Marine Resource Economics, Volume 22, pp. 335–346
Printed in the U.S.A.
0738-1360/00 $3.00 + .00

Advances in Property Rights Based Fisheries Management: An Introduction

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The papers published in this special issue of *Marine Resource Economics* were initially presented at the Workshop on Advances in Property Rights Based Fisheries Management held in Reykjavik, Iceland, August 27-29, 2006. This workshop was organized by RSE, an Icelandic think tank, with financial support from the Ministry of Fisheries in Iceland, the Federation of Icelandic Fishing Vessel Owners, and Iceland's commercial banks Glitnir and Landsbanki Islands. On behalf of the RSE, I use this opportunity to thank these sponsors for their generous support. I also thank my co-editor, Professor Rognvaldur Hannesson, for his help with the peer review process. Finally, thanks are due to The MRE Foundation, as represented by the editor, Professor James Anderson, and the technical editor, Barbara Harrison, for its support of this project.

Hopefully, it will not be seen as too much of a simplification to claim that economic science has generated three fundamental perspectives on the fisheries problem. One is the externality perspective. Another is the fisheries game perspective, and the third is the property rights perspective. These perspectives are by no means mutually exclusive. On the contrary, they complement each other. This does not mean that they are equivalent, however. One of them may be more illuminating or, more importantly, of greater help in improving fisheries than the others. The fundamental motivation for the workshop that generated the papers in this issue was that, at least when it comes to the practice of fisheries management, the property rights perspective is the most useful.

It is widely agreed that the modern theory of fisheries economics was launched by Scott Gordon's 1954 article in the *Journal of Political Economy* (Gordon 1954). Of course, this wasn't the first analysis of the problem—scientific progress rarely evolves in that way. In the years preceding Gordon's paper, an informal group of economists including A.D. Scott, J. Crutchfield, R. Turvey, and Gordon himself had been discussing the problems of fisheries along lines similar to the ones that Gordon made famous (Scott 1989, 1996, 2007). Besides, the Danish economist, Jens Warming, in a couple of articles in 1911 and 1931, forwarded essentially the same analysis (Warming 1911, 1931; Andersen 1983). There is little doubt that other precursors can be found by historians of economic thought.

In his seminal contribution to the topic, Anthony Scott attempted to bring the role of property rights to the forefront (Scott 1955a). Unfortunately, Scott's analysis was restricted to the case of a sole-owner fishery. While, on this basis, he essentially proved that property rights were central to the fisheries problem, this crucial point seems to have escaped most other researchers. Thus, my initial reading of Scott's article, under expert guidance some 20 years later, indicated that the number of participating fishers was crucial for the fisheries problem, not property rights as

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such. A reason for this obtuseness may have been that Scott, in his early contributions, did not proceed to the next stage of the analysis, namely fisheries property rights held by a number of individuals. The same limitation applied to the "Swiss Corporation" idea, which the UBC School of Fisheries Economics led by Scott promoted. The idea was first proposed and developed in Scott's book in 1955 (Scott 1955b) and subsequently taken up by Munro (1979) and Jones, Pearse, and Scott (1980). The "Swiss Corporation" is simply a sole-owner fisheries company whose equity is owned by fishermen or other stakeholders. Clearly, this sole-owner corporation idea remains a viable solution to the fisheries problem.

Scott's initial emphasis on property rights as the key to the fisheries problem was quickly overshadowed by the more traditional economic perspective in terms of externalities. An early promoter of this approach was Ralph Turvey (1964—see also Turvey and Wiseman 1957), and his lead was followed by most other researchers in the field, including Smith (1969), Plourde (1970), Bell (1972), Hannesson (1974), and Dasgupta and Heal (1979). One important consequence of the focus on externalities was that when it came to the practical issue of fisheries management, most researchers in the field almost instinctively reached for Pigovian corrective taxation (Crutchfield and Zellner 1962, Smith 1969, Brown 1974, Hannesson 1974, Dasgupta and Heal 1979, Dasgupta 1982).

The suggestion to solve the fisheries problem by taxing already quite poor fishermen was not exactly received with enthusiasm by fisheries managers. No matter how insistent fisheries economists were on that particular solution, the socio-political response remained a blank stare. As a result, the field of fisheries management was *de facto* abandoned to what I like to refer to as the engineering or operations research approach to the problem. This is an approach which sees the fisheries problem as essentially the technical task of adjusting fisheries inputs to biological and economic possibilities. It ignores most of the relevant human behaviour and incentives and has, consequently, proven singularly inept in suggesting effective solutions to the fisheries problem.

So, for the first few decades following the inception of modern fisheries economics, actual fisheries management, while not unaffected by economic analysis, was primarily conducted by direct restrictions on the fishing activity, which hardly any economist recommended. To protect and restore fish stocks, measures were taken to enhance the productivity of the stocks and reduce harvests. These included time and area closures to facilitate the spawning process and protect juvenile fish, limitations on fishing time and restrictions on fishing gear and engine power to reduce the capacity of the fleet, and, sometimes, the imposition of total allowable catches (TACs). To reduce aggregate fishing effort, investment restrictions, vessel buyback schemes, and limitations on the number of fishing licences were introduced. These and similar measures dominated ocean fisheries management from the 1950s until the 1980s and continue to constitute the backbone of the management of the majority of fisheries today.

Needless to say, these direct restrictions proved of little use in halting the decline of fish stocks and utterly ineffective in what really counted, restoring profitability. Thus, it gradually began to dawn upon fisheries economists that their focus on externalities as the culprit of the fisheries problem and taxation as the solution might not be the best product their science had to offer. In both academic and practical circles, ideas that individual fishing rights might at least alleviate the fisheries problem were discussed. Papers expressing these ideas started to emerge. At the same time, some fishing nations, including Holland and Iceland, began to experiment with rights-based fisheries management methods. Thus, in 1976, Holland introduced individual quotas (IQs) in her important North Sea flatfish fishery and Iceland in her domestic herring fishery (Arnason 2002).

The earliest papers explicitly suggesting IQs to solve the fisheries problem that I have been able to find is a limited circulation discussion paper by Christy in 1973. Similar thoughts seem to have been on the minds of Quirk and Smith in their paper in 1970, but not finding clear expression. My own paper in 1977, unfortunately only published in Icelandic, explicitly discusses tradable IQs and proposes them as superior to taxation for generating efficiency in fisheries. Finally, a clear, fairly systematic statement of the use of IQs to solve the fisheries problem was presented in English in a paper by Moloney and Pearse (1979).

Nevertheless, during the 1970s and the early 1980s, it is fair to say that developments in property rights based fisheries management were led more by events in the field than theoretical analysis. In addition to small-scale territorial use rights in fisheries (TURFs), which were popping up in various sedentary mollusc fisheries, a few important fishing nations designed and introduced IQs and individual transferable quotas (ITQs) in their fisheries, not minding much that the theoretical basis was largely non-existent. Thus, as already mentioned, Holland and Iceland introduced IQs in some of their important fisheries as early as 1976. Iceland instituted a fully fledged ITQ system in her herring fisheries in 1979. New Zealand introduced ITQs in her deep-sea fisheries in 1983, as did Iceland in 1984 in her all-important demersal fisheries. In 1986, New Zealand adopted a uniform ITQ system in all her fisheries—the first such comprehensive ITQ system in the world. In stark contrast to these real-life developments, it wasn't until the late 1980s that the theory of property rights based fisheries management caught up. An important landmark in this respect was the conference on rights based fishing held in Reykjavik in 1988 (Neher, Arnason, and Mollett 1989). At that conference, the theory and practical aspects of the ITQ fisheries management, as well as that of other property rights arrangements, such as TURFs and community fishing rights, were first systematically and clearly expounded.

Since the initial steps toward individual property rights in fisheries in the 1970s, the use of property rights based instruments in the world's fisheries has expanded greatly. The most important property rights based systems are TURFs, ITQs, and community fishing rights. TURFS have been found to be very effective, but they can only be applied to species that are relatively sedentary, such as certain types of shellfish. ITQs have broad applicability and are generally very effective in generating economic efficiency in fisheries. As a result, they have been widely applied over the world. Over 10 major fishing nations have already adopted ITQs as a key component of their fisheries management system. About 15% (some 12 million metric tonnes) of the global marine fish catch is currently taken under ITQs. Various forms of community fishing rights and co-management schemes exist around the world. They are particularly suitable where it is difficult to introduce individual fishing rights because of enforcement problems or for socio-political reasons. The economic efficiency generated by community fishing rights appears to depend on two main factors; the quality of the community fishing rights and how the community decision process is set up. If community fishing rights are high quality, the potential for efficiency is believed to exist. Unfortunately, there is not much hard evidence on the actual efficiency of community-managed fisheries. What there is, however, suggests that their efficiency varies a great deal from community to community.

Property rights in fisheries, like property rights in general, have proven to be extremely effective, flexible tools for generating economic efficiency, provided they are of sufficient quality. The world's fishing nations are still in the initial stages of adapting this tool and honing it for the needs of the various fisheries. There is no doubt that there is still a long way to go before the full potential of property rights in fisheries is realized. The papers published in this issue constitute attempts to identify ways to enhance their contribution to socially beneficial fisheries.

Limitations of ITQs

Two papers deal with the limitations of ITQs, as they are normally applied, for solving the fisheries problem. The paper by *Christopher Costello and Robert Deacon* entitled "The Efficiency Gains from *Fully* Delineating Rights in an ITQ Fishery" makes the fundamental point that the aggregative, discrete ITQ system—the kind of ITQ system whish is almost exclusively employed in the world's fisheries—will, in general, not be fully efficient. An aggregative ITQ system issues one TAC for the aggregate stock and, thus, does not distinguish between substocks by genetic make-up, growth potential, year class, location, catchability, market value, and so on. Obviously, to the extent that this heterogeneity applies, which would be the rule rather than the exception, the shadow value of the respective substocks will be different. Consequently, an aggregative ITQ system cannot be efficient.

A similar, but not quite identical, problem arises with discrete ITQ-systems. A discrete ITQ system is one which issues a TAC over a finite length of time. All of the world's ITQ fisheries do this, most commonly for a year at a time. If fishing conditions vary over the period, for instance because of developments in the stock size, seasonal catchability, and so on, the shadow value of the biomass will fluctuate accordingly. Thus, the optimal TAC should also do so. It follows that an ITQ system based on this kind of discrete TAC issue cannot be fully efficient. In addition, variability in individual profit functions over time, combined with discrete TACs, may give rise to new external effects, such as crowding when profitability is high or an inefficient harvesting profile over time.

Costello and Deacon explore these issues and how they relate to the limited property rights contained in ITQs. Their fundamental conclusion is that disaggregated ITQs; *i.e.*, ITQs by each economically distinct substock, would solve the problem stemming from aggregative ITQs and generate efficient utilization at each point of time. This, of course, is not surprising. A fundamental result in market economics is that heterogeneous goods should have different prices. Otherwise the problem of missing markets arises. The same applies to ITQ systems. ITQs based on undifferentiated TACs with respect to substocks only confer property rights in the aggregate stock. Hence, there cannot be separate ITQ prices for substocks. This results in missing markets and economic inefficiency. Basically the same thing applies to the time dimension. Shorter-period ITQ systems would reduce the inefficiency of ITQ use over time. Continuous-time ITQ systems would, of course, eliminate it altogether. Costello and Deacon refer to adequately diasaggregated and continuous-time ITQ systems as fully delineated rights.

Thus, Costello and Deacon do not only identify some important limitations in the property rights quality of most existing ITQ systems, they also point to the way of improving these property rights and, thus, make them more capable of generating economic efficiency.

The paper by *Rognvaldur Hannesson* entitled "Taxes, ITQs, Investments, and Revenue Sharing," considers another kind of limitation on the efficiency of ITQ systems. Hannesson points out that the common presumption that ITQs lead to optimal investment in fishing capital will be unwarranted if there are other sources of distortion in the system. The specific situation explored by Hannesson, the almost universal one in fisheries, is where fisheries labour is remunerated on the basis of a share in the gross output. This situation, of course, is essentially the familiar case of sharecropping, which is known to be economically inefficient (Marshall 1920), unless compensated by actual labour exertions. In his paper, Hannesson ignores this possibility and shows that that when labour remuneration in an ITQ fishery consists of a share in the gross output, investment decisions will not be socially optimal. In this sense, the ITQ system alone is not sufficient to generate full efficiency in the

fishery. The source of the problem, however, is not the ITQ system as such, but the distortion created by the share remuneration system. Indeed, a corresponding distortion would also apply in a sole-owner fishery, which was otherwise optimal, if it were working under the same regime of labour remuneration. So, Hannesson's basic point is that the ITQ-system will not correct for distortions which have nothing to do with property rights in the extraction process.

Having established this fundamental result, Hannesson goes on to explore ways to correct for this particular distortion. He shows that the correct tax on the value of fish landings will do the trick. On the other hand, according to Hannesson, no tax on quota holding can do so. It seems likely, although Hannesson does not explore this, that if sharecropping in an ITQ-managed fishery is truly inefficient, there will be a tendency to adopt a more efficient labour contract in the long run. Another interesting issue, not explored by Hannesson, is whether there are more incentives to adopt sharecropping labour contracts in common pool fisheries than there would be in an ITQ-based fishery in the long run.

Fisheries Management by ITQ Holders

My own paper entitled "Fisheries Self-management under ITQs," considers the economic aspects of having ITQ holders take care of the management of their fishery. Fisheries management comprises: (*i*) the selection and modification of fisheries management rules, (*ii*) the setting of specific fisheries management measures including the TAC, (*iii*) the enforcement of the fisheries management system, and (*iv*) the biological and economic research necessary for adequately discharging these functions.

The analysis is motivated by a number of empirical observations. First, fisheries management is generally a costly activity, representing, in most cases, a substantial fraction of the gross landed value of the fishery. Second, due to problems of inadequate information, inappropriate incentives, and misalignment of costs and benefits, the government is generally an inefficient provider of fisheries management services. Third, under a properly designed ITQ system, the need for government management is greatly reduced compared to what it would be under traditional fisheries management. This is because such an ITQ system defines reasonably high-quality property rights in harvest volume and, thus, eliminates many of the most detrimental externalities associated with common property resources.

Under ITQs, the interests of the various ITQ holders regarding the underlying marine resources tend to be aligned. Essentially, all of them want to maximize the value of their ITQs. Thus, they will find it in their individual interest to promote, participate in, and undertake collective measures to protect and enhance all the marine resources on which the fishery depends. Moreover, as a collective, the ITQ holders are in a position to negotiate the withdrawal of ITQs or reduction of the TAC with other users of ocean resources, such as the tourist industry and conservationists. Given well-defined property rights, this kind of negotiation may well lead to an efficient overall resource use according to principles first explained by Ronald Coase (1960). Thus, on *a priori* grounds, there appears to be strong reasons to expect that fisheries self-management by ITQ holders would be: (*i*) reasonably economically efficient and (*ii*) much superior to centralized management by the government.

I go on to make these arguments more rigorous, recognizing that collective decision-making within the group of ITQ holders is basically the outcome of a bargaining game. I show that when the ITQ holders can employ the same technology

(a condition not far from the reality in most fisheries), this game basically collapses to the efficient solution—the only moves that make sense to individual ITQ holders are those that maximize the overall value of the fishery. Moreover, even when fishers are heterogeneous with respect to their technology, they would, under quite plausible conditions, still agree on the value maximizing policy. Finally, irrespective of any diversity of ITQ holders, if the group as a management unit is coherent enough (or transaction costs are low enough) to make side payments possible, the overall benefit maximizing solution is almost bound to occur.

On this basis, I conclude that entrusting the management of an ITQ fishery to the ITQ holders may very well be the socially optimal way to proceed.

Community Management as an Alternative to ITQs

In a paper entitled "Turfs and ITQs: Collective vs. Individual Decision Making," *José Cancino*, *Hirotsugu Uchida*, and *James Wilen* consider space-based collective management alternatives to decentralized species-specific ITQs. They point out that while most of the fisheries management literature has been devoted to ITQs, other rights-based fisheries management alternatives exist. More importantly, these alternatives may be more appropriate than ITQs to certain fisheries and social situations. One obvious, and probably empirically highly relevant, case is where the enforcement of ITQs is prohibitively costly. This would, for instance, often be the case in small-scale, low-technology fisheries with a large numbers of fishermen, many landing places, and short post-harvest processing and distribution lines.

Cancino, Uchida, and Wilen specifically study two prominent cases of community-based management, the ones in the inshore fisheries of Chile and Japan. Their approach is primarily descriptive. However, by reviewing the experience, they manage to detect certain patterns of possible general validity.

In spite of a great geographical and social distance between the two fisheries and entirely different histories, there are many similarities between the community-based arrangements. In both situations, the community rights are based on collective TURFs. In the Chilean case, the TURFs are supplemented with collective harvesting quotas. In both cases, there is a hierarchy of management from the basic units—Fishery Management Organizations (FMOs) in the case of Japan and Management Exploitation Areas (MEAs) in the case of Chile—to regional and national organizations. This hierarchy is more developed in the case of Japan than Chile. In both systems, the fishermen belonging to the basic units have a high degree of collective autonomy over how to manage their biologically determined allocations. Considerable collective effort is devoted to the management of fishing effort over space and time in order to reduce spatial overharvesting and maximize revenues, often with revenue pooling. But in both cases the actual determination of TURF-level allocations is guided and ultimately restricted by the government fisheries authorities at high levels. Thus, in both cases, the system is properly described as one of co-management with higher authorities.

The history and state of evolution of the two systems are very different. The Japanese TURF-based community management system originated in the feudal system centuries ago. Since then, the system has evolved and taken forms according to the wishes of its members. Thus, the Japanese system is quite mature and settled with deep social and historical roots. Most of the rent generation appears to have been driven by devolution of community-level TURF management into multiple, smaller, species-specific FMOs that intensively manage their own fisheries. By contrast, the Chilean community management system was formally instituted by the Chilean government in the 1990s in response to the failures of the previous attempts

at managing shellfish fisheries. Being recent, the system is still subject to quite rapid evolution and change. At present, Chilean TURFs retain control and manage at the local ecosystem level, including spatial and temporal management of individual species, but also attempt to manage intra-species interactions. There are also differences in the species coverage of the two systems. The Japanese system comprises basically all inshore fisheries. The Chilean system has devoted most management effort to relatively sedentary benthic species, especially molluscs and seaweed.

One of the frequently mentioned conditions for a successful community management is a relatively small membership. It is interesting to note that this condition seems to be met in both systems. In Japan, the average FMO membership is reported to be 53, while in Chile the average MEA membership is 62. Another condition for successful community management is restriction of entry. Formally, in both systems, entry is open to new members who satisfy certain fairly unrestrictive conditions. In practice, however, both systems have set up informal barriers to entry that seem to be sufficient to keep new membership at bay. It is not clear, however, to what extent these barriers would hold, if the benefits of entry would substantially increase.

According to Cancino, Uchida, and Wilen, these two community management systems have been successful in generating and sustaining economic rents. This success has not been uniform, however, and some communities have apparently done much better than others. Differences in success appear to be determined by the fundamental potential for rent generation (biological productivity, species mix, market access) in each TURF and the ability of local decision-making bodies to overcome the transactions costs of collective management. How that differential success in overcoming transactions costs relates to the characteristics of the communities, leadership, group size, and other local characteristics is clearly material for further research. It is notable that a substantial part of the added net benefits stem from output and marketing improvements, not from input savings. This is in accordance with the experience from ITQ fisheries.

Assigning Property Rights

In his paper entitled "Assigning Property Rights in the Common Pool: Implications of the Prevalence of First-Possession Rules for ITQs in Fisheries," *Gary Libecap* considers the initial assignment of individual property rights to previously common pool resources. Libecap's approach is both analytical and empirical. More precisely, he uses theory to derive hypotheses about actual assignments of property rights and then compares them with empirical observations.

Libecap begins by noting that the social institution of private property rights generally reduces the economic waste associated with the common pool/common property arrangement. Moreover, as a rule, the higher the quality of the property rights, the more efficient the resulting resource use. Other approaches to avoid the common property waste, notably government regulations of various types, have generally been found to be ineffective. Thus, if economic efficiency is the aim, as social welfare dictates, private property rights constitute the most promising way of attaining it.

The introduction of private property rights into a situation of common property logically requires the assignment of the property rights to economic agents. In general, this assignment cannot be carried out independent of other economic and social variables. The way in which the assignment of property rights is done may have significant economic as well as socio-political implications. In his paper, Libecap explores these implications.

From a static perspective and in the absence of significant transaction costs, the

assignment of property rights is not a major economic issue. As long as the property rights are freely transferable, they will end up with those that can make the greatest use of them. In a more realistic setting, however, transactions costs of various types are often substantial and this result does not hold. Over time, even with no transaction costs, the rule for assigning property rights may have major economic consequences. The reason is that each method of assigning property rights affects the incentives for: (*i*) discovering new resources (or new uses for old ones) and (*ii*) developing new property rights technologies (including technologies for the enforcement of property rights). Since, as demonstrated by history, both activities are crucial for economic growth, the same applies to the incentives for undertaking them. Thus, in a dynamic setting, the rule for assigning property rights becomes crucial.

The purely technical task of selecting the most efficient rule for assigning property rights is further confounded by the almost inevitable social struggle for who gets these rights. As a general rule, the more potentially valuable the resource in question and the less well socially established the assignment rule, the more intensive is this fight. Social fights are costly, sometimes extremely so. This must be taken into account in suggesting modifications to existing assignment rules.

Libecap studies three ways of assigning private property rights: (*i*) first possession assignment, (*ii*) lottery or uniform allocation, and (*iii*) auctions. He convincingly argues that none of these assignment rules is uniformly most preferable or "best." The nature of the resource including its value; the presence of existing incumbents or resource holders; and a range of transaction costs regarding the establishment, protection, enforcement, and exchange of property rights all affect the best allocation rule in any given case. Digging deeper, Libecap argues that with a resource already under exploitation; *i.e.*, with current incumbents, or a new resource requiring costly search and discovery, a first possession rule would be most efficient. For a new resource (*i.e.,* one currently unexploited and, consequently, with no incumbents) which is highly valuable and subject to high subsequent transfer costs, an auction might be most efficient. Finally, for a new resource with low transfer costs that is subject to strong equity sentiments, a lottery or uniform allocation might be optimal.

On this basis—and apparently the axiom that efficient procedures tend to be adopted by society—Libecap forwards the following empirical hypotheses concerning the assignment of property rights:

(1) Resources already under exploitation: Assignment of rights to current users.
(2) New, naturally provided resources (with strong equity sentiments) and low transaction costs: Assignment by lottery or uniform distribution.
(3) New resources (not naturally provided and with comparatively weak equity sentiments) with high potential rents and transaction costs: Assignment by auction.
(4) The adoption of property rights based institutions (and assignment of property rights) comes relatively late when the cost of open–access and/or centralized regulation becomes too great.
(5) The most complete property rights are assigned to highly valuable, low mobility, and easily measured resources.

Libecap goes on to compare these predictions with the experience from five empirical cases in North America: (*i*) oil and gas reservoirs, (*ii*) surface water resources; (*iii*) radio spectrum, (*iv*) air pollution permits, and (*v*) fisheries. He finds that by and large his hypotheses are confirmed by these examples. It remains to be

seen to what extent they are confirmed by a wider set of examples for more disparaged parts of the world.

Fisheries Games

Professor *Gordon Munro* writes a multi-level paper entitled "Internationally Shared Fish Stocks, the High Seas and Property Rights in Fisheries." On one level, his paper may be read as an extremely clear, illuminating account of the expansion of national rights to marine resources in the post-World War II era. On another level, the paper considers the games fishing nations inevitably find themselves playing as they seek to maximize their benefits from marine resources they share with other nations. The probable outcomes of these games are discussed and illustrated with empirical examples. On the third level, Munro relates the types of games being played and, consequently, their probable outcomes to the quality of the property rights held by the various players. His fundamental conclusion is that the higher the quality of national property rights, the more likely it is that the equilibrium outcome of the game will be economically efficient.

Munro first explains how, during the post World War II period, the "Freedom of the Seas" doctrine, as formulated, among others, by the Dutch legal and political philosopher Hugo Grotius, was gradually eroded by the combined forces of rapidly advancing marine exploitation technology and increased national ability to assert sovereignty across open seas. Faced with this process, United Nations (UN) conferences may be seen as attempts to adjust international law to technological and political reality.

The first UN conference on the law of the sea, UNCLOS I, was held in Geneva in 1956 and resulted in important international law treaties in 1958. This, however, proved far from adequate and the second conference, UNCLOS II, was convened in 1960. This one, however, conducted at the height of the cold war, was largely unsuccessful and did not conclude any treaties. The third United Nations conference on the law of the sea, UNCLOS III, was convened in 1973 and lasted 10 years. In 1982, it resulted in a major revision of the international law of the sea, referred to as UN Convention on the Law of the Sea. These three UN conferences on the law of the sea did not deal exclusively or even primarily with fisheries. Nevertheless, fisheries and national fishing rights were among the many aspects of marine resources they were concerned with. Indeed, arguably the greatest accomplishment of UNCLOS III was in relation to international fisheries law. Thus, as pointed out by Munro, on the basis of UNCLOS III, and the UN Convention of the Law of the Sea, the 200-mile exclusive economic zone (EEZ) became acknowledged international law. Also, and no less importantly, Munro points out that further international agreements and treaties to deal with other unresolved fisheries issues have been completed on the foundation laid by these fundamental agreements. Among those is the UN Fish Stocks Agreement adopted in 1995, which deals explicitly with rights to the utilization of straddling and highly migratory fish stocks.

The second level of Munro's paper explores the games that inevitably arise between nations when their property rights to fisheries are limited or insufficiently clear. With regard to the types of games being played, Munro makes a clear distinction between transboundary fisheries resources and straddling fish stocks. The former are shared between two or more coastal nations. The latter are at least partially outside national EEZs and are thus subject to exploitation by distant water fishing fleets. In his analysis, Munro explicitly ignores the so-called high-seas discrete fish resources, which, for the most part, are fish stocks located in certain areas on the high seas often around sea mounts.

The first situation, transboundary fish stocks, constitutes a relatively tractable bargaining game situation with a fixed number of players. In this kind of a game, the economically efficient solution is often attainable and even stable. In other words, the core of the game is often nonempty (Shapley and Shubik 1969). However, it may take many moves and considerable time to reach the core. Indeed, there is no guarantee that it will ever be reached. An important result is that if so-called side payments are possible—total game payoff can be transferred in any proportion between the players—the core is guaranteed to be non-empty and the likelihood of reaching it quickly is greatly increased. Munro points out that when the transboundary stock is allocated as ITQs to individual fishers of the nations involved, the playing of this kind of a game becomes much simpler and the attainment of the core much more likely. Interestingly, it appears that an ITQ system with quotas transferable between fisheries of different nationalities is theoretically equivalent to unrestricted side payments. In transboundary fisheries games, the way the game is played is highly dependent on the respective quality and clarity of the property rights of the nations involved. It is precisely in this field where the various international agreements have contributed substantially. Munro finds that the outcomes of transboundary fisheries games where respective property rights have been well defined have been mildly encouraging.

According to Munro, there is less reason for this kind of guarded optimism with regard to straddling fish stocks. The main problem here is that of new entrants. According to current international law, any distant water nation can request and should be awarded access to straddling marine resources provided it is willing to abide by the general exploitation rules laid down by the Regional Fisheries Management Organization (RFMO). This means, as Munro carefully explains, that the regional coastal states have a greatly reduced incentive to make the effort to agree on an efficient utilization of the resource. For, were they to accomplish this, and the resource is moderately valuable, the odds are that new entrants would appear to request their "rightful" share in the proceeds. Thus, the benefits of cooperation are reduced, often greatly reduced, and the likelihood of an efficient utilization correspondingly diminished.

The third level of Munro's paper is to relate the types of international fisheries games that are played to the property rights held by the nations involved. According to Munro, the stronger the national property rights, the simpler the game, and the more likely it is that an economically efficient outcome will be attained. Munro sees the post-World War II evolution of international law of the sea as essentially an expansion in national property rights at the expense of international commons. It is interesting that this author, probably the world's most outstanding scholar in the empirics and theory of international fisheries games, concludes on the basis of his analysis and experience that "the only real solution is to finish the job" by eliminating the Freedom of the Seas by establishing *de facto*, if not *de jure*, state (or possibly joint) property rights to the marine resources currently under the auspices of RFMOs. By implication, the same should apply to the discrete high-seas fish resources, which are otherwise not explicitly discussed in Munro's paper.

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