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ITSQs IN ICELANDIC FISHERIES: A Rights Based Approach to Fisheries Management

By

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Introduction

Around the world in recent years, there has been a clear movement towards fisheries management based on property rights. This trend mirrors the earlier development of the organisation of economic activity on land. The spread of individual transferable quotas in fisheries is another stage in the historical expansion of property rights as a method of economic organisation. Economic history informs us that the extension of the private-property system has generally been motivated by the desire to increase economic efficiency, and private property is generally believed to be fundamental to the current high level of economic productivity on land. As with property rights on land, individual transferable quotas may be expected to yield substantial economic benefits (see Runolfsson 1997c).

Iceland is a front-runner in this development, and was among the first countries to introduce individual vessel quotas and individual transferable quotas in major ocean fisheries. In Iceland, vessel catch quotas were introduced in the herring fishery in 1975. In 1979, these quotas were made transferable, creating an individual transferable quota system in that fishery. Individual quotas and subsequently transferable quotas were introduced in to other Icelandic fisheries during the 1980s. Since 1991, all major fisheries within the economic exclusive zone have been subject to a uniform system of individual transferable share quotas (ITSQs) with only minor exceptions. Fisheries by Icelandic vessels outside the economic exclusive zone have also been subject to ITSQs.

Although Iceland is a rather affluent society (GDP per capita, current PPPs, in 1997 was US\$ 24,700), the economy is heavily dependent on the fisheries. Export of fish products account for around 75% of the commodity exports in Iceland and 50% of the foreign exchange earnings. The fishing industry's direct contribution to GDP is about 15%, but total contribution (direct and indirect) is estimated to be as high as 45% of GDP. In other words, without the fisheries Iceland's GDP would be only about 60% of current GDP (Arnason 1995a:85-86). The fishing industry's size relative to the whole economy means that any fisheries' policy has far reaching implications for the economy. The fishing industry is a major determinant of personal incomes and income distribution and in many parts of Iceland the fishing industry is virtually the only basis for economic activity. This means that anything that affects the fishing industry has a regional aspect that often turns out to be very potent politically. Fisheries management is as a result of all this a major component of the public discourse and on the formulation of Iceland's economic and regional policy.

This paper will look at the system of individual transferable share quotas as it developed in the Icelandic fisheries, describe the current structure of the system and evaluate its performance.

The Icelandic Fisheries

The most important of the Icelandic fisheries is the demersal. This fishery generates about 75 percent of the total landed value. The most important demersal species are cod, haddock, redfish and saithe. The cod-fishery accounts for about 30-35 percent of total catch value. Pelagic fisheries based on capelin and herring are also important, yielding about 10-15 percent of the total landed value. In addition to demersal and pelagic fisheries, shrimp, lobster, and scallop fisheries are significant. In all, about 40 species are harvested commercially. Total annual harvest in recent years has fluctuated around 1.5 million tonnes, with a landed value of some US\$ 800 million (1.7 million tonnes in 1998, US\$ 900 million).

The harvesting and processing sectors of the Icelandic fishing industry have until recently been characterised by numerous relatively small firms. Frequently these firms exhibit a high degree of vertical integration across the harvesting and processing sectors, but there was little horizontal integration.

The typical firm in the fishing industry is based in one fishing town or village. Vertical integration is the norm, although there are exceptions. Integration across regions is rare but on the increase. The firm operates one or more processing plants and usually runs one or more fishing vessels that supply most of its wetfish needs. Independent vessels provide for any additional needs, on the basis of implicit or explicit contracts or through wetfish floor markets. The first floor markets (auction markets) were established in 1987 and there are now about two dozen markets, at least one in every geographical region.

In recent years there has been a wave of horizontal mergers among processing firms, and also among processor/harvester firms. More than ten major mergers have taken place. The horizontal mergers, which also involve some vertical integration, seem to derive from a presumed need to diversify production processes and spread risk. Further, all of these firms have gone public, either before or after the merger. The mergers give the appearance of stronger companies, richer in quota holdings, and thus more attractive to potential investors. Many of these firms are in need of capital, both to lessen their debt burden and to

renew capital as to become more productive. A few of the, now merged, firms are rather big, at least on the Icelandic scale. Some have in excess of ten harvesting ships, owned directly or indirectly through subsidiaries, and quota holdings of 15-30 thousand tonnes (cod-equivalent tonnes). They operate several plants and are true multi-processors. Most also own processor ships, as well as other ships to provide for on-shore processing.

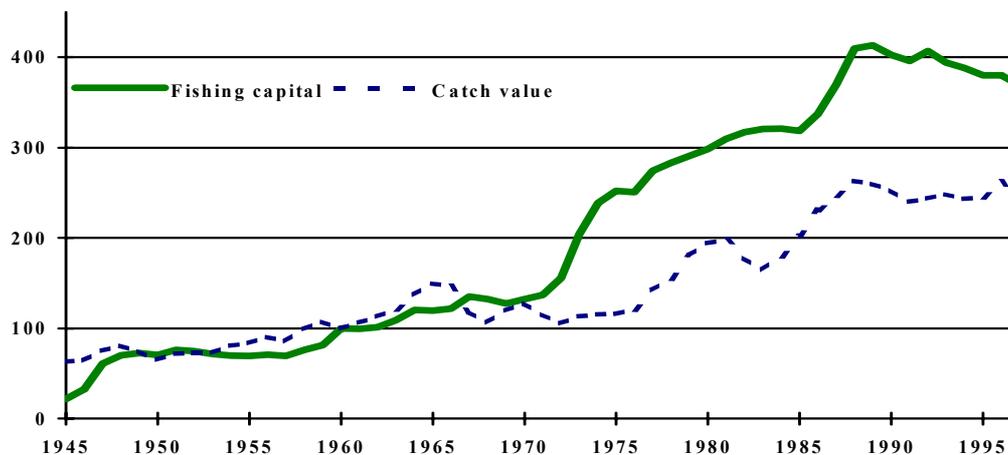
The Icelandic Fishing Fleet

At the end of 1998 the fishing fleet consisted of 795 decked vessels, measured about 121,000 gross registered tonnes (GRT), and was valued at US\$ 1 billion. The average age of the fishing fleet is rather high, or about 21 years. This reflects the effects of somewhat restrictive fishery management measures and official efforts in recent years to halt new investment in the fishing fleet. The fleet consists of several vessel types, and it is convenient to decompose the fleet in the following four main categories. The most important type is the deep-sea trawler. They are relatively large fishing vessels usually between 400 and 1400 GRT and 130 and 250 feet (40-75 m) in length. There are 102 vessels in this group with a total of 62,000 GRT, and the average vessel age is 20 years. They are engaged in the demersal fisheries employing bottom and, occasionally, mid-water trawl. Some are also used in the deep-sea shrimp fisheries. A few also catch herring and capelin. Due to their size, the deep sea trawlers have a wide operating range and are able to exploit practically any fishing ground off Iceland as well as international waters. Each trip in domestic fishing grounds usually lasts for about 5-15 days. A number of the deep-sea trawlers have in recent years been turned into freezer trawlers. The fishing trip of a typical freezer trawler is about 20-30 days, and longer if they go into distant waters. Currently, there are 54 processor vessels. Another type is the specialised purse-seine vessel. These vessels - 270 GRT and larger - are primarily engaged in the capelin fishery. Most participate also in other fisheries, particularly the deep-sea shrimp fishery and the herring fishery. The specialised purse seiners usually follow the capelin schools over great distances and land their catches where it is most convenient. There are 38 vessels in this group with a total of 20,000 GRT, and the average vessel age is over 27 years. The third type is the multipurpose vessel. They cover a wide size range, from 12 GRT to over 200 GRT. There are 327 vessels in this group with a total of 35,000 GRT, the average size being just over 105 GRT, and the average vessel age is just over 27 years. The multipurpose fleet is, for the most part, neither specialised with respect to fishing gear nor fishery. Most of the multipurpose fleet is designed as gill-netters or longliners although technically capable of employing trawl and purse seine as well. The geographical range of the smaller multipurpose vessels is limited and they are normally confined to fishing trips of one to three days, exploiting grounds relatively close to their homeport. The fishing trips of the larger vessels can last up to two weeks. A few are processing vessels. Finally, there is a class of fishing vessels that covers numerous vessels of sizes up to 12 GRT although most are under 10 GRT. In total there were 1196 vessels under 12 GRT in 1997. Of these, 313 vessels are decked with a total of 2,500 GRT, and the average vessel age is 12 years. The other 883 are open decked and a total of 4,400 GRT. These vessels are typically owner operated and employed on a seasonal basis. This fleet employs handline, gillnets and longline. Depending on the gear and fishery, the crew size is one to three persons. The vessels under 10 GRT were not subject to vessel quota restrictions until 1991, and those under 6 GRT can still opt for a hook-license.

The Evolution of the Fisheries Management System

Until the extension of the fisheries jurisdiction to 200 miles in 1976, the Icelandic fisheries were, for all intents and purposes, international and open access fisheries. Large foreign fishing fleets featured prominently on the fishing grounds, taking almost half of the demersal catch. The extension of the fisheries jurisdiction to 200 miles all but eliminated foreign participation in the Icelandic fisheries. However, the initial management measures taken in the demersal fisheries following the extension of the fisheries jurisdiction in 1976 were inadequate and therefore did not alter the common property nature of these fisheries as far as domestic fishers were concerned. They were still forced to compete for shares in the catch. Therefore not surprisingly, the development of the Icelandic fisheries in the post-war era closely followed the path predicted for common property fisheries exhibiting increasingly excessive fishing capital and effort compared to reproductive capacity of the fish stocks. The post-war development of fishing capital and catch values since 1945 is illustrated in Figure 1.

Figure 1. Fishing capital and catch values 1945-1997 (index 1960=100). Source: National Economic Institute.



The value of fishing capital employed in the Icelandic fisheries increased by well over 1200% from 1945-1983. Real catch values, on the other hand, only increased by 300% during the same period. Thus, the growth in fishing capital exceeded the increase in catch values by a factor of more than four, and, in 1983, the output-to-capital ratio in the Icelandic fisheries was less than one-third of the output-to-capital ratio in 1945.

This long-term decline in the economic performance of the Icelandic fisheries did not go unnoticed by the authorities. In fact, over the years, various measures were taken in an attempt to reverse this trend. However, before the extension of the exclusive zone to 200 miles in 1976, effective management of the fisheries, especially the demersal ones, appeared impractical due to the presence of large foreign fleets on the fishing grounds. For this reason, fishery management subsequent to the extension of the fishing limits to 200 miles was limited. With the *de facto* recognition of the exclusive 200-mile zone in 1976, the situation dramatically changed. The Icelandic fisheries gradually came under increased management until, after 1990, there was a uniform system of individual transferable quotas in practically all fisheries. The chronology of this development is summarised in Table 1.

Table 1. Chronology of the Key Steps in the Evolution of the ITSQ Management System

1975	The herring fishery: Individual vessel quotas
1979	The herring fishery: Vessel quotas made transferable
1980	The capelin industry: Individual vessel quotas
1984	The demersal fisheries: Individual transferable vessel quotas
1985	The demersal fisheries: Effort quota option introduced
1986	The capelin fishery: Vessel quotas made transferable
1988	Transferable vessel quotas in all fisheries. Effort quota option retained
1991	A complete uniform system of individual transferable share quotas in all fisheries for all vessels over 6 GRT

A more detailed review of the evolution of the individual transferable share quota (ITSQ) fisheries management system in individual Icelandic fisheries follows.

The Pelagic Fisheries

Due to an alarming decline in the herring stocks, an overall quota (total allowable catch) was imposed on this fishery in 1969. Since this did not halt the decline in the stocks, a complete herring moratorium was introduced in 1972. In 1975, when fishing from the Icelandic herring stocks was partly resumed, it was obvious that the whole fleet could not participate. Hence, an individual vessel quota system with limited eligibility was introduced in 1975. Vessel quotas were small and issued for a single season at a time. The quotas were, therefore, not permanent, but determined annually by dividing the TAC by the total number of eligible vessels applying to participate in the fishery. In 1979, spokesmen for the industry suggested fairly unrestricted transfers of quotas between vessels. The Ministry of Fisheries permitted transfers, as it had observed that there were various methods for bypassing the non-transferability of the vessel quotas

(Arnason 1996a). The *Fisheries Management Act* of 1990 made the vessel quota system in the herring fishery part of the general ITSQ system.

The capelin fishery, which became big in the 1970s, was subjected to limited entry and individual vessel quotas for licence holders in 1980, at a time when the stock was seriously threatened with overfishing. Again the arguments were the same as in the herring fishery previously, except this time the industry asked for regulations. Owners of the bigger purse-seine vessels met in June 1980 and decided that they would ask the Ministry of Fisheries to limit entry into the capelin fishery and allot a quota to each licensed vessel. Only 52 vessels received a license but there had been 68 vessels engaged in the capelin fishery the preceding year.

The positive experience with the vessel quota system in the herring fishery also proved a convincing argument for adopting a similar system in the much more important capelin fishery. In 1986, in conjunction with an increasing transferability of demersal vessel quotas, capelin vessel quotas became partly transferable. The capelin vessel quota system became a part of the general ITSQ system with the adoption of the *Fisheries Management Act* of 1990.

Demersal Fisheries

In connection with the extension of Iceland's exclusive fishing zone to 200 miles in 1976, the major demersal fisheries were subjected to overall catch quotas. The quotas recommended by the marine biologists soon proved quite restrictive, and difficult to uphold. As a result, individual effort restrictions, taking the form of limited allowed fishing days for each vessel, were introduced in 1977. As new entry remained possible, however, and the demersal fleet continued to grow, the allowable fishing days had to be reduced from year to year. In 1977, deep-sea trawlers were allowed to fish for cod 323 days a year but in 1981 they were only allowed 215 days a year. It gradually became obvious to everyone concerned that this system was economically wasteful.

In 1984, following a sharp drop in the demersal stock and catch levels, a system of individual vessel quotas was introduced. The Fisheries Association of Iceland held its annual meeting on December 2 and 3. At the end of that meeting, after some heated discussion, a proposal was agreed on to ask the Ministry of Fisheries to experiment with IQs for the demersal fisheries for one year, in 1984. On December 22, 1983, the parliament passed an amendment to the *Fisheries Act* of 1976. The amendment basically gave the Minister of Fisheries discretionary power to put a vessel quota system in place. In the upper house of the parliament, the amendment received only the minimum majority necessary, 11 of 20 MPs in support.

Due to generally favourable results of the system, it was extended for 1985 and 1986-1987. However, to ensure sufficient support for the system, a very important provision was added. Vessels were allowed to opt for effort restrictions instead of catch quotas. On January 8, 1988, the Icelandic parliament enacted general-vessel quota legislation that applied to all Icelandic demersal fisheries and was effective between 1988 and 1990. This legislation retained the effort quota option but made it somewhat less attractive.

In 1990 a comprehensive ITSQ legislation, the *Fisheries Management Act*, was passed by the parliament. This legislation abolished the effort quota option and closed certain other loopholes in the previous legislation, especially as regards the operation of vessels under 10 GRT (vessels under 6 GRT continued to be exempt from the ITSQ system). The legislation required licensing for all commercial fishing vessels and a moratorium on issuing new licenses. It also extended the ITSQ system indefinitely. Since then, however the system has continued to be modified, and the *Act* has been amended on several occasions since 1990.

The shrimp, lobster and scallop fisheries

The inshore shrimp, lobster, and scallop fisheries are relatively recent additions to the Icelandic fisheries. These fisheries were largely developed during the 1960s and 1970s and, from the outset, have been subject to extensive management, primarily limited local entry and overall quotas. An overall TAC was set in the lobster fishery in 1973, with restrictions on the size of vessels and, subsequently, licensing and vessel quotas in 1984. Legislation regulating the processing and fishing of inshore shrimp and scallop was passed in 1975. This legislation gave the Ministry authority to issue quotas for these fisheries, to the processors. There are seven inshore shrimp areas, each having regulations specific to it; two areas already had individual vessel quotas in 1974. In 1988, the deep-sea shrimp fishery was also subject to vessel quotas. The management of shrimp and scallop fisheries became part of the general ITSQ system with the *Fisheries Management Act* of 1990.

Evolutionary process, not design

As may be inferred from this description, the course towards a complete ITSQ fisheries management system in Iceland has evolved more by trial and error than by design. In most countries - and Iceland is no exception - there is a strong social opposition to radical changes in the institutional framework of production and employment. A great deal of this opposition derives not from rational arguments but rather from the desire to protect traditional values and vested interests. From a socio-political view, Iceland probably had to pass through an evolutionary process during which various management methods were tried in different fisheries. The knowledge and understanding gained from these experiments were crucial for the eventual acceptance of a more efficient ITSQ system.

At the same time, it should be noted, that the key steps in the evolution of the ITSQ system have usually only been taken in response to crises in the respective fisheries due to a sudden reduction in stock levels. Thus, individual vessel quotas were introduced in the herring fishery in 1975 following a collapse in the herring stocks and a prolonged moratorium on herring catches. Similarly, vessel quotas in the capelin fishery and the ITSQ system in the demersal fisheries were introduced in 1984 in response to a perceived danger of a corresponding collapse in the stock levels and a serious financial crisis in these fisheries.

This pattern reflects the reluctance of members of the fishing industry to accept changes in the traditional organisation of the fisheries. Only when faced with a disaster in the form of significant fall in income due to fish stock reductions or a drop in the world market price for fish products, have interest groups been willing to consider changes in the institutional framework of the fisheries. Rule changes in fisheries are frequently a response to crises, i.e. lower income for fishermen (Libecap 1989). One should bear in mind, though, that even if the adoption of an ITSQ system is a rather radical rule change, it was not new to the Icelandic fisheries, as IQs already existed in the herring and capelin fisheries at this time. As early as 1981, the favourable experience of quotas in these fisheries had influenced many vessel owners that nothing short of an ITSQ system was needed. Despite an increased catch of demersal species, the fishing industry was running at heavy losses in the period from 1981 to 1983.

The passing of the comprehensive ITSQ fisheries management legislation in 1990 constitutes a break in this pattern. For the first time, the fishing industry has agreed to a significant improvement in the fisheries management system without being threatened with the alternative of a financial disaster. This must be attributed to the potentially immense economic benefits of the vessel quota system, which were now becoming apparent to most of the participants in the fisheries.

The current ITSQ Fisheries Management System

Although this system was instituted at different times and in somewhat different forms in the various fisheries, it was made uniform by the *Fisheries Management Act* of 1990.¹ The fisheries management system is based on individual transferable quotas (ITSQs) and is therefore appropriately referred to as an ITSQ system. The essential features of the current ITSQ system are as follows: all fisheries are subject to vessel catch quotas. The quotas represent shares in the total allowable catch (TAC). They are permanent, perfectly divisible and, with some restrictions, freely transferable; they are issued subject to a small annual charge to cover enforcement costs. The ITSQ system is fairly uniform across the various fisheries. However, slight differences between the fisheries exist, mostly for historical reasons.

It should be noted that the ITSQ system was superimposed on an earlier management system designed mainly for the protection of juvenile fish. This system involving certain gear, area and fish size restrictions are still largely in place. The ITSQ system has not replaced these components of the earlier fisheries management system.

Total Allowable Catch (TAC)

The Ministry of Fisheries determines the TAC for each of the most important species in the fisheries. This decision is made on the basis of recommendations from the Marine Research Institute (MRI). The MRI has its own vessels to study the state of the fish stocks. In addition, the MRI relies on information from the fishers, such as with an annual trawler-rally and a gill-netters-rally. In addition to the government fisheries researchers, the Association of Vessel Owners employs its own researchers. In more recent years the Ministry of Fisheries has followed the recommendations of the Marine Research Institute quite closely.

¹ The *Fisheries Management Act* of 1990 has been amended almost every year since it came into effect (in 1992, 1994, 1995, 1996, 1997, 1998 and 1999), see Runolfsson 1999.

The cod fishery plays a very substantial role in the economy and therefore, not surprisingly, successive governments had been reluctant to curtail the cod TACs in accordance with the recommendations of the MRI. Only in the 1990s has the Ministry followed this advice and even stood firm on that decision despite political pressure, even from within the government. In 1995 a TAC-rule, which sets the TAC for cod at 25% of the fishable stock, was established.

Currently 15 species in Icelandic waters are subject to TACs and consequently ITSQs.² They include 10 demersal species: cod, haddock, saithe, redfish, Greenland halibut, plaice, wolffish, dab, long rough dab and witch, two pelagic species: herring and capelin; shrimp, lobster and scallops. Together these species account for over 90 percent of the landed value. Several species, those on which fishing pressure is regarded as slight, are not currently subject to TAC. This means that the corresponding fisheries can be pursued freely. These fisheries are, in most cases, commercially negligible.

Permanent Quota Shares

Each eligible vessel is issued a permanent share in the TAC for every species for which there is a TAC. These permanent quota shares may be referred to as TAC shares.

Initial Allocation of Permanent Quota Shares

The initial allocation of TAC shares to individual vessels varies somewhat over fisheries. In the demersal, lobster and deep-sea shrimp fisheries the TAC shares are normally based on the vessel's historical catch record during certain base years. In the demersal fisheries this usually equals the vessel's average share in the total catch during the three years prior to the introduction of the ITSQ system in 1984. There are noteworthy exceptions to this rule, however. If, for instance, the vessel in question was not operating normally during the period from 1981 to 1983 due for instance to major repairs, or had entered the fleet after 1981, the calculated share is adjusted upwards. Also, during the years 1985 to 1987, it was possible to modify the TAC shares by temporarily opting for effort restrictions instead of vessel quotas and demonstrating high catches during this period.

In the herring and inshore shrimp fisheries the initial TAC shares were equal for all eligible vessels. The same holds for the capelin fishery except that a third of the TAC shares were initially allocated on the basis of vessel hold capacity.

Annual Catch Entitlement

The size of each vessel's annual catch entitlement (ACE) in a specific fishery is a simple multiple of the TAC for that fishery and the vessel's TAC share. In some fisheries, such as the capelin and inshore shrimp fisheries, the management periods are seasonal, rather than a whole year. The same rule nevertheless applies. While the TAC share is a percentage, annual catch entitlements are denominated in volume terms.

The Icelandic demersal fishery is a mixed-stock fishery and vessels are bound to catch other species than aimed for. The ITSQs (or TAC shares) are, therefore, also denominated in cod- equivalent terms, as the cod-fishery is the most important fishery in Iceland. (Cod is used as the common denominator for the whole ITSQ system; cod equivalent values in 1998/99 are: cod 1.00, haddock 1.05, saithe 0.65, redfish 0.70, plaice 1.20, Greenland halibut 2.15, wolffish 0.85, witch 1.20, dab 0.65, long rough dab 0.60, capelin 0.08, herring 0.14, lobster-tails 8.55, shrimp 1.20 and scallops 0.40). This provides some flexibility for the vessels, as they can subtract bycatch of other species from their quota at fixed values.

Transferability

Both the TAC shares and the ACEs are fairly freely transferable and perfectly divisible. TAC shares are transferable without any restrictions whatsoever. Any fraction of a given quota may be transferred to another vessel. . Apart from this, transfers of quotas are only subject to registration with the Ministry of Fisheries. The particulars of the exchange, including price, are not registered. Table 2 shows the development of TAC shares in the period 1991-1998.

² In addition, international fisheries, such as the deep-sea redfish fishery, the shrimp fishery on the Flemish Cap, and the Norse herring fishery, are subject to ITSQs.

Table 2. Transfer of quota shares 1991-1998. Percentage of total quota shares in each year.

	91/92	92/93	93/94	94/95	95/96	96/97	97/98
Cod	10.6	13.0	6.7	18.1	18.7	11.8	31.3
Haddock	11.0	16.6	7.2	18.3	18.1	11.2	27.9
Saithe	10.3	14.2	9.2	12.8	17.9	10.0	28.8
Redfish	8.3	12.6	9.7	8.1	16.0	5.9	30.6
Greenland halibut	3.1	10.3	4.2	9.9	15.4	8.1	34.7
Plaice	10.7	18.	10.3	17.1	11.6	11.5	24.8
Herring	12.0	16.6	12.0	25.0	43.2	16.7	28.8
Capelin	2.9	6.7	9.4	2.7	11.2	3.8	21.0
Lobster	22.1	14.1	7.5	30.7	17.2	20.9	19.2
Deep-sea shrimp	14.7	15.2	13.3	22.6	24.9	20.2	44.4

Source: Fisheries Directorate

The Ministry of Fisheries must agree to transfer of ACE between geographical regions. The rationale for this stipulation is to stabilise local employment in the short run and hinder speculation in quotas. In practice, however, it appears that few inter-regional transfers are actually blocked. Transfer of ACE became subject to further restrictions in 1992 and 1994, when the parliament amended the *Fisheries Management Act* of 1990. These amendments were designed to discourage speculative quota holdings. They were, however, relatively insignificant. Further restrictions came in 1998; only up to 50% of ACE is freely transferable between vessels under different ownership. Offsetting transfers of different species with equal value are not subject to any such restrictions. Further, as vessel owners are not allowed to have the crew share costs in quota transfers all ACE transfers, as of 1998/99 have to take place publicly, at the Quota Trade Authority (this has reduced trade of ACE and increased price). Table 3 shows transfers of ACE in 1992-1998.

Table 3. Transfers of quota between vessels 1992-1998. As percentage of total ACE¹

Transfer ²	92/93	93/94	94/95	95/96	96/97	97/98
Type A	33.0	26.3	41.3	32.5	31.3	38.6
Type B	20.2	23.9	13.6	18.3	19.4	15.4
Type C	12.6	11.3	12.0	7.2	10.1	9.0
Type D	34.3	38.5	33.1	42.1	39.2	37.0
Total	66.2	63.7	78.1	71.2	68.1	69.3

1. These quotas are measured in cod equivalents and represent temporary annual quota (gross) transfers only.

2. Type A: Transfers between vessels with the same owner.

Type B: Transfers between vessels with different owners operated from the same port.

Type C: Offsetting transfers of different species with equal value between vessels with different owners.

Type D: Transfers between vessels with different owners operated from different ports.

Source: Fisheries Directorate.

Restricted Access

In addition to the ITSQ system, the Icelandic fisheries were subject to restricted access. All commercial fishing vessels must hold valid fishing licences, in addition to catch quotas. Fishing licences moreover, were issued only to vessels already in the fishery in 1990 and their replacements provided they were deemed comparable in terms of fishing power. The fishing licences are only transferable with the vessels.

One of the impacts of a well designed ITSQ system is to provide the socially appropriate incentive for investment (disinvestment) in the fishing fleet. The fishing licence stipulation clearly added a deterrent to investment in fishing vessels.

In December 1998 the supreme court reached a decision on a case brought before it, concerning an application by an individual for a commercial fishing licence and quota. The Ministry of Fisheries had declined the application and a lower court had decided the Ministry had grounds for the refusal on the basis of the *Fisheries Management Act* of 1990. Article 5 of the legislation stated that only vessels already in the fishery at the time of the legislation could receive licences. The supreme court found the article unconstitutional, on the grounds that it provided for unequal treatment of citizens. The court did not however decide on the second issue, the application by the individual for quota.

The parliament passed legislation in January 1999 to rectify the Fisheries Management Act. All registered vessels may now apply for commercial fishing licences. Access is therefore not restricted anymore. Receiving a commercial fishing license is only one step though, to fish TAC-species also requires a quota.

Exemptions from the ITSQ System

There is one minor exemption from the current ITSQ system. In demersal fisheries, hook-and-line fisheries by vessels under 6 GRT were allowed exemption from quota restrictions, but are subject, instead, to limited fishing days and an overall TAC. Although this arrangement was to end in 1994, the exemption was extended, though the number fishing days was reduced. Under the 1996 amendment to the *Fisheries Management Act*, these vessels now choose between a cod share quota system and a cod effort restriction system (maximum number of allowable fishing days). As a group, they receive a 13.75% share of the general TAC.

Cost Recovery

The Ministry of Fisheries initially allocated individual vessel quotas free of charge. However, in accordance with the *Fisheries Management Act* of 1990, the Ministry now collects fees for catch quotas to cover the cost of monitoring and enforcing the ITSQ regulations. The law imposes an upper bound on this fee amounting to 0.4 percent of the estimated catch value. The Ministry estimates to collect US\$ 8 million in quota fees in the 1998/99 fishing year. In addition, vessel owners pay an estimated US\$ 2 million in licensing fees in 1998/99. On top of that, each vessel has to pay harbour fees for docking at a port and fees for the weighing of the catch. The latter is paid, whether the public weight stations are used or private firms.

Deviations from an Ideal ITSQ System

The Icelandic ITSQ system has most of the crucial features of an ideal ITSQ system, as described in the literature (see Arnason 1990). However, there are particular aspects of the Icelandic ITSQ system that deviate from the theoretical ideal and subtract from its economic efficiency.

First, in the Icelandic ITSQ system, the ITSQs are associated closely with fishing vessels. More precisely, only those who own vessels with valid fishing licence can hold quotas. In addition, the total holdings of quotas must not exceed the fishing capacity of the vessel in question. This severely restricts the set of potential holders of ITSQs and clearly subtracts from the ability of the quota market to generate the most economically beneficial allocation of quotas. Second, the holders of TAC shares must harvest at least 50 percent of their TAC share every other year to retain the share. This stipulation is designed to obstruct speculative quota holdings. However, in doing so, it reduces the efficiency of the quota market and induces more vessels than would be optimal. Third, the ITSQ system in the demersal fisheries was combined with an optional limited effort system already in 1985. This option was not abolished until 1991 and in the meantime a large fraction of the demersal fleet opted for limited effort rather than quotas. Further, a small third of the small vessel fleet is exempt from the ITSQ system. Table 4 shows The ITSQs (ACE) as fraction of the demersal catch. The performance of the ITSQ system in the Icelandic demersal fisheries has to be interpreted with this in mind.

Since 1994 the group of small vessels, under 6 GRT in size, receive close to 14% of the TAC for cod. This means that the fraction for cod in Table 4 should be adjusted for this. Annual demersal ITSQs as a fraction of the total catch for cod are therefore 0.87 to 0.96 in the last 4 years.

Table 4. Annual demersal ITSQs as a fraction of total catch. A ratio in excess of unity indicates that the total issued ITSQs exceed the actual catch.

Year	Cod	Haddock	Saithe	Redfish	Greenland halibu
1984	0.88	1.38	1.25	1.09	1.00
1985	0.64	0.94	1.05	0.97	0.76
1986	0.32	0.51	0.52	0.37	0.29
1987	0.36	0.68	0.46	0.40	0.24
1988	0.52	0.74	0.66	0.43	0.33
1989	0.53	0.63	0.60	0.41	0.29
1990	0.49	0.58	0.54	0.39	0.46
1991*	0.96	0.95	0.94	0.87	1.06
91/92	0.94	1.09	0.90	1.02	0.85
92/93	0.79	1.34	1.22	1.01	0.87
93/94	0.73	1.14	1.28	0.97	1.06
94/95	0.73	1.00	1.46	0.84	1.14
95/96	0.71	1.04	1.70	0.83	0.90
96/97	0.79	0.87	1.29	0.88	0.82
97/98	0.82	1.13	0.86	0.94	0.90

Source: Ministry of Fisheries, *Utvegur* 1984-1997, *Aegir* 1998.

*The fishing year under the *Fisheries Management Act* of 1990, that is 1 January to 1 September. Subsequent fishing years from 1 September to 1 September the following calendar year.

Performance of the ITSQ System

The main purpose of the vessel quota system is to improve the economic efficiency of the fisheries. The Icelandic fisheries are biologically very productive and should be able to generate high economic rents. Until the adoption of the vessel quota system, however, comparatively low rents were generated in the industry. In fact, during the years preceding the introduction of the vessel quota system in the various fisheries industry profits was often highly negative.

The ITSQ system was introduced at different times and in different forms in the various fisheries and it is therefore appropriate to discuss the impact of the system on these fisheries separately.

The Pelagic Fisheries

The herring fishery resumed in 1975 after a three year fishing moratorium. A system of individual vessel quotas was imposed on the fishery, with eligibility for quota allocations limited to small vessels with a history of herring fishery participation. The larger purse-seiners were excluded on the grounds that they were capable of pursuing the North Sea herring fishery and the Icelandic capelin fishery. Due to the generally favourable experience with this system, the quotas were made transferable in 1979. In 1990, the herring fisheries management system was incorporated in the comprehensive fisheries management system for the Icelandic fisheries.

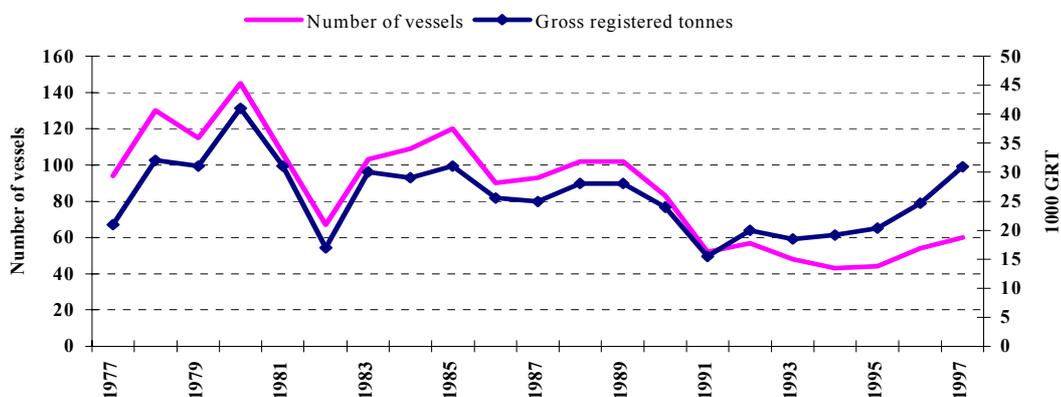
The ITSQ system in the herring fishery has been very successful. Since 1975 herring catches have increased almost tenfold. Fishing effort on the other hand has not increased. In fact it has declined substantially. The number of vessels in the fishery has decreased from about 65 vessels in 1975 to 30-40 in recent years (their numbers had actually increased up to 145 in 1980).³ Catch per unit effort in the herring fishery is now roughly 10 times higher than it was at the outset of the vessel quota system in the fishery over 20 years ago (Arnason 1993). Currently, the herring stock biomass is greater than at any time since the 1950s (Arnason 1996b, 120).

An individual vessel quota system was introduced in the capelin fishery in 1980. In 1986 the quotas were made transferable. In 1990 the capelin management system was incorporated in the overall Icelandic fisheries management system. The capelin is a short-lived species and the fishery is very volatile. Part of the capelin stock migrates seasonally into the jurisdiction of Greenland and Norwegian fisheries. The capelin is therefore a shared stock, but, through an agreement with these two countries, Iceland determines the annual TAC to be shared between the three countries. Iceland's share is 81 percent of the TAC and Norway and Greenland each receive percent. In winter, the capelin is fished exclusively in Icelandic waters. Since the introduction of the vessel quota system in 1980 there has been no trend in catch levels.

³ The vessel quota system in the herring fishery only applied to purse-seine vessels. In addition there were another 95 vessels with licenses for fishing herring with other gear, and they became subject to vessel quotas in 1985. In 1986 the vessel quota systems in the herring fishery were abolished, and instead a common ITSQ system instituted.

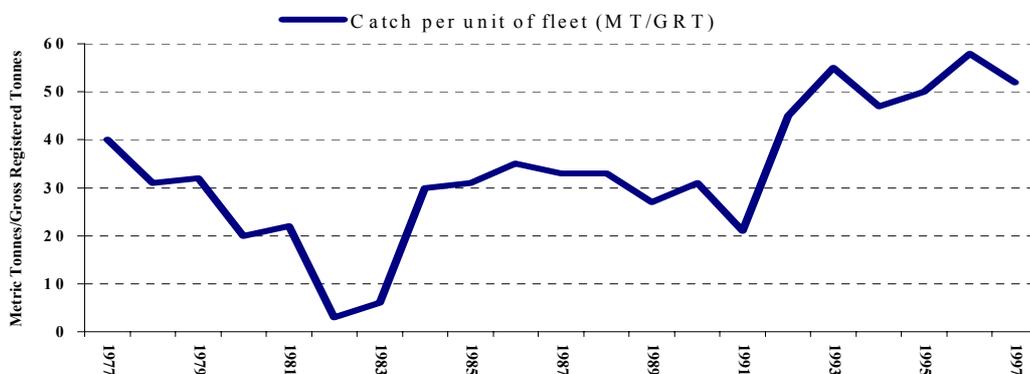
Mean catches have remained roughly unchanged. The capelin fleet, on the other hand, has been reduced: the number of specialised purse seine vessels declined from 68 in 1979 to 44 in 1996. The fleet total tonnage (GRT) was reduced by over 25 percent and total days at sea for the fleet had reduced by almost 25 percent. Thus, there are strong indications that the efficiency of the capelin fishery has increased substantially since the introduction of the vessel-quota system.

Figure 2. The Development of the Pelagic Fishery 1977-1997
Max. no. of active purse seine vessels in any one month



In the summer of 1994 the Atlanto-Scandian (Norse) herring fishery resumed. This herring stock migrates between Norwegian, Faeroe Islands, and Icelandic waters. ITSQs were issued for this fishery in 1998. Icelandic vessel caught 21,000 MT in 1994, but the catch had increased to 197,000 in 1998. The size of the capelin stock has also been growing and the TAC increasing as a result. The capelin catches averaged less than 700,000 MT in 1980-1995. The catch in 1996-1998 averaged 1,070,000 MT. This may have induced some vessel owners to revert to pelagic fishing.

Figure 3. The Pelagic Fishery. CPUP for the purse seine fleet.



Many of the new (or renovated) large trawlers are multi-purpose vessels, capable of using deep-sea trawls (especially shrimp trawl) and also special purse seine and pelagic trawl for herring and capelin. These larger multi-purpose vessels are therefore not only capable of pursuing pelagic fisheries year round (capelin in winter and late summer, and Atlanto-Scandian herring in early summer and Icelandic herring in the autumn), but can also pursue shrimp (or other species) in between the herring and capelin seasons.

It is appropriate to look at the development of the pelagic (purse seine) fishery as one, rather than separating the herring and capelin fisheries. The development of the pelagic fishery, in terms of vessel number and size is illustrated in figure 2 and in terms of catch per unit of fleet in figure 3.

Demersal Fisheries

The demersal fisheries are by far the most important Icelandic fisheries, accounting for around 80 percent of the total wetfish value. These fisheries have been subject to an ITSQ system in 1984, which has been

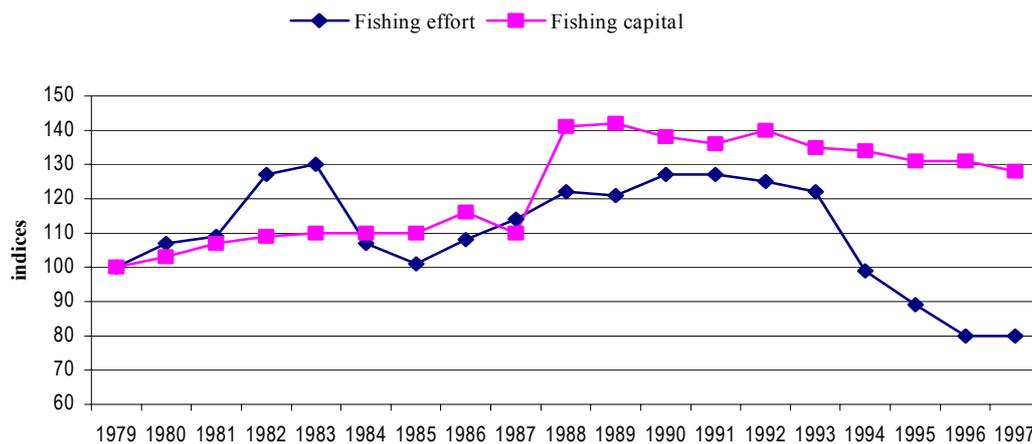
under continuous revision, even since the adoption of the comprehensive *Fisheries Management Act* of 1990.

The Trend in Fishing Capital and Fishing Effort

One of the reasons for the dissipation of economic rents in the Icelandic fisheries is overinvestment in fishing capital and excessive fishing effort. Therefore, one test of the efficacy of the vessel quota system is the development of fishing capital and aggregate fishing effort since the introduction of the system.

The trend in fishing capital and fishing effort in the demersal fisheries in recent years is illustrated in figure 4. The previous growth in the value of aggregate harvesting capital halted abruptly in 1984 when the vessel quota system was introduced. In fact, fishing capital contracted between 1984 and 1985. This was the first time since 1969 that the value of the fishing fleet actually decreased. In the preceding 15 years this capital value had grown at an annual rate of over six- percent. Thus, at this point, the vessel quota system seems to have generated beneficial results, although this halt in investment can hardly be attributed exclusively to the vessel quota system. The years 1982, 1983, and 1984 were periods of heavy losses for the fishing industry. In 1986 investment in fishing capital resumed at a high rate. This resumption of investment should not, however, be interpreted as a failure of the vessel quota system as such. After all, the increase in the value of fishing capital since the inception of the ITSQ system has amounted to just over two percent annually while during the preceding 15 years this annual increase was over six percent. Moreover, most of the investment since 1986 can be explained by factors extraneous to the ITSQ system.

Figure 4. Demersal fishing effort and capital 1979-1997

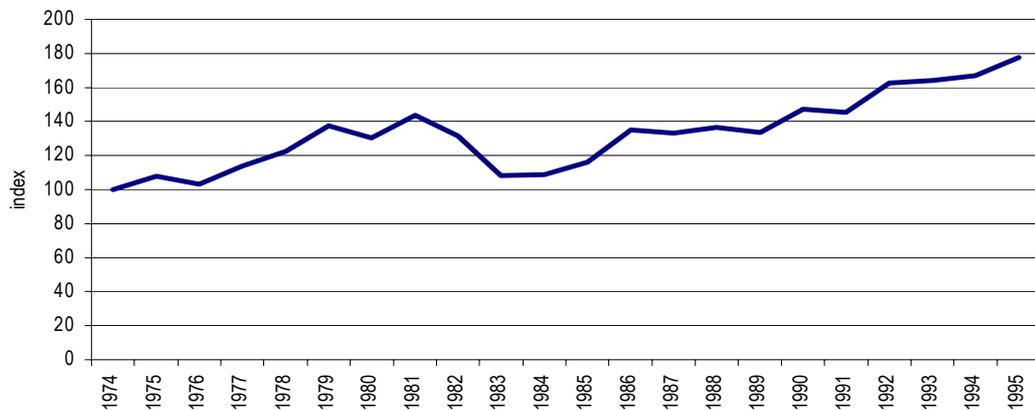


First, a good deal of the investment in fishing capital from 1986 onwards has consisted of installation of freezing equipment and the corresponding modifications of several deep-sea trawlers. In 1983 there were 3 processor vessels, in 1990 they were 26, and in 1997 they were 51. This part of the investment is, in other words, in fish processing capital employing new and profitable techniques. Second, a part of the investment was in specialised trawlers for the emerging and very valuable deep-sea shrimp fishery, which was not subject to vessel quotas until 1988. Third, by the mid-1980s a significant fraction of the deep-sea trawler fleet was due for replacement. As the years 1986 and 1987 were unusually profitable for the harvesting sector, many firms took the opportunity to replace their ageing vessels. Fourth, during this period there was a very significant investment in vessels under 10 GRT that were not subject to the vessel quota system. Their numbers increased from 1,067 in 1983 to 2,023 in 1990. Last but not least, the effort quota option in the demersal fisheries, introduced in 1985, undermined the efficiency incentives of the ITSQ system inducing many vessel owners to upgrade or replace their vessels. The effort quota option was abolished at the end of 1990 and, in fact, we see a significant reduction in fishing capital in the following years.

The course of the demersal fishing effort tells a similar story. As indicated in Figure 4, fishing effort in the demersal fisheries dropped by some 15 percent in 1984, the first year of the vessel quota system, and by an additional six percent in 1985. From 1986-1990, on the other hand, fishing effort increased considerably. This is no doubt due to the widespread selection of the effort quota option within the ITSQ system. Another important explanation for the increase in fishing effort in 1989 and 1990 is the decline in

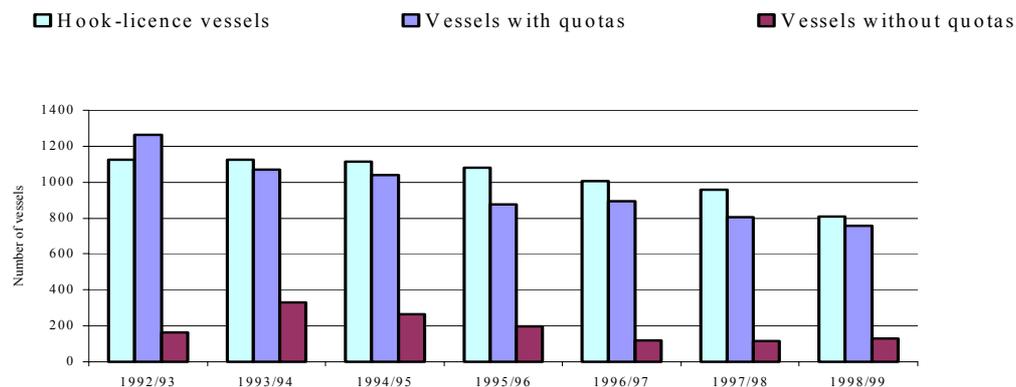
the demersal fish stocks without a commensurate reduction in the TACs. Thus, more fishing effort was required to fill the catch quotas. From 1991 and onwards demersal fishing effort has declined substantially.

Figure 5. Total factor productivity in the fisheries, at constant prices and adjusted for stock size.
Source: Institute of Economics



Productivity in the Icelandic fisheries has continued to increase after the ITSQ system came in to affect, as may be seen in figure 5.

Figure 6. Number of vessels with commercial fishing permits 1992-1998



The number of vessels with commercial permits was 2,552 at the start of the 1992/93 fishing season (see figure 6). Of these, 1,265 vessels were larger than 6 GRT had TAC shares and 1,125 vessels under 6 GRT were engaged in hook and line fishing (the other 162 vessels had permits but no quotas). At the start of the 1998/99 fishing year the number of vessels with commercial fishing permits was down to 1,695. Only 758 vessels 6 GRT and larger had TAC shares and 808 vessels under 6 GRT can participate under the small vessel arrangement. In addition there were 162 vessels with a commercial fishing permit, but no quota. In 1998 they were 129 such vessels. Included in the numbers above is a reduction in the number of vessel engaged in the inshore shrimp fisheries (from 50 to 44), the scallop fishery (from 21 to 15), and the lobster fishery (from 57 in 1992 to 42 in 1998).

Enforcement of fisheries management regulations

Monitoring and enforcement is necessary to counter any tendency to high grade and quota bust. Such violations, and violations of fisheries regulations, are subject to fines, expropriation of catch and gear and cancellation of fishing licences, depending on the seriousness of the violation. The Ministry of Fisheries⁴

⁴ The department office of the Ministry of Fisheries has a staff of 17 and a budget of US\$ 3 million.

and its agencies⁵ have rather discretionary powers to assess these penalties and a proven willingness to use them. Alleged violators have recourse to the court system in cases where they do not accept the Ministry's penalties.

To apprehend those who exceed their ACE, an effective landings control system is in place. By law, all marine catch is weighed on officially approved scales at the point of landing, and certified persons record the landings and verify the species composition of each catch.⁶ The landings-control system covers all 67 landing ports in Iceland, as well as the major foreign export ports. Processor vessels are subject to carrying on-board observers, and all new processor ships are required to have them on-board for the first few fishing trips.

The Directorate of Fisheries⁷ is responsible for applying legislation on fisheries management and is entrusted with the day-to-day administration of fisheries. Adequate management and surveillance of the ITSQ system is based on accurate data on commercial fisheries landings. In an ITSQ system uniform rules concerning the weighing in and recording of catch are necessary, as well as an efficient system to supervise the utilisation of the catch quotas of each vessel. In order to control the landings of every fishing vessel holding fishing permits, a computer system; "Lóðs" has been designed, linking the ports of landing to the Directorate of Fisheries, enabling the transmission of daily catch data directly to the Directorate's Computer department. All catch data are transmitted to the Directorate twice a day and processed for dissemination, through the Directorate's Web pages, through monthly publications or by phone to skippers and vessel owners checking their catch status. Status reports are sent regularly and upon request.⁸

In addition the Coast Guard⁹ has an important role in monitoring and enforcing domestic fisheries regulations. To further monitor adherence to quota rules and other fisheries regulation, the Ministry maintains a group of fisheries observers. At any point of time, some observers are based aboard fishing vessels during actual fishing trips while others travel between the landing ports.¹⁰

Despite elaborate monitoring and enforcement, there are some violations of the various regulations. All together though, they are negligible.

Weaknesses in the Fisheries Management System

There are certain weaknesses in the current fisheries-management system, especially from the point of view of economic efficiency. The most serious ones appear to be the following.

High grading

High grading, the discarding of less valuable catch, is a problem often attributed to ITSQ systems, especially in mixed fisheries. The Icelandic demersal fisheries are certainly mixed fisheries. Nevertheless, there is little evidence of increased discarding under the ITSQ system. According to measurements published in a 1993 report by a government commission, demersal discards range from one to six percent of total catch volume depending on gear and vessel type. According to this report there has been no detectable increase in discards since the introduction of the vessel quota system in 1984 (Arnason 1994, Runolfsson 1999).

⁵ The agencies are the Fisheries Directorate, Marine Research Institute, Fish Industry Research Institute, and Office of Industry Research. The Coast Guard is an agency of the Department of Justice.

⁶ The weight-stations are operated by the municipalities and they collect fees from the vessels to cover operating costs.

⁷ The Directorate of Fisheries has a regular staff of 59, but in addition the Directorate hires fisheries observers for the distant water fishing on a temporary basis. It has a budget of US\$ 5 million, but receives income, in the form of licensing and other fees of about US\$ 2.5 million.

⁸ The Directorate's Web pages of fisheries data in Icelandic show in detail catch status vessel by vessel, transfers between vessels or species, catch quotas, quota shares and landings. The English version shows summarised fisheries data such as TAC of all regulated species for the fishing year and transfers within a fishing year.

⁹ The Coast Guard has a staff of 80 and a budget of about US\$ 10 million.

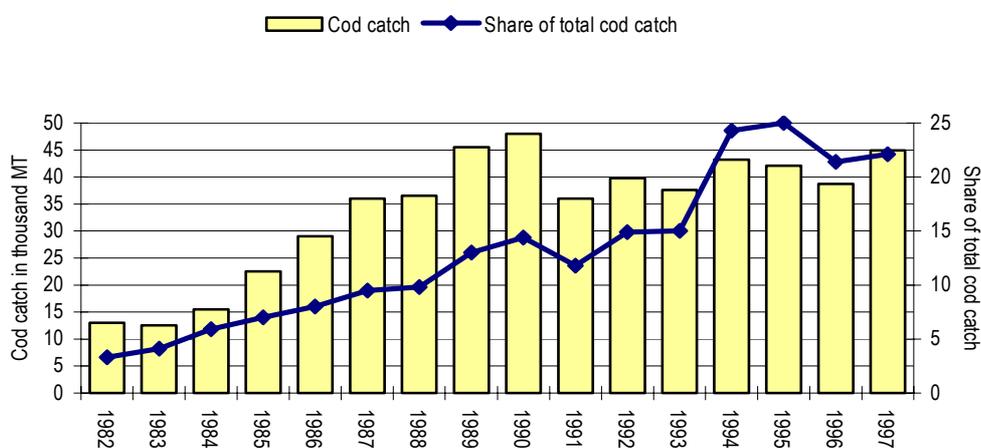
¹⁰ Satellite technology for enforcement is increasingly becoming cost effective. A large majority of the Icelandic vessels fishing for shrimp on the Flemish cap have installed necessary equipment for satellite communication. All Icelandic vessels will have such equipment by the year 2000.

Loopholes

Although the comprehensive *Fisheries Management Act* of 1990 closed many of the loopholes of the previous ITSQ system(s), one worrisome loophole did remain. Fishing vessels under 6 GRT in size were offered the option of remaining outside the ITSQ system provided they restricted their operations to hook and line fishing for demersal species. This exemption usually referred to as the hook license, was to expire in 1994, but the *Fisheries Management Act* was amended in 1996 so that this group now receives a common share of the TAC for cod, set at 13.75 percent in 1998. In 1998 there were 807 vessels in this group, 480 of which chose cod share quotas.

This exemption has resulted in distortion in the composition of the fishing fleet and in the amount of effort in the fishery. The fleet of small boats has increased its share in the demersal catch. The hook-license fleet (under 6 GRT) has expanded its share in the catch of cod from less than 3 percent in 1989 to over 20 percent in 1995 (17.5 percent in 1998). After the introduction of the ITSQ system in the demersal fisheries in 1984 the number of small vessels (under 10 GRT) mushroomed, almost doubled in number in 1990 compared to 1983. Further, investment in small vessels accounts for almost 15 percent of the total investment from 1984-1992.

Figure 7. Cod catch in MT and as share of total cod catch, vessels under 10 GRT



The development of the fleet of small boats is a clear example of rent seeking in the fisheries. In 1988 it was announced that small vessels would have to convert to ITSQs in 1991, and the vessel's catch in the years 1988 to 1990 would determine its quota share. This fuelled investment in small vessels and increased fishing effort on the part of fishermen using small vessels. In 1990, there were over 2,000 vessels under 10 GRT in the fleet (up from less than 1,100 in 1983). Their number has decreased by almost 800 since then; being officially retired or cashed in on their licences by selling the TAC shares.

Quota holdings

Quota holdings are limited to owners of fishing vessels. This restriction obviously reduces the number of potential quota market participants. As a consequence it severely limits the scope for quota arbitrage in the market. The efficiency of the market is correspondingly impaired and its effectiveness in allocating quotas to the most efficient operators reduced. A 1998 amendment to the *Fisheries Act* puts a maximum of 8-12% on the share of total quotas a firm can hold (10-20% for individual species).

Imprecision in stock management

The current ITSQ system allows quota holders to postpone the harvesting of up to 20 percent of the annual quota allotment until the following year. It also allows quota holders to exceed their quota allotment by up to 5 percent in any year subject to a corresponding quota reduction in other species (except cod). These provisions provide a certain operational flexibility to vessel owners. At the same time they also reduce the precision in the biological management of the stocks. With these provisions actual catches in a given year can deviate as much as 25 percent from the TAC. This degree of imprecision in the harvesting policy appears excessive.

Quality of the ITSQ property right

Economic theory suggests that the efficiency of an ITSQ system stems from its creation of private property in harvesting rights (see, for example, Scott 1989, 1996; Arnason 1990, 1995b; Libecap 1989). This suggests that the higher the quality of this property right, in terms of security of title, permanence, exclusivity, flexibility, divisibility and transferability, the greater will be the resulting efficiency of the ITSQ system (see Scott 1988, 1989 for more details). ITSQs are, of course, imperfect property rights. An ITSQ is a harvesting right and not property in the fish stock. They are, therefore, different from what we refer to as property rights to land. As pointed out by Hannesson (1994), ITSQs are comparable to a right to extract a certain quantity of timber from a given forest or the right to harvest a certain number of deer from a given colony. Although this may give the necessary incentives to cut the timber and catch the deer in efficient ways, it may not be suitable for the optimal husbandry of the forest or the colony of deer (see also Edwards 1994).

Article 1 of the *Fisheries Management Act* of 1990 states that the fish stocks in Icelandic waters are the common property of the Icelandic people. It further states that the allocation of ITSQs to individual firms and vessels does not give irrevocable property right in these TAC shares. The article has created uncertainty concerning the permanence and exclusivity of the ITSQs and undermined its economic effectiveness.

The uncertainty and insecurity of the property rights in ITSQs has also created problems for tax authorities and the banks. The tax authorities are uncertain whether a vessel-quota should be regarded as an asset on the firm's books, or if expenditures on quotas should be regarded as outlays that are deductible from taxable income. When the tax authorities and the Ministry of Finance could not agree on the rules, it was left for the courts to decide the matter. The courts reached a decision, which can be described as a compromise of differing views. Transfer of ACE is to be treated as taxable outlay, while transfers of TAC shares are to be treated as assets and depreciated over 5 years (depreciation of TAC was abolished in 1997). Allocated quotas, whether annual or shares, are not subject to these tax rules and are to be treated as non-taxable.

The banks have been unsure whether a vessel quota should be regarded as part of the vessel's equity (value) when a vessel is put up as collateral for a bank loan. The courts have ruled that the quotas are not to be regarded as the property of a vessel owner, and are, therefore, not a legitimate collateral for loans. Vessel owners and banks have, of course, figured out ways to circumvent this ruling: for example, the bank will make a loan on the condition that it must approve of any transfers of TAC shares.

Besides these rulings by the courts, legal scholars in Iceland have debated these issues and there seems to be a general consensus among them that Article 1 of the *Fisheries Management Act* of 1990 lacks grounding in other legislation. These scholars, it should be noted, do not consider the fishery the property of TAC shareholders, but rather that they have a property (an asset) in the harvesting rights.

Regional and Community Impact

In public and parliamentary discourse on the merits of the ITSQ system in Iceland, some claim that one of its faults is in undermining regional policy. The transferability of the quotas will lead to concentration of quota holdings in the urban Southwest region. This will have impact in various villages around the country, some of which rely exclusively on the fisheries. The result will be increasing unemployment in those regions and migration to the Southwest.

In the course of this debate various proposals have come forth on restricting the transferability of quotas. Some have even suggested attaching quotas to certain regions and restrict transfers, while others have proposed giving local governments, town councils or fishers' unions some veto power on transfers. The current fisheries management act makes TAC shares transferable without any restrictions whatsoever. Inter-regional transfer of ACE, however, is subject to some restrictions, except offsetting transfer of different species with equal value. In practice, however, few inter-regional transfers have actually been blocked.

There has been an ongoing public debate, in recent years, on the initial allocation of quotas. It may be separated into three aspects. The first concerns the base years for catch history. Allowing vessels to adjust their quotas through an effort restriction option in 1985-1990 basically solved this. The second aspect concerns whether others than vessels should receive quota, such as processing plants and fishers. The fact that vessels owned by firms with processing plants quickly caught a large majority of the demersal catches made this a non-issue. The third aspect concerns whether the government should have charged the

vessels for the initial allocation of quotas. In continuation a debate has arisen on whether the government should charge the vessels “rent” for using the resource (see Arnason, *et. al.*, 1992). Many argue that the initial allocation was as efficient and just as could be expected (see Gissurarson 1990, 1997; Arnason and Runolfsson 1991; Runolfsson 1992) and most likely the only Pareto-efficient solution.



ITSQ Management and Regional Impact

The purpose of any fishery management system must be to increase efficiency and rents in the fishery. This will be accomplished, at least partly, through a smaller fishing fleet, lesser effort and larger fish stocks, with increased TAC. A smaller fleet and decreased efforts are likely to alter the structure of employment and regional development. Fewer vessels may mean fewer fishers, although the decrease in their number should be proportionally smaller. With fewer vessels and increased TAC, catch per vessel will increase. The emphasis should also be on increased quality of the landed catch. All this should increase fishers' income, at least in total. Fewer vessels and decreased effort will also affect the suppliers of the fishing industry, such as shipyards and gear makers.

In an ITSQ system the quotas are the key to receiving catch landings. Quota holdings decide, at least for the most part, how much catch will be landed in a village and they therefore determine the employment opportunities in the village's fishing sector. To estimate the impact of the ITSQ system on regional development it is interesting to look at changes in regional quota holdings since the adoption of the ITSQ system.

The initial allocation of quotas was based on vessel catch history in 1980-1983. This allocation therefore mirrors the regional distribution of the fishing industry in terms of catches in those years. Since the initial allocation of quotas, subsequent allocation may have changed for any of four reasons. First, it may have changed with regard to catch history of vessels in the period 1985-1990, when vessels were allowed to opt for effort quota. Second, it may have changed as a result of a larger part of the fishing fleet coming under the ITSQ system, as the effort quota option and small vessel exemption (6-10 GRT) were abolished in 1991. Third, it may have changed because of transfers of TAC shares between vessels. Fourth, it may have changed with the sale of ITSQ vessels between regions. Only the latter two changes of quota allocation result from the ITSQ system.

Table 5 lists each regions share of allocated quotas, in terms of cod equivalents. The changes in quota holdings for the regions are rather insignificant. The most significant change is the gain in the Northeast region and the loss in the southwest.

Even if quota holdings define the opportunities villages have for job creation in a fishing industry, what determines the realised number of jobs is the actual catch landings in the village. Quota holdings and landed catch does not necessarily go hand in hand. Vessel owners may choose to land the vessel catch in another village, region or even export the catch unprocessed. It should therefore be of interest to look at data on the catch landings from the demersal fisheries.

Table 5. Regions' quota holdings 1984-1998 (cod equivalents, for cod, haddock, saithe, redfish and Greenland halibut, registered port of vessel). *Source:* Fisheries Directorate

Region	Southwest	West	Western fjords	Northwest	Northeast	East	South
1984	29.7%	8.9%	13.6%	6.1%	14.9%	13.2%	13.5%
1985	29.3%	9.0%	13.7%	6.2%	15.1%	13.3%	13.4%
1986	27.8%	9.7%	13.9%	6.3%	14.8%	13.7%	13.8%
1987	24.9%	9.9%	14.1%	6.9%	16.9%	13.7%	13.6%
1988	24.6%	9.6%	14.2%	7.4%	16.7%	13.5%	14.0%
1989	22.8%	9.3%	14.6%	7.9%	17.6%	13.2%	14.7%
1990	24.1%	9.0%	14.0%	7.6%	17.1%	12.9%	15.2%
1991	23.7%	9.4%	13.9%	7.9%	17.7%	12.5%	14.8%
1991/92	24.3%	9.3%	13.8%	7.2%	18.4%	12.6%	14.4%
1992/93	24.5%	10.1%	13.5%	6.6%	18.2%	13.2%	13.9%
1993/94	24.7%	10.0%	12.2%	6.9%	18.4%	13.4%	14.5%
1994/95	25.0%	10.0%	11.9%	7.0%	18.8%	12.4%	15.0%
1995/96	26.1%	10.2%	11.5%	7.4%	19.9%	11.4%	13.5%
1996/97	24.4%	9.9%	12.2%	7.4%	20.8%	11.4%	13.9%
1997/98	22.3%	10.8%	12.0%	7.9%	22.9%	11.3%	12.8%
1998/99	25.7%	12.4%	9.6%	8.4%	21.2%	11.1%	11.6%
Average	25.2%	9.9%	13.0%	7.3%	18.1%	12.9%	13.6%

Table 6 lists regional landings of the ITSQ species from the demersal fisheries. The five species included are cod, haddock, saithe, redfish and Greenland halibut, and are presented as cod equivalents. The table shows that the regional patterns of demersal landings have a much greater volatility than quota holdings. The Northeast shows an increased share of the landings, as it did in the quota holding. Another significant change is that the Southwest increases its share of landings substantially, despite its smaller share of quota holdings. This must be attributed to the introduction of floor markets but the three first floor markets are located there. These three floor markets are also among the biggest. They handled close to 50 percent of the total volume of all floor markets in 1994. From their introduction in 1987 they have grown to handle about a third of all groundfish landings of the domestic processing plants in 1997.

Another significant change concerns the exports of unprocessed groundfish, especially in containers that started in the 1980s. Export of unprocessed groundfish accounts for about six percent of the volume of demersal catches (ITSQ species) in 1983, about 17 percent in 1990 and 12 percent in 1998. The Southern region has traditionally been the leading exporter of unprocessed fish. In 1998 they exported about 20 percent of their groundfish ITSQ catches unprocessed, but all others were below 5 percent.

With a reduction in vessel numbers has followed a reduction in the number of fishermen. In 1983 there were about 6.200 fishers employed in the harvesting sector, and in 1997 about 4.600 (*Utvegur* 1983 and 1997). The catch value per fisherman has increased by over 20% since 1990 (Arnason 1996b). There has, also been a decrease in processing employment in the period. This decrease is in some explained by the increasing number of processor vessels, but mainly with smaller demersal catches and increased emphasis on export of fresh fish

Although the increased efficiencies of the fisheries through the ITSQ system may decrease employment for fishers and in industries that are a supplier for the fishing vessels, employment in other industries should increase. The increased rent in the fisheries and therefore higher income of those in the industry should create demand for other domestic services and industries. There is no reason to expect the net effect to be negative for total employment. Actually the opposite is probably true.

Table 6. Regions' share in groundfish landings 1983-1998 (cod equivalents for cod, haddock, saithe, redfish and Greenland halibut) as a fraction of groundfish landings for domestic processing. *Source:* Fisheries Directorate

Region	Southwest	West	Western fjords	Northwest	Northeast	East	South
1983	27.9%	11.2%	13.4%	5.3%	14.3%	13.7%	14.2%
1984	26.5%	10.9%	15.3%	6.1%	14.6%	13.0%	13.6%
1985	25.3%	11.0%	13.6%	6.8%	15.9%	14.3%	13.1%
1986	25.2%	11.8%	13.2%	6.8%	16.8%	15.2%	11.0%
1987	25.4%	12.0%	12.7%	7.7%	17.4%	15.1%	9.7%
1988	25.8%	10.2%	13.8%	7.3%	19.5%	14.1%	9.3%
1989	27.3%	10.4%	13.6%	6.5%	19.2%	13.0%	10.0%
1990	29.7%	9.4%	12.4%	7.6%	20.1%	11.2%	9.6%
1991	30.4%	8.9%	13.0%	7.8%	20.0%	11.3%	8.6%
1992	30.6%	7.7%	13.2%	7.9%	20.7%	11.6%	8.3%
1993	30.6%	8.8%	12.7%	7.8%	21.8%	10.1%	8.2%
1994	34.3%	7.9%	11.8%	6.4%	20.3%	10.7%	8.7%
1995	34.2%	10.3%	12.4%	4.4%	17.2%	12.5%	8.9%
1996	27.3%	10.4%	13.6%	6.5%	19.2%	13.0%	10.0%
1997	32.1%	12.8%	12.0%	4.2%	16.5%	12.4%	10.1%
1998	30.9%	13.1%	13.0%	4.2%	16.7%	12.0%	10.2%
Average	29.0%	10.4%	13.1%	6.5%	18.1%	12.7%	10.2%

Quota Holdings of the Largest Harvesting Firms

Shortly after the introduction of the ITSQ system in the demersal fisheries there was discussion on the potential concentration of quotas. If TAC shares were transferable, it was argued, the bigger and richer harvesting firms would in a short time buy the quotas from the smaller firms. It was even suggested that if permanent quotas were made transferable a limit should be set for quota holdings of any single firm.

Together, the 10 largest firms in the demersal fisheries in 1998 hold 37.6 percent (table 7) of the demersal quotas and about 35.5 percent of all ITSQs. The 50 largest harvesting firms (including their subsidiaries) held roughly 66 percent of all ITSQs at the start of the 1997/98 fishing year (*Kvótabókin 97-88:116-117*). In total the 10 largest firms have increased their share by some 13 percent points. Of these 10 firms, most exhibit a high degree of vertical integration, i.e. processing almost all the catches of their vessels in their own plants (and all own, one or more, processor vessels).

Table 7. The development of quota holdings of the largest harvesting firms in the demersal fisheries*. *Percentage of total quota shares. Source: Fisheries Directorate.*

Harvesting firm	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
UA Ltd. (NE)	4.0 (2)	4.6 (2)	4.6 (2)	5.0 (2)	5.4 (2)	5.4 (2)	5.0 (2)	5.5 (1)
Samherji Ltd. (NE)	3.2 (3)	3.4 (3)	3.4 (3)	3.5 (3)	3.6 (3)	4.2 (3)	5.6 (1)	5.5 (2)
Grandi Ltd. (SW)	4.3 (1)	4.9 (1)	4.9 (1)	5.1 (1)	6.1 (1)	5.7 (1)	4.9 (3)	4.8 (3)
Haraldur Bodvarsson Ltd (W)	2.2 (6)	2.3 (5)	2.3 (6)	2.3 (5)	2.6 (5)	3.3 (5)	4.5 (4)	4.3 (4)
Thormodur Rammi Ltd (NW)							4.0 (6)	3.8 (5)
Vinnslustodin Ltd. (S)	2.5 (4)	2.0 (6)	2.9 (4)	2.5 (4)	2.2 (7)	2.0 (8)	4.3 (5)	3.3 (6)
Skagfirðingur Ltd. (NW)	1.5 (9)	1.5 (10)	1.7 (8)	2.2 (7)	2.9 (4)	3.3 (4)	2.8 (8)	3.2 (7)
Snæfell Ltd. (NE)								2.6 (8)
Thorbjorn Ltd. (SW)							2.5 (7)	2.3 (9)
Basafell Ltd. (Wfj)							2.3 (9)	2.3 (10)
Total, 10 largest each year	24.9	25.9	27.0	28.2	30.7	31.8	38.1	37.6

*Shares of total cod equivalent values for each year. Quota holdings in cod, haddock, saithe, redfish, greenland halibut and plaice as percentage of total allotments of cod, haddock, saithe and redfish

That the 10 largest harvesting firms hold roughly 37 percent of all demersal quotas may be seen as a sign of concentration, especially considering that the 10 largest firms have increased their share by more than 50 percent in 8 years. As mentioned, there have been numerous mergers, both vertical and horizontal, in recent years which explains much of this concentration.¹¹

But looking only at the number of harvesting firms and their quota holdings can be somewhat misleading. Another view would be to look at number of shareholders that hold stock in these harvesting firms, since they should really be regarded as the owners of the harvesting rights. The number of stockholders in these corporations was well over 10,000; hardly a sign of concentration (see table 8).

Table 8. Distribution of stock in the 10 largest demersal harvesting firms in December 1998.

Harvesting firm	Year 1998/99	Number of stockholders	Institute. investor*	Corp & Coop**	Other	Biggest stockholders			
						one	Three	five	Ten
UA Ltd.	5.5%	1,720	35%	49%	16%	20%	50%	64%	76%
Samherji Ltd.	5.5%	3,864	9%	1%	89%	21%	62%	76%	80%
Grandi Ltd.	4.8%	1,080	18%	21%	61%	26%	47%	57%	71%
Haraldur Bodvarsson Ltd.	4.3%	1,227	19%	37%	44%	10%	24%	37%	59%
Thormodur Rammi Ltd.	3.8%	580	18%	23%	59%	19%	35%	42%	61%
Vinnslustodin Ltd.	3.3%	762	17%	35%	48%	18%	38%	48%	67%
Fisk. Skagfirðingur Ltd.	3.2%	197	22%	8%	70%	56%	74%	87%	94%
Snæfell Ltd.	2.6%	119	3%	96%	1%	92%	96%	98%	99%
Thorbjorn Ltd.	2.3%	368	6%	11%	83%	11%	34%	51%	71%
Basafell Ltd.	2.3%	332	18%	27%	55%	24%	39%	48%	64%
Total	37.6%	10,049							

* Stock owned by municipalities, cooperatives, pension funds, stock funds, etc.

**Corporations and cooperatives listed on the Icelandic stock exchange.

Further, the example of Samherji Ltd. counters the argument that concentration within an ITSQ system makes entry into the industry difficult. This firm, although founded in 1972, came under current ownership only in 1983, when its only asset was one (old and rusty) deep-sea trawler. Samherji Ltd. is today the largest quota holder in Iceland, in terms of overall quotas. The firm has also invested in other firms, domestic and foreign. Samherji Ltd and its subsidiaries operate 20 vessels from 5 countries. In addition they operate 2 shrimp processing plants, 2 reduction plants, 1 freezing plant, a and marketing firm in England (this list is not exhaustive all of their investments). Samherji Ltd. went public in 1997 and the current number of stockholders is close to 3,900.

Icelandic Fishing in International Waters

Icelandic vessels have increased their effort in catching deep-sea redfish (which migrates from Greenland waters, through international waters, into Icelandic waters) just inside and outside the 200-mile exclusive zone. There were negotiations with Norway, Russia, Faeroe Islands and Poland on the deep-sea redfish (in the NEFAC area), as these nations claim history of catch in that stock. Although these talks have not produced sufficient results, the Ministry allocated ITSQs, based on catch history, for that fishery in 1997. The catch was about 46,000 MT in 1998.

The Icelandic government has participated in international negotiations on several fronts recently. They negotiated with Norway and Greenland on the capelin stock, which migrates into their waters. They negotiated with the EU and Norway on the Atlanto-Scandian herring stock (in the NEFAC area), which migrates through international waters into Icelandic jurisdiction in the summer. Icelandic vessels' catch was 197,000 MT in 1998. The Ministry allocated tradable vessel quotas, based on catch history and vessel capacity, for that fishery with 52 vessels participating.

¹¹ Analysis of mergers since 1995 shows a slight decrease in concentration in total quota holdings of the ten largest (see Runolfsson 1999). It should also be noted that the total sum of ACE has usually been only 75-83 percent of the combined TAC (in cod equivalent terms). The 10 largest therefore only hold about 26.7 percent of the TAC.

Icelandic vessels resumed fishing for blue whiting in international waters in 1997. The catch in 1997 was 10,500 MT and in 1998 it was up to 64,000 MT.

Negotiations within NAFO have not led to an agreement on the shrimp fishery on the Flemish Cap. But the Ministry issued a TAC for Icelandic vessel and allocated ITSQs to vessels with catch history. There have also been talks with Norway and Russia regarding demersal fishing in the "loophole" in the Barents Sea, there now seems to be emerging an agreement on this issue. In 1998 the catch of Icelandic vessel in these international waters was 1,500 MT cod and 6,600 MT shrimp.

Icelandic firms have also been investing in foreign fisheries in recent years. Icelandic fishing companies are now involved in fishing in North America, South-America, Africa, and in several European countries, such as Britain, Germany, the Baltic and the Faeroe Islands. Besides investing money in these ventures, Icelandic firms have also used them as an opportunity for their redundant vessels. Icelanders are also involved in fish-processing numerous other countries.

Conclusion

Versions of the ITSQ fisheries management system have been in operation in Icelandic fisheries for close to 20 years. The evidence on the performance of this system is generally favourable. The ITSQ system in the herring fishery has resulted in increased efficiency. In the capelin fishery the ITSQ system also appears to have produced economic benefits, although the evidence is less conclusive. In the demersal fisheries the evidence is mixed. The fishing fleet has decreased only in the most recent years. Aggregate fishing effort decreased immediately after the introduction of the ITSQs in 1984 only to increase again in 1986-1990. From 1992 onwards there has, however, been a dramatic decrease in effort.

When interpreting the development of the demersal fisheries since 1984, one should bear in mind the imperfections of the ITSQ system especially in the period 1985-1990. During that period there was widespread use of the effort quota option and the fisheries management system was in fact only partially an ITSQ system in those years.

Despite increasing evidence on the favourable impact of the ITSQ system, there is still a debate on its merits. The debate is focused on three main issues: economic efficiency, equity, and regional implications. The equity issue is based on Article 1 of the *Fisheries Management Act* of 1990, which states that the fish stocks in Icelandic waters are the common property of the Icelandic nation. There is an ongoing political debate on whether the "rents" now accruing to ITSQ (licence) holders should be partly or fully expropriated and returned to the people (government). Some economists have also used the argument of efficient taxation as applying to the fisheries rent (see Arnason et. al. 1990, 1992). Others argue that such a tax may not be efficient (Runolfsson 1992; Gissurarson 1997; Johnson 1995). Many legal scholars claim that the content of Article 1 is a non-issue. The fish stocks are by older law common property and legislation, such as the *Fisheries Management Act*, only gives the government the power to regulate proper use of the resource. Harvesting rights are private property, they further claim, and any reallocation of these requires compensation (see *Ulfjotur* 1995).

The Icelandic ITSQ system does not appear to have had an adverse regional impact. In spite of substantial transfers of temporary and permanent quotas, their regional allocation has remained remarkably invariant. In fact, the regional landings of demersal catch show a much greater volatility than quota holdings, both before and after the introduction of the ITSQ system. The main discernible trend is some movement of quotas from the Southwest region including Reykjavik to the northern part of the country. This movement, incidentally, conforms nicely to the objectives of regional policy in Iceland.

The evidence on the economic benefits of the ITSQ system is becoming clearer, the fish stocks are in good condition, and TACs for some species have been increased. The fisheries industry, especially the harvesting sector, has become a profitable industry. The industry has modernised, horizontal mergers have become common, and, most, firms' stock is now traded on the stock market. They are also transforming into an international industry; Icelandic vessels are sailing into far away waters for additional catch and, some firms, investing in foreign fish industries in Europe and other continents. The institution of property rights, the ITSQ, has transformed the Icelandic fishing industry; it has indeed gone from rags to riches.

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