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Ocean fishing: Economic efficiency and the law of the sea

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OCEAN FISHING: ECONOMIC EFFICIENCY AND THE LAW OF THE SEA+

by

Wilfried Prewo

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OCEAN FISHING: ECONOMIC EFFICIENCY AND THE LAW OF THE SEA[+]

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OCEAN FISHING: ECONOMIC EFFICIENCY AND THE LAW OF THE SEA

I. Introduction

The legitimation of the "freedom of fishing" as the principle guaranteeing open, i.e., unconstrained and non-priced access to the oceans' living resources was in great part based on the premise that these resources are inexhaustible, that their use does not diminish their value. These observations were central to Hugo Grotius' writings on the "freedom of fishing".[1]

> "... all that which has been so constituted by nature that although serving some one person it still suffices for the common use of all other persons, is today and ought in perpetuity to remain in the same condition as when it was first created by nature."[2]

And, to reaffirm:

> "For by using, the sea itself is not at all impaired, and it needs no cultivation to bear fruit. Therefore, the sea deservedly remained common."[3]

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[1] These arguments on the freedom of fishing were subsidiary to Grotius' central goal of deriving the freedom of navigation and establishing the "freedom of the seas" as the encompassing principle: "For the cause was demonstrated from the effect, namely, the community of the sea from the freedom of fishing; and the less from the greater, for if fishing should be free, which takes something from the sea, much more would navigation, which takes nothing. This question of fishing therefore, was not 'a general position', but a 'special point', as is apparent to anyone who reads." H. Grotius, "Defense of Chapter V of the Mare Liberum", in Herbert F. Wright, Some Less Known Works of Hugo Grotius, Bibliotheca Visseriana, Vol. 7, 1928, at 155 f.

[2] Hugo Grotius, The Freedom of the Seas or The Right Which Belongs to the Dutch to Take Part in the East Indian Trade, originally published in 1608, translated by Ralph van Deman Magoffin, Oxford University Press, New York, 1916, at 27.

[3] Grotius,"Defense of ...", at 191.

For three centuries following the writings of Grotius, open access to fisheries continued to be the practical solution even though the presumption of inexhaustibility grew doubtful. Open access, as it turns out, was practical, not because ocean resources were free goods lacking any degree of scarcity, but because the benefits to be gained from limiting access and extending jurisdiction over the oceans did not justify the costs of establishing and enforcing an exclusive access system. First, rudimentary fishing techniques had, through the relation of cost to price, limited harvesting to levels which did not seriously affect the stocks' reproductive potentials, thus making them appear inexhaustible. Second, enforcement of exclusive jurisdiction, if at all technically feasible, would have entailed disproportionate costs. Such costs have played a major role in the historical development of the Law of the Sea. A prime example is the seaward extension of the territorial sea to three miles, which, as is often said, corresponded to the range of a cannon.

The situation has undergone radical change. As a result of demand increases for protein and improvements in fishing technology, the price-cost differential in fishing has widened substantially: fishing can command high economic rent. On the other hand, the development of modern surveillance techniques has greatly reduced the costs of enforcing exclusive access regimes. Control over the sea has become possible and worthwhile.

The recent developments in the Law of the Sea reflect the growing economic potential of the oceans. A majority of coastal states already claim exclusive 200-mile fishing zones, and the Third United Nations Conference on the Law of the Sea (UNCLOS III) attempts to globally re-order maritime user and property rights.[1] It is therefore timely to analyze various legal-institutional frameworks from an economic efficiency point of view.

The plan of the paper is this. Section II summarizes the received economic theory of the fishery[2] and illustrates the incompatibility between efficiency and open access[3] in fishing. Section III derives the legal, institutional, and economic policy conditions that are necessary for efficiency in fishing; and in Section IV, the 200-mile national zone concept is evaluated against this ideal scheme of reference. It is shown that the national zone concept, as envisioned at UNCLOS III[4], results in an improper assignment of property rights and will, at most, provide a second-best solution. More likely, however, the UNCLOS concept will lead to substantial welfare losses by its sanction of discriminatory and inefficiency-perpetuating fishery policies.

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[1] On the history and background of fisheries management and UNCLOS III, seeH. Gary Knight, "International Fisheries Management: A Background Paper," in H. Gary Knight, ed., The Future of International Fisheries Management, West Publishing Company, St. Paul, Minn., 1975, pp. 1-49.

[2] For the pioneering work, see H. Scott Gordon,"The Economic Theory of a Common Property Resource: The Fishery", 62 Journal of Political Economy, April 1954, pp. 124-142.

[3] "Open access" stands for free, unconstrained and non-priced access or the impossibility of exclusion.

[4] See the Informal Composite Negotiating Text, in Third United Nations Conference on the Law of the Sea, Official Records, Vol. VIII, UN Doc. A/CONF. 62/WP. 10, New York, 1978.

II. Economic Efficiency and the Dilemma of Open Access

1. Optimal resource use

A natural resource is extracted at a "socially optimal" rate when the net benefits of resource use that accrue to society are maximized. (Net benefits are defined as the excess of gross benefits, typically revenue, over cost.) Since resource use can be spread over long periods of time, the cost-benefit calculation requires consideration of the net benefits of current as well as future resource uses. This is achieved by determining the present value of resource use as the sum of current and discounted future net benefits.[1] The utilitarian optimality criterion then dictates that, among alternative "time-paths" of resource use (e.g., fast vs. slow extraction), the time-path associated with the highest present-value of net benefits should be selected. This time-path represents the optimal trade-off among future and current net benefits, or the optimal allocation of resource use over time.[2]

It may be illustrative to view a resource stock as a capital asset: resource depletion is analogous to the depreciation of a capital asset; abstention from resource use will leave the stock intact; and the cultivation of a renewable resource (e.g.,

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[1] The procedure is analogous to determining optimal investment strategies by discounting the stream of future net revenues.

[2] For discussion of utilitarian and alternative criteria and a selection of writings on the economic theory of resource extraction, see the "Symposium on the Economics of Exhaustible Resources", in 41 Review of Economic Studies, 1974; and Robert M. Solow, "The Economics of Resources or the Resources of Economics, 64 American Economic Review, May 1974, pp. 1-14.

plantings, fertilization, aquaculture) corresponds to the augmentation of capital through investment. Living resources are a special case, since they not only grow through man-made cultivation efforts, but also through biological reproduction. In fact, the latter is the only source of growth for most living ocean resources, for which "investment" by cultivation, fishfarming or aquaculture, is still atypical.[1]

The economic decision rule which follows from maximizing the present value of resource use dictates that a resource should be exploited up to the point where its price equals all costs associated with extracting the last unit.[2] These marginal costs consist of private and social cost components: marginal harvesting cost (e.g., the cost of catching one additional fish) and marginal user cost, the amount by which the present value of the resource is diminished as one more unit of the resource is withdrawn. In the case of fisheries, the current catch of one more fish reduces future harvesting possibilities by its own unit and, additionally, by its potential contribution to the stock's biological growth. As the present value of these foregone future opportunities, user cost is critically dependent

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[1] The past and current state of ocean fishing corresponds much more to primitive hunting practices rather than to modern-day farming or forestry. Aquaculture is typically restricted to high-valued and/or locally containable or stationary species; e.g., oyster beds.

[2] For a formal derivation, see Frederick M. Peterson and Anthony C. Fisher, "The Exploitation of Extractive Resources: A Survey," 87 Economic Journal, December 1977, at 685.

on the social rate of discount used.[1] In contrast to current harvesting costs, user cost is an "opportunity cost" which does not require current expenditures. Yet, if not taken into account, future generations will pay for its current neglect in the form of reduced opportunities.

Application of the maximization principle encounters two fundamental problems: First, present value calculations are sensitive to the magnitude of the discount rate, which should reflect social, rather than private, preferences about the allocation of resources over time. The second problem relates to the prevailing property rights structure over the stock of a resource; specifically, will private maximizing behavior, by itself, lead to social efficiency or are government interventions or a restructuring of property rights necessary for correspondence between private and social efficiency?

While the implications of discounting are known, exact measures of the social rate of discount are unavailable, as this would require interpersonal and intergenerational, or cross-sectional and intertemporal, comparisons of preferences, i.e., judgements

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[1] The higher the rate, the lower the present value imputed for future benefits and costs. At a zero rate, future costs and benefits are not discounted, i.e. present and future values would be identical; and at extremely high rates, the present value of benefits and costs in the distant future becomes negligible. User cost also depends on present and (expected) future prices, technological and biological parameters (biomass level and intrinsic growth rate). For example, if the stock is at or near its environmental capacity limit, user cost is negligible.

about "equity" and "fairness" in allocating resources among individual members of society and among present and future generations (whose preferences are yet unknown). In the absence of normative judgements of interpersonal and intergenerational equity, market rates of interest, such as the rate on long-term government bonds, are frequently used as proxies for the true, unknown social discount rate. Such proxies are, however, subject to the criticism of not fully capturing the social preferences, and, consequently, no practical present value calculation can, on the basis of the discount rate employed, claim to yield the only admissible evaluation of social costs and benefits.

Nonetheless, while the use of any proxy rate is debatable, the maximization principle is not rendered obsolete and such present value calculations are not worthless exercises. For they can, at the minimum, provide qualitative evaluations of alternative patterns of resource use by revealing the normative implications of alternative discount rates. Two examples of extremely low and high discount rates illustrate this: First, a social discount rate of zero would imply that society places an extremely high value on refraining from present resource use, since future benefits are not discounted at all. The sacrifices associated with reduced resource use in the current period would always be outweighed by the stream of corresponding future benefits (whose present value would amount to their sum, rather than their discounted sum). Thus, use of a zero discount rate would lead to the most conservative approach to resource management. On the other hand, an infinitely high discount rate

would imply that future benefits, since discounted to zero, carry no present value, i.e., that society places no value in reducing current resource use in order to be able to enjoy future benefits. This extreme case leads to the most rapid rate of resource use and, consequently, represents the least conservative approach. It is obvious that neither of these two extremes appears socially acceptable.

2. Inefficiency under open access systems

In the case of ocean fishing, the private maximizing behaviour of individual fishermen differs from the social optimum of equality between price and marginal harvesting plus user cost.[1] First, fishing is an industry with no or low barriers to entry, small firm (boat) sizes[2] and, consequently, favourable conditions for the development of competition among a large number of fishing enterprises. Second, with the exception of few species[3],

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[1] The economic theory of open-access fisheries was developed by H. Scott Gordon, op. cit. For a summary and survey of the subsequent literature on fisheries and other common property resources, see Peterson and Fisher, op. cit. Mathematical models are presented by Colin W. Clark, Mathematical Bioeconomics: The Optimal Management of Renewable Resources, John Wiley and Sons, New York, 1976. This section summarizes the theory of open-access fishing in the context of the theory of property rights.

[2] Relative to other industries, for example ocean transportation.

[3] In particular, sedentary species (e.g. oysters, sponges) that, at the harvestable stage, reside on or move in connection with the ocean floor in the continental shelf areas.

the ocean's living resources are fugitive and their whereabouts are not known with certainty: property over ocean fishes can only be established by seizure. Finally, under open access to fishing grounds, an individual's right to fish is non-exclusive as it does not confer any right to control or exclude others from present or future competitive use of the fishery.

These economic, biological, and legal-institutional aspects have both static and dynamic implications for the behaviour of individual fishermen. First, the value of the resource in situ (the uncaught stock), since it cannot be privately appropriated now, is of no influence on an individual fisherman's current profit and does not affect his current fishing effort. This is not to say that individual fishermen are unaware of the importance of sustaining stocks at satisfactory levels and the future benefits implied by conservation efforts. They are presumbly the ones who can best assess these aspects. Nonetheless, lack of appropriability causes their profit maximizing behaviour to ignore future opportunities, or user cost. In addition to these long run considerations, other social costs are neglected by short-run, or current effects of non-exclusive rights of access. Since fishing is a search-and-gather activity, there are diminishing returns to fishing a given species, with fishing costs rising as the stock level declines. Thus, at the margin, the catch of an additional fish by any one fisherman raises unit costs for the entire fishery. The individual fisherman neglects these diseconomies of expanded effort and does not "internalize", i.e. consider, the costs imposed on others. While

the marginal damage may appear insignificant, the aggregate, industry-wide effect of such reciprocal "external costs" can be substantial.[1] These relationships imply that the same total catch could be achieved with less effort and lower total harvesting cost.

The common cause for social (or "external") costs is that fishermen share a common constraint (the fishery) but make their decisions under decentralized competitive conditions without regard for their social implications.[2] The dilemma they are facing is that, while all fishermen may recognize the current and future benefits of a joint overall reduction in

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[1] In addition to these, there are further social costs related to fishing gear (mesh size affects the stock's growth rate) and to the crowding of fishing vessels in a single fishing ground. For the distinction between stock, mesh, and crowding externalities and their formal consideration, see Vernon L. Smith, "On Models of Commercial Fishing," 77 Journal of Political Economy March/April 1969 (No. 2), pp. 181-198. In addition, one could consider inter-species externalities to describe those cases of ecological interdependence among different species. A case in point is the "tuna-porpoise dilemma": tuna fishermen exploit the association of tuna and porpoise by locating porpoise, herding them, taking a combined tuna-porpoise catch with purse seining techniques, and later attempting to release the porpoise. Porpoise mortality has been found to be high. For a discussion of regulatory efforts, see Stephen O.Andersen, Robert C. Anderson, and Barbara J. Searles, "The Tuna-Porpoise Dilemma: Is Conflict Resolution Attainable?" 18 Natural Resources Journal, July 1978 (No. 3), pp. 505-519.

[2] Robert H. Dorfman, "The Technical Basis of Decision Making," in Edwin T. Haefele, ed., The Governance of Common Property Resources, Johns Hopkins University Press, Baltimore and London, 1974, at 9, considers "decentralized decision-making subject to a shared common constraint" to be the common characteristic of common property resources such as fisheries, common oil pools, highways or beaches.

fishing effort[1], lack of private appropriability induces them to neglect these benefits and limits them to maximize current profits in each period. Under competitive, open-access conditions fishing effort will thus expand until total revenue equals the total cost of harvesting, or price equals average harvesting cost. In contrast, the social optimum calls for fishing to cease as soon as price equals the sum of marginal harvesting and user cost. At any given level of harvest, the sum of marginal harvesting and user cost exceeds average harvesting cost.[2] Being equated to the former, price exceeds average harvesting cost at the socially efficient harvest level. That difference is called economic rent[3] and it reflects the scarcity value of the fishing grounds.[4] Under open access, rent is not captured[5] and goes to waste. Its prospect lures fishermen to expand their

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1 Under open-access conditions a concerted conservation effort by all competitors is illusory. Not only would negotiation and policing costs question its practicality, but a conservation agreement would be unstable, since there are no penalties for non-compliance and, even if all present fishermen would adhere to the agreement, new entrants would be attracted by the prospect of a "free ride" on the conservation efforts of the others and quickly dilute its benefits.

2 The inverse relationship between marginal harvesting cost and stock size implies that the marginal cost of catching an additional fish always exceeds the average (unit) cost for the total catch.

3 Since, at the social optimum, marginal harvesting and user cost equals price, rent can be either defined as the difference between price and average harvesting cost or, alternatively, as the sum of marginal user cost and the difference between marginal and average harvesting cost.

4 Demand increases (higher prices) and technological advances (lower costs) both tend to raise the value of the fishing grounds.

5 In the short run, some rent may be captured by individual fishermen, but not in long-run equilibrium, as the following arguments show.

effort in the hope of reaping the rent as part of their profit. But the associated diseconomies result in increased harvesting costs and eventually lead to a "dissipation" of rent. In value terms, open access implies excessive costs and waste of productive resources. In output terms, it implies "economic overfishing", excessive extraction of a natural resource.

Economic overfishing (or overhunting, overgrazing) will always occur as the result of open, non-priced access to scarce resources. Whether it will, however, result in "biological overfishing"[1] as characterized by the depletion of the stock below Maximum Sustainable Yield (the level which can sustain the largest possible harvest), will depend on the relation between price and fishing costs. With fishing costs high enough (relative to price), stocks may, in fact, not be depleted below Maximum Sustainable Yield (MSY)[2]. For at high costs privately optimal fishing effort may be at such a low level that only part of the stock's natural increment is "creamed off" at no detriment to the stock's reproduction potential. In the past, these relations may have prevented "biological overfishing". The development of modern fishing technology has, however, led to a substantial reduction in fishing costs, while the increasing demand for protein has contributed to widen the price-cost differential, or economic rent[3]. At higher scarcity rents, more intense fishing becomes privately profitable and, under open access, fishing effort will again be expanded until price and

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[1] Cf. Clark, op.cit., at 27 ff., for the distinction between "economic" and "biological overfishing".

[2] See id. at 13 for an exact definition of maximum sustainable yield.

[3] On the expected future developments of fishing technology and their legal implications, see Jon L. Jacobson, "Future Fisheries Technology and the Third Law of the Sea Conference", in Knight, op.cit., pp. 51-92.

average fishing cost are identical and rents are dissipated.[1]

While open-access (over-)fishing is economically inefficient in the sense that scarce resources are wasted, its normative implications still need to be revealed. They can be illustrated within the discounting framework by finding that hypothetical level of the social discount rate at which the privately optimal level of fishing would correspond to the social optimum. Next, one could ask what social norms would justify such a discount rate. First, since individual fishermen ignore all future benefits for the sake of maximizing current profits, their behavior corresponds to choosing a social discount rate of infinity, under which all future benefits would be discounted to a present value of zero. Only current benefits count and society would therefore exploit resources as rapidly as possible. This extreme case of the least conservative approach to resource management implies a sociel value norm which dictates to disregard all future generations.[2]

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[1] Of further concern is the development of new fishing methods, such as "pulse fishing", an oscillatory stop-go fishing practice which has endangered many species, especially those with low intrinsic growth rates. "Pulse fishing" is the practice of modern fishing fleets who sweep a certain area with little regard for the kind and age structure of the species taken. After an area has been swept, the fleets turn to another area, maybe returning to the first area in later years if and when stocks have been regenerated. This practice is profitable for modern fishing fleets with factory vessels and large freezing and processing capacities. Discrete, oscillatory "pulse fishing" may be biologically far more damaging than the continuous case of overfishing by oldfashioned fishing boats. See Clark, op.cit., at 172 ff. for the economic rationale behind "pulse fishing".

[2] The debate on the exact measurement and identification of the social discount rate is therefore immaterial to this result, as long as there is a consensus that it is less than infinity. In the capital theoretic context, an infinite discount rate would make any degree of capital accumulation undesirable, which further illustrates the extremism implied.

The discrepancy between competitive market behaviour and social optimality has originally been described as an instance of "market failure"[1], since perfect competition does not lead to social efficiency. More recently, attention has been drawn to "property rights failure", or to deficiencies in the property rights structure as the underlying cause of "market failure".[2] Under this interpretation, social costs are not internalized by individual firms, because the property-rights structure fails to reward socially desirable behaviour.[3] In fishing, non-exclusivity implied by open access is the main cause for property rights failure with the consequence that there are no contracts stipulating optimal behaviour and assuring private appropriability of the resulting benefits.[4]

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1 See Francis M. Bator, "The Anatomy of Market Failure", 72 Quarterly Journal of Economics, 1958, pp. 351-379.

2 See Harold Demsetz, "Toward a Theory of Property Rights", 57 American Economic Review, May 1967 (No.2), pp. 347-359, on the economic theory of property rights. Richard A. Posner, Economic Analysis of Law, 2nd ed., Little, Brown and Co., Boston, 1977, at 28 ff., lists the three conditions for an efficient property rights structure: property rights have to be universal, exclusive, and transferable. First, property rights have to cover all scarce resources; secondly, their definition and demarcation has to be unequivocal in order to avoid overlapping claims (appropriability requires fulfillment of the exclusion principle); finally, property rights have to be transferable (by sale or lease) so that resources can be put to their most valuable use. Violation of any one of these conditions results in property-rights failure, or "attenuation" of property rights according to Eirik Furubotn and Svetozar Pejovich, "Property Rights and Economic Theory, A Survey of Recent Literature," 10 Journal of Economic Literature, December 1972 (No. 4), at 1140.

3 Vernon L. Smith, "The Primitive Hunter Culture, Pleistocene Extinction, and the Rise of Agriculture", 83 Journal of Political Economy, August 1975, at 255, considers "incentive failure caused by cultural or institutional inadequacies" as a more adequate description for cases of market or property-rights failure.

4 Steven N.S. Cheung, "The Structure of a Contract and the Theory of a Non-Exclusive Resource", 13 Journal of Law and Economics, April 1970 (No. 1), pp. 49-70, on the relationship between the structure of a contract and the lack of exclusive rights.

III. The Legal-Instituional Framework for Optimal Fishery Management[1]

To attain social efficiency, the open-access condition must be replaced by a legal-institutional framework in which exclusion can be exercised and rent, as a reflection of the economic value of exclusive rights, can appear as a cost of fishing.[2] Exclusivity of fishing rights can be achieved by establishing either private property over entire fisheries or public ownership or control over private access to fisheries. Under certain conditions, social efficiency can be accomplished under either a private ownership or public control solution.[3] The two differ, of course, in their distributional implications[4]; and, while private property is feasible in the related cases of fishing ponds, lakes, or hunting grounds, it certainly is politically unacceptable in the case of ocean fisheries.[5]

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[1] For a set of general "Principles for a Global Fisheries Management Regime", see Knight, op.cit., pp. 213-236. While these principles are of a more general nature than the proposals made below, they also cover tangential aspects of fishery management which are not considered here.

[2] By this is meant that rent is recognized as an opportunity cost.

[3] Most importantly, the private rate of discount of the sole owner would need to be identical to the social rate, and monopolistic conditions in output markets would have to be absent for identity of social and private optimality under private ownership. See Clark, op. cit., at 37 ff. and 139 ff., on the formal discussion of sole ownership.

[4] The distributional implication of private ownership is that the economic rent would accrue to the person holding title to the fishing grounds. If the owner decided to engage in fishing himself, the rent would form part of his net revenues. If he, instead, decided to sell or lease fishing permits, rent would be reflected in their price and would become a cost of fishing. Efficiency could, in principle, be achieved.

[5] One need only think of possible interferences with other ocean uses, e.g., military uses.

Under the objective of social efficiency a public management agency must behave like the sole owner who maximizes the present value of the resource. This determines the socially desirable level of fishing. The agency would then, rather than engage in fishing itself, apportion and allocate private fishing rights by issuing permits which stipulate exclusive, but limited (by area, duration, etc.) access to resource use. The value of these licenses under such a controlled access system would reflect the economic rent in fishing in the same way as under the private ownership solution: rent would become a cost of fishing.

For optimal fishery management to become feasible and worthwhile, two prerequisites have to be fulfilled. First, an appropriate legal-institutional framework needs to be created; jurisdiction over fisheries must be established. Second, the legal institutional framework has to ensure that fishery management is achieved at minimum cost; and these costs must be less than its benefits, or the avoided resource waste associated with non-exclusivity.

1. Jurisdiction

Biological and economic considerations dictate the geographic extension and the contents of optimal jurisdiction over fisheries. Exclusivity requires that the management authority covers entire stocks or even entire ecosystems of interrelated species, whose

separate management could result in policy conflicts.[1] In view of the varying migratory patterns among interrelated species, the need for geographically extensive jurisdiction becomes apparent. In general, confinement of management to national coastal zones is inadequate, since only few species would be fully contained in the coastal waters of an individual state. As an example, not even the so-called EC-sea as the conglomerate 200-mile zone of the European Communities in the Northeast Atlantic can satisfy the exclusivity postulate for the commercially most important stocks.

Furthermore, while the habitat of most of the oceans' living resources is restricted to the shallow continental shelf areas[1], a seaward delimitation of jurisdiction to, say, 200 nautical miles would not be satisfactory in the cases of highly migratory species such as tuna, salmon, herring, whales. Many of these

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[1] Selective species or stock-related management is inappropriate, since it disregards both the interdependences among the species forming an ecological unit and the implications of modern fishing technology with which selective harvesting is no longer possible. System-related management has thus become a necessity for biological and economic reasons. See id., at 302 ff.; J.L. McHugh, "Biological Consequences of Alternative Regimes", in Giulio Pontecorvo, ed., Fisheries Conflicts in the North Atlantic: Problems of Management and Jurisdiction, Ballinger Publishing Company, Cambridge, Mass., 1974, pp. 71-94; Milner B. Schaefer, "The Resource Base: Present and Future", in Elisabeth Mann Borgese, ed., Pacem in Maribus, Dodd, Mead and Co., New York, 1972, at 112 f. and 117.

[2] The production of plant nutrients by photosynthesis sharply decreases with water depths. Little sunlight permeates below 50 meters, and below 200 meters there is nearly no marine flora. Therefore, fish density is highest in areas of shallow waters. Especially bottom-feeding, or demersal species (in contrast to free swimming, or pelagic species) generally stay in shallow waters.

species migrate across entire oceans.[1] Thus, for optimal fishery management to become effective, exclusive jurisdiction would typically have to extend over vast ocean areas, if not entire oceans. Consequently, fishery management should be carried out at the international level. The 200-mile national zone concept is inadequate, since its coastal delimitation according to national borders creates "common pool"-problems among neighboring states sharing resource stocks and since its seaward delimitation to 200 miles leaves a jurisdictional vacuum for highly migratory and High Seas fisheries.[2]

To promote efficiency, a management agency must have the right to control access and to allocate fishing rights. Access can be controlled by three alternative methods: quantitative (limiting total catch, catch per boat, fishing seasons), technological (prescribing mesh sizes, boat size and engine power), and fiscal (charging a user fee by levying a fee or "tax" on catch or capital and labor inputs) restrictions can be imposed on fishing. From an efficiency point of view, quantitative or technological restrictions, while widely

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[1] While relatively few species exhibit such extensive migratory patterns, these species are often of high commercial value.

[2] Important among High Seas stocks that always remain outside national 200-mile zones are Antarctic species, such as krill, which is a shrimp-like species with high protein content.

practiced, are inappropriate instruments.[1] Although such methods often succeed in reducing catch, they can only achieve this result by restricting efficiency in harvesting. At best, inefficiency and waste in the use of a resource are replaced by inefficient use of factors of production.[2] Other such regulations have even failed to conserve the resource, adding one kind of inefficiency to another.[3] In contrast to quantitative and technological restrictions, fiscal measures would directly raise private fishing costs, rather than indirectly through the

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1 For evaluations and critiques of alternative quantitative and technological restrictions, see James A. Crutchfield, "An Economic Evaluation of Alternative Methods of Fishery Regulations", 4 Journal of Law and Economics, October 1961, pp. 131-141; Ralph Turvey, "Optimization and Suboptimization in Fishery Regulation", 54 American Economic Review, March 1964 (No. 2), pp. 64-76; Francis T. Christy, Jr., "Property Rights in the World Ocean", 15 Natural Resources Journal, October 1975 (No. 4), pp. 695-712.

2 The Maryland oyster regulation is a celebrated case in point: There, access to oyster beds is restricted by prohibiting engines on boats. Obviously, while harvesting takes more (labor) effort and is slowed down, an expensive resource (labor) is wasted. Oystering is thus reduced by raising harvesting costs, not by inducing fishermen to internalize social costs. See Christy, op.cit., at 699. For similar examples, see James A. Crutchfield, "The Marine Fisheries: A Problem in International Cooperation", 54 American Economic Review, May 1964 (No. 3), at 207.

3 A frequently cited example is the imposition of total quotas and season closures on yellowfin tuna by the Inter-American Tropical Tuna Commission. These restrictions induced fishermen to invest in larger, faster boats so that they can maximize their share of the quota during the limited season. From 1967 to 1973, boat capacity increased threefold, while the season was reduced from about nine to three months. See Christy, op.cit. at 699 f.

prohibition of efficient harvesting techniques. The imposition of a user charge in the amount of the economic rent would force fishermen to reduce their effort to the socially desirable level, but would not restrict their choice in selecting least-cost harvesting techniques. Besides achieving efficiency in resource use, user fees would yield substantial revenues, and the economic rent collected by international fisheries agencies could become an important funding source for development projects.[1]

For the implementation of a user fee system it is sufficient to provide the management agency with fiscal authority over the fishery under its jurisdiction. In contrast to the immense geographic dimension required for an efficient management system, the functional contents of jurisdiction can be rather narrowly confined. This should allay the fears of those who suspect that the establishment of jurisdiction over fisheries could eventually impede other ocean uses and lead to a complete dismissal of the "freedom of the seas" as their governing principle.

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[1] Such a system could help to realize distributional objectives of the "common heritage"-doctrine which is used as the figure-head in regulating other ocean uses, in particular sea-bed mining. On this aspect, see Francis T. Christy, Jr., "Fisheries: Common Property, Open Access, and the Common Heritage", in Elisabeth Mann Borgese, ed., Pacem in Maribus, Dodd, Mead and Company, New York, 1972, at 201; Richard N. Cooper, "The Oceans as a Source of Revenue, in Jagdish N. Bhagwati, ed., The New International Economic Order: The North-South Debate, The MIT Press, Cambridge, Mass., 1977, at 109.

2. Fee management systems

While the necessity of a user charge on fishing is widely accepted in the economic literature, there are diverging opinions on its precise form.[1] In principle there are three alternatives: fees or "taxes" on the output (fish), the factor inputs (boats, gear, labor), or lump-sum charges such as license fees.[2] The choice among these charges is, foremost, an administrative and empirical problem contingent on the availability of data. While a tax on the product (or volume of catch) may in most cases be easier to administer than a tax on factor use[3], the data requirements are probably too formidable for the ex ante determination of any optimal tax rate or user fee. For such a determination, the taxing authority would not only have to possess biological data[4], but also information on the cost structure of fishing.[5]

Rather than setting tax rates, fishery commissions could auction fishing permits to the highest bidders. Under this alternative approach, the management agency would determine the number of

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1 On the use of alternative tax instruments, see G.M. Brown, "An Optimal Program for Managing Common Property Resources with Congestion Externalities," 82 Journal of Political Economy, January/February 1974 (No. 1), pp. 163-175; Clark, op. cit. at 116-127; Smith, op. cit., at 194 f.

2 Licenses may carry stipulations specifying total allowable catch, area, and duration.

3 See Clark, op. cit., at 117.

4 Such as on the stock's size, age structure, reproduction rate, and its interdependence with other species within an ecosystem.

5 In particular, the setting of optimal tax rates would require knowledge of the harvesting cost schedules of individual fishermen and of the social cost elements.

licenses to be offered and would let competitive bidding determine the user charge as the price of such licenses.[1] Auctions are attractive for several reasons: in contrast to the advance determination of user charges, the management authority (as the auctioneer) does not have to know the cost schedules of individual fishermen.[2] Furthermore, auctions would "ration" access to fisheries according to efficiency criteria, as opposed to political considerations.[3] The most efficient fishermen, i.e. those incurring the lowest harvesting costs, would tend to be the successful bidders. Their bids would reflect the "economic rent", the difference between harvesting costs and market price. Fishermen are thereby forced to pay for the social costs they impose on themselves and others[4], and the rent would accrue to

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[1] The fishing licenses, giving their holders exclusive, but limited rights, could be defined according to alternative criteria: geographic, quantitative (maximum catch or quota), time limits, or even technological restrictions (such as on mesh size), could be imposed.

[2] While the licensing authority must know and determine the "correct" (or optimal) level of total catch and issue a number of licenses accordingly, such direct quantitative control over the number of licenses and their stipulations may turn out to be an added advantage in preventing "overfishing catastrophes".

[3] E.g., equal quotas to individual fishermen, discrimination according to nationality, or allocation of quotas according to historical catch.

[4] On the other hand, auctions alone cannot guarantee that optimality in resource use will be achieved, i.e., that the full rent will be charged. First, the authority would have to possess the necessary biological and economic data to determine the "correct" number of licenses to be sold. Secondly, perfect competition among fishermen and perfect information on the value of a fishery (or of individual licenses) is required. While the information requirement will be difficult to satisfy, such imperfections cannot serve as arguments against auctions and in favor of other fee/management systems, for which such information is also necessary. At the same time, this is an argument in favor of government sponsored research on fisheries, the results of which should be openly disseminated to facilitate the determination of the licenses' "correct" market value in the bidding process.

the public, rather than to individuals. Thus, the distributional implications of private ownership of fishing grounds are avoided without affecting the private ownership of fishing capital. In comparison to other fee systems, the transition from the past quota regulation system to a bidding system does not require massive administrative change. In the past, quotas and quantitative restrictions have been recommended by various fisheries commissions.[1] Rather than recommending non-binding quotas, these commissions would have to become the sole authorities for determining the number of licenses to be sold in auctions. Additional institutional changes would involve enforcement and dispute settlement procedures.

3. Costs and benefits of optimal fishery management

To be worthwhile, optimal fishery management must yield positive net benefits. Gross benefits from efficient resource use consist of the amount of social cost presently ignored or, alternatively, the potential savings in resources that are wasted under a non-exclusive access system. Costs, on the other hand, arise in negotiating, institutionalizing, and enforcing optimal management. To avoid new resource waste, these costs must be at a minimum and must be outweighed by gross benefits.

There are but a few empirical studies on the extent of resource waste inherent in open-access fishing. Typically, these studies have addressed individual fishing regions or species, and there

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[1] For an overview and critique of fisheries commissions, see Rüdiger Wolfrum, "Die Fischerei auf Hoher See", 38 Zeitschrift für ausländisches öffentliches Recht und Völkerrecht, 1978 (No. 3-4), at 674 ff.

are only rough estimates on the world-wide scale of resource waste. But no matter how scattered the evidence is, there is wide agreement that efficiency in fishing would entail substantial benefits. One world-wide estimate was derived by Cooper on the basis of various studies on Northeast Atlantic and U.S. fisheries; he estimated that the scale of inefficiency (in terms of excess resource cost) exceeds 25 per cent for 60 per cent of the world's fisheries.[1] On this scale, the annual resource waste would amount to more than two billion dollars.[2]

Cooper argues that potential rents are even higher than the estimate of resource waste, since the latter only captures the cost of overfishing. It does not include other potential benefits of efficient resource management, such as those from improvements of harvesting techniques and "investment" in the resource by aquaculture or "pruning", and other improvements in the resource environment.[3] Under open-access conditions, such investments, if

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1 Cf. Cooper, op.cit., at 108 ff. Cooper's estimate is for 1975, and the base estimates on resource cost are for years between 1965 and 1971. Excess resource cost is defined as the difference between yields (e.g., catch per boat-days) in the present period (i.e., a year between 1965 and 1971) and a previous reference period, during which the fishery was not considered as "overfished".

2 On a 1975 basis. Cooper, at 110, emphasizes that this is a conservative estimate. To illustrate the dimension of his estimates he compares this amount with annual disbursements by the World Bank, which were below this estimate.

3 Salmon is a typical example of a stock that needs pruning; see Clive Southey, "Policy Prescriptions in Economic Models, The Case of the Fishery", 80 Journal of Political Economy, 1972 (No. 4), pp. 769-775. Other investment examples include fish ladders on dams, hatcheries, pollution control devices; see Christy, "Fisheries: Common Property, ..." at 193.

not absent altogether, will remain at sub-optimal levels, since, again, the investor has no guarantee of appropriation of the returns.

Studies by Bell and Christy give further support to Cooper's results.[1] Christy estimates the annual rent for the U.S. 200-mile zones at 300 million dollars.[2] For the world as a whole, Bell estimated potential catch at 103 million tons for 1973, a figure about 50 per cent above the actual volume.[3] At constant prices[4], the difference between actual and potential catch would amount to a revenue increase of slightly less than 10 billion dollars.[5]

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[1] Frederick W. Bell, "World-wide Economic Aspects of Extended Fisheries Jurisdiction Management", in Lee G. Anderson, ed., Economic Aspects of Extended Fisheries Jurisdiction, Ann Arbor, Mich., 1977, at 15; Francis T. Christy, "Limited Access Systems and the Fishery Conservation and Management Act of 1975," in Lee G. Anderson, op. cit., pp. 141-156.

[2] id., at 146.

[3] Bell, at 15. The volume for 1973 was 67.7 million tons, for comparison, 1977 volume amounted to 73.8 million tons. Cf. Eurostat, Statistisches Amt der Europäischen Gemeinschaften, Fischerei, Fänge nach Fanggebieten 1968-1977, Luxemburg, November 1978, at 27.

[4] Bell, at 14, estimates the weighted world unit value at ₰ 275 per ton.

[5] The information content of this figure is only of qualitative importance, since there is no information on average harvesting costs at the increased potential volume and on expected prices. It can be conjectured that average costs under efficient harvesting will be considerably below present levels, so that total harvesting costs might not exceed their present level. In this case, all of the indicated revenue would accrue as rent.

At present, the cost of an optimal management regime cannot be assessed with accuracy. There are neither regional, let alone world-wide estimates. The only available reference points are the experiences of those countries that have introduced limited access systems within their national 200-mile zones.[1] One such calculation has been made in the context of the U.S. Fishery Conservation and Management Act of 1976[2], which established the U.S. 200-mile zone. The cost estimates for enforcement and control of the U.S. zone are centered at ℳ 100 million.[3] In comparison with rent estimates of ℳ 300 million per year for the U.S. fisheries[4], the potential net benefits imply substantial welfare gains from optimal fishery management.

Finally, minimum cost considerations should determine the precise institutional format of fishery management and the division of labor between national and international agencies. Although the management of most (shared) fisheries requires an international approach, this does not imply the necessity of centralized

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[1] One important feature typical for these arrangements is the discrimination or even prohibition of fishing activity by foreign nationals. The protectionist nature of these arrangements results in lower benefits and higher costs than optimal management regimes, since exclusion of efficient foreign fishermen implies that the harvest may not be taken at minimum cost; furthermore, exclusion requires expenditures for policing. Therefore, benefit-cost calculations for 200-mile zones provide a lower bound to the gross benefits and an upper bound to the costs arising under optimal management.

[2] Public Law 94-265 was enacted on April 13, 1976.

[3] See U.S. Congress, 200-Mile Fisheries Zone and Joint Ventures, Hearings Before the Subcommittee on Fisheries and Wildlife Conservation, 94th Congress, First Session, Serial No. 94-44, U.S. Government Printing Office, Washington, D.C. 1976, at 47 ff. Bell, op.cit., at 21, quotes an earlier study which arrived at a cost estimate of ℳ 110 million per year.

[4] See Christy, "Limited Access Systems ...", at 146.

international administration and control over all aspects of fishery management. Decentralized, or mixed international-national management, in which only policy guidelines are determined at the international level, but administration and enforcement are delegated to national agencies, might be less costly than a centralized international regime.[1] Enforcement and control require equipment that is already available in individual states and has non-fishery uses as well.[2] Furthermore, effective control cannot be carried out at sea alone, but may require inspections in ports and within territorial waters.

IV. Evaluation of the New Fisheries Law

According to the Informal Composite Negotiating Text (ICNT) of the Third U.N. Conference on the Law of the Sea, coastal states shall have sovereign rights to explore, exploit and manage the living and non-living resources within their exclusive economic zones of 200 nautical miles.[3] This provision confirms, codifies and unifies the numerous actions that have been taken by individual coastal states, a majority of which already have declared fishery or economic zones of 200 nm.[4] It is fair to

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[1] Wolfrum, op.cit., at 663 f. distinguishes between functional and strict international or national approaches.

[2] Coast guard equipment and military surveillance techniques are major examples. Aspects of enforcement are discussed in detail by Robert H. Goldberg, "Ends and Means: The Role of Enforcement Analysis in International Fisheries Regulation", in Knight, op.cit., pp. 183-211.

[3] Art. 56 ICNT.

[4] Over 30 coastal states already have declared 200-mile fishery or economic zones.

say that the exclusive zone concept has already gained substance in customary international law and failure of UNCLOS III would not annihilate this concept of national control over coastal resources.[1]

Since 80 to 90 % of the commercially exploited fish stocks fall into the 200-mile areas, the vast majority of fisheries will, for the first time, be subject to jurisdiction, which, in principle, allows implementation of an efficiency oriented policy. The negotiating text expressly considers fee management systems as a regulatory device at the disposal of coastal states.[2] Nonetheless, expectations of a more prudent use of fisheries are premature. A pessimistic outlook is caused by three major characteristics of the ICNT's 200-mile concept: First, as already noted in Section III, the 200-mile seaward delimitation of fisheries jurisdiction leaves important, though few, species subject to overexploitation under open access. Second, the parcelling out of jurisdiction to individual coastal states violates the necessary condition of exclusivity in the majority

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[1] For evaluations and critiques of the ICNT and the exclusive zone concept, see Thomas A. Clingan, Jr., "The Changing Global Patterns of Fisheries Management," 10 Lawyer of the Americas, Winter 1978 (No.3), pp. 658-685; Lothar Gündling, "Die exklusive Wirtschaftszone," 38 Zeitschrift für ausländisches öffentliches Recht und Völkerrecht, 1978 (No.3-4), pp.616-658; Zouhair A. Kronfol, "The Exclusive Economic Zone: A Critique of Contemporary Law of the Sea", 9 Journal of Maritime Law and Commerce, July 1978, (No.4), pp.461-479. The economic implications of various management approaches proposed at the outset of UNCLOS III are discussed by Lee G. Anderson, "Economic Aspects of Fisheries Utilization in the Law of the Sea Negotiations", San Diego Law Review, May 1974 (No.3) pp. 656-678.

[2] Art. 62, Para. 4 (a) ICNT. In contrast, a major deficiency of the U.S. Fishery Conservation and Management Act of 1976 is the prohibition of fees as instruments in limiting access. For an evaluation of the U.S. law, see Christy, "Limited Access Systems..." ...

case of "shared stocks". Third, the contents of coastal state jurisdiction are uneccessarily broad. Conflicting and economically as well as biologically detrimental policies will be sanctioned under the new regime.

1. The national approach to fishery management

The ICNT envisions a rigid national approach to fishery management. In regulating access to their 200-mile zones, coastal states shall follow a two-step procedure: they first determine total allowable catch (TAC)[1], and then allocate this total among domestic and foreign fishermen.[2] The management guidelines specified are both vague and conflicting, containing references to biological, ecological and economic factors as well as to "special requirements".[3] Coastal states will enjoy a wide latitude of judgement in interpreting the management provisions and will find no difficulty in justifying a fishery policy in violation of biological and economic optimality criteria.

In the first stage determination of total allowable catch, the dominant, though not single and overriding management criterion favored by the ICNT is "Maximum Sustainable Yield, as qualified by relevant environmental and economic factors".[4] Maximum Sustainable Yield (MSY) is a purely partial, or single-species

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[1] Art. 61 Para. 1 ICNT: "the coastal state shall determine the allowable catch of the living resources in its exclusive economic zone."

[2] Art. 62 ICNT.

[3] Art. 61 Para. 3 ICNT.

[4] Art. 61 Para. 3 ICNT.

concept oriented at that growth rate of a species which allows the highest harvesting rate for an indefinite period of time. The concept has been criticized both by economists and biologists. From an economic point of view, MSY is an inappropriate criterion, since it totally ignores economic factors such as fishing and user cost.[1] From a biological point of view, this single-species concept becomes meaningless, when ecological interdependences among various fish populations within an ecosystem are considered. Such interrelations have gained in importance, since, with few expections, selective fishing of individual species has become impossible with modern fishing technology.[2] Fishery management must therefore follow a system-wide, rather than selective or partial approach as represented by MSY.[3] The irony is that, at a time when scientists are discarding the concept, MSY has become familar to diplomats grasping for a ready-to-use criterion. Yet, after spelling out this questionable criterion, the ICNT quickly dilutes its role as the supreme management guideline. Non-adherence to MSY can be justified by anything falling under the heading of "environmental and economic factors", "economic needs" and "special requirements".[4] The intermingling of these potentially conflicting criteria in a single paragraph

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[1] Cf. Peterson and Fisher, op. cit., at 698. MSY can widely diverge from the economically optimal rate of use.

[2] Cf. Clark, op. cit., at 302 ff.

[3] See McHugh, op. cit., at 86.

[4] Art. 61 Para. 3 ICNT.

serves to justify politically motivated fishery management, while paying lip-service to scientific conservation criteria.[1]

The second-stage allocation of total allowable catch among domestic and foreign fishermen, as provided by Art. 62, is also fully under the control of the coastal state. Protective and discriminatory practices are sanctioned. Without regard for the comparative costs in fishing (relative efficiency of domestic versus foreign fishermen), coastal states shall grant access to foreign fishermen only to the extent that domestic harvesting capacity falls short of total allowable catch.[2] Since the determination of both variables (TAC and capacity) is at the discretion of the coastal state, it is possible not only to discriminate against foreign fishermen but to exclude them entirely, simply by defining domestic capacity at or above TAC.[3] In addition to its sanction of fishery protectionism, the ICNT allows the coastal

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[1] The same question arises in the context of other parts of the ICNT, for example in the proposed techniques for limiting the production of manganese nodules from the seabed; see Wilfried Prewo, "Tiefseebergbau: Goldgrube, Weißer Elefant oder Trojanisches Pferd?", Die Weltwirtschaft, 1979 (Heft 1), at 192.

[2] Art. 62, Para. 2 ICNT. Access is given to other states, rather than its nationals, and it is subject to "agreement or other arrangements". According to Para. 4, such agreements could be made contingent on the payment of fees or compensatory bargains involving the transfer of fishing technology, co-operative arrangements such as joint ventures, or the conduct of fisheries research.

[3] "Capacity" can be measured by economic or physical concepts, and the ICNT does not suggest a definition. Some of the problems of defining and measuring capacity, along with suggestions on estimation, are considered by Robert A. Siegel, Joseph J.Mueller, and Brian J. Rothschild, 'A Linear Programming Approach to Determining Harvesting Capacity: A Multiple Specie Fishery", 77 Fishery Bulletin, 1979 (no. 2), pp. 425-433.

state to impose fiscal, quantitative, and technological restrictions on foreign fishing.[1] These measures may be applied in discretionary fashion. Discrimination among fishermen according to nationality is explicitly approved.[2]

2. Implications of the national zone concept

a. Unshared stocks

Depending on the migratory patterns of individual stocks and the length of a state's coastline, some stocks may remain within the 200-mile zone of an individual state over their entire life cycle. For these "unshared" stocks coastal state jurisdiction is both exclusive and universal, thus satisfying important neccessary conditions of an efficient property rights structure. In principle, it is conceivable that the new regime leads to an optimal management of these resources, since the broad coastal state rights authorized by the ICNT include efficiency-oriented measures such as fee management systems.[3]

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[1] Art. 62 Para. 4 ICNT. While fiscal controls may be efficiency-oriented, quantitative or technological restrictions will unambiguously perpetuate inefficiencies.

[2] Art. 62 Para. 4 (b) allows quota allocation according to nationality.

[3] Art. 62 Para. 4 (a) allows "licensing of fishermen, fishing vessels and equipment, including payment of fees and other forms of remuneration". While the intention of this provision is probably to allow discriminatory taxation of foreign fishermen, the ICNT, unlike the U.S. Fishery Conservation and Management Act of 1976, does not (and cannot) prohibit taxation of domestic fishermen.

But optimistic expectations are premature. First, only relatively few stocks fall into the category of "single-state jurisdiction". Secondly, the ICNT does not mandate efficiency-oriented management, but leaves it as an option to coastal states. National policy objectives will therefore be decisive for the management of unshared stocks. If coastal states aim to maximize the economic value of their newly-acquired rights, they would, acting as the sole owner, adopt an efficiency-oriented policy with a fee-management system.[1] This would require equal treatment of foreign and domestic fishermen and allocation of fishing rights according to comparative cost criteria. Obviously, political considerations, such as the demand by domestic fishermen for preferential treatment, may hinder or delay the adoption of an efficiency-oriented fee system. But, on the other hand, the prospect of substantial tax revenues, which a fee system provides, may be a politically persuasive argument for an optimal fishery policy.[2]

b. Shared stocks

Most fish stocks exhibit migratory patterns that are not bounded by the national zone of a single coastal state. Fish stocks will by typically "shared" by two or more states, and in this general case national jurisdiction cannot provide an efficient property rights structure. As noted above, optimal management of these stocks calls for an international approach.

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[1] On the assumption that individual states do not directly engage in fishing, but allocate fishing rights to individual firms.

[2] Where else can economic activity be taxed with a simultaneous gain in efficiency?

At the minimum, international cooperation among individual states is required, and national compliance with international guidelines would have to be mandatory to ensure unified management over entire stocks or ecosystems. The ICNT, constrained by its rigidly national approach, only obliges states to "seek to agree" on a coordinated approach to the management of shared stocks.[1] In effect, the supremacy of national control prevails.

On an optimistic note, one might surmise that the prospect of sharing the revenues resulting from an optimal fee management system would induce affected states to agree on a common international management approach. In principle, by negotiation a second-best international approach might evolve from the national zone concept.[2] The current experience, however, does not affirm such expectations. States that already have established 200-mile zones tend to take an extreme nationalistic posture and often remain unwilling to agree on common management. So far at least, national jurisdiction has exacerbated the potential for fisheries conflicts.

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[1] Art. 63 Para. 1 ICNT. "... States shall seek either directly or through appropriate subregional or regional organizations to agree upon the measures necessary to co-ordinate and ensure the conservation and development of such stocks without prejudice to the other provisions of this Part of the present Convention."

[2] This approach will always be inferior (or second-best) to the direct establishment of the least cost international approach, since the negotiations establishing a common management regime on the basis of national jurisdiction will be costly in terms of actual effort and time lost.

Leading examples are the ongoing disputes between the U.S. and Canada and between the U.K. and its Common Market partners over North Sea fishing rights.

c. Highly migratory and High Seas stocks

Since the ICNT establishes no jurisdiction over fisheries on the High Seas (seaward of 200 miles from shore), those stocks occuring on the High Seas will, partially at least, continue to be exploited under open access conditions. Into this category belong highly migratory species that can be found both inside and outside of 200-mile zones, and stocks that are only occurring on the High Seas. Examples for the latter are Antarctic species such as whales and krill, for the former, tuna.[1] For these stocks, the ICNT does not even offer a partial improvement over the already existing regulations of High Seas fisheries.[2] In demanding that states, whose nationals are fishing these stocks, "shall co-operate directly or through appropriate international organisations" the ICNT simply repeats and reaffirms the recommendations contained in the 1958 Geneva Convention on Fishing and Conservation of the Living Resources of the High Seas.[3] Such co-operation has usually taken the form of multilateral fishery commissions whose authority has been confined to recommend quantitative restrictions.[4]

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1 See Annex I ICNT for a list of highly migratory species.

2 See the 1958 Geneva Convention on Fishing and Conservation of the Living Resources of the High Seas, in UN-Doc A/Conf. 13/L.58, United Nations Conference on the Law of the Sea, Offcial Records, Vol. 2, pp. 139 - 141.

3 Art. 1 Para. 2 of the 1958 Geneva Convention is identical to Art. 117 ICNT in specifying that "All States have the duty to adopt, or to co-operate with other States".

4 See Wolfrum, op. cit., at 674 ff. for an evaluation of regional and species oriented fishery organisations.

Aside from the inefficiencies generated by purely quantitative controls, these regulation efforts have, in general, proven to be ineffective, since the commissions' recommendations usually cannot take effect without explicit or tacit approval by the individual member states. Thus, conservation efforts are diluted by considerations of political practicability, and the recommendations do not reflect biological or economic optimality criteria, but the lowest common denominator of the diverging interests of individual states.

d. Anadromous and catadromous species

Anadromous and catadromous species are special cases of highly migratory stocks, and their treatment in the ICNT (Arts. 66 and 67) is interesting as it hints at a possible solution to bilateral and multilateral fishery conflicts. Anadromous species spawn and originate in fresh waters, but spend most of their lives in the oceans; salmon is the major example. Catadromous species, on the other hand, spawn in the oceans, but spend most of their lives in fresh waters; eels are the major example. In both cases, the "host state" has a special interest in their management and conservation, since optimal resource use often requires investments, such as fish ladders on dams and hatcheries.

In the case of anadromous and catadromous stocks, as compared to other highly migratory species, the provision of proper investment incentives to host states is an additional and crucial task of fishery management.[1] In practice, such rewards can be effectuated by financial compensation to be paid by non-host states (as beneficiaries) or by allocation rules which give host states preferential treatment in fishing these stocks. One possible allocation rule is the partial or complete abstention from fishing by non-host states.

The treatment of anadromous and catadromous stocks in the ICNT is a first step towards general adoption of the "doctrine of abstention". The ICNT gives partial recognition to the special host-state interests and the need of appropriability of the returns from investments in the resource. It does so by granting host states a primary role in managing these stocks[2], and it postulates that fishing for these stocks should only be conducted within the 200-mile zones of host states.[3] But unfortunately, the

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[1] In theory, the adequate incentive would have to assure host states of the appropriability of investment returns.

[2] For anadromous species, states of origin "have the primary interest in and responsibility for such stocks", (Art. 66 Para.1) and "shall ensure their conservation by the establishment of appropriate regulatory measures". (Art. 66 Para. 2). For catadromous species, host states "have the responsibility for the management of these species". (Art. 67 Para. 1).

[3] For anadromous stocks, this postulate of restricting fishing to the host state's 200-mile zone is diluted by the clause "exept in cases were this provision would result in economic dislocation for a State other than the State of origin". (Art. 66 Para. 3(a)).

doctrine of abstention is only partially accepted: host states are not granted exclusive jurisdiction and they are not designated as the sole manager of these stocks, being only accepted as primus inter pares.[1] Furthermore, the ICNT does not contain compensation mechanisms, which are indispensable for the compliance of excluded parties.[2] In consequence, it can offer only little, if any, imminent improvement in the use of these stocks. Nonetheless, the provisions on anadromous and catadromous stock may be of a norm-creating value, as they suggest the doctrine of abstention as a possible solution technique to conflicts over shared stocks.

3. Models of conflict solution

That the doctrine of abstention has merit as a solution technique to fishery conflicts is illustrated by the first international conservation agreement on living marine resources, the 1911 convention on fur seals in the North Pacific, which was concluded between the United Kingdom (later Canada), Japan, the Soviet Union, and the United States. The doctrine of abstention is central to this agreement which prohibits the

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[1] In the case of anadromous stocks, establishment of TAC by the host state requires prior consultation with other states. See Art. 66 Para. 2.

[2] Indirectly, compensation is suggested, though not prescribed. For example, states sharing investment expenditures for anadromous stocks shall be given special consideration by the State of origin in the harvesting of stocks originating in its rivers". Art. 66 Para. 3 (c).

exploitation of fur seals in the open seas and restricts harvesting to the Soviet and U.S. breeding islands. Canada and Japan, in turn, are to be compensated for their abstention from pelagic harvesting.[1] The agreement has two important features, which account for its longevity. First, it addresses efficiency issues by granting exclusive jurisdiction and restricting harvesting to the minimum-cost locations.[2] Second, the agreement addresses equity issues by the compensation of excluded parties.

For possible solution techniques one might also look to the numerous agreements on oil and gas pools extending beyond national frontiers.[3] Invariably, these agreements aim at preventing the wasteful competitive over-exploitation of common deposits. The agreements either directly stipulate the unitized exploitation of a common deposit, i.e., a sole management solution by designation of a single operator or concessionaire; or, alternatively, they provide for various forms of joint decision-making and operation, which, in effect, simulate the efficient solution of

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[1] Canada and Japan receive fifteen per cent of the pelts. See Christy, "Fisheries: Common Property, ...", at 109. The principle of abstention also underlies the 1951 agreement between the U.S., Canada and Japan on the establishment of the International North Pacific Fisheries Commission (INPFC). Under this agreement, Japan abstains from fishing for salmon, herring and halibut east of the 175° W meridian. See Hiroshi Kasahara and William Burke, North Pacific Fisheries Management, Resources for the Future, Washington, D.C., 1973, at 34.

[2] Harvesting on the open seas is far more costly than on land. Furthermore, the harvesting of pregnant calves can be avoided if harvesting is restricted to the breeding islands.

[3] See Rainer Lagoni, "Oil and Gas Deposits Across National Frontiers," 73 The American Journal of International Law, April 1979 (No. 2), pp. 215-243.

unitized exploitation.[1] In these cases, in which distributional issues are not directly solved by the agreed-upon mehtods of exploitation, the agreements contain additional provisions for the sharing of joint proceeds.[2] Thus, equity and efficiency issues are, again, simultaneously resolved by these agreements.

It should not come as a surprise that the exploitation of common oil and gas deposits and Pacific fur seals is already regulated by international agreements. These cases support one of the central premises of this paper: removal of the open-access condition is warranted when the benefits of limited (or regulated) access outweigh the costs of establishing and enforcing an efficiency-oriented regime. In both cases, fur seals and oil and gas pools, the benefits from efficient management are obviously high; and the costs of regulating access were low, since agreement among only few states was required and since, in the case of oil and gas, the resource is not fugitive.[3] With

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[1] Lagoni, id. at 222 ff., defines four categories of agreements: (1) "geological cooperation" with production limitation via exchanges of information and consultation; (2) joint operations by both parties (or their concessionaires); (3) unitized exploitation with a single operator; (4) functionally limited condominium with a joint commission regulating production. Lagoni reasons that "the existence of an extensive and virtually uniform practice ... may be a step in the emergence of a customary rule of international law that would require states to cooperate in the exploration and exploitation of common deposits of liquid minerals." (id. at 233).

[2] For example, if "each party receives a share of the total production in proportion to the amount of reserves in its territory" (id., at 223), distributional issues are solved by the production formula chosen.

[3] Most oil and gas agreements involve only two states. Trilateral agreements are rare. Furthermore, there is no threat of new entrants, such as in the case of high seas fisheries, since exclusive jurisdiction has been established.

the increasing benefit-cost ratio of limited access to fisheries, it may only be a matter of time until efficiency-oriented agreements will be concluded. Yet it is tragic that the ICNT, riding the waves of a new fishery nationalism, fails to strictly mandate international management agreements; and it remains ironic that the first international agreement on the conservation of marine resources has offered a solution technique which is far superior to any subsequent attempts at fishery regulation.

V. Summary and Outlook

Efficiency in resource use requires exclusive, universal, and transferable property rights. In the past, the concept of the "freedom of fishing" has implied a violation of these necessary conditions, especially that of exclusivity. Under open, competitive access, individual fishermen are offered no incentive for considering the social costs that they impose on others and future generations. Instead of maximizing the present value of resource use, lack of appropriability of future opportunities leads them to maximize current profits, which calls for the economically most rapid rate of depletion and a dissipation of the economic rent inherent in fishing.

Applied to the living resources of the oceans, the economic theory of property rights requires the establishment of exclusive fishery jurisdiction. The geographic extension of jurisdiction is conditioned by the wide-ranging migratory patterns of stocks and the need to manage them as a unit. Since private ownership over vast ocean areas is ruled out, an international management agency is necessary. The agency, acting as the sole manager/custodian must have the authority to control access to fisheries on the basis of biological and economic optimality criteria. Efficiency under this system requires the imposition of user charges on fishing and the control of access on a non-discriminatory basis; in practice, this can be achieved by selling fishing permits at open auctions. The resulting revenues would reflect the economic value of the fishing grounds, and their collection and disbursement by an international agency could give substantive meaning to the distributive notions of the "common heritage" doctrine.

The 200-mile zone concept fails to provide an adequate assignment of property rights. The allotment of jurisdiction according to national zones creates overlapping rights, and their seaward delimitation to 200 miles leaves important stocks subject to continued open-access exploitation. Furthermore, the contents of coastal state rights extend beyond those measures (user charges on a non-discriminatory basis) necessary for efficient management. Furthermore, the negotiating text of UNCLOS III explicitly sanctions discriminatory and inefficiency-perpetuating fishery policies.

In spite of these serious defects, the new Law of the Sea contains some hopeful aspects. First, "unshared stocks" with migratory patterns fully enclosed by individual 200-mile zones can, in principle, be managed efficiently. Second, the creation of jurisdiction, albeit in an imperfect manner, over internationally "shared stocks", may induce coastal states to co-operate in the management of these shared fisheries, since maximum benefits can only be achieved under unitary management. Such co-operative agreements would have to address efficiency and equity aspects. Efficiency aspects can be solved either by common international management or by application of the "doctrine of abstention". Equity considerations require a formular for sharing net revenues. In principle, conflict solution should be possible, since efficient fishery management is a positive-sum game with efficiency gains outweighing distributive losses.[1] But international co-operative agreements cause negotiation and enforcement costs and they also face the political obstacles of a new fishery nationalism. Thus, it remains to be seen whether or not the national zone concept can evolve into a second-best solution to fishery management.

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[1] Thus, non-participants or excluded parties can be adequately compensated. This does, however, not imply that the present or future legal regime results in the "just" distribution of benefits which should therefore be upheld under any future system. Indeed, open access has resulted in a very skewed distribution of benefits with those nations that possess modern fishing fleets garnering the major share. On the other hand, the national zone concept redistributes potential benefits according to geographic criteria. The point made here is that distributional aspects cannot serve as arguments against efficient management, since the distributional outcomes of inefficient property rights assignments (open access or national zones) can be duplicated by compensation, after which some net benefits would still be left over.