5 RIGHTS-BASED OCEAN FISHING IN ICELAND

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For most of the last century the world's fisheries were outside the jurisdiction claimed by coastal nations and thus subject to pure open-access conditions, often referred to as 'common property'. With larger and more effective fishing fleets, coupled with the rise in demand for fish, rapid and dramatic overexploitation of fish stocks resulted. Fisheries management was limited and largely ineffective.

In the last decades of the twentieth century, countries shifted the management of ocean fisheries within 200 nautical miles of their coastline from open access to intensive regulation. Governments attempt to restrict the total harvest of fish in order to stabilise or increase fish stocks. Yet such regulatory regimes have largely failed to stem the decline of fisheries because they do not alter the fundamental incentives that lead to overfishing. Change is therefore inevitable in the fisheries. Managing a fishery through top-down regulation does not solve the basic incentive problems caused by the lack of property rights to the fish stock. Excessive fishing still exists because of the absence of property rights.

Recently, several countries have replaced fisheries managed by command-and-control regulations with systems based on property rights. Rights-based fishing is increasingly recognised as a practical alternative to the inefficiencies of direct controls and regulation. The role of property rights in fisheries should be no different from the role of property rights elsewhere in the economy: property rights, if adequately defined and enforced, encourage efficient use of resources in the present with an appropriate regard for the future. Fisheries are but the last of the 'commons' resources to which private property rights will develop. History tells of enclosures and clearances of common land in response to changed economic circumstances. The private property system for land and other resources is responsible for increases in economic productivity in recent history. The expansion of property rights as a method of economic organisation should extend to transferable harvesting rights in fisheries. As with property rights on land, rights-based fishing will yield substantial economic benefits.

The fisheries problem

Only a generation ago, the supply of fish available from the world's oceans seemed plentiful. However, advances in fishermen's ability to catch, preserve, transport and sell fish quickly exceeded the ability of fish stocks to reproduce. World marine catches increased more than fourfold from 1950 to 1990, from less than 20 million tonnes to more than 80 million tonnes, but have stagnated at that level since. Furthermore, most of the world's most valuable fish stocks

are either fully exploited or overexploited, and, in economic terms, more than 75 per cent of the world's fisheries are underperforming or are subject to economic overfishing. Though most fisheries are biologically and technically capable of yielding high net economic returns on a sustainable basis, few actually do.

As a whole, the ocean fisheries appear to yield very small or even negative net economic returns. A study by the World Bank and FAO found that in 2004 the global ocean fishery operated at a significant net economic loss, an estimated $50 billion a year, and this loss was often financed by government subsidies. By contrast, the same study found that with proper management, the global fishery could yield positive net returns of more than 50 per cent of revenues on a sustainable basis (World Bank and FAO 2009).

Governments have responded to the decline in fish stocks with command-and-control regulation. These regulatory regimes attempt to reduce overfishing through various types of restrictions, including limits on the length of fishing seasons, the number of fishermen, vessel size, types of gear and the amount of fish that can be caught. Because such regulation rarely works, additional measures have been tried in order to limit the intensity of fishing efforts and number of fishers in a given fishery, including limits on investment in fishing efforts, buyback schemes, licensing and limited entry.

While such regulations drive up costs and discourage some fishing effort, they do not alter the fact that fish are valuable but no one owns them. Fish that are in the waters today may not be there tomorrow. Those who catch the

fish earn money. This fact, as well as the existence in many countries of government subsidies for the acquisition of boats and gear, encourages fishermen to explore further means for finding fish. For example, limits on vessel size encourage investment in more boats and in more sophisticated equipment; specifying which days of the week, month or year one can fish encourages more intensive effort on those days. Restrictions on fishing efforts make fishing less efficient than it could be. Seasonal closures coupled with improved fishing technology most often results in overcapitalisation and wasteful racing for fish.

Overfishing and other inefficient fishing practices have nothing to do with the nature of the resource, the characteristics of fishermen or the localities in which fish are found. Rather, inefficiencies are the direct result of the definition and enforcement of property rights in fisheries, or rather the lack of these. Fisheries are troubled by overfishing because private property is lacking. Fishermen own only what they catch. The government, which is to say, everyone and therefore no one, owns the stock of fish from which the catch is taken.

Creating rights to fishing

If fish stocks were privately owned, incentives would exist to conserve them because the gains from their preservation as well as the costs of their exploitation would accrue to their owners. Private owners will neither race to take fish nor deplete stocks that would enhance future catch because if an owner does either, he bears the cost. The

fisheries problem is therefore, in a sense, man-made. It stems from a particular social arrangement stipulating that everyone, or at least everyone belonging to a defined group, can harvest the fish stocks. The obvious remedy, therefore, is to replace this social arrangement with one – rights-based fishing – stipulating that only those with well-defined rights to harvest can fish (Neher et al. 1989; Scott 2008; Arnason and Runolfsson 2008). These rights, obviously, amount to private property rights which have been well-established as being efficient in other areas of economic production. There are several possible types of private property rights in fisheries (Arnason 2012; Wilen 2006; Wilen et al. 2012).

Common types of the less-than-perfect property rights used in ocean fisheries are territorial use rights (TURFs) and individual quotas (IQs) that may be transferable (ITQs). Under TURFs, fishers are allocated a certain area of the ocean, very much like a plot of land, for their exclusive use. The establishment of private ownership in coastal fisheries, where fish stay put, is conceptually simple and very analogous to private property on land. A coastline could be carved up and private owners would be allowed to take exclusive possession of the fish in their area, a TURF. The problem with this approach is that most species of fish (not to mention their eggs and larvae) move around so much that either the TURFs would have to be huge in order to enclose them or additional coordination mechanisms are required. As a consequence, TURFs are generally applied only to relatively sedentary species such as certain species of shellfish.

A system of Individual Transferable Quotas (ITQs) modifies simple Total Allowable Catch (TAC) regulations to prevent the race for fish. Under an ITQ system, the TAC is allocated as individual quotas to fishermen, fishing firms, or fishing vessels. ITQs are rights to harvest a certain volume of fish. While ITQs are more widely applicable than TURFs, they are not property rights in the resources themselves (i.e. the fish stocks and their ocean habitat). This limitation reduces the quality of ITQs as property rights and therefore their effectiveness in maximising the flow of economic benefits from the fishery.

An ITQ system giving operators a right to a share of the harvest is not as good as a right to all fish in a defined territory. ITQs are not perfect rights because the gains from behaviour that negatively affects the stock of fish, like cheating on one's quota, accrue to only one person, while the losses are dissipated among all other owners of the quota. But because ITQs provide security for a share of the harvest, fishermen will not dissipate the wealth in a fishery by competing among themselves for a greater share of the total catch. Even though ITQs are not ideal property rights, they provide a practical and politically achievable reform for the traditional ineffective systems of fisheries management.

After the initial quotas are set, fishermen are free to adjust their share by buying, selling, or leasing a quota. This approach allows fishermen to better respond to market conditions by adjusting the nature, timing and scale of operations to produce a more profitable harvest. The quotas in an ITQ system should be proportional (the right to a percentage of the TAC) and permanent property rights. Absolute changes

in the TAC will then translate into proportionate changes in each individual's quota holdings without any adjustment in the ITQ. The ITQ should also be allocated in perpetuity. Fishermen with a permanent interest in the harvest will manage their behaviour more efficiently.

There has been a great increase in the use of ITQ systems in fisheries around the world in the past four decades since their introduction. That by itself suggests that they are generally found to produce at least some benefits compared to the alternatives. The particulars of individual quota systems do vary greatly, not least in the degree of quota tradability, and it can often be difficult to distinguish between systems of tradable and non-tradable quotas. Nevertheless, it can be safely asserted that ITQs have been adopted in hundreds of individual fisheries around the world. The first ITQ systems in ocean fisheries were introduced in the 1970s and by 2010 at least 22 significant fishing nations were using ITQ systems as a major component of their fisheries management. It has been estimated that the total volume of marine catch taken under ITQs may be about 22 million tonnes, out of the annual global ocean harvest from capture fisheries of just over 80 million tonnes in recent years. Catch taken under ITQs is therefore as much as a quarter of the global harvest (Arnason 2012).

Criticism and concerns about an ITQ system

Despite their growing acceptance, ITQ systems have attracted criticism. Several different claims are frequently made and we will examine the most important ones here.

The first criticism concerns our understanding of fish stocks and that it is insufficient to determine the correct TAC. The critics are correct that fisheries management is as much art as it is science. But the scientific limits of our knowledge of fishery dynamics affect all fisheries management systems equally. That is because the TAC concept is a central feature of all systems of fisheries management. The purpose, whether it is explicit or implicit, of the restrictions and regulations in all systems of fisheries management is to limit the catch to a level that a fishery can tolerate. The explicit TAC in an ITQ system is preferable to the indirect ineffective methods of limiting the catch.

The benefits of an ITQ system exist even in the presence of scientific uncertainty about the long-run sustainability of any particular TAC. The TAC will be continuously adjusted because of the inherent biological variability in fisheries and their ecological interrelationships. Our understanding of those issues, and hence our ability to set TAC at a sustainable level, should improve over time. Whether the TAC is set too high or too low will not affect the assertion that ITQs will maximise income from the TAC. For most fisheries, only a TAC that is set too high year after year will create difficulties. There is also some evidence that under ITQs the previous long-term decline of fish stocks has been halted and even reversed (Costello et al. 2008, 2010). This empirical evidence, limited though it may be, fits well with the economics behind ITQs.

Another criticism concerns the discarding of fish. Although discarding in world fisheries is well known and estimated to be quite high (World Bank and FAO 2009), there

is concern that this problem is even larger under ITQs. When ITQs are used in a multi-species fishery there may be a problem of by-catch. That is, fishing vessels aiming to harvest particular species which they have quota for may harvest other fish for which they do not have quota and will therefore discard those fish. But ITQs are now being used in multi-species fisheries and the lessons learned from that experience indicate that this is not really a problem. Fishers most often have sufficient mix of quota for the various species that are likely to be by-catch.[1]

In addition to by-catch problems, critics claims ITQs encourage 'high-grading'. This refers the process of discarding smaller fish in the hope of catching larger, more valuable ones.[2] Providing proper incentives for fishers and sufficient monitoring of their actual behaviour should reduce high-grading and other discarding of fish.

1 One way to address the potential discard problem of by-catch is to have some flexibility in the system. Sufficient flexibility in balancing catches after the fact by acquiring additional quota for the by-catch could help. Another option to increase flexibility would be to establish 'equivalent rates' of fish species, whereby catch in one species can be covered by quota of another species. Yet another is to allow landings of some by-catch that would not be counted towards the fisher's quota, but where the fisher has to surrender the catch value of that by-catch.

2 This problem arises, at least partly, due to the fact that the quota refers not to the number of individual fish but rather to the weight of fish. For some species of fish market prices could be such that one kilo of 'big fish' is more valuable that two kilos of 'small fish'. This situation could provide incentives for 'high-grading'. How much of a problem this would be depends on the price dispersion between the different sizes, as well as the costs and benefits of additional fishing, transporting, etc. Monitoring and enforcement of discarding also matter of course, as well as the flexibility mentioned in the previous footnote.

The problems of high-grading and discarding also seem to be much smaller than claimed and the empirical evidence suggests, contrary to critics, that lower discard rates are one of the benefits of catch-share systems. A recent paper reports that the discards-to-retained-catch average in the fisheries studied actually fell by almost a third over a five-year period and two thirds over ten years. Almost all the fisheries studied reported a lower discard rate under catch shares than under traditional management (Grimm et al. 2012).

Yet another criticism is concentration of quotas: that communities or geographical regions may suffer quota loss and that 'smaller' fishermen will lose out to 'bigger' fishermen. The empirical evidence would appear to offer some support to this assertion. The reason is the improved economic efficiency of the fisheries, and from that viewpoint these results are to be welcomed. In fact, many would point out that a key purpose of reforms in the fisheries is to decrease the number of fishing vessels that are chasing the fish, and fewer vessels result in fewer fishing firms operating.

But if there are concerns about this there is always the option of limiting these effects. An ITQ system could limit ownership concentration through regulatory caps, set aside community quotas which may only trade within a community or region, and set up separate ITQ systems for 'small' and 'big' vessels that have more restricted trade between systems. Such limitations will no doubt come at the cost of economic efficiency and that should be acknowledged explicitly by policymakers.

A related criticism is the concern that harvesting rights will exclude new fishermen. The perception that closing

the commons excludes some from access to fishing is accurate, but the concern is overstated. The fishing of ocean resources is currently excessive, so by definition, some who are currently fishing will not be fishing in the future. This fact is unaffected by the management system in place. The ITQ system, in fact, is superior to the traditional system because as long as people can trade the quota rights, nobody is automatically excluded. And once you obtain an ITQ right, the fish will actually exist for you to catch. Under a traditional system, everyone is free to fish, but the race to harvest often implies only a 'right' to harvest fish at no profit, a right worth nothing.

The argument that ITQs allow the use of fisheries by some people to the exclusion of others often seems nothing more than an argument against the institution of private property. The long and bitter experience with public ownership of resources in the former Soviet bloc suggests that the argument should be put the other way; lack of private ownership allows the exploitation of resources by some to the detriment of others. By contrast, a legitimate concern in the creation of an ITQ system is the mechanism used to distribute the initial quota rights. An auction favours those who have access to capital. A lottery favours those who are lucky. Allocation to existing fishermen favours history, and is politically the most feasible and most appropriate option from an economic perspective (Anderson and Libecap 2010; Anderson et al. 2011).

One additional criticism of ITQs is that such schemes are more expensive to administer and enforce than traditional types of schemes. All fisheries management

schemes have costs, but the advantage of ITQs is that they focus attention on the explicit costs of management versus the economic benefits. Improvements to management are more likely to be initiated if the costs of management are transparent. As ITQs result in improved economic efficiency and profitable fisheries, they can pay for increased and more expensive monitoring and enforcement.[3]

ITQs in practice

Several countries have recognised the need for change and taken a different approach, after experimenting first with various regulatory regimes and witnessing their failure. Their emphasis is to rely more on managing the fisheries within a rights-based framework instead of management by direct control and regulation. Although no country has yet completely privatised their fisheries, many countries have experimented with property-rights-based management including Australia, Canada, the US, Chile, Peru, Namibia, South Africa, Norway, Russia, the Netherlands, the UK and several other European Union countries (Arnason and Gissurarson 1999; Shotton 2000; Arnason 2002; Hannesson 2004). In addition to these examples, New Zealand and Iceland have used property-rights management more

3 It seems that in countries that had adopted ITQs by 2000 the cost of enforcement was no greater and often smaller than in the other countries (Schrank et al. 2003). A suggested explanation may be found in the ineffectiveness of other types of management systems, that led governments to implement increasingly complicated and costly measures to address the resulting problems (see Arnason 2012).

extensively than other countries. Here we will look briefly at the Icelandic experience with fisheries management in recent decades (Runolfsson 1999; Arnason 1995, 2005).

Iceland was one of the first nations to adopt the ITQ system in its fisheries in the 1970s and 1980s, and there is therefore considerable evidence on the system's impact. Iceland is a moderately large fishing nation (19th on a global scale in 2009) and one of the most fisheries-dependent countries in the world. In recent years catches have amounted to about 1.6 million tonnes annually (reaching a peak of 2.2 million tonnes in 1997), some 2 per cent of the global marine harvest. About 40 per cent of its export earnings have been generated by fish products. The fishing industry has directly accounted for over 10 per cent of gross domestic product and, according to a recent estimate, directly and indirectly for up to 25 per cent (Arnason 2008).

Before the introduction of its ITQ system, Iceland experimented with a wide range of alternative fisheries-management systems. These included access licenses, fishing effort restrictions, investment controls and vessel buyback programmes, all of which were found to be unsatisfactory. The Icelandic ITQ system was created because of sharply declining stocks of herring in the late 1960s and early 1970s, and cod in the 1980s.

Following the extension of the exclusive fishing zone (EEZ) to 200 nautical miles, the major demersal fishery, the cod fishery, was subjected to an overall catch quota (TAC). The annual quotas recommended by the marine biologists soon proved difficult to maintain. Hence, individual effort

restrictions, taking the form of limited allowable fishing days for each vessel, were introduced in 1977. The demersal fleet, however, continued to grow both through improvement of existing vessels and via new entry as it was still possible for new vessels to be added to the fleet. The annual allowable fishing days, therefore, had to be reduced from year to year. At the beginning of the individual effort restriction regime in 1977, deep-sea trawlers were allowed to pursue the cod fishery for 323 days only. Four years later, in 1981 this number of allowable fishing days for cod had been reduced to 215 days. This system was economically wasteful. Following a sharp drop in the demersal stock and catch levels, a system of individual vessel quotas was introduced in 1984.

Initially, the vessel quota system was instituted for one year only. Only vessels under 10 GRT (Gross Register Tonnage), which accounted for only a tiny portion of the demersal catch, were exempt from the quota system. In 1985, the system was extended for another year but with an important provision added; vessels preferring effort restrictions could opt for that arrangement instead of the individual quota restriction. This system was extended largely unchanged for an additional two years in 1986, and then again for the period 1988–90, and now included all vessels except small vessels using only hook and line gear. Although the acceptance of the individual vessel quota system was based on agreement between the government, parliament, the fishing industry and other stakeholders, policy challenges emerged in the late 1980s. For example, the catches of the many important species were still

exceeding scientific advice and even the TACs decided by the government. The excessive fishing became unacceptable and there was substantial pressure to integrate different effort restrictions into a single management system so that all operators could use the same rules. These developments led to the Fisheries Management Act in 1990, providing a legal basis for a fairly uniform and comprehensive ITQ system.

This Act, which became effective in 1991 and is of indefinite duration, abolished the limited effort option in the demersal fisheries. Moreover, vessels between 6 and 10 GRT were incorporated into the ITQ system. However, the exemption from the ITQ system for vessels under 6 GRT was retained with the provision they could only use fishing gear based on 'hooks and line', i.e. fishing with any type of nets was forbidden. Since then, the ITQ system has been extended in several steps and now comprises practically all Icelandic fisheries.[4]

Before 1991, the ITQ systems in place were limited both in terms of the fisheries they applied to and fleet coverage. Several fisheries and fishing fleet classes were not covered and the continuation of the policy was somewhat uncertain. Long-term transfers of quota rights were still problematic and, as a result, quota holdings were generally

4 A comprehensive fisheries-management legislation stipulating ITQs as the main fisheries-management system was passed in 1990 (Act no. 38/1990). Since then, changes in the legislation and the associated regulations have been made almost every year. So many were the changes and amendments (35 by 2005) that the whole legislation was rewritten in 2006 (Act no. 116/2006). Since 2006 many further changes and amendments have been passed by the parliament.

not accepted directly as collateral by financial institutions. Fisheries management legislation had limited duration, for one to three years, due to the use of sunset clauses. The quality of the property rights created was therefore limited.

This changed with the 1990 Act, which made the ITQs indefinite. The system was formally established as the cornerstone of Icelandic fisheries management. Its coverage was greatly increased and its property-rights attributes were clarified. Thus, in spite of the small-vessel exemption (abolished in 2004), from 1991 onwards a high-quality ITQ system may be said to have applied in the Icelandic fisheries. However, the legislation for the system still does not establish perfect (harvesting) property rights. Most importantly, there is still some uncertainty about the system's permanence as a parliamentary majority could always revoke the legislation and revert to regulated open access. In addition, the quotas are subject to special taxation, which reduces the value of the property right.

The basic property right in the system is a share of the TAC for every species for which there is a TAC. The quotas are permanent (of indefinite duration), perfectly divisible and transferable.[5] The legislation has a provision for a ceil-

5 The term or duration of the TAC-shares is not stipulated in law. Although it is clear that they are not explicitly in perpetuity, they may turn out to be so. More precisely, according to legal opinion, the ITQ system may be abolished and the TAC-shares withdrawn without compensation to the holders, provided a notice of several years is given. Therefore, this basic asset of the ITQ system must be regarded as being of uncertain duration. TAC-shares, however, are secure in the sense of being protected by law like any other asset and they exhibit certainty in exclusivity over the corresponding harvests.

ing or maximum quota holding for individual species as well as an overall ceiling for all species.[6] The permanent TAC-shares held by any company or individual are subject to an upper bound that ranges from 12 per cent of the TAC for cod up to 35 per cent of the TAC for ocean redfish. Moreover, an individual company must not control more than 12 per cent of the value of all TACs. These stipulations are explicit to prevent what is regarded by parliament as excessive concentration in the fishing industry.

The cost of administering and monitoring the ITQ system in Iceland has not been greater than expected. The Fisheries Management legislation indirectly provides for cost recovery of fishery management costs. In addition to a (small) fee for commercial fishing licenses, there is both a general tax and a special tax on quotas, and the former may be seen as a cost recovery measure. The Icelandic government operates the Marine Research Institute (MRI), which conducts oceanographic and fisheries research and makes recommendations about annual TACs in different species of fish to the Ministry. Its operating costs are paid out of the government budget.

What has the ITQ system in the Icelandic fisheries achieved and what could it be expected to achieve? Some

6 ITQs or TAC-shares are calculated in so-called cod equivalents. The term 'cod equivalent' refers to weight and implies the relative value of different fish species on the market compared with cod. For each vessel having a quota for several species, the total quota may be calculated in kilos as cod equivalents. This aggregate value is calculated in cod equivalents using species exchange rates (essentially price ratios) set annually by the Department of Fisheries and Aquaculture within the Ministry of Industries and Innovation.

critics have claimed that it has not resulted in a recovery of fish stocks, cod stocks in particular. As cod stocks are recovering and stocks in general are in a stable condition, this criticism is misplaced. Resource conservation is achieved by setting the total quota appropriately, no matter what system of fisheries management is adopted. The ITQ system is mainly a tool to achieve economic efficiency, given that a TAC and ITQs also help conservation by making it easier to keep the catch within the set limits and by fostering an attitude of conservation among quota holders.[7] The total catch quotas in the Icelandic fisheries were simply set too high by the government during most of the past few decades and it is only in recent years, with support and even effective pressure from the industry, that TACs have been more conservative. Setting catches more conservatively is in the long-term interest of the industry when they have a stake in increased future catches.[8]

The experience with the ITQ system is generally favourable. The Icelandic summer-spawning herring stock was

7 A survey by Branch (2008) of more than 200 peer-reviewed papers on the effects of ITQ programmes reports that participants in catch-share fisheries often support lower TACs. Based on this, there seems to be a general tendency that the adoption of catch-share reforms encourages fishers to support lower and more sustainable TAC limits.

8 The government therefore now follows the TAC advice of the MRI very closely. The recommended TAC by the MRI, it should be noted, is the biologically based maximum sustainable yield (MSY) and not (necessarily) the economically MSY. The difference in essence is that the MRI is trying to maximise the biological yield (the maximum catch from a sustainable stock) whereas an economist (or owner) would maximise the economic yield; the long-term profit (maximum catch for maximum sustainable profits).

the first fishery where ITQs were initiated, when the fishery was reopened in 1975 after it collapsed in the late 1960s. Catches of herring increased and, more importantly, catch per unit effort has increased significantly.[9] The number of vessels in the fishery has declined from more than 200 in 1980 to fewer than 30 by 1995, although the average vessel size has increased substantially.

The demersal fisheries, for example, cod fisheries, have been slow to improve, one reason being that the TACs were set too high in the 1980s and there was still fishing in excess of TACs into the 1990s. Politicians chose a gradual approach to reducing the cod catch, despite recommendations by the Marine Research Institute (MRI) for steeper cuts. Only more recently has the TAC been close to the levels suggested by the MRI. That was done at the insistence of the Association of Vessel Owners (an organisation of the owners of larger vessels), which wants to preserve the value of their ITQ assets. Stocks seem to have rebounded in recent years. Both the fishable stock and the spawning stock of cod have grown over the last few years and the spawning stock is now more than twice as large as it was for most of the last decade. Indeed, it hasn't been this big since the early 1960s. The fishing mortality rate of cod has decreased and the harvest rate (proportion of the fishable stock) has also decreased. This change means that year classes last longer in the overall population and stocks are growing as a result. The proportion of older fish

9 In 2009 the Icelandic summer-spawning herring stock was heavily infected by *Ichthyophonus*. It is estimated that roughly 40 per cent of the stock died because of the infection but it has slowly recovered since then.

in catches has increased despite the fact that rather small year classes are now the majority of the fishable stock. These effects are seen in increased catch per unit effort and more economical use of allowed quotas.

As noted above, high grading – the discarding of less valuable catch – is a problem often attributed to ITQ systems, especially in mixed fisheries. The Icelandic demersal fisheries are certainly mixed fisheries. Nevertheless, there is little evidence of increased discarding under the ITQ system. In fact, according to measurements by the MRI, discards in the most important demersal species are only 1 per cent of average of total catch volume.[10] The rate of discards has also declined since the introduction of ITQs. Discards in pelagic fisheries are also insignificant.

As mentioned above, small vessels were initially exempted from the ITQ system, with the aim of protecting 'little' fishermen from 'big' fishermen. Predictably, this exemption resulted in a large increase in the number of small vessels. To counter this increase, several measures were introduced. In 1988 small vessels were limited to only using fishing gear based on 'hooks and line' and in 1991 vessels between 6 and 10 GRT were incorporated into the ITQ system. Finally, in 2004 a separate ITQ system for the fleet of small vessels with hook-and-line permits was put

10 Discards depend on gear and vessel type and can amount to a high of almost 5 per cent, although the total average is less than 1 per cent (see http://www.hafro.is/Bokasafn/Timarit/fjolrit-171.pdf). There is some flexibility in the Icelandic system (see above), such as allowing catch in one species to be covered by quota of another species, with 'cod equivalent rates' and by allowing landings of some amount of juvenile fish that is not counted towards the fisher's quota.

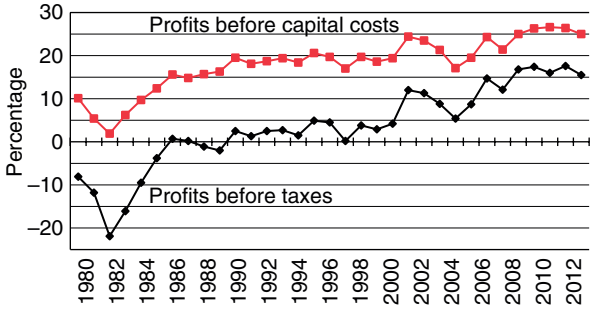
in place.[11] About 300 small vessels were active in fishing in 1984 and this had increased to more than 2,000 in the early 1990s, but in 2012 there were only 342 in the small vessel ITQ system.[12]

Since 1990, when the comprehensive ITQ system went into effect, there have been substantial improvements in the economic efficiency of the demersal fisheries. Total fishing effort went down by more than 30 per cent in the first 10–15 years after the ITQs were introduced. Fishing capital, which had increased by more than 400 per cent during the period 1960–90, has actually declined since 1990, and the number of vessels has also declined. In 1992/93, there were 1,265 vessels with ITQs and another 1,125 with hook licenses, or 2,390 in total (there were some 162 additional vessels with commercial fishing licenses but without quota). In September 2012 only 603 vessels in total were allocated quotas (had ITQ shares), of which 261 were in the ITQ system for larger vessels and 342 in the small-vessel ITQ section (the total number of fishing vessels in Iceland was 1690 in January 2012). This reduction in the number of vessels, and increased quota concentration

11 With the change in 1988 a number of small vessels chose to receive quotas and become part of the ITQ system so that they could continue to use the fishing gear of their choice. Their individual quota was based on their catch in previous years. This provided an incentive for other small vessels to race for quota and not only race for fish. That is, they invested in a catch record, expecting this would determine their individual quota in the future, when all commercial vessels would be incorporated into ITQs.

12 As part of this process of small vessels being subject to an ITQ system the vessel size limits have been changed from the initial 6 GRT in 1991 to 15 GRT in 2008, and 25 GRT in 2014.

Figure 4 Profits in the Icelandic fisheries industry, 1980–2012



Note: Net profit as a % of revenue before and after (imputed) cost of capital, based on actual accounts.
Source: Statistics Iceland.

at the same time, is financed by the fishing industry itself. That is, the fishing firms buy each other out and improve their efficiency, without the state being directly involved or government subsidies.

The main purpose of the ITQ system is to improve the economic efficiency of the fisheries. The Icelandic fisheries are biologically very productive and should be able to generate high economic rents. Until the adoption of the vessel quota system, however, comparatively low rents were generated in the industry. In fact, during the years preceding the introduction of the vessel quota system, industry profits were often highly negative (see Figure 4). Since the introduction of ITQs the quality of the harvest and profits have improved significantly and, as mentioned above, fishing effort has been reduced. Overall productivity and efficiency has therefore increased greatly.

Conclusion

The current global marine catch could be harvested with approximately half of the current global fishing effort. In other words, there is massive overcapacity in the global fleet. Excess fleets competing for limited fish resources result in stagnant productivity and economic inefficiency. In response to the decline in physical productivity, the fishing industry has attempted to maintain profitability by reducing labour costs, lobbying for subsidies and increasing investment in technology. Partly as a result of its poor economic performance, real income levels of fishers remain depressed as the costs per unit of harvest have increased.

From an economic perspective the race to fish, the drive to increase fishing power, and the perversion of the politics of the management process are all driven by the insecurity of access faced by fishermen under most fisheries-management systems. Insecure harvest rights provide distorted incentives and lead fishermen to compete wastefully with each other and with fisheries managers.

Rights-based systems have dramatically changed individual incentives and the behaviour of fishermen in fundamental ways. This change in behaviour is broad-based and persistent, and arises because security of access allows fishermen to shift attention away from attempting to capture larger shares of a fixed pie and towards maximising the value from the secure shares that they command under rights-based systems. This change has profound effects on all dimensions of fishing, from harvesting strategies, to investment, to stewardship of the resource, to marketing innovations, to

conducting science and fish stock assessment. By contrast, traditional top-down management systems, with their input and output control methods, fail to generate long-term stewardship incentives and therefore perpetuate the adversarial relationship between users and regulators.

Although the theoretical shortcomings of institutions based on property rights have been argued about for years, there is now enough evidence to enable a focus on empirical results rather than mere speculation, theoretical or otherwise. Almost all the relevant experience suggests that rights-based management institutions alter incentives in ways favourable to conservation and stewardship. A very important inducement for behavioural changes is the wealth capitalised in the value of tradable quotas in such systems.

The rapid adoption of ITQ systems around the world is indicative of their relative success in overcoming the commons problem and improving the economics of fisheries. Empirical evidence confirms that ITQs have reduced excessive fishing effort and overcapitalisation in fisheries and significantly increased the unit value of landings. These improved economic results reflect improved allocative efficiency, which is a virtually inevitable outcome of any reasonably designed and enforced ITQ system.

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