WORKING PAPERS

FISHERY MANAGEMENT UNDER EXTENDED JURISDICTION

AND A MODEST PROPOSAL

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I. INTRODUCTION

On April 13, 1976, President Gerald Ford signed into law a bill which he described as providing "a comprehensive domestic and international program for the conservation and management of our fisheries." The Fishery Conservation and Management Act of 1976 establishes U.S. managerial jurisdiction over a 200-mile limit fishery conservation zone. It calls for creation of regulatory arrangements designed to achieve the optimum sustainable yield from each fishery. Management plans are to be developed by eight Regional Fishery Management Councils with oversight by the Secretary of Commerce.

This paper considers some of the economic issues posed by extension of managerial jurisdiction over the coastal fisheries. Section II describes the congressional rationale for the new Law and summarizes its principal provisions. Section III examines the economic justification for government intervention in fisheries, and analyzes the advantages and disadvantages of various means for internalizing external effects in fishery exploitation. Section IV evaluates the prospects for success under the new management regime and offers a policy prescription. Summary remarks follow in Section V.

II. THE NEW LAW

The Fishery Conservation and Management Act of 1976 establishes a "fishery conservation zone" within which the U.S. assumes exclusive fishery management authority over all fish except highly migratory species. 1/ The conservation zone has the seaward jurisdiction of the coastal States as its inner boundary and a line 200 nautical miles from the baseline from which the territorial sea is measured as its outer boundary.

Rationale: The congressional debates on the Act depict a Congress intent on taking immediate action to halt the depletion of valuable natural resources that contribute to the Nation's food supply, economy, health and recreation. 2/ In the Act, Congress concludes that as a consequence of increased fishing pressure and because of the inadequacy of fishery conservation and management practices, certain stocks of fish have been overfished to the point where their survival is threatened, and other stocks have been so substantially reduced in number that they could become similarly threatened. 3/ Congress also notes that the economies of many coastal areas are dependent upon fishing and related activities, and that they have been badly damaged by the overfishing of fishery resources at an ever-increasing rate over the past decade. This damage is in turn partially attributed to the activities of massive foreign fishing fleets in waters adjacent to coastal areas of the U.S. Foreign fishermen have also evidently interfered with domestic fishing efforts and damaged the fishing gear of U.S. fishermen. The need for

immediate action is premised on a recognition that international fishing agreements have not been effective in preventing overfishing in the past, and the view that irremediable damage might take place before an effective international agreement on fishery management jurisdiction can be negotiated, signed, ratified, and implemented. 4/

Management Mechanism: The new law provides for a national program for conservation and management of fishery resources through a system of fishery management plans prepared by eight Regional Fisheries Management Councils. Management plans prepared by Regional Councils must be reviewed by the Secretary of Commerce to determine whether they are consistent with provisions of the Act and any other applicable law. The Secretary must notify each Council in writing of his approval, disapproval, or partial disapproval of any management plan or amendment. In the case of disapproval or partial disapproval, the Secretary must include in his notification a statement and explanation of his objections, suggestions for improvement, a request to change the plan or amendment to satisfy the objections, and a request to resubmit the modified plan or amendment within 45 days after the date on which the Council receives notification.

If a Regional Council fails to develop and submit an appropriate management plan either initially or after notification of disapproval by the Secretary of Commerce, the Secretary himself may prepare a management plan. The Regional Council then has 45 days to recommend changes. After expiration of the 45-day period, the Secretary may

implement his plan through normal procedures. 5/ There are, however, two important constraints on the Secretary's behavior. First, the Secretary may not include in any fishery management plan or amendment prepared by him a provision establishing a limited access system to control effort, unless the system is first approved by a majority of the voting members of the appropriate Council. Second, while the Secretary may establish the level of permit fees authorized in any management plan, the level may not exceed the administrative costs incurred in issuing permits.

All fishery management plans and regulations promulgated to implement such plans must be consistent with the following national standards for fishery conservation and management: 6/

(1) Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery. 7/

(2) Conservation and management measures shall be based upon the best scientific information available.

(3) To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.

(4) Conservation and management measures shall not discriminate between residents of different States. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (A) fair and equitable to all fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.

(5) Conservation and management measures shall, where practicable, promote efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.

(6) Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.

(7) Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.

The "except" clause in Standard (5) was proposed as a technical amendment by Senator Stevens. In offering the amendment, he stated that:

> The intent of this amendment is to make certain that those management and conservation measures shall not be for the sole purpose of economic allocation of the fishery resources. We have no such intent.
>
> In effect, I am saying that a regional council could not, for example, say that only vessels over a certain size can fish for one species, and only those under another size for another species.
>
> We have no intention to permit the regional council to have economic authority over fisheries resources. They are to have conservation and environmental authority, but not economic. 8/

There was no further discussion on the amendment, and it was accepted along with the proviso that it be considered as original text.

To set economic objectives and provide for creation of a management system to achieve them, while simultaneously holding that there is no intent to permit Regional Councils to have economic authority over fishery resources, would seem inconsistent. The Stevens amendment

appears, rather, to anticipate potential equity/efficiency tradeoffs. Under this interpretation, a Regional Council could not, for example, assign output shares to a quota catch for the sole purpose of minimizing production costs--a Council could not assign "full production" shares to 50 fishermen rather than "less than full production" shares to 500 fishermen solely because this would minimize costs of harvesting the quota catch. 9/ The effect of the amendment is to withhold authority to promulgate regulations solely designed to rationalize production efficiently. Conservation and management measures may promote efficient production, but only in the process of serving some other objective.

To achieve the optimum yield from each fishery, the Act provides for the use of several different control mechanisms. Any fishery management plan may: 10/

> (1) require a permit to be obtained from, and fees to be paid to, the Secretary with respect to any fishing vessel of the United States fishing, or wishing to fish, in the fishery conservation zone, or for anadromous species or Continental Shelf fishery resources beyond such zone;
>
> (2) designate zones where, and periods when, fishing shall be limited, or shall not be permitted, or shall be permitted only by specified types of fishing vessels or with specified types and quantities of fishing gear;
>
> (3) establish specified limitations on the catch of fish (based on areas, species, size, number, weight, sex, incidental catch, total biomass, or other factors), which are necessary and appropriate for the conservation and management of the fishery;

(4) prohibit, limit, condition, or require the use of specified types and quantities of fishing gear, fishing vessels, or equipment for such vessels, including devices which may be required to facilitate enforcement of the provisions of the Act;

(5) incorporate (consistent with the national standards, the other provisions of the Act and any other applicable law) the relevant fishery conservation and management measures of the coastal States nearest to the fishery;

(6) establish a system for limiting access to the fishery in order to achieve optimum yield if, in developing such a system, the Council and the Secretary take into account--
(A) present participation in the fishery,
(B) historical fishing practices in, and dependence on, the fishery,
(C) the economics of the fishery,
(D) the capability of fishing vessels used in the fishery to engage in other fisheries,
(E) the cultural and social framework relevant to the fishery, and
(F) any other relevant considerations; and

(7) prescribe such other measures, requirements, or conditions and restrictions as are determined to be necessary and appropriate for the conservation and management of the fishery.

Finally, with respect to foreign fishing, the Act specifies that the total allowable level of foreign fishing, if any, shall be that portion of the optimum yield of each fishery that will not be harvested by vessels of the United States. In determining the allocation among foreign nations, the Secretary of State and the Secretary of Commerce are supposed to consider: 11/

(1) whether, or to what extent, the fishing vessels of such nations have traditionally engaged in fishing in particular fisheries;

(2) whether such nations have cooperated with the United States in, and made substantial contributions to, fishery research and the identification of fishery resources;

(3) whether such nations have cooperated with the United States in enforcement and with respect to the conservation and management of fishery resources; and

(4) such other matters as the Secretary of State, in cooperation with the Secretary of Commerce, deems appropriate.

Foreign fishermen must obtain fishing permits, for which they may be charged "reasonable" fees. The Secretary of Commerce, in consultation with the Secretary of State, is required to establish and publish a schedule of fees, which are to apply nondiscriminatorily to each foreign nation. In determining the level of fees, the Secretary is supposed to take into account the cost of carrying out the provisions of the Act with respect to foreign fishing, including, but not limited to, the cost of fishery conservation and management, fisheries research, administration, and enforcement.

III. ECONOMIC RATIONALE FOR GOVERNMENT INTERVENTION AND ALTERNATIVE CONTROL MECHANISMS

Exploitation of fishery resources has historically been governed by the doctrine of "freedom of the seas." Under this doctrine, fisheries are treated as a common property resource, with access to the resource open so that it may be exploited by all who wish to engage in fishing. Fishery resources are replenishable, but under the common property concept, the reproductive capacities of given fish stocks are not the

property of individuals or firms and cannot be traded on a market. With open access rights, no fisherman has an incentive to take into account the effect of his effort upon the size of the stock and hence the rate of growth of the fish population. As is well known, the resulting open access equilibrium is characterized by super-optimal rates of exploitation. 12/ Fishing effort expands until the value of average (rather than marginal) product is equal to the incomes foregone by a marginal transfer of resources to the fishery.

Besides the problem of the commons, other inefficiencies may arise from open access treatment of the resource. The size and type of fish (the net mesh size and other gear selectivity variables) an individual fisherman considers optimal may not be optimal for the fishery as a whole. Crowding diseconomies may occur if the fish population is sufficiently concentrated to cause vessel congestion over the fishing grounds and, hence, higher operating costs to harvest a given amount of fish. 13/

The existence of external diseconomies arising from the absence (or difficulty of assigning) property rights to fishery resources suggests a possible rationale for collective action through the political institutions of the state. 14/ The conclusion that collective action is warranted should be based upon a favorable comparison of the benefits and costs associated with a particular program. External diseconomies stemming from the common property, unappropriated character of fishery resources are "potentially Pareto-relevant." 15/ This simply means that there may be opportunities for improvement. We can search for

better arrangements, but we do not know for sure that a better outcome is attainable. 16/ Internalizing fishery externalities is not a costless activity. All management mechanisms entail sacrifices of other goods. This implies that complete internalization may not be desirable. If society's goal is efficient allocation of scarce resources, management efforts should be organized in a manner that minimizes the resource expenditure required to bring about any given degree of internalization, and should be expanded until incremental costs and benefits are equalized.

Analytical Framework: If an individual fisherman could identify a fish stock, monitor its movements and prevent other fishermen from harvesting the stock, the inefficiencies previously described would not arise. A "sole owner" would perceive the effect on fishing cost of a reduced fish population caused by an additional unit of catch or reduction in mesh size. He would perceive the incremental crowding costs caused by directing an additional boat to a particular area of the fishing ground. Since he would perceive these costs, he would take them into account in deciding how to harvest his stock. His harvesting behavior would thus be potentially optimal from society's point of view because it would maximize net present value of the resource.

The objective of fishery regulation may be conceptualized as an attempt to alter the behavior of decision-making units within a decentralized competitive industry to make it correspond to that of a sole owner. Collective action to improve the allocation of resources in coastal fisheries could take many forms. Historically, regulatory

attempts to control fishing effort have taken the form of limits on total allowable catch, restrictions on fishing gear, closed seasons or fishing grounds, and different combinations of these and similar techniques. Economists have suggested that effective internalization might be achieved either through imposition of a system of corrective taxes or creation of limited access rights to use of marine fisheries. In the following sections, we examine the advantages and disadvantages of alternative means for internalizing externalities in fishery exploitation, in an attempt to discern a relatively efficacious combination of control mechanisms.

Regulation of Inputs: A production function relates inputs of resources and output of goods or services. Fish may be produced using different combinations of various resources (fishermen, boats, sources of propulsion, harvesting gear, access to fish, etc.). The traditional approach to fishery management has been to regulate inputs. Closed seasons or fishing grounds, restrictions on vessel size or automotive power, and prohibitions against use of certain kinds of net materials or power equipment all represent attempts to control inputs to the production process.

The efficacy of input regulation depends critically upon the objective of management. If the goal is to achieve and maintain desired yield from a fish stock, most kinds of input regulation are likely to be neither effective nor efficient. 17/ Opportunities for substitution in the production process are ubiquitous. Restricting use of some

factors of production inexorably leads to substitution of others. 18/ If restricting use of an input leads to substitution of alternative inputs, production costs must be higher or substitution would have occurred before the restriction. With given demand conditions, an input restriction that increases the costs of catching fish reduces the size of the profit-maximizing catch.

Input regulation imposes technological inefficiency while striving to achieve desired yields. There are several examples of fishery management schemes that have attempted to control catch without capturing economic rent. Under these schemes, rent is dissipated in excess capacity. 19/ Some analysts have argued that gear restrictions are clearly inefficient because they create economic waste, that is, they increase the costs of catching fish but not the amount caught. 20/ The fact that input regulation creates economic waste does not necessarily imply that it is inefficient. Economic waste is a cost of internalization using input regulation. Restricting use of certain inputs is inefficient if there are alternative, lower cost means for achieving desired yield, or if the costs of restrictions exceed the benefits and there are no better alternatives. The question of efficiency thus turns on the costs of alternative control mechanisms. Before examining alternatives to input regulation, reference should be made to circumstances where the case for gear restrictions is more clearcut.

Suppose a fisherman has acquired rights to harvest a certain quantity of fish. He desires to minimize harvesting costs. The net mesh size that minimizes his production costs may not minimize society's costs. The individual fisherman does not perceive the effect on production costs of a reduced fish stock caused by an incremental reduction in mesh size. The rationale for mesh control is to limit the harvest to mature fish whose growth rates are slower than those of younger fish. Mesh size and other gear selectivity variables could be controlled by imposing fines large enough to deter use of nonoptimal gear. If the fine were high enough, use of nonoptimal gear could be deterred with little enforcement effort.

Gear restrictions may also provide an efficient means of internalizing incidental catch externalities. The problem of porpoise deaths associated with tuna harvesting provides a timely example. It is estimated that in 1975 some 154 thousand porpoises were killed by fishermen seining yellowfin tuna in the Pacific. 21/ Porpoises are not consumed (not traded on a market), but they are a beloved species, and their destruction is a social cost of tuna production with present harvesting technology. One way to internalize this externality would be to impose a tax on dead porpoises, reflecting the social costs of a reduced porpoise population. The problem with this approach is that it would be extremely difficult to monitor the number of porpoises destroyed. Estimates of porpoise deaths are just that--no one actually counts them. Effective enforcement requires effective monitoring. Effective monitoring would require an (honest) observer on each boat. Alternatively, a

tax might be imposed on tuna production, an extraction fee on each pound of tuna docked by a vessel. Tuna would now cost more, consumers would buy less, and fewer porpoises would be killed. But suppose there is an alternative, higher cost tuna harvesting technology that allows porpoises to live. 22/ Fishermen would not freely adopt this production process because it is more expensive. As long as the cost of tuna production with the alternative technology is less than what the price of tuna would be with a tax, society would be better off forcing fishermen to use the alternative technology. Again a high fine could deter use of nonoptimal gear with little enforcement effort. 23/

Corrective Taxes: An alternative means for internalizing the stock externality in fishery exploitation would be to impose a system of taxes designed to equate marginal private and social costs of production. Several analysts have attempted to show how social costs could be imposed on decision-making units in a fishery through an appropriate system of taxes. 24/ The basic idea is to levy an extraction fee on each pound of catch reflecting the effect on fishing cost of a reduced fish population caused by an incremental unit of catch. The purpose of the tax is to confiscate the economic rent that provides incentives to excessive fishing effort. In principle, the same result could be achieved by taxing inputs, but in practice this would be quite difficult since all factors of production would have to be taxed in an optimal way. The license limitation scheme for salmon fisheries in British Columbia provides an illustration of the problems to be expected with input taxation. 25/ It began by limiting the number of vessels through a

system of limited licenses--the same result could have been achieved by taxing boats. This led to an increase in vessel size, prompting a government limit on total tonnage, stimulating heavier investments in sophisticated gear, and so on.

Taxing output might therefore be relatively simpler than taxing inputs, but it would by no means be simple. An optimal tax on catch depends upon, and therefore requires knowledge of, prices, biological growth functions and production relationships. Growth and production functions are defined with respect to particular stocks so that optimal taxes would vary according to the stocks being exploited. Furthermore, inter-species relations would often have to be considered in specifying growth and production functions. This would further complicate calculation of optimal rates of exploitation and, hence, optimal taxes. 26/ Economic and technical difficulties, not to mention political constraints, perhaps explain why this type of regulation is virtually never utilized. 27/ At the same time, it should be recognized that all types of regulation require similar knowledge. 28/ An alternative, second-best approach might involve selection of a target level of catch and the use of a tax to insure the attainment of this target in an efficient manner. 29/ In this situation, however, a simple auction of catch rights might be easier than iteration toward the target catch via adjustments in the tax. We therefore conclude our discussion of alternative control mechanisms by considering the advantages and disadvantages of limited access rights for fishery management.

Limited Access Rights: Under this approach, a target catch would be determined and divided into shares that would be distributed among fishermen. Creation of limited catch rights would effectively control entry into the industry. If rights to portions of the target catch were auctioned, they would tend to go to the most efficient fishermen, and there would be incentives to minimize costs borne internally by fishing firms. Creation of limited access rights is presumptively meant to deal with only the stock externality arising from common property treatment of the resource. Internalization of other externalities would require that contracts for catch rights include specific provisions regarding permissible fishing practices and gear. 30/

A limited access scheme might require more provisions regarding permissible fishing practices and gear than would a tax. This is because of the difficulty of assigning catch rights for extended periods of time. Long-term contracts do not appear to be feasible because the size of the socially optimal catch is likely to change as a result of changes in the value of particular fish and of goods produced with other ocean resources (mineral deposits, navigation channels, recreation areas, etc.), whose exploitation conflicts with fishing a particular stock. 31/ Complete contingent claims contracts in this situation would be extremely difficult to write, negotiate and enforce. Incomplete long-term contracts, in which adaptations to unanticipated developments were accomplished by permitting renegotiation of terms subject to penalty clauses, would not

be self-enforcing and would pose execution problems. If rights to catch a certain amount of fish were granted for only a short period of time, there would be an "end game" or termination problem in that the least expensive method of taking the last catch may be to kill all the fish (e.g. through the use of explosives), thereby nonoptimally reducing the value of the resource in subsequent periods. Contracts for catch rights would thus presumably have to deal explicitly with possible end game phenomena. Other costs of maintaining flexibility through recurrent short-period contracting may arise if capital resources are relatively specialized and there are problems of asset valuation and transfer. Since capital resources in fisheries appear to be relatively unspecialized and do not appear to pose serious valuation difficulties, these costs are likely to be small.

We have not yet considered the crowding externality that occurs if the fish population is sufficiently concentrated to cause vessel congestion over the fishing grounds. One method for internalizing this externality would be to levy an annual license fee that reflects the congestion cost caused by an additional vessel in the fishery. 32/ It is not clear, however, that this kind of tax would always effectively reduce crowding. An annual license fee might reduce the number of boats in a fishery, but the remaining boats might still congregate in particularly fertile areas. To be effective, a crowding tax would have to be

time- and location-specific in the same way as would a freeway tax designed to reduce congestion. Because of the required degree of flexibility, a crowding tax might not be practicable in many circumstances. An alternative to the crowding tax would be a rule specifying certain navigational procedures to avoid congestion. 33/ This rule could be enforced by imposing a fine large enough to deter violations.

Another alternative would be to delineate catch rights in terms of an area of the fishing ground rather than a quantity of fish. Under this approach, a fishing ground would be divided into a number of fishing areas. Rights to fish in some of these areas would be distributed for specified periods of time, while other areas would be kept free of fishing. Fishing rights in a given area would be allocated to a single firm. Maintenance of the total stock of fish would be controlled by varying the number and/or the size of areas in which fishing is allowed. The feasibility of the system is premised on the idea that no matter how heavily the resources within a particular area are exploited, control of the size and number of exploited areas can insure maintenance of an approximately optimal size stock. With sole rights to fish in a particular area, each firm would perceive crowding diseconomies and would internalize these costs in deciding how to harvest the fish. On the other hand, there may be arbitrary boundary costs under this approach, 34/ and stock levels for different species may not be optimally established. 35/

Finally, the process for distributing catch rights should be explicitly considered since it may itself have important efficiency aspects. If catch rights were auctioned, they would tend to go to the most efficient fishermen and costs of production would be minimized. An administrator could conceivably assign shares in such a way that firms acquiring rights would be able to minimize costs, but there are incentives for firms to enter the industry to secure some share of the rents that restriction of output generates. If the administrator tries to assign quota shares to target output so as to allow all potential entrants some share, the industry may be characterized by too many firms, each producing its assigned output inefficiently. 36/ Problems of inefficient production could, however, be mitigated by allowing subsequent transfer (purchase and sale) of catch rights by private parties. Under this approach, rents would be captured by those who were assigned catch rights.

The latter approach is used to distribute many onshore oil and gas leases for deposits on federal lands administered by the Bureau of Land Management (BLM). These leases are issued under the so-called "simultaneous filing" system. 37/ Under this system, the BLM office in each region compiles a monthly list of properties whose leases have been relinquished, terminated, canceled, or have expired. It then accepts applications for these leases for a specified period of time. An individual or corporation can submit only one application for any particular lease. At the end of the period, if more than one

application has been submitted for a property, a random drawing is held to determine who will be awarded the lease.

The evolution of the simultaneous filing system is itself of some interest since it appears to have developed in response to the same kind of circumstances prevailing in fisheries. The government had made an explicit decision not to confiscate scarcity rents. All non-competitive leases were initially awarded on an over-the-counter basis to the first qualified applicant. The system proved to be unworkable, leading, at least figuratively, to shoot-outs on the courthouse steps--there were a large number of lawsuits contesting the validity of leases on the basis of precedence in filing (i.e., raising the question of who was really the first applicant). The fiction of simultaneous filing was adopted to put an end to those disputes.

Ideally, each lease should be issued to the company or individual able to exploit it most efficiently. This person can presumably be identified because he is the one willing to bid the highest price. Under the simultaneous filing system, the winner of a lease is not apt to be the one best able to exploit it. But since leases are transferable, more efficient producers can, an usually do, acquire them from lottery winners. 38/ If a competitive bidding process were used, more efficient producers would generally submit higher bids and acquire leases directly. The two-stage assignment, search, negotiation and transfer process increases transaction costs, but may be perceived to be more equitable.

Synopsis on Control Mechanisms: There are likely to be difficulties with any regulatory mechanism, and it is unlikely that any one scheme will be appropriate in all circumstances. The best approach will depend upon the particular conditions existing in each fishery, specifically, the migratory patterns of different fish stocks, and the complex interrelationships among fish species and fishing effort. Nevertheless, the broad functional outline of an appropriate set of control mechanisms seems fairly clear.

The fundamental problems in fisheries stem from the common property, unappropriated character of the resource. In most industries, resources are invested until the return on additional investment is equal to the return on foregone alternatives. In a common property fishery, resources are invested until total costs and revenues are equalized. Positive profit stimulates additional investment, even though the additional resources add to total costs and simultaneously reduce levels of catch and total revenues. The principal task of fishery management is to control effort to prevent overfishing. There are basically three ways to control effort: input regulation, taxes and resource rights. Regulation of inputs, either directly or through taxes, tends to be ineffective and costly. Other inputs are substituted for controlled inputs, and as demand grows, restrictions must be made more severe to limit effort. Output taxes control effort by confiscating the rents that provide incentives for excessive effort. Optimal output taxes would be extremely difficult to calculate. A more realistic approach might

involve selection of a target level of catch and the use of a tax to achieve the target. If this is to be the approach, however, it might be easier simply to distribute rights to portions of the target catch. If catch rights were competitively auctioned, they would tend to go to the most efficient fishermen. Costs of production would be minimized and economic rent would be maximized. Assigning transferable rights through a nonmarket rationing process could generate comparable results, although the government would not capture scarcity rents under this approach. Resource rights would thus appear to be the most effective and lowest cost means for controlling effort. 39/

Establishing resource rights does not obviate the need for gear restrictions or taxes. Resource rights cope with only the stock externality. Mesh, interspecies, incidental catch, crowding, end game and other externalities may require additional control mechanisms. The appropriate control mechanism will vary from case to case. In some instances, it may be easy to monitor destruction of particular species and to levy a tax. If monitoring is difficult, the choice may be between taxing landed fish and input controls, and would depend upon costs of more selective gear relative to costs with a tax. In other instances, it may be that exploitation of certain species should be encouraged because they prey on desired species or inhibit the harvesting process. In this case, a negative tax (subsidy) may be appropriate.

Optimization requires knowledge of relationships among fishing effort, harvesting technology, fish catch and stock level. In many instances, production of such knowledge may initially entail use of regulatory-induced variations in effort to determine the shapes of yield schedules for different stocks. It is important to recognize at the outset that major downward revisions in effort are likely to be extremely difficult to implement once interests are vested in greater amounts of effort. This 'fact of life' suggests the advisability of a careful, incremental approach to management whatever control mechanisms are adopted. In terms of a limited access scheme, this implies that catch rights should initially be distributed (auctioned) to a relatively small number of fish or area of the fishing ground. As experience with the system develops, changes in the target catch or fishing area would permit movements toward desired levels of catch.

IV. PROSPECTS FOR SUCCESS UNDER THE NEW REGIME

An analysis of the prospects for successful management under the new fishery regulatory system must focus on the Regional Management Councils. The Councils are responsible for developing fishery management

plans, and while the Secretary of Commerce may intervene when he disapproves of a Council's plan, only a Council may approve adoption of a limited access licensing scheme to control effort. Our profile of alternative control mechanisms suggests that limited access rights may be the efficient way to internalize common property stock externalities in fishery exploitation. To understand why this kind of approach might not be adopted, it is necessary to consider the behavioral motivations of fishery managers and the pressures to which managers are liable to be subjected.

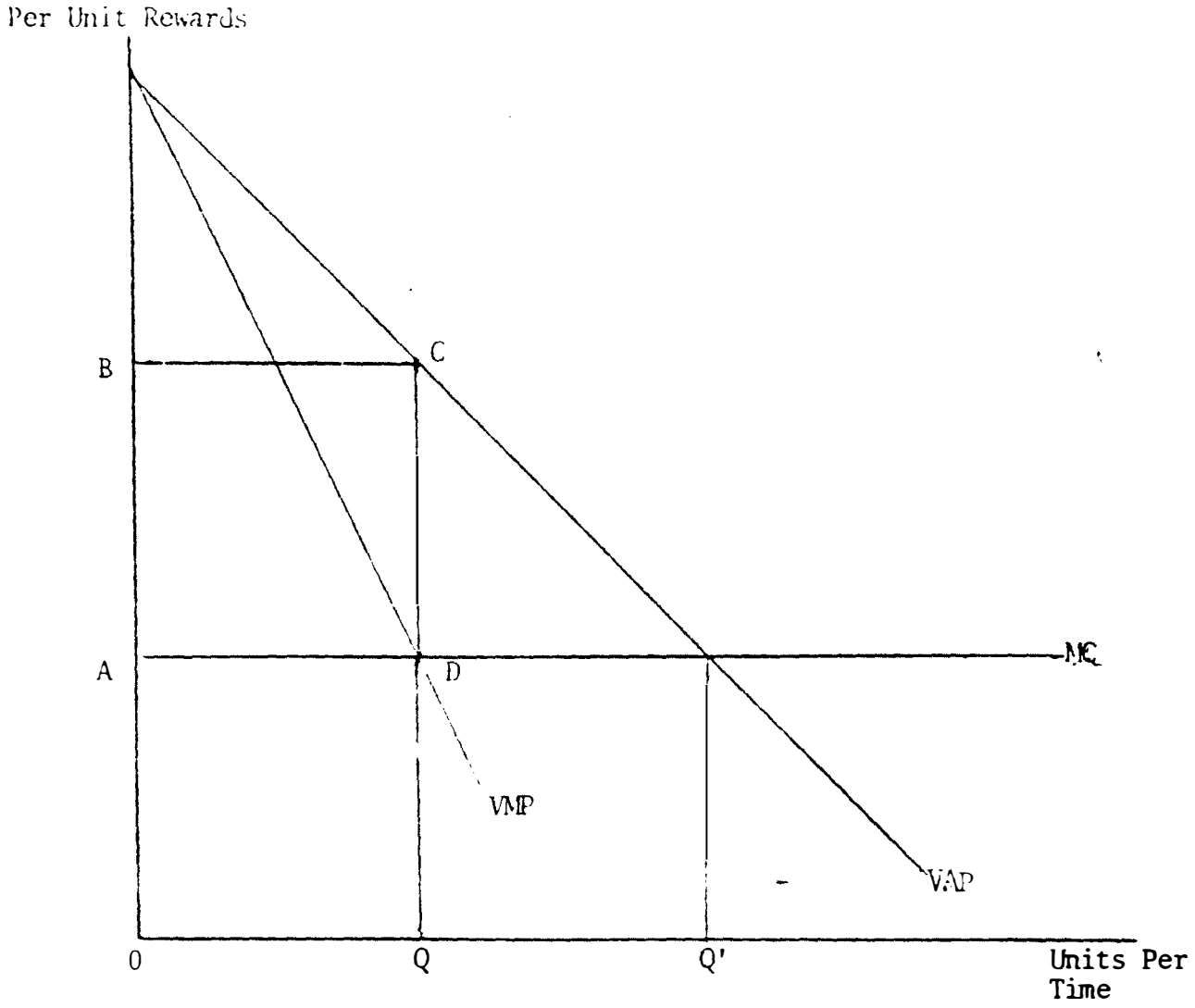
The traditional economic assumption is that individuals are motivated by self-interest. This does not imply that people never take into account effects of their behavior upon others--self-interested individuals may find it advantageous to behave selflessly. It merely recognizes that individuals rarely, if ever, take action with no regard for effects upon themselves. It would surely be unrealistic to assume that in making decisions regarding alternative control mechanisms, fishery managers will choose solely in accordance with societal costs and benefits, treating their own positions in the community as if they were the same as those of any other members. 40/ They will not ignore societal costs and benefits, but they will not ignore their own costs and benefits either. A particular action may be 'socially' desirable, but if it makes managers' lives miserable, it may not be taken.

Internalizing the stock externality in a fishery would generate benefits in the form of an economic rent reflecting the scarcity value

of fish and outputs of goods produced by resources currently employed in excessive exploitation. Consider Figure I, which displays the effect of stock diseconomy internalization in an overfished fishery. If fishermen's marginal opportunity costs are equated to value of marginal product, Q units are demanded, whereas Q' units are demanded under common property (marginal cost equal to value of average product). The rent from internalization is represented by the area of rectangle ABCD. With open access, this rent is a residual, and provides incentives for additional effort, even though the marginal benefits of such effort are less than the costs. Since fewer fishermen would be demanded after internalization, fishermen might be expected to oppose efforts to internalize stock externalities. Some fishermen would have to incur relocation and retraining costs, and the possibility of being in this group may motivate each fisherman to join in collective efforts to protect "jobs." 41/ Since the internalization benefit to any member of the public at large is likely to be small in relation to the loss each fisherman is likely to perceive, the latter is perhaps more likely to inform outcomes of the policy-making process. 42/

The conclusion that fishermen are better off under common property and will oppose efforts to internalize stock externalities assumes that fisheries are overfished (i.e., that internalization would reduce fisheries labor). The exclusion of foreign fishermen may relieve pressures upon stocks of some species. 43/ In these instances, it may be easier to prevent rent-dissipating entry since interests have not yet

Figure 1



been vested in greater amounts of effort. If they capture the rents, fishermen in these fisheries are better off if entry beyond the point where rents are maximized is prevented. But just as profit-maximizing firms in a perfectly competitive industry individually act contrary to their interests as a group, so too would each fisherman find it advantageous to behave in a manner detrimental to fishermen's collective interests (i.e., to expand effort). This is the rationale for coercive government intervention to prevent overexpansion in fisheries (provision of a public good), and against coercive intervention to fix prices in a competitive industry (provision of a public bad).

In fisheries in which domestic fishermen predominate and there is overfishing, internalization may be more difficult to accomplish. Internalization rents reflecting the scarcity value of fish could be used to compensate fishermen to overcome opposition to change. 44/ As the Law is presently drawn, fishermen would, in fact, receive most of the scarcity rents if there were any. Regional Management Councils can adopt a limited access licensing scheme under the Law, but the level of any license fees is to be set by the Secretary of Commerce, and can only reflect the administrative costs incurred in issuing licenses. Limited rights to fish would be valuable and marketable as such. 45/ A limitation on the level of fees appears to preclude use of a competitive auction to allocate rights. And since the purpose of an auction is solely to promote efficient production (absent a mandate for government

confiscation of rent), it is presumably precluded by the Stevens amendment. Under the Law, assignment of fishing privileges must be "fair and equitable" to all fishermen. As noted previously, if managers try to assign shares to targeted output so as to allow all potential entrants some share, there may be too many firms, each producing its assigned output inefficiently. The right number of fish may be caught, but scarcity rents will tend to be dissipated in higher costs. However, this problem can be mitigated to some extent by allowing transfer (purchase and sale) of catch rights. If quota shares were assigned to a limited number of firms, these firms would receive the scarcity rents. Assignment of transferable shares in a random fashion (as in the simultaneous filing system for onshore oil and gas leases) might be construed as a fair and equitable method of distribution. It would promote efficient utilization, but this would not be its sole purpose, and it might therefore not conflict with the Stevens amendment.

The Law also limits the level of fees foreign fishermen may be charged. Such fees are to be "reasonable" and are to apply nondiscriminatorily to each foreign nation. To the extent that fees reflect only the costs of carrying out provisions of the Law pertaining to foreign fishing and not the scarcity value of fish, foreign fishermen would receive the rents. Again, however, rents are liable to be dissipated in higher costs unless full production quotas are assigned or quota transfers are permitted. Under the Law, the allowable level of

foreign fishing is to be that portion of optimum yield not harvested by vessels of the U.S. To the extent that foreign fishermen would bid more for rights to certain fish than U.S. fishermen, rents would not be maximized in the absence of transferability.

V. SUMMARY REMARKS

The Fishery Conservation and Management Act of 1976 establishes U.S. managerial authority over an extended fishery conservation zone. The purpose of the Law is to provide a mechanism for achieving the optimum yield from each fishery. Economic overfishing and resource depletion stem from the common property, unappropriated character of fishery resources. Private fishermen in competition have incentives to harvest as many fish as they can at any given time without taking into account the relation between stock size and its rate of replenishment. Resource extinction is prevented only to the extent that it is uneconomic to deplete stocks beyond their lowest viable level.

To achieve desired yields, the Law provides for use of several different kinds of control mechanism. An analysis of these alternative management tools suggests that creation of limited fishing rights may be the most efficient and effective means for controlling effort. Most types of input regulation tend to be ineffective and costly, and would, by definition, not achieve management objectives (as conceived in the Law rather than perceived by fishery managers) in an efficient manner, given the existence of less costly alternatives. Nevertheless, this

kind of approach might be adopted because the collective choice setting is one in which a relatively small, intensely interested pressure group may exert more effective influence on decisions than the general public, each of whose members stand to gain only a small amount. 46/

Limited access is a possibility under the new regime, but the statutory limitation on permit fees and prohibitions embodied in the Stevens amendment appear to preclude a competitive auction of catch rights. Normally, the idea of 'giving away' valuable natural resources that belong to 'all the people' would prompt a congressional investigation. In this case, fishermen may be (or already have been) successful in staking a claim to scarcity rents as a form of compensation. Assigning transferable rights helps to mitigate problems of inefficient production, but is accompanied by problems of deciding (or deciding how to decide) who should get rights to what. Should all potential entrants receive shares? Or only 'established' fishermen? In terms of efficiency, the initial assignment of catch rights is not important. Voluntary exchange of such rights can be relied upon to insure that target catches are harvested in a reasonably efficient manner. In terms of equity, the initial assignment of rights is more critical. A random assignment of catch rights among fishermen may be perceived to be fair and equitable, and does not appear to be precluded under the new Law. Since the alternative appears to be a system of regulatory controls that would impose unnecessarily high costs, stifle technological innovations, and

not effectively control effort, this modest proposal perhaps possesses some merit. In the fisheries literature, the transitional problems of implementing a limited access scheme to control effort have often been stressed. The exclusion of foreign fishermen under the new Law provides an opportunity for the creation of effective, efficient controls in some fisheries. If the regulatory mistakes of the past, both of omission and commission, are repeated, this opportunity will have been wasted and we will soon end up where we started out.

Footnotes

1/ All anadromous species throughout their migratory range beyond the fishery conservation zone (except when they are found within any foreign nation's territorial sea or fishery conservation zone) and all Continental Shelf fishery resources beyond the fishery conservation zone are also under U.S. management authority.

2/ The Library of Congress' Congressional Research Service estimates the retail value of the coastal commercial catch and the annual revenues of the recreational fishing industry to be at least $10 billion a year. See Zilberberg (1975).

3/ In the National Marine Fisheries Service's (draft) National Plan for Marine Fisheries, 30 of 48 species of commercially significant stocks are characterized as either fully utilized or overfished.

4/ Those who opposed passage of the bill cited possible adverse effects on international negotiations at the U.N. Law of the Sea Conference, and the status of U.S. fishermen in foreign fisheries as reasons to postpone action. Proponents of the legislation expressed skepticism and pessimism over the prospects for success at the Law of the Sea Conference, and noted that those provisions of the Act establishing U.S. managerial authority over an extended conservation zone were intended to be temporary, and would cease to be of any legal effect as soon as a Law of the Sea treaty was signed by the U.S. and made effective. See U.S. Congress, A Legislative History of the Fishery Conservation and Management Act of 1976 (Legislative History), in passim.

5/ After approving or preparing a plan, the Secretary must publish the plan and any regulations proposed to implement the plan in the Federal Register. Interested parties have 45 days to submit comments. The Secretary may also schedule hearings in accordance with section 553 of title 5, United States Code. After considering all relevant matters presented to him during the 45-day period or produced in any hearing, and if he finds that the plan is consistent with all applicable law, the Secretary may take action to implement the plan-

6/ Public Law 94-265, Section 301.

7/ For purposes of the Act, the term "optimum" means the amount of fish (A) which will provide the greatest overall benefit to the Nation, with particular reference to food production and recreational opportunities; and (B) which is prescribed as such on the basis of the maximum sustainable yield from such fishery, as modified by any relevant economic, social, or ecological factor. Public Law 94-265, Section 3.

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Crutchfield (1975, pp. 13-14) notes that "Maximum physical yield is not an operational objective, and can be seriously misleading as a guide to policy in the common cases with which the fishery manager normally deals. If maximum sustained physical yield really means maximum output of some physical unit (e.g. weight or calories) then the marginal physical product (that is, the incremental addition to output) must be equal for all alternative distributions of labor and capital employed in fishing effort. In this sense the proposition reduces to an absurdity very quickly. There can be no doubt that we could redistribute capital and labor from the halibut and salmon fisheries of the Northwest and the world tuna fisheries and, with the same inputs, produce far greater quantities of edible food--directly or via conversion into oil and meal and hence into other animal food products. But this, surely, is as nonsensical as asking how much output of edible material could be obtained from the land mass of the United States. If people do not want some of the output, will not eat it, and would cheerfully give up larger quantities of the undesired though edible material for smaller quantities of something which appeals to their tastes and preferences, then maximization of calories from the land area or from the sea makes absolutely no sense in terms of human well being."

8/ Legislative History, p. 345.

9/ See Section III, pp. 19-20 and Section IV, pp. 27-29, infra.

10/ Public Law 94-265, Section 303.

11/ Public Law 94-265, Section 201.

12/ There is a voluminous economic literature dealing with the common-pool problem in fishery exploitation. A comprehensive bibliography is contained in Hannesson (1974). Standard economic references include Clark (1973), Gordon (1954), Scott (1955), Smith (1969), and Turvey (1964).

13/ In commercial fisheries, crowding diseconomies are concretely manifested in cut lines, tangled nets and vessel collisions. In recreational fishing, crowding costs may be less tangible--the pleasure I derive from the experience may be inversely related to the number of fishermen in my immediate vicinity. If, on the other hand, I am gregarious, there may be economies to crowding over some range.

14/ Marine fishery resources are, for the most part, wild species, which makes assignment of property rights to particular fish infeasible (highly costly). Cheung (1974) emphasizes the importance of a species' susceptibility to naturalization and policing in terms of the costs of establishing property rights.

15/ See Buchanan and Stubblebine (1962) and McKean (1972).

16/ Noting that government regulation of fisheries has not been much of an economic success in the past, Sweeny et. al. (1974, p. 186) state that "It is an interesting but unsettled question whether the waste associated with regulation makes the world worse off than under no regulation."

17/ For other purposes, there is a rationale for certain types of restriction. Closed seasons are often set during periods when fish are in spawning condition. Spawning and nursery areas are often closed to fishing during critical periods of a species' life cycle.

18/ A simple limit on total catch has the same kind of effect. Under this approach, fishing stops when the quota catch is taken. This creates incentives for fishermen to buy bigger, faster boats in an attempt to gain as large a share as possible before the quota catch is taken and the season closes.

Christy (1973, pp. 30-31) reports that "In the case of the Pacific halibut fishery, the season dropped from nine months to four weeks in one regulatory area and to less than two months in the other area. In the case of the total quota for yellowfin tuna in the eastern tropical Pacific, the season dropped to about three months from the usual nine months or more . . . . (A)fter the season for yellowfin tuna closes in the eastern Pacific, many of the vessels move to the Atlantic and contribute to the excessive pressures on tuna in that ocean. The necessity for controls in the Atlantic leads, in turn, to further displacement of vessels and the eventual need for controls on a worldwide basis."

19/ See Crutchfield and Zellner (1963) on the Pacific halibut fishery, and Crutchfield and Pontecorvo (1969) on Pacific salmon.

20/ See Sweeny et. al. (1974, p. 186).

21/ See Norris (1977).

22/ Norris (1977) describes such a harvesting technology. It involves gear and net modifications and the training of fishermen in pre-backdown release methods.

23/ Note that in the porpoise-tuna incidental catch example "society" must be broadly defined for an optimal result to obtain. If only U.S. fishermen were constrained to use the higher cost technology, porpoises might still be destroyed by foreign fishermen harvesting tuna. Note also that there is some private incentive for investment in the alternative harvesting process since porpoises enter the production function for tuna. Tuna and porpoises often swim together, and fishermen sight porpoises to locate tuna. Optimal investment is unlikely because of "free-rider" problems. An individual fisherman can expect to capture only a small portion of the harvesting cost savings associated with use of the alternative process.

24/ See Smith (1968, 1969), Quirk and Smith (1970), and Burt and Cummings (1970).

25/ See Zilberberg (1975).

26/ Hannesson (1974, p. 41) comments that "Broadening the view to take account of interrelations between species opens up a Pandora's box of externalities."

27/ There are no provisions for imposition of corrective taxes contained in Public Law 94-265.

28/ Another difficulty arises in that upward tax adjustments may be difficult to implement once financial interests are vested on the basis of expectations of greater effort. Adjustment problems of this sort are endemic to all types of regulation. See Section III, p. 23, infra.

29/ Baumol (1972) suggests the use of this approach. He argues that taxes cannot be relied upon to reach an optimal solution because of the difficulty of distinguishing between local and global optima.

30/ Sweeny et. al. (1974, p. 186) suggest an auction of rights to portions of a quota catch to deal with the stock externality. Non-stock externalities "could be handled by the regulator putting suitable rules into contracts for the catch rights bought at auction."

31/ Williamson (1976) and Goldberg (1976) have explored many of the pre- and post-contractual difficulties involved with putting a "natural monopoly" out to competitive bid. They hold that the relative efficacy of a competitive bidding mechanism depends critically upon the subject matter of the bidding competition. In building "a case against the case against regulation," they argue that the interesting problems of comparative institutional choice arise in circumstances in which the operating environment is characterized by a nontrivial degree of uncertainty. In such an environment, both the initial and adaptability attributes of alternative organizational modes are important, and their critique thus stresses the complexities involved in devising and administering contracts when frequent and extensive adaptations are required. Their approach also suggests that many of the problems associated with regulation lie in what is being regulated, not in the act of regulation itself, and consequently, that alternative organizational modes may actually converge in many circumstances.

32/ See Smith (1969).

33/ See Sweeny et. al. (1974).

34/ Fishermen might pursue a school of fish for many miles only to confront the border of their fishing area. The general problem is one of defining fishing areas large enough to permit efficient harvesting.

35/ What is regarded as a desirable species by one fleet may be undesired by another because of artificial barriers to trade, as well as the physical impossibility or commercial unprofitability to serve different markets at the same time.

36/ See Buchanan and Tullock (1975).

37/ See Roush (1976).

38/ Roush (1976, pp. 449-450) reports that "One study examined two sample sets of Federal leases acquired by a group of major petroleum companies. One set was let competitively and the other noncompetitively. Of the competitively let tracts, 87.1 percent were acquired directly from the Government, while only 12.9 percent had been orginally acquired from the Government by other companies or individuals and then later assigned to the major companies. Of the noncompetitively let tracts, only 25.6 percent were assigned directly to the major companies by the Government, while 74.4 percent were transferred through middlemen."

39/ In contrast, The Regional Fisheries Management Council Operations Manual prepared by the National Marine Fisheries Service states that "experience with limited access is still meager and refinement of the technique is required. The Act intends that limited access should be used carefully, and only when other tools fail to achieve management objectives." Unless managers regulate all substitutable factors of production, input regulation would tend not to be effective. It would also be extremely costly since restrictions would have to be made increasingly severe as demand increased.

40/ See Buchanan (1969) and McKean (1972).

41/ For discussions of trade union goals, see Cartter and Marshall (1972) and Atherton (1973).

42/ See Olson (1965).

43/ However, The Wall Street Journal (20 April 1977, p. 1) reports that "The American fishing industry has become the target of heavy foreign investment as governments that depend on fish as a food source seek to tie up the catch Congress thought it was reserving for Americans.

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The new law gives priority rights to Americans within 200 miles from shore but fails to provide against a foreign-controlled firm's meeting its legal requirements, and such countries as Korea and Japan are rapidly acquiring interests in the industry, already about 10 percent foreign-owned."

44/ See Buchanan and Tullock (1975). Regardless of whether or not adverse equity effects 'should' be compensated, their existence generally forms a basis for opposition to change. The idea of compensating losers is, of course, not without real world precedent. The Federal Communications Commission compensated radio broadcasters, motion picture producers and theater chains for the adverse effects of television by bestowing upon them licenses for virtually all of the high quality, VHF television channel assignments.

45/ Zilberberg (1975, p. 17) notes that under the limited entry scheme in the British Columbia salmon fishery, "even with its defects, the value of the right to fish has risen to more than $100,000 for a 20-ton vessel."

46/ Christy (1973, p. 33) notes that "(T)his technique generally serves to maintain fisheries labor. Because of this, the political pressures to adopt gear restrictions may be quite strong."

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