CEMARE Report 58

A review of international experiences with ITQs

Annex to
Future options for UK fish quota management

R Arnason

A Review of International Experiences with ITQs

Ragnar Arnason
University of Iceland

Annex to
Future Options for UK Fish Quota Management. Report to the Department for the Environment, Food and Rural Affairs.
CEMARE, University of Portsmouth, June 2002.

University of Portsmouth
Centre for the Economics
and Management
of Aquatic Resources
Locksway Road
Portsmouth PO4 8JF
United Kingdom

First published University of Portsmouth 2002

For bibliographic purposes this publication may be cited as: **A review of international experiences with ITQs: an annex to *Future options for UK fish quota management*.** R. Arnason. *CEMARE Rep.* no.58. 2002, 64p.

ISBN 1 86137 275 2

Table of Contents

Acronyms and abbreviations

mt =	Metric tonnes
IQ =	Individual quotas
ITQ =	Individual transferable quotas
ITSQ =	Individual transferable share quotas
TAC =	Total allowable catch
GRT =	Gross registered tonnes
MCS =	Monitoring , control and surveillance
NMFS =	National Marine Fisheries Service
NRC =	National Research Council
CDQ =	Community development quotas
SAFMC =	South Atlantic Fisheries Management Council
DFO =	Department of Fisheries and Oceans

1. Introduction

Ocean fish stocks have traditionally been regarded and arranged as common property resources. Thirty years ago the common property arrangement was virtually universal. Today, at the outset of the 21st Century, it is still the most common arrangement in Ocean fisheries.

Common property resources, it is well known and established (Gordon 1954, Hardin 1968) are subject to fundamental economic problems of over-exploitation and economic waste. In fisheries, the common property problem manifests itself in:

(1) Excessive fishing fleets and effort,
(2) Too small fish stocks.
(3) Little or no profitability and unnecessarily low personal incomes.
(4) Unnecessarily low contribution of the fishing industry to the GDP.
(5) A threat to the sustainability of the fishery

The reason why the common property arrangement is so economically and biologically damaging is not too difficult to understand. Under the common property arrangement, the fishermen are basically forced to overexploit the fish stocks, even against their own better judgement. When many fishermen have access to the same fish stock, each has every reason to grasp as large a share of the potential yield as possible lest the other fishermen reap all the benefits the resource can offer. Prudent harvesting exhibited by one fisherman in order to maintain the stocks will, for the most part, only benefit other more aggressive fishermen without preventing the ultimate decline of the stocks. Thus, each individual fisherman, acting in isolation, is powerless to alter the course of the fishery. His best course of action is to try to grasp his share as quickly as possible while the resource is large enough to yield some profits. As a result, the fishery virtually inevitably evolves to excessive fishing effort, reduced fish stock — even to the point of collapse —and little or no net economic benefits.

Property rights based approaches to fisheries management attempt to eliminate the common property problem by establishing private property rights over the fish stocks. Since the source of the economic problems in fisheries is the absence of property rights, this approach should in principle be successful in securing full economic benefits from the fishery.

Several types of property rights regimes have been employed to alleviate the fisheries problem. These include territorial use rights (TURFs), individual catch quotas and community fishing rights.

Individual catch quotas attempt to solve the common property problem not by defining property in the fish stocks themselves but by allocating individual harvesting rights from these stocks. Thus, individual catch quotas constitute at best an indirect property right in what

really counts, the fish stocks and their natural environment. However, it can be shown (Arnason 1990 and 2000) that this indirect property right goes a long way toward resolving the common property problem.

Transferable and divisible catch quotas are usually referred to as individual transferable quotas or ITQs. If the ITQs are also permanent they constitute a complete property right just like a building or a piece of land. In that case, standard economic theory should apply and, barring market imperfections, the fishery should automatically reach full efficiency.

With permanent and transferable catch quotas the quota holders will find it to their advantage to preserve and, if necessary, rebuild the marine resources. After all, larger fish stocks means more profitable fishing operations. Moreover, the market value of their permanent quota, as a share in the future TACs, depends on the state of the fish stocks and the sustainability of the fishery. The larger the fish stocks the higher the value of their permanent quota share. Thus, the ITQ system provides the fishing firms with a powerful incentive to preserve the fish stocks and, in fact, the marine ecology as a whole.

Since the ITQ system goes a long way toward eliminating the basic common property problem of fisheries and are widely applicable, there has now emerged a consensus among fisheries economists that this management system offers the most promising general approach to managing ocean fisheries. This does not mean, however, that ITQs are necessarily the best management in all fisheries. For instance, a prerequisite for this method to work is that the individual quota constraints should be enforceable. If that is not the case, some other management method may be preferable.

Since the 1970 there has been a clear trend toward the adoption of ITQ systems in the various fisheries around the world. Already several major fishing nations employ ITQs as their primary fisheries management system. Many others employ ITQs in some of their fisheries.

Here we review some of the more important ITQ systems in the world. There are hundreds of different ITQ systems in existence. However, as will become apparent, there is severe lack of accessible information on many, if not most, of these systems. One reason is that many of these systems are quite recent. There just hasn´t been the time and experience to evaluate them. A more important reason, one suspects, is that the nations that have adopted ITQs have seen little reason to systematically record their outcomes. For these reasons it is only possible to deal with the most prominent ITQ systems in this report. This will be done on country basis, including all seven fishing nations that have made ITQs a major part of their fisheries management systems as well as the United States. The report will focus only on certain key aspects of these systems. Nevertheless, as will become apparent, due to lack information it will not be possible to provide anything like full information on most of these systems.

2. Australia

2.1 Background

Australia has one of the largest EEZs in the world. Nevertheless, due to the relatively low biological productivity of her waters, Australia is not a major fishing nation. In recent years, annual catches have only been slightly above 200,000 tonnes. Much of this harvest, however, consists of high value species such as lobster, shrimp and abalone. Therefore, the value of the fishery is quite high or over USD 700 million (OECD 1997b, McIlgorm and Tsamenyi 2000a).

The jurisdictional aspects of Australian fisheries management are somewhat involved. The state governments have jurisdiction over and, consequently, responsibility for fisheries management up to three nautical miles from their coastlines. The national or Commonwealth government's jurisdiction is from the three mile limit to the 200-mile boundary of the Australian EEZ. This jurisdictional separation is problematic for fisheries management. Many species reside in two or more jurisdictions or periodically migrate between them. In those cases, the law allows for "Joint Authority" management between the jurisdictional entities. However, these "Joint Authorities" have proven to be administratively cumbersome and ineffective (Morris, 1994).

The inshore fisheries, i.e. those under state jurisdiction, account for over three quarters of the total value of the Australian fisheries (Morris, 1994). These fisheries have, for the most part, traditionally been managed by direct restrictions; seasonal and area closures, gear restrictions, access limitations and the like. In recent years, ITQs have been applied to a number of state managed fisheries. These include (i) the rock lobster fisheries off New South Wales, South Australia and Tasmania, (ii) the abalone fisheries off New South Wales, Victoria, South Australia, Western Australia and Tasmania, (iii) the crab fsiheries off Queensland, Southern Australia and Tasmania and (iv) several other fisheries including scallops, pilchard, pearl oysters and others (Morris 1994, Kaufmann et al. 1999).

In the Commonwealth fisheries, a variety of management techniques have been employed. Again, direct restrictions on the fishing activity are most common. However, property rights based methods, including access licences and ITQs, are becoming more common. Currently ITQs are applied to five important Commonwealth managed fisheries; (i) the Southern bluefin tuna fishery, (ii) the South-east trawl fishery, (iii) the South-east non-trawl fishery, (iv) the Southern shark fishery and (v) the Bass Strait central zone scallop fishery (McIlgorm and Tsamenyi 2000a., Kaufmann et al. 1999).

Currently there are at least twenty ITQ-managed fisheries in Australia. These have been introduced on an individual fishery basis since the early 1980s with the rate of adoption increasing over time. In terms of volume, ITQ fisheries currently account for about 34% and about 22% of the total value of Australian fisheries. A summary of the current ITQ coverage by type of fishery and time of introduction is presented in table 2.1.

Table 2.1 Extent of ITQs in Australian Fisheries

Species	Fishing method	ITQs intro-duced	Annual harvest (1000mt)	Value M. ASD	ITQs by volume	ITQ by value
Abalone	Diving	1985-9	5.2	181	100%	100%
Snapper, tuna	Hand/longline	1984-7	18.6	131	61%	59%
Pilchards etc.	Purse seine	1992	41.5	33	42%	23%
Lobster, crab	Pots	1993-9	19.5	440	38%	31%
Finfish	Trawl	1992-8	59.1	182	54%	36%
Finfish	Nets		21.9	64	2%	0%
Prawns	Trawl		34.5	391	0%	0%
Others	Various	1982-9	9.2	50	43%	63%
Total			**209.6**	**1473**	**34%**	**22%**

Data refers to 1997/8; Sources: McIlgorm and Tsamenyi 2000a and Kaufmann et al. 1999

The first ITQ fishery in Australia was the West Australia pearl oyster fishery which came under ITQs in 1982. This was followed by the Southern bluefin tuna fishery in 1984. Probably the single most valuable ITQ fishery is the South-east trawl fishery which was subjected to ITQs in 1992. The various abalone fisheries are now all under ITQ management.

Due to the number and diversity of the underlying fisheries and the somewhat un-coordinated way of their adoption, Australia's ITQ systems are quite varied. Of course, they share the basic features of all ITQ systems, i.e. individual, quantitative harvesting rights, but as regards particulars such as the method of allocation, transferability, duration and so on, there is substantial diversity. Hence, as in the Canadian case, no two Australian ITQ systems are identical. As a result, it is not possible to provide one general description of Australia´s ITQs. In what follows we will therefore attempt to paint the broad outlines and then briefly give further details about four of the most valuable ITQ systems, i.e. the (i) Tasmanian abalone fishery, (ii) the South-east trawl fishery, (iv) South Australia Southern Zone rock lobster fishery and (iv) the Southern bluefin tuna fishery.

2.2 Initial allocation of entitlements

The initial allocation of quota entitlements in Australian ITQ fisheries has primarily been based on two criteria; (i) historical catch rates and (ii) the principle of equality, i.e. equal distribution (Kaufmann et al. 1999). The combination of these criteria is frequently adopted. Thus, especially in small scale crustacean (crabs, lobster) and shellfish (scallops, abalone) fisheries, historical catch rates have been tempered by the imposition of maximum and

minimum allocations. Other considerations, such as prior investment, have come into play but compared to the general pattern they have been relatively insignificant.

An interesting feature of the Australian process of ITQ allocations is the widespread use of "independent allocation advisory panels" whose role is to study the situation and recommend an allocation formula (Kaufmann et al. 1999). This mechanism seems to have been highly successful and is now generally employed when new ITQ systems are being contemplated.

2.3 Definition of entitlements

The basic quota entitlement in Australian fisheries is the ITSQ, i.e. a share in whatever TAC is adopted by the fisheries authorities every fishing season. This multiplied by the TAC then gives the seasonal quota (Kaufmann et al. 1999).

The duration of the ITSQ varies. In most cases it is the same as the duration of the fishing licence. Generally, if the duration of the fishing licence is stipulated, it is limited in time. Common terms of duration of fishing licences is one to five years (McIlgorm and Tsamenyi 2000b). Renewal, however, is fairly automatic. If the duration is not stipulated, the fishing licence and, consequently, the associated ITQ it may be taken to remain in force until cancelled.

The legal status of the Australian ITSQ appears considerably stronger than that in e.g. Canada and the USA. Thus, quota right is generally regarded as a property by the Australian courts (McIlgorm and Tsamenyi 2000b, Kaufmann et al. 1999). This implies constitutional protection and certain rights to compensation should the ITSQ be revoked.

2.4 Mechanisms to facilitate quota trades.

As far as can be determined, there are no particular mechanisms set up by the fisheries authorities for the purpose of facilitating quota trades. Apparently, for most fisheries, quota trades take place through direct contact between the interested parties, i.e. the licence holders in question. Quota brokerage does not seem to have emerged on noticeable scale, if at all. One reason for this may be the low number of participants in most fisheries (Kaufmann et al. 1999, Baulch and Pascoe 1992).

2.5 Restrictions on trade and ownership

Australian ITQs are generally transferable, both permanently and within the season (McIlgorm and Tsamenyi 2000b, Kaufmann et al. 1999). In fact, as any property ITQs would be transferable unless expressly stipulated otherwise (McIlgorm and Tsamenyi 2000b). However, in many cases, restrictions apply. A common restriction is that quotas may only be transferred to those with a fishing licence in the particular fishery (Kaufmann et al 1999). As

fishing licences are often difficult to obtain, this stipulation, in many cases, goes a long way toward effectively closing the group of potential quota holders. When quotas can be transferred to non-industry members, foreigners and foreign companies are generally excluded. In some fisheries, esp. abalone and similar fisheries, quotas can only be transferred along with the fishing licence (Kaufmann et al. 1999). This, clearly makes the quotas effectively indivisible.

In many fisheries there are restrictions on the maximum quota holding and, in some fisheries, the minimum quota holding as well (Kaufmann et al. 1999). The motivation for the latter seems to be that the industry participants want to exclude part time fishers or recreational fishermen from the fishery.

2.6 Volume of quota trade

Not much information on the volume of quota trade in the various ITQ fisheries is available. Anecdotal evidence suggests that the extent of quota trades varies greatly across the various fisheries. Generally, however, with the limited number of participants in most Australian fisheries [(1)] and the common stipulation that quotas may only be transferred to current licence holders the quota market is generally quite thin (Baulch and Pascoe 1992, Kaufmann et al. 1999). This may have had the effect of discouraging the emergence of quota brokers and forced the fishermen to rely on their own business network to seek potential trading partners (Kaufmann et al. 1999). In spite of this Connor and Alden (2000) report that quota trading in the South-East trawl fishery has contributed to the flexibility of the system.

2.7 Resource rents extraction and/or management cost recovery

The initial allocation of quota rights or ITSQs has in all cases been without charge. The same applies to the annual issue of quotas. Nevertheless, in 1989, the Commonwealth government declared its intention in a policy statement to extract rents from the users of fish resources (Commonwealth 1989). These plans have not been put into effect and, in fact, it is unclear whether they still apply. Thus, in Australia, fisheries profits are just subject to the normal income and capital gains taxation.

Australia, on the other hand, runs an extensive management cost recovery programme. Already in 1985-6 a high proportion (38%) of the management costs of the Northern prawn fishery and the Southern bluefin tuna fishery were recovered (OECD 1997b). Since 1994, the 90% of management costs that can be attributed to individual fisheries have been recovered and the current policy is to recover 100%. (OECD 1997b). This, of course represents a smaller fraction of total management costs. Thus, Kaufmann et al. (1999) report that in one

[1] A typical number of operators in an Australian ITQ fishery is less than a hundred and often only a few dozens (Kaufmann et al. 1999).

fishery in 1996/7, 57% of total management costs were being recovered. This cost recovery is effected through levies on the fishing industry, most commonly licence fee charges (Kaufmann et al. 1999, OECD 1997b).

2.8 The enforcement system

ITQ restrictions are basically enforced in two ways in Australia; (i) the paper trail system, i.e. the collection of vessel landing reports and the comparison of these with reports from the chain of catch sales and resales, and (ii) dockside monitoring of landings (Kaufmann et al. 1999).

Traditionally, reliance has been placed on vessels' landings reports and the paper trail method complemented by spot checks at landing sites. Over time this system has been improved by the requirement that fishers give prior notice of their arrival in port for landing catches and various electronic systems to facilitate monitoring and reporting. Nevertheless, this system has been found to be both complex to operate and less than fully effective (Kaufmann et al. 1999).

More recently, the trend has been toward dockside monitoring of landings. The cost of this is believed to be similar to the cost of the paper trail system (Kaufmann et al. 1999). The main advantage of the dockside monitoring is greater compliance compared to the paper trail system. Another advantage is thought to be that by preventing violations before they occur, co-operation with the fishermen is facilitated compared with the paper trail system which seeks to deter violations by the threat of prosecution and penalties (Kaufmann et al. 1999).

2.9. Evidence of increased or reduced quota-induced discarding

There is evidence of substantial catch discarding in many Australian fisheries (See e.g. OECD 1997b, Kaufmann et al. 1999, Baulch and Pascoe 1992). Thus, Kaufmann et al. (1999) on the basis of on-board-observations, report very substantial discards in the Southern shark fishery and the South-East trawl fishery (of up to 68%) by species. What is not clear, however, is whether this discarding has increased under the ITQ system. Indeed, Kaufmann et al. (1999) assert that most of the discards in the South-East trawl fishery are market driven and would occur under any fisheries management system.

2.10 Evidence of increased resource stewardship

There is some anecdotal evidence that in ITQ fisheries that co-operation with the fishermen has improved and enforcement of regulations become easier (see e.g. Morris 1994, Kaufmann et al. 1999, Rogers and Penn 2000). In some cases, fishermen have taken greater responsibility for the management of the fishery. This for instance is exemplified in the

Western Australian fisheries and the Southern bluefin tuna fishery (Rogers 2000, Kaufmann et al. 1999)

2.11 Individual ITQ systems

2.11.1 The Southern Bluefin Tuna Fishery

Southern bluefin tuna is a highly migratory species. Spawning takes place off Java. Juveniles migrating to the south-east form large surface schools off southern Australia while mature bluefin tuna are dispersed throughout the southern oceans. On this migratory route, the bluefin tuna are fished by many nations, including Japan, Korea, Indonesia, Taiwan and New Zealand as well as Australia.

Until the 1970s, fishing pressure on the southern bluefin tuna was comparatively light and the fishery was completely unmanaged. Following greatly increasing fishing effort during the 1970s, the stocks seemed to decline and the economics of the fishery deteriorated. Consequently, toward the end of the 1970s, further entry of vessels into the fishery within the Australian EEZ was stopped. This, however, did not halt the increase in fishing effort. Many licenced vessels were replaced by more powerful ones and the fishing power of the others was increased by modifications and the adoption of new fishing techniques. Consequently, harvesting continued at an unsustainable rate and the stocks continued to decline.

In 1983, a scientific meeting attended by scientists from all the main fishing nations concluded that the southern bluefin tuna stock was seriously depleted and urged an immediate reduction in total catch levels. Following this advice, the Australian government imposed a TAC limitation within its EEZ. An industry inquiry (the Industries Assistance Commission) quickly concluded that the TAC regime, although biologically necessary, was economically wasteful. Further, it was determined that the joint goals of stock conservation and economic efficiency would be most easily attained with the help of an ITQ-based fisheries management regime. Hence, after consultation with the relevant state governments and industry organisations, the Commonwealth government in October of 1984 established an ITQ fisheries management system for the bluefin tuna within the Australian EEZ.

The southern bluefin tuna ITQs are permanent rights to harvest a certain proportion of the TAC each year. These rights are perfectly divisible and transferable to any Australian operator in the fishery. Thus, these ITQs are fairly high quality property rights.

The initial allocation of quota shares was subject to extensive negotiations and bargaining with members of the industry. The quota rights were allocated to all significant participants in the fishery prior to the introduction of the system. “Significant operators” were defined to be those that had landed at least 15 tonnes of bluefin tuna during the three preceding seasons. These received permanent quota share based on a formula that gave 75 per cent weight to

their actual catch share during the previous 3 years and 25 per cent weight to the value of their fishing vessels. Complaints by those that felt they had been unfairly treated by this procedure were handled by an appeals tribunal.

Enforcement of the southern bluefin tuna ITQ system is carried out by state agencies on behalf of the Commonwealth. This involves both at-sea observations and on-land monitoring by the actual weighing of landings. Although the quota enforcement system seems to be quite effective, there have been some problems. For instance, the shift toward increased long-lining and the direct export of whole, unprocessed fish to Japan has made monitoring the harvest volume more difficult. There are also difficulties in monitoring and preventing the discarding of inferior fish at sea.

There are strong indications that the ITQ system has led to a substantial increase in economic efficiency in the Australian bluefin tuna fishery. There has been a large reduction in the fleet size (Geen & Nayar 1989; Geen et al. 1993, Kaufmann et al. 1999, Cambell and Battaglene 2000). Also, substantial benefits have been generated by the employment of fishing techniques designed to increase the unit value of catch (Morris 1994). Recently, the operations of the industry have evolved toward capturing the tuna alive and raising in sea-cages to the ideal market size (Kaufmann et al. 1999).

Thus, in spite of a substantial cuts in TACs, the industry has remained highly profitable. Simulation exercises carried out during the early part of the ITQ management period (Geen and Nayar 1989) suggest that industry profits under the previous management regime would have been no more than 25 per cent of those achieved under the ITQ system.

2.11.2 The South-east Trawl Fishery

The South-east trawl fishery is one of the most valuable Australian fisheries. In 1997/8 the catch value was about A$58 million (Kaufmann et al. 1999). It is a multi-species fishery with a long history of commercial exploitation. A large number of species are involved, the most important being orange roughy, blue grenadier and warehou. The main fishing gear is otter trawl and Danish seine.

This fishery was first subjected to management in 1985, in response to increased fishing pressure and declining stocks. Entry to the fishery was restricted and various constraints on inputs imposed. These measures, however, proved ineffective. Fishing effort continued to increase, threatening to deplete certain fish stocks (Morris 1994). Consequently, a TAC regime was imposed on the gemfish fishery in 1988. In 1992, after extensive consultations with the industry, an ITQ system was introduced in the fishery.

About 16 species, constituting the bulk of the south-east trawl catch, are currently covered by the ITQ system. As in the bluefin tuna fishery, the ITQs are permanent rights to harvest a certain proportion of the TACs each year. These rights are divisible and transferable. In this sense the ITQs constitute reasonably complete property rights.

The initial allocation of quota shares was to the two trawl sections -- otter trawl and Danish seine, separately. However, the allocation rule differed only in minor details. In both cases, the allocation was made on the basis of the historical catch record during 1984-89 and the level of investment in the fishery. In the case of otter trawl vessels, 80 per cent of the allocation was based on historical catches. In the Danish seine fishery, 70 per cent of the allocation was based on historical catches (OECD 1997b).

Enforcement of the south-east ITQ system has apparently been somewhat problematic. This hardly comes as a surprise. A good part of the catch is valuable for local consumption, and there are many landing places. Moreover, as mentioned above, some fishing methods are not subject to the quota constraint, making enforcement of the regulations even more difficult.

Due to the relatively recent introduction of the ITQ system in the south-east trawl fishery, data on its impact is quite limited. The available evidence, moreover, is mixed. According to Morris (1994), there was a slight increase in the profitability of the industry, especially the offshore fleet, in 1992 and 1993 compared to that in previous years. That this happened in spite of reduced TACs suggests that, the ITQ system may, indeed, have generated some increase in efficiency. However, there have also been a many problems with the system. One of them is the bycatch of quota-bound species when other species are being targeted. Another, not unrelated, problem is the seemingly increased discarding of unwanted fish during the early period of the ITQ system (Baulch and Pascoe 1992, Morris 1994).

2.11.3 Southern Zone Rock Lobster Fishery

With an annual value of approximately A$50 million the Southern zone rock lobster fishery is among the most valuable fisheries in Australia. [(2)] In 1997/8 the harvest was 1645 mt and the number of licences 185. Almost the entire harvest is exported.

During the 1980s the fishery was managed on the basis of limited entry, pot limits and seasonal closures. Since this failed to curtail fishing effort and ensure sustainability of the fishery, a TAC was introduced for the 1992-3 season. Industry dissatisfaction with this arrangement let to intensive government/industry consultations that resulted in an agreement to introduce ITQs during the following season. In the first year 1993-4, quotas were allocated according to the larger of pot or catch share during recent years. Following intensive debate and court challenges, however, this was changed in 1994-5 to an equal share of the TAC per

pot (the number of pots being restricted by licence). Thus, in effect, the ITQ units are the pots. There is a limitation on the maximum and minimum number of pots that can be held by any licence holder in the fishery. This then is equivalent to a minimum and maximum quota holding.

Until 1998 pot licences (and therefore the quotas) could be transferred to family members only. Since then, however, the quotas can be transferred to any licence holder provided the traders do not violate the minimum and maximum pot stipulation. Someone wanting to exit the fishery can of course sell all his licences though.

Evidence of the effectiveness of this system is not readily available. However, the indications are that it is working well to restrict the harvest level and to increase economic efficiency.

2.11.4 The Tasmanian Abalone Fishery

The Tasmanian abalone fishery is probably the largest in the world providing roughly 25% of the world harvest of abalone. This is a low technology fishery with individual divers collecting abalone by hand from bottom rocks.

The fishery was subjected to limited entry in 1969. Concerns about overfishing led to various management schemes until 1985 when an ITQ system was introduced. Abalone share quotas were allocated equally to licenced diver. Initially transferability was limited to less than half of the annual quota but in 1991 the diving licence was separated from the quota and both made freely transferable.

In 1994, the Abalone Deed of Agreement (DoA) was established. The DoA is what is referred to as delegated legislation (Kaufmann et al. 1999). Abalone quota holders can convert their quota into shares under the DoA. Shares under the DoA have a ten year term and automatic renewal compared to only one year term for the original quotas. Consequently, the property rights quality of the DoA shares is considerably higher than the previous abalone quotas. Over 95% of the abalone quota holders have opted for DoA shares.

[2] This section and the following section are extensively based on material in Kaufmann et al. 1999

3. Canada

3.1 Background

Canada is among the world's larger fishing nations. In the 1990s, the annual ocean harvest has averaged about 1 million metric tonnes (FAO 2001). This puts Canada in the group of the world's 20 greatest fishing nations.

Geographically, Canada´s fisheries can be divided in three main parts; the Atlantic coast fisheries, the Pacific coast fisheries and waters and the inland freshwater (mostly lake) fisheries. In terms of volume, the Atlantic coast fisheries account for over 60%, the Pacific coast for about 30% and the inland fisheries for about 5%. (OECD 1997b). The total number and diversity of fisheries is very high. Many of Canada´s fisheries especially those for salmon and crustaceans (lobster crabs and shrimp) are high value ones. The most valuable important Canadian fisheries are the Atlantic coast lobster and crab fisheries and the Pacific coast salmon fisheries (OECD 1997). In 1993, the total value of Canada´s commercial fisheries was put at approximately USD 1 billion. The contribution of the fisheries to the GDP, however, is small or some 0.3% (OECD 1997).

Canada is a federal state with power shared between the federal government and the provinces. The federal government has jurisdiction over both marine and inland fish resources and consequently is responsible for their management. However, the provinces have jurisdiction over property rights and all matters of private and local nature. In addition, the indigenous people (mainly various indian tribes) have certain constitutional rights to natural resources that limit federal jurisdiction over the fisheries. The basic fisheries legislation is the federal *Fisheries Act*. This act assigns the power to issue fisheries licences and quantitative allocations to the Minister of Fisheries and Oceans.

All significant fisheries (commercial and recreational) in Canadian waters require fishing licences that are issued by the Department of Fisheries and Oceans (DFO). Apart from this, the DFO does not advocate a particular fisheries management policy (Burke and Brander 2000). Canada is culturally and geographically a very heterogeneous country. There is a multitude of fisheries each with its own biological and cultural characteristics. Consequently, the DFO's policy is first of all to do whatever is necessary to conserve the fish resources and secondly to support whatever reasonable fisheries management regime the fishery participants are able to agree on. Thus, when the ITQ fisheries management system is introduced in a fishery, it is generally at the request of a sufficient majority of the participants in that fishery (Burke and Brander 2000).

Over the past 25 years, ITQs have been introduced into one fishery after another. Currently, ITQs and IQs are in place in over 40 different Canadian fisheries accounting for over 50% of

the value of landings (Burke and Brander 2000) and substantially more in terms of volume. Generally, fisheries that have been subjected to TACs have evolved toward IQs and ITQs (Burke and Brander 2000). The most valuable fisheries not under ITQs yet, are the Atlantic lobster fisheries and the Pacific salmon fisheries neither of which have been subjected to TACs. Although the various ITQ systems share the basic features of all ITQs, none of them are identical. They all differ in various respects including the timing of their introduction, their origins and motivation, the allocation, exact definition and transferability of fishing rights and the general rules of their operation (Burke and Brander 2000). This lack of standardisation reflects the particular needs and conditions they are designed to meet.

The following table (Table 3.1) lists the main IQ/ITQ systems currently in operation. In many cases, there are more than one fishery associated with each category in the table. Therefore the time of introduction may cover a range of years. The terminology IQ/ITQ is intended to indicate that in some of these systems transferability is significantly restricted.

Table 3.1. Canadian IQ/ITQ systems

Area	**Species/Fishery**	**Years of adoption**
Atlantic		
	Groundfish	1982-99
	Offshore	1982
	Mid-shore	1987
	In-shore	1984-99
	Pelagic	1976-83
	Custaceans	1977-96
	Shellfish	1986-98
Inland		
Ontario fisheries	All major species	1984
Lake Winnipeg	All major species	1972
Cedar Lake	All major species	1982
Pacific		
	Groundfish	1990-97
	Halibut	1991
	Sablefish	1990
	Groundfish trawl	1997
	Pelagic	1975
	Crustaceans	1994-6
	Shellfish	1980-96

Adapted from Burke and Brander 2000

The experience of these ITQ systems is generally viewed as having been good both form the biological and economic perspectives (Anonymous 1994, Casey et al. 1995, Grafton 1996a and 1996b, Burke and Brander 2000, Turris 2000). Moreover, these systems have continued to enjoy a good deal of social support after being introduced. This observation is supported by

the fact that in spite of a long experience, no ITQ system has so far been abandoned and the rate of the adoption of ITQ systems has been increasing over time (Burke and Brander 2000).

Due to the high number and diversity of Canada´s ITQ systems, it is not possible to provide a single description of these systems. Moreover, most, if not all, of the existing ITQ systems are still evolving, — mostly toward greater transferability and less restrictions. What follows, therefore, should be regarded as a characterization of the common elements of Canadian ITQ systems.

3.2 Initial allocation of entitlements

Most of the Canadian ITQ systems evolved out of TAC restrictions being imposed on the fishery. In due course (that varied from one fishery to another), this was typically followed by the adoption of individual harvesting entitlements that, if not transferable from the outset, subsequently evolved into ITQs. The initial allocation of individual harvesting entitlements (quotas) was commonly based on the historical catch record. This, however, was often tempered by other criteria such as vessel size and capacity and recent new investments. Considerations of equity and equality giving rise to more equal shares also featured as a part of the initial allocation rule in some fisheries (Burke and Brander 2000).

In all cases, the eventual allocation rule was arrived at by a high degree of industy member consensus after lengthy and often difficult negotiations. Similarly, in all cases, the eventual allocation formula was well defined and explicit (Burke and Brander 2000).

3.3 Definition of entitlements.

The basic quota entitlement in Canadian fisheries is an ITSQ, i.e. a share in whatever TAC is adopted by the authority every year. This multiplied by the TAC then gives the annual quota. With a few exceptions in individual fisheries, there is no term limit on the holding of ITSQs but there is no guarantee of permanence either (Burke and Brander 2000). Therefore, it must be assumed that the term of the ITSQ is the same as the term of the fishing licence. This has a maximum term of nine years although it is generally issued for one year at a time. Fishing licences, however are more or less automatically renewed (Burke and Brander 2000) with the result that the life-span of ITQs must be regarded as indefinite.

The legal status of the Canadian ITQs is a bit unclear. Fundamentally it is simply based on the Department of Fisheries obligation to manage the fisheries. The Fisheries Act requires the DFO to issue fishing licences. From a legal standpoint an individual fishing quota is simply a fishing licence with a certain tupe of stipulations. An ITSQ does not have a legal status as a property. Legally speaking it is not even a “right”. It is more like a privilege granted by the state. Thus, the fisheries authorities are careful to use the term “fishing privilege” in formal documents dealing with the ITQ system (Burke and Brander 2000). This also means that the

ITSQs cannot be legally permanent because privileges can be revoked. Thus, the permanence of the ITQ system and the associated ITSQs is fundamentally based on sufficient political support as translated through the policies of the DFO.

3.4 Mechanisms to facilitate quota trades.

There are no particular mechanisms set up by the fisheries authorities for the purpose of facilitating quota trades. Apparently, for most fisheries, quota trades take place through direct contact between the interested parties, i.e. the licence holders in question.

3.5 Restrictions on trade and ownership

In most Canadian quota-managed fisheries quotas are transferable within the year (in contrast with permanent transfers of quota shares (ITSQ)). At the time of establishment of quota systems, concerns have sometimes expressed that that independent fishermen will be bought out by corporate interests, which will then become dominant. Occasionally this sentiment has been felt strongly enough by the stake-holders for the ITQ programme to be established without quota transferability (i.e. IQ system). In many such cases, restrictions on transferability have been removed after a few years (Burke and Brander 2000). A common transitional move has been to allow temporary transfers of quotas within the fishing year so that the permanent quota share remains with the original recipient. It follows that as regards transferability of the quotas, permanent transferability of quota shares is considerably less common that transferability within the year. Of the 40 ITQ systems currently in existence about half allow permanent transfers of ITSQs (Burke and Brander 2000). Interestingly, even in the ITQ fisheries where transferability of the quotas is restricted, fishing licences are always transferable. This means that the fisherman can transfer the ITSQ permanently as long as he is willing to transfer the licence as well (Burke and Brander 2000).

Canadian fishing quotas can most often be held by any Canadian legal entity (including individuals) that has a licence to operate in the fishery. In many ITQ systems, however, there are restrictions on the maximum amount of permanent share quotas that may be accumulated by one fisherman/company.[3] While this stipulation is scrupulously enforced, it is obviously easy to circumvent and, in that case, it is very difficult for the authorities to establish who really controls a given quota (Burke and Brander 2000). In most fisheries, a degree of quota concentration has occurred following a movement to ITQs.

3.6 Volume of quota trade

Numerical information on the volume of quota trades in the various ITQ fisheries is not generally available. The available evidence, however, suggests a substantial amount of trade

[3] This is for instance exemplified by the British Columbia sablefish and halibut fisheries ITQs, Turris 2000).

in many fisheries subject to ITQs. This is for instance is indicated by the general reduction in vessel numbers and increased concentration by most fisheries managed on the basis of ITQs (Burke and Brander 2000, Grafton 1996a, Turris 2000).

Casey et al. (1995) report significant trades in the early stages of the British Columbia Halibut ITQ system in spite of substantial restrictions. Similarly, Grafton (1996a) reports substantial transfers of quotas in several Atlantic Coast fisheries.

3.7 Resource rents extraction and/or management cost recovery.

The initial allocation of quota rights or ITSQs has in all cases been without charge. The same applies to the annual issue of quotas. Thus, in spite of considerable prosperity in many of these fisheries (Burke and Brander 2000), there have been no attempts to extract resource rents from the ITQ fisheries.

In 1996, fisheries licence fees were imposed on all commercial and recreational fisheries. In the case of IQ and ITQ fisheries this fee is based on the annual quota multiplied by the landed prices of the species in question. The actual charge was set at 5% of the average landed landed value of the species over a period of some previous years. Subsequently, however, this charge has been reduced somewhat for fishermen at the lower end of the income spectrum (Burke and Brander 2000).

Compared to many other fishing nations, 5% of landed value represents a fairly high charge. In the case of Canada, however, it is unlikely to cover management costs. These seem to be a substantially higher fraction of the value of landings (Arnason, Hannesson and Schrank 2000).

3.8 The enforcement system

Traditionally, before the introduction of the various ITQ systems, catch monitoring in Canadian fisheries has been based on vessel reports supplemented by information from the buyers of landings. Some of the earlier ITQ systems attempted to rely on this system with unsatisfactory outcomes. Since about 1990, most, if not all, ITQ-managed fisheries have implemented dock-side monitoring systems where landings are separated into species and weighed. This activity is performed by independent companies certified by the DFO and the cost borne by the fishermen. In many fisheries, this activity is supplemented by regular radio reports on catches from vessels at sea which are verified by at-sea checks by official enforcement staff on coast guard vessels and on-board-observers (Burke and Brander 2000).

It is believed that the dock-side monitoring is very accurate and effective. On the other hand, enforcement staff acknowledges that in some fisheries significant violations of ITQ rules in the form of discarding and high-grading still occur (Burke and Brander 2000).

The effect of the ITQ system on the cost of enforcement is unclear; the accounting methods of the DFO simply do not allow the extraction of statistics of this nature (Burke and Brander 2000). Although the ITQ system requires considerable catch monitoring activity to be effective, Canada´s ITQs have, in many case, replaced much more complex and, therefore, more expensive management schemes. In general there is no evidence that the adoption of ITQ management system have increased enforcement costs compared to the previous management regimes (Burke and Brander 2000).

3.9 Evidence of increased or reduced quota-induced discarding

One of the perceived weaknesses of the ITQ systems in Canada is the built-in incentive to discard inferior fish (Burke and Brander 2000). However, while this may be due to increased monitoring effort, there is little evidence that discarding of catch at sea has actually increased under ITQs. In fact, there is evidence of decreased discards following the introduction of ITQs in some fisheries (Burke and Brander 2000). In other fisheries such as the Atlantic offshore groundfish fishery, managed by a variant of ITQs called enterprise allocations, there is general belief that substantial discarding of catch occurred for a period of time before the collapse of the Northern cod stock (Grafton 1996b).

3.10 Evidence of increased resource stewardship

There is some evidence from many of the ITQ fisheries that enforcement has become easier, fishing methods have become less damaging and the pressure on raising the TAC has been alleviated (See e.g. Casey et al. 1995, Grafton 1996a and 1996b, Turris 2000). Burke and Brander (2000) explicitly state that as a general rule in Canadian fisheries fleets operating under ITQ management are more willing and better able to participate in the management of the fishery and to pay for research, monitoring and other management functions. Turris (1998 and 2000) provides examples of this effect from the British Columbia sablefish and Pacific groundfish fisheries. For instance in the sablefish fishery, the industry has conducted its own stock assessment with the help of some of the world’s most renown stock assessment scientists. In spite of these well documented examples, the extent of increased resource stewardship by the ITQ stakeholders remains, at this point, rather unclear.

4. Chile

4.1 Background

Chile is one of the largest fishing nations in the world. Average annual catches between 1993 and 1998 were well in excess of 6 million mt which places Chile in the 3rd place overall in the world after China and Peru and just above Japan. The bulk of these catches, are relatively low value pelagic fisheries for anchovies, horse mackerel and sardines. There are also significant high value fisheries for squid and demersal species such as hake, lobster and other species (FAO, 2001)

Inshore artisanal fisheries for local consumption have a long history in Chile. large scale industrial type fisheries only emerged in the 1950s (Bernal et al. 1999). They became significant in the 1960 and reached a peak of 7-8 million mt in the mid-1990s. Since then catches have declined somewhat and some stocks show signs of overexploitation (Bernal et al. 1999, FAO 2001).

The management of the Chilean fisheries is based on the General Fishing and Aquaculture Law (Ley General de Pesca y Acuiculture) of 1991 (GFAL 1991). This is a general law covering the utilization of all marine and aquatic resources including fish farming. As regards fisheries management its most relevant provisions for the purposes of this report are the following:

- The basic principle of General Fishing and Aquaculture Law (hereafter referred to as GFAL) is the principle of *res nullius* (no-one´s property), i.e. free and open access to marine resources.

- Within that basic principle, however, the law specifies three different management regimes depending on the state of the fishery.

    1. *An underdeveloped fishery*. A fishery may be declared as underdeveloped if actual catches are less than 10% of the TAC, provided one can be reasonably determined. In such a fishery a system of ITQs may be established . (GFAL Section 40 and 2.32)

    2. *A fully exploited fishery*. This type of fishery defined as one where harvesting capacity is in conformance with biological production, a TAC may be set and the issue of new licences discontinued. A fully exploited fishery, in other words, may become a closed access one. (GFAL Section 33)

3. *A fishery under recovery*. This refers to an overexploited fishery where harvesting has previously been halted for 3 years and a TAC can reasonably be established. This kind of fishery may be controlled by assigning ITQs. (GFAL Sections 29 and 2.32, Bernal et al. 1999)

- The GFAL also establishes priority artisanal fishing zone of 5 nautical mile from the coast. In practice priority access means almost exclusive access. Artisanal fishing vessels are those held by invididuals (maximum two per person), less than 18 m. long and under 50 GRT (gross registered tonnes).

  Public authority over the fisheries is vested in three institutions: (i) The Ministry of the Economy, (ii) the Undersecretariat of Fisheries (a subministry under the Ministy of Economy) and the National Fisheries Service (NFS). The first two are concerned with policy and administrative decisions such as setting TACs and issuing regulations. The third, is in charge of an enforcing the fisheries regulations.

  On the basis of this general law, four Chilean fisheries were in the 1990s subjected to ITQs as follows (Table 4.1):

  Table 4.1 Chilean ITQ fisheries

Fishery	ITQs established	Legal basis
Squat lobster	1992	Fishery in recovery
Yellow prawn	1997	Fishery in recovery
Black hake	1992	Underdeveloped fishery
Orange Roughy	1997	Underdeveloped fishery

  As the traditional pelagic fisheries started to show clear signs of overexploitation in the mid to late 1990s demands increased to have these fisheries subjected to ITQs as well. After some abortive initiatives in the Legislature, a law to this effect was passed in 2001 (Gobrierno de Chile. 2001, Anonymous 2001). According to this legislation, the pelagic fisheries for anchovies, horse mackerel and sardines and some other species are subjected to ITQs for a period of 2 years at which point the outcome of the system will be reviewed (Anonymous 2001).

  Given the high average volume of catches from these new ITQ-fisheries in recent years (over 5 million mt), this development represents a major expansion in ITQ-managed fisheries in the world. Roughly speaking the volume of fisheries managed on the basis of ITQ is doubled and the fraction of ocean fisheries managed by ITQs increases from about 6% to about 12%.

The ITQ arrangement for these fisheries is somewhat different from the previous ones. Therefore, following the discussion of the existing ITQ systems below, we briefly account for this new system.

4.2 Initial allocation of entitlements

The initial allocation of rights is by auction. This is followed by subsequent auctions where 10% of outstanding ITSQs are auctioned off. This means that each company's holdings are reduced by 10% every year. But the companies can replenish their holdings by successful bids in the annual auctions. It should be noticed, however, that these four fisheries are dominated by a few participants. Thus, there are less than 10 firms in each fishery with four of the largest ones typically harvesting some 90% of the total catch (Cerda-DiAmico and Urbina -Véliz 2000).

4.3 Definition of entitlements.

The entitlement is an ITSQ for a period of 10 years. Annually 10% of the ITSQ held reverts to the state and is sold at an auction (see above).[4] The ITSQ allows the holder the stated percentage of the annual TAC. These entitlements are not linked to particular vessels. They, as well as the corresponding annual quotas, are transferable and divisible.

4.4 Mechanisms to facilitate quota trades.

There is no particular official mechanism to facilitate trades established. As already stated, the number of companies involved in these fisheries is low. Presumably they do informal trades with each other. There are few participants in these fisheries and they are all familiar with each other (Salgado 2001).

4.5 Restrictions on trade and ownership

Ownership is restricted to Chilean citizens and Chilean registered companies. No upper limit on quota holdings. But those that hold ITSQs are not allowed to bid for more than 50% of the ITSQs at each annual auction. This suggests an upper limit of 50% of the TAC. However, due to company mergers and annual variations in the TACs, holdings in any one year may exceed this fraction (Bernal et. al. 1999). There are no restrictions on ITSQ or annual quota trades.

4.6 Volume of quota trade

There is no information available on this.

---

4 The initial allocations are reduced by 10% each year and auctioned off. Any rights allocated by auction has a fixed 10 year term. This results in 10% of the outstanding quotas being auctioned off every year in perpetuity.

4.7 Resource rents extraction and/or management cost recovery.

These ITQ fisheries are subject to two kinds of charges; licence fees that depends on vessel size and auction incomes (Cerda-DiAmico and Urbina-Véliz 2000). Of these the auction income accounts for 95% (Cerda-DiAmico and Urbina-Véliz 2000). The income at auctions could in theory approach 10% of quota rents. However, according to Cerda-DiAmico and Urbina-Véliz (2000), there is a good deal of collusion and price fixing co-operation between the companies, so the expected income from the auctions is subsantial less than 10% of attainable rents. Nevertheless Cerda-DiAmico and Urbina-Véliz (2000) report that since the inception of the ITQ system in the squat lobster fishery auction income has amounted to about 8% of revenues. This, however, includes the initial auction for 100% of all licences. Table 4.2 gives auction quota prices (per mt) for the four species for the duration of the ITQ system to about 1996-8.

Table 4.2 Average ITSQ prices in auctions

Species	Years covered	Price *(Average per year; US$/mt)*
Squat lobster	1992-2000	210
Black hake	1992-1996	724
Yellow prawn	1997	962
Orange roughy	NA	NA

Source: Bernal et al. 1999, Cerda-DiAmico and Urbina-Véliz 2000

4.8 The enforcement system

The institute in charge of enforcement is SERNPESCA (previously SERNAP). It keeps a boat registry and collects catch reports from the companies and vessels (Pena-Torres, 1997). This information is double-checked by reports from processors and exporters along the lines of the New-Zealand volume of catch monitoring system but is much less extensive (Pena-Torres, 1997). There is little no dock-side monitoring of catches and on-board observers for MCS purposes is minimal. Violations of fisheries rules are subject to monetary fines and prosecuted as civil cases (Pena-Torres, 1997). There are indication of inadequate enforcement of the quota constraints for instance in the black hake fishery (Bernal et al. 1999).

4.9 Evidence of increased efficiency and/or adherence to overall TAC limits.

According to the available reports (esp. Bernal et al. 1999 and Cerda-DiAmico and Urbina-Véliz 2000) the Chilean ITSQ system has been biologically and economically beneficial. First, stock levels have generally been re-built and stabilized. Second, the system has generated some substantial rents in the form of income from ITSQ auctions. Moreover, there is evidence that substantial additional rents are being retained by the operators themselves. Third, the quality and value of the final product is reported to have been improved (Bernal et

al. 1999). Fourth, it is reported that the ITSQs have led to a more orderly and predictable system of management making the running of the fishing companies easier. Fifth, there is clear evidence that the ITSQ system has lead to lengthening of the fishing seasons in the squat lobster and the black hake fisheries (Bernal et al. 1999, Cerda-DiAmico and Urbina-Véliz 2000). Finally, reportedly, under the ITSQs the adherence to the predetermined TAC has been good

Indeed, in the squat lobster fishery, where the ITSQ have been in operation since 1992 most of the key indicators of fishery efficiency have improved substantially. Thus, the number of vessels in the fishery has been reduced. The fishing season has substantially increased. Fish discards have virtually disappeared, illegal catches are minimal and the exploitable biomass has greatly improved (Bernal et al. 1999, Cerda-DiAmico and Urbina-Véliz 2000).

4.10 Evidence of increased or reduced quota-induced discarding

The available reports, esp. Bernal et al. (1999) claim that discards in the squat lobster fishery have declined substantially compared to the previous regime of open access.

4.11 Evidence of increased resource stewardship

According to Pena-Torres (1997) and Bernal and Aliaga (1999), the ITSQ systems in Chile improves the incentive for self-regulation of the respective fisheries. These incentives presumably also applies to resource stewardship in general. However, at this point, no direct data on this is available. The indirect data is the generally improved stock levels following the introduction of the ITSQ systems, widespread support of conservative TAC levels and general adherence to these levels.

4.12 The new ITQ system:

The ITQ system to be introduced in the other major Chilean fisheries during this year is still under preparation. However the broad outlines of the system are known and will be briefly described below (Main sources are Anonymous 2001, Gobrierno de Chile. 2001 and a communications with Prof. Hugo Salgado Cabrera University of Concepcion). In important respects it differs from the existing ITSQ systems. Needless to say, there is no evidence on the operation of the system yet.

The main motivation for the introduction of this system came from the industry itself especially the horse mackerel fleet which has suffered greatly because of diminishing stocks and low fish meal prices.

The initial allocation of ITQs is on the basis of historical catch shares, four years for the purse seiners and two years for the trawlers, and, in the case of purse seiners, 50% on hold capacity.

This allocation, however, is only for the next two years at the end of which it will be reviewed.

The entitlements are standard ITSQs as in the other Chilean ITQ fisheries described above. However, transferability of the quota shares is severely restricted. The ITSQs are not transferable. However, vessel owners may form vessel groups (e.g. within their own companies) and share the quotas between the vessels in that group. Obviously, this, in fact, permits quite free quota trades.

At this point there is no particular rent extraction, apart from the normal licence fee that all vessels in Chile pay.

Combined with the introduction of this system, there are extra incentives to reduce the active fleet, at least temporarily. Thus, vessels that are not employed will not be required to pay licence fees and will retain their historical and hold capacity rights. The owner of a vessel that is permanently retired from the fleet may retain the harvesting rights indefinitely.

5. Iceland

5.1 Background

Iceland is among the larger fishing nations in the world. In recent years, the total annual harvest has fluctuated between 1.5 and 2.2 million tonnes placing Iceland in the 10-15th place in the world (FAO 2001). The landed landed value of this catch is usually some USD 800 million (Arnason, 1995). Currently, about 40 species are harvested commercially in Icelandic waters, but only about 15 of these constitute a basis for targeted fisheries. The others, mostly various demersal species, appear as bycatch. The most important fisheries are for demersals (esp. cod, haddock, redfish and saithe) with about 75 per cent of the total landed value, followed by crustaceans (esp. shrimp and Norwegian lobster), pelagics (esp. herring, capelin and blue whiting) and shellfish (esp. scallops and ocean quahog). The single most important fishery is the cod fishery normally representing about 50 per cent of the total landed value of the Icelandic fisheries. (Arnason 1995)

Iceland was one of the first nations in the world to introduce ITQ fisheries management system in her fisheries. The system was instituted gradually at different times and in somewhat different form in the various fisheries. The ITQ system was made uniform across fisheries by the passing of the comprehensive *Fisheries Management Act* in 1990 which became effective in 1991 (Ministry of Fisheries 1999). The key stages in this development are listed in Table 5.1 (Arnason 1997).

Table 5.1 Key Steps in the Evolution of the ITQ Management System: A Chronological Overview

Year	Fishery
1975	Herring fishery: Individual quotas (IQs)
1979	Herring fishery: Individual transferable quotas (ITQs)
1980	Capelin fishery: Individual quotas (IQs)
1984	Demersal and crustacean fisheries: Individual transferable quotas (ITQs)
1985	Demersal fisheries: Effort quota option introduced
1986	Capelin fishery: Individual transferable quotas (ITQs)
1991	A complete uniform system of ITQs in all fisheries

Since 1991, the fisheries management system has continued to be evolve and the *Fisheries Management Act* has been amended several times. Most of the modifications, however, have been quite minor and none has altered the basic structure of the system enacted in 1990. The essentials of the current fisheries management system are as follows:

(1) The quotas constitute a right to catch a given proportion of the TAC every year.

(2) The quotas are perfectly divisible and transferable with minor restrictions on trans-regional transfers.
(3) All important commercial fisheries are subject to these quotas.
(4) The quotas were initially allocated on the basis of catch history prior to the institution of the quota system.
(5) The quotas are subject to a small fee to cover administration and enforcement costs.

Currently, 16 species (and about 30 substocks) are subject to the ITQ system. These species account for over 95% of the volume of harvest taken within the Icelandic 200 mile EEZ.

The main official institutions involved in running the ITQ system in Iceland are (1) The Ministry of Fisheries, which is in charge of the development of the system and sets the TACs,. (2) The Marine Research Institute which carries out biological research and recommends TACs to the Ministry, (3) the Fisheries Directorate which is responsible for the enforcement of the system and (4) the Coast Guard that assists in the enforcement of the system at sea under the direction of the Fisheries Directorate. The first two institutes report to the Ministy of Fisheries. The third, the Coast Guard operates under the Ministy of the Interior.

The Icelandic ITQ system is among the best documented and researched in the world. Some of the more useful references of the available sources of information are to be found in the list of references. Generally the outcome of the ITQ system has been felt to have been very good. Economic efficiency has improved substantially. Many of the fisheries subjected to ITQs have exhibited growing stock levels. The social impact of the system, somewhat surprisingly given Iceland´s economic reliance on fisheries (Arnason 1995), has not by any means been dramatic (Arnason 1995, Runolfsson 1997, Palsson and Helgason 1997, Agnarsson 2000).

5.2 Initial allocation of entitlements

The method by which the TAC shares were initially allocated to fishing vessels varies somewhat across fisheries. In the demersal, lobster, scallop and deep-sea shrimp fisheries the TAC shares were based on the vessel's historical catch record during certain base years. In the demersal fisheries this usually equalled the vessel's average share in the total catch during the three years prior to the introduction of the vessel quota system in 1984. There were exceptions to this rule, however. If, for instance, a vessel had not been operating normally during 1981-3 due, for example, to major repairs or to having entered the fleet after 1981, the calculated share was adjusted upwards.

In the herring and inshore shrimp fisheries the initial TAC shares were equal for all eligible vessels (i.e. vessels with a recent history of participation in the fishery). The same rule applied

to the capelin fishery, except that a third of the TAC was allocated on the basis of vessel hold capacity.

5.3 Definition of entitlements.

The basic entitlement in the Icelandic ITQ system is the ITSQ which stipulates the holders percentage share in whatever TAC is set for that fishery every season (usually a year). The ITSQs must be associated with vessels. The multiple of that ITSQ and the annual TAC then gives the vessel's catch quota for that year.

The term (or duration) of the ITSQ holding is currently indefinite. However, it seems likely that in the future their permanence will be reduced either by a fixed limit e.g. 25 years or a steady reduction by an annual fraction reverting to the government and being resold.

5.4 Mechanisms to facilitate quota trades.

A very brisk market has developed in quota trades, both the ITSQ and the annual ITQs (Arnason 1995, 1996d, 1997; Runolfsson 1999). The bulk of these trades have taken place with the assistance of independent traders or brokers that, seeing a profit opportunity, emerged spontaneously. These private operations, of which I believe 3 to 5 are currently active, have been very efficient making it possible to trade quotas by telephone virtually instantaneously for a brokerage charge typically of 0.5% of the value of the trade. In addition to this the Association of Vessel Owners has operated its own trading office for its members.

In 1998, in response to a fisheries labour dispute where the fishing labour complained that the fish price was being kept artificially low by a collusion between vessel owners and processors involving the latter providing the former with inexpensive quotas, an official ITQ exchange was established by law. Its purpose was to ensure that all quota trades were at arms length so that particular processors and vessel owners could not trade ITQs at artificially low prices. All trades of annual quotas were required to take place anonymously at this quota exchange which works pretty much as an computerized stock exchange. The purpose by this quota exchange was not to facilitate quota trades. Indeed, quota traders complained bitterly that not only was the quota exchange more expensive that the previous brokerage system but it was also slower and more cumbersome. (Runolfsson 2000). It is important to realize that only trades of annual quotas (or ITQs) go through the quota exchange. Trades of permanent quota shares are still effected privately with the help of quota brokers.

5.5 Restrictions on trade and ownership

Regarding quota transferability, one must distinguish between the permanent TAC share and the annual quota. TAC shares are transferable without any restrictions whatsoever. On the other hand, there are some relatively minor restrictions on the transferability of annual quotas.

First, transfers of annual quotas between geographical regions must be agreed to by the Ministry of Fisheries. The purpose of this restriction is to avoid short term destablization of regional employment. In practice, however, few inter-regional transfers have actually been blocked by the Ministry. Second, a vessel that doesn't harvest at least half of its annual quota two years in a row forfeits its TAC share. This restriction, introduced in 1992, apparently stems from rather widespread public dissatisfaction with the "unearned" quota rents received by some quota holders.

All quotas must be associated with a vessel. This means that only those indiviudals or firms that own vessels can hold quotas. Clearly, although there are ways around this stipulation,[5] this restricts the set of possible quota holders significantly.

5.6 Volume of quota trade

The volume of quota trades has been very high virtually from the beginning (Arnason, 1995, Runolfsson and Arnason 1997, Runolfsson 2000). For demersals, trades of annual quotas have in recent years typically been in the neighbourhood of 80-90% of each year's total quota. This suggests that many of the trades are speculative, back and forth trades, i.e. many quota holders both buy and sell depending on the time of year and the evolution of their expectations. This high level of quota trades is considerably up from the beginning of the demersal ITQ system in 1984 where annual trades were more like 20% of outstanding quotas. The trade in other species, i.e. crustaceans, pelagics and shellfish is much less. The exception is shrimp where the level of trades is also very high.

The trade in permanent quota shares or ITSQs is much less brisk than the trade in the annual quota but still remarkably high. Thus, trades for most species (excluding shellfish) have been some 10-20% of the total every annually since 1991. As in the case of the trade in annual quotas, this trading percentage has been increasing over time.

5.7 Resource rents extraction and/or management cost recovery.

There is currently no provision in the law for any resource rent extraction from the Icelandic fishing industry above normal income taxes. The law, on the other hand, allows for charge to cover fisheries management costs. This is collected in two different ways (a) an annual quota fee depending on each vessel's quota allocation (b) an annual fishing licence fee. If these two the quota fee is much more significant. Currently the combined income from both charges is about 1.5% of the total landed value of the catch. This should be compared to estimates of total management costs (research, administration and enforcement of some 3-4% of the total landed value (Arnason et al. 2000).

[5] For example, by contracting with a vessel owner that he hold one´s quota on his vessel.

In Iceland in recent years there has been somewhat heated debate about whether or not to extract rents from the fishing industry. Judging by the Report by the Committee on Natural Resources (2000), it now seems likely that fee extraction from the fishing industry will indeed be increased in the near future. It seems fairly save to predict that these charges will be increased in a gradual fashion to cover management costs within the next few years. Whether net resource rents will be extracted as well seems doubtful.

5.8 The enforcement system

Thanks to Iceland's relatively few landing ports (about 60), an effective landings control system, and the fact that over 99 per cent of the catches are processed for export, enforcement of the ITQ system is not much of a problem.

On behalf of the Ministry of Fisheries, a separate public organization, the Fisheries Directorate, is charged with the responsibility of enforcing the quota system. For this purpose, the Fisheries Directorate operates an elaborate landings control system covering every landing port in the country. The cornerstone of this system is the legal requirement that all marine catch for commercial purposes be weighed on official scales at the point of landing. Public officials record the landings, determine the species composition of the catch and assess its quality. The information collected in this way is then promptly conveyed to the Fisheries Directorate's central data-bank via a direct computer link. To cope with the export of fresh fish, a similar landings control system has been established in foreign export ports. With the help of this landings control system, the Fisheries Directorate is able to maintain a day-by-day record of the cumulative landings by every licenced fishing vessel in the country.

Monitoring the output quantities of the processing plants at the export level provides a check on their received fish inputs and, thus, serves as a further check on vessel landings. A similar system, utilizing estimated catch-product transformation coefficients, supplemented with on-board observations, is used to calculate the harvest of freezer trawlers.

To further monitor adherence to vessel quota rules and other fisheries regulations, the Fisheries Directorate maintains a group of fisheries observers many of whom are retired fishing captains. At any time, a number of these observers are based aboard fishing vessels, while others conduct inspections in fishing ports. On the basis of observers' reports, the Fisheries Directorate may promptly assess fines or other penalties or order further investigation into alleged violations.

There is, some evidence of inferior catch being discarded at sea in order to maximize the value of the vessel quota. While this practice is not thought to occur on a significant scale (estimates range from 0-6% depending on the fishery and fishing gear used (Arnason 1996c, 1997, Committee on Natural Resources 2000, Agnarsson 2000), it violates the terms of the

quota and is punishable by fines or revoking of fishing licences. It is, however, difficult to verify. Increasing the role of on-board observers has become focussed on combating discarding.

5.9 Evidence of increased efficiency

There is ample evidence that the ITQ in Iceland has yielded considerable economic benefits. New investment in fishing capital has been reduced and the fishing fleet has contracted. In some fisheries the number of operating vessels has dropped significantly. Fishing effort has also been significantly reduced. Finally, estimates of the actual economic rents generated by the system as well as analysis of quota values strongly indicate that very substantial economic benefits are already being generated by this management system. (Arnason 1995, 1997, Runolfsson 1999, Gissurarson 2000, Agnarsson 2000)

To illustrate a part of the evidence on which these results are based, it may be useful to briefly review the experience of two of Iceland's major fisheries:

5.9.1 The pelagic fisheries

The pelagic fisheries are essentially based on two species; herring and capelin. The predominant fishing gear is purse seine. The herring fishery was subjected to IQs in 1975 and ITQs in 1979. The much larger capelin fishery was came under IQs in 1980 and ITQs in 1986. So the big change came in the early 1980s

Since then there has been a dramatic decline in the number of the number of fishing vessels and a smaller decline in the total tonnage (GRT) of the pelagic fleet. This is illustrated in figure 5.1. At the same time the pelagic catches have increased, so there has been a substantial increase in the catch per unit of fleet (metric tonnes/GRT) as illustrated in figure 5.2.

Figure 5.1 The Pelagic Fishery: Maximum number of vessels in any one month

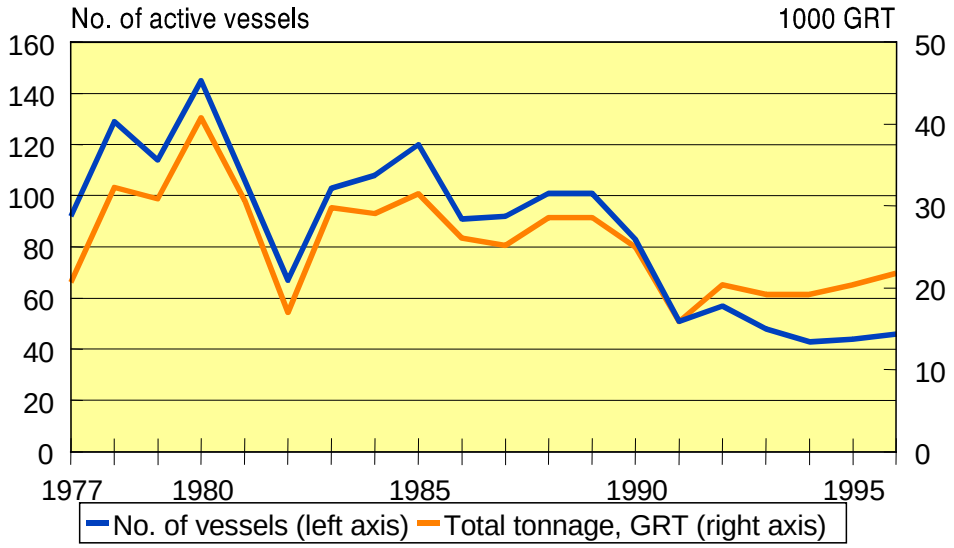
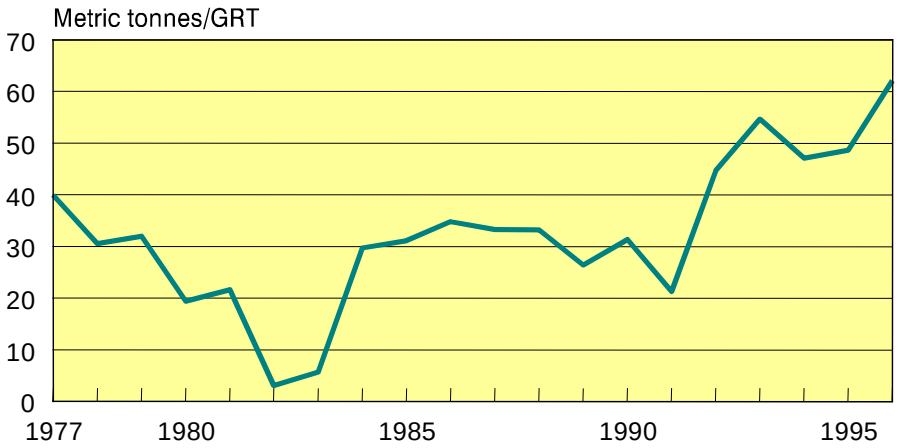


Figure 5.2 Pelagic Fishery: Catch per Unit of Fishing Fleet (Metric tonnes/gross registered tonne)



Now in pelagic purse seine fisheries, catch per unit of fleet is a good indicator of productivity. Hence the experience in the pelagic strongly suggests a dramatic increase in the technical efficiency in this fishery.

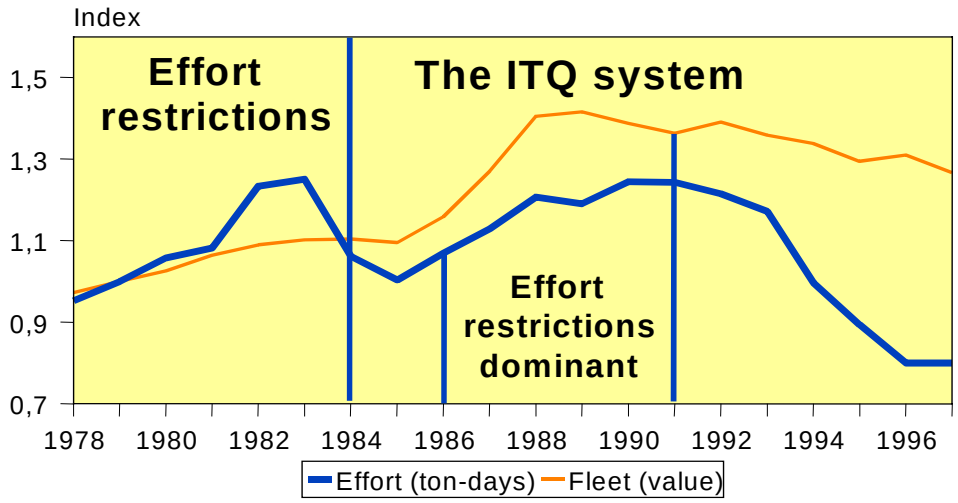
5.9.2 The Demersal fisheries

From 1978 to 1984, the Icelandic demersal fisheries were managed on the basis of effort restrictions in the form of limited fishing days for cod. An ITQ system was introduced in 1984. However in 1985 this was supplemented with an option to go for limited fishing days instead of a catch quota. As it turned out, a large number of vessels took this option with the

result that from 1986 to 1990 more than half of the demersal catch was taken under effort restrictions rather than quota restrictions. The effort option was made less attractive in 1988 and abolished at the end of 1990. Since 1991 a fairly pure form of the ITQ system has been in operation in the Icelandic demersal fisheries.

The experience of this system is to a certain extent illustrated in Figure 5.3.

Figure 5.3. The Evolution of the Demersal Fishing Fleet and Effort

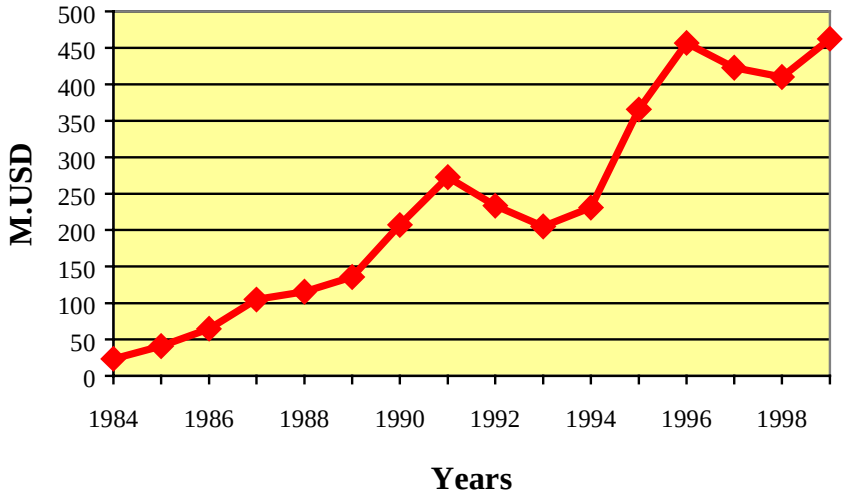


As indicated in this figure, periods where the fishery was managed on the basis of effort controls — a typical direct economic restriction — corresponds to a period of increasing fleet size and fishing effort. On the other hand, the periods of the ITQ management have implied substantially reduced fishing effort and a slowly reduced fishing fleet. Thus from 1990 to 1997, under the complete ITQ system, demersal fishing effort was reduced by over 30%. A similar speedy reduction in fishing effort occurred in 1984-5 when ITQ restrictions were dominant. Thus, clearly, the ITQ system has brought the demersal fishery towards greater efficiency.

Another, and more direct way to assess the efficacy of the ITQ system in the demersal fisheries to look at quota values. As the quotas are transferable, an efficient market for trading them has evolved. According to standard economic theory, the total market value of quotas should provide us with a good measure of the net rents generated in the fishery.

The evolution of the annual quota values is illustrated in Figure 5.4. This figure, more precisely, describes the total annual rental value of quotas in all Icelandic fisheries

Figure 5.4 Annual Quota Rental Values in the Icelandic Fisheries (Million USD)



As shown in the above figure, the quota valuation of the Icelandic fisheries has greatly increased form 1984 onward. It is currently about USD 450 million per annum, almost 20 times what it was in 1984. This implies two things:

1. Since 1984, under the ITQ fisheries management system, the efficiency of the fisheries has increased dramatically.
2. Currently, the economic rents generated by the fisheries, as measured by the quota price evaluation, constitutes a substantial fraction of the average landed value.

5.10 Evidence of increased or reduced quota-induced discarding

There is no evidence that discarding of fish at sea has been reduced by the ITQ system. On the contrary, there has been suspicion fuelled by theoretical analysis (Arnason 1994) and anecdotal evidence, that the ITQ system has indeed led to a significant discarding of perfectly good fish. The various systematic estimates that have been undertaken (some of which are reported in Agnarsson 2000, see also Arnason 1994 and 1995), however, generally put the level of discards for those species most likely to be discarded at well under 10% and, moreover, do not suggest that the overall level of discards has been increased under the ITQ regime.

5.11 Evidence of increased resource stewardship

There is evidence of substantially improve resource stewardship under the ITQ system. First, TACs are now generally adhered to. Second, and more importantly, there are pretty clear indications that the fishing industry, i.e. the holders of ITSQs, are much more willing now than before to accept and even support radical reductions in TACs in order to rebuild the fish stocks. Indeed, one now sees the spokesmen of the Association of Vessel Owners stepping

forward to defend the TAC recommendations of the Marine Research Institute against the criticism of individual fishermen and their municipalities. Third, one now sees the industry work hand in hand with the Ministry of Fisheries, the Marine Research Institute and the Fisheries Directorate in order to stamp out violations of fisheries regulations.

All this change in behaviour which unfortunately is hard to verify with hard data, is in accordance with theoretical predictions. The ownership of ITSQs gives its owners vested interest in the future of the fishery and, consequently, its healthy biological state. The ITQs are simply assets whose market value hinges critically on the future of the fishery. Hence, the owners become like farmers or other investors in natural resources. It is to their own advantage to maximize the value of their asset.

6. Namibia

6.1 Background

Namibia gained independence from South-Africa in March 1990. At this point of time the Namibian fisheries jurisdiction was only 12 nautical miles. Extensive fishing by foreign fishing fleets was taking place off Namibian shores and most of the on-shore fishing industry was in foreign hands. One of the new Republic's first act was to extend the EEZ to 200 miles thus closing off these waters to the previously unhindered and extensive international fishing. (Stuttaford, 1994, Oelofsen 1999). Immediately following this extension of the EEZ, conservative TACs were imposed in order to rebuild the fish stocks which were seen as heavily overexploited. This was followed by the imposition of a system of individual quotas (Arnason 1994b, Oelofsen 1999).

The Fisheries Act of 1992 (Act 29/1992, Oelofsen 1999) set the legal framework for the current fisheries management. The essentials of this system are as follows (Arnason 1996b, Oelofsen 1999):

- The Ministry of Fisheries sets TACs for all important species on an annual basis.
- Agents (companies or individuals) hold fishing rights of limited duration (4-10 years) in the various fisheries. These rights are formally just fishing licences but have many of the characteristics of what has been called share quotas (i.e. percentage shares in the annual TACs). Notice, however, that the actual share in the TAC they represent is not guaranteed.
- Each year, the Ministry of Fisheries issues catch entitlements (individual quotas) to rights holders. This issue is broadly on the basis of the agent's existing fishing rights but there may be deviations. These deviations officially depend on the agent's agent's adherence to the Government's fishing policy especially as regards the so-called Namibianization of the fishery. However, in practice, reallocation is more or less at the Ministry's discretion.
- So far, the likelihood of a quota issue in proportion to the historical share seems fairly high.
- The quotas are formally non-transferable. But there are in practice significant transfer possibilities with agents agreeing to fish each other's quota and even combining quota rights. Such transfers often take place on the basis of monetary compensation to the agent handing over quotas. Both types of transfers appear to require the tacit agreement of the Ministry of Fisheries.
- Annual quota issue is subject to a levy that depends on the type of fishery, nationality of the company and vessel crew and the extent of domestic processing.

So the Namibian fisheries management system may be regarded as an proportional ITSQ (Individual Transferable Share Quota) System with quite restricted transferability and considerable uncertainty of renewal.

The Namibian Fisheries have yielded between 500.000 and 700.000 mt (metric tonnes) in recent years.[6] This harvest puts Namibia among the 30 largest fishing nations in the world. The most important species in terms of volume are horse mackerel (some 400.000 mt), hake (some 150.000 mt) and pilchard (up to some 100.000 mt).

6.2 Initial allocation of entitlements

The initial allocation of entitlements following independence was according to applications that were subsequently evaluated by the government. The allocation criteria employed were not very clear and the whole procedure not particularly transparent. This description also applies to subsequent allocations to this day (Ministry of Fisheries 1991, Ministry of Fisheries 1995, Oelofsen 1999). However, it seems that a catch history in the industry, willingness to invest in on-shore processing facilities, domestic participation in the operation and adherence to government policies have been major considerations for both the initial and subsequent allocations. As a part of the government's policy of Namibianization, i.e. bringing the fishing industry into native Namibian hands, a fraction of the TAC[7] has been set aside annually for allocation to new entrants (Arnason 1996c, Oelofsen 1999). Existing entitlement holders are likely to get their entitlement renewed according to their historical shares.

6.3 Definition of entitlements.

The entitlements are simply fishing licences. These licences are issued to persons or firms. They are not associated with particular fishing vessels. They are of limited duration with a term of two, seven and ten years. These licences do not actually confer firm rights to annual quota allocations although such allocations have normally always taken place. Neither do they guarantee the same proportional allocation out of TAC as the year before. Indeed there are several cases of this proportion being altered. The criteria for these alterations seem to be the same as for the allocation of the entitlement it self as well as whether the entitlement holder has managed to harvest his full quota allocation the year before. Neither the fishing licences nor the annual quota allocations are supposed to be transferable. However, a degree of transfers takes place with the tacit approval of the Ministry of Fisheries.

So these entitlements may be regarded as weak versions of limited term ITSQs. They are weak forms because they do not guarantee a fixed proportion of the annual TAC and, more importantly, transferability of the right is severely restricted.

---

6 It should be noted that FAO harvest figures for Namibia grossly understate the actual catches taken within Namibian waters. The reason may be that a good part of the horse mackerel harvest is landed abroad.

7 The actual fraction is variable, but up to 10% has not been uncommon in the past.

6.4 Mechanisms to facilitate quota trades.

There is no particular mechanism set up by the fisheries authority for the purpose of facilitating quota trades. This is reasonable, as transferability of entitlements and quotas is not built into this system.

6.5 Restrictions on trade and ownership

Ownership of harvesting entitlements, i.e. the fishing licences, is not restricted. it can be held by any Namibian citizen or company registered in Namibia. However, quota fees discriminate against foreign held companies Entitlements and annual quotas are not formally tradable. However, some trade in annual quotas takes place apparently with the tacit approval of the Ministry of Fishery. Entitlements also seem to be tradable to a certain extent. One way to do this is to merge firms. Trades for money may also to take place. Both types, however, require consultation with and the approval of the Ministry of Fisheries which conducts the annual quota allocation.

6.6 Volume of quota trade

Understandably, there is no firm information available on this. It seems that the trades of annual quota is low, perhaps 5-10% of allocations. The trade in harvesting entitlements is mainly via mergers and buy-ups and here is even less information about this.

6.7 Resource rents extraction and/or management cost recovery.

The Namibian fishing industry is required to pay very substantial charges to the government. These charges are of five types (Arnason 1996c, Oelofsen 1999, Wiium 2001):

A quota fee

This fee is imposed as the quota is allocated. This is payable in two to three instalments during the year independently of whether catch is taken or not. The fee is quite substantial. For hake e.g. it ranges from USD 72 per mt to USD 144 with the actual fee depending on the degree of Namibian ownership and crew use, i.e. Namibianization (Oelofsen 1999). If the catch is landed in Namibia there is a rebate of USD 36 (Oelofsen 1999).

Bycatch fee

The quota allocation is for specific species. Since many of the Namibian fisheries (especially the trawl and long-line fisheries are multi-species fisheries) bycatch is common. Certain, in some cases quite hefty, fees are assessed for bycatch. It may be mentioned that discarding of catch is not allowed.

Research fee

A special fee is assessed on all landings to fund marine research. This fee goes to the Sea Fisheries Fund which is under control of the Ministry of Fishereis and is used among other things to pay the costs of marine research Oelofsen 1999, Wiium 2001).

Licence fee

The issue of fishing licences (the harvest entitlements) is subject to a small nominal fee. The income from this fee is also deposited in the Sea Fisheries Fund.

Cost of on-board observers

Finally, the cost of a very extensive system of on-board observers is paid for by the fishing industry. This, which involves both the salary of the observers and their board is paid for by the owner of the vessel in question (Oelofsen 1999).

In total, the fees extracted from the Namibian fishing industry, ignoring the cost of on-board observers, amount to a significant fraction of the industry's total revenues. From 1994 to 1999 these fees averaged almost 9% of the industry revenues on average (Wiium 2001). Of this income, about 3/4 is accounted for by the quota fees. Moreover, this income substantially exceeded the fisheries management costs (research, administration and enforcement) which averaged about 5% of industry revenues during the same period (Wiium 2000, Wiium 2001). Thus, Namibia is one of the very few if not the only country in the world where the treasury directly collects a positive net income from the fisheries.

6.8 The enforcement system

The Namibian MCS (monitoring, control and surveillance) system is quite extensive and seemingly effective (Oelofsen 1999). It is based on three pillars. First, there is at-sea MCS conducted by two patrol boats and one aircraft. Second, all vessels with space available ae required to have on-board observers. Although their salaries and maintenance is paid for by the vessel in question, these observers are trained Ministry personnel. Moreover, they are placed on boats according to Ministry discretion and systematically rotated between vessels. Their role is to monitor adherence to fisheries regulations and collect biological data. Third, there is dockside monitoring of catches. Fisheries control officers check all landings for volume and species composition. This forms the basis for controlling that quota allotments are not exceeded.

6.9 Evidence of increased efficiency and/or adherence to overall TAC limits.

Since the same fisheries management system has been in operation since independence and the Namibian fishing industry ahs basically evolved within the confines of this system, there is no earlier regime to compare with. Having said this, there is a good deal of evidence that the Namibian fishing industry is in fact quite efficient (Arnason 1994b, 1996c; Oelofsen 1999; Wiium 2001)

- The industry is profitable in spite of paying quite substantial charges to the government (Arnason 1996b; Oelofsen 1999; Wiium 2001).
- The contribution of the fisheries sector to Namibia's GDP is very high and has grown very fast since the introduction of the fisheries management system. Thus, in 1998, the contribution of the fisheries sector to the GDP was about 10% of which the harvesting part accounted for 4.2% and the processing for the rest. This compares very favourably with the contribution of the fisheries sector of of only some 4% at independence (Oelofsen 1999). This increased share of the fishing sector in the Namibian economy is particularly impressive as economic growth has been good in Namibia since independence.
- The state of most stocks (except pilchard) has improved and stabilized since independence in spite of severely adverse environmental conditions in the mid-nineties. (Oelofsen 1999).
- The TAC-limits have been well adhered to (Oelofsen 1999).

6.10 Evidence of increased or reduced quota-induced discarding

There is no direct evidence on the change. However, the available data indicates that the current level of discards is minimal (Oelofsen 1999). This, however, may be due to the extensive on-board observer programme rather than any inherent features of the ITQ system.

6.11 Evidence of increased resource stewardship

There is no evidence of increased voluntary compliance or voluntary industry funding of management and research under the Namibian. The whole system is and continues to be heavily centralized.

7. Netherlands

7.1 Background

The Netherlands operate three main ocean fisheries; the flatfish (plaice and sole) fishery, the roundfish (cod, haddock and whiting) fishery and the herring and mackerel fishery. Of these, the flatfish fishery is by far the most valuable. These fisheries are largely independent, except that the flatfish fishery takes a good deal of roundfish as bycatch.

In recent years Dutch ocean catches have been around 400.000 mt. annually (FAO 2001). While this is only about 0.5% of the global ocean harvest, much of this catch is high value, so in terms of value, the Netherlands' placement in the world's fisheries is substantially higher.

Dutch ocean fishery is subject to European Union common fisheries policy, according to which the Netherlands are allocated national quotas for a range of species annually. The current Dutch fisheries management procedure is to divide this national quota into individual fishing rights, many of which exhibit the features of ITQs. Thus, the Dutch fisheries management system is large extent and ITQ regime. The nature of the ITQs, however, varies somewhat across fisheries.

7.1.1 The flatfish fishery

The flatfish (mainly plaice and sole) fishery is the most important Dutch fishery accounting for 60-70 per cent of the total value of landings. Before 1976, this fishery was mainly controlled by minimum mesh and fish size regulations. The results of this management was not good. The stocks declined and fishing profitability was unsatisfactory. In 1976, an IQ system with very limited transferability was introduced. The national quota was allocated as IQs to vessels on the basis of historical catch shares and vessel capacity measured in terms of engine power. Quotas were attached to specific vessels and transferable only with the vessel. However, this restriction was reportedly widely circumvented (Anonymous, 1994b). Consequently, in 1985, the quotas were made more easily transferable.[8]

This system, one of the very first IQ or ITQ fisheries management systems in the world, was not particularly successful in the beginning. As the fishery was subject to a closure when the European Community's (EC's) overall flatfish quota was reached (presumably due to the excess harvesting by other nations coupled with the inability of the Dutch government to enforce national quota restrictions), individual quotas did not represent high quality property-rights. Hence, in spite of the quota system, the race-to-fish was not eliminated. However, as

[8] It is now possible to buy and sell quotas. However, a fisher wanting to sell his quota has to sell all of it although there may be many buyers each purchasing a part of the quota.

the quota enforcement was improved -- on the international level by the issue of national quotas by the EC in 1983 and on the national level by an improved quota monitoring system in the Netherlands in 1988 -- the efficiency of the system has greatly improved.

An unusual aspect of the Dutch flatfish ITQ system is that this system is supplemented by both engine power restrictions and maximum days at sea. According to Davidse (1997, 1999), these regulations were found to be necessary companions to the ITQ system work. Taking that assertion for granted the most likely reason is that the enforcement of the ITQ system was problematic.

7.1.2 The roundfish fishery

The targeted cod fishery was subjected to a limited licensing scheme in 1981. The purpose was to restrict fishing effort and thus prevent an early closure of the fishery due to exhaustion of the national quota. In 1985, due to expansion of the flatfish fishery, it was felt necessary to introduce landing quotas for cod as bycatch. In 1987, all cod fishing rights were allocated as weekly individual nontransferable quotas. In 1994, these quotas were set on monthly basis and made fully transferable. Due to the transferability of the cod quotas, it is expected that the flatfish fleet will in due course acquire much of the roundfish quota to meet its bycatch quota needs.

7.1.3 Herring and Mackerel

Until 1993, the Dutch North Sea herring fishery was subject to very little specific management apart from that represented by the national quota. In 1993, however, the Dutch government decided to allocate the herring TAC to fishermen's producer organizations. These organizations, in turn, generally reallocate their TAC shares to individual vessels as IQs.

The mackerel fishery which primarily takes place to the west of the British Isles, was subjected to IQs as early as 1983. These quotas became freely tradable within the group of mackerel trawlers in 1985.

7.2 Initial allocation of entitlements

The initial IQ-shares in the flatfish fishery were allocated on the basis of historical catch shares 1972-74. In 1977, due to widespread dissatisfaction, the allocation rule was altered giving equal weights (50%) to the basis of the historical catch record and the engine power of the vessel (Davidse 1999a). Similar allocation rules apply in the roundfish fishery which was put on ITQs in 1994. In the pelagic fisheries, initial allocations were on the basis of historical catch record only.

7.3 Definition of entitlements.

The basic entitlement is the ITQ-share or ITSQ. This right is issued for an indefinite period (Davidse 1997). The ITSQ entitlement does not provide a legal right to the corresponding proportional quota allocation every year. However, by convention annual quotas have always been allocated precisely according to the ITSQ share (Davidse 1997). Hence, although the system is on somewhat weaker legal basis than, say, the New-Zealand and Icelandic ITQ systems, it is clearly a fairly standard ITSQ system.

The ITSQ entitlement may be used as collateral. Its value as a secure property right may be inferred from the fact that banks regularly accept it as a collateral (Davidse 1999b).

7.4 Mechanisms to facilitate quota trades.

There are no particular mechanisms in place in the Netherlands to facilitate quota trades. However, the so-called Management Groups — organizations of vessel owners usually in the same region charged with the responsibility to manage parts the fishery in co-operation with the fisheries authorities (Hoefnagel and Smit 1997, van Vliet 1998) — often work to facilitate trades amongst their members (Davidse 1997).

7.5 Restrictions on trade and ownership

Trades of both annual quotas and the ITSQ-rights may take place subject only to approval by the Ministry of Fisheries (Davidse 1995, 1997). Officially, IQs and ITSQs are not divisible and, consequently, are expected to be traded as whole units (Davidse 1997). However, the establishment of the Management Groups (in 1993) has changed this. For all intents and purposes quotas are now divisible for leasing and trading at least within their Management Group membership (Davidse 1997, 1998).

Quotas are associated with vessels. So, it seems that ownership of fishing vessels is a prerequisite for holding a quota. However, as in other property rights based systems, there are obvious ways around this.

7.6 Volume of quota trades

Before the introduction of the Management Groups in 1993, quota trades were subject to the inconvenience of indivisibility and cumbersome registration. In that period quota trades were comparatively small. Thus, Davidse (1997) reports that during 1988-1992 sole and plaice quota trades typically amounted to about 4-5% of the TAC. Since the volume of quota trades seems to have increased substantially (Davidse 1998, 1999a).

7.7 Resource rents extraction and/or management cost recovery.

There is no collection of resource rents in the Dutch ITQ system. Moreover, until recently, there has been no fee collection toward defraying the cost of management. Since the year 2000, however, various fishing licence fees have been collected on an annual basis. All counted, these fees would typically be about USD 900 per vessel (Davidse 2001).

7.8 The enforcement system

Enforcement in the Dutch fisheries is carried out by the General Inspection Service, the Management Groups (since 1993) under the auspices of the Ministry of Agriculture and Fisheries. Alleged violations are prosecuted by the Public Prosecutor (Davidse 1997).

The enforcement of the flatfish quota regulations in the Netherlands was initially very poor (Davidse 1997, 1999; van Vliet 1998). Catch monitoring depended on vessels' reports supplemented by dock-side sampling. The sampling regularly led to fines, but the fines were too low to constitute a sufficient deterrent (Davidse 1978, 1999a). As a result, the quota restrictions may be said to have primarily been for reference purposes and were consistently exceeded as was the TAC. From 1988, however, the Dutch Fisheries Minister took major steps to beef up the enforcement of the system. Landings were closely monitored by a team of 120 dock-side observers. The permissible place and time of landings was stipulated and constraints on the fishing power of the vessels (engine capacity and beam length) imposed. It is important to realize that the main purpose of these restrictions was not to reduce fishing capacity per se, but to make exceeding the quota constraint more difficult (Davidse 1998).

This new enforcement regime was partially successful. Losing the possibility of exceeding their quota constraint several owners wound up their operations and had their vessels decommissioned (Davidse 1998). At the same time other vessel owners sought new ways (bypassing fish markets, landing illegally etc.), to avoid being bound by their quota constraints. These activities lead to clashes with the police and even riots in some fishing ports. The level of fines imposed rose dramatically. All in all, for a period of a twoto three years , the relationship between the fishermen and the Ministry of Fisheries was extremely acrimonious and volatile . Reconciliation came in 1991 and 1992 with the Ministry and the fishermen agreeing on the need to enforce the quota limits jointly and fairly. Fishermen's Fisheries Management Groups (technically Producer Organizations) were set up to co-operate in the fisheries management and the enforcement of the management rules with the Ministry. This was the beginning of the Dutch system of fisheries co-management (Davidse 1998, van Vielt 1998, Hoefnagel and Smit 1997).

The current enforcement system is based on (i) vessel and Management Group catch reports, (ii) considerable dock-side monitoring of landings assisted by a restricted number of

permissible landing sites, (iii) compulsory sale of the landings in fish auctions. and (iv) heavy penalties (fines) for violations. Davidse (1999a).

The Management Groups play a crucial role in the enforcement system. The Management Groups are responsible for the compliance of their members (Davidse 1999a). This presumably means that the Management Group as a whole may be punished if members violate their quota constraint. As a result, considerable expert knowledge and peer pressure is brought into the enforcement process. This is very effective as 95% of the fishing vessels belong to a Management Group, in spite of membership being voluntary. An important reason for this are the benefits in terms of quota trades and quota adjustment that is possible within the Management Groups.

Since the establishment of this new enforcement system, the system has come under considerable strain as the plaice quota was cut by 32% in 1996. However, the system withstood this shock although quota trading prices for plaice increased by 17% (Davidse 1999a).

The above description applies to primarily to the flatfish ITQ system. However, very much the same enforcement arrangement applies in the roundfish fishery. The enforcement of the pelagic fishery (being conducted by relatively small number of large vessels) depends on landings reports and is not felt to be a problem.

7.9 Evidence of increased efficiency

Generally speaking, the system seems to have had quite beneficial results. There has been a substantial reduction in fleet size. Thus, between 1987 and 1993 the number of flatfish vessels declined by 23 per cent and the total engine power of the flatfish fleet by 12 per cent (Anonymous 1994b). The development of the complete North Sea fishery (flatfish and roundfish) between 1983 and 1998 is given in the Table 7.1, adapted from Davidse (1999b).

Table 7.1. Dutch demersal North Sea fishery: Percentage changes in fleet capacity and effort 1983-98

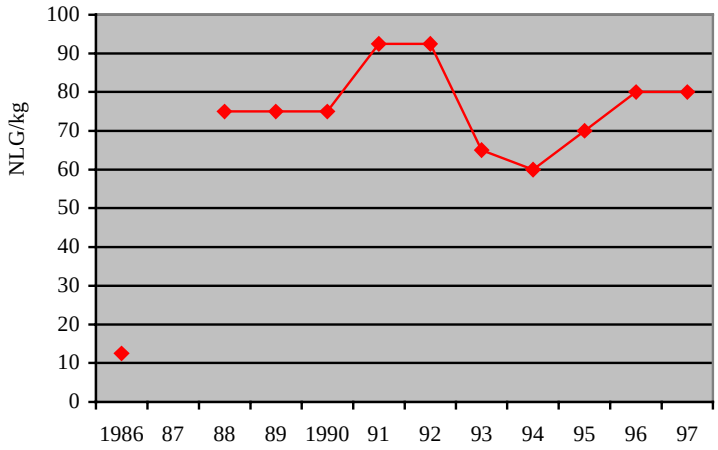
Measure	% change
Total number of vessels	-32%
Total engine power	-13%
Total fishing effort	-7%

More importantly, the Dutch fishing industry, especially the flatfish fishery, seems to be highly profitable (Davidse, 1995).

Finally, quota prices have been quite high. This, of course, is a strong indication of the fisheries rents being generated by the system. Thus, ITSQs for sole have in recent years been

in the neighbourhood of USD 30 per kg. Davidse (1999b) Assuming a rate of discount of 15-10%, this corresponds to an annual quota rent of USD 1.5-3 per kg. The evolution of these prices is illustrated in Figure 7.1.

Figure 7.1 Dutch ITSQ prices for Sole (NLG/ kg).



Quota prices for other species have been similarly high. Thus cod/whiting ITSQ prices have been some 6-8 USD/kg. (Davidse 1999b)

7.10 Evidence of increased or reduced quota-induced discarding

There is no evidence on the effect of the ITQ system on discarding of catch at sea.

7.11 Evidence of increased resource stewardship

The existence of the Management Groups and, more importantly, the favourable outcome of the co-management system (Hoefnagel and Smit 1997 and van Vielt 1998) suggests that the ITQ system may have contributed to improved resource stewardship by the industry. According to Davidse (2000) and van Vielt (1998) the ownership of ITSQ rights has convinced the holders that strong enforcement of the regulations are really in their own interest.

Since TACs are set by the European Union, increased resource stewardship cannot really be brought to bear upon the setting of TACs in any significant way.

8 New Zealand

8.1 Background

New Zealand's EEZ is approximately 1.2 million square miles. Although among the largest in the world, this EEZ is not particularly productive as a fishing zone. The main reason is the relative narrowness of the continental shelf. About 72 per cent of the EEZ consists of water deeper than 1000 meters.

About 130 species are fished commercially in New Zealand waters. The most important ones in terms of value are orange roughy, hoki, snapper, ling, abalone and spiny rock lobster. The total annual harvest in recent years has fluctuated between 5-600 thousand mt (FAO 2001). Including aquaculture the harvest in 1993 was 593 thousand mt with value of some USD 330 million (OECD 1997). In 1998 the landed volume was 636 thousand mt (FAO 2001) and the landed value presumably in excess of USD 400 million.

New Zealand extended her fisheries jurisdiction to 200 miles in 1978. Prior to this, New Zealand fisheries consisted mostly of small scale inshore fisheries within the 12-mile fishing zone. The deep-sea fisheries outside the 12-mile zone were dominated by foreign fishing fleets, especially Japanese, Korean and Soviet ones. The management of the fisheries was minimal. The inshore fisheries were open access ones and almost devoid of any fishing regulations (Clark 1994, Batstone and Sharp 1999). The offshore fisheries were operated by distant water fishing nations and, consequently, not subject to New Zealand control at all.

From 1970 to 1977, the total harvest off New Zealand increased from 50 thousand mt to 500 thousand mt primarily due to the foreign offshore fishing activity. At the same time, the inshore fisheries, encouraged by investment grants and tax breaks, also expanded (OECD 1997b, Clark 1994). This resulted in overexpansion of the inshore fleet and, consequently, overexploitation of the stocks and poor profitability in the industry.

Following the extension of the fisheries jurisdiction to 200 miles in 1978, measures were taken to curtail what was generally regarded as excessive fishing pressure. This marks the beginning of modern fisheries management in New Zealand waters.

In the foreign deep-sea fishery outside the 12-mile zone, catch limits and licence controls were introduced. This initially resulted in a substantial drop in the offshore fishery but, due to increased participation of New Zealand companies, this fishery quickly recovered. Within 5 years of the extension of the EEZ the offshore catch had reached 400 thousand mt with New Zealand companies taking about two-thirds directly and through joint ventures.

In the inshore fisheries, on the other hand, the introduction of licence limitations and other input control measures did not prove effective (Clarke 1994, Batstone and Sharp 1999). Investment in fishing capacity continued unchecked. Consequently, effective fishing effort kept on rising in spite of the restrictions, the decline in the inshore fish stocks was not arrested and the economics of the fishery deteriorated further.

In an attempt to deal with these problems, the *Fisheries Act* was passed by the New Zealand parliament in 1983 (Pearse 1991). This act consolidated all previous legislation on fisheries management and vested the responsibility for fisheries management squarely in the national government. According to the *Fisheries Act*, the objective of fisheries management was not only resource conservation but also maximum economic return from the fishery. The *Fisheries Act*, although fairly general and vague, constituted a watershed in New Zealand fisheries management history. On the basis of this act, significant steps toward efficient management of the fisheries were undertaken.

First, in the deep-sea fishery, a property rights based fisheries management regime based on ITQs (deep-water quotas) was introduced. Under this scheme, later known as the Deep-Water Trawl Policy (Clark, 1994), deep-water quotas were allocated to fishing firms on the basis of the size and capacity of their fishing vessels. In order to encourage New Zealand participation in the fishery , the allocation of these quotas was restricted to firms with at least 75 per cent New Zealand ownership. In addition, the quota holders were required to process at least 35 per cent of the catch onshore in New Zealand (Clark, 1994). The Deep-Water Trawl Policy was implemented in 1983. It constitutes one of the first examples in the world of an ITQ system in a major demersal fishery.

Second, part-time fishers were summarily excluded from the inshore fisheries. This meant that about half of the inshore fisheries licences were retired. The reduction in fishing effort was much less, however, as the remaining commercial licences (about 2,500) had accounted for most of the catch.

A period of intense debate about the most effective means of addressing the twin problem of overfishing and overcapitalization followed. The outcome of this debate, no doubt influenced by the apparent success of the Deep-Water Trawl Policy, was a consensus for the introduction of property right-based fisheries management. Consequently, by an amendment to the *Fisheries Act*, a uniform system of ITQs in all major fisheries was introduced in 1986.

The ITQs were initially set as fixed permanent quantity, i.e. not as shares in the future TACs. The idea was that to effect adjustment in the TAC the fisheries authorities would simply buy-back or sell additional quotas. However, it was soon discovered that the government had greatly overestimated the sustainable yield of important fish stocks, especially orange roughy, in its initial quota allocation. Therefore, to reduce total catch rights to sustainable levels, the

government was committed to buy back quotas. In 1986 alone, the New Zealand government spent approximately US$30 million for this purpose. Consequently, this policy of quota buy-backs could not be sustained. Hence, in 1990, following protracted negotiations with the fishing industry, a new amendment to the *Fisheries Act* transformed the ITQ system into a proportional or share quota system. More precisely, instead of fixed volumes, the permanent quotas would now be a percentage of whatever annual TAC set by the government.

The evolution of the New Zealand fisheries management system is summarized in Table 8.1.

Table 8.1. Evolution of the New Zealand Fisheries Management System

Year	Management system
1963-78	Minimal management
1978	Extension of the fisheries jurisdiction to 200 miles
1978-83	Licence limitations and various input restrictions
1983	ITQs in deep-sea fisheries; quantity quotas
1986	A uniform ITQ system in all fisheries; quantity quotas
1990	Proportional ITQ system; share quotas (ITSQs)

The current New Zealand fisheries management system is based on ITQs. The quotas represent shares in the TAC and are permanent, perfectly divisible and transferable. Further details of the system are as follows:

- The government sets TACs for all important commercial species in each fishing area within the New Zealand EEZ. There are currently ten fishing areas and 40 species covered by TACs.[9] These ITQ systems represent about 85% of the total fish catch within the New Zealand EEZ (Harte 2000).
- The basic property right in the system are permanent shares in the TAC for every species for which there is a TAC. These TAC shares constitute a right to harvest a fixed proportion of the given TAC every season in perpetuity. The annual quota for a given species is given as a simple product of the TAC share and the TAC for that species.
- Both the permanent quota shares and the annual quotas are perfectly divisible and transferable to any New Zealand resident or to firms with less than 25 per cent foreign ownership. However, no single person or firm is allowed to hold more than 35 per cent of the total deep-sea quota and 20 per cent of the total inshore quota.
- The ITSQs constitute a permanent private property and are as such protected by the New Zealand constitution.

[9] In principle there could be 400 different TACs, but since not all of the species are found in all fishing areas and the TACs of some are independent of fishing areas, the actual number of TACs set is considerably lower (OECD, 1997 and 1997b).

- ITQ fisheries are subject to a government charge designed to recover the cost of managing the fishery.
- All commercial fishers must hold a fishing permit. Fishing permits, which must be granted to any person or firm holding quota, impose certain conditions on the fishing activity in terms of fishing methods, areas, species, provision of information to the fishing authorities etc.

The outcome of the New-Zealand ITQ systems is generally regarded as having been good (Dewees 1989, Sharp and Roberts 1991, Clark 1994, Grafton 1996, Annala 1996, Batstone and Sharp 1999). Overexploitation has been greatly reduced and the stock size of most species has either increased or stabilized. Profitability of the fishing industry has been greatly improved and is currently very good (Batstone and Sharp 1999). The industry continues to be a staunch supporter of the system (Harte 2000, Kidd 2000, Major 1999).

8.2 Initial allocation of entitlements

The ITQ system introduced in 1986 consisted of permanent annual catch rights in volume terms. The initial allocation of these ITQs varied a bit across the offshore and inshore fisheries. In the offshore fisheries, the initial allocation of quotas according to the Deep-Water Trawl Policy of 1993 was based on participation in the fishery in 1992, the actual catch volume during that year and the vessel's capacity. This allocation was not altered by the general ITQ system of 1986. In the inshore fisheries, the allocation was based on two criteria: only vessels active in the fishery in 1985 were eligible for ITQs, and the amount of ITQs received depended on their catch history in 1982-4. For fishers that believed themselves unfairly treated by the initial allocation, there was an appeal process.

Subsequently, in 1990 the permanent quantitative rights were converted to share quotas, ITSQs. This, however, did not represent any reallocation of rights. Each quantity right was simply turned into an equivalent ITSQ.

In 1992, the government reached an agreement with the Maori people concerning the latter claim on the fishery resources under the Waitangi Treaty. The settlement gave the Maoris a substantial portion (almost 40%) of the New Zealand fisheries (NCR 1999, Major 1999). This was affected not by reducing the shares of the other participants in the industry but essentially by a monetary outlay by the government to purchase quotas and fishing company shares for the Maoris.

8.3 Definition of entitlements.

The basic harvest entitlement in the New Zealand fisheries is the ITSQ, i.e. a share in whatever TAC is adopted by the authority every year. This multiplied by the TAC then gives the annual quota.

The ITSQ is a permanent property right of the holder and protected by the constitution in the same way as any other property right. The ITSQ is also perfectly divisible and transferable. Similarly, the annual quota is perfectly divisible and transferable.

Any New Zealand citizen or company (not under foreign control) can hold ITSQs corporation. There are upper limits on the extent of quota ownership held by any one agent. These upper limits vary across fisheries from a minimum of 10% for rock lobster within any given management area (and there are several) to 45% of the combined orange roughy TAC over all management areas. (Batstone and Sharp 2000).

8.4 Mechanisms to facilitate quota trades.

There are no particular mechanisms set up by the fisheries authorities for the purpose of facilitating quota trades. Apparently, for most fisheries, quota trades take place through direct contact between the interested parties, i.e. the licence holders in question.

8.5 Restrictions on trade and ownership

There are no restrictions on the trade of New Zealand ITQs, neither the permanent quota shares nor the annual quotas, provided the buyer is a New Zealand citizen or company under New Zealand control. Note however the upper limits on quota ownership discussed in section 2 above.

8.6 Volume of quota trade

Little numerical information on the extent of quota trades is not available. The quota market is informal and most trades seem to take place directly between fishermen and fishing companies without much intermediation by traders or brokers. As a result, although trades must be registered with the quota authority, little is known about actual trading prices.

By most accounts, however, quota trades are substantial. Moreover, the market seems to be efficient enough for quota prices to exhibit the usual arbitrage-free characteristics [(10)] as recently verified by Sharp (2001) in selected New-Zealand fisheries

[10] Non-arbitrage means basically that prices are sufficiently random walk for there to be no riskless trading profit opportunities.

8.7 Resource rents extraction and/or management cost recovery.

At the inception of the ITQ management regime in 1986, the government announced its intention to recover a substantial part of the expected fisheries rents by charging the fishing industry on the basis of quota values. In fact, until 1993/4 this charge, called resource rentals, was imposed on the industry. Amounts recovered, however, were not high and were further reduced following the switch to a proportional quota system in 1990. In 1994, plans for resource rent collection were dropped and instead a new legislation, the *Cost Recovery Act*, provided for the recovery of all fisheries management costs including those associated with fisheries research, enforcement of the fisheries management system and conflict resolution. It is estimated that about US$25 million will be collected from the industry for this purpose in 1994-5 (OECD 1997b). This is equivalent to about 7.5 per cent of the annual value of the fishery.

8.8 The enforcement system

With the introduction of the ITQ system, the enforcement activity has, to a great extent, been shifted from the enforcement of input restrictions (access, area, season, gear) to the enforcement of output restrictions (catch volumes) in the form of the individual quota constraint. This requires the monitoring of individual catch volumes and the comparison of those with quota holdings.

The catch monitoring system is largely based on a system of catch handling documents supplemented, with physical surveillance as needed. The fishers are required to submit catch and landing reports. The buyers of catch and other fish traders are required to submit trading documents and records and corresponding documentary requirements are made of fish processors and exporters. A good deal of the monitoring process consists of matching these documents against each other and other data. Discrepancies that are discovered serve as indications that a closer inspection may be needed.

The skills needed for this type of monitoring are general investigative and auditing skills. Hence, the composition of the New Zealand fisheries enforcement staff has changed considerably since the introduction of the ITQ system. A substantial number of enforcement officials are now investigators, investigating accountants and solicitors. The number of the traditional fisheries surveillance officers has been correspondingly reduced. The total number of enforcement staff since 1986 has not been increased, however (OECD 19975b).

At the inception of the ITQ system, it was realized that under-reporting of catch might be more difficult to detect than violations of some of the more traditional input control. For this reason, it was decided to impose heavy penalties (heavy fines as well as forfeiture of quota) on violations. Alleged violations of quota restrictions are tried before a judge (not jury) in the

general criminal courts. Due to the penalties involved, the average time and expense of these trials has greatly increased.

Although little hard evidence is available, it is known that under-reporting of landings has occurred to some extent in the past (Annala 1996). However, enforcement has improved and it is generally felt that there is relatively little under-reporting of landings and that the enforcement of the system generally in good shape (Gibson, 1989; Clark, 1994; OECD 1997b; Grafton, 1996). Discarding of catch at sea, however, may pose a more serious problem (Grafton, 1996).

8.9 Evidence of increased or reduced quota-induced discarding

Discarding of quota managed species is illegal in New Zealand except in very special circumstances. Nevertheless, a degree of catch discarding is known to take place although the exact quantities are difficult to verify. In the multispecies inshore fisheries, fishers have been known to discard quantities of non-targeted fish instead of purchasing the corresponding quota (Annala 1996). In the off-shore fisheries, vessels with on-board-observers have landed higher proportion of non-targeted fish than vessels with no observers (Annala 1996).

It is not clear, however, that discarding has increased under the ITQ system. In any case this would be difficult to establish empirically as much of New Zealand fisheries were developed under the ITQ system. Boyd and Dewees (1992) maintain that enforcement and industry pressure soon reduced excessive discarding during the initial years of the ITQ system.

8.10 Evidence of increased resource stewardship

There is good deal of evidence of increased resource stewardship by the fishing industry under the New Zealand ITQ system. Few nations have progressed as far in the direction of government/industry co-management of the fisheries and even self-management by the industry. The industry carries out considerable biological research on its own and regularly confers with the Ministry of Fisheries in setting TACs. The industry is also active in the enforcement of fisheries rules. Thus, in 1999, a company owned by quota holders took over the responsibility of running large parts of the quota enforcement and compliance system (Crothers 2000). Arbuckle and Drummond (2000) and Harte (2000b) describe how a special company, The Challenger Scallop Enhancement Company, has taken complete responsibility for the southern scallop fishery of New Zealand carrying out all management functions as well as stock enhancement activities. As argued by these authors the basis for this self-management is secure property rights on the basis of the ITQ system.

9. United States of America

9.1 Background

The USA is a major fishing nation. In recent years (from 1992) the annual harvest has been in excess of 5 million mt which makes the USA the world's fifth largest fishing nation in after China, Peru, Chile and Japan (FAO 2001).

US fisheries are extremely numerous and varied. By far the largest fishery in terms of volume is the Alaskan pollock fishery which normally accounts for well over half of the overall USA catche but much less in terms of value (OECD 1997, FAO 1991). Other important species in terms of volume are menhaden, salmon , Pacific hake, cods, crab and shrimp. Shrimp is actually the most valuable single fishery followed by the crab and salmon fisheries(OECD 1997).

The basic fisheries management law in the USA is the Magnuson Fishery Conservation and Management Act of 1976. With its numerous amendments and changes it is now called the Magnuson-Stevens Fishery Conservation and Management Act of 1996 (NRC 1999). This act sets the framework for fisheries management in the USA. Among other things, the act established eight regional fisheries management councils. These regional councils are responsible for developing fisheries management plans for their areas within the scope set by the Magnusson and subsequently Magnusson-Stevens Act. These plans are subsequently implemented by the National Marine Fisheries Service (NMFS). Since their establishment, the various regional fisheries management councils have adopted a very wide range of fisheries management measures. The first (and to date the only) ITQ systems, were introduced in the ocean quahog/surf calm fisheries, wreckfish fisheries and the Pacific halibut and sablefish fisheries in the first half of the 1990s. Based on the perceived success of these programs, as well as similarly positive outcomes of ITQ-managed fisheries elsewhere in the world, interest in introducing ITQs in more fisheries mounted. Thus, in 1995 and 1997, the introduction of two additional ITQ programs, in the Gulf of Mexico red snapper fishery and the Pacific sablefish fishery, was decided upon by the respective fisheries management councils (Criddle and Macinko 2000). The implementation of these programs, however, was blocked when Congress in 1996 declared a temporary moratorium on any additional use of ITQ systems in USA fisheries until their impact could be more fully studied. This study was subsequently entrusted to the National Research Council which in 1999 submitted its report (NRC 1999). The most pertinent conclusion of that report is that ITQs have certain attractive properties and should be an allowed option for regional fisheries management councils.

Currently there are three ITQ-managed fisheries in the USA; the ocean quahog/surf clam fishery [11] established in 1990 off the New England to Mid-Atlantic coasts of the USA, the wreckfish fishery of the South-Atlantic coast established in 1992 and the North Pacific halibut and sablefish fishery [12] established in 1995. Compared to the US fisheries as a whole, these are all relatively small fisheries with the Pacific Halibut and sablefish fishery by far the most valuable.

These three ITQ systems fisheries all share the same basic characteristics but differ in the details. In all cases the quotas represent permanent shares in the TACs. The initial allocation is always on the basis of the historical catch record combined with other criteria in some of the fisheries. The quotas are all divisible and tradeable but with varying degrees of restrictions. There are no charges imposed on the quota allocation or holdings.

The outcome of these ITQ systems is generally judged to have been quite favourable both in biological and economic terms (Buck 1995, Ludicello et al. 1999, NCR 1999). The industry's satisfaction with the system can be inferred from the fact that Congress in 1996 felt it necessary to impose a temporary moratorium on further adoption of ITQs in US fisheries pending a comprehensive study of their effects.

9.2 Initial allocation of entitlements

9.2.1 Ocean quahog and surf clams

The initial allocation of ITQ (or more appropriately ITSQ) entitlements was on the basis of the historical catch record. For surf clams the historical catch record was for the four year period prior to the introduction of the system 1986-1989. For ocean quahog the historical period of reference was the nine years 1979-87 with more weight given to the last four years. In both fisheries there were some relatively minor modifications to this basic rule (Raizin 1992, Buck 1995, NRC 1999, OECD 1997).

9.2.2 Atlantic wreckfish

Half (50%) of the initial allocation of ITQ entitlements was based on the vessel owner's their catch record in either 1989 or 1990 (the ITQ program became effective in 1992) with the other half divided equally to all that had a history of participation in the fishery. To qualify as one with a history in the fishery, a vessel owner had to have landed at least 5000 pounds of wreckfish prior to 1991 (Buck 1995, NRC 1999).

---

[11] Actually, the ocean quahog/surf clam are two distinct fisheries with separate ITQ systems. However, as the product is similar and both fisheries are typically pursued by the same vessels, the fisheries are usually combined in written treatments and discussion.

[12] Again, these are two distinct fisheries with separate ITQ systems. The reason for treating them jointly is very much the same as for ocean quahog and surf clams.

9.2.3 Alaska halibut and sablefish fishery

The initial allocation of ITQ shares was only to vessel owners and lessors that had landings in at least one of the years 1988-1990 (the ITQ programme commenced in 1995). For halibut the allocations were based on the best 5 of the 7 years between 1984 and 1990. For sablefish, it was based on the best 5 out of the 6 years between 1985 and 1990. (Buck 1995, NRC 1999)

9.3 Definition of entitlements.

In all three fisheries the basic quota entitlement is an ITSQ, i.e. a share in whatever TAC is adopted by the authority every year. This multiplied by the TAC gives the annual quota. There is no term limit on the holding of the ITSQ. (Buck 1995, NRC, 1999).

It should be noticed that in the Alaska halibut and sablefish fishery, the ITSQ entitlement is only out of that part of the total TAC that is allocated to the ITQ fishery. The rest of the TAC goes to community development quotas (CDQ) and catches by other gear. It is not clear whether the ITQ part of the TAC will be constant. (Buck 1995, NRC, 1999).

In the Ocean quahog/surf clam fishery and the wreckfish fishery, ownership of a fishing vessels is not a requirement for holding quotas. Thus, quotas can be held by non-fishermen. In the Alaska halibut and sablefish fishery, the quotas are associated with vessels. Moreover, an owner who has bought his quota must be aboard the vessel when of his quota is caught. (Buck 1995, NRC, 1999). Clearly, this reduces the value of a quota to a potential buyer. Moreover, in the Alaska Halibut and sablefish fisheries, the fishing rights apply to specific management areas and specific vessel classes. Transferability of the fishing rights is restricted to the same management area and vessel class (Buck 1995, NCR 1999).

Thus it should be clear that the quality of the ITQ property rights (Arnason 2000) in the Alaskan halibut and sablefish fishery is considerable less than the other two fisheries.

9.4 Mechanisms to facilitate quota trades.

Apparently, there are no particular mechanisms set up by the fisheries authorities for the purpose of facilitating quota trades.

9.5 Restrictions on trade and ownership

In the ocean quahog/surf clam fishery the ITQs (both the permanent entitlement and the annual quota) are freely tradable. Anyone can hold ITQs and there are no upper limits on the size of ownership except to the extent that it may violate US antitust law (Buck 1995).

In the wreckfish fishery the ITQs are freely tradeable within the management area . As in the case of ocean quahog/surf clams, there are no upper limits on the size of ownership imposed by the management system. (Buck 1995, Ludicello et al. 1999, NCR 1999)

In the Alaska halibut and sablefish fishery, ITQ trades and holdings are subject to a number of restrictions that are constantly evolving (NRC 1999). ITQ may be traded within the same management area and vessel size/type category. Only 10% of catcher vessel ITQs may be leased however but all of freezer vessels' ITQs. Maximum individual holdings of 0.5% of the halibut quota and 1% of total sablefish quota are imposed. Further sub-area holdings restrictions also apply (Pautzke and Oliver 1997). Ownership of quotas is limited to initial recipients or those that can demonstrate at least 150 days of commercial fishing experience.

9.5 Volume of quota trade

Numerical information on the volume of quota trade in the ocean quahog/surf clam fishery and the wreckfish fishery is not available. However, anecdotal evidence (Buck 1995, Ludicello et al. 1999) indicates that trade in quotas has been substantial. This is also evidenced by the dramatic reduction in the the number of participants in the ocean quahog/surf clam and the wreckfish fisheries has been dramatically reduced (from 128 to 59 vessels in the first two years of the ITQ system in the ocean quahog/surf clam fishery and from 90 vessels to 40 in the first year of the ITQ system in the wreckfish fishery (OECD 1997)). This reduction in vessel numbers has continued. By 1995 the number of vessels in the ocean quahog/surf clam fishery was down to 35 (Ludicello et al. 1999, see also NCR 1999). In the wreckfish fishery the number of vessels was down to only 9 in 1996-7 compared to about 90 at the outset of the ITQ system (Ludicello et al. 1999).

Similar comments seem to apply to the Alaska halibut and sablefish fishery. Numerical data on trades are not available. Neverthless, trades seem to have been extensive (Ludicello et al. 1999). From the introduction of the system in 1995 to 1997, the number of halibut and sablefish quota holders was reduced by 24% and 18%, respectively (NCR 1999, See also Ludicello et al. 1999).

9.6 Resource rents extraction and/or management cost recovery.

The Magnuson and Magnuson-Stevens act explicitly prohibits the selling of quotas to the initial receivers. There is no special recovery of resource rents in these three ITQ fisheries. Recently, in 2000, a provision allowing the imposition of a management cost charge up to 3% of the total value of landings was implemented in the Alaska halibut and sablefish fishery (NMFS 2000). It is not clear to what extent the permission has been exploited.

9.7 The enforcement system

9.7.1 Ocean quahog/surf clams fishery

Monitoring on landings is based on reports from both fishers and processors (Raizin 1992). Cage tags, special tags associated with cages which are standard unit of measurement for clam landings, play an important role in this system. They must be attached to every cage and can thus be traced over the chain of transactions. In addition to this, some landings surveillance is conducted (NRC 1999). According to the NRC (1999), enforcement of the ITQ system was "rocky" at the outset but has since settled down and is believed to be in a fairly good shape (Ludicello et al. 1999). Following the introduction of the ITQ system, enforcement costs have plummeted (Buck 1995). The main reason is that with the introduction of the ITQ system, a lot of detailed conservation regulations became redundant and could be scrapped (Buck 1995)

9.7.2 Wreckfish fishey

The wreckfish MCS system is similar to the one for ocean quahog/surf clams. The annual quota allocation is accompanied with coupons representing quantity of fish. These coupons must follow the landed fish through the purchasing chain, thus making it possible to verify landings reports by following selling reselling trail. Reportedly, this system works pretty well (Buck 1995). As in the ocean quahog/surf clam fishery, the cost of enforcement has been reduced under the ITQ system (Buck, 1995, Ludicello et al. 1999)

9.7.3 Alaska halibut and sablefish fishery

The NMFS is responsible for the enforcement of the Alaska halibut and sablefish ITQ system. Enforcement is effected through a combination of real-time observation and the auditing of post-landings documentation. There is some dock-site monitoring but far from complete. However to facilitate the verification of landed volumes, deliveries of landings can only be made to registered purchasers with a minimum six hours notice to the NMFS (NRC 1999). The landings accounting system is highly automatic. At the beginning of the season, ITQ holders are issued with an IFQ (Individual Fishing Quota) card. This card works as a debit card. Annual quota allocations and purchases are added to the card and landings subtracted. At the time of landing the card holder swipes the card through specially programmed terminals and enters the relevant landing information which is then debited from his account. In addition a written report has to be submitted to the IPHC (International Pacific Halibut Commission). The landings information is verified by spot checks at the landing places and subsequent examination of the records submitted by the registered buyers of landings (NRC 1999). In addition to this, considerable at-sea MCS takes place both by Coast guard personnel and on-board observers (NCR 1999). Violations are punished by fines, forfeiture of quotas and even prison (NMFS 2000).

Apparently, the enforcement activity in the Alaska halibut and sablefish ITQ system has been quite successful (NMFS 2000, NRC 1999). Compliance with the quota restrictions seems to be good.

It is clear that under the Alaska halibut and sablefish ITQ system, the MCS activity has increased substantially. So has the cost (Buck 1995, NRC 1999). According to Buck (1995), the additional cost of the MCS in this fishery might be USD 2 million annually. However, the economic benefits are thought to greatly outweigh this cost.

9.8 Evidence of increased or reduced quota-induced discarding

Discarding has not been seen as much of a problem in the ocean quahog/surf clam and the wreckfish fisheries neither before nor after the introduction of the ITQ systems in these fisheries. there appears to have been a decline in discards of small clams in the ocean quahog/surf clam fishery after the introduction of the ITQ system (NRC 1999). In the wreckfish fishery there is no evidence of increased discarding after the introduction of the ITQs (Ludicello et al. 1999).

In the Alaska halibut and sablefish fisheries discarding has been regarded as a problem (NRC 1999). There is considerable evidence of reduced discards under the ITQ system. Thus in 1995, a few months after the completion of the introduction of the ITQ system, discards of halibut were reported to have been reduced by 24% in hte halibut fishery and 10% in the sablefish fishery (Buck 1995). Gilroy et al. (1996) find an even greater reduction in the discards of halibut but not a significant reduction in the discards of sablefish. This observation is confirmed by Pautzke and Oliver (1997). It is not clear whether these trends in discard behaviour can be attributed to the ITQ system as such or whether other factors such as increased monitoring are responsible.

9.9 Evidence of increased resource stewardship

There is good deal of anecdotal evidence of increased compliance and increased resource stewardship under these three ITQ systems. Thus, Ludicello et al. (1999) report that following the ITQs in the wreckfish fishery, the fishermen voluntarily greatly reduced the deployment of bottom longlines which are thought to damage corals, in favour of less damagin gear. Similarly, following the introduction of the ITQ system, fishermen´s demands for higher TACs evaporated (Gauvin et al. 1994). Finally, the SAFMC (South Atlantic Fisheries Management Council) reports that wreckfish ITQ holders have been co-operative and compliance is good (Buck 1995). Similarly, in the Alaska halibut and sablefish fishery, enforcement managers report good co-operation with the fishermen (NMFS 2000).

10. References

Adelaja, A., B. McCay and J. Menzo. 1998. ITQs: Market Share, Efficiency and Conservation. *Marine Resource Economics* 13(2): 115-34.

Agnarsson, S. 2000. Fisheries Management in Iceland (in Icelandic). In *Committee on Natural Resources: Report with Appendices*. Committee on Natural Resources. Reykjavik.

Annala, J.H. 1996. New Zealand's ITQ System: Have the First Eight Years Been a Success or a Failure? *Reviews in Fish Biology and Fisheries* 6:43-62.

Anonymous. 1994. *Experience with Individual Quota and Enterprise Allocations (IQ/EA) Management in Canadian Fisheries, 1972-1994*. Working Group Report. Policy and Economics Branch. Department of Fisheries and Oceans. Halifax.

Anonymous. 1994b. Fisheries Management Techniques. The Netherlands, OECD, Room Document nr. 12. OECD Paris.

Anonymous. 1995. *The First National Development Plan*. Vol. 1 and 2. National Planning Commission. Windhoek.

Anonymous. 2001. An ITQ System Introduced in Chile (in Icelandic). *Morgunblaðið* 14. Feb 2001 C2. Reykjavík.

Arbuckle, M. and K. Drummond. 2000. Evolutionof Self-Governance by Individual Transferable Quota. In R. Shotton (ed.) *Use of Property Rights in Fisheries Management*. FAO Fisheries Technical paper 401/1. Food an Agricultural Organization. Rome.

Arnason, R. 1990. Minimum Information Management in Fisheries, *Canadian Journal of Economics 23*:630-53.

Arnason, R. 1994. On Catch Discarding in Fisheries", *Marine Resource Economics* 9:189-207.

Arnason, R. 1994b. *Seaflower Whitefish Corporation: A Project Assessment*: A Report for the Nordic Development Fund. The Nordic Development Fund. Helsinki.

Arnason, R. 1995. *The Icelandic Fisheries*: *Evolution and Management of a Fishing Industry*. Fishing News Books. Oxford.

Arnason, R. 1995. On Selectivity and Discarding in an ITQ fishery. A paper presented at the 5th EAFE Workhop on Bioeconomic Modelling. Edinburgh.

Arnason, R. 1996a. Property Rights as an Organizational Framework in Fisheries. In B.L. Crowley (ed.). *Taking Ownership: Property Rights and Fishery Management on the Atlantic Coast*. Atlantic Institute for Market Studies.

Arnason, R. 1996b. *Analysis and Recommendations*. Industrial Fisheries Economics. Report 2. Ministry of Fisheries. Windhoek.

Arnason, R. 1996c. *On the Economic State of the Demersal and Midwater Fishing Sectors*. Industrial Fisheries Economics. Report 1. Ministry of Fisheries. Windhoek.

Arnason, R. 1996d. On the ITQ Fisheries Management System in Iceland. *Review in Fish Biology and Fisheries* 6(1):63-90.

Arnason, R. 1997. The Icelandic Individual Transferable Quota System: Motivation, Structure and Performance. In E.K. Pikitch, D.D. Huppert and Michael P. Sissenwine (eds. *Global Trends: Fisheries Management*. American Fisheries Society. Bethesda.

Arnason, R. 2000. property Rights as a Means of Economic Organization. In R. Shotton (ed.) Use of Property Rights in Fisheries Management. *FAO FisheriesTechnical Paper* 401/1. Food and Agriculture Organization of the United Nations. Rome.

Arnason, R. 2001. *Modern Fisheries Management*. A paper presented at the EFTA seminar on Fisheries Management Jan. 25, 2001. Brussels. Forthcoming.

Arnason, R. R. Hannesson and W.E. Schrank. 2000. The Costs of Fisheries Management. *Marine Policy*

Arnason, R., R. Hannesson and W.E. Schrank. 2000.Costs of fisheries management: The Cases of Iceland, Norway and Newfoundland. *Marine Policy* 24:233-43.

Batstone, C.J. and B.M.H. Sharp. 1999. New Zealand's Quota Management System: the First Ten Years. *Marine Policy* 23:177-90.

Baulch, K and S. Pascoe.1992. Bycatch Managemetn Options in the South-East Fishery. *ABARE Research Report* 92. Canberra.

Bernal, P.A, B. Aglia. ITQs in Chilean Fisheries. In A Hatcher and K. Robinson (eds.) *The Definition and Allocation of Use Rights in European Fisheries*. CEMARE. Miscellaneous Publications 46.

Bernal, P.A, D. Oliva, B. Aliaga and C. Morales. 1999. New Regulations in Chilean Fisheries and Aquaculture: ITQs and Territorial Users Rights. *Ocean and Coastal Management* 42:119-42.

Boyd, R.O. and C.M. Dewees. 1992. Putting Theroy into Practice: Individual Transferable Quotas in the New Zealand Fisheries. *Social Natural Resources* 5:179-98

Buck, E.H. 1995. *Individual Transferable Quotas in Fishery Management*. Report for Congress. Committee for the National Institute for the Environment. Washington DC.

Burke, D.L. and G.L. Brander. 2000. Canadian Experience with Individual Transferable Quotas. In R. Shotton (ed.) *Use of Property Rights in Fisheries Management*. FAO Fisheries Technical paper 401/1. Food an Agricultural Organization. Rome.

Campbell D. and T. Battaglene. 2000. Individual Transferable Catch Quota: Australian Experience in the Southern Bluefin Tuna Fishery. In R. Shotton (ed.) *Use of Property Rights in Fisheries Management*. FAO Fisheries Technical paper 401/2. Food and Agricultural Organization. Rome.

Casey, K.E., C.;. Dewees, B.R. Turris and J.E. Wilen. 1995. The Effects of Individual Vessle Quotas in the British Columbia Halibut Fishery. *Marine Resource Economics* 10:211-30.

Cerda-D'Amico R.J. and M. Urbina-Véliz. 2000. ITSQ in Chilean Fisheries: The Case of the Squat Lobster. A Paper submitted at *IIFET 2000* (forthcoming).

Clark, I. 1994. Fishery Management in New Zealand. In E.A. Loayza (ed.) *Managing Fishery Resources*, World Bank Discussion Papers 217. Washington DC.

Committee on Natural Resources. 2000. *Report with Appendices*. Committee on Natural Resources. Reykjavik.

Commonwealth. 1989. *New Directions for Commonwealth Fisheries Mangement in the 1990s: A Government Policy Statement*. AGPS. Canberra.

Connor, R. and D. Alden. 2000. Indicators of the Effectiveness of Quota Markets: The South-East Trawl Fishery of Australia. In R. Shotton (ed.) *Use of Property Rights in Fisheries Management*. FAO Fisheries Technical paper 401/2. Food and Agricultural Organization. Rome.

Criddle, K.R. and S. Macinko. 2000. Political Economy and Profit Maximization in the East Bering Sea Fishery for Walleye Pollock. A paper submitted at *IIFET 2000* (forthcoming).

Crothers S. Administration of Enforcement Mechanisms for Rights-Based Fishereis Management Systems. In R. Shotton (ed.) *Use of Property Rights in Fisheries Management*. FAO Fisheries Technical paper 401/1. Food an Agricultural Organization. Rome.

Davidse, W, 2001. Personal Communication.

Davidse, W. 1995. ITQs in the Netherlands: The Quota Market and its Consequences on Industry and Firms. Unpublished mimeogram. LEI-DLO the Netherlands.

Davidse, W. 1997. ITQs in the Netherlands. In G. Petursdottir (ed.) *Property Rights in the Fishing Industry*. Fisheries Research Institute. University of Iceland. Reykjavik.

Davidse, W. 1999a. *The Development toward Co-management in the Dutch Demersal North Sea Fisheries*. A paper submitter at Fish Rights 99. FAO. (Forthcoming).

Davidse, W. 1999b. The Effects of Transferable Property Rights on the Fleet capacity and Ownership of Harvesting Rights in the Dutch Demersal North Sea Fisheries. A paper submitter at Fish Rights 99. FAO. (Forthcoming).

Dewees, C.M. 1989. Assessment of the Implementation of Individual Transferable Quotas in New Zealand Inshore Fishery. *North American Journal of Fisheries Management* 9:131-139.

FAO. 2001. Databank. http://apps.fao.org/page/collections?subset=fisheries.

Fisheries Act. Revised Statutes of Canada. c.F-14, s.1.

Gauvin, J, J. Ward and E. Burgess. 1994. Description and Evaluation of the Wreckfish Fishery Under Individual Transferable Quotas. *Marine Resource Economics* 9(2):99-118.

Geen, G. and M. Nayar. 1989. Individual Transferable Quotas in the Southern Bluefin Tuna Fishery: An Economic Appraisal. In Neher et al. (ed.) *Rights Based Fishing*. Kluwer. Dordrecht.

Geen, G., W. Nielander and T.F. Meany. 1993. Australian Experience with Individual Transferable Quota Systems. In *The Use of Individual Quotas in Fisheries Management*, OECD. Paris.

Geen, G. 2001. Bycatch Management under ITQs in Australia. Paper given at 3° Seminario Internacional Del Promaspe. Buenos Aires.

GFAL. 1991. *Ley General de Pesca y Acuiculture* (in Spanish). Decree DFL no. 430 (28. Sept. 1991). Santiago.

Gibson, A. 1989. *ITQ Assessment - New Zealand*. Canadian Department of Fisheries and Oceans. Ottawa.

Gilroy, H, P.J. Sullivan, S. Lowe and J.M. Terry. 1996. *Preliminary Assessment of the Halibut and Sablefish IFQ Programs in Terms of Nine Potential Conservation Effects*. International Pacific Halibut Commission. Seattle

Gissurarson, H. H. 2000. *Overfishing: The Icelandic Solution*. Institute of Economic Affairs. London.

Gobrierno de Chile. 2001. *Law to Establish Management on the Basis of Maximum Catches per Fishing Vessel in Industrial Fisheries and Regulations for Registering Artisanal Fishing* (in Spanish). Subsecretaria de Pesca. Santiago.

Gordon, H.S. 1954. Economic Theory of a Common Property Resource: The Fishery. *Journal of Political Economy* 62:124-142.

Grafton, R,Q. 1996. Individual Transferable Quotas: Theory and Practice. *Reviews in Fish Biology and Fisheries* 6:5-20.

Grafton, R.Q. 1996a. Performance and Prospects for Rights-Based Fishereis management in Atlantic Canada. In B.L. Crowley (ed.) Taking Ownership: Property Rights and Fishery Management on the Atlantic Coast. Atlantic Institute for Market Studies. Halifax.

Grafton, R.Q. 1996b. Individual Transferable Quotas: Theory and Practice. *Reviews in Fish Biology and Fisheries* 6:5-20.

Hardin, G. 1968. The Tragedy of the Commons. *Science* 162:1243-47.

Harte, M. 2000. Industry Perspectives: Taking the Initiative for the Management of New Zealand's Commercial Fisheries. In R. Shotton (ed.) *Use of Property Rights in Fisheries Management.* FAO Fisheries Technical paper 401/1. Food an Agricultural Organization. Rome.

Harte, M. 2000b. Fisher Participation in Rights-Based Fishereis Management: The New Zealand Experience. In R. Shotton (ed.) *Use of Property Rights in Fisheries Management*. FAO Fisheries Technical paper 401/1. Food an Agricultural Organization. Rome.

Hoefnagel, E. and W. Smit. 1997. Co-management and Property Rights in the Netherlands. In G. Petursdottir (ed.) *Property Rights in the Fishing Industry*. Fisheries Research Institute. University of Iceland. Reykjavik.

Kaufmann, B, G. Geen and S. Sen. 1999. *Fish Futures: Individual Transferable Quotas in Fisheries*. Fisheries Research and Development Corporation and Fisheries Economics Research and Management Pty Ltd. Kiama.

Kidd, D. 2000. A Ministers Perspective on Managing New Zealand's Fisheries. In R. Shotton (ed.) *Use of Property Rights in Fisheries Management*. FAO Fisheries Technical paper 401/1. Food an Agricultural Organization. Rome.

Ludicello, S., M. Weber and R. Wieland. 1999. *Fish, Markets and Fishermen: The Economics of Overfishing*. Earthscan Publications. London.

Macgillivray, P.B. 1990. *Assessment of New Zealand's Individual Transferable Quota Fisheries Management* , Canadian Department of Fisheries and Oceans , Economic and Commercial Analysis, Report no. 75, Ottawa.

Major, P. 1999. Evolution of ITQs in New Zealand. In R Arnason and H. Gissurarson (eds.) *Individual Transferable Quotas in Theory and Practice*. University of Iceland Press. Reykjavík

McIlgorm A, and M. Tsamenyi. 2000a. Rights-Based Fisheries Development in Australia: Has it Stalled. In R. Shotton (ed.) *Use of Property Rights in Fisheries Management*. FAO Fisheries Technical paper 401/2. Food and Agricultural Organization. Rome.

McIlgorm A, and M. Tsamenyi. 2000b. Enhancing Fisheries Rights Through Legislation—Australia's Experience. In R. Shotton (ed.) *Use of Property Rights in Fisheries Management*. FAO Fisheries Technical paper 401/2. Food and Agricultural Organization. Rome.

Ministry of Fisheries. 1991. *Towards Responsible Development of the Fisheries Sector*. A White Paper. Ministry of Fisheries and Marine Resources. Windhoek.

Ministry of Fisheries. 1995. *Rreport of Activities and State of the Fisheries Sector*. Ministry of Fisheries and Marine Resources. Windhoek.

Ministry of Fisheries. 1999. *Fisheries Management 1999/2000: Laws and Regulations* (in Icelandic). Ministry of Fisheries. Reykjavik

Morris, P. 1994. *Economic Aspects of Living Marine Resources: Australian Contribution. Fisheries Management Arrangements in Australia: An Overview*. Australian Bureau of Agricultural and Resource Economics. Canberra.

NFMS. 2000. *2000 Report to the IFQ fleet*. Alaska Region National Marine Fisheries Service. Juneau.

NRC. 1999. *Sharing the Fish: Toward a National Policy on Individual Fishing Quotas*. Committee to Review Individual Fishing Quotas. National Research Council. National Academy Press. Washington.

OECD. 1997. *Towards Sustainable Fisheries: Economic Aspects of the Management of Living Marine Resources*. Organization of Economic Cooperation and Development. Paris.

OECD. 1997b. *Towards Sustainable Fisheries: Economic Aspects of the Management of Living Marine Resources: Country Reports*. Organization of Economic Cooperation and Development. Paris.

Oelofsen, B.J. 1999. Fisheries Management: The Namibian Approach. *ICES Journal of Marine Science* 56:999-1004.

Palsson, G and A. Helgason. 1997. Figuring Fish and Measuring Men: The ITQ System in the Icelandic Cod Fishery. In G. Palsson and G. Petursdottir (eds.) *Social Implications of Quota Systems in Fisheries*. Tema Nord 1997:593. Copenhagen

Pautzke, C.G. and C. W. Oliver. 1997. *Development of the Individual Fishing quota program for Sablefish and Halibut Longline Fisheries off Alaska*. North Pacific Fishery Council, Anchorage.

Pearse, P.H. 1991. *Building on Progress: Fisheries Policy Development in New Zealand.* A report prepared for the Minister of Fisheries, Wellington.

Pena-Torres, Julio. 1997. The Political Ecponomy of Fishing Regulations: The Case of Chile. Marine Resource Economics 12(4):233-80.

Raizin, 1992. Individual Transferable Quota Management of the Surf Clam and Ocean Quahog fishery of the Northwest Atlantic. *OECD Workshop on Individual Transferable Quotas* 1992, Paris.

Rogers P.P. and J.P. Penn. 2000. Shark Bay Prawn Fishery—A Synoptic History and the Importance of "Property Rights" in its Ongoing Management. In R. Shotton (ed.) *Use of Property Rights in Fisheries Management.* FAO Fisheries Technical paper 401/2. Food and Agricultural Organization. Rome.

Rogers, P.P. 2000. Topward a Better Future in Fisheries Management: Rights-Based Fisheries Management in Western Australia. In R. Shotton (ed.) *Use of Property Rights in Fisheries Management*. FAO Fisheries Technical paper 401/1. Food and Agricultural Organization. Rome.

Runolfsson, B, and R. Arnason. 1997. Individual Transferable Quotas in Iceland. In L. Jones and M. Walker (eds.), Fish or Cut Bait: *The Case for Individual Transferable Quotas in the Salmon Fishery of British Columbia*. Fraser Institute. Vancouver B.C.

Runolfsson, B. 1997. Regional Impact of the ITQ system in Iceland. In L. Jones and M. Walker (eds.), Fish or Cut Bait: *The Case for Individual Transferable Quotas in the Salmon Fishery of British Columbia*. Fraser Institute. Vancouver B.C.

Runolfsson, B. 1999. ITQs in Iceland: Their Nature and Performance. In R. Arnason and H. Gissurarson (eds.) *Individual Transferable Quotas in Theory and Practice*. Institute of Economic Studies, Reykjavik.

Runolfsson, B. 2000. *The Quota Exchange: The Fish Price Office and Restrictions on Transfers of Quotas* (in Icelandic). A Report for the Minister of Fisheries. Reykjavik.

Sharp, D.C. 2001. Monitoring the Performance of Commercial Fisheries Policy. *Marine Resource Economics* (forthcoming).

Sharp, D.C. and P.R. Roberts. 1991. *Task Force Review of Fisheries Legislation.* A submission presented by the New Zealand Fisheries Industry Board to the New Zealand Government Task Force on Fisheries Legislation.

Smith, P.J. 2000. The Pacific Halibut and Sablefish Individual Fishing Quota (IFQ) program off Alaska - a discussion of its Background, provisions, Performance and Pending Proposed Changes. A paper submitted at *IIFET 2000*. Forthcoming.

Stuttaford, M. 1994. Recovering from a near collapse of a rich resource. *Namibia Brief* 18, June 1994:12-17.

Turris, B.R. 1998. *Presentation to: Standing Senate Committee on Fisheries*. April 29 1998.

Turris, B.R. 2000. A Comparison of British Columbia's ITQ Fishereis for GroundfishTrawl and Sablefish: Similar results from Programmes with Different Objectives, Designs and Processes. In R. Shotton (ed.) *Use of Property Rights in Fisheries Management*. FAO Fisheries Technical paper 401/1. Food an Agricultural Organization. Rome.

van Vliet, M. 1998. Fishing as a Collective Enterprise — ITQs and the Orgaization of Fishermen. In D. Symes (ed.) *Property Rights and Regulatory Systems in Fisheries*. Fishing News Books. Oxford.

Weninger, Q. 1998. Assessing Efficiency Gains from Individual Transferable Quotas: An Application to the Mid-Atlantic Surf Clam and Ocean Quahog Fishery. *American Journal of Agricultural Economics* 80:750-64.

Wiium, V.H. 2000. *Fishery Management Costs: The Case of Namibia*. A paper presented at IIFET 2000.

Wiium, V.H. 2001. Resource Rent Collection in Namibian Fisheries (in Icelandic). *Morgunblaðið* 7. Feb. 2001. C5. Reykjavik.