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Ecology, Efficiency, Equity, and Competitiveness

JOHN B. GATEWOOD

Historically, marine fish of the United States have been regarded as an open-access resource. Fish belong to whoever catches them, and there are no legal restrictions on entrance into the fisheries. These conditions have led to repeated overexploitation and overcapitalization, prompting Garrett Hardin to use ocean fisheries as a classic example of what he called "the tragedy of the commons."[1]

Over the past thirty years, economists and other social scientists have proposed a variety of regulatory mechanisms that would prevent the competition among fishermen in an open-access fishery from resulting in overexploitation of their resources and overcapitalization of their vessels. Some of these mechanisms are monopolistic ownership, fleet quotas, limited entry licensing, and individually transferable catch quotas. Virtually all of these regulatory devices run counter to American ideals of equal opportunity, social equity, and distributive justice, though in varying degrees. In consequence, America's fisheries show a wide range of management policies reflecting local compromises between the goals of resource conservation, economic efficiency, and social equity. These same fisheries are now faced with yet another challenge: international competition.

This paper reviews select examples of fisheries management in the United States, outlining the trade-offs inherent in alternative regulatory regimes in the face of international price competition. For example, should the United States continue management policies congenial with large fleets of small vessels, or should policies favor consolidation of our fleets to achieve greater harvesting efficiency? The lessons of competition and cooperation from the particular case of fisheries are then transposed to America's competitiveness situation more generally. There, too, unrestrained

exploitation of an open-access resource (the international marketplace in a free trade environment) threatens to be ruinous in the long run. The fisheries model is a miniature of the contending forces, policy options, and likely outcomes of national industrial competition.

The first section of the paper describes abstract, theoretical frameworks that explain why commercial fisheries around the world tend to be overexploited and overcapitalized. The second section discusses the various interventionist responses proposed to solve these problems. The third section examines how the new factor of international price competition can undermine even carefully crafted management plans. The final section draws some general lessons from the case of fisheries to larger-scale discussions of competitiveness.

THEORETICAL FRAMEWORKS FOR UNDERSTANDING FISHERY DYNAMICS

The very expression "fishery" is somewhat ambiguous. An unutilized fish resource is not a fishery. Similarly, a group of humans who claim they are "fishing" but catch no fish does not constitute a fishery. At a minimum, then, a fishery refers to an exploitative relation between some population of humans and some population of fish (finfish, mollusks, crustaceans, et cetera). Technical definitions also take account of the fact that the human population usually shows a gradation in terms of involvement in direct exploitation: fishermen (primary harvesters), processors, distributors, consumers, and managers. It should be no surprise, therefore, that fisheries research is highly interdisciplinary, involving not only biologists but also a variety of social scientists (economists, anthropologists, political scientists).

This section reviews the basic theoretical frameworks that guide much fisheries research. For convenience, the presentation is organized somewhat along disciplinary lines. Beginning with the underlying mathematical models of population biology, we will move to economic perspectives on fisheries, then consider the more complex human motivations and behaviors that are part and parcel of commercial fishing.

Biological Perspectives

From the biologist's perspective, there are two basic mathematical frameworks for understanding population dynamics in fisheries.[2] The more complex of these two is the Volterra-Lotka model, which describes the population dynamics generated by a predator-prey interaction. This formulation explicitly recognizes that the population size of the predator group (fishermen) will causally affect the population size of the prey group (fish), and vice versa, as expressed in Equation (1) below:

$$(1) \qquad \begin{aligned} dx/dt &= bx(1-(x/N)) - sxy \\ dy/dt &= sxy - my \end{aligned}$$

where

bx	:	a density dependent "birth" term for the prey,
1–(x/N)	:	a saturation level determined by the maximum niche size, N,
sxy	:	conversion of prey into predator, and
my	:	natural predator mortality.

Note that if the niche size, N, is infinite, then these equations produce never-ending oscillations in the population sizes of both predator and prey. If, however, N is finite, which is much more plausible empirically, then the oscillations are damped and will converge around a stable stationary state. In this latter case, the model requires some sort of additional input for the system to exhibit ongoing oscillatory behavior.[3]

Human predatory interactions with fish differ, however, in some interesting ways from the classic cases of wolves with caribou or anteaters with ants. First, humans are a very generalized and omnivorous species. We seldom depend on any single prey species for a large proportion of our diet. Second, the bulk of human sustenance today comes from *domesticated* plants and animals rather than from hunted or gathered wild species. Through our food-producing technologies, we dramatically increase and stabilize the population level of our prey species, whether plant or animal. Third, in most fishing communities of the world, and especially in the commercial fisheries, only a small segment of the human populations engages in fishing. For example, whereas adult wolves either hunt or die, less than one percent of Americans fish for a living. Fourth, the immediate human motivation responsible for most of the world's catch is profit rather than hunger. Price rather than poundage drives fishing effort. These complicating factors undermine the tight causal dependency between predator and prey populations described in the Volterra-Lotka model. Perhaps for

these reasons, the Volterra-Lotka model has *not* been used much in fisheries management.

The dominant mathematical formulation for fisheries management has been the logistic equation, which describes the growth of a single species in a limited environment. Milner Schaefer reviews the history of this ecological model and is commonly given credit for its application to fishery dynamics.[4] The logistic equation can be made more complicated— by incorporating competition among species for the same resource or building in age-cohort calibrations for determining the breeding population—but its basic form is:

$$dx/dt = bx(1-(x/N)) - mx - Fx \qquad (2)$$

where

bx : a density dependent "birth" term;
1–(x/N) : a saturation level determined by the maximum niche size, N;
mx : natural fish mortality; and
Fx : fish mortality due to fishing (i.e., the yield).

The equilibrium solution for yield, Fx, is a parabola with a maximum value at that point of total fishing effort where F = (b-m)/2. This defines the fishery's *maximum sustainable yield* (MSY)—that level of catch at which fish mortality (both natural and human-caused) equals the population's increase rate. The fish population will decline if exploitation goes beyond this level, and for this reason, conservation-minded managers usually target the "total allowable catch" (TAC) for a fishery at slightly less than its calculated MSY.

The fundamental logic of these biological models is to determine the maximum production level a given wild fishery resource can sustain. Thus, to espouse MSY as the proper management target is to focus strictly on how much biomass (protein, calories, etc.) can be harvested from a wild fishery without depleting the resource. There are other factors to be considered, as discussed below, which is why MSY is no longer the pillar of fisheries management it once was.[5]

Economic Perspectives

The same year that Schaefer published his formulations of the MSY idea, H. Scott Gordon, an economist, published his seminal article on the economic theory of common property resources.[6]

His ideas and arguments map onto a Schaefer production function quite easily, by simply renaming the vertical axis "value of catch" instead of "number of fish" (see Figure 1).

Gordon was concerned with optimal economic utilization of fishery resources. Thus, instead of focusing on how much biomass can be harvested on a sustainable basis, he developed the notion of *maximum economic yield* (MEY)—that level of catch at which the difference between the fleet's total revenue and total cost is greatest.[7] Obtaining the most "rent from the sea," rather than the most "food from the sea," should be the manager's objective, and the fact that MEY is always less than MSY ensures resource conservation (see Figure 1).

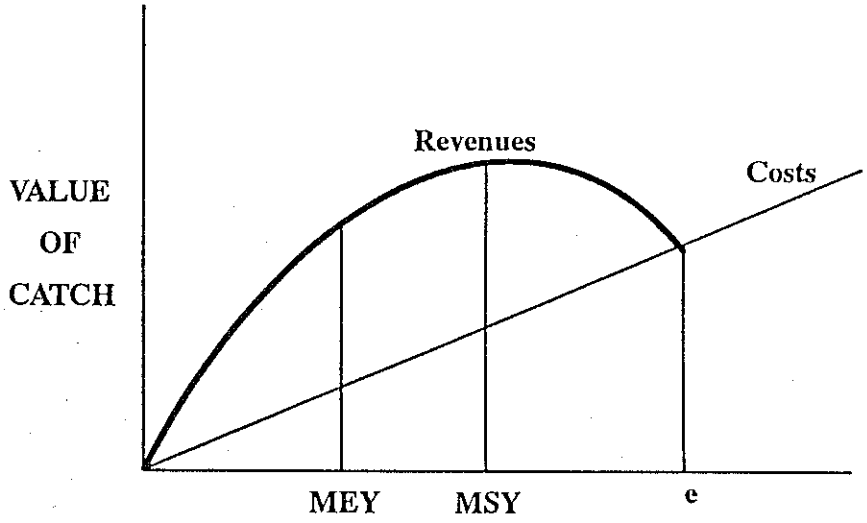


Figure 1

He then addressed the question of why this economically optimal level of exploitation is so seldom achieved in the world's major fisheries. The reason, according to Gordon, lies in the common property nature of our marine fisheries. When individuals cannot exert property rights over a resource or exclude others from entering the fishery, they are caught up in a prisoner's dilemma between short-term self-interest and the long-term collective good. This situation undermines internal restraint, because, unless everyone cooperates, the long-term savings produced by individuals who refrain from intensifying their fishing effort only benefit their competitors. In conse-

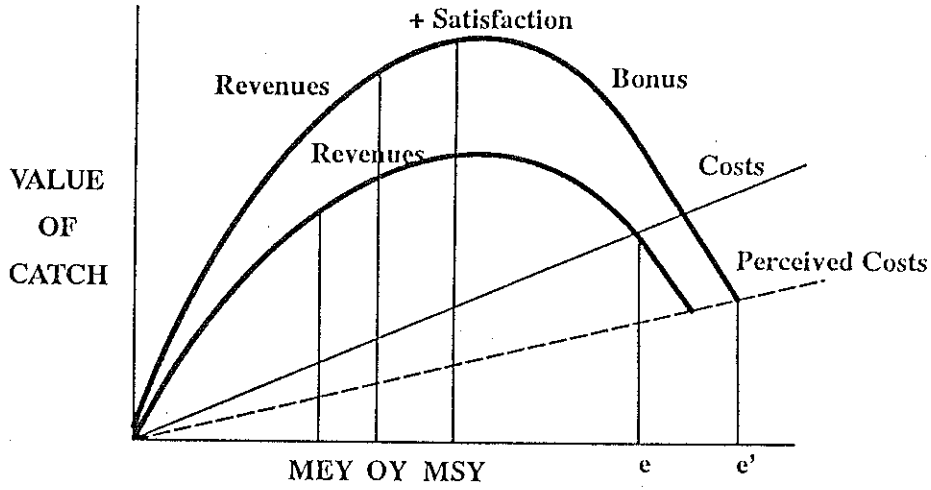
quence, fishing fleets tend to become overcapitalized, whether through more vessels entering the fishery or through upgrading of existing vessels. Indeed, unless the fundamental political economy of the fishery is altered or subjected to external regulation, the fleet's fishing effort will increase to the equilibrium point where revenue equals cost (*e* in Figure 1). The end result is Hardin's "tragedy of the commons," namely, resource depletion and profit loss.

Gordon's economic formulation of both the proper policy objective (MEY) and his analysis of why fisheries tend to be overexploited and overcapitalized are central pillars of contemporary fisheries management. Whether the tragedy of the commons scenario is an inevitable and inherent aspect of all fisheries is an issue receiving considerable attention, but the conceptual framework itself guides virtually all current discussions. Following the implications of Gordon's argument, economists today tend to favor economic efficiency ("rationalization") as the proper management target and champion "privatization" of rights over the resource as the most efficient regulatory regime.

Sociocultural Perspectives

Anthropological case studies of fisheries throughout the world have contributed to the "common property" theoretical framework in several ways. For example, the very notion of optimal yield has been expanded to include the *non*-monetary rewards (sociocultural values) as well as the economic benefits obtained through fishing. Lee Anderson and Courtland Smith's notion of "worker satisfaction bonus" is a promising sociocultural elaboration of the Schaefer-Gordon model.[8] Because fishermen tend to enjoy their work—fishing is not only a means to an end, but also an end in itself—the exploitation level producing the greatest total rewards (at least to the harvesting sector) will generally lie between MEY and MSY, at the point OY in Figure 2.

There are tactical problems, glossed over in Figure 2, that impede applying this conceptualization of *socially optimal yield* (OY) to actual cases. For the Anderson-Smith model to be more than just a useful abstraction, there must be some reasonable way to convert job satisfaction into dollar values, and this is problematic.[9] Still, the Magnuson Fishery Conservation and Management Act requires regional management councils to consider all "relevant social, economic, and ecological factors" when developing management plans, and the Anderson-Smith conceptualization of OY offers one vision of how this might be achieved.



Because fishing tends to be positively valued as a way of life, the "Optimal Yield" occurs at that level of fishing effort where the net returns, including satisfaction bonus, to the factors of production is greatest.

Assumptions : Costs are proportional to effort.
Satisfaction bonus is proportional to revenues.
Price per unit of catch is constant.

Figure 2

Relatively greater effort has gone into ascertaining the conditions under which tragedies of the commons might or might not occur. Detailed studies of fisheries around the world have revealed a wider spectrum of possible solutions to the so-called "commons problem" than were considered by Gordon and Hardin.[10] For example, in coastal Japan, many places in Micronesia and Polynesia, and among most Northwest Coast Indians, fish resources were subject to property rights vested in kin groups or local communities that controlled access to, and exploitation levels in, their territorial waters. Such studies show that the relation between property regimes

and sustainability of fish resources is not simple and automatic in effect.[11] Similarly, cooperation to regulate fish resources can be achieved through a variety of institutional structures working under differing property right systems. These various comanagement arrangements show that privatization and external regulation are not the only viable regulatory solutions.[12]

Finally, comparative study shows that the human motivation for fishing is crucial to understanding fishery dynamics. In particular, although open access to the resource may set the stage for tragedy, it seems to be the capitalist profit motive that triggers excessive exploitation and rent dissipation. So long as fishing is motivated by subsistence needs or organized as part of a household economy, resource depletion and/or overcapitalization in even an open access fishery do not necessarily occur.[13]

The policy implications of sociocultural research for fisheries management are difficult to summarize succinctly.[14] Whereas the biological and economic models consider relatively few variables and lead to quantifiable management targets, anthropologists typically consider a multitude of qualitative issues on a case-by-case basis with the end product being descriptions of how fisheries are situated within broader social contexts. In their emphasis on the relevance of such factors as fishermen's job satisfaction, the microeconomic organization of production, relations of the fishery to community life, the social consequences of displacing fishing laborers, and other economic opportunities, anthropologists are endorsing the idea of socially optimal yield and elaborating on the range of human values it should incorporate. Generally speaking, these social scientists tend to champion social equity as a criterion to be used along with resource conservation and economic efficiency when evaluating specific management plans.

Combining the biological, economic, and sociocultural perspectives on fisheries, we see the complexity of the "commons problem" in wild marine fisheries. While this review has been necessarily brief and the precise conditions that trigger the tragedy scenario are still subject to scholarly debate, we may summarize the emerging understanding as follows. Unrestricted access to a wild fish resource sets up a conflict between short-term self-interest and the long-term collective good, which, if exploitation is motivated by profit returned to capital, seems to result in (a) overexploitation of the resource, and (b) overcapitalization of the fleet. The question is, What can we do about it?

THE REPERTOIRE OF SOLUTIONS

To succeed in a competitive arena generally requires strategies that look beyond the immediate situation to longer-term objectives. Napoleon won the battles but lost his war with Russia. Today's prosperous industries, if they neglect research and development, are forfeiting the future. And, short-sightedness is an element of the commons problem in fisheries, as well.

There are two fundamentally different attitudes countries and fleets may adopt towards commercial fishing. On the one hand, people may recognize the commons problem but elect to do nothing about it. In high-capacity fleets, this orientation generally leads to "pulse fishing," that is, intensive exploitation of a given fish stock until it becomes unprofitable, then shifting to another fish stock or species, during which time the first stock may recuperate. So long as the fleet's market has eclectic tastes for fish products and the fleet can move to new locations easily, this shifting pattern of exploitation will work, at least in the short term (several decades). The Japanese and (former) Soviet distant-waters fleets are examples of this. MSY, MEY and OY are non sequiturs in such systems, for the explicit logic driving exploitation is short-term profitability utilizing a broad spectrum of fish resources rather than long-term sustainability of each resource considered separately.

Alternatively, people may subscribe to the idea of "scientific management," that is, management of a given fish stock to achieve long-term sustainability of the resource and to stabilize the human values realized from it. Scott identifies four, more specific reasons to regulate fisheries: (a) to achieve "X"-efficiency, usually done by effort restrictions such as limited entry or gear/temporal restrictions; (b) to increase the quality, weight, or size of individual fish in the catch; (c) to achieve redistribution of income; and/or (d) to prevent waste of labor and capital.[15]

Most coastal fisheries in the world operate, nominally at least, under the second policy attitude. Virtually all United States marine fisheries are subject to governmental management, and this practice is mandated by the Magnuson Fisheries Management and Conservation Act, which established a system of regional councils charged with developing fisheries management plans (FMPs) for the marine resources in their areas. Sharing this common underlying value, however, does not guarantee agreement regarding specific management policies and tactics. As reviewed above, there are

at least three plausible conceptualizations of the proper management target—MSY, MEY, and OY—and there are a wide variety of management tools for achieving them.

The key to any fisheries management program lies in gaining the cooperation, willingly given or coerced, of the exploiters. There are examples of international cooperation for the purpose of fisheries management, such as the Pacific Halibut Commission and the Inter-American Tropical Tuna Association, but scientific management is more easily implemented when a fishery is under the jurisdiction of a single state. Thus, following Peru's lead, most countries in the world today claim the waters within 200 miles of their coasts as exclusive economic zones. The United States expanded its territorial claim from 12 to 200 miles in 1977 as part of the Magnuson Act. This expansion of the state's legal jurisdiction can also be used to exclude foreign fleets, thereby reducing the level of fishing effort within coastal waters.

Currently, there are six basic kinds of regulatory tactics in the tool kit of fisheries managers in the United States. A necessarily brief review is provided, below, in which each tactic is also evaluated in terms of its consequences with respect to the goals of resource conservation, economic efficiency, and social equity.

Regulatory Tactics

1. Fleet Quotas. Fleet quotas are the most direct and obvious mechanisms to curb over-fishing. The key data for this form of regulation are biologists' estimates of the maximal exploitation level for a given fish stock, during a specified season, using some variant of MSY reasoning. Regulators review this scientific advice, decide on the season's legal TAC for the fleet as a whole, and monitor the catch (usually as recorded by processors) as the season progresses. Once the TAC has been landed, the season ends.

This sort of regulatory regime is an elegantly simple solution to the problem of fish stock conservation. If properly calculated and enforced, TACs are clearly capable of preventing overexploitation. There is nothing in the logic of fleet quotas, however, that addresses issues of efficiency in how the harvesting is done or equity in the disbursement of the captured rent. Fundamentally, a TAC regulation simply says, "The fleet can fish until X fish are landed; the number and type of vessels are up to the industry." Economic and equity concerns can and often do enter into the picture, but only insofar as the announced TAC may deviate from the scientific advisors' MSY estimates. This sort of "fudge factor," because it is

informal and inexplicit, subjects regulators to considerable political pressures. For these reasons, TACs, by themselves, constitute an inadequate regulatory regime. They remain, however, a fundamental and generally presupposed component in more complex management plans.

2. Gear and Temporal Restrictions. Gear restrictions can be used to address three sorts of management objectives. First, they are sometimes instituted as a means of resource conservation. By limiting the exploitative efficiency of harvesters one unit at a time, one hopes to reduce or at least retard the growth of the fleet's overall catch. Second, fine points of gear (mesh size, vessel storage facilities) can be regulated to improve the quality of the catch. Finally, gear restrictions can be used to address, rather directly, issues of income redistribution, for example, banning the use of specific gear types for a given fish stock.

Temporal restrictions follow a logic similar to gear restrictions. Officials can simply close fishing grounds for spans of time as a means of preventing overexploitation of the spawning stock. Income redistribution among different kinds of harvesters can be achieved by closing areas only to some gear types.

While gear and temporal restrictions can be successful in terms of conserving fish stocks and achieving income redistribution among user groups, they are simply at odds with the goal of economic efficiency.[16] The fundamental reasoning behind these regulatory tactics is sequential consideration of only two management objectives: first and foremost achieve MSY, then worry about allocation or social equity issues. The root of the problem is that gear restrictions control the cost of fishing only for each harvesting unit taken singly, but not for the fleet collectively. In consequence, if these are the only forms of regulation in force, the fleet tends to be highly overcapitalized in the sense of a large number of small vessels that fish only occasionally instead of a small number of highly efficient and busy vessels.

3. License Fees and Landing Taxes. Unlike gear/temporal restrictions and TACs, license fees and landing taxes, if sufficiently large, are means to limit the inputs to the fishery rather than restrict its output. The difference between fees and taxes is largely a matter of when payments to the government (the public) are received. Fees are paid up front for the opportunity to engage in a fishery, whereas landing taxes are levied ex post facto on a vessel's catch. Both mechanisms have the desirable aspect of returning a goodly portion of a fisher's rent to the public at large.

Most U.S. fisheries require commercial fishermen to purchase a

license. Currently, these are cheap relative to the income derived from fishing (typically, $50 per person) and exist principally to defray the costs of fisheries administration. The price could be considerably higher, however, and in this way discourage the more marginal fishermen from participation. Similarly, the government could impose rather substantial taxes on landed catch to discourage inefficient vessels from participation.

Aside from the practical problem of calibrating the fee or tax structure, this regulatory logic is generally criticized on three grounds. First, the power to impose taxes, at least in the United States and Canada, is vested in legislative bodies rather than given over to bureaucratic agencies. Thus, were fisheries managers to institute fees or taxes large enough to reduce participation in a fishery, their action would almost certainly encounter constitutional objections.[17] Second, imposing severe fees or landing taxes would be politically naive, for it would amount to assessing a new charge on people who already suffer low incomes and underemployment.[18] Finally, a fee or tax system cannot be manipulated rapidly enough to deal with year-to-year, season-to-season fluctuations in fish stocks.[19]

4. Limited Entry Licenses. Limited entry licensing is the most direct and dramatic way to restrict inputs to a fishery. As the name implies, limited entry systems restrict the fishing power of a fleet by limiting the number of harvesting units (and, thereby, the capital investment) allowed in a fishery. Ideally, managers would determine the number of vessel licenses to be issued by estimating the TAC for the fish stock in question and dividing that by the catching power of vessels of a given type. In this way, each vessel could work at its maximum efficiency and still not overfish the resource.

The difficult issue in limited entry systems, of course, is how the licenses are to be distributed initially. One disbursement scheme is to auction off the licenses, for example, by selling them to the highest bidders. More commonly, licenses are distributed to all vessel owners who meet specified qualifications regarding historic participation. A third possibility is a random lottery. There are also questions of whether licenses should be issued for a fixed or indefinite duration, whether they could be bought or sold during their term, and so on.

Another problem with limited entry is that, by itself, it is only a temporary solution to overfishing and overcapitalization, for it does not eliminate the motivation of each vessel owner to increase his or her vessel's catching power. Thus, to be effective, limited entry must be part of a management plan that includes gear restrictions

or other means of inhibiting vessel enhancements. In such configurations, limited entry systems are, in principle at least, an effective way to achieve conservation and efficiency goals (provided the system has not simply grandfathered an already overcapitalized and overly powerful fleet). They are objectionable, however, in terms of excluding marginal people, especially native populations, who have few other economic opportunities than fishing.[20] Also, they run counter to deeply held cultural values that see fishing in the special category of a "God-given right of citizenship."

5. Individual Vessel Quotas. Individual vessel quotas are a form of privatization achieved by managers allocating a given TAC among a fixed number of vessels participating in a fishery. The advantages of vessel quotas are (a) they accomplish resource conservation as effectively as a fleet quota system; (b) they can be recalibrated quickly to respond to short-term or seasonal fluctuations; (c) they do not increase the costs incurred by fishermen; and (d) they restrict capital inputs much more effectively than a limited entry system. This last point is especially significant in arguments favoring vessel quotas. Because vessel owners know in advance their quotas, and these are guaranteed independent of what other fishermen do, they are freed from the "prisoner's dilemma" situation and will be motivated to configure their vessels in the most economically optimal fashion capable of catching their quotas.[21]

On the negative side, individual vessel quotas, which logically presuppose some sort of limited entry system, are subject to the same debates regarding equity that apply to limited entry. Additional problems revolve around how the vessel quotas are to be determined—that is, whether quotas should be equal among participating vessels, variable based on historical performance of the vessels, variable based on the catching power of the vessels, or variable based on capital value of the vessels. Further, the rights vested in vessel quotas could be transferable, of fixed duration, and/or priced (hence marketable). Finally, as Gatewood and McCay argue, precisely because vessel quotas eliminate the competitive aspects of fishing, they may diminish the nonmonetary rewards (aspects of "social benefits") derived from some fisheries.[22]

6. Sole Ownership of Fishing Rights. Scott argued in favor of sole ownership of fishing rights as the most satisfactory long-term solution to the commons problem. (Sole owners differ from monopolistic owners in that they cannot control price.) He noted that the simple existence of private property is insufficient to assure economic rationalization of a fishery: privatization of the resource had to be "on a *scale* sufficient to insure that one management had

complete control of the asset."[23] The essential differences between sole ownership at the proper scale and a competitive regime are that the sole owner can (a) maximize short-terms gains by reorganizing production to take advantage of economies of integration and of scale; and (b) maximize long-term gains by fixing current output at that level where marginal current net revenue is equal to marginal user cost.[24] While sole ownership does not guarantee resource conservation, it should foster greater efficiency in production.

The first problem with this regulatory scheme is how to establish the exclusive property rights. A common way of allocating state-owned property is for the state to auction exclusive leases to highest bidders, such as is done for offshore oil tracts. An auction of this sort would return some rent directly to the general public and reward those who can organize efficient exploitation of the resource, but it ignores several social considerations. There are social costs when labor is displaced from an economic sector, which is a principal way sole owners can establish more efficient operations. This issue will loom large in regions of the country where few other economic opportunities exist (for example, Alaska, Maine, much of the Gulf Coast). Also, the share system of payment for crew members, which is customary in fishing, means that the entrepreneurs who will enjoy the benefits of the property rights do *not* hazard the usual business risks. If fishing is bad, it is the laborers who have had no say in the matter who absorb a large proportion of the consequences.

None of the various regulatory alternatives is perfect. Each is capable of achieving some management objectives, but none addresses completely the triadic goals of conservation, efficiency, and equity.[25] Because the schemes have differential social impacts, they are also highly political. Different groups of people enjoy the benefits and endure the costs depending upon which plan is in force. The six basic regulatory alternatives grade along a continuum from those preserving open access (nonexclusionary) to those creating property rights (privatization), as illustrated in Figure 3.

In broad terms, fleet quotas, gear and temporal restrictions, and license fees and landing taxes, because they preserve the right of any citizen to exploit marine resources, favor equity concerns (equal opportunity) over economic efficiency. By contrast, limited entry licenses, individual vessel quotas, and sole ownership are forms of economic protectionism in that they establish state-sanctioned private property rights, either to fishing opportunities or

Schematic of the Trade-Offs Inherent in the Six Major Regulatory Alternatives

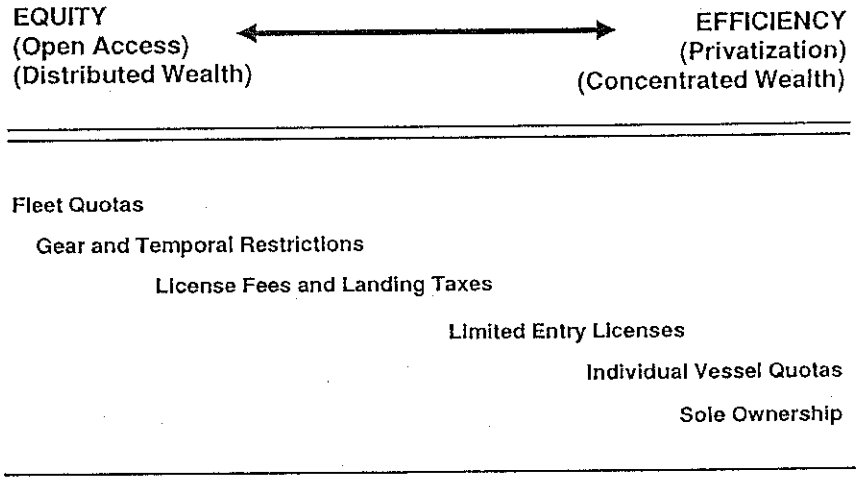


Figure 3

specified fish resources, where none previously existed. As social policies, they explicitly favor efficiency over equity and hope to achieve efficiency by creating property regimes that will induce fishermen to restrict their own capital and effort investments.

The current rage in scientific and managerial literature is for individual vessel quotas. The first large-scale implementation of this kind of system occurred in New Zealand a few years ago. A similar system has just been instituted in Mid-Atlantic surf clam fishery. But these management regimes have not been in place long enough for anyone to ascertain their full consequences.[26]

Because no management panacea exists and because each regulatory alternative has different ecological, economic, and social consequences, there are a wide range of management plans in effect in the United States. In regions where fisheries are one of very few economic opportunities for the population, we tend to find non-exclusionary management regimes such as fleet quotas in conjunction with gear and temporal restrictions. In other regions, where a variety of other economic opportunities exist, we find more concern with economic efficiency; hence, their management regimes often include individual vessel quotas or other privatization strategies.

The larger point, which bears upon the subsequent discussions of competitiveness, is that each fishery management plan reflects *locally appropriate compromises* among conservation, efficiency, and equity concerns. Regulatory agencies usually insist on conservation objectives, but they resolve efficiency versus equity tradeoffs through involuted political processes as well as through consultation with social science advisors. Not surprisingly, then, debates concerning proper management policies are ongoing as managers respond to pressures from the various interest groups. In principle and in law, managers are supposed to optimize the social benefit derived from the publicly-owned resource. Pursuit of this diffuse objective may or may not result in lower fish prices.

THE "COMPETITIVENESS" PROBLEM IN FISHERIES

The complex management compromises that exist in several major U.S. fisheries are now being confronted by another kind of challenge: international price competition. While our management schemes were being worked out under the political-legal umbrella of the United States to achieve locally appropriate definitions of "socially optimal yield," people in other countries have gradually increased their shares in the international market and in some of our domestic markets.

Growth in the market shares of foreign fish does not necessarily indicate a competitiveness problem, however, for there are two ways countries can increase their share of the international and U.S. domestic markets. These should be clearly distinguished at the outset.

Firstly, markets for fish can expand, either through (a) increases in the size of human populations, that is, growth in the sheer number of human consumers; and/or (b) increases in the per capita consumption of fish. This second source of increased demand is particularly relevant to the U.S. market, where the recent diet and health craze has substantially increased the domestic demand for fish. The U.S. per capita consumption of fish during the 1960s averaged 10.73 pounds, essentially the same as that during previous decades back to 1910. This average rose to 12.49 pounds per person during the 1970s and to 14.07 pounds during the 1980s. For 1989, the per capita consumption was 15.9 pounds, a record high.[27] America's wild marine fisheries, because of the sorts of ecological limits discussed previously, cannot simply increase production to

supply this increased demand without overexploiting our resources. Thus, in these cases, foreign fish is required to satisfy increased demand, and the competitiveness of our domestic fisheries is not at issue.

Alternatively, the percentage of foreign fish in world and U.S. domestic markets can increase because foreign fish is cheaper and/or is considered to be of better quality than fish produced domestically. In these cases, the "competitiveness" of U.S. domestic fisheries is at issue and could affect management policies.

For many years, despite its abundant fish harvest, the United States has run a trade deficit with respect to fish imports and exports. In 1989, the most recent year for which statistics are available, the United States imported 3.2 billion pounds of edible fishery products valued at $5.5 billion, plus another $4.1 billion of imported nonedible fishery products (primarily fish meal used in animal feed). Offsetting this, we exported 1.4 billion pounds of edible fishery products valued at $2.3 billion, plus $2.4 billion of nonedible fishery products.[28]

In terms of dollar value, the general pattern of U.S. foreign trade in edible fishery products has been stable for at least a decade. Shrimp and tuna are our major imports; salmon is our major export. Given the importance of the U.S. salmon industry with respect to offsetting our foreign trade deficit in fish, and the fact that it is currently losing ground in the world market, salmon illustrates very nicely the general problems "competitiveness" poses for fisheries management in the United States. And, because most of the U.S. salmon catch comes from Alaska, it is appropriate to focus attention on the Alaskan salmon fisheries for our principal case.

The remainder of this section first describes the productive and regulatory history of Alaskan salmon fisheries, particularly in the southeast region, which was the first to be developed. Then, recent trends in the world market for salmon are reviewed to show that a genuine competitiveness problem exists for the U.S. salmon industry. The section concludes by sketching out and evaluating alternative ways the U.S. salmon industry might respond to its competitiveness problem.

Historical Overview of the Alaskan Salmon Fisheries

Salmon are caught as they return from wide-ranging ocean migrations to spawn in fresh water streams and rivers. The indigenous peoples of Alaska who lived along the coastlines and rivers looked forward to the annual salmon runs as a time of bounty. They em-

ployed a variety of fishing techniques, such as traps, nets, angling devices, and harpoons, and built up food surpluses from the summer season by preserving their catch through drying or smoking. In many regions, ownership rights over specific fishing stations or territories were vested in corporate kin groups.[29] It was only toward the latter part of the nineteenth century, however, that Alaska's salmon resources became subject to commercial, profit-motive exploitation, and within a short time, the native property-right system was ignored in favor of an open-access regime that benefited immigrant Whites.

In 1878 the first cannery appeared in Alaska (village of Klawock), and within a few decades, an influx of non-native fishermen and cannery workers had developed a booming commercial industry based on canning.[30] During the early years of this commercial fishery, the principal catchment technique was scooping up salmon schools with beach seines at barricaded stream mouths, but by the mid-1890s, the mobile purse seine began to be used in southeastern Alaska. Around the turn of the century, both the stationary and the floating fish trap were in use, and between 1905 and 1920 the floating trap was responsible for about a third of the total southeastern salmon catch.[31] In the mid-1920s, the first regulatory intervention in salmon harvesting was imposed. The U.S. Bureau of Fisheries (now defunct) imposed a gear restriction on vessels working in the Alaska purse seine fisheries: vessels could not be greater than 58 feet in overall length.[32]

From around 1920 to 1941, salmon production reached its peak levels in the southeast region of Alaska. In the ten years 1915–1924, for example, the southeast region produced an annual average of 40,720,000 fish, and production continued at nearly that level through 1941.[33] During the years 1915–1944, between 61.8% and 84.2% of southeastern Alaska's salmon was caught by traps.[34] These devices, generally owned by the canning companies, were located at stream mouths. Traps cost relatively little to build and maintain, at least in comparison to today's vessel costs, and involved no labor costs other than a trap-watcher and the occasional visit by crews to bring the entrapped fish back to the cannery. Without doubt, traps were (and still are) the best salmon harvesting technology to be devised, at least from the viewpoint of economic efficiency. And, although it was not much of a concern before the 1950s, traps make resource conservation relatively simple, because the number of salmon allowed to escape upstream for spawning is easily controlled.

During the first half of the twentieth century, then, the pattern

of salmon exploitation was quite similar to what was happening in other industrial sectors across America. There was a steady displacement of labor-intensive (wealth distributing) techniques by capital-intensive (wealth consolidating) techniques. Economic efficiency, pure and simple, seems to have been the driving consideration. Canning companies—whose owners might live in Seattle, San Francisco, Boston, or New York—got most of the salmon pack from their own traps, and relatively little of the resource's value was paid to primary harvesters. Thus, as over-exploitation of the resource led to declines in the salmon catch during the 1940s and 1950s, the fish trap became symbolic of the rampant absentee capitalism that had drained away Alaska's wealth in natural resources with little or no return to residents.[35] The antagonism between small-scale, independent vessel owners and company-owned, passive-gear traps often led to "fish pirating"—vessels coming alongside traps at night and stealing the fish. More than once, these clandestine encounters involved physical violence between boat-fishermen and the company trap-watchers.

Given this political climate, as Alaska prepared for statehood, the Secretary of the Interior declared fish traps illegal in 1959. This decision was an endorsement of social equity over economic efficiency with respect to how Alaska's salmon wealth should be harnessed to achieve the greatest social benefit. In declaring traps illegal, the government deliberately reallocated the entire salmon catch to small-vessel harvesters, that is, to the purse seine, gillnet, and trolling fleets. The hope was that by restricting the catch to small-vessel harvesters, Alaska's fishery resources would attract and support a growing resident population and, in this way, a more secure economic foundation for the new state would develop.[36]

Subsequent regulation of the salmon fisheries has maintained this general policy. For example, as purse seining became more efficient, additional gear restrictions were imposed. Seines cannot exceed 250 fathoms in length, and drum-seining is not allowed. Similarly, in the rich Bristol Bay drift gillnet fishery, vessels cannot exceed thirty-two feet in overall length, and until 1952, they could not be powered by engines.[37] The basic logic of these restrictions is to prevent both overexploitation of the resource and overcapitalization of the vessels by controlling the catching power of individual vessels. Such a regulatory regime gives rise to large fleets of small boats, which is a way to distribute wealth generated from the natural resource as widely as possible. Conservation objectives are achieved through temporal closures in specified areas until "es-

capement" targets (specified numbers of fish allowed upstream to spawn) have been met.

Unfortunately, even though traps were no longer in use, salmon production continued to decline through the 1960s. The catching power of each vessel was being restricted, but the catching power of the fleet was not, because additional vessels could enter the fisheries freely. In the southeast region, during the interval 1965–1974, the average annual catch dropped to a record low of 15,166,000 fish. Also, the fleet's catching power had increased to the point that the 1975 southeastern purse seine season consisted of only eighteen days of legal fishing.

Responding to declines in the resource and to the fleet's overcapitalization, state officials instituted a limited entry license system in 1973. By 1979, there was a total of 9,861 commercial permits distributed to individuals throughout the state.[38] Permits belonged to individual vessel owners (or, in the case of set gillnets or fish wheels, to gear owners) who could demonstrate specified levels of historical participation in the fishery.

The last major ingredient in Alaska's overall management regime for salmon occurred in the mid-1970s. The state enacted legislation allowing private non-profit salmon hatcheries to commence operation. Fry from these hatcheries are released into the wild; hence, this is technically an enhancement program rather than full-blown aquaculture or fish-farming. The hatchery program differs philosophically from regulation in that the objective is to increase the abundance of salmon directly, rather than to trust in natural population increases as a result of restricting exploitation.

Today the management regime for the Alaskan salmon fisheries includes the following ingredients: (a) escapement targets for specific streams and regions enforced by temporal closures; (b) a variety of gear restrictions; (c) limited entry licenses; and (d) a growing hatchery program. The combination of these measures has curtailed the decades-long decline, and Alaskan salmon production is slowly recovering, although it is unlikely to achieve a sustainable yield at the 1920–1941 levels. From 1975–1984, for example, the average annual catch in the southeast region was 21,538,000 fish.

Improvements in the technology for fish-processing have also had a felicitous effect on the salmon industry. For the industry's first fifty to sixty years, the vast majority of Alaskan salmon ended up in cans. With the development of fish-freezing technology, which began in the early 1900s, the high volume of salmon caught between August and July could be preserved for subsequent canning. In the last few decades, however, frozen Alaskan salmon has increasingly

been diverted to the fresh (frozen) market, particularly as an export product to Japan.

In summary, the Alaskan salmon fishery has run full cycle. One of the world's most abundant fish resources went from subsistence fishing to unrestrained capitalistic exploitation (salmon traps) resulting in resource decline, to regulated inefficiency (gear and temporal restrictions) as a means of achieving greater social equity, to modest privatization (limited entry), to aquacultural enhancement. What appeared to be Alaska's "fading future" in 1960[39] is now on the rebound. But just as the industry appears to have weathered the storm successfully a new cloud has appeared on the horizon. Foreign developments in salmon-farming technology are eroding the United States's market share and calling into question the "competitiveness" of Alaska's rejuvenated salmon industry. Whereas fellow citizens may tolerate the higher prices that result from management policies favoring social equity over economic efficiency, consumers in the international marketplace seem less inclined to subsidize American fishermen.

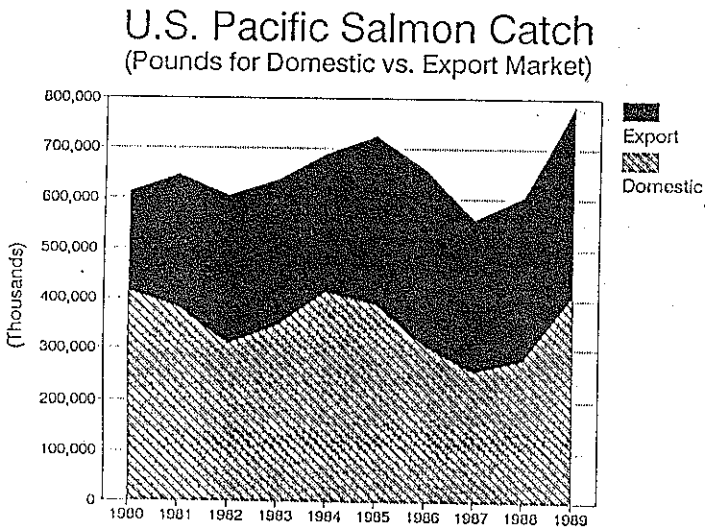
The World Market in Salmon

In the decade of the 1980s, the landed weight of the U.S. Pacific salmon catch has been relatively stable, fluctuating from a low of 562 million pounds in 1987 to a high of 786 million pounds in 1989. During that same interval, the percentage of the catch exported has grown from about a third to a half (see Figure 4).

The pattern of U.S. salmon exports by product type has also changed substantially during the 1980s. There are three main types of edible salmon products distinguished in U.S. government statistics: canned, whole or eviscerated, and fillets or steaks. The percentage of exported canned versus fresh salmon (including both frozen whole/eviscerated and frozen fillets/steaks) reflects the changes in consumer taste noted previously, that is, preference for fresh rather than canned products. In 1980, canned salmon comprised 37% of the U.S. export by weight, whereas by 1989, it had declined to only 11% (see Figure 5).

The world market in fresh (frozen or chilled) salmon is dominated by a handful of countries. Japan, France, and ironically, the United States are the major importing nations. The United States, Norway, and Canada are the major exporting nations. The import-export patterns of trade for the year 1987 are shown in Figures 6 and 7.

The three majors suppliers of fresh salmon—United States, Nor-

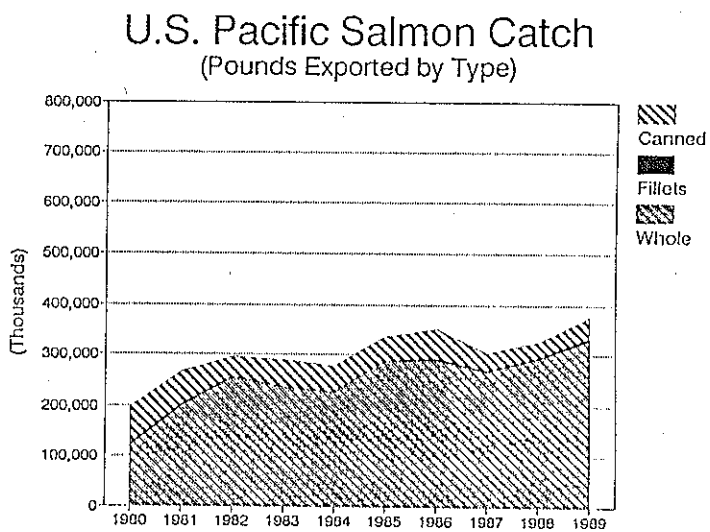


Source: Fisheries of the United States, 1980–1989. Department of Commerce, NOAA, NMFS.

Figure 4

way, and Canada—differ substantially in their production technologies and the particular markets they supply. Both the United States and Canada rely on intricately managed, wild-harvested salmon, whereas the Norwegians have developed a technology for salmon-farming.[40] Further, virtually all of Norway's exported salmon is for the high-quality chilled salmon market, whereas Canada exports mainly frozen salmon, and all of the United States' "fresh" salmon exports are actually frozen. Figure 8 shows the total export values of the world fresh salmon market from 1980 to 1987, as well as the those for each of the three major exporting countries. Figure 9 shows the market shares of the United States, Norway, and Canada expressed as percentages of total salmon export values.

The clear point from Figures 8 and 9 is that Norway's new salmon-farming technology has been successful in increasing Norway's market share, with this at the expense of the United States and Canada. The United States retains the huge Japanese market in frozen salmon, but Norwegian chilled salmon (higher-quality, more expensive than frozen) now dominates the European market. Indeed, the United States itself imports a substantial amount of chilled salmon from Norway. Thus there is, in fact, a "competitiveness" problem developing for the U.S. salmon industry vis-a-vis Norway. Further, the problem will only intensify as Norwegian production increases and as other countries, such as Iceland, Chile, and New Zealand, adopt the new salmon-farming technologies.



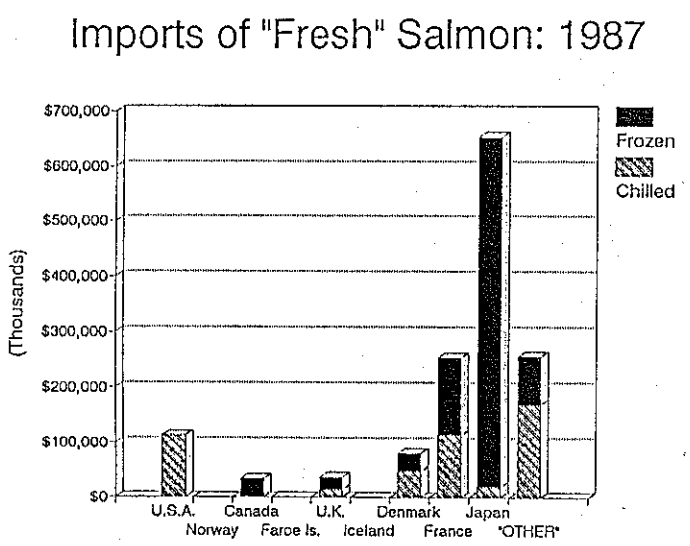
Source: Fisheries of the United States, 1980–1989. Department of Commerce, NOAA, NMFS.

Figure 5

Possible Responses to the Competitiveness Problem in Fisheries

There are several ways that the U.S. salmon industry might respond to its growing competitiveness problem:

1. develop processing and transportation capabilities to compete in the chilled salmon market;
2. develop salmon-farming programs comparable to Norway's;
3. launch a marketing/advertising campaign stressing the product superiority of "natural" salmon vis-a-vis farmed salmon;
4. launch a marketing/advertising campaign stressing patriotic consumerism ("Buy American");
5. protect the domestic market by raising the price of foreign salmon via tariffs or other import restrictions;
6. achieve greater competitiveness in the world market by reducing the price of U.S. salmon products.



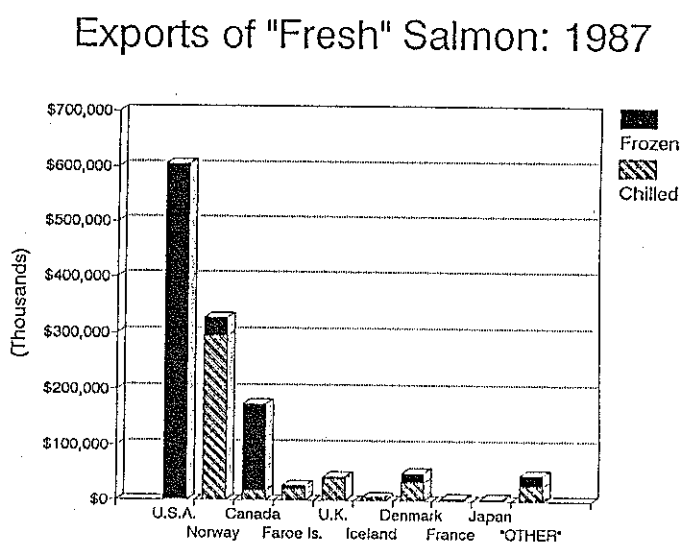
Source: F.A.O. Yearbook of Fishery Statistics, v. 67, 1988.

Figure 6

The first and second responses involve capital-intensive restructuring of the U.S. salmon industry to compete in the world market using the newest technologies of production and food-processing. Basically, these would be attempts to catch up with the Norwegians. Efforts in this direction would almost certainly be additional to, rather than substitutive for, wild salmon harvesting and, in the political-legal context of the United States, developments of this sort would most likely be left to private firms.

The third and fourth strategies would attempt to manipulate consumer attitudes without really modifying the structure of the U.S. industry. Such efforts may or may not be successful. Encouraging patriotic consumerism, however, even if successful, would work only to protect the U.S. domestic market; it would not help the United States in the larger world market.

The fifth response represents a common political solution to economic problems. Unfortunately, tariffs, like efforts to engender patriotic consumerism, work only to protect the domestic market and do virtually nothing to improve the position of U.S. products in the world market.



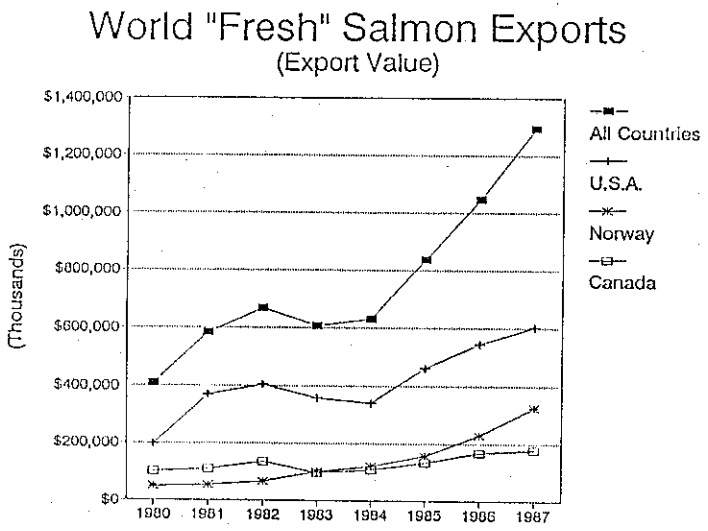
Source: F.A.O. Yearbook of Fishery Statistics, v. 67, 1988.

Figure 7

The sixth strategy, reducing the price of U.S. salmon products, is the most direct way to regain competitive advantage in both the domestic and world markets. Further, it is the cheapest solution, because it does not require large-scale capital investments in a new salmon-farming technology. Price, however, can be reduced in four very different ways, and it is the differences among these that highlight the fundamentally political nature of "competitiveness" problems:

(a) In the short run, prices could be lowered by increasing the size of the catch. Because of the ecological limits discussed previously, however, the industry would pay for these short-term gains with years, and perhaps decades, of poor fishing; hence, this is not a serious alternative.

(b) Fish-processing firms could reduce their prices by paying harvesters less for wild-caught salmon. This would make primary producers bear the burden of international price competition, but it would not modify the basic social policy implicit in the current management regime (income redistribution via small-vessel harvesters).



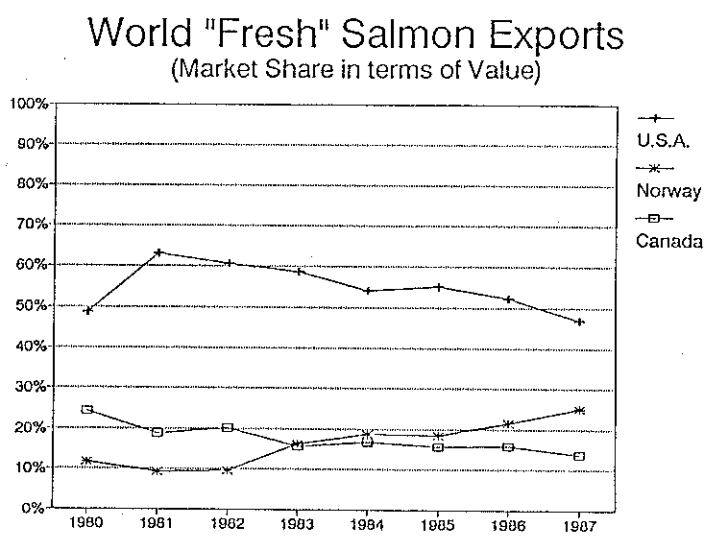
Source: F.A.O. Yearbook of Fishery Statistics, v. 65, 1987.

Figure 8

(c) Fish-processing firms could reduce their prices by reducing their profit margins. In this scenario processors, instead of producers, would bear the burden of international price competition. This is an unlikely turn of events in a capitalist political economy, but it could be accomplished relatively easily if processing firms were state-owned, non-profit, or fisherman-cooperative enterprises.

(d) Prices could be reduced by altering the current management regime to realize greater economic efficiency in wild-salmon harvesting. This would reduce the operating costs of firms, and the means of achieving this sort of efficiency is well known, that is, repeal the ban on salmon traps. However, the reasons traps were banned in 1959 remain true today: traps consolidate salmon revenues into very few hands, whereas other catching technologies result in a more equitable distribution of income, which is deemed essential if Alaska is to gain the economic vitality and long-term stability appropriate to a state of the union rather than an internal colony.

In summary, competitiveness problems in the international market conflict with issues of social equity at home. This is the lesson from fishing, and it seems to be true of many other industries as



Source: F.A.O. Yearbook of Fishery Statistics, v. 65, 1987.

Figure 9

well. Whether and how we choose to modify our modes and relations of production to become more competitive will always be a highly political issue because different decisions benefit different groups of people; but, to the extent that it is the business of governments to be concerned about the welfare of their citizens, rich and poor, it is clear there will always be a need to accept the political challenge and formulate explicit fisheries policies. The notion that fisheries should be deregulated and left to laissez-faire market forces (such as Presidents Reagan and Bush have championed for most American industries) would most certainly lead to ruination. On the other hand, each policy option has its pitfalls. Policies maintaining fisheries as open-access public resources may spread the wealth to more people, but they lead to inefficient (less competitive) configurations of capital and labor. The various privatization solutions may improve the cost efficiency of our fisheries (and thereby restore their competitiveness), but they would do so by displacing large numbers of already marginal laborers to the benefit of a few individuals who are already relatively well-to-do. This is the social dilemma that competitiveness issues raise. Let me now extrapolate from the particulars of fishing to America's industrial competitiveness problems more generally.

AMERICAN COMPETITIVENESS: SPECULATIONS ON ALTERNATIVE FUTURES

There are three conditions that seem to underlie and give rise to economic competitiveness: abundant and/or cheap natural resources, abundant and/or cheap labor, and a technological advantage in the mode of production.

Throughout most of its brief history, the United States has been fortunate to have all three conditions working to its advantage. The early European settlers came into a continent whose natural resources were not only diverse, but virtually untapped. Cheap labor arrived with each boatload of immigrants, indentured servants, and slaves. And the latest industrial technologies were put into place de novo, without having to calculate the cost-efficiency of replacing older and superseded modes of production.

In this most felicitous environment, capital and labor alike prospered without need of a far-flung colonial empire. Especially with the passing of income redistributive laws (anti-trust, income tax, social security) in the early decades of the 20th century, the average American's standard of living soared to new heights. In the wake of such prosperity, and especially in the political aftermath of World War II, ideologies new to the American people began to guide national policy and everyday life. On the one hand, long-standing isolationist tendencies gave way to a view of America as "leader of the free world" and "world policeman." The military-industrial complex burgeoned in an arms race with the Soviet Union, diverting much of America's economic resources into military capabilities. On the other hand, fueled by Madison Avenue marketing, conspicuous consumption and built-in obsolescence became the order of the day. Conservation, thrift, and delayed gratification gave way to wastefulness, buying on credit, and indulgence. Compounding matters, we carelessly imagine that economic growth can continue without bumping up against ecological limits.

The puzzling aspect of contemporary American values and ideology is that we cling to our belief in the benefits of free trade, but also believe we are somehow entitled to a higher standard of living than the rest of the world. Thus, the growing realization that other countries now make many consumer products superior in quality as well as cheaper in price than we do represents a fundamental challenge to our sense of manifest destiny. We are addicted to consumerism—buying sustains our private sense of self-worth—but increasingly we consume other people's products instead of our own. Our cultivated optimism and complacency (or, as Herodotus would have called it, our "hubris") have resulted in massive trade deficits, factory closures, and lost jobs. Our national pride is offended.

Given the current state of affairs, it would appear there are basically two roads we may follow: (a) go for domestic equity, that is, protect our domestic industries from foreign competition, at least in the U.S. market; or (b) go for efficiency, that is, compete in a free trade global market. This choice presents a perennial and familiar tension in fisheries management, but it seems less well recognized in other industries. Each view has its proponents and detractors. What I would like to consider is the large-scale, long-term consequences of each response.

The most ethically compelling argument for protectionism is that free trade is not always fair trade. Nations differ in the extent to which fiscal cooperation is allowed between public and private sectors. So long as foreign industries are not on a comparable legal-fiscal footing with U.S. industries, tariffs or import quotas are "fair" ways to "level the playing field." Alternatively, politicans and business leaders can stir up protectionist consumer sentiment without imposing formal trade barriers. Indeed, this desired effect seems to underlie much of the current rhetoric about American competitiveness (see Morgan and Rosenwein, this volume). The problem with protectionism, of course, is that other countries usually reciprocate with their own trade barriers. Thus, the long-term consequence of protectionism is global economic stagnation.

If, on the other hand, we continue to operate in a free trade environment, there are three plausible scenarios for America's future. First, many American industries may simply lose ground to foreign competitors, such as has been happening with salmon, shoes, and steel. Second, American industries may become more competitive (improve the quality of products and make them cheaper) by lowering labor costs, whether through reducing wages paid to American citizens or by moving production facilities abroad, such as has happened with the San Diego-based tuna processing, General Motors factories, and "Made in America" television sets. Third, American industries may become more competitive by developing new and more efficient modes of production, as the Norwegians have done with their new methods of salmon-farming. This last scenario is the hope of those who believe in technological fixes to social system problems, but it is a short-term solution because other countries invariably catch up and competitiveness problems reappear (see Smith, this volume). Thus, al-

though they may initially appear to differ, the three scenarios lead to the same global system outcome: eventually, free trade will diminish the differences among national standards of living, countries will become specialized in the kinds of products they export, and return to capital will become increasingly multi-national. The differences among the three scenarios is a matter of how long Americans (and other First World countries) can sustain inflated lifestyles vis-a-vis Third World countries.

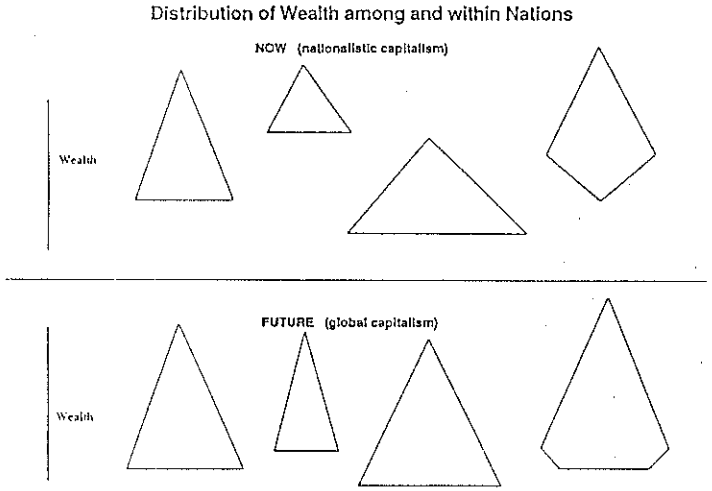


Figure 10

Currently, although there are vast differentials of wealth in America, the variance in wealth *among* nations is still greater than the variance *within* nations. The long-term effect of free trade in a capitalist global market, however, will be reduction in the difference among nations and an increase in the wealth differentials within them. (see Figure 10). When that happens, the stage will be properly set for a true, world-wide class struggle.

Thus, looking ahead to the twenty-first century, or perhaps the twenty-second, when capitalism seems likely to complete its transformation to global scale, the rhetoric of competitiveness will be seen as anachronistic, for it makes sense only on the presumption that there must be a correspondence between sovereign nations

and economic systems. In this future light, all the late twentieth-century hoopla about "competitiveness" will be seen as only the last gasp of nationalistic capitalism, when owners tried one more time to subdue and exploit workers by fanning patriotic fervor.

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