Chapter 6

Development of the individual transferable quota system in Iceland

Iceland is one of the leading countries to have adopted the Individual Transferable Quota (ITQ) system and applied the system to fisheries management. Therefore, Icelandic experiences in the ITQ system development provide good insights for fisheries policy reforms at the national level. This chapter describes the evolution of quota system in the Icelandic fisheries sector, key features of the current ITQ system and outcomes of the system. Furthermore, this chapter aims at sharing information and lessons learned from the Icelandic experiences.

Background

Before discussing the ITQ system in detail, it is necessary to overview the key figures and economic importance of the fisheries industry in Iceland. The fisheries industry is one of the most important industries in Iceland in terms of its contribution to the Gross Domestic Product (GDP) and exports. As Table 6.1 indicates, fishing and fish processing industries had accounted for 10-15% of GDP up until 2000 when the contribution fell below 10%. However, the contribution to GDP is the highest among OCED countries. Although the contribution of the fisheries industry to GDP has declined over the past decades, actual gross outputs in prices have kept an increasing trend (Table 6.2). The share of marine products in total exports of goods has also been declining, from 80% in 1991 to around 42% in 2007. This, however, can be traced to significant increases in other exports, mainly aluminium, since the value of exports of marine products has not been decreasing. With respect to fish catches of Icelandic vessels, the total catches in the 1980s and early 1990s were relatively stable at between 1.5 million and 1.6 million tons, as Table 6.3 reveals. The catches reached at the peak at 2.2 million tons in 1997 followed by a sharp decrease in 1998 and 1999. Although total catches showed a short recovery in 2002, they have considerably reduced since 2003 mainly because of the sharp decrease of capelin catch that tends to vary significantly between years.

The most important fisheries in Iceland are demersal or groundfish fisheries catching mainly cod, haddock, saithe, redfish and Greenland halibut (Eythórsson, 2000). From 2003 to 2006, the demersal fishery generated about 78% of the total catch values, as indicated in Table 6.4, while cod is the most commercially important single species. Pelagic fisheries catch around two-thirds of the total volume in Iceland, but the value of the catches contributes less than 20% to the total value.

Table 6.1. Contribution of the fisheries industries to GDP in Iceland (1975-2005)

	1975	1980	1985	1990	1995	2000	2005
Fishing (%)	6.4	8.0	7.7	9.6	9.5	7.0	4.7
Fish Processing (%)	6.0	7.8	6.2	4.8	4.7	2.7	1.3
Total (%)	12.4	15.8	13.9	14.4	14.2	9.7	6.0

Source: Statistics Iceland.

Table 6.2. Gross output of the fishing industries in Iceland, 1975-2005 (ISK million, current prices)

	1975	1980	1985	1990	1995	2000	2005
Fishing	191	1 866	14 030	46 011	55 347	63 659	72 020
Fish Processing	378	3 217	20 867	49 400	66 007	70 512	81 241
Total	569	5 083	34 897	95 411	121 354	134 171	153 261

Source: Statistics Iceland.

Table 6.3. Catches of Icelandic fishing vessels, 1975-2006

	Total	Cod	Haddock	Saithe	Redfish	Herring	Capelin	Shellfish	Others
1975	988 571	265 759	36 658	61 431	38 291	33 433	501 093	7 298	44 608
1980	1 508 071	428 344	47 915	52 380	69 868	53 268	759 519	12 358	84 419
1985	1 672 279	322 810	49 553	55 135	91 381	49 363	992 999	27 279	83 759
1990	1 502 292	333 652	66 030	95 015	94 848	90 338	693 740	31 389	97 280
1995	1 605 127	202 900	60 125	47 466	118 750	284 473	715 551	84 556	91 306
2000	1 980 163	238 324	41 698	32 947	116 297	287 663	884 858	46 198	332 178
2001	1 986 584	240 002	39 825	31 941	92 527	178 950	918 417	46 820	438 101
2002	2 133 327	213 417	49 951	41 839	110 876	223 843	1 078 818	54 765	359 819
2003	1 979 545	206 405	60 330	51 935	111 143	250 097	675 625	45 729	578 280
2004	1 727 785	227 258	84 563	62 965	84 513	224 365	515 581	32 678	495 862
2005	1 668 927	212 456	96 580	67 736	77 540	264 660	605 059	14 036	330 859
2006	1 322 914	199 375	96 591	75 460	82 595	291 380	184 431	6 081	387 001

Source: Statistics Iceland.

Table 6.4. Catch Values by Species in Iceland, 2003-2006 (unit: 000 ISK)

	2003	2004	2005	2006	2003-2006	Percentage
Total	67 277 674	67 975 107	67 920 065	76 163 325	279 336 171	100.0
Cod	26 051 833	27 979 389	24 924 027	27 588 627	106 543 876	
Haddock	5 863 722	7 660 219	8 881 445	11 418 054	33 823 440	
Saithe	2 488 788	2 777 740	3 086 148	4 684 188	13 036 864	
Redfish	4 705 417	3 719 051	5 466 266	6 537 375	20 428 109	
Oceanic redfish	3 209 537	2 637 371	1 666 045	3 129 867	10 642 820	
Catfish	1 542 247	1 126 124	1 396 560	1 681 676	5 746 607	
Other demersal	7 491 012	7 664 598	6 865 319	7 703 133	29 724 062	
Demersal subtotal	51 352 556	53 564 492	52 285 810	62 742 920	219 945 778	78.7
Herring	1 755 601	2 364 477	1 988 124	2 394 990	8 503 192	
Norwegian spring-spawning herring	1 911 468	2 185 623	5 161 065	3 951 852	13 210 008	
Capelin	4 877 527	4 033 234	5 030 553	2 180 468	16 121 782	
Blue whiting	3 441 615	2 820 029	1 489 498	3 584 730	11 335 872	
Other pelagics	195 683	506 725	458 632	450 888	1 611 928	
Pelagics subtotal	12 181 894	11 910 088	14 127 872	12 562 928	50 782 782	18.2
Crustaceans	3 639 776	2 422 513	1 450 762	817 238	8 330 289	3.0
Molluscs	103 449	78 013	55 623	40 240	277 325	0.1

Source: Statistics Iceland.

Evolution of the quota system in Iceland

In Iceland, soon after Iceland gained control over the Exclusive Economic Zones (EEZs) in 1976, the previous management system was completely overhauled. The overhaul was initiated by various problems that Icelandic fisheries were faced with, including overexploitation of stocks, and poor economic performances. In order to address these issues, a series of actions has been taken.

An individual vessels quota system was introduced for herring fishery in 1976 by expanding a Total Allowable Catch (TAC) system that was established in 1969 due to the continuous decline in herring stocks (Runolfsson, 2001 b). The individual vessel quotas were made transferable in 1979. Then, the TAC system was applied to the demersal fisheries starting with cod in 1976 and individual effort restrictions were added to the fisheries management in 1977. For example, Cod fishery or trawlers was first limited to 323 days a year. However, these restrictions were ineffective and the days at sea in the cod fishery were reduced to 215 days in 1983. In addition, the individual transferable vessel quota system was applied to the whole demersal fisheries in 1984, including included haddock, saithe and redfish, except for small vessels. The initial quotas were basically allocated on the basis of catches in a reference period, which was determined to

be the three-year period between 1981 and 1983.Furthermore, the capelin fishery was added to the individual vessel quota system in 1980 and the quotas were made transferable in 1986Although individual vessel quota system was accepted based on agreement among the Icelandic government, the Parliament, fishing industry and other stakeholders, policy challenges emerged in the late 1980s. For example, the catches of the most important species were still exceeding scientific advice and TACs decided by the government. The excessive fishing became unacceptable and there was a substantial pressure to integrate different effort restrictions into a single management system so that all operators can play under the same rules. These developments led to the legislation of the Fisheries Management Act in 1990, providing a legal basis of a fairly uniform and comprehensive ITQ system. Since the Fisheries Management Act entered into force in 1991, most commercially important species have been managed by the ITQ system. In addition, the ITQ system started to cover all Icelandic fishing fleet in 2004. In the fishing year 2006/2007, 19 species were subject to the individual quota system. Meanwhile, due to the importance of the fisheries industry in Iceland, the ITQ system has continued to feature heavily in political debate and has been subject to modifications (OECD, 2004; Sanchirico *et al.*, 2006).

Key features of the current ITQ system in Iceland

Quota allocation

Under the current ITQ system, TACs of each species are determined by the Ministry of Fisheries[1] by taking into account the recommendations from the Marine Research Institute (MRI) for stock status of target species. Special rules are applied for cod, capelin and herring in deciding TACs. In 2007, the MRI recommended the TAC for cod should be based on the average of last year's TAC and 20% of the estimated fishable biomass in the assessment year. According to this formulation, the cod TAC for 2008/2009 fishing year was recommended to be 124 000 tons.[2] For capelin, the rule is that at least 400 thousand tons should be allowed to spawn in order to maintain the sustainability of the stock. In addition, the TAC for herring is recommended based a specific fishing mortality rate. Fishing vessels are allocated their "annual catch quotas" based on the vessel's "permanent quota shares" and the total quotas of the species that the vessels intend to catch. The permanent quota shares have been provided to eligible fishing vessels mainly based on catch histories, usually during three years prior to the introduction of the quota system for the species. The combined quota share for all vessels amounts to 100% of each species. Fishing years are normally from September of the year in concern to August of the following year even though some fisheries have shorter fishing periods (OECD, 2004; Sanchirico *et al.*, 2006)

Divisibility and transferability

Quota shares and annual catch quotas are divisible and transferable to other fishing vessels with minor restrictions. The restrictions, designed to discourage speculative quota holdings, include that (1) no vessels may purchase quotas that are clearly excessive of what the vessel can harvest, and (2) any vessel that does not harvest 50% of its annual catch quotas in two subsequent years will lose its permanent quota share. Another constraint is that the quota-shares held by any company or individual should not exceed certain limits, ranging from 12% of the TACs for cod to 35% for ocean redfish (OECD,

2004). In addition, any company or individual's quota share should not exceed more than 12% of the value of the total quotas allocated for all species.

In addition, some flexibility is provided to vessel owners. They can transfer 20% of their quotas to the following fishing year and catch fishes up to 5% in excess of the quotas under the condition that the excess catch is withdrawn from next fishing year's quota of the vessel (Iceland Ministry of Fisheries website, *www.fisheries.is*).

Each year, a large share of the annual catch quotas is traded. Much of this trade is internal transfers between vessels owned by a same operator. A large part of the trade is also in the form of interspecies exchange. That is, one operator trades a part of its annual quotas in one species for quotas in another species. Moreover, some of the annual catch quotas are traded for money. Applications for quota transfers should be submitted to the Directorate of Fisheries which verifies and registers the transfers on its website. The Icelandic Quota Exchange was established in 1998 and operated to 2001. Since 2001, quotas have been transferred on an open market by individual firms or through brokers.

Fee

A special fishing fee has been levied on annual quota allocation from September 2004 according to the 2002 amendment of the Fisheries Management Act. The fee is calculated based on the certain rate of net landed value, i.e. value of after deduction of operation costs and fishermen's salaries from total landed values of the species. The rate in the 2004 fishing year was 6% and it will increase to 9.5% by the 2009 fishing year (OECD, 2004; *www.fisheries.is*).

Management of small fishing vessels

In the process of quota system development in Iceland, small fishing vessels have been given special consideration because it was not administratively desirable to include them in the ITQ system because of the large number of small vessels with minimal percentage (about 2%) of total catch. When an initial individual transferable vessel quota system was adopted for the demersal fishery in 1984, small vessels under 10 Gross Registered Tonnage (GRT) were exempted from the system. However, as the number of small vessels and their catch increased, there was a need to strengthen the exemption criteria.

With the legislation of the Fisheries Management Act of 1990, small vessels under 6 GRT are allowed to choose between the general quota regime and effort restrictions. Most small vessel operators chose the effort restriction option. However, the small vessels became effective and their increased catches became unacceptable. Therefore, individual vessel quotas had been imposed on the small vessels step by step, with the final step being taken in 2004. Now, the quota management system for small vessels is identical to the general quota management regime for larger vessels except for small vessels that can only use long-line or hand-line. There is full transferability of fishing quotas between small vessels but it is not possible to transfer small vessel quotas to larger vessels. In short, small vessels must comply with the general quota management rules in addition to the special fishing gear and quota trading restrictions.

Catch data collection

Information on each vessel's catches, weight and species composition for instance, is collected by officials at landing ports. Weighing stations are normally operated by municipal authorities and weighing fees are collected. Once weighing is completed, the relevant port authorities transmit the catch information to the central database of the Directorate of Fisheries. As required by the Article 17 of the Fisheries Management Act, special fisheries inspectors of the Directorate of Fisheries "supervise the landing, weighing-in and processing of the catch". They also "accompany fishing vessels on voyages or board the vessels to check their cargo and fishing gear". The information accumulated in the database is provided to vessel owners and skippers to check their quota status. The database is updated daily and accessible by the general public to ensure transparency (Gissurarson, 2001; *www.fisheries.is*). Furthermore, buyers of the catch (usually the processors) have to register and send the Directorate of Fisheries information on the value and amounts of the purchase and the disposition of the catch. This registration system provides double checking of the catch information.

Cod equivalents or species exchange

Iceland is the leader in using species exchanges under which quota shares can be converted into a "cod equivalent" or a "cod currency." The term "cod equivalent" implies the relative value of different fish species on the market set by the Ministry of Fisheries regulation every year. For each vessel having a quota for several species, the total quota may be calculated in kilograms as cod equivalents. However, there are some restrictions on the exchange. It is not allowed to convert more than 5% of total annual catch quotas and no more than 2% of the total quotas can be converted into any one species (Sanchirico *et al.*, 2006, *www.fisheries.is*).

Special regional quota allocation: shock absorbers

The Minister of Fisheries has the authority to allocate certain amount of cod equivalent for special purposes. The amount is normally less than 3% of the total quota allocations. The specially allocated quotas are basically intended to serve as shock absorbers and regional policy instruments. These quotas are used for special allocations when local stocks collapse and this affects severely a limited group of vessels that has specialised in local fisheries to catch the stocks. This arrangement has been applied to coastal shrimp and scallop fisheries that have large fluctuations in stock status and catches. These quotas are also used to compensate small communities that lose quotas for various reasons. A community that suffers from the loss of quotas through transfers or because of a reduction in catches for other reasons can apply to the Minister for a special regional quota allocation.

These shock absorbers have been considered as a very important policy instrument since they deal with geographically isolated problems within the quota system and solve them without a special legislation when they arise. However, it is important to note that the extent of these shock absorbers and other special measures should be limited because all special allocations might hamper the function of the system and affect the competitiveness of the operators.

Monitoring and enforcement

Several government agencies and institutions are involved in monitoring and enforcing the ITQ system. The Directorate of Fisheries under the Ministry of Fisheries is the principal agency monitoring compliance with fisheries laws and regulations and enforcing fisheries management measures. The Directorate issues commercial fishing permits and allocates catch quotas to fishing vessels. It also records quota transfers between vessels and collects catch data. The Icelandic Coast Guard, under the Minister of Justice, monitors fishing activities at sea, including surveillance of areas closed for fishing and inspection of mesh sizes and other gear related practices (*www.fisheries.is*). Marine observers, employed by the Ministry of Fisheries, play an important role in checking compliance with regulations on mesh size, by-catch, etc. They may take trips on fishing vessels and may travel between fishing. Violations of the Fisheries Management Act and related regulations may result in heavy penalties including expropriation of catch and gear and cancellation of fishing permits (Gissurarson, 2001).

Outcomes of ITQ system

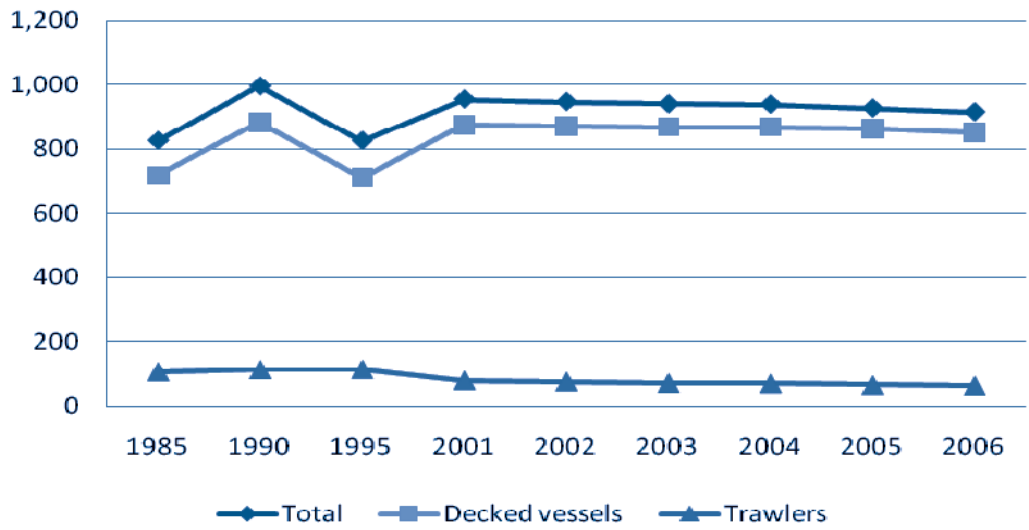
Outcomes of the ITQ system in Iceland can be analysed by examining the questions of whether fishing fleet has been reduced, whether fish stocks have increased and whether economic performance of the fishing industry has increased. One of the overall evaluations is that fish stocks have recovered, landing quality has improved, and the catch per unit fleet capacity has risen significantly in Icelandic fisheries (Hentrich 2006). In the following section, these factors are examined in detail.

Fishing fleet change

An ITQ system does not directly control the number of vessels and vessel size but the quota management system let the fishing industry adjust the fishing fleet. In general, a well-functioning ITQ system results in downsizing fishing fleet. Figure 6.1 shows an overall trend of the number of decked vessels and trawlers. Over the last two decades, decked vessels have increased by 18%, with a sharp increase in the late 1980s mainly due to increased sizes of replacement vessels. However, the number of the vessels has remained relatively stable since 2001. Trawlers, normally having greater tonnage than decked vessels, have decreased by 41%. This opposite direction has resulted in a stable trend in GRT at between 110 000 and 125 000 tons over the same period. In the meantime, undecked vessels, mostly small vessels less than 10 Gross Tonnage (GT), have considerably reduced over recent years. The number of undecked vessels was 1 134 in 1998, but was reduced to 744 in 2007 while the GTs of the vessels has also decreased from 5 208 tons to 3 556 tons.

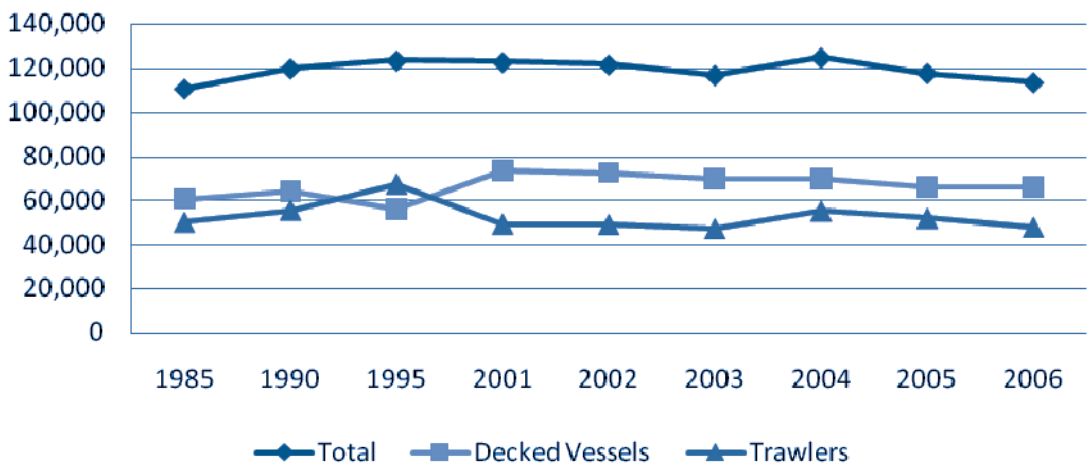
In terms of fishing fleet composition, as seen in Figure 6.4 decked vessels accounted for more than 50% of the total numbers and gross tonnages in 2007. Trawlers accounted for about 44% of gross tonnages although they contributed only 4% to the total number of the vessels. The number of undecked vessels accounted for about 45% but the percentage of them in gross tonnages was only 2%.

Figure 6.1. Trend in number of Icelandic fishing vessels (trawlers and decked vessels)



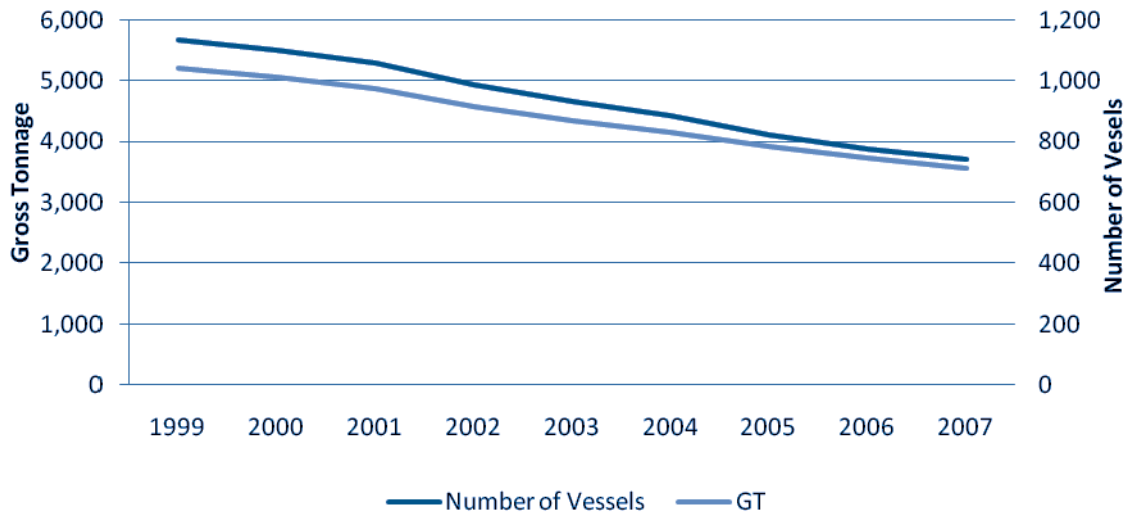
Source: Statistics Iceland.

Figure 6.2. GRT of Icelandic fishing fleet (trawlers and decked vessels)



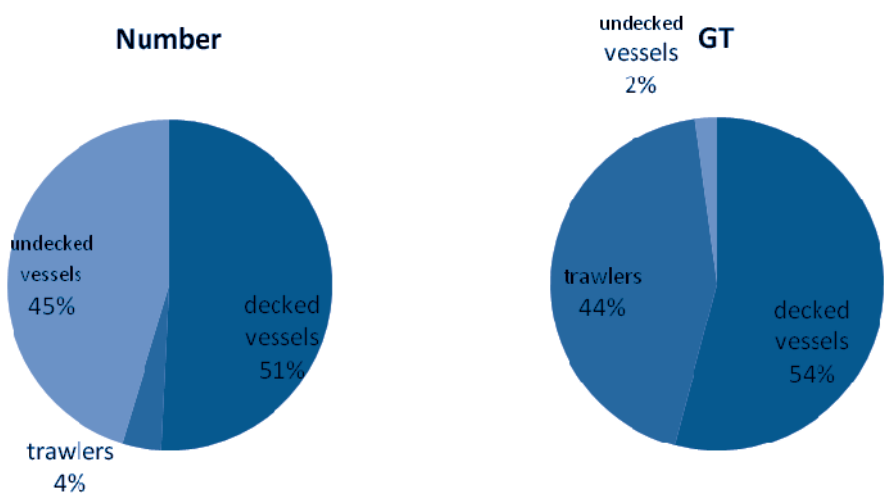
Source: Statistics Iceland.

Figure 6.3. Undecked fishing vessels in Iceland



Source: Statistics Iceland.

Figure 6.4. Composition of the fishing fleet in Iceland, 2007



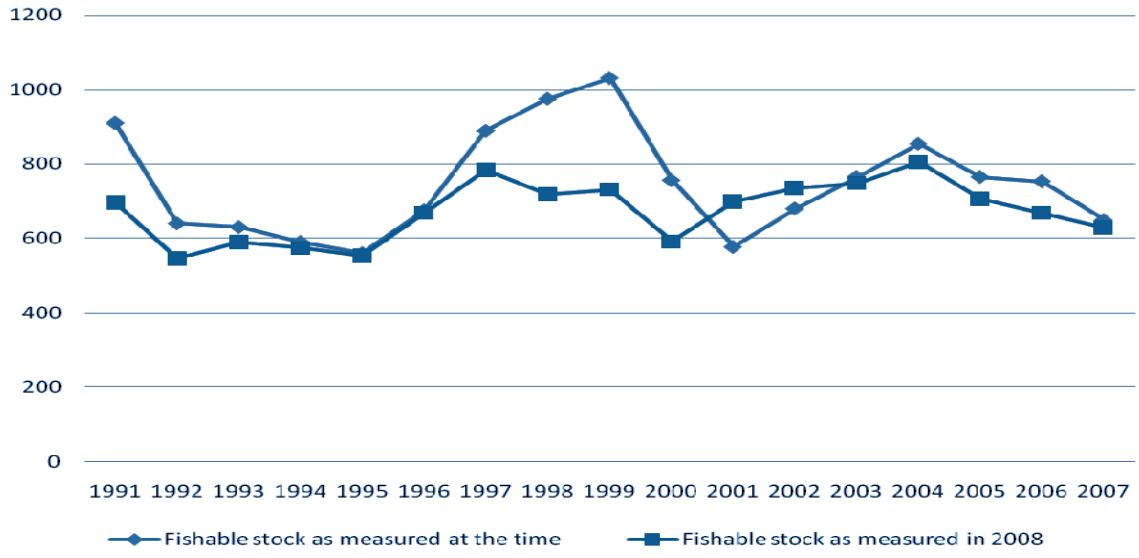
Source: Statistics Iceland.

Changes in fish stocks and total quotas

Figure 6.5 describes the trend in stock changes of cod, the most important single species in Iceland. Fishable stock biomass of cod (four years and older) increased in the late 1990s and it remained above 700 000 tons although it dropped to 591 tons in 2001. However, the cod stock has shown a slightly decreasing trend since 2004. Consequently, cod TACs have reduced in recent years as seen Table 6.5. It is worthy to noting that stock assessment has a tendency to overestimate biomass although they are refined later on due to increased data availability including catch data. As seen in Figure 6.5, stock biomasses measured at the time were greater than those measured in

2008 except for 2000 and 2001. As a whole, the difference between biomasses measured at the time and in 2008 has been less than 10% of total biomass except for 1997-2001.

Figure 6.5. Cod Stock Assessments (1991-2007)



Source: Ministry of Fisheries, Iceland

Stock changes can also be analysed in an indirect way by examining the trend in TACs of important species because the TACs are determined by the Ministry of Fisheries based on MRI's scientific stock assessment on the species.

Table 6.5 shows that total TACs in Iceland have varied over the past ten years. An overall decrease (868 232 tons) from 1997/98 to 2007/08 fishing year is mainly due to the reduction of capelin quotas (850 782 tons) since capelin has long been the single largest contributor to the total catches in Iceland.[3] There are however several species that show increasing trends in their quotas. They include haddock (45 000 tons in 1997/98 to 100 000 tons in 2007/08 fishing year), saithe (30 000 to 75 000) and Icelandic herring (100 000 to 150 000) although there were fluctuations depending on the specific circumstances of the fishing year. On the other hand, decreasing trends have been observed in cod (218 000 to 130 000), redfish (65 000 to 57 000), capelin (1 008 028 to 157 246) and offshore shrimp (75 000 to 7 000).

Table 6.5. Evolution of TACs in Iceland

Unit: 000 tons

	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08
Total	**1 602**	**1 544**	**1 422**	**1 453**	**1 661**	**1 314**	**1 328**	**1 413**	**811**	**947**	**734**
Cod	218	250	250	220	190	179	209	205	198	193	130
Haddock	45	35	35	30	41	55	75	90	105	105	100
Saithe	30	30	30	30	37	45	50	70	80	80	75
Redfish	65	65	60	57	65	60	57	57	57	57	57
Catfishes	13	13	13	13	16	16	16	13	13	13	12.5
Greenland Halibut	10	10	10	20	20	23	23	15	15	15	15
Icelandic Herring	100	70	100	110	125	105	110	110	110	130	150
Capelin	1 008	995	892	919	1 096	765	737	803	194	318	318.2
Others	113	76	2 530	54	71	66	51	50	39	36	38

Source: Directorate of Fisheries, Iceland.

Even though this analysis does not show a clear direction, it should be noted that the quotas for cod and haddock, the most important species in terms of catch values, accounting for more than 50% of total catch values from 2003 to 2006 as shown in Table 6.4, have increased and, therefore, contributed to the better economic performances in recent years as discussed below.

Economic performance of Icelandic fisheries

Table 6.6 indicates the trend of net profits of fishing and fish processing industry in Iceland using annuity approach with 6% rate of return. The total net profits were positive in most years except for the years of 1997 and 1999. It is noticeable that the profits in 2001, 2002, 2003 and 2006 were much higher than those in other years.

Table 6.6. Net profits of fishing and fish processing in Iceland, 1996-2006

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Total	2.2	-1.4	3.3	-1.3	2.3	18.1	10.1	10	5.9	8.4	16.9
Demersal species	-1	-5.5	2.8	1.4	6.4	19.6	11.5	10.3	7.5	9.7	18.5
Shrimp	0.3	-2.5	-1.6	-0.7	-3.5	8.2	1.6	10.8	0.8	-	-
Capelin	21.4	15.2	9.3	-20.1	-19.3	17.4	9.5	7.7	0.8	1.1	8.9

Source: Statistics Iceland.

Trend in the catch per unit effort (CPUE) in fishing is an indication of efficiency of the fishery. In the case of cod, with the standard for CPUE set at 100 for all types of gear in 1991, the CPUE increased considerably in 1994-97 for all types of gear but it fell significantly after 1998 In recent years, the CPUE has increased again in trawl and longline fishing while that of gillnet fishing dropped to the lower level than the early 1990s (*www.fisheries.is*).

With regard to employment in the fishing and fish processing industries, as Table 6.7 shows, the number of employees and the percentage of them to the national employment have constantly decreased. From 1990 to 2005, employment in the fishing industry reduced by 36% from 6 985 to 4 440 while, in the fish processing industry, employment decreased from 7 554 to 6 400 although the decreasing rate was lower than the fishing industry at 15%. As a consequence, fishing and fish processing industry's contribution to the national employment has also declined considerably from 11.6% to 6.6% over the same time. However, this decreasing trend is not unique in Iceland, rather it is common in other industrialized countries where employment has been shifting from primary industries to service industries. Also, it can be interpreted as a result of efficient operation of the fishing industry since the reduced number of employees creates greater value.

Table 6.7. Employment of the fishing industry in Iceland 1

	1990	1995	2000	2001	2002	2003	2004	2005
Fishing	6 985	6 396	6 210	5 790	5 850	5 490	4 850	4 440
Fish processing	7 554	7 339	6 600	6 570	6 530	6 360	6 640	6 400
Total	14 539	13 735	12 810	12 360	12 380	11 850	11 490	10 840
Percentage of national employment	11.6%	11.1%	8.3%	7.9%	7.9%	7.6%	7.3%	6.6%

1 This table is combined with two tables from the Statistics Iceland: number of man-years by economic activity 1963-1997 (1990, 1995) and employed persons by economic activity, nationality, sex and regions 1998-2005 (including foreign nationals).

Source: Ministry of Fisheries.

Lessons learned

"Evolutionary process, not design"

The evolution of the Icelandic ITQ system was "a process of gradual discovery and difficult bargaining" (Gissurarson, 2000). That is, the course towards a complete ITQ fisheries management system in Iceland has evolved more by trial and error than by a grand design. The main lesson to be learned from this process is that the introduction of the ITQ system in fisheries management is not a simple task (Runolfsson, 2001b).

The introduction of ITQs was marked by opposition from various interest groups that wanted to protect their traditional values and interests, as well as by conflicts between stakeholders. Some of the conflicts went to court to seek resolution. Others have been resolved through negotiations and the introduction of legislation and regulations. However, it is generally accepted that the ITQ system in Iceland has succeeded in realizing its objectives although there are several issues that attract policy attention. The rest of this section reviews how controversial issues involved in the ITQ system have been addressed in Iceland and what their implications might be for other countries introducing the system.

Response to crisis

The key steps in the evolution of the ITQ system have usually been taken in response to crises in respective fisheries mainly due to a sudden reduction in stock biomass levels. Therefore, individual vessel quotas were introduced in the herring fishery in 1975, following a collapse in the herring stocks and a moratorium on herring catches. Similarly, vessel quotas in the capelin fishery and the ITQ 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 process reflects the reluctance of the fishing industry to accept new fisheries management systems on a voluntary basis. Only when faced with a crisis, especially involving a significant fall in income, were stakeholders were willing accept policy changes (Runolfsson, 2001b).

By catch or "high-grading" issue

Discards of non-target species and the practice of 'high-grading', an attempt to increase total value of catch by throwing away low-value fishes caught unintentionally, have been seen as one of the possible problems in fisheries quota management systems in general (Hentrich, 2006)[4]. In order to discourage discards, it has been decided in Iceland that every vessel could land up to 5 % in excess of the vessel's annual catch quota. As mentioned above, a vessel's excess catches are subject to be withdrawn from the following year's quota. In addition, fishers can land small or undersize fishes with only 50% of the weight being charged against the annual catch quota up to a certain limit, generally 10% of the total landings of each species.

Furthermore, strict surveillance of fishing vessels, including observers on board, stiff penalties for violations of ITQ rules and regulations and flexibility in quota management allowing transfer of quotas between different species, have played an important role in addressing the high-grading issue. As a consequence, there has been no detectable increase in high-grading in Iceland (Gissurarson, 2000; Hentrich, 2006; Sanchirico *et al*., 2006).

Concentration of quota ownership: distributional effects and equity issue

It has been argued by critics of the ITQ system that the system could encourage quota concentration and therefore result in high unemployment in fishing communities that are heavily dependent on the fisheries industry (Liu, 2000).

There are two different views on how to interpret the trends in quota concentration. Eythórsson (2000) argues that there has been substantial concentration of quota shares from large companies since the introduction of the ITQ system. 22 companies holding more than 1 % of total quotas shared 47.2% of the total quotas in 1994, compared to 25.5% in 1991. Another figure shows that 20 largest companies held rights to harvest 56.6 % of the total allowable catches in 1998/99. Many fisheries-dependent communities, especially those in remote villages have lost their fishing quotas and therefore are faced with finding alternatives economic activities and employment opportunities. In order to cope with the growing concentration, upper limits were set up in 1998 (for example, 10% for cod and haddock and 20% for herring and capelin) (Eythórsson, 2000).

However, Runolfsson (2001) argues that concentration is not a serious problem in Iceland. Although the percentage of total quota shares of the 10 largest harvesting companies increased considerably from 24.7 % in 1991 to 37.6% in 1998, this trend was a result of the wave of the mergers in the fisheries sector. Most of the 10 largest companies merged with other large and small companies in the 1990s. In addition, the increased percentage of the quota shares of large companies does not necessarily mean that the ownership have been concentrated because the number of stockholders of the companies, considered as the owners of harvesting rights, increased from less than 2 800 in 1990 to over 10 000 in 1998 (Runolfsson, 2001).

Pálsson (1995) points out that even if the number of stockholders increases, decision-making is being made by a small group of company managers and consequently fishing communities are likely to be dependent on their decision regarding employment and incomes. An analysis using the Gini coefficient reveals a substantial increase in the distributional inequality during the period examined, 1984-1994. According to the analysis, the coefficient rose from 0.677 in 1984 to 0.799 in 1994 (Pálsson, 1995).

The issue of concentration of quota ownership is closely related to the initial quota allocation issue. Due to its distributional effects, initial allocation of quotas is a key issue in increasing acceptance of the quota management system. In practice, allocation based on historical catch has been widely used (Hentrich, 2006). In Iceland, the general rule was to issue permanent quota shares to eligible vessels based on catch records in the previous three years even though there were several exceptions. This was a result of continuous modification efforts to balance various interests and has contributed to smooth transitions to new quota management system (Runolfsson, 2001).

However, the equity issue involved in the initial allocation has been legally challenged in Iceland. A district judge in the Western Fjords decided in 2000 that the initial allocation of quotas on based catch history had violated the constitutional principles of economic freedom and equal treatment by noting that the method of the allocation discriminated the group of quota recipients with other people. However, the Supreme Court reversed the ruling and determined that the initial allocation had not included any arbitrary or unconstitutional discrimination and therefore the allocation was constitutional (Gissurarson, 2000). More recently, the United Nations Human Rights Committee discussed the issue of the initial allocation of rights under the Iceland ITQ system (UNHRC, 2007).

Conflicts between stakeholders

The conflict between vessel owners and crewmen has dominated the ITQ debate for many years in Iceland. There were two main issues in the dispute. First of all, pricing of fish in vertically integrated companies was a serious problem for many years. The compensation to crews on Icelandic fishing vessels was basically a proportion of the value of landings. The crew unions were constantly fighting against vessel operators over landing prices when the operators bought the catch for their own processing facilities. This dispute was the main cause of periodic strikes and animosity between the crews and the vessel operators. This issue was solved in such a way that pricing of landings in vertically integrated companies is now done using a formula incorporating the prices in auction markets. Another highly disputed issue was pricing of fish when a quota was rented to another vessel. When operators rent quotas to their vessels, they often wanted to use a net price, i.e. price after deducting quota rental costs from a gross price, as a basis in calculating share of crews. However, crews wanted to be paid based on the gross price since in many cases there were big differences between the gross price and the net price. It is now illegal to pay the crew out of the net price except for small operators who rent quotas for their vessels and are also members of the crews at the same time.

These conflicts have been resolved with a new institutional framework that was established in 1998. The institutions include: the Share-price Office to control leasing transactions; a committee with representatives from both vessel owners and crewmen to resolve conflicts between the two sides; and the Quota Exchange Market where all quota leasing contracts should be made (Eythórsson, 2000).[5]

Property rights issue

Allocation of individual quotas involves the question of whether or not the quotas are private property rights. This goes to the heart of the question of whether the quotas can be the target of taxation, depreciation and collateral for loans.

Before discussing this question in detail, it is important to review the key features of property rights, which include security, exclusivity, permanence and transferability. Security refers to the ability of a property owner to protect its ownership against challenges by other individuals, institutes and the government. Exclusivity is characterized by the ability of a property holder to utilize and manage it without outside interference. Permanence refers to time span of the right. This can be ranged from zero (then, the property right worth nothing) to indefinite duration. Transferability means the ability to transfer the whole or a part of the right to someone else. Therefore, divisibility is an important feature of the transferability (Arnarson, 2005).

Analysis of the characteristics of ITQs in line with the key features of property rights reveals that ITQs are not the same perfect property rights as the property rights on land for instance. ITQs are basically harvesting rights and not ownership for fish stock itself. Therefore, ITQs are sometimes compared to a right to extract a certain quantity of timber from a given forest or a right to harvest a certain number of deer from a given population (Runolfsson, 2001).

The Fisheries Management Act of 1990 defined the fish stocks in Icelandic waters as public property. Article 1 of the Act states that "*The exploitable marine stocks of the Icelandic fishing banks are the common property of the Icelandic nation… The allocation of harvest rights provided for by this Act endows individual parties neither with the right of ownership nor irrevocable jurisdiction over harvest rights*." However, the Article has been criticized on the grounds that it has created uncertainty concerning the permanence and exclusivity of the ITQs and has undermined the economic effectiveness of the system.

In addition, the legislation did not resolve the controversies over taxation and collateral issues. The taxation issue went to court and the Supreme Court ruled in 1993 that quota holding should be taxed as private capital while they could be depreciated by the same rate as copyrights (at an annual rate of 20%). Another issue of whether ITQs can be collateral in a financial transaction went to court as well. Previously, this had been solved by mutual agreements to ensure that quota shares and vessels could not be separated without consulting the bank. In 1999, the Supreme Court recognized ITQs as indirect collateral of the fishing vessel to which they were issued. These court decisions demonstrate that the ITQ legislation did not anticipate the wide range of consequences of quota allocation (Eythórsson, 2000; Gissurarson, 2000).

Arnason (2005) found that the quality of the Icelandic ITQ property right was about 0.86 on a scale of zero to one[6], calculated by what is called "Q-measures", taking into account four characteristics of property rights, i.e. security, exclusivity, permanence and transferability. The Q-value of Iceland was lower than that of New Zealand ITQ property rights (0.96) and higher than that of Norway (0.44).

In summary, ITQs in Iceland have many common features of property rights: they are perfectly individual and divisible; they are also exclusive to a great extent; and they are transferable with minor restrictions. However, they are not really permanent and secure (Gissurarson, 2000). Therefore, there is some scope to ensure more secure and long term individual quota rights and increased transferability.

Resource tax debate

Some Icelandic economists have argued that resource rentals should be paid by ITQ holders as a form of special tax for cost recovery because they have been benefited from the fisheries management system. However, the argument has not been broadly supported by the public as well as by the fisheries industry (not surprisingly) and has proven politically unfeasible in Iceland (Eythórsson, 2000; Gissurarson, 2000). Instead of the tax, a resource fee has been introduced and charged to quota holders, as mentioned above.

Notes

1. The Ministry of Fisheries became the Ministry of Fisheries and Agriculture in January 2008 by merging with the former Ministry of Agriculture.
2. The Ministry of Fisheries decided the cod TAC to be 130 000 tons for 2008/2009 fishing year.
3. It should be noted that in deciding the capelin quota it is taken into account that the species is an important feed for cod stock.
4. Arnason (1996) argued that an ITQ system could either increase or decrease discards compared to unmanaged fisheries. It has also been pointed out that high-grading has been prevailing not only in quota management system but also in other management systems.
5. As mentioned earlier, the Quota Exchange Market was operated only from 1998 to 2001. Since 2001, quotas have been transferred to an open market.
6. Q-value 1.0 means a perfect property right.

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