THE TIES THAT (DO NOT) BIND: THE ITQ SYSTEM AND CONCENTRATION IN THE ICELANDIC FISH PROCESSING INDUSTRY, 1987-2004

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ABSTRACT

This paper explores the reasons why the ties between harvesting and processing have been severed in the Icelandic fisheries in recent decades, and traces the role played by better transport, the emergence of domestic wet-fish markets, and the introduction of freezing trawlers, as well as other factors in this development. Attention then is focused upon increasing concentration in the processing industry, with special attention paid to the role played by economies of scale and the ITQ system, which was introduced in the main demersal fisheries in 1984 and, six years later, in all other fisheries.

Keywords: Harvesting, processing, concentration, economies of scale, ITQ system

INTRODUCTION

In the late 1960s, those in the Icelandic fisheries sector found themselves at a crossroads. The trawler fleet had been allowed to stagnate during the previous two decades, and the collapse of the herring fisheries in 1967-1969 had seriously undermined the viability of that fleet. To make up for the fall in herring catches, Icelandic fisheries started to increase their harvesting of cod and other demersal species. However, it was clear that further exploitation of the fishing stock in Icelandic waters was crucially dependent upon two conditions. First, Iceland had to gain full or, at least, improved control over her own fishing grounds; and second, it was essential that the country renew its fishing fleet, in particular its trawlers, as well as its land-based processing facilities. The first objective was reached in the 1970s, when Iceland extended her fishing limit, in two steps, to 200 miles. Meanwhile, in the same decade, the Icelandic government initiated a policy aimed at rebuilding the trawler fleet and land facilities.

There were three aims of the investments in trawlers and processing plants. First, as mentioned above, the industries were, at the time, in dire need of renewal. The trawler fleet was old and out-dated, and the processing facilities did not meet the demands of the modern age. It also was obvious that, once Iceland had gained better control of her own fishing grounds, it would prove necessary for it to improve the productive capacity of the fishing sector, both at sea and on land. The third aim reflected the belief that a serious regional imbalance had developed in Iceland, and that it was the role of the government, both at state and municipal levels, to address this issue. By creating more stable employment at sea and ashore in the fishing villages and small towns, it was hoped that migration to the capital area could be checked. Care also was taken to invest in an improved infrastructure, and social services were upgraded. Thus, the 'ring road' around Iceland was completed in 1974. Until then, many villages and towns in the country had been very isolated, and could only be reached by sea or via miserable, roundabout roads.

However, the economy of the many villages and towns that dot the seaside was precarious. Easy access to government investment funds and insufficient screening had resulted in loans being made available to firms that were on unsteady ground, right from the beginning. Further, inflation was rampant in the 1970s and 1980s, averaging 28%; and loans provided by the commercial banks often bore negative real interest rates. For debtors, this situation really was too good to last, and firms could not realistically count on the willingness of banks to continue offering such favourable rates. In addition, serious over-investments had

occurred in vessels and processing plants, as these often were designed to meet the demands of peak harvest.

While community-owned firms, in many cases, had been involved in harvesting and processing in earlier years, many more joined the fray in the 1970s, and those already engaged in the fisheries became further involved. While this policy certainly could benefit the local economy, there was a risk that this kind of involvement could seriously undermine the finances of the community in times of trouble.

SEVERING THE TIES

At the heart of the great investments in the 1970s lay the strong belief, shared both by state and local governments, that reshaping the fisheries sector would make it possible to re-establish the small fishing towns and villages and, thus, make living there a viable alternative to moving to the capital area. Strengthening the ties between harvesting and processing was a fundamental issue. Consequently, it was necessary to adapt the processing capacity of the land-based industry to the productive powers of the new trawler fleet. However, the investments did not change the industrial structure of the fisheries. As before, the fishing towns and villages represented the basic production units, with economic activity in each community usually dominated by a single firm [1]. The dominant firm operated a fleet of fishing vessels, in most cases including a newly-purchased trawler, and also owned the plants in which the catches were processed. In addition, the firm frequently bought all the fish supplied by other local vessels. Most of the catches of demersal, crustacean and shellfish species were processed domestically, often in the home port of the vessels; but trawlers also frequently sold their iced catches to foreign markets, mostly in England and Germany. On the other hand, the reduction fisheries, based primarily on capelin, were centred at 20-30 major reduction plants along the migration route of the capelin, from its feeding to its spawning ground. Hence, the ties between harvesting and processing were much looser in the reduction fisheries than in the other main fisheries.

With her new trawler fleet and modernised processing plants, Iceland – and its coastal communities in particular – was ready to reap the rewards of the heavy investments that had been made in the fishing sector. But the unchecked fishing of previous decades by Iceland and other nations had undermined the most important fishing stocks and, in 1975, the *Marine Resource Institute* (MRI) issued a ‘black report’, warning of the consequences of further overexploitation. In 1976, a total catch quota was set for the most important demersal species, cod, and the following year individual effort restrictions were introduced in the cod fishery.

Diminishing catches were not the only dark clouds on the horizon. The fishing industries, especially the harvesting sector and the reduction industry, had been hit hard by the two oil crises that occurred in the 1970s; and, throughout the 1970s, the prices of Icelandic marine products declined.

The unfavourable price development, rising oil costs and declining catches all combined to reduce the profitability of both harvesting and processing. During the 1970s, the fishing sector had managed to muddle its way through; but diminishing cod and capelin catches nearly paralysed the sector in 1982. Losses in harvesting averaged almost 17% of production value; the processing industries performed better and only experienced a 2% loss.[a] The next few years were exceedingly difficult, and it was only until 1986 that both branches enjoyed profits. By now, the era of cheap credit had come to an end, and the commercial banks were charging positive real interest rates for all loans to fishing firms. Rising capital costs proved an increasingly difficult burden for the indebted export firms, and slight profits turned into losses in 1987-1989. It was apparent that many fishing firms would be unable to go on much longer.

Consequently, the government felt forced to step in to help restructure the financial situation for the badly-maligned export industries.

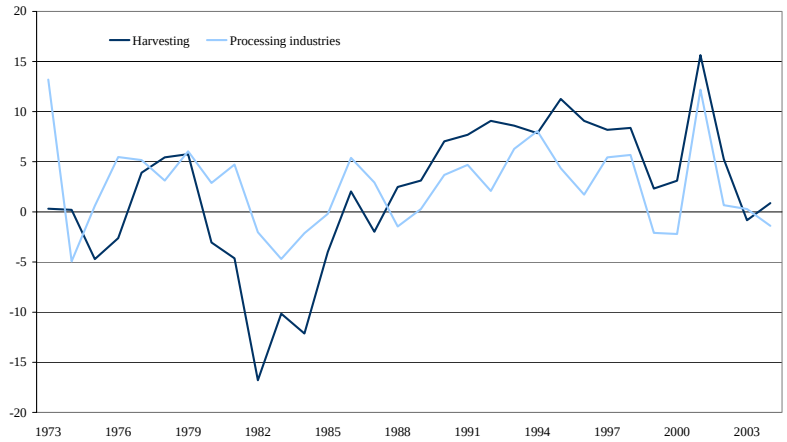

Figure 1: Profits in harvesting and processing industries 1973-2004, as a percentage of production value.

The combination of a government initiated bail-out and more favourable market conditions brought some respite to the fishing firms, so that their economic performance improved drastically over the next few years. Indeed, as is clear from Figure 1, the industry appeared to have left its turbulent past behind and seemed, at least until the last few years, to enjoy much smoother sailing than before. But there also were other factors at play, factors that would sever and, in some places, break the bonds between harvesting and processing in the demersal fisheries. Here, we focus on three of these causes; the introduction of freezing-trawlers; new and improved transport technology; and the emergence of wet-fish floor markets in Iceland.

In 1982, the first freezing trawler entered the Icelandic fleet, and the operation of these ships soon proved to be much more profitable than other vessels, in particular trawlers. According to data assembled by the *National Economic Institute*, which constantly has monitored the performance of the fisheries, freezing trawlers operated at an average 7,4% profit in 1984 and 8,5% profit in 1985. This was in stark contrast to the profitability of the normal wet-fish trawlers. In 1984, the smaller trawlers were run with average 10,5% losses and those larger than 500 GRT with 6,7% losses; in 1985, the operations experienced 3,9% and 1,1% average losses, respectively. Not surprisingly, the number of freezing trawlers grew quite rapidly over the next few years, as well as the proportion of demersal catches processed at sea. By 1986, almost 5% of all demersal catches were processed onboard freezing trawlers; two years later, that share had risen to 12%; and, in 1990, it was at 16%. Over the last few years, the share of freezing trawlers involved in the production of demersal products has hovered around 30%. It is important to bear in mind that not all freezing trawler products are exported without further processing on land. However, the bulk of the catch is exported directly.

A second fundamental change occurred in 1986, when a complex system of funds and transfers within the fishing sector was abolished. The main features of the system, which had been set up during the 1960's and 1970's, were an export tax levied on almost all fish products; and reimbursement for sales tax from

the government. Although this change had almost no effect on fish prices paid by the processing industry, price formation was made much more transparent, and the 'new' fish prices also were directly comparable to prices obtainable in foreign wet-fish floor markets. This simplification may be viewed as having been an important prerequisite for the introduction of domestic auction markets, which were established in Iceland a year later, in 1987. The proportion of all landed fish sold at the auction markets rose rapidly during the first years the markets were in operation. By 1990, more than 10% of all catches were sold in the markets and, by 1996, the share was approaching 25%. However, over the last few years, the share of the floor markets has fallen again, and is now approximately 18%.

Further important developments to take place in the 1980s were the containerisation of the fishing industries, and improved infrastructure in the country, especially with respect to the road network. Icelandic fishery statistics do not separate out the amount of fresh or iced fish exported in containers until 1986; but, in that year, some 12% of the total catch of demersal species was exported in that fashion. That proportion increased slightly over the next few years, but then declined again, partly because of increased use of air transport. Although export by flight only started on a very small scale, by 1989 it had grown to about 2% of the total production of demersal products. Lately, iced fish has been exported in equal quantities by ship and plane; and, in 2004, these exports together amounted to 18% of the total output.

Thus, throughout the 1980s, an ever-increasing share of the demersal catches was being exported as fresh or iced fish, either by ship or plane, or processed aboard freezing trawlers. In 1988, the share of these outputs amounted to a quarter of the total. The share reached 40% in 1996, and 50% in 2004.

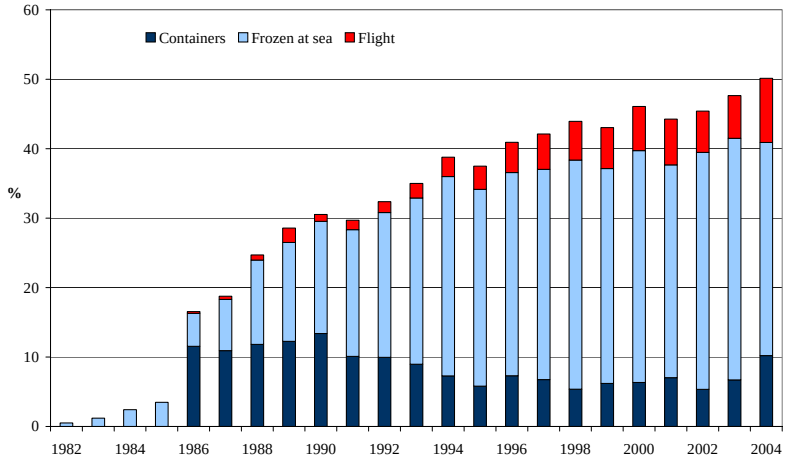

Figure 2: Proportion of total demersal catches that were exported iced in containers or by flight, or that were frozen at sea, 1982-2004.

In addition, the introduction of the wet-fish markets and the improved road system had made the process industry much more flexible. Processing plants no longer had to rely on fish from local vessels, but could – albeit at higher prices – obtain what they needed from floor markets. Indeed, many processing firms, especially the smaller ones, do not operate fishing vessels themselves, but rely completely on the floor markets for supply. This greatly increased the scope for specialisation, be it in fish species or sizes, and resulted in the emergence of small export firms that serve niche markets abroad. The new and superior transport and processing technologies meant that the quality of the exported fish, whether iced or frozen, had become far better, and the products therefore commanded better prices in foreign markets.

SCALE ECONOMIES AND CONCENTRATION

Whereas the 1980s and 1990s witnessed a movement away from land-based processing, development over the last decade or so has been more towards increased concentration in the processing industry, especially in the production of frozen products. Contrary to the earlier period, the driving force has not so much been technological progress; instead, firms seem to have been striving to take advantage of the possible existence of economies of scale and scope. But are Icelandic firms enjoying these economies? To answer this question, we quickly present the results of three empirical studies on the Icelandic fish processing industries.

Using data for the period 1991-1994, Haraldsson [2] estimated a hybrid translog variable cost function for three different kinds of processing industries; freezing plants, salt fish production, and fish-meal plants. The results indicate that there are some economies of scale present in all processes, although the hypothesis of constant-returns-to-scale never can be rejected statistically. Further, the results indicate that there are some economies of scope in the production of frozen products and fish-meal plants, but not in salt fish production.

Later studies have confirmed the existence of economies-of-scale, but also have indicated that firms are not using the available inputs in the most economical fashion, and that these inefficiencies may be quite severe. Agnarsson [3] measured the economic performance of Icelandic processing firms over the period 1998-1995, using both parametric and non-parametric methods. Results from the estimation of the stochastic frontier indicate that productivity grew, on average, by 1,5% annually over the above period, boosted primarily by technical changes. Slight scale economies appear to exist, but firms were unable to take full advantage of these economies, and this failure consequently decreased productivity. Finally, technical efficiency declined, and this further hampered productivity growth. Results from the non-parametric methods employed support the view that technical efficiency had been declining over the 11-year period.

In a separate paper, Agnarsson [4] used DEA to assess further technical and scale efficiencies in the Icelandic fish processing industries. It was found that technical inefficiency decreases with size, indicating that large firms are more likely to be efficient than small firms. Diversity in production, on the other hand, was shown to impede efficiency. The results, therefore, would seem to indicate that large, specialised firms were more technically efficient than more diversified – and possibly smaller – firms. Capital intensity - i.e a large capital/labour ratio - also seemed to increase efficiency. Looking at scale inefficiency, the results indicated that capital intensive firms were less likely to fully utilise their scale economies, especially firms that produced a wide variety of outputs. Finally, it was clear that firms in the reduction industry enjoyed higher technical efficiency and were more scale efficient. In the paper, an attempt also was made to quantify the opportunity cost of inefficiency. In all, it was estimated that the total revenue lost due to inefficiency over the period 1985-1995 amounted to one third of the value of total sales of the industry in 1990.

These three empirical studies clearly reveal that Icelandic processing firms in the early 1990s were too small, and that economic performance could be improved by taking better advantage of the possible economies of scale, as well as by improving the usage of available inputs. In addition, there are other benefits that come with size. Larger firms are more likely to attract the financial capital needed for new investments and, because of this, also are more likely to implement new methods and production processes. The tendency towards larger firms also may be regarded as a sign of risk aversion, since large firms often process a wider range of fish products than smaller ones; therefore, they are better able to cope with shocks, such as declining catches or falling output prices. Whereas a small firm might, for instance, specialise in shrimp processing or salt-fish production, a larger firm likely would operate several plants, possibly in different locations, and each would specialise in the production of a single output type:

e.g. frozen demersal products, salt-fish, frozen shrimp, frozen lobster, salted herring, and fish-meal and fish-oil. By consolidating ownership and concentrating production in fewer processing units, it is possible to reap the benefits of larger firm size and, at the same time, avoid the drawbacks of excessive diversification within a single processing plant. This is precisely the road many Icelandic firms have followed in recent years. Through mergers and acquisitions, it has been possible to organise the production into larger units, each one specialised in the production of specific outputs.

The trend towards greater concentration can be illustrated by looking at the production of frozen demersal and salt-fish outputs. In 1992, 43% of the land-based production of frozen cod took place in 10 ports around Iceland. Over the next decade, this proportion rose almost continuously, such that, by 2004, the share of the 10 largest processing centres had risen to 69%. The share of the 10 largest salt-fish production centres has, on the other hand, remained rather stable at around 70%. A similar picture emerges when the production of other demersal products, such as frozen and salted haddock, saithe, redfish and Greenland halibut, is examined. In 1992, the concentration ratio in the production of frozen output was 55%; but it increased to 66% by 2004, while the concentration in salt-fish production rose from 79% to 89%.

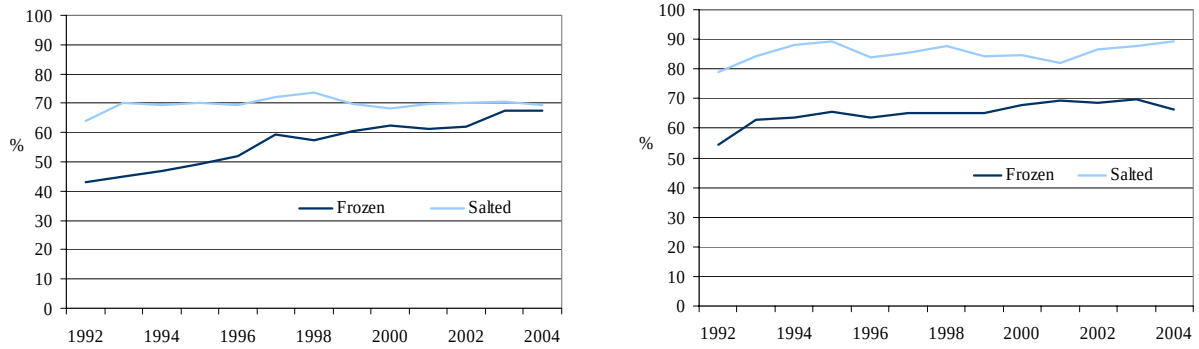

Figure 3: Concentration in the production of frozen and salted cod products (left) and other dermesal products, 1992-2004 (right). Percentage share of the 10 largest firms.

Similar increases in concentration have not been observed in the processing of shrimp, lobster or other shellfish, or in the reduction industry, mainly because production already was highly concentrated. Thus, in 1992, over 85% of the production of fish-meal and fish-oil took place at 10 plants, while the figure was over 70% for shrimp processing. Seven firms processed 99% of all lobster catches that same year.

One of the most important implications of the mergers and acquisitions that have occurred over the last 20 years has been the privatisation of many community-owned fishery firms. In 1984, when the quota system was established, three of the five harvesting firms that were allocated the largest share were public firms, and local communities also owned a share in the other two. When the quota system was reinforced in 1990, a totally different picture emerged. By then, four of the five largest quota holders were privately-owned firms, but the town of Akureyri held a 20% share in the fifth. In 2004, all of Iceland's largest fishery firms were controlled entirely by the private sector. In some cases, poor economic performance forced the authorities to sell off the fisheries, while shifting political winds may have been the main reason in other instances. But, irrespective of the reasons, the change in ownership often has meant that less emphasis has been placed on keeping fish processing firms in the community. Without the financial backing of the local government, it has, in many cases, proved impossible to maintain the same level of operation as before; and, in some cases, the processing plants have been shut down altogether.

CONCENTRATION AND THE QUOTA SYSTEM

In the Icelandic quota system that was introduced in major demersal fishing in 1984 and applied to most fisheries in 1990, quotas are allocated to fishing vessel owners, but not to processing firms or individual communities. However, many of the harvesting firms also operated processing plants at the time of initial allocation. Additionally, through the years, there have been numerous mergers and acquisitions between harvesting and processing firms that have resulted in the latter gaining indirect control of quotas. Nevertheless, processing firms, by themselves, cannot own quotas, as they must be linked to individual vessels. It, therefore, should be clear that there are no direct ways in which the quota system can affect the processing industry. Nonetheless, it is conceivable that increased concentration in quota holdings will lead to a corresponding concentration in processing, if the harvesting companies also are involved in processing or have close ties with other local processing firms. But is this the case? To informally test the validity of this assumption, we first must consider how large the share of the catches is that is processed at the home port of the fishing vessels, and then analyse the share of processing that takes place in those fishing towns and villages that hold the majority quota.

Let us start by looking at how a large proportion of land-based production of demersal products currently takes place in home ports, and how this proportion has changed over the last decade and a half. In 1987, 17% of the cod was processed in home port; this percentage was neither processed at sea nor exported iced in containers or by flight; it either was frozen or salted in the fishing village or town where the fishing vessel bringing in the catch was registered. This proportion rose rapidly over the ensuing years, reaching 57% in 1993. It has remained in the range of 55-60% most years since. The same picture emerges in the processing of flatfish and other demersal species. In both these cases, home production was very limited in 1987 (11% and 16%, respectively), but it increased rapidly through the late 1980s. By 1993, the proportion that was salted and frozen at the home port had grown to 53% (flatfish) and 67% (other demersal species). Thus, in all three cases (cod, flatfish and other demersal species), increased emphasis appears to have been placed on home processing over the period 1987-1993, but the proportion that is frozen or salted at the port where the fishing vessels are registered has remained quite stable since that time. Thus, increased concentration in the fishing industry over the last 15 years does not appear to have changed the proportion of land-based processing that takes place at home ports.

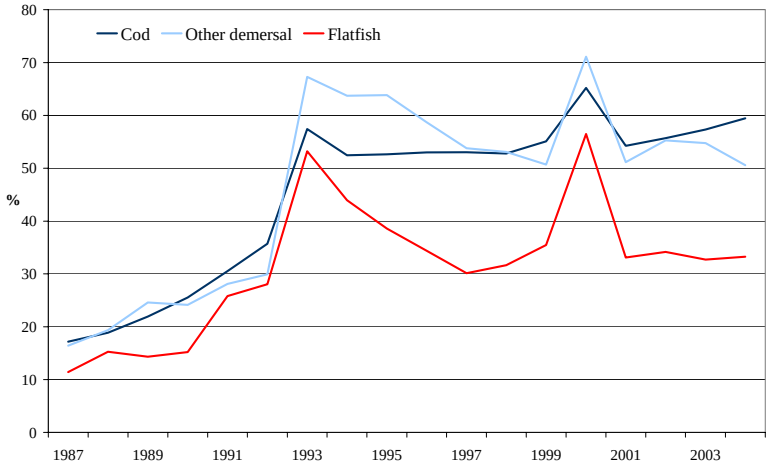

Figure 4: Proportion of catches of cod, other demersal species and flatfish processed at home ports 1987-2004.

In recent years, the concentration has been growing in quota holdings. The largest firm held 4,3% of the total quota for all fisheries – measured in cod equivalence units – in 1984, but 8,9% in 2005; while the

share of the 10 largest firms had increased from 22% to 48%, and the share of the 25 largest firms jumped from 39% to 69% over the same period. But are the communities which hold most of the quota the same localities where fish processing is most prominent? In Table I, we list the 10 fishing ports that held most of the demersal quota at the start of the fishing year 2004/2005, as well as their rank in the land-based production of frozen and salted products in 2004.[b] Six of the most important cod harbours also were among the top 10 processing communities; but the other four ranked 21st, 22nd, 23rd and 27th. Of the 10 localities that held most of the quotas in other demersals, seven also were among the top 10 processing communities, and two were ranked 20th and 25th; but no processing took place at all in the 6th-ranked harvesting harbour.

Table I: The 10 most important demersal harbours and their ranking in the production of frozen and salted products.

Cod		Other demersal species	
Harvesting	Processing	Harvesting	Processing
1	5	1	1
2	1	2	4
3	6	3	7
4	8	4	20
5	10	5	9
6	23	6	
7	22	7	2
8	21	8	5
9	27	9	6
10	3	10	25

To further explore the relationship between concentration in harvesting and processing, we next calculate the rank correlation coefficient between the largest harvesting harbours and processing localities in 2004. Localities were ranked according to their quota holdings in cod and other demersal species, respectively, at the beginning of the fishing year 2004/2005, and according to their relative share in total land-based production of frozen and salted products in 2004. In a few cases, no processing took place at home port, and those localities were assigned a rank of zero. The rank correlation between harvesting and processing of cod was 0.12, and 0.11 in the case of other demersal species. In neither case, do we identify a significant positive correlation between concentration in harvesting and processing. However, the rank correlation coefficient rose to 0.51 and 0.46 for cod and other demersal species, respectively, when all localities where no processing took place were dropped from the sample. The low correlation may seem at odds with the results in Table I, which clearly show that significant concentration in processing has taken place at most major fishing ports. It certainly is true that concentration in harvesting, through mergers and acquisitions and close cooperation between harvesting and processing firms, sometimes also led to concentration in processing. However, concentration in processing also has occurred in localities that hold limited or no quotas, while hardly any land-based processing facilities are in operation in some of the fishing villages or towns that hold substantial demersal quotas. As is clear from Table II, the number of localities where cod and other demersal species are processed has declined in recent years. In 1992, frozen cod products were produced in 50 communities and salted products in 41, while the

corresponding numbers for products from other demersal species were 50 and 34, respectively. In 2004, cod was processed in only 34 localities, while frozen products from other demersal species were produced in 35 towns and villages and salted products in 25 communities.

Table II: Number of localities in Iceland where cod and other demersal products were produced 1992-2004.

	Cod		Other demersal	
	Frozen	Salted	Frozen	Salted
1992	50	41	50	34
1993	48	39	49	34
1994	50	40	50	34
1995	49	46	49	37
1996	49	47	50	34
1997	48	45	49	37
1998	46	42	44	29
1999	43	43	44	33
2000	40	45	38	34
2001	43	38	44	27
2002	40	35	42	26
2003	40	37	42	24
2004	34	34	35	25

Most of the largest processing localities are situated close to the largest international airport in Iceland, just outside the capital, or close to Akureyri Airport in the north, or close to ports that have frequent cargo service to Europe and North-America. The improvements in transport technology, outlined above, therefore have played a significant role in the spatial distribution of Iceland fish processing plants.

Conclusions

The 1970s was a very eventful decade for the Icelandic fisheries. The fishing zone was extended to 50 miles in 1972, and 200 miles three years later, and huge government-initiated investments took place in the harvesting sector and in land-based processing. The primary aim of these investments was to renew an aging capital stock, specifically primarily trawlers and processing plants, as well as to improve the productive capacity of the fishing sectors, so that further utilisation of the main fishing stocks in Icelandic waters would be feasible. In addition, it was hoped that, by thus creating more stable employment at sea and ashore in the fishing villages and towns, it would be possible to address the serious regional imbalances that result from migration to the capital area. Strengthening the ties between harvesting and local processing was viewed as a fundamental issue; but the investments did not change the structure of the industry. As before, each locality represented, in essence, a basic production unit, with economic activity usually dominated by a single large firm which, in many cases, was at least partially community-owned.

But black clouds began to gather on the horizon in the late 1970s. The condition of the main demersal species, especially cod, had deteriorated due to over-fishing by Icelandic and foreign vessels, and the two oil shocks of the decade hugely affected the fisheries sector. In addition, prices fell in foreign markets in

the early 1980s. Declining harvests, increasing costs and falling output prices weakened the economic performance of the fishery firms; and, in the 1980s, the rising cost of servicing past investments added to that burden.

To counter this reversal of fortunes, Icelandic fisheries turned away from traditional demersal production, mainly frozen and salted products, and increased processing at sea and exports of iced fish by containers or flight. But this development resulted in severed ties between harvesting and processing. The importance of land-based processing declined and, in some localities, local processing came to a close. This development was driven by changes in technology, both in processing and transportation, but can hardly been blamed on the Icelandic ITQ system.

In the 1990s, firms placed added emphasis on taking advantage of possible economies of scale and improving the utilisation of existing inputs. Rather than place production of all maritime products at the same plant, production was spread out, with each unit specialising in a specific production. These units now sometimes are located in the same community; but, in many cases, this trend has resulted in spatial specialisation of processing. Concentration primarily has been rapid in the production of frozen cod products. There are signs that this concentration can be traced, at least partially, to concentrations in quota holdings, but that relationship is far from clear, and there obviously have been other factors at work, as well. However, the concentration in processing in the 1990s, coupled with the trend away from land-based production in the previous decade, has dealt many small fishing localities a devastating blow, so that they now face a very uncertain future.

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ENDNOTES

a. Data used in this paper are taken from Icelandic Directorate of Fisheries (www.fiskistofa.is), National Economic Institute (www2.stjr.is/frr/thst), Statistics Iceland (www.hagstofa.is) and Marine Research Institute (www.hafro.is).

b. The fishing years runs from Setpember 1st to August 31st of the following year.