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Background Paper

The Development of Economic Institutions in World Fisheries

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1. INTRODUCTION

This paper deals primarily with the development of economic institutions in fisheries. The fishing industry is a particularly interesting case. The institutional arrangements in this industry have undergone a radical change, and some would even say a revolution, over the last quarter century. This change is twofold. First, there is the establishment of the 200-mile exclusive economic zone which, with the exception of the Latin American countries that pioneered this concept, occurred in the latter part of the 1970s. This made the second change possible, i.e., establishment of fisheries management systems based on exclusive use rights in some form.

A further reason why the development of economic institutions in fisheries is interesting is its international dimension. The establishment of the 200-mile exclusive economic zone came about through an international effort on a perhaps unparalleled scale. The Third UN Conference on the Law of the Sea, which went on for ten years, can be seen as an international legislative process to codify international law. The 200-mile zone was the outcome of consensus in the “legislative assembly”, although there is undoubtedly much truth in saying that the strongest military powers at the time, the United States and the Soviet Union, called the shots, as has always been the case in international law. But there is more to the international dimension than the Law of the Sea Conference. Many, and probably most, fish stocks are shared between two or more states, because they migrate between the economic zones of different states. A successful management of such stocks therefore requires cooperation between the states involved. Some stocks are even fished on the high seas outside the 200-mile limit where no single state has jurisdiction.

A central theme of this paper is which factors promote versus impede success in establishing economically efficient fisheries regulations. Such problems are not unique for the fishing industry; in all sectors where market failure occurs there is a similar need for establishing efficiency-promoting regulation systems, but there may of course be differences vis-à-vis the fishing industry making the experience of the latter less than fully relevant. Nevertheless, there could be some useful lessons to be learned with respect to other industries, in particular those that are based on natural resources (forests, groundwater, and possibly others).

The outline of the paper is as follows. First (Section Two) we discuss why fisheries need to be managed. We begin by briefly discussing material versus non-extractive benefits from fisheries. Non-extractive benefits are having an increasing impact on fisheries management, although extraction of material benefits is still the primary concern for most nations and, therefore, the main subject of this paper. The discussion then moves on to the common property problem, which is the basic reason why fisheries need to be managed if material benefits are to be maximized in a long term perspective.

Given that the problems of fisheries management arise from common property, the solution can be sought in an appropriate form of property rights. This is the subject of Section Three. Making fish stocks private property would be a logical solution, given that
common property is the root cause of the problem, but for various reasons this has seldom been done, nor is it likely to occur except in rare cases. The solution lies rather in appropriate definition of use rights. This implies a division of tasks between the private sector and the government; while governments are the guardians of the productivity of fish stocks, the private sector’s role is to maximize the economic returns. An appropriate system of use rights would accomplish this, as well as giving the private sector a stake in preserving the productivity of the stocks and so supporting the governments’ role in this regard. Alternative forms of use rights are discussed; individual transferable quotas, licensing of fishing vessels, and territorial use rights.

Most fish stocks used to be international common property by virtue of being accessible on the high seas where no single state has jurisdiction. Without establishing exclusive national jurisdiction over the areas where the fish stocks are located it is difficult to see how exclusive use rights could be established. Section Four deals with the development of the international law of the sea since the Second World War and what this has meant for fisheries management. It also discusses remaining international problems in this area, such as fish stocks shared between two or more countries and the problems associated with fishing on the high seas.

Even if the establishment of the 200-mile zone was driven by a desire among nations to appropriate the resources in the zone, fish stocks among others, the progress towards private property rights to these resources, or exclusive use rights, has not been rapid. Section Five discusses factors hindering versus helping the establishment of such rights. Such factors must be looked for both in government policies and in the industry itself. Any change in the management system will have to be sanctioned by the government, and ultimately the legislature, although the initiative need not come from there. This section begins with discussing government policies in fisheries, which certainly have not been uniformly concerned with promoting economic efficiency. No plan to initiate exclusive use rights in a fishery has succeeded, however, without a critical support from the industry, and it is hard to see where else that support would come from. We discuss how industry support has been elicited and reasons why this has sometimes failed. But given that industry can have something to gain, one would expect that it might in fact itself take the initiative for putting in place rights based management systems in a way that ensures that this happens. This is now occurring more frequently, and some of these cases are discussed. We then move on to how open access fisheries may become poverty traps and sinks for investment and well-intentioned government support. The section ends with a discussion of policy dilemmas confronted in many developing countries and illustrated with the fisheries in the Gulf of Thailand.

It is often alleged that the world fisheries are in trouble. Figures are quoted on how many of the world fish stocks are fully fished and overfished. Looking at aggregate figures for the world catch of fish a picture of stagnation rather than crisis emerges. In Section Six this is discussed. First we look at what has happened in world capture fisheries since 1950, in the aggregate and for certain groups of fish species. While world catches have stagnated, the picture varies from one group of stocks to another; for some the catches have risen and are still increasing while for others the catches have stagnated or declined.
We then look at individual fish stocks. Also here different pictures emerge; the catches from some stocks fluctuate enormously but without much of a trend while for others the catches are in a long term decline. Finally, Section Seven offers some conclusions.

2. WHY FISHERIES NEED TO BE MANAGED

What are the factors determining success or failure of management institutions in fisheries? To answer this question we need, first of all, to clarify what the purpose of fisheries management is. Since time immemorial, the living resources of the oceans have been a source of material wealth. For those who lived by the sea and went fishing or hunting for seals and whales these resources were a direct source of food, but also a source for consumption of other commodities through trading with those who did not exploit marine resources directly. The living resources of the sea were also for a period important as sources of materials for other purposes than nutrition. Not so very long ago, fat derived from whale blubber was important as fuel, as lubricant, and for various other purposes.

Lately we have seen a major change in attitude towards the living resources of the oceans. Such resources are no longer regarded exclusively as sources of material wealth but also as providing immaterial benefits. This change in attitude is most clear with respect to seals and whales. Hunting seals and whales has largely come to a halt, partly because some countries have banned imports of products derived from these animals, and partly because the hunting itself has been banned in many countries. Fish are to a much lesser extent affected by this, but also fish are increasingly seen primarily as a part of a wilderness fauna playing their role in the grand scheme of things in nature and not as a source of food. Fisheries are increasingly seen as interfering with the processes of nature, and there is a growing concern about the effect of fisheries on wildlife that is not targeted by fishing (sea birds, dolphins, turtles, etc.).

Whether fish and other living resources of the sea are viewed as a source of material benefits or as sources of intangible benefits has far reaching implications for what kind of institutions are needed for dealing with these resources. The derivation of material benefits requires exploitation of stocks of marine animals, and management for the sake of material benefits is all about limiting the exploitation so that these benefits are maximized in a long term perspective. To deal with this, exclusive use rights are instrumental, as will be further elaborated in Section Three. By contrast, the derivation of intangible benefits requires that human interference with the processes of nature be limited or avoided altogether. Intangible benefits arising from fish as wildlife, either through viewing them or just knowing they are there, is a collective, non-consumptive good, for which individual use rights of extraction are out of place.

There is no doubt that such non-consumptive benefits from the living resources of the sea are having an increasing influence on the management of these resources. The first and clearest example of this is provided by the International Whaling Commission. Originally, this body was established for the purpose of preventing the erosion of material
benefits through excessive exploitation of whale stocks. In this it almost certainly failed. Even if all whaling nations were members of the commission they were not prepared to limit whaling to what the stocks would bear, and some stocks, in particular the blue whale, were decimated to near-extinction. It is, however, possible to argue that extinction might have been a rational outcome if only material benefits counted. Due to low growth rates of whales, the return on “investing” in whales by leaving some of them in the sea might be less than the required rate of return for profit-maximizing operators.¹

Since the capture of most whales was banned in the 1970s, the International Whaling Commission has come under the influence of constituencies whose overriding objective is to preserve whale stocks as intact as possible. Hence, the International Whaling Commission has on a number of occasions abstained from allowing whaling, even if the proposed whale quotas would pose little or no threat to the survival of the stocks. At one level this could be taken as an example of responsiveness of international institutions; if indeed it is the prevalent opinion in the world that whaling should cease, it can be argued that the institution regulating this activity should make sure that this happens. But this raises many difficult questions of accountability of institutions. Do they represent the world population at large? Is there an informed opinion behind the representatives who sit on this body, or are they catering to narrow constituencies with idiosyncratic values? Are whale stocks the common property and concern of mankind or do they belong to the countries in whose exclusive economic zones they are encountered, like the fish? These questions are particularly vexing because reconciling material and immaterial ones is a difficult trade-off. Some people do not seem willing to accept any such trade-off at all; preserving wild animals is the opposite of hunting them, and those who are most bent on preserving are often not satisfied with just leaving behind a viable stock after the hunters have taken their share.

In a number of cases the aim of preserving stocks of marine animals has led to major modifications of the operations of fishing fleets. Concerns over the incidental catches of dolphins by purse seiners fishing for tuna resulted in trade disputes over tuna products and the disappearance of the purse seine tuna fleet from California in the 1990s. Two UN Resolutions in 1989 and 1991 led to a ban on the use of drift nets on the high seas. The reasons for this ban were the incidental catches of marine mammals and other species, as well as catches by nets lost at sea. The evidence on which this ban was instituted appears to have left much to be desired.² The precarious status of Steller’s sea lions in Alaska has led to a closure of large areas for the fleet fishing for Alaska pollock, even if the effect on Steller’s sea lions appears to be uncertain.

With due respect to the non-consumptive benefits, the rest of this paper is mainly concerned with successes and failures of management institutions from the perspective of material benefits. In most countries fish are still being viewed primarily as a source of material wealth, and in some countries or regions they play a very important role as such. About six percent of the world’s protein supply and 16 percent of all animal protein

¹ The classic references on the impact of the discount rate on optimal stock levels are Clark (1973a, b).
comes from fish.\(^3\) Even if the fisheries may not be very important globally they are a critical source of food in some areas, particularly in the developing countries. Furthermore, in some developing countries fish is a major and sometimes critical source of export income and a potential engine of economic development (Mauritania, Namibia, Peru).

**The common property problem**

It goes without saying that we ought to use fish resources wisely, as all other resources. Yet we often fail to do so. The reason is that fish stocks typically are common property for an unspecified number of individuals (or firms). It is well known that common property resources tend to be overexploited. When many individuals exploit a common, renewable resource they all depend on its productivity. That productivity is in turn influenced by the exploitation effort exerted by each individual; if some individual intensifies his exploitation the productivity of the resource will be affected. This affects all those who exploit the common resource, but each individual has little incentive to take into account the effects on others. How much exploitation effort each individual applies will be determined by the effect on his private benefit. This typically leads to overexploitation; fish stocks are reduced to levels below that which would provide maximum economic return for all in a long term perspective.

How much waste is involved in the overexploitation of fish stocks is an empirical question, and undoubtedly it varies from case to case. Excessive fishing causes an economic loss because the factors of production (manpower, capital, fuel, etc.) used for fishing could produce a greater value if used elsewhere. Large or small, this mismatch between the opportunity cost and the net return from fishing would seem to be particularly relevant for a developing country where investment funds are scarce, the cost of fuel and other inputs high, and where fishing is conducted exclusively for material benefit in the form of food supply or export income.

Excessive fishing does not necessarily mean that less fish is being caught than it would be possible to catch. Excessive fishing could simply mean that more fish is being caught than it is worth while to catch, with an appropriate account taken of the opportunity cost of fishing. But it is quite possible that uncontrolled fishing of a common stock is excessive to such an extent that the catch of fish is less than it could be. This would be the result of decimating fish stocks to low and unproductive levels. In fact something even more serious might happen. Excessive fishing could reduce fish stocks to so low levels that they could not reproduce and would become extinct. That this has rarely happened is probably more due to luck than to anything else. Some terrestrial animals (e.g., the great auk, the kiwi bird, the American buffalo) have become extinct or nearly so due to excessive and uncontrolled hunting. Uncontrolled fishing from a common stock is just one form of uncontrolled hunting, but fish stocks are probably more resilient to exploitation than terrestrial animals.

\(^3\) "WHAT" (2000), p. 12.
3. SOLUTIONS TO THE COMMON PROPERTY PROBLEM

As we have seen, in order to exploit fish stocks optimally we need a system where some individual or organization has an incentive to take into account how fishing affects the productivity of fish stocks. A possible remedy would be to establish ownership rights to fish stocks. The owner of a fish stock would have an incentive to maximize the net economic benefit from exploiting the stock. This cannot be accomplished unless the impact of fishing on the productivity of the stock is fully taken into account. In a “perfect” market economy this would lead to an efficient exploitation of the stock; the long term marginal contribution of fishing effort would be equal to its opportunity cost, and no gain could be achieved by allocating resources differently. As is well known, there are a number of market imperfections that could get in the way and make the private ownership solution less than ideal; one such could be an excessive private rate of discount making the owners of fish stocks less willing than they should be to conserve fish stocks for future benefit. But despite potential market imperfections, there is every reason to believe that private ownership of fish stocks would be much preferable to treating fish stocks as common property to which a large and perhaps indefinite number of exploiters have free access. Under the latter arrangement the exploiters will treat fish stocks as if they were free and limitless resources whereas they are in many cases scarce and highly valuable.

Private ownership of fish stocks is, nevertheless, definitely the exception and not the rule. There are a number of reasons for this. Most importantly perhaps, until relatively recently the most basic requirements for private property rights to fish stocks were not in place. The ocean outside a narrow band along the coast (usually three nautical miles) was a global commons where no state had jurisdiction and where no one had the right to interfere with fishing. Obviously private property rights to fish stocks could not be implemented in a setting like that. The development of the international law of the sea will be discussed in Section Four.

In the 1970s the 200-mile exclusive economic zone became accepted in the international law of the sea. In this zone the adjacent coastal state has jurisdiction over all natural resources including fish. The coastal state can set limits to fish catches in its zone and control fishing as it sees fit. These jurisdictional rights would make it possible to establish and enforce private property rights to fish stocks in the exclusive economic zone; the coastal state has the necessary jurisdictional powers to persecute those who would violate property rights to fish stocks in its economic zone. Nevertheless, there are few if any examples of private property rights to fish stocks having been established after the 200-mile zone came into being. One reason is undoubtedly that many fish stocks migrate across national boundaries at sea. Two or more states would therefore have to cooperate in establishing and enforcing private property rights to such stocks. Another reason is that some fish stocks migrate out of the 200-mile zone and into the high seas where they are accessible for anyone. Property rights to stocks that migrate into the high seas would be tenuous and of negligible value for the most migratory stocks.

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4 The pioneer paper on sole ownership of fish stocks is Scott (1955).
Exclusive use rights

Whatever the merits of private ownership of fish stocks, it seems, for the time being at least, sensible to base solutions of the fisheries management problem on national ownership of the stocks, or shared ownership by two or more states in cases where a stock migrates between the economic zones of different states. A part of the solution is defining the appropriate roles of the private versus the public sector and designing an appropriate system of incentives to be put in place. The type of solution which seems most appropriate is one where the government, acting in the trust of the general public, decides how much can be caught from any given stock in any given period, preventing the stock from being depleted to an unproductive level or perhaps extinguished. The government could also, again acting in the public trust, lay claim to the scarcity value of the fish stocks, that is, the rent that will result from the exploitation, and use the rental revenue for the benefit of the general public. It is highly unlikely, however, that a government or its agencies should play the role of entrepreneur in fishing. That role is much better left to the private sector. There are indeed few examples of government owned and managed fishing operations, and those that exist are not encouraging.

A management system built on exclusive, long term and transferable use rights seems the most appropriate one for maximizing the long term economic benefits of exploiting fish stocks. A system like that would have the additional advantage of giving the industry a stake in maintaining the productivity of the stocks, as the value of a use right that is transferable and valid for the long term depends on the expected future catches from the stock to which it pertains. The expected catches, in turn, depend on how well the stock is managed. This financial stake by the industry would make it easier for the government to play its role as the guardian of the future productivity of the stocks, as it would have the support of the industry in this endeavor. This alerts us to the fact that the two roles assigned to government versus industry are less clearly divided than this simple exposition purports; the government will be influenced by industry and its preferences, and the fish stock management policy followed by government will for its own part influence industry.

The proposed assignment of roles to industry versus government is neither novel nor specific for the fishing industry. Many natural resource industries are managed along similar lines. Offshore oil resources are defined as state (or federal or commonwealth) property, and governments manage these resources by deciding where oil exploration and field development is allowed and then lease the tracts to the industry for exploitation, creaming off a substantial part of the oil rent on behalf of the citizenry who is the ultimate landlord. Governments lease out timberland in the public domain, on condition that certain public interests in the land be honored, and claim a fee in return.

What form should exclusive use rights in fisheries take? There are various options open here, each with its own advantages and disadvantages. The three major options are individual transferable fish quotas, licenses to own and operate fishing boats, and territorial use rights. Below we discuss each of these. Which one is most appropriate depends on the circumstances in each individual case. These circumstances vary greatly
from one fishery to another, depending on whether the fishery is directed at just one or a multitude of different fish species and whether it is possible to fish them discriminatingly, the ease of monitoring and enforcement, etc. While the so-called individual transferable quotas (ITQs) have some definite advantages, there are circumstances in which these are defeated by difficulties in enforcement.

**ITQs**

An ITQ is a right to catch a specific quantity of fish from a given stock within a given time period. The individual quotas can be determined either as fixed quantities or as shares of a total permitted catch. This system is therefore appropriate when the government protects a fish stock by setting an upper limit to how much can be caught from the stock in any given time period. This kind of conservation policy has been extensively applied since the 200-mile zone came into being. Most, if not all, ITQs in existence are “share quotas”, but New Zealand had fixed tonnage quotas in place for a few years.

The main attraction of ITQs is that they provide incentives to maximize rents in the fishery and to utilize fish stocks efficiently. With a given fish quota for the current fishing season, it obviously makes sense for the quota holder to turn it into as valuable product as possible and to minimize the cost for catching it. There are a number of examples to support this statement. Since ITQs were established in the Pacific halibut fisheries in Canada and the United States, more halibut has been sold to the fresh fish consumer market. The extremely short fishing seasons that had developed in response to the competition for a given total quota had made it necessary to freeze most of the fish caught, which meant turning it into a less valuable product. In the cooperatives that have recently been established in the fisheries for Pacific whiting and Alaska pollock in the United States and which operate an internal ITQ-system, some members rent out their quotas to other members and lay up their vessels or use them for other purposes.

If ITQs are valid for a long term they provide incentives to invest optimally in fishing vessels. Long term quotas enable quota holders to make rational predictions about their future catches, provided the total catch being permitted each season is based on rules that do not change over time in an unpredictable way. Through buying and selling quotas, fishermen (firms) are able to choose an optimal scale of operations, buying additional quota if it is more profitable to use a bigger boat (or more boats), and selling if a smaller scale is preferable.

Establishing ITQs in overcapitalized fisheries amounts to an industry-financed buyout program. More efficient operators will buy out less efficient ones, and the overcapacity of the fishing fleet will gradually be eliminated. Consolidation of the fishing fleet has

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5. This is not true under all circumstances; it can be shown that when the crew is remunerated by a share of the catch value and not with a fixed wage there will most likely be an incentive to overinvest (Hannesson, 2000). Even so, it is likely, to say the least, that overinvestment will be much less of a problem with ITQs than without them.
occurred in most if not all ITQ-programs; examples are Iceland and the surf clam fishery in the United States.

The most serious problem with ITQs, from the point of view of efficiency, is monitoring and enforcement. Each individual quota holder has an incentive not to report his catch. ITQs are therefore not likely to be a good option in small scale fisheries where fish landings could easily become a part of the informal economy (say, when fish are landed on the beach and sold directly to consumers). There is also an incentive for throwing away fish which it would be worth while to bring ashore. One reason is that some fish are less valuable than other specimens of the same stock; obviously fishermen will try to make the most of their limited quota. Another is accidental catch of fish for which one does not hold quota (to be effective for stock conservation, fish quotas have to be stock-specific). This could make ITQs difficult to use in fisheries where many different kinds of fish are caught simultaneously and perhaps indiscriminately. There seems, however, to be a tendency in the public debate to exaggerate this problem; no one makes much money from throwing away fish.

In most cases ITQs have been given away to boatowners, on the basis of their recent catch management system. We will return to this in Section Five. Another reason is that in many if not most cases the fishery has been in economic crisis, with fishing capacity exceeding the capacity needed to take the permitted catch and many and perhaps even most firms in the industry operating at a loss. In such cases ITQs initiate a rationalizing process which was referred to above as an industry-financed buy-back scheme. Over time rents emerge and become capitalized into a market value of ITQs. Although the value of quotas is a result of rationalizing the industry and not something being taken at anybody’s expense, its capture by boatowners that happened to be active in the industry when the ITQs were given away has been controversial (Iceland is one such case). Rent capture for the benefit of the public, through a tax on ITQs or an auction of ITQs, would be a possible remedy. Note, however, that the quota holders are likely to become less interested in a good management of the fish stock the more successful the government is in its rent capture. In Chile and Estonia ITQs have been allocated through auctions.6

**Vessel licenses**

Another form exclusive rights may take is licenses to own and to operate fishing vessels. This will not go very far towards controlling the catches of fish unless the licenses are further specified with regard to the size and other attributes of fishing vessels which determine their fishing power. Even this would not suffice. Because fish stocks fluctuate greatly in response to environmental factors that have nothing to do with their exploitation it will normally be necessary to supplement fishing licenses with regulating the use of the licensed vessels (regulation of fishing effort) or the amount of fish they are allowed to catch (individual vessel quotas). When an El Niño event occurs there is very little anchoveta off the Peruvian coast, and it would be risky to allow unrestricted fishing

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6 On Estonia, see Vetemaa et al. (2002). The Chilean quotas pertain to some small but valuable fisheries (see Peña-Torres, 2002).
by the entire fleet ordinarily fishing the anchoveta during such events. Too lax control of
the Peruvian anchoveta fishery may have seriously impeded the recovery of the stock
after the El Niño event in the early 1970s (see Section Six and Figure 6.3). The stock of
Barents Sea capelin falls to a very low level under certain conditions, and it has been
found necessary in such cases not to allow any fishing of this stock.

The Norwegian fisheries regulation system is based on vessel licenses (concessions) and
quota control; the capacity of the fishing fleet is controlled through the concession
system, and the catches are controlled through vessel quotas. The vessel concessions can
be traded. This in fact amounts to an indirect trade in long term fish quotas. The
individual vessel quotas are related to the size of the vessel, and by buying and
decommissioning a fishing vessel it is possible to add its quota to one’s own (with certain
restrictions). Leasing of quotas is not permitted, however.

Transferable fishing licenses are more likely than ITQs to lead to excessive investment in
fishing fleets, even if open access is worse still. The reason is that this system does not
end the “race for the fish” but only reigns it in to a certain extent, unless it is
supplemented with individual vessel quotas. Without the latter, fishermen still have an
incentive to take advantage of any avenue open to them to increase the capacity of their
boats and capture a bigger share of the total catch. The capacity of a fishing vessel
depends on many factors which it is difficult to control in detail. Not surprisingly,
experience shows that fishermen expand the capacity of their vessels in ways that are not
under control; adding fishing gear if there is no gear control, increasing engine power if
that is unrestricted, and so on. Technological progress may over a relatively short period
increase the capacity of the fishing fleet way beyond what at some point in the past was
deemed adequate. Over the years there has been considerable technological progress in
fishing by way of electronic fish finding and positioning equipment, computer controlled
fishing gear, better quality ropes and nets, etc. Naval architects have also been very
clever at changing the design of fishing vessels and packing more power into technical
specifications such as maximum vessel length, etc. Finally, we may note a paradox. The
more successfully fishing capacity is controlled the more the industry may be locked in a
straitjacket preventing technological progress and the potential gains that go with it.
Technological progress often requires a change in the design of fishing vessels, but such
changes might run afoul of specifications deemed necessary to keep the capacity of the
fleet under control.

One advantage fleet and effort control may have over quota control is easier monitoring
and enforcement. Fishing vessels can be counted and measured and their movements can
be tracked, if necessary by a satellite monitoring system. When fish quotas are difficult or
costly to monitor, fleet and effort control could be a better option despite its
disadvantages. But one should be aware than one might be controlling the wrong thing,
however effectively. It should also be noted that controlling fish catches by controlling

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7 As an example, a regulation was introduced in Norway permitting small trawlers to fish within the old
twelve mile territorial limit. At the time the regulation was issued the so-called large trawlers were well
above the size limit, which was 300 GRT (gross registered tons). As the fleet was renewed, the new vessels
typically measured 299.9 GRT.
fishing effort is an indirect and imprecise method. If such control were to be effective, the catch per unit of effort would have to be predictable. In many cases it is not; the catch per unit of effort depends on the weather and the distribution of the fish in the sea, which is likely to change from year to year and may also depend on the size of the fish stock. Fisheries management based on catch quotas is often criticized for being risky; it is based on stock assessments which are anything but precise, and quotas based on an overestimated stock might risk depleting the stock. Management based on catch per unit of effort is not necessarily better; the latter fluctuates randomly and is probably not a good indicator of the abundance of the fish stock.\(^8\)

**Territorial use rights in fisheries (TURFS)**

A third type of exclusive use rights involves rights to fish within a given territory. The efficiency of this type of use rights depends critically on the migrations of the fish. If a fish stock stays entirely within the assigned territory the TURF will essentially amount to an ownership of the stock, with all that this entails with respect to optimal utilization. For stocks that migrate in and out of the assigned territory the property rights over the stocks will be diluted or in effect non-existent. The 200 mile exclusive economic zone is in fact a TURF; a country has exclusive use rights to fish within its zone and shares the ownership of a fish stock that migrates into another country’s zone with that country.

In Japan the inshore fisheries are managed by TURFs. These rights are usually assigned to fishermen’s associations and not to individuals or firms. There exists considerable literature on these rights and associations in the English language, and there are indications that this system is successful.\(^9\) In the United States, some oyster beds are privately owned (or leased) while others are not. A comparative study of private versus public beds showed that the privately owned beds were better maintained and more productive.\(^10\)

**4. INTERNATIONAL ASPECTS**

The establishment of the 200-mile zone is a good example of how property rights emerge in response to increased scarcity of resources. At the beginning of the 20\(^{th}\) century the internationally recognized limit of the territorial sea was three nautical miles from shore. Great Britain, the leading maritime power at the time, vigorously supported the three mile limit. This was, needless to say, in her interest as a major trading power and as the dominant naval power, and she also had important fishing interests in distant waters. But more was involved. About a century ago European biologists could debate seriously

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\(^8\) On this, see, e.g., Ulltang (1980). One reason why the Canadian fisheries biologists were slow in discovering the depletion of the Northern cod (see Section Six) was that the catch per unit of effort of the commercial fleet held up well despite the fact that the stock was diminishing.


\(^10\) See Agnello and Donelley (1975).
whether fishing had any significant effect on the abundance of fish stocks. This was not without reason. The growth of fish stocks is much influenced by natural fluctuations in ocean currents and temperature, and for a long time these fluctuations masked any effect from predation by man. Our understanding of these processes is still rudimentary; in fact the effects of fishing can in certain cases be difficult enough to discern even today.

Gradually the effects of overexploitation on the most heavily exploited stocks, such as the ones in the North Sea, became increasingly clear. The reduced fishing pressure in the Northeast Atlantic brought about inadvertently by the two world wars was like natural experiments further driving home this point. Both fish catches and fish stocks in this area recovered significantly after the two world wars. This is well illustrated by the Icelandic cod stock (see Section Six and Figure 6.6).

The major thrust for extended jurisdiction at sea came from two proclamations by the American president Harry S. Truman right after World War Two (1945). In one of these he proclaimed that all resources on and underneath the seabed on the continental shelf of the United States were the property of the federal government. In practice this meant oil resources first and foremost, oil having by that time become a vital source of energy and possible to extract from offshore fields at moderate sea depths. The second proclamation concerned fish. Here the president was satisfied with reserving the right to proclaim conservation zones but stopped short of proclaiming exclusive rights for the United States. Fish was not then, any more than now, of strategic importance.

Other nations saw this differently. The Icelanders saw no reason why there should be a different set of rules for the resources in the water column above the continental shelf. In 1948 the Icelandic parliament passed a law claiming national ownership to all resources on, underneath and above the continental shelf, which in those days was usually taken to mean the extension of the land mass out to a depth of 200 meters. A similar claim was put forward by Argentina. The Pacific countries of Latin America, Chile, Peru and Ecuador, also laid claims to fish resources off their shores. Unlike Iceland and Argentina these countries have a very narrow continental shelf, and they exploit fish stocks high up in the water column over depths much greater than 200 meters. To incorporate these resources they claimed jurisdiction stretching 200 nautical miles from the coast. Thus was born an idea which later developed into the 200-mile exclusive economic zone that we are familiar with today.

After World War Two fishing technology improved continuously, and the world catch of fish increased steadily by about six percent per year up to the early 1970s (see Section Six) but, parallel to this, the pressure on the fish stocks also increased. The international disputes over fish stocks increased in intensity but so did also the attempts to defuse them and to reach internationally agreed solutions. The UN held three conferences on the law of the sea in the period 1958 – 1982. The first of these, held in Geneva in 1958, managed to reach agreement on the rules governing exploitation of resources on and underneath the sea bed. In essence this conference codified the Truman Proclamation, recognizing

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11 A fascinating account of this debate is in Smith (1994). No lesser authority than Thomas Huxley, a leading British biologist at the time, held this view.
the ownership of coastal states of the resources on and underneath their continental shelf. The conference failed, however, to reach agreement on jurisdiction over the living resources of the sea. At that time the major fault lines were between those who wanted to preserve the old three mile limit and those who wanted a wider jurisdiction, at least for fish resources. A compromise with an extension to twelve miles and recognition of historical rights was attempted but failed to reach the required two-thirds majority, both at the 1958 conference and at the Second UN Conference on the Law of the Sea two years later.

The evolution of technology put the unresolved issues in the law of the sea under an increasing pressure. Pressure on fish stocks continued to intensify, and the mining of mineral nodules from the deep sea bed came within reach. This stimulated two very different agendas. First, coastal states dependent on fishing wanted ownership over the fish resources off their shores. Second, opposition arose against the possibility that certain states or private companies would get hold of the mineral resources of the deep sea bed. Idealists talked about the deep sea as a common heritage of mankind, and the developing countries feared that the rich countries of the world would gain hold of these resources for themselves by virtue of their technological superiority.

These concerns led to the Third UN Conference on the Law of the Sea. In addition to deep sea bed mining it considered fisheries, pollution, navigation, and issues regarding the delimitation of the continental shelf raised by the ongoing advances in offshore technology. The conference lasted no less than ten years, beginning in 1973 and ending in 1982 with the Law of the Sea Convention, which a number of countries, most notably the United States, in the end voted against, because of its articles on deep seabed mining. The Law of the Sea Convention formally became international law in 1994, having by then been ratified by the required minimum of 60 states (as of early 2002 it had been ratified by 137 states). Some of the rules it codified nevertheless became de facto international law much earlier, some even before the conference was concluded. Already in the latter part of the 1970s many countries established a 200-mile exclusive economic zone, which by that time had gained wide support at the conference.

The Law of the Sea Convention is no minor achievement and hopefully bodes well for the future. Most of human history is a history of ethnic cleansing and rule by the club, the sword, the cannon, the machine gun, and the bomb. Gradually we seem to be entering the phase of the rule of law. The Law of the Sea Conferences are perhaps the most impressive achievements so far of the rule of law in international affairs. The time-consuming deliberations of the Third UN Law of the Sea Conference had many of the trappings of a legislative assembly, even if the delegates were not elected. Factions were formed, horses were traded, logs were rolled, and delegates could claim to have returned home with barrels of pork. Most importantly, contentious issues were settled peacefully.

12 Supplementary agreements have since been reached on deep seabed mining and the countries that voted against the convention no longer oppose it.
13 A standard reference on the operations of the Third UN Law of the Sea Conference is Nordquist (1985-). Another informative text is Miles (1998).
As far as the fisheries were concerned, the Third UN Conference on the Law of the Sea was indeed a sea change. The 200-mile limit once claimed by a handful of states in Latin America became recognized as an exclusive economic zone, in which the coastal state has the right to manage the exploitation of natural resources. For fish resources this right is conditional in that the coastal state is required to share with others any surplus that it cannot utilize, but in practice this is a dead letter; it is the coastal state that decides what the total allowable catch of fish is, and there are many examples of coastal states leasing fishing rights to others at their own discretion. For all intents and purposes the fish resources within the 200-mile exclusive economic zone have become the property of the coastal state, and the sovereign rights of the coastal states to manage these resources as they best see fit appear to be universally recognized.

The reason why this happened probably owes much to the fact that the Third UN Conference on the Law of the Sea was a multi-issue conference. Different groups of countries could leave it feeling they had won on some point; the compromises involved were of the kind “I get this and you get that” rather than meeting somewhere between two extremes. In this it was very different from the Straddling Stock Conference, to be discussed below. It appears that the countries which were after the fish had a perhaps unique window of opportunity. The two superpowers at the time, the United States and the Soviet Union, had a common interest in preventing “creeping jurisdiction” that might interfere with their interests in unimpeded navigation of military vessels through straits and archipelagos that would become territorial waters if the limits of such waters were extended. To avoid this they were prepared to concede jurisdiction over natural resources within a 200-mile zone or whatever could be agreed upon while restricting the territorial sea to twelve miles, with special provisions for passage through straits and archipelagos. But the exclusive economic zone also owes much to the fisheries interests of the United States. The US was one of the countries that stood to gain handsomely from extending national jurisdiction over fish resources, even if it also stood to lose some interest in distant water fishing, mainly over tuna. The US Senate established a 200-mile fisheries conservation zone in 1976, which later became formally an exclusive economic zone. This prompted many other coastal states to establish a 200-mile exclusive economic zone in the years 1977 – 78. The 200-mile zone was also promoted by the fact that the developing countries endorsed this idea.

The establishment of the 200-mile zone may be taken as an example of how institutions emerge in response to need. There is no doubt that the increasing pressure on fish stocks was a major contributing factor. An important driving force was the self-interest of the nations involved; in the face of increasing scarcity of fish resources the coastal nations wanted to preserve them for themselves and to establish mechanisms for halting or reversing the decline. But why was the geographic principle of proximity chosen to decide who should and who should not have access to these resources? Later establishments of use rights such as ITQs or vessel concessions have typically been based on the track record of those who fish. If a similar principle had been used in limiting the access rights of nations, British fishermen would not have been excluded from fishing off Iceland or in the Barents Sea, and the Japanese would not have to pay license fees to various states in the Pacific for continuing their distant water fishing.
Reasons why the geographic principle of proximity was chosen include a perception that people who live in coastal areas typically depend on fisheries for their livelihood and that their needs should be catered to prior to anyone else’s. Another was that the United States, one of the superpowers at the time, and several influential states with rich fish resources off their coasts, felt increasingly threatened by factory fleets from distant nations, particularly the Soviet Union and their East European satellites. These fleets were developed in the 1960s and increased the exploitation rates of several important stocks tremendously in a short period of time (see Figure 6.8 in Section Six of catches of the Northern cod of Newfoundland). The most important reason may, however, have been that the developing countries came to support this idea and saw it as a part and parcel of wresting control over resources out of the hands of ex-colonial powers and other rich countries. The 200-mile zone thus was not entirely a rational, “engineering-type” solution to the problem of overfishing, it also came about for other, if related, reasons. This is probably true of many other economic institutions. Such institutions may owe much to factors only remotely related to the problems they eventually help to solve, and they may also have come about partly or wholly because of a misperception of the problems they were intended to solve. Presumably, however, institutions survive if they prove adept at solving problems, irrespective of whether those problems are the ones they were originally meant to deal with.

The somewhat bizarre origin of the 200-mile limit is a further example of the element of arbitrariness in the formation of economic institutions. During World War Two a Chilean company had discovered a new method to process whale fat but feared that it would be out-competed as the whaling fleets of other nations resumed their activities once the war was over. The Chilean industry wanted to ban whaling for foreigners in waters off the coast of Chile and sought legal advice on how this might be accomplished. The experts consulted found little precedence other than a neutrality zone declared by the foreign ministers of the American states at a meeting in Panama in 1939. These countries wanted to avoid belligerent activities by the warring states of Europe in the waters off their shores and, to this effect, declared a neutrality zone around the United States and Latin America defined by lines drawn between specified coordinates. The distance from the coast to these lines varied; in some places it was not far from 200 miles, in others closer to 300. An allegedly inaccurate map published in a Chilean magazine, indicating that this zone was approximately 200 miles wide, was the precedence for the 200 miles. Some authors have disputed this and argued that the 200 miles were based on the Humboldt current off the west coast of South America, but others have vigorously dismissed that claim. In any event, the Humboldt current is a local phenomenon.

Finally, it may be observed that the 200-mile limit was not the only conceivable way to establish national control over fish stocks. An alternative way would have been a functional approach; i.e., to assign jurisdiction over a certain fish stock to the coastal state in whose nearshore waters it originates, no matter where it is caught. This principle was for a short while proposed by the United States at the Third UN Conference on the Law of the Sea. Elements of this principle survive in the approach to anadromous fish like

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14 For the story on the 200 miles, see Hollick (1977), and Armanet (1984).
salmon which spawn in rivers and migrate to sea for feeding; fishing for salmon has now been banned on the high seas, in the interest of the coastal states where these fish originate, while they can be lawfully taken within a distant state’s 200-mile zone. But a clearly drawn geographical limit is probably the most easy one to observe and enforce.

**Shared stocks**

The 200-mile zone is only a prerequisite for managing fish stocks effectively. Each individual country has to devise a system that regulates access to fish stocks within its jurisdiction in such a way that the material benefits from fishing the stocks are maximized. This requires, *inter alia*, that the total amount of fish captured from each stock in any given period be limited to whatever is consistent with maximizing the material benefits in an intertemporal perspective. Obviously, when a fish stock migrates within the 200-mile zone of two or more countries they will have to cooperate if the total catch of fish is to be controlled in any meaningful way. Hence the management of fish stocks will be accomplished more easily for stocks that are confined to a single country’s jurisdiction.

Agreements with respect to how to limit and share the catches from shared fish stocks are still the exception rather than the rule. There is no agreement, for example, between Chile and Peru on the anchovy and sardine stocks that straddle their boundaries. Neither is there agreement on stocks shared between the United States and Canada on their Atlantic coasts (there are in fact no direct limits on total catch on the American side of the border, only indirect through effort regulations and closed areas). From the Northeast Atlantic there are examples of agreements on stock sharing. The Soviet Union and Norway early on (1977) agreed on how to share the fish stocks in the Barents Sea and have annually set catch limits for these stocks ever since, with Russia succeeding the Soviet Union. Also in the late 1970s Norway and the European Union agreed on how to share the fish stocks in the North Sea. Some stocks proved more contentious than others; the notoriously volatile herring stock whose spatial distribution depends on its size was for a while a bone of contention, as Norway felt that the small stock of the 1970s was not representative.

Even if an agreement on total catch from a shared stock and its distribution has been reached this does not mean that it is set as appropriate from a long term perspective. For one thing, different nations may have different views on what exactly is the appropriate catch, from a long term point of view. Negotiations on total catch quotas from shared stocks have often been difficult and marred by controversy. The aforementioned dealings between Norway and Russia and Norway and the European Union, and even negotiations among the member states of the latter, offer many examples of this.

It is not easy, in the view of this author, to draw any firm conclusions with regard to what promotes and what hinders agreements on shared stocks. Suffice it to say that countries such as the Soviet Union and Norway managed, in their self-interest, to agree on sharing the fish stocks in the Barents Sea despite the fact that they had widely different economic systems, belonged to the opposite military alliances of the Cold War, and had not even settled the border between their economic zones. The cooperation between Norway and
the European Union has not been any smoother, nor has Russia been an easier partner than the Soviet Union. Relations between Canada and the United States, two countries with generally friendly and cooperative relations, over salmon fishing on the Pacific coast have occasionally been marred by deep disagreements, sanctions against perceived unfair and uncooperative practices, and subsequent retaliations. Changes in environmental factors affecting the behavior and distribution of fish stocks is certainly something that may hinder agreements or lead to their breakdown, as happened with the salmon agreement concluded between the United States and Canada in 1985. Such changes are likely to affect the “threat points” of parties in a bargaining situation, so that one party may be enticed to withdraw from an agreement which under different conditions seemed a reasonable compromise. Salmon and herring are stocks particularly susceptible to such regime changes.

Not surprisingly, perhaps, most of the success stories in fisheries management involve fish stocks that are fully contained within the jurisdiction of a single state. In Section Five we shall discuss success and failure factors, but first we conclude this section with a brief discussion of fishing on the high seas.

**Stocks on the high seas**

Many fish stocks are, to a lesser or greater degree, accessible outside 200 miles. The high seas are, for all intents and purposes, global commons to which vessels from any nation have access. The 200-mile limit led, not surprisingly, to an increased fishing activity outside 200 miles, and many coastal states felt that their fisheries management regimes were threatened by this. The most notorious examples were perhaps the “holes” that were left between the 200-mile zones of neighboring countries, or even within the zone of one single country. In the North Pacific there are two such holes, the Peanut Hole inside the Russian zone, and the Donut Hole between the Russian and the American zones. Alaska pollock is accessible in both these holes and fishing fleets from the Koreas, Poland, and various other countries fished there. The most notorious hole in the Northeast Atlantic is the Loophole in the Barents Sea, between the Russian and the Norwegian zones. Icelandic trawlers suddenly descended on that area in 1994 in significant numbers, and vessels flying flags of convenience have been encountered there as well. Two other contentious areas are the nose and the tail of the Grand Banks of Newfoundland where turbot and, while it was still around, cod are accessible. Some may remember the conflict between Canada and the European Union in the mid-1990s over Spanish trawlers fishing for turbot in this area. Still another area with lively fishing outside 200 miles is the Reykjanes Ridge southwest of Iceland.

A UN conference on “straddling stocks and highly migratory fish stocks” (hereafter simply the Straddling Stocks Conference) was called in 1993 and held several sessions, ending in 1995 with an agreement. The purpose of the conference was to bring fishing on the high seas under control in a way compatible with the Law of the Sea Convention of 1982. The conference did not, however, take what would seem to be a logical step and extend the exclusive economic zone still further, to close various holes and include areas

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15 On this, see Miller et al. (2001).
such as the nose and the tail of the Grand Banks. Instead it opted for international cooperation through strengthening the role of regional fisheries organizations.

The reason why this option was taken probably is the simple fact that the Straddling Stocks Conference was a single issue conference. Coastal states and distant water nations confronted one another, and although some had mixed interests the fronts were fairly clear. If a compromise was to be reached it had to be somewhere between the demands of the coastal nations (a larger exclusive economic zone or at the minimum greater influence in an area adjacent to the 200-mile zone) and the position of the distant water nations (minimum constraints on fishing outside 200 miles). This supports the notion that the establishment of the 200-mile zone was a window of opportunity, opened up by the multitude of issues before the Third UN Conference on the Law of the Sea 1973 – 82. A critical mass of countries could leave that conference saying that they gained something. That would not have been possible if the Straddling Stocks Conference had ended in a further extended coastal state jurisdiction. This further illustrates the notion that useful economic institutions often come about through a roundabout process and not straightforwardly as carefully designed engineering-type solutions to well-defined problems. There is no doubt that the 200-mile zone has been useful in laying the necessary groundwork for rights based fisheries management, even if it leaves much to be desired (see Section Six below on the development of fish catches).

Can the straddling stocks agreement be rated as a success? Time will show. The agreement has two main weaknesses, associated with vesting insufficient power in the regional organizations supposed to manage fisheries outside 200 miles. First, these organizations do not have the power to exclude any nation; on the contrary all nations with “material interests” are encouraged to become members of such organizations, but nowhere is it defined what “material interest” is. It can be argued that successful management by a “club” that at a given time exploits a fish stock on the high seas would be self defeating, as it would most likely attract new members. If the “club” refused the potential new member a quota, the candidate would probably opt to remain outside the club and do as he pleases. It is unclear what sanctions could legitimately be applied under such circumstances. Attempts have been made to deny vessels belonging to such nations access to harbor facilities, but it is unclear with what effect.

This gets us to the second weakness of the regional fisheries management organizations; they have no jurisdictional power to punish those who violate their regulations. Such power is still with the state whose flag the offending vessel is flying. This is potentially very serious, because some states are known for their flags of convenience, which means lax rules or little diligence in enforcing rules. The problem with regional fisheries management organizations is well illustrated by the International Commission for Conservation of Atlantic Tunas (ICCAT). Some nations fishing the eastern Atlantic tuna stock set their own quotas, others disregard whatever quotas have been set and take what they want. There are fewer challenges to the western stock, but even so it has also been
fish by nations that do not abide by agreements on quotas, and this activity seems to be on the increase.\textsuperscript{16}

In some cases the fishing on the high seas has been brought under control, however. The nations fishing in the Donut Hole agreed in the 1990s on limiting this fishery, but not until it had come to a halt by itself because of declining catches. The Icelanders were given fish quotas in the Loophole in the Barents Sea, after fishing at will for a few seasons. Fish quotas for mackerel, herring and redfish outside 200 miles have been agreed within the Northeast Atlantic Fisheries Commission (NEAFC), but its members have yet to agree on blue whiting; at present the member states seem busy in establishing a track record for the time they eventually come to agree, presumably hoping that the fish will not be gone by then. The members of the Northwest Atlantic Fisheries Organization (NAFO) have agreed on the fishing of shrimp in the Northwest Atlantic. By contrast, the Pacific countries (Japan, Australia, New Zealand, Taiwan, and South Korea) fishing for southern bluefin tuna failed to agree on its management in 2001. The list is not exhaustive, but it tells of successes and failures.

While going for international solutions like strengthening regional fisheries organizations rather than extending the jurisdiction of individual states may sound nice, it leaves much to be desired in terms of efficacy. International organizations typically are weak, with little power to enforce their rules and regulations. This is so because sovereign states are very reluctant to dilute their rights to enforce their own rules within their territory, and they are similarly reluctant to acknowledge any rights of international organizations to enforce rules on their subjects on the high seas. There is a reason, therefore, to be parsimonious in giving international organizations a mandate to deal with environmental problems. Very few environmental problems are truly global in the sense that they affect everyone irrespective of the source of the damage. Global warming, if in fact it is happening and man-made, and the depletion of the ozone layer are probably the only ones known presently. But many environmental problems have an international dimension in that more than one country are affected simultaneously; a damage may be caused in Country \( A \) by Country \( B \)'s actions, and more than one country may share a natural resource such as fish. These problems can, however, be dealt with by negotiations between the states affected, and this has often been successful, as the above mentioned examples from the fisheries show. This approach also has the advantage that regulations framed at the individual state level usually have a much greater legitimacy than decisions framed by an international organization, because people tend to feel allegiance and loyalty to their country and the people with whom they share creed and culture. The problems of the European Union with its own version of “ex pluribus unum” bear testimony to that.

\textsuperscript{16} There is extensive documentation available on Atlantic tunas from ICCAT, which is based in Madrid, Spain.
5. WHAT HELPS AND HINDERS SUCCESSFUL MANAGEMENT?

The management of wild fish stocks is, without exception as far this author knows, the prerogative of governments. It is natural, therefore, to seek the reasons for good fisheries management, or mismanagement, in the incentive structures governments are faced with. This does not preclude fisheries management by individual use rights; indeed, as discussed in Section Three, this is likely to be the most efficient way of managing fisheries. Neither does it preclude the possibility that the industry itself may, in its own interest, take initiatives towards exclusive use rights or other measures that will promote efficiency in fisheries management. We shall return to that point below, but first we consider the incentive structures governments are faced with.

For a successful fisheries management regime to emerge, there are two main prerequisites:

(i) the political authorities must be interested in promoting economic efficiency in the fishing industry;
(ii) the critical political support for a system of management promoting economic efficiency must be forthcoming.

**Government policies and economic efficiency**

It goes without saying that if governments are to set up a management system promoting economic efficiency they must regard economic efficiency as a priority. The reader is tempted, perhaps, to ask, why wouldn’t they? Doesn’t the success or otherwise of governments depend on them being perceived as doing something to enhance the living standards of the population at large, to which more efficient fisheries would be one of many contributions? But things are not always that simple.

First it may be noted that there will always be some obstacles to be overcome in the implementation of changes, be it in fisheries management or any other sector of the economy. Even if efficiency-enhancing changes have the potential to adequately compensate those who would lose from the change there is always some uncertainty about whether such compensations will be made, how large they would need to be, etc. Some would even argue that requiring such compensations always to be made would be the surest way of nipping in the bud all or a great many changes whose aggregate benefits outstrip the aggregate losses, and that it should be legitimate to trade sufficiently small losses against larger gains, even if they accrue to different individuals. However that may be, it seems safe to conclude that the aggregate gains must be sufficiently great to make it worthwhile to do battle with those who oppose any given change. This translates into saying that the fisheries sector must be large enough to make a difference at the aggregate level in terms of material wealth. A case in point would be Iceland, where the fisheries sector is responsible for approximately 70 percent of merchandise export revenues. In a case like that, overexploited fish stocks could pose a threat to the overall standard of living. It comes as no surprise, therefore, that Iceland is one of the countries that has implemented a comprehensive ITQ-system.
Another case in point is New Zealand. The fishing industry of New Zealand is nowhere as important, from a macroeconomic perspective, as the fishing industry in Iceland, but nevertheless it is an important export industry. New Zealand is also among the most successful countries of the world in terms of fisheries management. The ITQ-system which New Zealand put in place in 1986 (and in the deep sea fishery in 1983) was a part and parcel of a determined drive to enhance the efficiency of the economy of the country. Immediately after World War Two New Zealand was at the top of the league among the OECD countries in terms of GDP per capita but had, by the early 1980s, slipped to a middle position. It was widely felt that this was due to overregulation of the economy in the form of subsidies and tariffs. The ITQ system is a way to utilize the market mechanism in order to correct a market failure and ensure that the fishery is efficient. The ITQ-system thus conforms with the overall philosophy of the economic reforms taking place in New Zealand in the mid-1980s.

There are nevertheless cases where efficient fisheries management systems have been set up despite the fact that the fishing industry is next to insignificant at the national level. ITQ-systems have been put in place in certain fisheries in the United States and Canada. Even if these fisheries are important regionally they are insignificant on a national scale. The ultimate responsibility for setting up these systems lies at the federal level but the initiative in all cases arose at the local level. The Canadian government has no explicit policy to set up ITQ-systems or something similar in its fisheries but has been happy to do so when the industry has asked for it, as has occurred in several of its Pacific coast fisheries. This passivity is somewhat surprising, given the prominent role the Canadian government played in nationalizing the fish resources off its coasts through extended jurisdiction.

Lately there has been a major policy reversal in the United States with respect to the application of ITQs, with this particular instrument now being explicitly forbidden by the US Congress, even if there are ways to circumvent this (like the so-called fishing cooperatives that have emerged in some west coast fisheries in the United States). Three things seem to account for this reversal of policy; (i) the fishing industry is not a very important industry overall in the United States, so that efficiency in this industry is not a major concern at the national level; (ii) ITQs in the important fishery for Alaska pollock were perceived as a disadvantage for the state of Alaska whose senators are influential in fisheries policy; and (iii) economic efficiency in the fishing industry is increasingly being sidelined in the American policy debate by environmental concerns.

In the European Union, rights based fishery regimes have evolved and are evolving in a number of places. The fishing industry is economically insignificant at the Union level, even if it is important in some regions. The Union has a common fisheries policy by which limits on total catches from various fish stocks and other regulations are determined at the union level. After several years of bickering, a regime evolved in the 1980s by which the member states are allocated fixed shares of the total catch quota of each fish stock. In the Netherlands a system of ITQs has evolved in the flatfish fisheries

17 See Burke and Brander (2000).
on the basis of this regime. In the United Kingdom the national quotas are allocated among so-called producer organizations which in turn allocate them among their members. Some of these organizations are engaged in both short term leasing and long term buying and selling of quota allocations, a practice that appears to have become more widespread and more similar to fully fledged ITQs after the mid-1990s.

The policies many governments in industrially developed countries have followed vis-à-vis their fisheries show clearly that economic efficiency has not been a priority. These governments have subsidized their fishing industries by significant amounts of money and over long time periods. The European Union has provided both price support and, more significantly, support for building new fishing vessels and refitting old ones. Recently it has been announced, however, that these subsidies will be cut drastically. The Norwegian government began subsidizing its fishing industry already in the 1950s, and at their high point in the early 1980s these subsidies amounted to 70 percent or more of the value added in the industry, but by the mid-1990s they had been all but eliminated. The government of Canada has supported employment in the fishing industry of Newfoundland by generous unemployment insurance and in other ways.

It is difficult to think of policies which are more perverse than fisheries subsidies, in terms of efficient resource utilization. The basic economic problem in fisheries management is that too much capital and labor tends to be employed in this industry. Subsidizing the industry will, needless to say, make that problem worse. The opposite, imposing a special resource tax or levy on the industry, would go some way towards correcting this, although such measures alone are not likely to be sufficient to ensure an economically efficient utilization of the fish stocks. In any event, governments which throw money at their fisheries are not likely to take any bold initiatives towards more efficient management.

Why have governments engaged in these types of policies? At the outset, these policies were probably meant to ensure that fishermen, often among the poorer strata of the population, obtained an income on par with other comparable occupations. This was the explicit purpose of the Norwegian subsidies when they were initiated in the 1950s. Newfoundland is the poorest province in Canada and most of its fishermen used to work in what was a highly seasonal industry, so the generous unemployment insurance scheme was seen by many as being fair. In the European Union the fishing industry is typically located in rural areas with limited opportunities. The fisheries subsidies were seen as a part of regional income equalization and a part of income transfers from richer member states to poorer member states, with Spain and Portugal being the major beneficiaries of the fisheries subsidies.

There are several problems with this approach to boost incomes in the fishing industry. In the first place, fisheries subsidies will to some extent be self-defeating, aggravating overexploitation of fish stocks, which in turn will call for even larger subsidies. Prior to the establishment of the 200-mile zone subsidies could, perhaps, be seen as a counterproductive but still understandable response to a lagging profitability of the fishing industry; before the 200-mile limit there was little individual states could do to
improve the profitability of their fisheries by better fish stock management. After the 200-mile zone was established they became an impediment against better management.

In the meantime, the fisheries subsidies had given rise to vested interests bent on maintaining them. Not only the fishermen themselves but employees in related industries, bureaucracies, and possibly even entire communities, had become dependent on the subsidies. The interest organization of Norway’s fishermen used its lobbying power successfully for many years for fishing in the Treasury what could not be wrested from the sea. The economic consequences of the fisheries subsidies and unemployment insurance in Newfoundland have repeatedly been pointed out, to no avail.

Defenders of fisheries subsidies point to their role for maintaining employment and settlements in rural areas such as Northern Norway and Newfoundland. To some people there may be value in maintaining human habitation in places that appear to be economically and otherwise disadvantaged, and the point can be made that societies are free to support such things, just as they support activities that do not have a high monetary payoff, like the humanities and the opera. It is likely, however, that such policies are grounded in the fact that the benefits of such schemes are concentrated to small and easily identified groups while the costs are spread over a large population of taxpayers who are either unaware of the costs or do not much care. The real costs of such schemes are the goods and services which would be produced by a more productive use of labor and capital which subsidies keep unnecessarily in the fishery. Supporting employment in economically disadvantaged places can in the long term be a disservice for those who live there and who would do better by moving to greener pastures.

**Political support for use rights in fisheries**

What enlightened politicians and civil servants might wish to attain is one thing, the political support making it possible to accomplish what they want quite another. The appreciation and understanding among the general public of the institutions that most promote economic efficiency varies a great deal from person to person. If economic institutions were to be selected on the basis of their appeal prior to real life testing, profit driven market capitalism would probably be rejected as unjust and appealing to our primitive and selfish instincts. The opposition to these institutions has indeed been fierce at times, and the reason why they have survived and even carried the day is that they have been experienced as better at delivering the goods than alternative systems which, at their face value, have seemed more appealing.

There is hardly much of a reason to seek political support from the general public for so specific issues as use rights in fisheries management. Most people have little or nothing at stake and are fairly ignorant of the fishing industry, and economizing on time and information gathering and processing is a reason why this is to be expected. The necessary support for specific measures in fisheries management will therefore have to come from the industry itself. Even in countries like Iceland where the national economy depends critically on the fishing industry, the appreciation among the general public about what is at stake sometimes leaves much to be desired. Many people oppose the
ITQ-system on the grounds that it makes it difficult to enter the industry—as if barriers to entry were not precisely what is needed. Sentiments such as “young people should not be barred from making a living from our common resources” are often heard, which betrays ignorance of the elementary fact that no new wealth is created by having people competing for fish that others could easily have taken. Wasting manpower and capital in competing for a given amount of fish is, needless to say, the best recipe one could give for sliding into poverty for a country in a position like Iceland. In most other countries such policy prescriptions would be unhelpful but of little consequence at the national level.

The critical political support for efficiency-enhancing changes in fisheries management will therefore have to come from the industry itself. It goes without saying that if such support is to be forthcoming, the industry will have to perceive a significant gain from the change. In principle that should not be a tall order; after all, enhanced efficiency means a positive expected gain. All that is needed is to make sure that a sufficient part of this gain accrues to the fishing industry. This, however, raises some difficult questions of the distribution of such gains. As already indicated, it may be difficult to devise ways whereby everyone is sure of getting a share of the gains from a more efficient system. If for no other reason, different individual judgements as to what is likely to happen and what would constitute a sufficient compensation make it difficult to reach a consensus within the industry to support a change towards a more efficient management system. While it would be sufficient to gain the support of a critical part of the industry, even this may be difficult if the industry is divided and heterogeneous. In a case like that, an easily identifiable part of the industry whose members conceive a common interest may organize separately and fight a change which they perceive as harmful. The fault line has often lain between what are termed small scale versus large scale operations, or ocean-going versus coastal fisheries. Such conflicts have been highly visible both in Iceland and in Norway.

Giving the industry a share in the rents emerging from a more efficient fisheries management system may, however, generate controversy. Many people regard rents from natural resources in the public domain as being a legitimate object of capture by governments acting in trust of the people at large. There is, furthermore, a case for taxing rents rather than other forms of income, because rent taxes, if appropriately designed, do not create the distortions that other types of taxes do. There are nevertheless few examples of rent taxes in fisheries. In New Zealand there was originally a plan for using rent taxes in the form of fees on fish landings, and such fees were in fact implemented for the deep water fishery for orange roughy. These fees were abolished, however, in connection with a revision of the fisheries management system in the early 1990s. The New Zealand ITQs had originally been set as fixed tonnages for all future, but a substantial overestimation of the long term yield potential of the orange roughy stocks generated a long term fiscal liability of the government vis-à-vis the fishing industry (the government was required to buy back the quotas that the stocks would not support). To get out of this the government changed the system to quotas set as fixed proportions of the annual permitted catch. The industry demanded an economic compensation for this,
and in the end the resource rentals were abolished. This outcome may be regarded as a price for the necessary support of the industry.

In Iceland there has been an ongoing discussion for many years about resource rent taxes in the fishing industry. This discussion has been stimulated by the very substantial prices at which fish quotas change hands; rental fees for fish quotas have sometimes been more than one-half of the ex-vessel price of fish. After more than ten years of controversy the Icelandic parliament has passed a law establishing rather moderate resource rentals which will not do much more than cover the costs of fisheries management (most of these costs are paid from general government revenue). The absence of resource rentals is undoubtedly in part due to the need to buy the political support of the industry for the quota management system.

Not surprisingly perhaps, the only other examples of resource rentals in fisheries known to this author involve fisheries largely or wholly conducted by foreign fishing fleets. Such fleets are, needless to say, at the mercy of the national authorities in the areas where they operate. Neither their owners nor their employees vote in elections in the host country, and there is no need to buy their political support. Namibia has a resource rent tax system in place, but at the time it was implemented most of the Namibian fisheries were conducted by foreign fleets. The Falkland Islands derive very substantial incomes through license fees from their fisheries, which are mostly conducted by foreign fleets.

**The “grandfathering” principle**

Exclusive use rights have usually been put in place through so-called “grandfathering”; i.e., those who were in the industry at the time were given a right to remain in the fishery, based on their previous track record, while new entrants had to buy their way in. In ITQ systems this has been done through allocating catch quotas on the basis of recent history; for example, through giving a boatowner a share in the annual permitted catch equal to his share of the total catch for the last \( x \) number of years. Sometimes this rule has been modified to allow a partial account to be taken of invested capital, which favors recent entrants with a short catch history but a large commitment in the form of investment.\(^{18}\) A rule like that can be said to be equitable, in that it allows people to go about their business much as they have in the past despite the change in the management system, and it also prohibits their share of the total catch from being eroded by new entrants. It is noteworthy, however, that in no case have ordinary crewmembers without any financial commitment been included in this scheme of things despite sometimes having a long track record as fishermen. Including crewmembers has sometimes been rejected on the basis that they have not taken a risk on par with investors (e.g., the Alaska halibut fishery). It would seem that risking life and limb in what is one of the most dangerous occupations in the world would be an acceptable level of risk taking; pragmatic arguments such as how to establish a track record for a fleeting labor force would carry more weight. In the current discussions on rationalizing the crab fisheries off Alaska, including crew in the initial allocation of fish quotas has figured prominently.

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\(^{18}\) This has happened, for example, in the Australian Southern bluefin tuna fishery (Robinson, 1986), and the surf clam fishery in the United States (McCay and Brandt, 2002).
The way grandfathering buys the support of capital owners in the industry is obvious. Not only do they get protection against new entrants who would otherwise erode the incumbents’ share of the total catch, they also get an asset which will gain value to the extent the management system is successful. More often than not, quota management systems have been put in place when the industry has been close to the long term open access equilibrium predicted by theory; i.e., one where rents have been negligible and the value of quotas likewise so. Over time a restructuring has taken place; more efficient operators have bought out others, and rents have emerged and quotas gradually acquired a market value. Note that all boatowners who happen to be in the industry when a quota system is put in place share in this; the less efficient operators who are destined to leave the industry do so by selling their quotas to the more efficient ones and so get a share of the gains from the management system.

Management systems that do not rely on ITQs, or do so only in a limited form, have also been implemented in this way. In Norway vessel concessions were originally given to those who were in the industry at the time entry became restricted. Over time the concessions have acquired a market value, through extra value of boats to which the concessions are attached over and above their value as means of production. Similar developments have taken place in the salmon fisheries in Alaska and in the Canadian province of British Columbia, but both these fisheries are regulated by transferable boat licenses. The interest of those who are in the industry at any given time in supporting a system like that is obvious.

**Recent developments: initiatives from industry**

Given that the industry stands to gain, perhaps handsomely, from transferable quotas or fishing concessions it is a bit surprising that the initiative to establish such management systems have not primarily come from the industry itself. The ITQ-systems in New Zealand and Iceland were initiated by the respective governments, and those in the surf clam fishery and the Pacific halibut fishery in the United States were initiated by the management authorities. All, however, did get critical support from the industry. There are signs now that this may be changing and that the industry is increasingly taking the initiative. An early example of an industry initiative, or one where industry played a major role, is the wreckfish fishery off the southeast coast of the United States. This fishery developed in the late 1980s, and those who discovered the wreckfish stock were keen on keeping the fishery profitable for themselves and played a key role in having it managed by individual transferable quotas allocated to themselves.

A more recent and a very interesting development are the so-called fishing cooperatives in some fisheries on the Pacific coast of the United States. These cooperatives have been established in the offshore whiting fishery in the Pacific North West and in the fishery for Alaska pollock. The basis for these cooperatives is a split of the total catch quota for these stocks between different groups of vessels, such as factory trawlers and vessels delivering to these versus shore-based processors and associated boats. Given that the shares of the total catch allocated to different fleet categories are fixed, there is an
obvious gain to be realized by each group through minimizing the effort with which they take their allotted catch. The quota shares of each fleet can be split into individual quota allocations that can be traded between individual fishing vessels.

The fishing cooperatives sprang up in the late 1990s, in response to two things. First, there was the moratorium on ITQs put in place by the US Congress in 1996. The cooperatives are a way to circumvent this ban. A decision by the members of a fishing cooperative receiving a given share of the overall catch quota to minimize their effort to take it in fact realizes some of the efficiency gains that the ITQs are meant to accomplish. In fact these cooperatives allocate their quota share among the individual members who then trade them among themselves, much as would happen under ITQs.

The second reason why the cooperatives were initiated was distrust by industry in the ability of the regional councils for fisheries management to deal effectively with the allocation of fish quotas among individual fishermen or fishing firms. In the Alaska halibut fishery this turned out to be a long and difficult process characterized by much controversy and rent seeking. It took several years from the ITQs were first proposed until they were finally in place. The presumption among the initiators of the fisheries cooperatives was that this could be more easily dealt with internally among the members of an industry group. This turned out to be correct, but it is important to note that these cooperatives consist of a limited number of players; the whiting cooperative has only four members, and the largest of the Alaska pollock cooperatives have 10 - 20 members, with one or a few dominant members. How well such an arrangement would work for a fishery with tens, let alone hundreds, of participants, is another issue.

This development towards cooperatives may point a way towards the future. It is an example of an industry taking an initiative for a better management in its own interest, but one that also serves the social interest by promoting economic efficiency. This may be viewed as an example of how institutions arise in response to need, much as the 200-mile limit itself came about and without which the said cooperatives would not be possible. It is possible to argue that this type of solution may have advantages vis-à-vis an ITQ system. The cooperatives are likely to make it easier for the industry to exercise its collective interest in a better management of the stock they fish from. In fact, the cooperatives on the US west coast already finance substantial research on fish stocks and their habitat. The compliance with the allocation regime within the cooperative is likely to be better than under an ITQ system overall, because of peer pressure and a greater legitimacy of the quota allocation, the latter having been decided among the participants themselves.

One noteworthy feature of the cooperatives in the Alaska pollock fishery delivering its catches to the land-based processing industry in Alaska is that they are formed around a particular fish processor. Members of a fishing cooperative cannot switch to another one without the penalty of having to spend one year in open access (this can, however, be circumvented). This arrangement is due to fear among fish processors of being disadvantaged by a longer fishing season resulting from a transition to ITQs. The open access competition for a given quota for the total fish catch led to a progressively shorter
fishing season and a corresponding excess capacity in the processing industry. With ITQs and a longer fishing season there is less demand for processing capacity. Hence processors might be tempted to bid up the raw fish price, and some might not manage to get sufficient deliveries to keep their operations profitable.\footnote{The issue of also grandfathering in processors owes much to a paper by Matulich, Mittelhammer and Reberte (1996).}

Developments are under way in other places towards solutions reminiscent of the US west coast cooperatives. In the salmon fishery in Alaska this kind of solution is being discussed, much encouraged by the severe fall in salmon prices, due to increased production of farmed salmon, which has made cost cutting a necessity in the traditional capture industry. It is possible, however, that the legal framework in Alaska may prove inadequate for this, as all fishermen licensed for this fishery have a constitutional right of equal access. The evolution of the quotas allocated by the producer organizations in the United Kingdom towards individual transferable quotas has already been mentioned. In the maritime provinces of Canada a similar development is under way. So is also the case in Chile, although that development seems to be driven just as much by the government as by the industry itself.

**Industry opposition to exclusive use rights**

Despite the gain the key players seem bound to obtain from transferable quotas or concessions, plans to establish such systems have sometimes stranded on the unwillingness of the industry to support them. This was the case in Norway when it was attempted to establish ITQs in the early 1990s (but fishing concessions, with some parallels to ITQs have long been in use). The fishing industry in New England in the United States has long opposed ITQs, and even non-transferable vessel quotas. There are a number of reasons for this. One is unwillingness to acknowledge that fish stock scarcity needs to be dealt with in this way. Access to fish resources has since time immemorial been open to anyone, and keeping things that way is seen as having a value in itself. To the extent the adherents of this view do not deny the need to deal with the increasing pressure on fish stocks they prefer to do it in other ways, such as rationing the access in the form of limits on fishing days, amount of gear used, restrictions on the efficiency of fishing vessels, and so on. Needless to say, economic efficiency is not high on the list of priorities among those who adhere to such views.

Ideological issues also play a part in the resistance to ITQs or other forms of rights which rely on the market mechanism to ration access to fish stocks. Public resources, it is felt, should not in any way be made the object of private ownership and enrichment. There is, in particular, reluctance to see people cash in a windfall gain from fish quotas or concessions which they were given for free. Needless to say, there are means to address the latter issue, such as fees for or auctioning of fish quotas and fishing concessions. This reluctance to accept private ownership of resources or rights to use resources harks back to ideas perhaps most eloquently expressed in Henry George’s classic “Progress and Poverty”. While one can sympathize with many of the sentiments expressed by George and followers it is worthwhile to keep in mind that private ownership as an institution is
productive. Private property rights give the property owner a claim to the benefits arising from taking good care of the property (cf. rented versus owned dwellings) and using it as productively as possible. Such rights also minimize the waste that would follow from repeatedly having to stake a claim to a resource, a piece of land, or whatever. The attempts that have been made to abolish private property as an economic institution have not been successful and should encourage rather than discourage experimentation with private property rights in the fishing industry. It is worthwhile, however, to note that the overall distribution of property rights, or the fruits of their use, will have to satisfy some minimum standard of fairness if it is to be supported by society at large; history is not wanting for examples of revolutions that have arisen from a perceived injustice in the distribution of income and wealth.

Sometimes the industry is too fragmented to lend any unified support to schemes such as ITQs or fishing concessions. The fishing industry typically consists of heterogeneous units; there are large fishing boats, sometimes owned by vertically integrated corporations, and there are small one-man operations where the owner himself (or herself) is also the one that is engaged in the fishing. The business culture of such diverse firms is typically quite different, and they do not often see much commonality of interest even if they fish on the same stock that may be threatened by depletion. Typically the small scale operators see the large scale operations as being more harmful to the stocks, or at least would have us believe that this is so. Large trawlers, it is alleged, harm the stocks by the enormity of their catches and the environment through wreaking havoc on the sea bottom where their giant trawls are dragged to and fro. While it is true that large scale operations are capable of taking larger catches than small scale ones it should be kept in mind that a sufficiently large number of small scale operations can be quite effective. A small boat in the Icelandic coastal fisheries is typically equipped with several computer controlled devices, each of which jigs a line with multiple hooks and pulls it up when enough fish have swallowed the bait. In times of good fishing the operator may have his hands full in attending these machines and unhook the fish that they have pulled up for him. From the point of view of fish stock management it would not seem to matter much whether a fish is pulled out of the water by a hook, a net, or a trawl. Yet some industry activists would have us believe so. In any case, different groups in the industry often seem to regard their interests as being better served by lobbying for privileges at the expense of another part of the industry rather than see all operators being grandfathered into an ITQ system or whatever. Both in Norway and Iceland this has been a major controversy, with the fault lines lying between large scale operations and small boats.

The developments that are occurring on the west coast of the United States and elsewhere may be a way to overcome such industry fragmentation. It will often be possible to separate a fragmented industry into two or more reasonably homogeneous groups whose members have sufficient commonality to divide among themselves a catch quota allocated to the group. All that would be needed, then, for a more rational management would be to divide the overall total catch between the groups, as is presently done for Alaska pollock. If, however, it is not permitted to trade quota allocations between groups, it may not be possible to realize efficiency gains that would arise from abandoning fishing methods having become obsolete.
Finally, the resistance against market driven management often has a geographical
dimension. Earlier it was pointed out that even if better management would result in a net
benefit, the changes accompanying this could easily harm some people. A rationalization
of an overcapitalized industry through transferable quotas, for example, comes about by
less efficient operators selling their quotas to more efficient ones. For the buyers and
sellers of quotas there would be a mutual gain; otherwise such transactions would not
take place (that people can misjudge the profitability of such transactions is an entirely
different issue with many parallels in other facets of life). Such transactions do, however,
often have repercussions for others not directly involved. A concentration of fish quotas,
necessary as it is for more efficient operations, may threaten the existence of a local fish
processing industry and the employment of fishermen being made redundant.

“Grandfathering in” capital owners in the fishery will not suffice to compensate such
losers, and to the extent this is deemed necessary and desirable other ways of
compensation have to be found. Considerations of this kind played a major role in the
demise of the plans to implement ITQs in Norway in the early 1990s and have been
advanced as criticisms of the Icelandic ITQ system.

Fisheries as poverty traps

Rationalization of a fishery in which there are too many fishing vessels and redundant
labor, compared with what an efficient fishery would entail, is often hampered by what
can be termed a poverty trap. People have invested in fishing boats and sought
employment in the fishery even with low remuneration, because there have been few or
no other opportunities; the fishery has been an employment of last resort. Typically, and
unsurprisingly, one finds a situation like this in the poor countries of the world where a
large part of the population ekes out a subsistence, be it in fisheries or in agriculture.

A situation like this is, however, not unknown in countries with ample employment
opportunities and a high GDP per capita. The fishing industry has in many places been
seen as a means to maintain employment in areas with few other opportunities. This has
in some cases been pursued to the point of overexploitation of fish stocks and
overcapacity in the industry. The most disastrous consequences of this kind of policy
occurred in Newfoundland in the early 1990s when the Northern Cod, traditionally one of
the most important fish stocks of the world, collapsed (see Section Six and Figure 6.8). A
factor contributing to the collapse was that the Canadian government cut the catch quota
too little and too late. This problem was exacerbated by the fact that the Canadian
government had for years maintained unprofitable jobs in the fishing industry through
generous unemployment insurance schemes which made fishermen eligible for support
for the rest of the year even if they had fished for only a few weeks. This was
undoubtedly popular at the local level but its wisdom may certainly be called into
question. The Canadian economy is one of the most prosperous economies of the world
and has over the last decades attracted a large number of immigrants from alien cultures.
People born in one of the country’s provinces and speaking one of its two official
languages would presumably have an easier time at shaping their careers even if they
would have to move to a different part of the country. Instead they became a drag on the
federal budget and generated little wealth for the country as a whole. But it was presumably difficult for the Canadian government to end these subsidies, even if the problem was well known and had been thoroughly analyzed for years by hordes of economists. The subsidies had in effect gotten the government entangled in a poverty trap.

A further illustration may be provided by a story from Kerala. On the wharf, one can watch the boats coming back from fishing in the morning, but they seem to be loaded more with people than fish (as one might expect in a country with low wages, fishing is labor intensive). On the quay one can observe boatowners, fishermen’s wives, and others, waiting. In a conversation one of the boatowners told this author that he had earned some money in the Gulf States and invested in a fishing boat. He had been losing money for some time but was still waiting for the big catch that would pay off the investment. It did not arrive that morning.

The thought that goes through the visitor’s mind on an occasion like this is that such unproductive investment is the last thing a place like Kerala needs. The state is one of the poorer ones in India but has a relatively well educated population, so lack of human capital is much less of a constraint than lack of financial capital. But coming up with a recipe of how to get investment going in other sectors of the economy so that it can absorb redundant labor from the fisheries and elsewhere is not an easy task. Which should come first, the employment opportunities or the redundancies in a fishery to be rationalized? Would redundancies in the fishing industry and closing the opportunity to invest there automatically create investment and employment in other sectors? There is no easy answer to these questions.

In many other developing countries, particularly in Southeast Asia and parts of Africa, one finds problems like this. What makes the problem even less tractable is that the fishermen, or fisherfolk, involved have few skills that are useful in other sectors of the economy even if there were opportunities there, which there often are not (piracy might be the most relevant option). Rationalization of a vast, and vastly overpopulated, small scale fishing industry is a long term project of transformation, providing useful skills to young people who otherwise would get trapped in the fishery. What makes the problem even less tractable is that these fisheries often are a world to themselves over which the powers that be have very little control. A case in point is provided by a regulation banning pushnet fishing in inshore waters in Thailand. This regulation has been on the books since 1972 but yet this fishing gear is still widely used. The fisheries in the Gulf of Thailand will be further discussed below.

In general, the prevailing view of the small scale fisheries of Southeast Asia seems to be a gloomy one of overfishing and destructive fishing practices. That notwithstanding, this does not (or not yet) show up in falling catches overall in this part of the world; in the Southeast Asian countries fish catches have either stabilized with year to year fluctuations or increased.

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20 Willmann et al. (2002).
21 See Silvestre and Pauly (Eds., 1997).
In any event, in some Southeast Asian countries, most notably the Philippines, local fishing communities, with foreign aid and with help from non-governmental organizations, have made progress in fisheries management.\textsuperscript{22} This is all the more important as the power and resources of the central government are often too weak to deal with the fisheries, and the actions taken on the spot are likely to be perceived as more legitimate than those coming from a remote central government. Perhaps we can take this as another example of institutions arising out of need.

**Gulf of Thailand: A policy dilemma**

One case in point is the fishery in the Gulf of Thailand. This fishery has been studied extensively over the years.\textsuperscript{23} The fishery is conducted with various types of boats and fishing gear and the catch consists of a variety of fish species. The catch increased several times over as trawlers were introduced into this fishery in the 1960s.

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{catches_gulf_of_thailand.png}
\caption{Thai catches in the Gulf of Thailand. Source: Boonchuwong et al. (2002).}
\end{figure}

All studies of the Gulf of Thailand fishery that this author is aware of have concluded that it is plagued by overfishing. Yet this does not show up as declining catches. Figure 5.1 shows the catches of demersal fish and trash fish in the Gulf of Thailand 1971 – 1995. The catches have almost doubled since 1971. The increased fishing pressure (the number of boats has roughly doubled since 1972) has led to smaller fish on the average (growth overfishing) and more catches of trash fish (fish that is not wanted for direct consumption). The reason why the total catch in the Gulf of Thailand nevertheless has held up very well probably is that this is one of the most productive areas in the world, with a rapid growth and turnover of biomass due to the high sea temperature (around 30\(^\circ\) C.).

\textsuperscript{22} Silvestre and Pauly (Eds., 1997).
\textsuperscript{23} For a summary and bibliography, see Boonchuwong et al. (2002).
When we look at the catch per unit of standardized effort (catch per hour) we see a possible manifestation of overfishing; too much effort is being spent on catching the fish. Figure 5.2 shows two lines for the catch per unit of effort. One is for the commercial fleet. This line shows, if anything, an upward trend. The other line shows the catch per unit of effort for research vessels. The latter type of data are more likely to reflect what in fact has taken place. A falling catch per unit of effort indicates that the stocks have been depleted so that it has become progressively more difficult and expensive to catch each tonne of fish. The commercial fleet has presumably undergone various kinds of technical change that have increased its efficiency, and furthermore it does not fish at random but seeks suitable concentrations of fish, all of which helps maintain the catch per unit of effort even if fish stocks become depleted. This harks back to our discussion in Section Three of the pitfalls of controls based on catch per unit of effort.

Figure 5.2: Catch per unit of effort in the Gulf of Thailand. Source: Boonchuwong et al. (2002).

Accepting the conclusion that an economically efficient fishery requires substantially less effort than now is exerted, how is a developing country like Thailand to get there? First, it may be noted that the desirability of reducing fishing effort lies partly in the opportunity cost of labor and capital, i.e., that the resources used in the fishery could otherwise be directed to other sectors of the economy where they would produce a greater value (there would also be a gain in the form of larger fish; i.e., less growth overfishing). Existing boats probably cannot be used for other purposes or sold to other fisheries where they are needed, so the transition to a more effective industry should probably take place through attrition of the existing fleet. This is the avenue proposed by Boonchuwong, Dechboon and Ahmed who recommend, inter alia, “prohibition of construction of new trawlers.” They also have doubts about the wisdom of pushing labor too rapidly out of the fishery:

“Under the prevailing conditions of rising landlessness and swelling unemployment in the rest of the economy, only broad-based rural development will put an end to the continual drift into ‘common property’ resources and major urban centers. In its absence, fisheries regulation cannot be effective and, if effective, it will simply push the problems into some other sector: unemployed fishermen have little choice but to encroach on reserved forests, mineral concessions and public
lands or simply move into the urban centers creating a host of social and environmental problems.”

This underlines very well that the problem of overfishing is related to the development process overall and that alleviating poverty in the fisheries sector is a question of economic growth in general. A rising tide lifts all boats, and the important thing is that young people are steered away from the fishing sector where they might otherwise get trapped with acquired skills which are not easily portable to other sectors of the economy. Unless there is ongoing economic development, rationalization of the fisheries sector may not be very meaningful. On the other hand, overexploitation of fisheries to the point of declining aggregate yield is no solution to poverty, it will only spread it more widely. Under such conditions maximizing sustainable yield and distributing it equitably would seem to be the most sensible objective.

Suppose, however, that rationalization of the fisheries sector makes sense and that the Thai government pursues this kind of policy. There are a number of challenges it will confront as it goes along. If successful, this policy will generate or raise rents in the fishery. Ordinarily this would attract more boats, so this has to be prevented. One way would be for the government to cream off the rent, but most likely this will only be partially achieved, and in any case it will not be popular among the fishermen, or at any rate the boatowners. Suppose the government closes entry into the fishery and gives the participants individual transferable quotas (if that is at all a possible policy in a fishery of this type) or exclusive boat licenses. If the policy is successful, the value of the quotas or the licenses will rise and the owners of these rights will be better off than the rest of the community, which may generate resentment and cause people to call the legitimacy of this into question.

Lastly, however we answer the above questions, an effective management policy will make considerable demand on administrative resources. At the present time the administration of the Gulf of Thailand fisheries appears anything but effective. Willmann, Boonchuwong and Piumsombun (2002) cite a ban on pushnets in inshore waters which has been on the books since 1972, but nevertheless this gear is used by 3,000 boats involving 9,000 fishermen.

6. THE STATUS OF WORLD FISHERIES

There is growing concern about the status of world fisheries. Figures published by the FAO in 1994 showing that 25 percent of fish stocks are fully utilized, 35 percent overfished, and 40 percent still developing, are frequently cited and taken as indicators for a general overexploitation of the fish resources of the world.\textsuperscript{24} It is often claimed that the situation is getting worse.

It is possible to distinguish between two types of overexploitation of fish stocks, biological and economic overexploitation. In the popular parlance, biological

\textsuperscript{24} Review of the State of World Fishery Resources: Marine Fisheries. \textit{FAO Fisheries Circular} No. 920.
overexploitation is usually what is meant be overexploitation. Let us begin, therefore, with discussing that concept, briefly addressing economic overexploitation below.

Biological overexploitation of a fish stock means that it is pushed below the level which gives maximum sustainable yield. To fix ideas, it is useful to have the following simple formula in mind:

\[
\text{Catch} = \text{surplus growth of stock} - \text{change in stock}
\]

The surplus growth of a stock is growth in excess of what is needed for replenishment due to natural decay. For an unexploited stock in a natural equilibrium the surplus growth of the stock is zero. If we start catching fish from a stock in a natural equilibrium the catch would initially be due solely to driving down the stock from that equilibrium position (a negative change). If the rate of exploitation were kept constant the stock would sooner or later become stabilized at some equilibrium level (this ignores environmental fluctuations, which will be dealt with below). The catch that this equilibrium stock would sustain would be less than the maximum sustainable yield unless the equilibrium stock happened to be equal to the one that gives maximum surplus growth. Sustainable yield is, of course, synonymous with surplus growth; catching an amount equal to the surplus growth leaves nothing to augment the stock, but neither would it decrease.

From the above formula we see that the catch from a stock may fall for some time even if the stock is not biologically overexploited, as the stock is driven down from its pristine equilibrium (the last term on the right may be greater than the maximum surplus growth). The length of this phase depends on the rate of exploitation and the growth rate of the stock. For slow growing stocks this phase may be quite long; certain whale and turtle stocks were hunted to extinction or nearly so over several decades. For most fish stocks this phase is likely to be relatively short (a decade or less). As a stock is depleted below its maximum sustainable yield level the catch will sooner or later fall, but a falling catch may not be a good indicator of whether and when this happens; the fact that sustainable yield (surplus growth) will fall as the stock is driven below the maximum sustainable yield level may for quite some time be masked by the last term on the right in the above formula. To identify the stock level giving the maximum sustainable yield, independent stock assessment methods are needed. A long time series of falling catches is, however, certainly likely to indicate biological overexploitation.

A further and still more serious obstacle to identifying overexploitation is the fact that the growth of fish stocks fluctuates very considerably in the short to medium term. Declining catches could be caused by adverse environmental conditions instead of overexploitation. For some long-lived fish stocks a phase of environmentally caused decline and subsequent recovery could take a decade or more. “Sustainable” yield should therefore be understood as a long term average, and “maximum sustainable yield” similarly as the maximum attainable over a long term. Hence we need a quite long time series to identify for sure whether a biological overexploitation occurs or not.
Finally, there are long term changes in ocean climate affecting the productivity of the stocks. These changes occur on a decadal scale or longer and make the concept of sustainable yield doubtful.

These long-term environmental changes could be confused with irreversible changes caused by biological overexploitation. Some stocks are known to have disappeared from certain areas for environmental reasons. One example is the cod stock at Greenland. This stock was replenished by migrations of young cod from Iceland, but as the ocean off Greenland cooled in the 1960s these migrations ceased and the stock disappeared. The collapse of the Californian sardine in the 1950s has been attributed to overexploitation, but analyses of sediments off the coast of California have shown that sardine and anchovy have alternated as dominant species over time. The collapse of the herring stocks in the Northeast Atlantic have likewise been attributed to overexploitation, but herring stocks are known to have come and disappeared throughout history. In the past, herring fisheries have risen to prominence and possibly been a major source of wealth for entities such as the Dutch provinces of Zealand and Holland and the Hanseatic League. And then they have collapsed. The herring fishery off Scania in the Baltic collapsed in the late 1400s. The herring fishery in Bohuslän, since 1666 a province in western Sweden, collapsed in the late 1500s and was down for about 70 years. Whether this was due to environmental factors or whether the primitive fishing technology of the 15th and 16th centuries was capable of fishing out the stocks is too late to tell. The collapse of the Northern cod of Newfoundland coincided with overexploitation and cooling of the ocean off Newfoundland. We shall discuss some of these cases in greater detail below.

Factors other than biological overexploitation or changes in ocean climate could be behind a long term decline in catches from fish stocks. One is that less effort is being applied to fishing. That is certainly not typical of world fisheries today. Another is pollution inhibiting the growth of stocks. This is probably not the case except for certain local stocks in coastal waters affected by pollution and salmon stocks in rivers affected by dams and logging; contamination of fish with heavy metals or other substances which accumulate through the food chain is likely to be a more serious consequence of industrial pollution than a dearth of fish. Global warming could be a cause for decline of certain stocks, at least in certain localities, but then again may affect other stocks and localities positively. The possible causes of a decline in yields will not be addressed here; we will only examine whether or not this is taking place, but our presumption is that when it is seen to happen it is due to biological overexploitation.

Finally, a few words about economic overexploitation. This means that more capital and manpower is being used in the fishery than maximization of the long term benefits would warrant. Economic overexploitation does not necessarily mean biological overexploitation; if the cost of fishing, relative to the price of fish, is sufficiently high it could occur even if the stock level exceeds what maximizes the long term yield. But economic and biological overexploitation could also occur simultaneously, and it is worthwhile to note that a situation like that could easily be sustainable. All that is needed

25 Fulton (1911)
for sustainability is that a stock is not pushed to a level from which it cannot recover. Fish stocks are typically so fecund that their threshold levels of viability are very low. Hence, a fishery could limp along indefinitely, at a low level of productivity, both in an economic and a biological sense. A careful analysis of economic overexploitation would need data on stock levels and the economics of fishing and is beyond the scope of this paper.

The overall development in world fisheries

Figure 6.1 shows the world catches from capture fisheries 1950 – 2000 (until 1970 there are no separate data on aquaculture, but aquaculture was rather unimportant prior to 1970, as Figure 6.1 shows). Up to 1970 the total production of fish grew at a rather steady rate of about six percent per year. In the early 1970s there was an abrupt fall in the catches, associated primarily with a collapse of the anchoveta fishery in Peru. From 1970 to the mid-1980s the growth in fish catches was much slower than earlier. Then it picked up again, and for about five years (1983-88) the catches grew at about four percent per year, but since the late 1980s the world captures of fish are most appropriately characterized as stagnating. The total has varied between 85 and 96 million tonnes and does not seem likely to exceed 100 million tonnes any time soon.

![World fish production](image)

Figure 6.1: World fish production 1950 – 2000. Source: FAO (Food and Agricultural Organization of the United Nations).

Despite the stagnation in world capture fisheries the total production of fish has continued to increase. Since 1970 the increase has mainly come from aquaculture. In 2000 the total production of fish surpassed 140 million tonnes.\(^{27}\) Taking into account the

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\(^{27}\) The validity of the FAO database, from which these figures are taken, has been called into question, most recently by Reg Watson and Daniel Pauly in Nature, Vol. 414, November 2001, pp. 534 – 536. It is
recently alleged deficiencies of the Chinese fisheries statistics would not greatly affect the conclusion of an overall stagnation in the catches from world capture fisheries; instead of a slightly rising trend since the late 1980s we would get a slightly falling trend. After correcting the Chinese statistics, Watson and Pauly\(^ {28} \) found a downward trend in world catches of 0.36 million tonnes per year since 1988, instead of an increase of 0.33 million tonnes per year. On the rising trend, the total world catch would have been forecast at 93.8 million tonnes in 2000, while on the declining trend it would have been 85.5 million tonnes, taking 1988 as a base year. The FAO database reports a catch of 96.1 million tonnes in 2000.

**Some aggregate groups**

What picture does emerge if we look at individual groups of fish species? Figure 6.2 shows the catches of the five most important groups of fish species, where “importance” relates to total captures in 2000. The “groups” are defined in the FAO database for world fish catches. Some large groups, not included here, are too heterogeneous to be informative.\(^ {29} \)

The largest group is *herring, sardines* and *anchovies*. The captures of these fish rose rapidly to exceed 20 million tonnes in the late 1960s and then fell abruptly to about half of that in the early 1970s. The catches started rising again around 1980 and reached a new and higher peak of 25 million tonnes in the late 1980s, then fell, only to rise again in the late 1990s. Even if the catches of these fish show a rising trend they have fluctuated violently. The stocks of herring and other small pelagic fish (fish that live close to the surface of the ocean) are notorious for their fluctuations. These fluctuations are caused by natural variations in environmental conditions, which are still poorly understood. The picture that emerges from considering these fish stocks is hardly one of overexploitation but rather full utilization with natural variations. It is possible, however, that the decline in the 1970s was caused by overexploitation. We will return to that point below in our discussion of the Peruvian anchoveta and the Atlanto-Scandian herring.

The second most important group of fish, *cods, hakes* and *haddocks*, is also characterized by substantial variations in catches. The total catch may be characterized as stagnating since the 1970s; it reached a preliminary peak in 1976, then dipped and rose to a new and slightly higher peak in 1987 but has since fallen. It gives some cause for concern that for more than ten years the catches of these fish have fallen substantially and almost without interruption. These fish are among the most valuable food fishes and hence the ones where the forces causing overexploitation under inadequate management are likely to be strong.

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\(^ {29} \) The second largest group in 2000 was "marine fishes not identified". Four "miscellaneous" groups were larger than shrimps and prawns. The classification being referred to is known as ISSCAAP (international standard statistical classification of aquatic animals and plants) groups.
Figure 6.2: Catches of selected groups of fish 1950 – 2000. Source: FAO.
The three remaining groups show an almost uninterrupted increase. These groups are (i) *tunas, bonitos* and *billfishes*; (ii) *squids, cuttlefishes* and *octopuses*; and (iii) *shrimps and prawns*. Some of these fish are highly priced food fish (shrimp, tuna, bass, squid) for which the incentive for overexploitation in the absence of good management will be strong. Yet we see, at this aggregate level at any rate, few signs of overexploitation. Judging from the development in catches in the recent past there might even still be some room for further expansion.

**Some individual stocks**

(a) Pelagic stocks

Even if there are few signs of overexploitation for aggregate groups of fish there could still be overexploitation of individual stocks. In general, one can expect the following development scenario for fisheries. First, the most valuable fish stocks will be exploited. Then, as these stocks become depleted, the fishing fleets are diverted to less valuable stocks. For a time it would be possible to maintain the aggregate level of catches, or even increase it, by exploiting successively less and less valuable stocks, but ultimately this avenue will run into a wall.

To get an idea of whether this might indeed be the case, we shall look at the catches from a few important fish stocks. Which stocks have been selected for this purpose depends on our previous knowledge of different fisheries and the availability of data on different stocks. This is not a global inventory of fish stocks but a selective review which we nevertheless believe sheds an important and interesting light on the question of overexploitation. In addition it illustrates the importance of natural fluctuations.

**The Peruvian anchoveta**

![Catches of Anchoveta](image)

Figure 6.3: Catches of anchoveta 1950 – 2000. Source: FAO.
This is one of the most important fish stocks in the world and also the one most notorious for its fluctuations, which are associated with the El Niño phenomenon.

Figure 6.3 shows the catches of Peruvian anchoveta. The catches reached a peak of 13 million tonnes in 1970 but fell abruptly in 1972 and remained below two million tonnes from 1977 to 1985. The catches recovered again in the early 1990s and reached their previous peak, fell again abruptly in 1998 (El Niño again), but recovered quickly. It is possible that the long trough of the 1970s and early 1980s was caused by bad management, but the fishery did ultimately recover, and the recovery was rapid after the latest El Niño disaster.

**The Atlanto-Scandian herring**

The Atlanto-Scandian herring (alias Norwegian spring-spawning herring) is another stock notorious for its variability. Explaining this variability has long been a challenge for fisheries biologists and oceanographers.

![Catches of Atlanto-Scandian Herring](image)


Figure 6.4 shows the development of catches from this stock since 1950. The catch fell abruptly in the late 1960s and did not recover on a significant scale until very recently (after 1990). The abrupt fall in the catch was associated with a steep decline in the stock, which is generally believed to have been caused by overexploitation. The figure shows a very steep rise in the catches in the 1960s. This rise was caused by a leap in fishing technology. A device called the “power block” made it possible to haul purse seines mechanically instead of by hand, which in turn made it possible to use much larger boats and seines. Another technological leap at about the same time was fish finding equipment which made it possible to locate shoals below the sea surface (earlier the fishermen depended on seeing the shoals ripping the sea surface) Over just a few years the fishing
capacity of the fleet was increased many times over and by more than the herring stock could sustain. This was well before the 200-mile economic zone and before any serious joint management of fish stocks was initiated, in the North Atlantic at any rate; there was no control whatsoever over fishing capacity, effort, or the total catch.

The Atlanto-Scandian herring is a stock that migrates between the 200-mile zones of a number of countries (Norway, the Faeroe Islands, and Iceland) and is also accessible on the high seas outside 200 miles. Since the late 1990s the countries concerned (Norway, Russia, the Faeroe Islands, Iceland, and the European Union) have managed to agree on limiting the total catch of this fish. This does not automatically imply that they have succeeded in setting the catch at the level which would be appropriate from a long term perspective, but there is reason to believe that the agreed catch limits may not be far above this; the quota agreement for 2001 implied a fishing mortality of 0.14 instead of 0.125 recommended by fisheries biologists.  

**Pilchard and anchovy**

Pilchard and anchovy are two pelagic fish species also notorious for their variability. What is also interesting is that they seem to vary against one another, so that one stock replaces the other over time. Whether these shifts are caused by exploitation or natural forces can be argued over, but it is well known that such shifts have taken place for natural reasons in various places and at various times (sardine and anchovy off California is one example). Figure 6.5 shows the catches of pilchard and anchovy in three areas; off Japan, Southern Africa, and Chile and Peru. There is a certain tendency for the catches of these species to vary inversely with one another, especially off Chile and Peru. This points to climatic conditions, such as the El Niño, as the source of these variations and in such a way that the carrying capacity of nature is alternatively utilized by either of these species. To the extent these variations are caused by variations in natural conditions it would clearly be inappropriate to take declining catches as a sign of overexploitation, but an interesting and intriguing question is whether overexploitation of one species rather than natural forces might cause such shifts in stock abundance.

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**Catches of Anhovy & Sardine in Chile & Peru**

![Catches of Anhovy & Sardine in Chile & Peru](image)

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(b) Demersal stocks

**Icelandic cod**

The Icelandic cod stock is one of the most important fish stocks in the Northeast Atlantic and one that has been exploited for a long time. Figure 6.6 shows the catches of Icelandic cod since the early 20th century. The effect of the two world wars is clearly visible; both wars brought a major reduction in fishing pressure due to the disappearance of foreign fleets. After both wars the fishery expanded greatly. Since 1955 the trend in the total catch has been downwards, albeit with substantial year to year variations. It is not possible to see any positive long term effect on the catch of the 200-mile zone; in the year immediately following its establishment in 1975 the total catch increased, and
particularly the catches taken by the Icelanders themselves, as they replaced the foreign fleets in the area. This is all the more serious as the Icelanders have total control over the stock and make repeated claims of managing it successfully. To some extent adverse environmental conditions could be to blame; the sea temperature around Iceland has been lower since 1960 than in previous periods.

Figure 6.6: Catches of Icelandic cod 1905 – 2000. Source: Útvegur (Fisheries Statistics). Statistics Iceland, Reykjavik.

The Arcto-Norwegian cod

The Arcto-Norwegian cod is also one of the largest and most important stocks of demersal fish in the world. The stock has been exploited since time immemorial, but the catches which it was possible to wrest from rough seas and in bad weather were severely limited by the primitive technology of the past. For a long time the catches were limited to the feeding and spawning migrations to the Norwegian coast from the Barents Sea and the seas around Spitzbergen. This all changed with the development of deep sea trawlers in the last century.

Figure 6.7 shows the catches from the stock since World War Two. As for the Icelandic cod, World War Two provided a temporary reduction in fishing pressure. The catches peaked in the mid-1950s, just as for the Icelandic cod, and the trend has been downwards ever since. Also similarly to the Icelandic cod it is not possible to see any positive long term effect of the 200-mile zone on the catches. Some would argue, however, that the 200-mile zone made it possible to avoid a total collapse of the fishery around 1990. The stock was then at an all time low, and the catches were cut back severely, through a joint effort by Norway and the Soviet Union. The stock recovered and catches increased, but lately the catches have started to decline again.

**The Northern cod of Newfoundland**

![Catches of Northern Cod](image)

Figure 6.8: Catches of Northern cod of Newfoundland 1850 – 1993. Source: Dr. Ram Meyers, Canadian Department of Fisheries and Oceans, St. John’s, Newfoundland.

The bleakest story is told by the fishery for the Northern cod off Newfoundland. This used to be one of the richest fisheries in the world, and European nations (the British, the French, the Spanish) fought over the access to this fishery in the past. Figure 6.8 shows the catches from this stock from 1850 until this fishery collapsed in the early 1990s. There was an enormous increase in the catch in the 1960s, due to the development of deep sea factory trawlers, mainly from the Soviet Union and its satellite states in Eastern
Europe. This was probably not sustainable, although the collapse of the stock came many years later and well after most of the stock had come under the jurisdiction of Canada (part of the stock was still accessible in the open sea on the so-called nose and tail of the Grand Banks of Newfoundland).

The collapse of the stock has by many fisheries biologists been attributed to faulty management by the Canadian authorities. The biologists responsible for giving advice on the management of the stock did not discover the stock decline early enough, and the Canadian government was slow in cutting back the total permitted quota, because of the adverse effects this would have on job opportunities in Newfoundland. Cooling off of the ocean off Eastern Canada may, however, have been a contributing factor, and some would argue that this was the decisive factor. Increased herds of seals feeding on cod, due to the near halt of the seal hunt, has also been mentioned as a possible reason for the collapse, and for the fact that few signs of recovery have been detected over the nearly ten years that have passed since the fishery was closed down.

*The Faeroe cod*

![Faeroese Catches of Cod](image)


A more optimistic story is told by the cod stocks at the Faeroe Islands (Figure 6.9). The Faeroese catches of cod in home waters are taken from two apparently separate stocks. Both of these were at their all time low in the early 1990s, and fisheries biologists recommended that no catch at all be taken from one of them while the catch should be severely curtailed for the other. The advice was not fully heeded, although the catches were severely reduced. The stocks nevertheless recovered, and a few years later the total catch had recovered to a level similar to the mid-1980s. Fortunately the debacle of the Grand Banks was not repeated at the Faeroes.
Alaska pollock

Figure 6.10: Catches of Alaska pollock 1950 – 1999. Source: FAO.

The fishery for Alaska pollock is an example of a fishery which developed rather late (Figure 6.10). The development of this fishery took off in the mid-1960s, and the stock was at that time mainly fished by Japanese vessels. There was a dip in the landings after 1975, due to the establishment of the 200-mile limit and the fact that the United States did not have a fishing fleet at the time to take over the fishery, but landings quickly increased as American vessels were built and the United States entered into joint venture agreements with foreign fleets. Since the late 1980s the catches have declined, and in 2000 they were only one-half of what they were at their peak in the 1980s. Whether this is due to a normal variability in nature or mismanagement of the stocks is still a bit early to tell, but the signs so far are not good. The Alaska pollock is fished both in the Russian and the American economic zone, from separate stocks, with some migration between the zones. The American catches are also shown in Figure 6.10. These have been rather steady for more than ten years, indicating that the American fishery is being managed sustainably.

Orange roughy and Patagonian toothfish

Finally, in Figure 9.11, we have two recently developed fisheries, the fisheries for orange roughy and Patagonian toothfish. Both appeared on the scene in the late 1970s. The orange roughy is found at great depth (about 1000 meters) in cold waters and so its growth rate is very low; it is believed to reach sexual maturity at an age of 30 and to have a life span of 60 – 100 years (some environmentalists have tried to persuade people not to buy this fish with the slogan “would you eat a fish that is as old as your grandmother?”).
The landings of orange roughy peaked in 1990 and have since fallen by one-half. This is not, however, a clear sign of mismanagement; when a previously unexploited stock suddenly becomes exploited the catches are often high and unsustainable for a while, as explained above. The peak of the orange roughy landings is consistent with driving down a large but slowly growing stock to a lower level which can sustain some surplus production. The landings of Patagonian toothfish appear to have reached a sustainable level around 1990, but with year to year fluctuations.

![Two recently developed fisheries](image)

Figure 9.11: Catches 1977 – 1999 from two recently developed fisheries, Patagonian toothfish and orange roughy. Source: FAO fisheries database.

**Summary on individual stocks**

What can we conclude from these examples of individual stocks? As to the pelagic stocks, the picture is one of very large fluctuations but little or no long term decline in catches. Some of the collapses may not be entirely due to nature but may have been precipitated by overexploitation, or are perhaps entirely due to overexploitation, particularly the collapse of the Atlanto-Scandian herring, which occurred when open access was still the order of the day.

A much more serious picture emerges from the demersal stocks. Some of these stocks are the largest and most valuable fish stocks in the world. The picture is one of a downward trend in landings which has persisted over a long time, in some cases over half a century or so. Even more seriously, this trend has not been reversed after the establishment of the 200-mile zone despite the fact that the stocks in question have come under the jurisdiction of one or just a few states which have cooperated in managing them. The Northern cod is by far the most serious example. This stock collapsed despite the fact that it was largely controlled by the Canadian government, which could rely on the advice of some of the best fisheries scientists in the world. Reluctance to cut catches in a timely fashion, in order to avoid throwing people out of work, contributed to this disaster. The
fact that the stock was partly accessible for foreign fleets outside the Canadian 200-mile zone certainly did not help, but was hardly decisive.

The catches from the Icelandic and the Arcto-Norwegian cod stocks have declined for half a century or so. The decline has continued after the 200-mile zone was established despite the fact that it gave Iceland full control over its cod stock. A contributing factor may have been that the Icelandic fishing industry and the Icelandic politicians have repeatedly ignored the advice of their own fisheries biologists and set total catch quotas well above what the latter recommended, especially when the stock has been in a poor shape. Since long term ITQs were put in place in 1990 there has been, however, a noteworthy change in attitude by the industry and a better correspondence between the quotas set and the advice of the fisheries biologists, but nevertheless the long term decline has not yet been reversed. The Arcto-Norwegian cod stock is jointly controlled by Russia and Norway, and these countries cooperated around 1990 in setting historically extremely low catch quotas. A recovery resulted, but in recent years the long term decline has again gained the upper hand, and the two countries have not been able to agree on as severe a cutback in fish quotas as fisheries biologists have recommended.

The Alaska pollock fishery has been in a long term decline since the late 1980s. This fishery is conducted both in the Russian and the American 200-mile zone. The stock used to be partly accessible in two “holes” outside the 200-mile zones, the Donut Hole and the Peanut Hole. Agreement on the international fishery in the larger of these holes (the Donut Hole) was reached, but only after the stock in the area had been depleted and the fishery came to a standstill by itself. Russia and the United States thus have full control over the stock of Alaska pollock and it would be in the interest of both to avoid depletion and declining catches. The American fishery seems, however, to be managed on a sustainable basis.

**Status summary**

The overall picture emerging from this review is mixed. In total the production of world capture fisheries appears to have reached a limit slightly below 100 million tonnes. The yield of some stocks, or groups of stocks, is still on the rise while the yield from others has stagnated or is in long term decline. Looking at individual stocks the yield from some of the most important fish stocks in the world has been in decline for a long period. This decline has not been reversed since the 200-mile limit came into being, even if this apparently made it possible to limit the total catch. Russia and Norway have an agreement on limiting and sharing the total catch of the Arcto-Norwegian cod. Iceland has full control over the fishing of its cod stock. Canada dominated the fishery for the Northern cod of Newfoundland.

As to irreversible changes, there are few clear examples of this. The Northern cod of Newfoundland may be one; there are still no signs of recovery even if the fishery has been closed since 1992. Rather than irreversible changes, the most serious consequences of overexploitation may be prolonged troughs and delayed recovery. It is likely that the collapse of the Peruvian anchoveta and the Atlanto-Scandian herring was precipitated,
and perhaps singularly caused (the Atlanto-Scandian herring), by overexploitation, but the stocks ultimately recovered. The recovery may, however, have been seriously delayed by knocking the stocks down to extremely low levels. The recovery of the Peruvian anchoveta took about twenty years and the recovery of the Atlanto-Scandian herring about thirty years. Decades of lost catches is a substantial cost for a few years of excessive exploitation.

### 7. CONCLUSION

Is international fisheries management over the last quarter century or so a success and an example to be emulated in other sectors facing similar problems? The establishment of the 200-mile zone is an excellent example of an adequate international framework being put in place through an international lawmaking process, but it is well to note that this was not a perfect example of putting in place a carefully thought out engineering-type solution; the 200-mile limit may owe a lot to political issues such as developing countries wanting to keep rich countries at bay, and the willingness of the superpowers at the time to secure navigational rights through near-coast waters by conceding rights to living resources. As is also true of the national legislative process, the international legislative process has its own twists and turns, and its lawmaking may come under the influence of issues that are unrelated or irrelevant for the problem at hand.

The process of setting up efficiency-promoting management systems based on exclusive use rights has perhaps been less vigorous than one could expect. New Zealand and Iceland are the ones that have gone furthest in this regard; most of their fisheries are managed by ITQs. Some fisheries in the United States, Canada, the Netherlands, Chile and Australia are under ITQ management. The so-called fishing cooperatives on the west coast of the United States function in many ways like ITQs. The fishing industry in Norway is partly based on use rights through vessel concessions, and the management of the fisheries in the United Kingdom, which takes place through so-called producers’ organizations, is increasingly taking on the character of exclusive use rights.

Why have efficiency-promoting management systems been slow in coming? First, efficiency must be seen as a priority by the authorities responsible for establishing management systems, which means governments and legislative assemblies at the federal or state levels. In many cases the fishing industry is probably not seen as important for generating national wealth, due to its smallness at the national level. In such cases it may be seen as an employer of last resort and a pacifier for depressed regions, for which a more efficient industry might mean loss of jobs and tax income.

It is not surprising, therefore, that some of the examples of a successful rights-based management systems come from countries where the industry is important at the national level (Iceland, New Zealand). But even here the political support for such systems has mainly come from the industry itself through appropriation of most of the rents that have emerged through better management. This has by some people been seen as excessive and an undesirable side effect of the management system. In countries (USA, Canada)
where the industry is almost insignificant at the national level rights based management systems have nevertheless been established through local initiatives, again because the industry has perceived a gain from such systems. It may thus be an appropriate bottom line to state that industry support, through perceived gains in the form of cashing in on emerging rents, is crucial for establishing such systems.

In recent years, an interesting development in fisheries management has been taking place. The fishing industry is becoming more and more active in working for exclusive use rights. This is, needless to say, in its own interest but it also serves the wider interest of society in promoting efficiency. In the United States this takes the form of fishing cooperatives which have a fixed share of the total allowable catch but divide it among their members as they best see fit. Comparable developments seem to be under way in Eastern Canada and the United Kingdom. This is in many ways similar to the process by which the 200-mile limit was established; coastal states wanted to get hold of marine resources for their own benefit. Those who form the cooperatives want to realize the largest possible gain from the fish quota being allocated to them as a group. Devolving fisheries management to the industry is perhaps a promising way to go. But it is well to note that to what extent the industry’s strive to promote its own interests leads to greater economic efficiency overall depends critically on the rules of the game set by governments. If governments are prone to hand out privileges at the taxpayers’ expense, or to maintain and generate inefficiencies that benefit certain groups, the industry will direct its efforts to secure such privileges. The agricultural policies of most western industrialized countries are a powerful testimony to that. From the fishing industry we have, inter alia, the successful lobbying by the Norwegian fishing industry for subsidies, particularly in the 1970s and 80s.

While the 200-mile zone was essential for establishing rights based systems, it is not possible to state unequivocally that it has led to an improved management on a global scale, in the sense of increasing fish yield or reversing the decline of important fish stocks. As discussed in Section Six, some of the most important fish stocks in the world have been in decline for a long period, albeit with large year to year fluctuations. The 200-mile limit does not appear to have reversed that decline. The disappearance of the Northern cod of Newfoundland happened despite the fact that the Canadian government had been managing that stock by a total annual catch quota since the late 1970s. Although the stock was partly accessible outside the 200-mile limit and the nations fishing in that area were uncooperative, it seems far fetched to attribute the crash in the stock to their activities; most of the catch was taken by Canadian fishing vessels. Likewise, Iceland has not succeeded in reversing the long term decline of its cod stock.

It may be noted that reversing a long term decline of fish stocks is not primarily the role of a rights based management system, insofar as the rights do not amount to property right in the stock itself, and that is seldom if ever the case. The exclusive rights that exist in world fisheries amount to use rights, not ownership of fish stocks. The rise or decline of fish stocks depends on the total catch that is taken from the stocks, not how it is divided between the fishing vessels. Rights such as ITQs promote an efficient allocation of a given total catch between the vessels participating in the fishery, but the total catch
quota could be entirely inappropriate for maximizing long term benefits. It would, however, be paradoxical if countries that have opted for ITQs or concession systems for the sake of efficiency would not be interested in setting a total catch quota in such a way that the long term benefits are in fact maximized.

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