Private Property Rights in World Fisheries: Individual Transferable Quotas

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At the beginning of the 21st century, overfishing has emerged as a major problem all over the world, not only biological overfishingCexceeding the maximum sustainable yield of a given fish stock in a given fishing groundCbut also economic overfishingCinvesting too much capital in the harvesting of fish. How can the fish stocks of the seven seas be managed to the maximum benefit of mankind? While the worldwide extension of exclusive economic zones, EEZs, to 200 miles has enabled individual countries to manage fish stocks within those zones, national problems of fisheries management still must be solved. Such problems include how to restrict access to the fisheries, how to reach an agreement with owners of fishing capital (fisherman) on controlling fishing effort; how to set total allowable catches (TACs) in different fish stocks; how to monitor harvesting; and how to manage fish stocks that migrate in and out of territorial waters. 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. Indeed, ITQs share many of the most important features of private property rights. Now, many countries, including Chile and Argentina, are seriously considering the adoption of a comprehensive system of ITQs. In this paper, the Icelandic ITQ system will be briefly analyzed and some common objections to ITQs discussed (for a fuller exposition, Gissurarson, 2000).

How to restrict access to the fisheries

Between 1945 and 1975, with the introduction of increasingly 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, to be expected under open access (Gordon, 1954). There was also biological overfishing. One of the most commercially important species at that time was herring which roams in large schools over vast areas of the sea, near the surface. After a great Aherring boom@ of the mid-1960s, a moratorium was declared in 1974. In 1975, Iceland extended her EEZ to 200 miles. This meant that she could begin controlling her valuable fish stocks.

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. 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 of the TAC. Thirdly, there were no special local interests: the fleet chased the herring all over Iceland=s territorial waters and even beyond. Soon, the boat owners realized their gain in being able to transfer quotas between themselves. In 1979 the individual herring quotas were made transferable, making this one of the first systems of ITQs in the modern 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 commercially more important. Territorial by 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 were different 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, ranging from large factory trawlers through mid-size multi-purpose vessels down to small boats, even undecked rowboats. Those two characteristics of the demersal fisheries meant that initial allocation of individual quotas was likely to be 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 the number of allowable fishing days sufficient to reach that. Predictably, this started a competitive rush to harvest as much as possible during the allowable period. Vessel owners in the demersal fisheries invested in ever greater fishing capacity, so the already overly large fishing fleet became larger still. 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.

By 1983 it became clear that the limits on fishing efforts were not working. The Icelandic government supported by a majority of fishing vessel owners imposed individual vessel catch quotas in the demersal fisheries, similar to those previously issued in the pelagic fisheries. A strong minority of vessel owners and their crews from towns close to the most fertile fishing grounds resisted, preferring restrictions on effort rather than catch, and owners of small boats. Beginning in 1984, individual vessel catch quotas were issued in the demersal fisheries, as shares of the TAC, on the basis of catch history for the previous three years. They soon became transferable, and in 1990, a comprehensive law established quotas in all Icelandic fisheries without any time limits, and with minor restrictions on transfers. Expressed in percentages of the TAC, the quotas are called TAC-

shares. Expressed in the allowed catch by weight, over a given fishing season, they are called Annual Catch Entitlements, ACEs,Cthe ACE of a vessel being a simple multiple of the TAC over the season and the vessel=s TAC-share. The law took effect in 1991.

How to reach an agreement with fishermen on reducing fishing effort

The ITQ system in Iceland has worked tolerably well. Despite some reluctance by owners of fishing capital to divest (because they hope for stronger stocks in the near future and want to be ready if new stocks appear whether inside or outside Icelandic waters) the fishing fleet has been reduced, as shown in Figure 2. However, fishing effort has been reduced much more, especially in the pelagic fisheries (Runolfsson, 1999). 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 metric tons (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 (Hagstof Islands, 2001). The ITQ system in Iceland is quite similar to the system in operation in New Zealand (cf. Major, 1999) and the Netherlands and in individual fisheries in Canada, Australia and some other countries. When the massive over-capitalization of fisheries prevalent in the world is observed, one might wonder why such a better system is not adopted more. But owners of fishing capital strongly resist the restriction of the traditionally open access. If ITQs are to be adopted, those owners have to be partners in any change in the system by which they harvest. One clear principle by which ITQs should be allocated initially to minimize resistance is that no fisherman would be worse off, and at least some better off (this is of course, the Pareto principle, cf. Buchanan, 1959).

Consider the alternative means of restricting entry in the fisheries, proposed by some Icelandic economists in the late 1980s

(Cylfason, 1990) that called for the government to auction off individual quotas to the fishing vessel owners. Fishermen would not be deprived of anything, it was argued. Instead of wasting large sums of money on excessive fishing capacity and effort, the vessel owners would be using the same sums of money to pay government for individual quotas. The rent from the fishing grounds, previously dissipated in over-capitalization, would simply be captured by government. But the fishing community was not persuaded, and for a good reason: while *as a whole*, it would not have been worse (or better) off, many individuals within it would have been worse off, namely those driven out by their inability to pay for the quotas in a government auction. Therefore, this proposal proved unacceptable to the fishing community, to vessel owners as well as to their crews. 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, they would grudgingly accept this.

When the individual quotas were made transferable, soon after their initial allocation, the fishing effort was gradually, and peacefully, reduced. Those who benefitted most from continuing to fish (typically because they were more efficient), could buy individual quotas from those who wanted to leave the fisheries. They could add the quotas to their vessels and expand their operations to efficient levels. The less efficient fishermen were bought out by attractive offers 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 those who chose to leave at a freely negotiated price. This occurred gradually, enabling the crews that lost their jobs to enter the labor market ashore. The end result was more or less the same as if the quotas had been initially auctioned off by government. The process took longer and no stakeholder in the fisheries**C**nobody with an existing interest in harvesting fish**B**became worse off. Those who had been exploiting the fish stocks became owners of extraction rights to those stocks. They gained, while nobody else lost anything except the less valuable

right to participate in a competitive and costly rush to harvest fish until the possible profit had fallen to zero**C**as is typically the case under open access. It was difficult enough to develop the ITQ system in Iceland; it would have been virtually impossible to achieve 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 ITQ 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 that of Iceland, is that the private interests of individual fishermen is made to coincide with the public interest. Holding a right to extract a given share of the TAC in a given fish stock, owners of fishing capital want to maximize the long-term value of this fish stock. In Iceland, owners of fishing vessels now support conservative settings 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 making 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 (Scott, 2000a).

At present, TACs in different fish stocks in Icelandic waters are set each year by the Ministry of Fishery 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). The advice of the MRI on the MSY in each species has been as good as the available scientific knowledge allows. When the traditional economic model of a fishery is analyzed, as in

Figure 3, it can be seen, however, that the MSY (here illustrated with a fishing effort of 10 boats), should not really be the aim. Instead, it should be the maximum profit (the greatest difference between total revenues and total costs; here shown with a fishing effort of 8 boats) which will practically always mean a lower TAC than the MSY. Putting it differently: it is not revenue (i.e., catch) which should be maximized, but profit. Thus, 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 interest in trying to set TACs responsibly. It would be a step from the management of fisheries to their self-management (Scott, 2000b). Indeed, it can be demonstrated that the TACs can be set without having to process all the (sometimes unreliable) biological and economic data which can be collected about the fish stocks (Aranson, 1990). The TACs should simply be set in such a way that the market value of the ITQs will be maximized.

Monitoring is neither difficult nor expensive under the Icelandic ITQ system. 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 million a year with a total catch value, in the late 1990s, on average of about US$800 million a year.

It is true that the Icelandic fisheries are much more complex than the simple (but illuminating) model in Figure 3 would suggest, not least because they are multi-species. This fact does not however make their management by means of ITQs impossible. Consider the much-

discussed problem of discarding: bycatches and highgrading. This is caused by the fact that, over a fishing season, quotas have to be expressed in metric tons (MT), whereas the values of two such tons need not be equal, either because they come from different species of fish or because specimens of one species differ in value. BycatchesCdiscarding non-targeted speciesCare not much of a problem in the Icelandic fisheries because quotas in one species are easily transferred to quotas in another species. The TAC-shares in different fish stocks are interchangeable: cod is the common denominator of the system, the term Acod 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 bycatch is therefore of value to the vessel owner. It is only if the cost of carrying it is higher than its market price that there is an incentive to discard it. HighgradingCspecimens (usually younger and smaller) of the targeted catch, depending on types of gear and vessels (Arnason, 1994). It does not however seem to be on the increase since the ITQ system became comprehensive in 1991. A possible means of minimizing highgrading might be to issue different quotas in the same fish stock and to make them interchangeable: the vessel owner has to regard it as a real cost to discard the less valuable specimens of the species. If this is not feasible and 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, like oceanic redfish in the Irminger Sea southwest of Iceland; or they migrate in or out of it, like herring and capelin; or they are wholly outside the EEZ, in international waters, like deep-sea shrimp found in the AFlemish Cap@ east of the Canadian EEZ

and cod in the ALoophole@ between the EEZs of Russia and Norway. With the oceanic redfish in the Irminger Sea, Iceland negotiates an annual TAC, including her share thereof, within the Northeast Atlantic Fisheries Commission (NEAFC). The members of NEAFC are: 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). For 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, along with her share. 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 Organization, 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 by Norway and Russia, harvesting by Icelandic vessels in the Loophole ceased in 1999 under a treaty between those two countries and Iceland.

An efficient management of fisheries in international waters certainly seems 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 as ITQs in private fishing firms. 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 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 among those countries concerned with their relative share; how to exclude other countries from fishing; and, how to allocate TAC within each participant. It is most likely that such issues could only be settled on historical principles, i.e., by recognizing the entitlements that individual firms and countries may have acquired by engaging in harvesting fish in international waters. The easiest way to introduce ITQs in international waters is to change such entitlements 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.

Two objections: concentration and inequality

Two common objections to using ITQs to regulate fishing are that it will lead to the concentration of quotas in the hands of a few, and that it will create intolerable inequality in the fisheries. While ITQs may be efficient from an economic point of view, it is said that their social consequences are neglected, or Aunder theorized@ (Palsson, 2000). It is true, as shown in Figure 4, that there has been a concentration of quotas in the hands of the largest Icelandic fishing

firms. In the fishing year 1991/92, the ten largest firms held 24.6% of the demersal quotas, whereas in 1998/99 they held 37.6%. This was to be expected. Consider again Figure 3, the traditional model of a fishery. Under open access, in this fishery effort will increase, i.e., boats added, until all profit has disappeared there (here, at 16 boats). The aim of fisheries management is to reduce the size of the fleet from 16 to 8 boats. This will almost inevitably, and desirably, mean some concentration: there were too many boats, and the task was to reduce their number. What is important in the Icelandic fisheries is that no fishing firm holding quotas is in a dominant position. The two largest firms in the demersal fisheries each held only 5.5% of the demersal quota in 1998/99. Also, those firms have become public corporations that have come under the ownership of many more people than before. The reason that many of them could increase their share of the total quota was precisely that they transformed themselves from small family-owned companies into large public corporations. The new owners, often numbering thousands of people, brought in the capital necessary to increase their share of the total quota. In 2001, there are about 20,000 shareholders in Icelandic fishing firms (out of a population of about 280,000). Therefore, at the same time as the quotas are in the hands of fewer firms than previously, those very firms are in the hands of many more people. It is likely that in this sense the quotas are in the hands of many more people than they were when originally assigned in the demersal fisheries beginning in 1984.

Underlying the argument against the assignment of ITQs to individual fishing firms is a belief that there is something unjust about allocating quotas to boats. Why did only vessel owners receive ITQs in Iceland, but not their crews, or even the general public? Why, in essence, were the vessel owners allowed to appropriate this valuable

resource, the fish stocks in Icelandic waters? One obvious answer is that it was they who had already made the decisions and took the risk. Over-capitalization in the fisheries can be regarded as an externality, or a harmful effect of economic activity (cf. Coase, 1960). It was the vessel owners who faced the externality; it was they on whom the cost was imposed. Their crews did not face any such externality; they simply sold their labor and their income was presumably determined by competition in the labor market; they could just as well have sold their labor ashore. Compare over-capitalization with another more familiar externality such as a factory emitting a foul smoke over a town. People realize that this is an externality because they can see and smell the smoke; it is irritating to them. The solution in this case would be to Ainternalize the externality@ by enabling those concerned to trade with one another, e.g., by requiring the factory to compensate the inhabitants of the town fully for the pollution (which would also induce the factory to seek other ways of disposing of the material presently emitted as smoke). But there are two important differences between the foul smoke from the factory and over-capitalization in a fishery. First, people do not always recognize over-capitalization as an externality, because they cannot smell any smoke, or hear any noise; the externality can only be brought out by economic analysis; it consists in profit foregone, in rent dissipated (Buchanan, 1997). In the second place, the factory pollutes the air for the inhabitants of the town, whereas the fishermen impose the cost of one another. But in both cases, the solution is essentially the same, to Ainternalize the externality@ by enabling those concerned to trade with one another. It would be ungainly if government stepped in and appropriated the profit foregone in the fisheries instead of allowing those exploiting the resource to enjoy it. Then the situation would not have improved for any of the fishermen: it would only have benefitted the government.

Concluding remarks

The Icelandic ITQ system is by no means perfect from an economic point of view. Some of its defects are institutional (and therefore corrigible), such as a partial exemption of small boats from the system and some (minor) restrictions on transfers. To be more efficient, it should be comprehensive, with no restrictions on transfers. Moreover, ITQs should not be attached to vessels, as they are at present, but rather freely transferable to and from all Icelandic citizens. An important improvement would also be to make the vessel owners responsible for decisions on TACs and the administration of the system. The worst institutional defect of the system is however, the uncertain legal status of the ITQs, stemming from the reluctance of the government to recognize them on a par with private property rights. While the Icelandic courts have not supported the opponents of the system in their attempts to challenge it, they have not, either, affirmed the rights of the quota holders. There is vocal opposition in Iceland to any recognition of ITQs as private property rights. Be that as it may, a system of ITQs is very attractive in theory. It seems to provide what economists sometimes regard as an impossibility, a Afree lunch.@ In an ITQ system the rent dissipated 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 the necessary restrictions on entry. 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. 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. Here as elsewhere, if political reforms are to succeed, private interests have to coincide with the public interest. This is the main lesson Chile, Argentina and other countries considering the adoption of a comprehensive system of ITQs in their fisheries can learn from the Icelandic example.

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