal, coastal fishery.. About 70% of the landings were caught in the time span January to April. These are also the months when the winter herring fishery and the cod fishery took place, for example, the Lofoten cod fishery.

Offshore catches (catches taken near Iceland, West-Greenland, Bear Island, Spitsbergen and the Barents Sea) amounted to 10-15% in the 1950s, while the rest came from the fishery close to the coast. In the 1960s this changed, and in 1965 the offshore fishery amounted to 36% of the total catch. It is not unknown that crisis forces people to rethink and search for new opportunities, which create growth. The strongest structural changes were observed along the west coast of Norway. The growth in the mackerel and herring fishery in the North Sea was rapid during the 1960s. One important reason for the pronounced rush into the said fisheries in the North Sea was the collapse in the winter herring fishery. This collapse forced the fishing industry to look for alternatives. But we must not forget that in the 1960s new fishing technology made it possible to exploit fish resources far from the coast. Examples are new technology to detect the fish (asdic, echo sounding), new manoeuvring technology, such as side propellers, and a new processing technology, such as pumping the fish on board. Larger boats with greater cargo capacity were built. New technology for cooling was installed. New technology for laying out and hauling in the seine was developed. The introduction of the power block in the early 1960s increased significantly the efficiency in the herring and mackerel fisheries. For the big purse seines the power block technology reduced the need for fishermen by 7-8 persons per boat. The need and demand for labour was reduced by almost a half.

The statistics for herring caught by the Norwegians near Iceland and landed in Norway shows a reduction 1963 and 1964. The main cause was bad weather. The fishermen from Norway did not use the power block technology, and were therefore more vulnerable than the Icelandic fishermen, who applied the power block and caught much more fish.

Figure 12 shows the participation in the North Sea herring and mackerel fishery, and the development of number of purse seine boats over 80 feet. It took three to four years to rebuild the purse seine fleet and equip it with power block during the 60s. The first year with a North Sea fishery dominated by the power block was 1964.

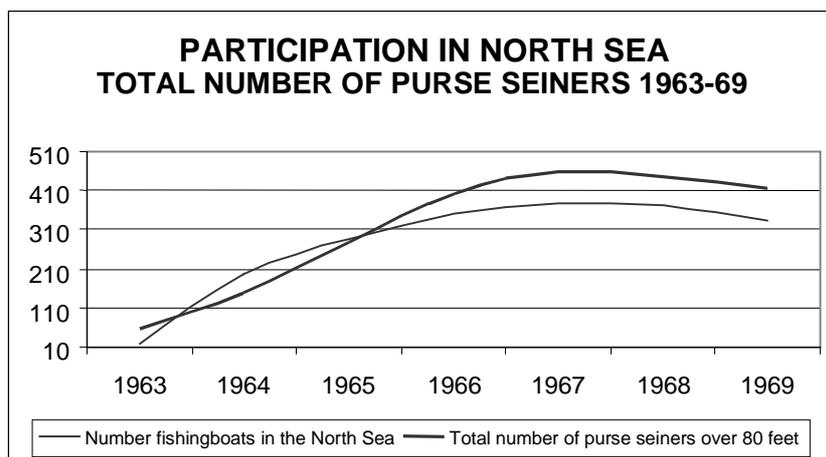


Figure 12: Participation in the North Sea herring fishery (Source: Johansen [19899, p. 160).

From an open fishery to regulations

The extreme efficiency of the power block-purse seine technology was first observed in the North Sea herring fishery. About 1960 the Norwegian fleet landed 180 000 hectolitres of

North Sea herring. The first real power-block fishery was in 1964, and that year the Norwegian purse seine fleet caught 2 million hectolitres of herring. The year after they caught 6.5 million hectolitres. The power block-purse seine technology was much more efficient than the North Sea trawling-technology.

In the early 1960s the share of the total catch of the Norwegian fleet was only 3%, but in 1964 the share had increased to about 40%. As a consequence of the extremely high entry rate in the fishery and the efficiency in applying the purse seine technology, it was difficult to control the fishery – especially the North Sea herring fishery. The exploitation of the North Sea herring increased during the 1960s. Other nations taking part in the fishery also increased their effort, among others Denmark, Sweden, Holland and West Germany.

The total landings of North Sea herring increased from 7-8 million hectolitres about 1960 to about 17 million in 1965. The total catch was reduced dramatically to about 12 million hectolitres in 1966. The decline continued in 1967 and subsequent years. As we can see from Figure 12 the entry rate into the North Sea fisheries was high. Finance institutions complained to the government and wanted to restrict the entry. In the late 1960s some restrictions on import of steel boats older than 10 years and wooden boats older than 5 years were put in place.

The herring fishery in the North Sea declined dramatically during the 1970s, and years the fishery was banned in 1977. What were the reasons for the decline? In 1967 Danish fisheries biologists complained that the exploitation of the North Sea herring was too intense, but their Norwegian colleagues didn't agree with that view. The recruitment of herring was weak during 1964 to 1968. It is difficult to say what was actually the main cause behind the low recruitment. It could have been due to changes in the eco-system causing irregular and low recruitment, or it could have been due to overexploitation of the resource. These hypotheses are similar to the explanations advanced for the collapse in the Atlanto-Scandian herring in 1957. In 1969 the fisheries biologists in Norway came out in favour of protecting the young year-classes of herring.

Looking for alternative resources to exploit

Besides the North Sea herring, the winter herring fishery was the most important fishery for the purse seine fleet in the first part of the 1960s. The decline and subsequent collapse in the herring fishery, both the winter herring and the North Sea herring, pushed the purse seine fleet to look for alternative resources to exploit, and shortly after the decline they intensified the exploitation of mackerel in the North Sea. The growth of this fishery was similar to the development of the herring fishery in the North Sea some years earlier, and the maximum volume was reached in 1968. Thereafter the landed quantity was reduced except for a short boom in 1973.

Other fishing nations also increased the exploitation of the mackerel in the North Sea. The need to find out how much should be caught was generally accepted. The fisheries biologists pronounced that the total catch was greater than the recommended catch. But at this point in time international cooperation on fisheries management was not yet institutionalised. After the decline of the mackerel fishery the purse seine fleet was “rescued” by a new fishery – i.e. the capelin fishery (winter and summer capelin fishery) off the coast of Finnmark county. Almost all of the capelin catch went to the fishmeal and oil industry. The capelin fishery in

the summer months was located further away from the coast of Finnmark county than the winter capelin fishery.

Figure 13 shows the mackerel (including young mackerel) and capelin fisheries 1960-1980. The relatively fast growth of the winter capelin fishery led to a regulation of this fishery in 1970. A general prohibition on fishing capelin west of zero-meridian was imposed for the period June 1st to July 15th. New regulations were implemented after 1971, and the capelin fishery became one of the most regulated fisheries.

The tragedy of the commons (Hardin 1968.) seems to have come closer and gradually to have become recognized by everyone in the fishing industry. Because of the dramatic increase in the efficiency in the fishing technology and the situation after 1970, the fisheries biologists came to understand that they had to play the role of a “watchdog” to avoid overexploitation.

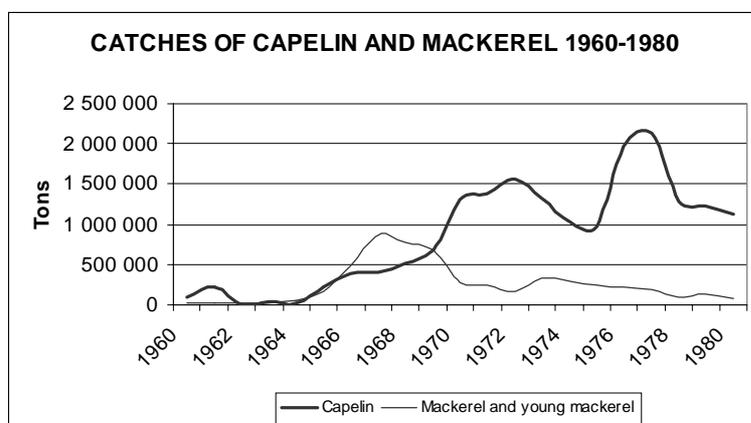


Figure 13: Catches of capelin and mackerel (source: Statistics Norway).

Expansion in new fisheries - sand eel, Norway pout and blue whiting

The collapse of the winter herring fishery during the late 1950s stimulated especially the purse seiners to enter the North Sea herring fishery. The entry rate was high in the early 1960s (Figure 12), until the power block technology took over in 1963-64.

During the late 1950s, especially after the collapse of the winter herring fishery, new fisheries were evolving, for example the sand eel-fishery, which was started by Danish fishermen. The oil and fishmeal industry was searching for input substitutes after the collapse in the winter herring fishery in the late 1950s. During the early 1960s many of the purse seiners were rebuilt so they could trawl for sand eel in the North Sea.

In 1959-60 Norwegian fishermen also began to trawl for and exploit Norway pout west and south of Jæren. Danish fishermen also initiated this fishery. The Norwegian fishing fleet landed 1 million hectolitres of Norway pout in 1963. Ten years later they landed about 2 million hectolitres. The volatility (variance) or oscillations in the Norway pout-fishery was relatively high. The life span of Norway pout is maximum three years, so it is similar to sprat and capelin.

During the 1970s it was quite easy to get trawling concessions for sand eel and Norway pout. In 1978 405 fishing boats had concession to exploit these species. Trawling for capelin off the coast of Finnmark county in the winter months and for Norway pout and sand eel in the North Sea during the summer months apparently was a lucrative combination. This was typical for medium sized purse seiners, which were not big enough to install power block technology. Many North Sea trawlers exploited blue whiting, a codfish, as a by-catch when they caught Norway pout. Figure 14 shows the landed quantity of Norway pout, sand eel and blue whiting during the period 1962-1980.

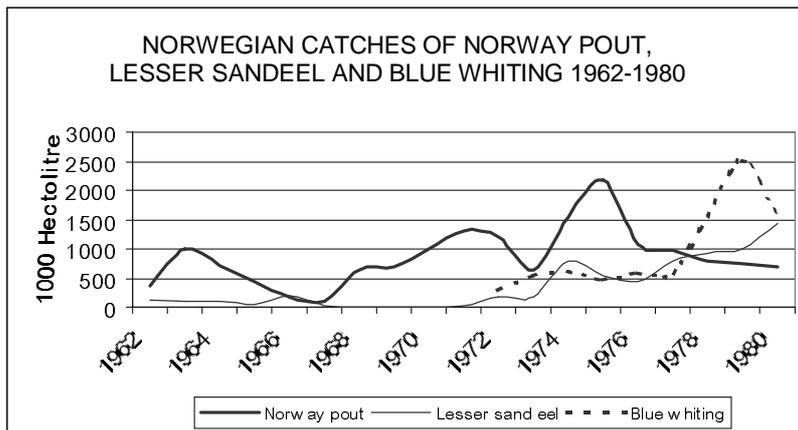


Figure 14. Norwegian catches of “new” species in the North Sea for the oil and meal industry (source: Statistics Norway, Fishery Statistics).

As already stated, the North Sea trawling for sand eel, Norway pout and blue whiting was mainly pursued by medium sized purse seiners. Some of the larger purse seiners also became equipped for trawling after blue whiting, especially after the decline in the capelin fishery. Blue whiting is caught in deep water, and for doing this the boats need a powerful engine. Today only the biggest purse seine boats trawl for blue whiting.

Some of the fishermen from the west coast of Norway, especially fishermen from Hordaland county, increasingly took part in the trawling for cod along the coast of Finnmark in the 1950s. This fishery was relatively popular until the expansion in the purse seine fishery in the North Sea started in 1963. We have not detected any increase in offshore fishing at the fishing banks off Hordaland after the collapse in the herring fishery – not from Hordaland. It was a more typical fishery in Møre/Romsdal county and in Sogn/Fjordane county.

It should also be mentioned that trawling in the North Sea for Norway pout, sand eel, and to some extent blue whiting, was combined with basking shark fishery. We are not sure about what year this fishery started, but the fishery kept going until 1982-83. The municipality of Fedje had the biggest share of both the basking shark concessions and the basking shark fleet.

The Norwegian purse seine fleet also took part in the sprat fishery in the North Sea near Scotland and North-England in the first part of the 1970s. The landings of sprat increased dramatically. The combination of falling prices of sprat in the raw fish market and falling prices of canned sprat resulted in a worsening situation for the sprat-fishermen along the west coast of Norway. A concession system for the sprat fishery was approved in 1979. When the sprat fishery was reduced and regulated, seining for saithe (medium size saithe) increased.

There was also an increasing demand for fillets of saithe at that time. In the late 1960s 1000-1500 tons of saithe were landed in Hordaland county, and the landings increased to over 4000 tons in 1972. The record was 6000 tons in 1981.

In Hordaland many fishermen also took part in the drift net fishery for salmon especially in the beginning of the 1960s. Many of the fishermen on the purse seine fleet also took part in the drift net fishery because they had time to do so between the herring seasons. The drift net fishery was regulated with concessions in 1978.

Aquaculture and oil

During the early 1970s the expansion of the fish farming industry started. Many fishermen took part in the establishment of the fish farming industry. The combination of decline in some fisheries and technological development in the fisheries in general led to a decline in the number of fishermen, and many of them found good employment opportunities in fish farming and the growing petroleum industry, especially on the west coast of Norway.

6. Two fishing communities - how they adapted

Bømlo and Fedje are two small fishing communities, and municipalities, which are located in the extreme south and north of Hordaland county, Bømlo in the south and Fedje in the north. The collapse and changes in the fisheries during the late 1950s and 60s significantly affected both communities, but they adapted and evolved differently. In the following we will analyse these communities.

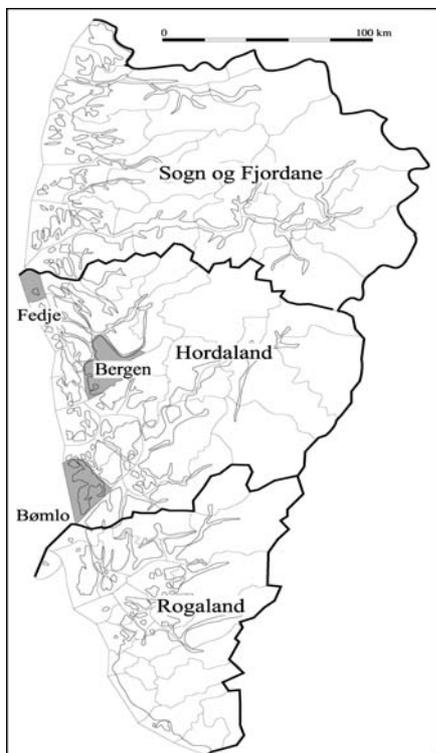


Figure 15: Bømlo in the south and Fedje in the north of Hordaland.

Bømlo has a relatively large and all-round fishing fleet. The number of fishermen has been relatively stable over the last twenty years. Fedje, on the other hand, has had a different development. The community has experienced emigration and a reduction in the number of fishing boats.

All communities on the west coast of Norway were more or less negatively affected by the collapse of the herring fishery in the late 1950s. Before the war the fishing industry was dominated by land seine and fishing net. After the war most of the herring fishery became dominated by purse seine technology. The Bømlo fishermen made this transition in technology relatively quickly. Some fishermen used fishing net. The use of drift net was popular during the 1950s and did not disappear.

Variety and an all-round fleet characterized the fishing community in Bømlo. The lobster fishery was relatively big, and the fishermen took part in the herring fishery off Iceland. In some parts of Bømlo the fishing industry dominated, and in other parts people combined fishing and farming. In the early 1950s the fishing industry provided about two thirds of Bømlo's total tax income.

The structure of the fishing fleet in 1958

In 1958 the composition of the fishing fleet in Bømlo and Fedje was as follows:

Bømlo

50 fishing boats under 30 feet,
31 fishing boats between 30 and 50 feet,
19 fishing boats between 60 and 90 feet,
8 fishing boats over 90 feet.

Fedje

49 fishing boats under 50 feet,
27 fishing boats between 30 and 60 feet,
10 fishing boats between 60 and 90 feet,
1 fishing boats over 90 feet.

Fedje had a smaller number of large fishing boats compared to Bømlo. Bømlo had five purse seiners, and these boats remained in the community after the ring purse seine fleet reached its top about 1967-68.

In contrast to many other fish-dependent communities, Bømlo avoided reducing its purse seine fleet during the 1970s. Moreover, Bømlo succeeded in becoming the biggest trawler municipality for fish for the meal and oil industry, like sand eel, Norway pout and blue whiting. Another fact is that fishermen from Bømlo also succeeded in building up a modern long line fishery. This kind of development was not observed other places in Hordaland county. In addition to the ground fishery and long line fishery and the sea-fishing fleet (trawling), Bømlo built up a relatively big and differentiated coastal fishing fleet for fishing sprat, seine fishing for saithe, drift net fishing for salmon and mackerel, pot fishing for eel, crab and lobster, and net and long line fishing for ling, tusk, cod etc.

Fedje

Fedje is mainly based on the fisheries. Between 60 and 70% of the tax income in the municipality is generated by the fishing industry. In the late 1940s four out of five workers were employed in the fishing industry.

During the winter herring fishery Fedje was one of the central harbours for the fishing fleet. After the war the shoreward migration of the herring moved farther north, so Fedje became less important as a harbour.

The fishermen in Fedje used drift nets, and they did not shift to purse seines in the 1950s as was typical for the fishing industry in Bømlo. One important reason was that relatively big purse seines (90-100 feet or more) are not useful for the alternative fisheries on which the fishermen in Fedje bet their money during this period, for example tuna fishing and whaling, including basking shark. With the benefit of hindsight we can say that they put their money on the wrong horses.

During the 1950s the activity in the basking shark fishery and whaling was relatively high. In the early 1950s Fedje succeeded in establishing a canning factory. In 1961 a cold storage plant was also established. A feed factory was established in 1968, and some years later an engineering workshop was set up.

If we take into consideration the relatively differentiated activities both on sea and land, it is to be expected that the fishing industry in Fedje had the same ability to adapt as was the case for Bømlo. The facts indicate that the fishing industry in Fedje did not adapt to the changes in the same way as the fishing industry in Bømlo did in the late 1950s and the first part of 60s. Historians explain this “failure” (compared with Bømlo) partly by the establishing of industry in general. Many fishermen went ashore and started to work in the industry, some after the collapse in the herring fishery and some as a consequence of the decline in the tuna fishery.

The “old” and traditional fishing technology, respectively drift net and land seine, in combination with a fishing fleet including only few boats over 60-70 feet, made it difficult to make the transition to the purse seine technology.

When the number of purse seine boats reached its maximum in 1967-68, Fedje had only one such boat. After the purse seine fishery became regulated it became well nigh impossible to enter into this part of the fishing industry. Fedje did also experience a reduction in the basking shark fishery and whaling. In addition Fedje experienced a general reduction in coastal fishing.

After the end of the 1970s the problems for Fedje increased. The seine fishing for saithe was gone, the trawling in the North Sea for blue whiting, sand eel and Norway pout had more or less ended, the whaling was marginal or prohibited, the cold storage plant (freezing plant) went bankrupt in 1983, and the feed manufacturing plant went bankrupt in 1986.

The introduction of the concession system for regulating the fisheries made life difficult for the fishermen in Fedje. The problem was that they stayed passive when fishermen were invited to apply for concessions for different fisheries. Fishermen from Fedje also lost concessions or fishing rights because they did not use them. The combination between

passivity and investment in fisheries that had no growth potential made the situation even worse.

From the comparison of the two municipalities we may conclude that a differentiated structure of the fishing fleet and an ability to exploit different fish stocks has resulted in more stable income and profitable activity, compared to an economic structure built on narrowly specialized fishing boats dependent on a minor group of species. A differentiated economic structure seems to internalise and reduce the exposition of economic risk.

7. Conclusion

This paper has described how the collapse in the herring fishery in the late 1950s affected the fishery-dependent parts of the west coast of Norway, especially in Hordaland county. As we have seen, these changes were on a major scale, some might even use words as spectacular and disastrous. They also took place over a relatively short period of time. Negative effects of climate change on fisheries are not likely to be any greater or to be more rapid, so this story should provide some clues as to what to expect and how to respond. Needless to say, climate change may also affect fisheries in a positive way. Such changes pose much less of a strain but they might nevertheless be a mixed blessing, because some fish stocks may decline or disappear while others rise, necessitating a structural change and a transition bringing with it some of the pain otherwise involved in a sudden, major decline.

In retrospect it must be said that the effects of the herring collapses were soon overcome. New fish stocks were found which replaced the herring that had disappeared. A major leap in technology (the power block and the asdic) may be seen as the culprit for the collapse of the herring; in a very short period of time it became possible to increase the catches many times over, and there was no management mechanism in place at the time which could limit what was essentially an international, open access fishery. But the new technology also made the transition to new stocks possible. The purse seine and the power block and the asdic were all very adept at finding and catching mackerel and capelin. Some communities were, however, more successful than others in making the necessary transition. And there was a transition not just to new fisheries but to other occupations. The collapse of the herring coincided with a transition to a greater occupational specialization; the farmer-fisherman was on his way out, and so was the farmer-fisherman-carpenter or farmer-fisherman-jack-of-all-trades, giving way to full-time employment in farming, in industry or whatever. This was a period of rapid economic growth, which eased the absorption of redundant fishermen into other occupations.

The collapse of the herring stocks slightly preceded the emergence of two new growth industries of late 20th century Norway, the fish farming industry and the petroleum industry. Many people who left the fishing industry or who would otherwise have looked for a career in the fishing industry found their way into those new industries. The impact of the herring stock collapses was undoubtedly much softened by the fact that they took place in a period of economic growth and rising employment.

What does this hold for future structural changes of a negative kind, such as might emerge from climate change? The Norwegian economy is more prosperous than ever and thus in a better shape to bear the costs of any structural changes, be they in the fishing industry or elsewhere. But there are other trends which might pull in the opposite direction and make any such changes more difficult. First, there are probably no “new” stocks to which the fishing

fleet can be directed, in case of a collapse of major fish stocks. Second, the labour market has in some ways become less flexible. Skills of various kinds are in high demand, but those without skills, or with special skills not easily portable to other industries, may have greater difficulties in finding new employment than the redundant fishermen of the 1960s and 70s.

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Appendix

Description of variables in Figure 1 and 2

Categories	Species included in the categories
Crustaceans	Crab, lobster and deep water prawn
Cod fish	Cod haddock, saithe, and various other species
Mackerel etc.	Mackerel, capelin, horse mackerel, blue whiting, sandeel and Norway pout
Flatfish	Halibut, Greenland halibut, plaice, witch
Herring and sprat	Sprat, Icelandic herring, North Sea herring, small herring, fat herring and winter herring
Other	Mackerel shark, spiked dogfish, catfish, Norway haddock (redfish), tuna, blue ling, ling, wild salmon and trout etc.