International Cooperation in Fisheries Management: 
The ITQ System in an International Perspective

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SUMMARY: Many fish stocks are fugitive resources, migrating in and out of territorial waters. A system of individual transferable quotas, ITQs, may make their efficient management possible. Iceland is an example. She has negotiated, with her neighbouring countries, a share in the total allowable catch of several fish stocks in the North Atlantic Ocean. Then government has allocated this share as ITQs to fishing firms, on the basis of catch history. This makes owners of fishing vessels responsible partners in fisheries management, with a vested interest in the future of the stocks.

KEY WORDS: fisheries management, property rights, individual transferable quotas, international cooperation

INTRODUCTION

In the beginning of the 21st century, overfishing has emerged as a major problem: not only biological overfishing—exceeding the maximum sustainable yield of a given fish stock in a given fishing ground—but also economic overfishing—investing too much capital in, and committing too much labour to, the harvesting of fish. How can the fish stocks of the seven seas be managed to the maximum benefit of mankind? It is true that the worldwide extension of exclusive economic zones, EEZs, to 200 miles has enabled individual countries to manage fish stocks within those zones. But what about fish stocks that migrate in and out of territorial waters? And how are practical problems, even within territorial waters, to be solved? Such problems include how to restrict access to the fisheries, how to reach an agreement with owners of fishing capital (fishermen) on reducing fishing effort, how to set total allowable catches, TACs, in different fish stocks and to monitor the harvesting. Iceland, probably the only developed nation in the world largely dependent on fishing, has developed a system of individual transferable quotas, ITQs, in her fisheries where most such problems seem to be solved. In this paper, this system will be analysed and the analysis then briefly extended to harvesting in international waters.1

HOW TO RESTRICT ACCESS TO THE FISHERIES

In 1975, Iceland extended her EEZ to 200 miles. This meant that she could begin managing her fertile fish stocks. Between 1945 and 1975, with the introduction of ever more efficient fishing gear, and practically no restrictions on entry in the Icelandic fishing grounds, the Icelandic fishing fleet grew at a much faster rate than the total catch, as shown in Figure 1. This was a clear example of economic overfishing. There was biological overfishing, too. One of the most important species then was herring which roams in large schools over vast areas of the sea, near the surface. After a great “herring boom” of the mid-1960s, the stock collapsed in the late 1960s, until a moratorium was declared in 1972. Harvesting of herring resumed in 1975, but on a much reduced scale. Iceland now decided to set a TAC in herring over the annual fishing season and to divide this TAC equally between the herring boats in operation. To simplify somewhat: if there were 100 herring boats, then each received a quota of 1% of the TAC in herring; if the TAC for a given fishing season was set at 300,000 metric tonnes, MT, then each boat were allowed to harvest 3,000 MT over that fishing season.

In essence, this was an enclosure of the herring stock. Owners of fishing vessels in the herring fishery did not resist this for three main reasons. First, they were mindful of the collapse of the stock in the late
1960s. In the second place, the herring boats were all of roughly the same size, and with a similar catch history: initial allocation of individual quotas was therefore non-controversial; owners of boats received each the same individual vessel catch quota, a share in % in the TAC. Thirdly, there were no special local interests: the fleet chased the herring all over Iceland's territorial waters and even out of it. Soon, the boat owners realized their gain in being able to transfer quotas between themselves. Consequently, in 1979 the individual herring quotas were made transferable. A system of ITQs was now in place in the herring fishery, arguably one of the first such systems in the world. The other important pelagic species of fish in Icelandic waters is capelin, harvested in much the same way as herring. In 1980, individual vessel catch quotas were introduced in the capelin fishery, and in 1986 they were made transferable.

However, the demersal species of fish in Icelandic waters, first and foremost cod, but also redfish, halibut and other species, are even more important for the economy. Relatively territorial in nature, cod and other demersal species are found in feeding grounds near the bottom of the shallow continental shelf around Iceland. It became apparent soon after the extension of Iceland's exclusive economic zone in 1975 that the cod stock was declining. But how was access to be restricted? The demersal fisheries differed from the pelagic ones in two important respects. They were based on local fishing grounds, close to some fishing towns (where fishermen perceived their interests to be different from those of fishermen in other towns); and the fishing fleet was quite diverse in nature, consisting of large factory trawlers through mid-size multi-purpose vessels down to small boats, even undecked rowboats. Those two facts about the demersal fisheries meant that initial allocation of individual quotas was potentially much more controversial than in the pelagic fisheries. Indeed, in 1977-83 Iceland tried to manage the demersal fisheries by restricting effort directly, i.e. by setting a TAC and deciding on a number of allowable fishing days over the season with the aim of reaching this TAC. Predictably, this started a competitive rush to harvest as much as possible during the allowable fishing days. Vessel owners in the demersal fisheries invested in ever greater fishing capacity, and the already too large fishing fleet became larger still. Meanwhile, the number of allowable fishing days went down dramatically, for large trawlers in the cod fishery, for example, from 323 in 1977 to 215 in 1981. The system was also difficult to monitor, real total catches usually exceeding TACs by far.

When it became clear in 1983 that the system was not working, the Icelandic government, supported by the majority of fishing vessel owners, decided to experiment with individual vessel catch quotas in the demersal fisheries, similar to those previously issued in the pelagic fisheries. Resisting this was a strong minority of vessel owners from towns close to the most fertile fishing grounds (who preferred restrictions in terms of effort rather than catch) and owners of small boats. From the beginning of 1984 individual vessel catch quotas were issued in the demersal fisheries, as shares in % in the TAC, on the basis of catch history for the previous three years. They soon became transferable, and in 1990 a comprehensive law was passed under which such quotas were issued in all Icelandic fisheries without any time limits at all, and with few and insignificant restrictions on transfers. Expressed in percentages of the TAC, the quotas are called TAC-shares. Expressed in the allowed catch in MT over a given fishing season, they are called Annual Catch Entitlements, ACEs,—the ACE of a vessel being a simple multiple of the TAC over the season and the vessel's TAC-share. The TAC-shares in different fish stocks are interchangeable: cod is the common denominator of the system, the term “cod equivalent” denoting the relative market value of different species of fish, as determined by the Ministry of Fisheries each year. For example, in the 1998-9 fishing season the values were 1.00 for cod, 0.70 for redfish, 2.15 for Greenland halibut, 0.09 for capelin, 0.14 for herring and 8.55 for nephrops (lobster). The law began to apply in 1991.

HOW TO REACH AN AGREEMENT WITH FISHERMEN ON REDUCING FISHING EFFORT

The ITQ system in Iceland has worked tolerably well. Despite the reluctance of owners of fishing capital to divest (both because they hope for stronger existing stocks in the near future, and because they want to be ready if new stocks appear inside or outside Icelandic waters) the fishing fleet has been somewhat reduced, as shown in Figure 2. However, fishing effort has been reduced much more, especially in the pelagic fisheries. Moreover, fishing firms have become fewer, bigger and more efficient. It is significant that in 1990, total catch by the Icelandic fishing fleet amounted to 1,502,000 MT, while crews in the fishing fleet numbered, on average, 6,500. In 1999, on the other hand, total catch amounted to 1,730,000 MT, while crews numbered, on average, 4,400. The ITQ system in Iceland is quite similar to the system in...
operation in New Zealand and in individual fisheries in Canada, Australia and some other countries. When the widespread overinvestment in fisheries all around the world is observed, one might wonder why such a system is not more common. But the real question should be why such a system exists at all. The reason is that owners of fishing capital are likely to resist the restriction of their traditionally free access to the fisheries. What is crucial, therefore, is to reach an agreement with them on how to restrict this access. They have to be partners to any change in the system under which they harvest.

This can best be seen by looking at the alternative means of restricting entry in the fisheries which some economists proposed in the sometimes heated discussion about fisheries management in Iceland in the 1980s. They wanted government to auction off individual quotas to the fishing vessel owners, arguing that thus they would not be deprived of anything: Instead of wasting large sums of money on excessive fishing capacity and excessive fishing effort, the vessel owners would be using the same sums of money to pay for individual quotas. The rent from the fishing grounds, previously dissipated in excessive fishing effort, would simply be captured by government. This proposal was clearly unacceptable to the fishing community, to vessel owners as well as to their crews. They would have refused to pay for what they previously had enjoyed without any charge at all. On the other hand, receiving individual quotas on the basis of catch history, i.e. maintaining their share of the total catch over a previous period, would not have meant a radical change for them. Therefore, grudgingly, they could accept this, as they indeed did.

When the individual quotas were made transferable, soon after their initial allocation, a process was initiated by which fishing effort was gradually, and peacefully, reduced. Those who for whatever reason wanted to continue harvesting fish (for example and most commonly, because they were more efficient), could buy individual quotas from those who wanted to leave the fisheries, transfer the quotas to their vessels and consequently plan their harvesting operations more efficiently. The less efficient fishermen were bought out by tempting offers of money for their quotas, not driven out by their inability to pay for quotas in a government auction. Neither group could complain, those who chose to remain in the fisheries, and the others who chose to leave at a freely negotiated price. This was also a process over time, enabling the crews that lost their jobs to enter the onshore labour market.

It was the transferability of individual quotas which enabled those operating under the system to move from less to more efficiency. It is true that the end result was more or less the same as if the quotas had been initially auctioned off by government. The difference was that the process took longer and that no stakeholder in the fisheries—nobody with an existing interest in harvesting fish—became worse off. What happened was that those who had been utilising the fish stocks became owners of use rights to those stocks. They gained, while nobody else lost anything except the less than meaningful right to participate in a competitive and costly rush to harvest fish until the possible profit had fallen to zero—as will usually be the case under free entry. In other words, what happened was that a natural resource which had been treated as a free good, and therefore over-utilised, now became a capital good. It was difficult enough to develop the ITQ system in Iceland, and it would have been virtually impossible to develop it if the vessel owners had not received their initial shares in the TAC free of charge. Indeed, owners of some small boats still manage to stay outside the Icelandic system. They operate under effort restrictions, i.e. a given number of allowable fishing days.

**HOW TO SET TACS AND TO MONITOR HARVESTING**

The advantage of an ITQ system such as the Icelandic one is that the private interests of individual fishermen coincide with the public interest. Holding a right to harvest a given share in the TAC in a given fish stock, owners of fishing capital want to maximise the long-term profitability of this fish stock. In Iceland, owners of fishing vessels now fully support a cautious setting of TACs in different species. They have become ardent conservationists. This is hardly surprising. The change from a system of free entry to that of entry restricted to holders of ITQs amounts to taking the fish stocks in the Icelandic waters into custody and to make the owners of fishing vessels...
their custodians. ITQs have some of the most important characteristics of private property rights, such as durability, exclusivity, divisibility and transferability, and they serve to a large extent the same economic function as such property rights. But how are TACs set in the Icelandic system? The Ministry of Fishery sets them each year for the next fishing season on the recommendations of the Marine Research Institute, MRI, and after consulting with interest groups. After the ITQ system became comprehensive in 1991 the advice of the MRI has usually been followed quite closely. It is based on biological rather than economic considerations, with the aim of approaching the maximum sustainable yield, MSY.

Another agency, the Fisheries Directorate, FD, manages the system, mainly by controlling landings. All catch is weighed and its species composition recorded in special weighing stations in the 67 ports of Iceland (and in foreign ports as well). These data are fed into a computer at the FD which makes them available to holders of individual quotas who can check their catch status at any time. The FD also records quota transfers. All these data are posted daily on the FD’s homepage on the Internet. The Icelandic Coast Guard monitors fishing vessels at sea and enforces regional closures when they are deemed necessary by the Ministry of Fisheries.

The administrative costs of the ITQ system in Iceland are relatively small, about US$30 millions a year with a total catch value, in the late 1990s, on average about US$800 millions a year. The advice of the MRI on the MSY in each species has been as good as the available scientific knowledge allows. The fish stocks in the Icelandic waters have strengthened somewhat in the 1990s, but in mid-year 2001 it emerged that the MRI had somewhat overcalculated the strength of the cod stock. Therefore the TACs in cod for the next few years have to be set lower than previously expected. It should be pointed out that this mistake is not a reflection on the ITQ system but rather on the limitations of marine biology, a very complex and difficult discipline. When the traditional economic model of a fishery is analysed, as in Figure 3, it can be seen however that the maximum sustainable yield, MSY (with a fishing effort of 10 boats in the example in Fig. 3), should not really be the aim. Instead, it should be the maximum profit (the greatest difference between total revenues and total costs; with a fishing effort of 8 boats in the example in Fig. 3) which will practically always mean a lower TAC than if the aim is MSY. Putting it differently: It is not revenue (i.e. catch) which should be maximised, but profit. It should therefore not unduly worry the Icelanders if some TACs have to be reduced in the next few years. However, in the long run it would probably be best to move decisions on TACs from the Ministry of Fisheries to the Association of Fishing Vessel Owners: they have a direct, clear interest in trying to set TACs responsibly. It would be a step from the management of fisheries to their self-management. Indeed, it can also be demonstrated that the TACs can be set without having to process all the (sometimes unreliable) biological and economic data which can in theory be collected about the fish stocks. The TACs should simply be set in such a way that the market value of the ITQs will be maximised.

The Icelandic ITQ system is by no means perfect. Some of its defects are institutional: the partial exemption of small boats from the system; some (minor) restrictions on transfers; and the uncertain legal status of the ITQs, stemming from the reluctance of government to recognise them as at least on a par with private property rights. A much-discussed further defect is that of bycatches and highgrading. It is caused by the fact that, over a fishing season, quotas have to be expressed in metric tonnes, MT, whereas the values of two such tonnes need not be equal, either because they come from different species of fish or because specimens of one species differ in value. Bycatches—throwing away non-targeted species—are not much of a problem in the Icelandic fisheries because a quota in one species is easily transferred to a quota in another species, as they have a common denominator, namely cod. Highgrading—throwing away specimens of the targeted species, usually younger and smaller specimens—seems a greater problem. According to one estimate, it ranges from 1 to 6% of total catch, depending on types of gear and vessels. It does not however seem to be on the increase since the ITQ system became comprehensive in 1991. Until technology makes it possible to differentiate in harvesting rather than in landing between specimens.
of different values, strict surveillance of harvesting, e.g. by video cameras and observers onboard, seems the only feasible solution of this problem.

HOW TO MANAGE FISHERIES IN INTERNATIONAL WATERS

Some species of fish harvested by Iceland’s fishing fleet straddle her EEZ, shown in Figure 4 (above), like oceanic redfish in the Irminger Sea southwest of Iceland; or they migrate in or out of the EEZ, like herring and capelin; or they are outside the EEZ, in international waters, like deep-sea shrimp found in the “Flemish Cap” east of the Canadian EEZ and cod in the “Loophole” between the EEZs of Russia and Norway. On the oceanic redfish in the Irminger Sea, Iceland negotiates an annual TAC, and her share in it, within the Northeast Atlantic Fisheries Commission, NEAFC (the members of NEAFC being Iceland, the Faroese Islands, Norway, Russia and the European Union). Since 1997, Iceland’s share in this TAC has been allocated to individual vessels on the basis of catch history (the three best years of the six years in which this fishery had then been operated, with 5% of the total reserved for those who had started the harvesting, a so-called pioneers’ quota). On the Atlanto-Scandian herring which suddenly reappeared in the Northeast Atlantic Ocean in 1994 after the collapse of the late 1960s, Iceland also negotiates a TAC, and her share in it, within NEAFC. For the first few years, in 1994-7, entry was free each year until Iceland’s total share had been reached, but since 1998 Iceland’s share has been allocated to individual vessels on the basis of the then established catch history (and also to some extent, of vessel hold capacity).

On capelin, mostly found in Icelandic waters, Iceland negotiates with Greenland and Norway an annual TAC, and her share in it. Iceland’s share is then allocated to individual vessels on the basis of catch history. On the deep-sea shrimp in the Flemish Cap, Iceland has refused to participate in an agreement made by the North Atlantic Fishing Organisation, NAFO, because NAFO tries to control entry by restricting effort, i.e. allowable fishing days, while Iceland wants to control entry by restricting catch, i.e. by an ITQ system. Since 1997, Iceland has therefore unilaterally set a TAC for her own vessels on the Flemish Cap and allocated it to individual vessels as ITQs on the basis of catch history. In the cod fishery in the Loophole where Icelandic vessels operated in 1993-9, Iceland has not implemented any rules of her own. Disputed both by Norway and Russia, harvesting by Icelandic vessels in the Loophole ceased in 1999 under a treaty between those two countries and Iceland.

The lesson from this is that an efficient management of fisheries in international waters is certainly possible. Countries with an interest in harvesting fish stocks in those waters simply have to negotiate a TAC in those stocks and the share of each country in that TAC. Then each country can allocate its share in whatever way it wants to, where most economists would probably suggest ITQs, held by private fishing firms. The valuable tuna stocks in the Pacific Ocean immediately come to mind: Often harvested outside territorial waters, they have recently been in danger of over-utilisation. While an efficient management of international waters may thus be possible, it does not mean that it is likely to be introduced in the near future. Coastal countries on the one hand and countries with fisheries in distant waters on the other hand may, for example, perceive their interests to be quite divergent (just like fishermen in towns close to the most fertile fishing grounds in Iceland thought, in the 1980s, that their interests were different from those in other towns). The Icelandic experience suggests that the most difficult issues might be, neither the setting of TACs nor the monitoring of harvesting: once owners of fishing capital gain an interest in the long-term profitability of the resource, they will support a cautious setting of TACs and engage in monitoring one another. The most difficult issues might be how to reach an agreement between those countries concerned on their relative share in it, how then to exclude other countries from harvesting, and also how to reach an agreement within each country on the allocation of its
TAC-share. It is most likely that such issues could only be settled on historical principles, i.e. by recognising the interests that individual firms and countries may have gained by engaging in harvesting fish in international waters. The easiest way to introduce ITQs in international waters is to change such interests into well-defined rights and to make those rights transferable between individual firms of different nations. Then fishing firms from different countries will be able to trade their problems away instead of having to put pressure on their governments to fight them out.

CONCLUDING REMARKS

A system of ITQs is very attractive in theory. It seems to provide what economists sometimes often regard as an impossibility, a “free lunch”: In an ITQ system the rent dissipated by too much fishing effort under free entry will be captured, at least partially, and can be used to entice stakeholders in fisheries, most importantly owners of fishing capital, to accept restrictions on entry, in essence the enclosure of fish stocks. It is this captured rent which constitutes the free lunch. But in practice, the introduction of such a system may be difficult, although by no means impossible. There must be at least a strong majority in the fishing community that would perceive it as its own private interest to restrict entry to quota holders; and this it would only do if its very members were the quota holders—if in other words owners of fishing capital would be allowed to keep all or at least most of the rent which could be captured by this radical change in systems. If government appropriates the rent, or tries to do so, it makes less likely the widespread acceptance in the fishing community of the new system, however attractive it is in theory. Similar considerations apply to the introduction of an ITQ system in fisheries in international waters. It has to be advantageous to those with a stake in those fisheries. Here as elsewhere, if improvements are to be made, private interests have to coincide with the public interest.

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