# Global marine fisheries resources: status and prospects

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**Abstract:** This paper discusses the current status of the world's fisheries and their prospects for the future, from the perspective of the economics discipline. We focus on governance institutions within which fisheries are conducted, discussing their evolution during the post WW II period with particular emphasis on the jurisdiction extension codified by the Law of the Sea Convention in 1982. We discuss the stages through which governance institutions in fisheries seem to be moving, culminating with a discussion of recent experiences with rights-based systems. Of particular importance is the manner in which behavioural incentives are framed by governance institutions. We discuss evidence about how rights-based systems fundamentally alter incentives in comparison with systems that retain vestiges of open access incentives. Promoting sustainable use of the world's fisheries is critically dependent upon the alignment of economic incentives with conservation objectives, a prospect that appears possible only when rights-based management is adopted.

**Keywords:** global marine fisheries; institutions; sustainability; economic incentives; rights-based management.

**Reference** to this paper should be made as follows: Sanchirico, J.N. and Wilen, J.E. (XXXX) 'Global marine fisheries resources: status and prospects', *Int. J. Global Environmental Issues*, Vol. X, No. Y, pp.XXX–XXX.

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## 1 Introduction

Most of the protein in the world's food supply is derived from either grain or animal sources, each of which provides roughly half the supply. Fish resources generally account for about 16% of the protein attributed to the animal group. Although not a dominant source of the world's protein, fisheries resources are nevertheless important in several ways. Firstly, fish and crustaceans are important and high quality sources of amino acids, which are nutritionally important types of protein found only in small amounts in cereals and grains. This turns out to be important for global nutrition and particularly important to some food deficient, low-income countries. Secondly, fisheries are locally important sources of food, trade and income in many developed and developing coastal nations. Trade in fisheries products is an important source of foreign exchange for some countries and has been of growing importance as global markets for both food fish and fishmeal have grown. Finally, fisheries provide employment and income earning opportunities for considerable numbers of people, particularly in the less developed and employment-scarce coastal countries (Bell, 1978; Delgado et al., 2003).

In the 21st century, population and income growth – and the unequal distribution of both – will place increasing stresses on all global resources, including fisheries resources. The bad news is that there are daunting institutional impediments to attaining and maintaining sustainable use of the world's fisheries in the face of these inexorable driving forces. The good news is that, if these can be solved individually and cooperatively by resource users, marine resources will be able to contribute their full potential to global well-being. In this paper, we discuss the status of the world's fisheries and their prospects, paying particular attention to these institutional impediments. In the next section, we review events since the close of World War II that have influenced exploitation trends that lie behind the current status of global fisheries stocks. In the Section 3, we discuss the impact of the important Law of the Sea Convention of the mid 1970s. We then assess the biological and economic status of the world's fisheries, followed by a look at the manner in which fisheries management institutions have evolved. In the Section 6, we discuss the economic and biological potential of global capture fisheries and the Section 7 concludes.

## 2 Global trends in exploitation

In order to understand the current status of the world's global fisheries resources, one has to look back only as far as the end of World War II. In 1945, total world fisheries production was about 14 million metric tonnes (MT). Of that amount, about one-third was allocated to production of fishmeal and fish oil, used mainly as a protein supplement for animal feeds. There was very little aquaculture produced and only a modest amount of trade in fishery products. Most fish stocks were healthy biologically, partly as a

result of low prior exploitation and partly as a result of the near moratorium indirectly imposed by war-time use of the sea. Many biologists viewed the oceans as capable of producing as much fish as available technology could profitably yield and few saw any limits in the foreseeable future, if ever (FAO, 1993).

The 1950s saw a post-war ship-building boom that expanded global fishing capacity several fold. An important engine of this growth was the drive by centrally planned economies including countries of the former Soviet bloc to capture protein for planned dietary goals of their citizens. Ships from Soviet bloc countries like Poland, together with ships from Asian coastal nations such as Japan, China, the Philippines and Thailand, quickly came to dominate global marine production by the late 1960s. This period also saw the development of the so-called factory ships – vessels capable of catching huge volumes in weather and seas of all conditions; these ships were able to process the catch on board, freeze it into blocks and then store the processed raw product until return to port, a trip that often took many months.

The 1950s also saw the first hints of potential limits of marine capture fisheries, as fishery scientists began to develop and test new theories of exploited populations, as well as understand symptoms of overfishing that were just beginning to reveal themselves. Some of the important intellectual foundations of fisheries science, such as the concept of Maximum Sustainable Yield (MSY), were developed during this period, as were techniques of monitoring and recording the impacts of growing effort on the world's fish populations (e.g. by the International Commission for Northwest Atlantic Fisheries (ICNAF), established in 1949).

During the post-war period of rapid expansion of fishing fleets throughout the world, most coastal nations claimed jurisdictions extending 12 nautical miles from shore, an area that encompassed only a fraction of the ocean's most productive upwelling and continental coastal shelf areas. The post-war global fleet expansion thus brought a huge increase in fishing effort to the near-shore waters of all coastal nations, increasing fisheries production in proportion.

By the 1970s, global marine harvests had quadrupled from the 1945 levels of 14 million MT to 60 million MT, about a third of which was consumed by Soviet bloc countries (Christy, 1997). The expansion of fishing capacity coupled with increasing demand for seafood products naturally led to increases in conflicts between domestic fleets fishing operating within their territorial waters and foreign fleets operating just outside. These conflicts led to several international confrontations as exemplified by the 'cod wars' between Iceland and Great Britain.

In 1982, at the conclusion of the UN Conference on the Law of the Sea, the UN Convention on the Law of the Sea (UNCLOS) was signed. The signing of the Convention was the culmination of several years of negotiation that began at the start of the Third Conference on the Law of the Sea in 1973 and that stretched into much of the 1970s. UNCLOS provided the legal foundation for the immensely important institutional change that led coastal nations to extend jurisdictions from 12 to 200 miles and establish Extended Economic Zones (EEZs). The implementation and enforcement of extended jurisdictions was initiated as early as 1975 by some nations in anticipation of the 1982 Convention and then gradually adopted by other nations over the next two decades into the 1990s.

Since most of the world's fisheries are found in the upwelling zones and continental shelf areas close to coastal borders, this territorial change effectively brought the bulk of the world's fisheries under the control of coastal nations. Some of these fisheries came

under the control of single nations; others came under joint control (shared or straddling stocks). For other fisheries of highly migratory species (such as tuna) that spend most of their life in the high seas beyond 200 miles, UNCLOS also initiated the long and protracted debate and negotiation over sovereignty for these resources, over principles of responsible management and over obligations by member States to cooperatively manage such resources for sustainability.

It is difficult to overemphasise just how important the jurisdiction extension was to the world's fisheries. Most importantly, the change converted what was largely a global commons into a system that effectively gave coastal nations the immediate ability, if not necessarily the legislative and regulatory means and political will, to manage fisheries rationally. Prior to the mid 1970s, few nations found it in their national interest to manage their own domestic fleets on stocks that straddled or extended beyond 12-mile limits, even in the face of evidence of overexploitation. While there were attempts to manage high seas fisheries with international commissions such as ICNAF, these proved inadequate to implement and enforce policies that curtailed effort. This was the so-called tragedy of the commons at work, in that any harvest curtailment by domestic fleets designed to maintain stocks at sustainable yield levels would ultimately and inevitably be dissipated by foreign fleets attracted by the very success of such actions. Under these conditions, it should not be surprising that the growth in yields during the 25 years following World War II came about largely through chaotic and unplanned capacity growth rather than careful and rational management of the world's fisheries.

## 3 Impacts of the jurisdiction extension

What was the impact of the conversion of the world's commons into this new system of coastally 'privatised' fisheries? Firstly, there was a shuffling of production and changes in the patterns of world trade as a number of the world's fishing nations found themselves shut out of coastal waters they once exploited. Some nations like China turned to aquaculture and inland-produced fish to supplement diets. Others turned to trade to procure what was lost as domestic fleets were shunted into the still-open high seas. Japan, for example, rose to dominate world trade in fisheries in the past two decades, currently providing a market for more than a third of the world's imports. Still other nations, like the U.S.S.R., formed joint ventures with domestic fleets, purchasing fish from local fishers that were (prior to the 200-mile territorial extension) caught by global open seas fleets. Secondly, the new global configuration set off a series of national experiments as nations undertook to learn how to manage the new fisheries suddenly under their control. The legacy of fisheries management shows a wide spectrum of response, from plans that barely changed conditions of operations to radically new systems developed specifically in response to new challenges.

Many nations' first order of business was to replace foreign fishing capacity with domestic capacity. In many instances, this was accomplished via vessel construction subsidies and loans that allowed the domestic fishing fleets to expand rapidly to fill the void left by the exclusion of the foreign fishing fleets. Unfortunately, the problems associated with too many foreign fishing vessels that occurred under the global commons regime was often simply supplanted by domestic overcapacity under new management institutions. This resulted in continued growth in harvesting power embodying new fish finding technologies, improvements in gear and large-scale handling and processing

operations. In parallel and often in conflict, most coastal nations established scientific and bureaucratic institutions to begin assessing fisheries potential, estimating sustainable yields and enforcing Total Allowable Catches (TACs) and other regulations designed to manage harvests.

The overall legacy of the new domestic fisheries management institutions implemented after UNCLOS is clearly mixed and quite controversial (FAO, 1993). While the extension of jurisdiction provided legal preconditions for more rational management, the institutional follow-up by individual countries was varied for many reasons. Firstly, the extension of jurisdiction did not 'privatise' all of the world's valuable fisheries and leave them under undisputed claim by single nations. Fish stocks do not honour political boundaries and circumstances range from nations with large continuous coastlines encompassing some fisheries completely within territorial waters to densely packed countries sharing resources that overlap many different political boundaries. But even under the most favourable conditions (countries with contained fisheries) we have not seen universal success in bringing rationality to management.

Some of the poorer and less developed countries have not been able to develop the infrastructure needed to promulgate and enforce domestic laws to achieve sustainable resource use (Alder and Sumaila, 2004). Others have seen corrupt leaders invite foreign vessels in to 'mine' out the resources in unsustainable ways (Kaczynski and Fluharty, 2002; Kelleher, 1997). Other countries have developed sophisticated, scientifically based management targets, only to abandon the scientific advice in the face of local political pressures to permit higher exploitation rates. Still other nations have scrambled to develop and innovate new methods of assessing, forecasting, enforcing and monitoring, all in the face of steadily growing domestic fleets.

While having stocks contained within single jurisdictions is an ideal precondition for success, most fisheries are shared by two or more nations, necessitating complicated and protracted negotiations between neighbours over migrating and straddling stocks. For the most part, agreeing on restrictions that limit total catch to sustainable levels has been inextricably tied up with negotiations over how to share a resource among joint claimants. This has frequently led to delays in the process of establishing conditions for sustainable management, coupled with further expansions of subsidised capacity-building in order to establish bargaining stances in discussions over relative shares. Negotiations over straddling and shared stocks have been slow to resolve, taking most of the rest of the 20th century to conclude in many cases.

## 4 Assessment: biological and economic status of global fisheries resources

Any assessment of the success of global fisheries management during the 30 years since the jurisdiction extension depends upon whom one asks and what criterion one is using to judge success. The most commonly used measure is the biological status of existing stocks of fish or more specifically, their ability to continue producing sustainable yields.

The UN Food and Agriculture Organization (FAO) State of the World's Fisheries reports group fisheries into 'health status' categories including: under-exploited, fully exploited and over-exploited or depleted (FAO, 2005). The most recent data suggests that about half of the world's fisheries fall into the fully-exploited category, one quarter

in the under-exploited category and a final quarter in the over-exploited or depleted category. Those who view the legacy positively point out that, ideally, we would want all of the world's fisheries in the fully exploited category and hence a record with three quarters of the world's stocks either fully- or under-exploited seems reasonably successful at this stage of fisheries development (Hilborn et al., 2005). Those who view this legacy as unsuccessful often use the same data with a different spin, summarising by concluding with alarm that "three quarters of the world's fisheries are fully- or over-exploited". Many environmental groups decry lack of progress in management, citing important and highly visible management failures, such as the collapse of the Atlantic cod (*Gadus arenosus*), Peruvian anchovetta (*Engraulis ringens*) and New England groundfish fisheries. Some prominent scientists have extrapolated these cases, concluding that these kinds of failures are inevitable and a result of the inherent unpredictability of fisheries coupled with political pressure to continually expand TACs (Ludwig et al., 1993).

Our judgment is that the regulatory legacy should be viewed more charitably. In the first place, the relevant comparison should be what might have been without the important extension of jurisdiction. Most would agree that, by the 1970s, a large fraction of the world's most important fisheries was badly overexploited and severely overcapitalised. This trend would have surely continued, driving even more species into overexploitation and perhaps extinction. The past 30 years have seen an arrest of the decline of many fisheries, gradual and dramatic rebuilding of stocks in some cases and a general move toward establishing responsible institutions charged with rational management. None of these developments would have been likely if the open access conditions of the global commons were allowed to continue.

In the second place, the period during which one ought to assess the regulatory record is comparatively short, effectively only 30 years. While some might view progress to date as too slow, an alternative view (comparing, e.g. the evolution of water and air pollution regulation over the same period) would acknowledge that there has been considerable institutional evolution during the past two decades. A more optimistic interpretation would also acknowledge the difficulties of setting up management institutions, establishing requisite scientific monitoring and stock assessment and agreeing on goals and TACs that reflect not only the science of population assessment but also complex socio-economic tradeoffs. In contrast to the situation 30 years ago, most of the world's most valuable fisheries now are part of the purview of regulatory institutions that are charged with long-term goals of sustainable fisheries. Whether one views the summary finding that 75% of the world's fisheries are currently fully- or under-exploited as a 'half empty glass' or 'half full glass' seems to depend upon the trust one has in the ability of institutions to evolve in response to the complexities they face. But the importance of jurisdiction extension is that it reduced the class of claimants by converting global open access resources into national resources.

While virtually all of the attention has been placed on biological objectives as measures of the success of global fisheries management institutions, there are other objectives by which one might judge the success of the past 30 years of regulatory activity. One important measure is whether the world's fisheries resources are providing any economic return. On this score, even the most charitable interpretations lead to less favourable assessments than those focused on biological criteria. One heavily cited FAO report estimated that, in 1990, the world's marine capture fisheries resources yielded output worth about 70 billion US dollars in market value (Christy, 1997;

Grainger and Garcia, 1996). But the same report estimated that the actual out-of-pocket operating costs of producing this output were of the order of $92 billion. Hence, the conclusion was an extremely dismal one, namely that the world's fisheries were not only failing to return a profit, but they were actually draining income from other, potentially more productive uses.

How could this be? Firstly, it was estimated that a huge fraction of fisheries income ($30 billion) was going to vessel capital maintenance. This high fraction is due to the dramatic fleet build-up that occurred under global open access conditions during the 1950–1976 period and the continued growth in capital that occurred even after jurisdiction extension. Another factor explaining outright operating losses is the considerable subsidisation granted the fishing industry in many countries. As recently as the early 1990s, many countries were subsidising fishing investment in the face of global overcapacity, generally in order to increase catch histories as means to gain bargaining advantages in contested shared stock negotiations.

While perhaps surprising enough on the face of it, the finding that the world's fisheries are operating at a global net loss actually understates how poor the economic record for global marine capture fisheries is. This is because these resources ought to not only earn enough to cover all operating expenses but they also should be earning enough to cover payment to the valuable resource productivity that is inherently responsible for fisheries yields in the first place. This important concept can be explained by thinking about farming and the value of land.

In sustainable privatised farming systems, the value of output produced earns not only enough to cover labour, capital maintenance, fertiliser and other variable inputs, but it also earns something to contribute to what economist's refer to as land rent. A tenant farmer or sharecropper who uses land owned by someone else must pay rent, which is a payment to the inherent productive capability of the land itself. More productive land generally generates higher rents. Moreover, even a farmer who owns his own land must earn enough after expenses to cover what he is giving up by not renting or leasing his land out to someone else.

The analogue with fisheries resources carries directly over and helps explain why we do not see the world's fisheries generating any returns on the productive capacity of the resources themselves. If the world's fisheries could be divided up and privatised like farmland, the 'owners' could charge rental fees to the fishing industry for the privilege of using the ocean's productivity. Under these circumstances, the fishing industry would compete for access, reduce costs and rationalise inputs and seek out higher-valued uses for fish in order to generate the maximum value from the access rights. Given the right circumstances, we would then see fisheries covering basic (and reduced) operating costs plus a return paid to owners of the resource and its productivity.

## 5 Evolution of fisheries management institutions

Unfortunately, the past 30 years have not seen a wholesale move toward policies that mimic or otherwise approach what we might see under a hypothetically privatised regime of ocean governance. What we observe in hindsight is that fisheries management regimes seem to evolve through four distinct stages as the resource continues to become more valuable in the face of demand growth. The initial stage is *pure open access* in which there is no regulation of access possible, much as we witnessed outside the territorial

waters during the global fleet build-up between World War II and 1976. Within this stage, the most likely outcome is severe overcapacity coupled with dramatic overexploitation. The end result is generally one in which the target population is driven to a low level, the extent of which is governed by costs and markets. With highly valued products caught with technologies that produce at low costs, these fisheries may be driven close to, or beyond, levels that ultimately lead to extinction.

A second stage in the evolution of fisheries management is conversion to what might be called *regulated open access* (Homans and Wilen, 1997). In this regime, access is still open to entrants, but participants are obligated to abide by regulations, generally biologically-motivated to hold aggregate harvests at sustainable levels or to maintain a certain spawning biomass. The progression from open access to regulated open access requires institutions and mechanisms capable of enforcing compliance with the rules of the regime. Fisheries contained solely within territorial waters of any coastal nation generally manage these tasks with national fisheries management legislation and regulatory institutions. For resources shared by a few nations exclusively, treaties often set out the process by which regulations are set, with national governments enforcing those regulations on citizens. A good example of the latter is the Pacific Salmon Treaty (1985) between the USA and Canada over shared salmon stocks.

The regulated open access stage is significant because it is the stage that most coastal nations quickly evolved into after the jurisdiction extension in 1976. It is also the stage that a large number of the world's fisheries find themselves in currently. In contrast to pure open access, which often drives biomass to low levels, under regulated open access, conventional effort control measures, such as closed seasons and mesh size and gear restrictions, are used to attempt to achieve sustainable biomass and yield levels. This is the dominant current institutional structure that seems to be responsible for the paradox of having fisheries at or below maximum sustainable exploitation, but without any economic returns being generated. Under regulated open access, entrants are driven to build more vessels, with more capacity, under increasingly frantic conditions (the so-called 'derby fisheries') in order to capture a larger share of a biologically determined TAC. This 'race to harvest' leads to the allowable harvest being caught with too many inputs to generate any return. Moreover, there are other well-known symptoms manifested in poor quality raw product, excessive by-catch and discarding, non-selective gear adoption and low-valued end products, all of which waste the ultimate income earning potential of renewable resources (Homans and Wilen, 2005).

The next stage in the evolution of fisheries management institutions that has been observed is the conversion from regulated open access to *regulated restricted access*. This differs only in that some form of limited entry is adopted so that subsequent competition is among a closed group of participants. What experience has shown is that fisheries will begin to generate some returns under this regime, even though the fundamental incentives to race for the fish still exist (Wilen, 1988). In particular, if numbers in the closed group are low and if the form of limited entry restricts critical dimensions of capacity expansion (e.g. gross tonnage, engine size and hold capacity) then, fishers will be unable to fully subvert these restrictions to such an extent as to dissipate all potential returns. It should be emphasised, however, that regulated restricted access systems are still fundamentally driven by perverse incentives operating between participants to maximise their shares of the fixed TAC. Everyone, for example, will quickly adopt any innovation that improves fish catching power, even when there is no gain to the group as a whole because total output is fixed. And this will set off new

rounds of regulatory response as managers continually attempt to 'chase' input and capacity growth in order to maintain targeted harvest levels.

The last stage of institutional innovation that we have seen over the past 30 years is the development of the so-called *rights-based* fishing systems (Neher et al., 1989). These are radically different in that fishers or groups of fishers hold shares in the TAC. Hence, instead of racing to harvest larger quantities before competitors get it, individuals will be driven to focus on maximising the value of the shares of the TAC they hold. The kinds of institutions that have developed under the rights-based rubric include Individual Quotas (IQs) Individual Transferable Quotas (ITQs), Territorial Use Right Fisheries (TURFs), cooperatively managed fisheries and Community Development Quotas (CDQs).

From the experience in New Zealand, Iceland, Canada, Australia and the USA where approximately 180 species are managed with a rights-based system, it is clear that these systems generate radically different incentives compared with systems that retain full or vestige open access incentives. Most early participants in such schemes were sceptical of the potential benefits of these systems, but most current participants are virtually unanimously in favour of them. The kinds of changes in both the techniques of fishing as well as in downstream value-added activities (cf. Fox et al., 2003; Grafton et al., 2000) have far outstripped most early expectations. Large resource rental values have been generated in virtually all fisheries rationalised with ITQs and similar rights-based systems and a few anticipated problems such as high grading and black market sales have not materialised. A common feature of these systems is that they promote a race to value as opposed to a race to fish, in the sense that fishermen holding secure access privileges become focused on better quality, slower and more cautious fishing, market development and more selective fishing (Casey et al., 1995).

Most knowledgeable observers give rights-based systems a vote of confidence, both in the incentives to generate economic return and in the incentives towards stewardship that they typically induce (Dupont and Grafton, 2001; Newell et al., 2005; OECD, 1997; Sanchirico et al., 2006). It is widely believed and supported by anecdotal evidence that once fishers have a financial stake in the returns from sensible investment in sustainable practices, they are more easily convinced to make sacrifices required to rebuild and sustain fisheries at high levels of economic and biological productivity.

## 6 The future potential of world capture fisheries

As discussed above, after 30 years of institutional evolution following jurisdiction extension, the report card on global capture fisheries remains mixed. For the most part, national governance institutions have been implemented to replace the wasteful pure open access regime that existed before the jurisdiction extension was implemented. Not all of these institutions have been able to overcome the internal political pressures brought to bear on the process by participants, however, and this has manifested itself in the failure to rebuild and sustain fisheries and the failure to generate economic returns. Our view is that the next 30 years will see continued evolution of management institutions away from the regulated open access scenarios towards more restricted-access regimes and rights-based systems.

During this transition, fisheries plagued by overcapacity and in the depleted status categories will recover and move into the fully exploited categories. At the same time,

under utilised fisheries and some yet to be exploited will likely experience market-driven value increases until they, too, become fully utilised. The key to attaining both sustainable physical yields and economic returns seems to be in realigning fishers' incentives, away from those generated under derby (race for fish) conditions, towards those generated by circumstances experienced under rights-based systems. While the later have their detractors, the successes are hard to ignore and we know much more about how to tailor programmes to address various anticipated deficiencies.

How much potential is there in the world's marine capture fisheries? At a current level of 90 million to 95 million MT, it is not difficult to believe that, within the next 30 years, we might witness levels in excess of 100 million MT. This ought to materialise out of recovering stocks, growth in under- and unexploited commercially feasible stocks, improved forecasting and fine tuning of harvest targets, reduced catch and discard waste and some increased harvests of krill and other species at the extensive margin of feasibility. Perhaps more important, however, is the possibility of generating net economic returns from the world's fish resources instead of the current situation whereby these potentially valuable assets are contributing little to economic security and well-being.

A back-of-the envelope computation of what seems feasible is instructive. If we begin with the 1990 estimate of world revenues of $70 billion, it is not difficult to imagine a doubling of this by 2015 from at least two factors. Firstly, the real demand for fish protein will likely continue to grow at some positive rate as incomes and world population grow, regardless of structural changes occurring in marine capture fisheries and markets. A 1.7% demand induced growth in prices would increase revenues by about 50% after 30 years. Secondly, to the extent that fisheries are rationalised with rights-based systems, new incentives to add value in the marketplace will emerge and products serving higher-valued end uses will be created. Past experience shows that revenues can increase by 50% very soon after implementing management systems that generate incentives to alter the composition and quality of products.

Commensurate with these changes in revenues or market value, rationalisation will reduce inputs and costs, including the costly overhang of excess capital and variable input costs now witnessed under regulated open access. Again, evidence in several rights-based ITQ fisheries shows that rents often rise to levels approaching 60 to 70% of gross revenues. If we take, for the sake of argument, a figure of 66% of the (doubled) $140 billion in revenues, we can conclude that fisheries might generate more than $90 billion in returns per year, instead of the current losses being experienced yearly. This is a significant sum and a measure of how much the world has foregone as a result of the legacy of inefficient and wasteful open access institutional conditions.

## 7 Concluding remarks

This overview of the status and prospects for global marine capture fisheries has, quite naturally, adopted a distinctly economic perspective rather than the typical biological perspective. While biologist observers of the status of global fisheries have focused on alternative characterisations using various measures of biological health (cf. Jackson et al., 2001; Myers and Worm, 2003; Pauly et al., 1998), few have paid attention to why these measures seem to be declining or what is to be done about it. This paper takes the economist's perspective about the 'fisheries problem', namely the belief that insecure

access rights are the core causes of human-induced fisheries the decline of (Smith and Wilen, 2002; Leal, 2005). Our discussion of the expansion of capacity under open access conditions after World War II provides the context for discussion of the importance of the Law of the Sea jurisdiction extension in 1976. That single institutional innovation, perhaps more than any other factor over the past century, has altered the course of fisheries development and provided the foundation for a more prosperous and sustainable future for marine capture fisheries.

Much of the difference in opinion between economists and other observers of the state of the world's fisheries can be traced to different views about the fundamental cause (and therefore solution) of fisheries problems (Wilen, 2006). Economists reject the notion that fisheries are overexploited because of greed or corruption or other character flaws of users and regulators. Instead, economists believe that the institutional framework within which fishermen have historically operated has generated perverse incentives and perverse outcomes that are attributable to institutions rather than inherent human character. And that is why the body of this review places so much emphasis on the evolution of fisheries institutions over the 30 years since the Law of the Sea negotiations. There has been clear progress, albeit some would contend slow progress, as fisheries institutions have developed in coastal nations and as regulatory structure has evolved from open access, through regulated open and restricted access, to today's circumstances which include rights-based management.

While the economic perspective is often criticised for emphasising profitability before sustainability, this criticism is misplaced for several reasons. Firstly, all of the experience with rights-based institutions reveals a dramatic move toward conservation-minded behaviour that occurs only if the fundamental problem, namely insecure access privileges, is fixed. Once fishers are granted a secure and long-term financial stake in a resource (via ITQs or harvester cooperatives with dedicated quotas or assigned territories), they no longer aim at maximising the *volume* of landings but instead aim at maximising the *value* of landings. This fundamental shift in focus has multiple peripheral benefits. It slows the pace of fishing, which reduces by-catch, discards and habitat destruction. And it aims innovation towards market niche development, product quality improvements and better handling, rather than the incessant drive to increase raw fishing power that exists under race to fish conditions. By removing the race to increase fishing power, regulators are no longer under the continual pressure to keep pace with capacity growth in a never-ending adversarial process that pits fishermen against regulators. Secondly, the very creation of market rights spurs a stewardship ethic that manifests itself in a long-term view of the resource productivity. This occurs because expectations of future conservation-minded management get capitalised immediately in dedicated access privilege prices (Newell et al., 2005) and it then becomes in the interests of rights holders to preserve those capitalised values by promoting actions that sustain future biological and economic sustainability. In the same manner that shareholders have an interest in ensuring that managers maintain the asset value of firms, so do shareholders of rights-based fisheries have an interest in ensuring that their quota values are protected by wise and forward looking policies.

The important summary point is that economic performance should not be viewed as a secondary objective to be pursued only after the primary objective of biological sustainability has been achieved. Instead, it is more accurate to suggest the obverse, namely that the quest for biological sustainability will always prove elusive and ephemeral until institutions are in place that generate sustained economic benefits from

fisheries resources (Grafton et al., 2006). From the perspective of economists, any review of the status and future prospects for the world's marine fisheries that does not give primacy to the role of governance institutions in generating conservation-minded incentives will not be very illuminating about either the cause or the solution to any problems identified.

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