Property Rights and the Texture of Rents in Fisheries

By

James E. Wilen
Dept. of Agric. & Resource Economics
University of California, Davis
Davis, California

Paper prepared for
PERC’s 13th Political Economy Forum:
Evolving Property Rights in Marine Fisheries
Big Sky, Montana
March 21-24, 2002
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I. Introduction

The fisheries resources of the world’s oceans appear to be reaching the end of a long period of steady growth in aggregate yield. The total harvest from the world’s marine capture fisheries began to accelerate in the 1950s and 1960s as a result of the post-WWII shipbuilding boom that took place in countries including the former Soviet Union, China, Korea, Japan, and Poland. From a world-wide harvest of 20 million metric tonnes in 1950, production tripled to 60 million by 1976. 1976 is significant because it was a watershed year in ocean governance, marking the assertion of new claims by coastal nations on marine resources out to 200 miles. Since 1976, production has continued its upward trend, albeit at a slower rate. Total harvest from marine capture fisheries is now approaching 90 million metric tonnes.¹

What this legacy of steady growth implies about the future for the world’s marine resources depends very much on one’s perspective. The FAO reports widely cited statistics showing that, among fish stocks for which assessment information is available, roughly one quarter are underexploited, half are fully exploited, and another quarter are overexploited or depleted and recovering from overexploitation.² Optimists view these statistics with a “half full glass” interpretation, namely that having 75% of the stocks fully utilized or currently capable of expansion is a good record. Pessimists view these

² FAO, ibid., pg 10-11.
statistics with a “half empty glass” interpretation, often lumping fully exploited with overexploited to emphasize with alarm that 75% of the world’s fisheries “are fully- or overexploited” at present. Regardless of one’s perspective, what is clear at this point in the evolution of fishing the world’s fisheries is that their future depends critically on management. In yield terms, successful restoration and rebuilding of overfished stocks could add another 5-10 million tonnes to annual production in the next decade. In addition, technological improvements could open up new fisheries that are currently unexploited, particularly at lower levels of the trophic system. Alternatively, management failures in existing fisheries or new assessments of overexploited stocks for which no current information is available could paint a more dismal future.

While ecologists and most in the environmental community use yields and stock levels as metrics of success and sustainability, economists have attempted to direct attention to the flow of rents generated and the consequent value of marine stocks as economically productive assets. On this score, the legacy of the past 50 years is not impressive. Another widely-cited FAO study in 1990 estimated that gross revenues from the world’s capture fisheries was about 70 billion dollars, but that operating costs were approximately 92 billion dollars. This deficit is believed to be partially funded by the widespread practice of subsidizing fisheries in many countries. But the remainder of the deficit is associated with a failure of current fisheries to fully cover replacement costs and the full opportunity cost of the huge overcapitalization of fleet investment that has occurred over the past twenty five years. If a conservative rate of 10% is also added to

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3 See Marine Fisheries and the Law of the Sea: A Decade of Change, in FAO, The State of Food and Agriculture 1992. FAO Fisheries Circular No. 853, Rome, 1993. Estimated costs were broken into capital maintenance (30 billion), insurance (7 billion), fuel (14 billion), supplies and gear (18.5 billion), and labor (22.6 billion).
costs to cover current vessel capital opportunity costs, the deficit would actually be 32 billion rather than 22 billion dollars per year.

While dismal enough, the above financial performance accounting of the world’s fisheries actually understates how poorly these resources are being used and managed as financial assets. That is because, in addition to actually running a deficit in operating costs, the world’s fisheries are, for the most part, also failing to generate a rate of return on the productive value of the natural resources themselves. Economists know this as resource rent. Well-managed fisheries should not only be fully covering operating and investment costs, but they should also be earning a return for the resource itself. While this is sometimes a confusing concept, it is perfectly analogous to land rent. A farmer who allowed renters to utilize his land would not be satisfied with the use of his land if the renters squandered all the crop revenues by buying tractors that were too large and quantities of other inputs that were wasteful, leaving nothing to pay for the productivity of the soil itself.

How much rent should the world’s fisheries be earning? This paper takes a look at this issue. We begin by briefly discussing some conceptual background about economists’ depictions of rent and rent dissipation in the next section. We then discuss the history of fisheries regulation and management changes, with particular attention to the period since jurisdiction extension in the 1970s. In the third section we review a couple of case studies of rent generation in order to flesh out, with real details, some of the “texture” of how rents are generated in practice. The final section concludes and summarizes.
II. Rents and Rent Dissipation

The economics profession’s understanding of rents and rent dissipation owes much to the important paper of H.S.Gordon.\textsuperscript{4} The Gordon paper laid out a remarkably simple depiction of fisheries under open access, borrowing from the basic economic theory of input use. Gordon’s point was that that productive resources in a private property-based economy (like land) are managed by resource owners who carefully choose other inputs in order to maximize the economic profits from the use of the resource. In contrast, wrote Gordon, fisheries are essentially productive resources without property rights. In fisheries without property rights, there is no entrepreneur/owner or rent-collector to guide and coordinate the entry of other inputs, and these inputs are attracted far beyond optimal levels. The important consequences of this open access mechanism operating in fisheries, according to the Gordon model, is two-fold. The first consequence is that, for any biomass level, with too many inputs, the short run harvest will be larger than optimal. But this will, in the long run, lead to a biomass level that will be depleted to lower levels than an optimizing owner would choose. This effect of open access is the one most often recognized and focused on by environmentalists, although their focus is not so much on a lower than “optimal” biomass but more on the risk of collapse associated with having low biomass levels per se. The second consequence of open access, less recognized by environmentalists and more appreciated by economists, is that the rent generation capacity of the natural resource will

\textsuperscript{4} Gordon, H.S. 1954. The Economic Theory of a Common Property Resource: The Fishery, \textit{Journal of Political Economy}, 62:124-142. The Gordon paper may be the most cited paper in resource economics. My recent count using the Social Science Citation Index shows approximately 550 citations for the paper, since 1954, in journals currently covered by the SSCI.
be squandered. By attracting too many inputs, the resource will be not only harvested in such a way that drives the biomass to low levels, but the output produced will also not generate any surplus returns that normally go to the owner/entrepreneur who has property rights to the resource’s productivity. Gordon’s insight was that this process will inevitably and continually attract inputs until total input costs are equal to the value of output.5

How well has the Gordon model done in describing what has unfolded in fisheries over the past fifty years? Remarkably well, although with important caveats relating to institutional context. The Gordon model certainly fits the period up until the Law of the Sea jurisdiction extension in 1976. The 1950s and 1960s clearly witnessed an attraction of a huge amount of fisheries inputs into world fisheries. Those inputs were driven by the potential rents that existed in many under- or un-exploited fisheries, steadily fueled by the rising prices for fish protein due to population and income growth. By the mid 1970s there was good evidence and general agreement that many fisheries had been driven to levels far below MSY. In addition, other physical consequences of overharvesting were emerging, including smaller fish and a “fishing down the food chain” process of switching to sequentially less profitable fish species.

At the same time, the evolution of the world’s fisheries since 1976 does not quite follow the story predicted by Gordon. This is not surprising in hindsight, because the jurisdiction extension in 1976 essentially gave coastal nations the opportunity to eliminate or at least mitigate the prime motive open access forces that drove the

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5 Vernon Smith’s (V.Smith. 1968. Economics of Production from Natural Resources. *American Economic Review* 58.) extension of the Gordon model showed that the dynamic process leading up to an open access zero rent equilibrium could involve long periods in which rents were actually negative as vessels with specialized capital persisted and depreciated out their investments.
pessimistic conclusions of the Gordon model. In particular, by asserting new property rights over previously open access resources, coastal nations established the preconditions necessary to begin a process of more rational exploitation. What was made of these opportunities varies greatly around the world, and the present state of affairs in fisheries largely reflects the mix of regulatory methods that was adopted after this watershed in ocean governance was achieved. But the jurisdiction extension changed circumstances dramatically from those in place when Gordon first described the plight of fisheries in 1954.

As has been described and argued in some detail in other papers, it is more accurate to describe the post Law of the Sea period as one reflecting not the open access conditions that Gordon described, but rather regulated open access or regulated restricted access conditions. These institutional descriptions emphasize that most coastal nations reacted to new opportunities for fisheries control after 1976 by introducing regulatory schemes, either under continued open access (to citizens) or under restricted access (such as limited entry programs). To a degree that is almost exclusive, however, the new regulatory schemes put in place after 1976 focused on the biomass safety consequences of open access. Many regulatory programs introduced long run stock rebuilding schemes that were tied to conservative aggregate harvest guidelines implemented with season length reductions. Others utilized gear restrictions such as minimum mesh sizes aimed at rebuilding and maintaining the reproductive potential of the stocks. Very few regulatory schemes explicitly or implicitly acknowledged Gordon’s important insight, that the overharvesting that regulators were battling was only a

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symptom of an important cause, namely the inexorable drive to capture (and ultimately dissipate) rents that exists under open access incentives.

Since 1976, the majority of regulatory schemes adopted by coastal nations have continued to allow open access incentives to drive input and investment choices. The results have been continued growth of overcapacity associated with investment and other inputs. Regulators concerned about biomass safety have repeatedly been forced to stifle this excess capacity after it has occurred with inefficiency-inducing regulatory instruments that mitigate the effects on excessive inputs on harvests. Few programs have been explicitly designed to staunch the flow of these inputs, and until recently, very few schemes have acknowledged that the goal of fisheries might be one of generating economic returns to the ocean’s valuable renewable productive assets.

The current state of affairs in the world’s fisheries thus reflects the most important insights that Gordon recognized nearly fifty years ago, with some modifications. First, under open access (largely the period up until 1976), harvest from the world’s fisheries expanded significantly as vessel capital and other inputs were attracted to the large initial rents that were available in underexploited fisheries. Second, during the post-1976 regulated open access period, the regulatory schemes focused on rebuilding over-harvested stocks and maintaining under-harvested stocks at sustainable and safe levels have produced the steady but slower increase in yields witnessed. Third, because most regulations have been directed at the biological consequences of open access, the economic consequences emphasized by Gordon have been largely ignored. As a result, we witness the paradoxical situation of a system with reasonably healthy biological resources producing virtually zero or even negative economic returns.
III. On The Texture of Rents: Evidence from Property Rights Creation

Insightful as the Gordon model was, it can be argued that some of its simplifications led economists astray in appreciating the nature of rents, rent generation, and rent generation in fisheries. One simplification was Gordon’s depiction of open access as attracting a composite “effort” index. As the notion took hold in the academic and management literature, effort quickly came to be interpreted as boats, ignoring the fact the fishing production is essentially a multi-input process. What wasn’t fully appreciated is that rent generation in real fisheries has much more “texture” in the sense that rents are actually produced by inputs such as crew coordination, skipper fish-finding skills, vessel design, gear efficiency, travel and search time, and so on. An important consequence of this failure to fully appreciate the more complex nature of rent generation was that early management advice from economists came to characterize the open access problem in practical terms as “too many boats chasing too few fish”. While this was a catchy way to characterize the essence of Gordon’s story with a single input, it led to the earliest restricted access programs being centered on limited entry licensing attached to boats alone.

The first management attempts to address the ills of overcapacity with limited entry licensing were introduced in the coastal jurisdictions of several nations, including British Columbia’s salmon fishery, Australia’s rock lobster fishery, and South Africa’s

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Following the extension of jurisdiction, many other fisheries adopted limited access licensing systems. It is not an exaggeration to state that fisheries economists in the 1970s were optimistic that licensing systems, because they were a form of property rights, ought to be successful in generating and sustaining rents. And it is not an exaggeration to say that fisheries economists were surprised when the first analyses of limited entry schemes began to be reported in the 1970s. What was evident from the analysis was that limited access restrictions placed on boats alone did not stifle the open access process that Gordon described. In particular, even when vessel were limited and licensed, regulators were forced to “chase” the other unregulated dimensions of effort that expanded even when the number of boats were limited. In British Columbia’s well documented salmon license program adopted in 1967, for example, regulations were placed first on vessel numbers, then on vessel tonnage, followed by tonnage/length restrictions, then by gear class restrictions, and so on.

Importantly, this evidence emphasized that, without a property rights system attached to the resource itself, the open access incentives would still operate. That is, one could establish quasi property rights to participate in the fishery (via a limited access license), but if more fully delineated rights to the resource itself were not granted, then users would still “race” to dissipate rents by trying to out-compete each other in the dimensions that were left unregulated.

This realization that focusing on the symptoms of the open access process might be self-defeating in the long run led to suggestions that right-based systems attached to

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the resource itself were needed. These have come to be called individual quota systems, or individual quota systems (ITQs), and they all have the characteristic that fishermen are granted shares of a biologically determined total allowable catch (TAC). While it might seem that having a property right restricting participation to a fixed number (as in a limited access licensing system) might foster efficiency, the fact is that a rights delineation based on the resource itself leads to dramatically different behavior. As the evidence with limited access licensing showed, without a secure right to the resource itself, fishermen will engage in attempting to increase their share of the resource. With some dimensions of effort fixed and others free, fishermen will compete in the free dimensions, leading ultimately to dissipation of at least some of the potential rent that might be generated with efficient input combinations.

A rights-based system with rights to shares of the resource creates a dramatically different incentive system. Instead of racing to increase shares of their quantity of the resource, fishermen will, with an ITQ system, be led to increase the value of their catch. One way, consistent with the Gordon story, is to reduce excess inputs and save costs associated with open access overcapitalization in the broad sense. But, as we are discovering after looking at what has happened under existing ITQ systems, there are seemingly endless ways that values can be enhanced, once proper incentives to generate those values are in place. In the remainder of this section, we take a closer look at a couple of case studies of ITQ formation. In a real sense, these cases illuminate the

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12 First mention of ITQs was in Christy, F. T. 1973. Fishermen Quotas: A Tentative Suggestion for Domestic Management, University of Rhode Island Law of the Sea Institute, Occasional Paper no. 19, Kingston, RI.
manner in which resource rent generation has “texture”. By that I mean that there are numerous ways that value is created once effective property rights to fisheries are created. The corollary to this is that the rent dissipation process itself must be far more complicated and multidimensional than the Gordon story led us to believe. The rents that are emerging from modern creation of property rights can be looked at as the reversal of the rent dissipation process, much like a movie run backwards.

A. The Pacific Halibut Fishery

The North Pacific Halibut first came under exploitation in the late nineteenth century by long liners off Alaska and British Columbia. Within a few decades, rapid growth in vessel numbers led to unsustainable harvests. In the 1920s, the U.S. and Canada began a long dialogue over joint management that eventually culminated in the 1930 Pacific Halibut Treaty. The Treaty called for a rebuilding program to be carried out by both nations of the shared stocks. Most significantly, it was one of the first programs in which scientifically determined total allowable catch (TAC) targets were set and enforced jointly by two nations sharing a stock. By the late 1950s the biomass had been rebuilt to levels that supported higher TACs and most biologists hailed this as a success case for scientifically managed fisheries.

While most biologists and fisheries scientists agreed that the halibut case was a success story, prominent fisheries economists held it up as an abject failure. Economists pointed out in 1960 that there were no apparent rents being generated, that overcapacity in vessels had forced regulators to restrict seasons to a mere month in length, that near-
port grounds had been disproportionately exploited, and that most of the rent dissipating incentives that Gordon identified were still operating, even with allegedly safer biomass levels. In 1964, the halibut stocks began a precipitous decline, reaching a low in the early 1970s that required a nearly twenty year period to rebuild. By the time stocks began to recover in the 1980s, the old symptoms of regulated open access were reasserting themselves but even more dramatically. Capacity continued to rise during the second rebuilding period. Canada responded by introducing a limited entry licensing scheme in 1980, whereas Alaska left entry open. As a result of the continued increase in effort induced by stock recovery and rising demand, regulators were forced to restrict seasons to shorter and shorter periods. By 1990, the season in the fisheries off Canada had shrunk to six days from a 60 day season in 1982, while those off Alaska fell to five days by 1995.

In 1991, British Columbia adopted an ITQ program applicable to the 435 vessels that remained in its fleet since adoption of its limited entry program. Alaska followed suit in 1995, after a contentious debate about the merits of ITQs and other regulatory options. In 1993, we initiated survey efforts in order to determine the effects on the British Columbia halibut fishery as a result of adopting ITQs. In September 1993, we interviewed 12 of the 14 primary halibut processors identified by the Department of Fisheries and Oceans (DFO) as handling about eighty percent of the Canadian volume. We collected data on processor characteristics, products handled, marketing and distribution scope, and changes after ITQs. In the Spring of 1994, we also sent a mail

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survey to all licensed fishermen, asking details about changes made under the ITQ program. A similar survey was sent to Alaskan license holders in 1994, asking ex ante questions about Alaskan’s expectations about their impending program as well as baseline questions about pre-ITQ fishing practices.\textsuperscript{15}

Some of our findings have been documented in other papers.\textsuperscript{16} For the purposes of this paper, however, it bears repeating that the most important findings concerned the degree to which dramatic changes were taking place in the market. In hindsight, it is obvious that this was due to the fact that cost and production changes were constrained during the first few years by design of the program. In particular, the British Columbia ITQ program was set up with a “trial period” that allowed fishermen and regulators to understand the workings of fishing under ITQs. In the first two years, quota holders could neither lease nor sell quota. In the second two years, limited transferability was allowed. Each quota owner could split his holdings into two equal sized units, and these could be either leased out, or up to two additional quota units could be leased in. Regardless of intent, the imposition of quota trading rules during the first few years of the British Columbia experiment provided us with a “natural experiment” in which there were only limited avenues to add value.

\textsuperscript{14} In keeping with convention, we will refer to the British Columbia halibut program as an ITQ program. Canadian documents refer to it as an Individual Vessel Quota (IVQ) to highlight that quota transfers are subject to some restrictions and are not completely transferable.

\textsuperscript{15} Results reported in Casey, K.E. 1997. \textit{Assessing the Impacts of Individual Transferable Quotas in the North Pacific Halibut Fishery}, Ph.D. Thesis, Dept. of Agric. & Resource Economics, Univ. of California, Davis;

The kinds of changes that occurred in the market during the first few years of the ITQ program in British Columbia were dramatic and lucrative. The most important change was that the fishery became virtually year-round, up from a week prior to ITQs. With a longer fishery, marketers were able to sell fish into fresh markets over most of the year. This saved the costs and risks of storage and opened up new markets in which the better quality product could generate higher wholesale and hence ex-vessel prices. Our computations suggested that ex-vessel prices to halibut fishermen rose by about 40%, compared with the neighbor program in Alaska which continued to operate under fishing “derby” incentives.

Our interviews with processors put more flesh on this picture of rent generation under the new scheme. Under ITQs, processing costs were reduced and value was added by marketers who developed new markets for British Columbia fresh halibut. Prior to ITQs, most halibut in the fishery was processed by a few large processors who handled salmon, groundfish, herring, and the rest of the suite of Canadian fisheries. Since halibut seasons were confined to a week before ITQs, large processors were faced with a scramble to handle the whole season’s catch, gut and butcher it, and ship it to cold storage to be dissipated out over the year. Several processors claimed that halibut processing was of marginal profitability, and done mostly to retain the delivery business of salmon fishermen. After ITQs were implemented, the handling of halibut shifted away from the few large processors to more numerous smaller handlers and wholesalers. These firms essentially were market makers in the new fresh market for halibut. Most important to many was the need to ensure a steady supply to retailers, who then could generate new business with products that could be marketed continuously to consumers
as a year-round product. One processor revealed the extent to which new markets were
developed by telling us that “in the beginning (of the ITQ program) we could only put
100,000 pounds on the market per week before prices started to drop. Now we can put
900,000 pounds on the market before prices start to drop”. What this comment revealed
is that new markets were being created over the first two years, and this generated rents
in the form of higher wholesale and ex-vessel prices.

Aside from important changes in the market, we also documented the beginning
of changes in fishing practices and inputs. Because fishers were frozen into their original
historically based harvest totals, some practices remained unchanged at the time of our
survey, two years into the program. By and large, fishers slowed the pace of fishing, in
order to concentrate on delivering a better product. Trip distances from port were largely
unchanged, but trip lengths were shortened to delivery fresher fish. The average days at
sea per trip declined slightly and the number of trips per season increased slightly.
Harvest per trip dropped substantially, as did average harvest per fishing day, and number
of units of gear set per day. Since our original interviews, the B.C. program has been
opened up to consolidation by allowing freer transfers of halibut quota. Recently, the
number of active vessels landing under the quota system has dropped to about 240
vessels, approaching the long run limit of half the original 435 vessels. Discussions
with industry leaders suggest that typical vessels fish more shorter trips, using fewer gear
soaks per trip, with roughly the same amount of labor per vessel. This lack of change in
labor use counters our early findings of a slight drop. Current discussions suggest that
the industry employs proportionately fewer crew members due to the reduction in active
vessels, but that crew fish more days per year and devote more time in fishing to fish
handling, gutting, and icing in order to receive premium prices. Overall, the picture is one of continued improvements in quality of the output, reduction, consolidation and saving of some inputs, and changes in fishing practices that support more measured production throughout the year. A measure of the success of the program is in the transaction prices for ITQ shares. Currently, quota shares both lease for a yearly period and are transferred permanently. Ex-vessel prices appear to have been increased by roughly 40% over what they would have been without the quota program. Lease prices are typically about 60% of ex-vessel prices, a good indicator that rents are about 60% of revenues. As a rule of thumb, licenses typically transact for sale prices of 10-12 times the lease value. Current harvests are on the order of twelve million pounds, at ex-vessel prices of about $U.S.2.50 per pound. This suggests rents of approximately eighteen million dollars per year, with an asset value of 2 billion dollars.

B. Bering Sea Pollock Fishery

The Bering Sea pollock fishery is North America’s largest scale fishery, with landings this year approaching 2 million metric tonnes and a first wholesale value approaching a billion dollars. Two primary groups harvest this fishery, and we focus here on the important offshore catcher-processor fleet. These vessels are integrated operations that both harvest the fish from large midwater aggregations, and then process them in below-deck processing lines. Catcher-processors are typically large (average 285 feet in length) and significant investments (on the order of 30 million dollars). The pollock fleet was originally developed to process surimi, which is an industrial grade raw

\footnote{Archipelago Marine Research Ltd. 2000 Halibut IVQ Fishery Data Summary, Victoria, BC, Canada.}
product used in a wide spectrum of finished and semi-finished fish products, primarily in Japan. Typical fishing operations involve sweeping large midwater trawls through spawning pollock. After holding the pollock for a brief time, the pollock are run through processing lines located below. Processing for surimi involves first removing the flesh of the pollock with special cutting machines, grinding the flesh up, and then washing, drying, and reconstituting the flesh in a manner that yields a fish paste with uniform texture and fiber. The surimi paste is mostly shipped to Japan where it is delivered to secondary processors who make fish sausage, imitation crab and other products.\(^{18}\)

The Bering Sea pollock fishery has been a source of contention since its early development in the late 1980s. The main issue has been how much of the resource to allocate to the offshore catcher-processor sector and how much to allocate to the inshore sector. The inshore sector was developed on Alaska soils in the early 1990s by Japanese firms to serve as a source of surimi for their integrated wholesale/retail system. The inshore sector has been dominated by two large Japanese conglomerates and one American company over the decade. The offshore sector has, until recently, been dominated by U.S. firms from the State of Washington, and a large Norwegian firm. Prior to 1998, there were about 30 vessels operating offshore, owned by about 10 firms. These offshore firms have also traditionally sold surimi into the Japanese market, but at an outsiders’ disadvantage in competition with the two Japanese firms that own the inshore plants. Partly as a diversification strategy, the offshore sector also built up

processing flexibility to deliver fish fillets and deep-skin fillet products from their integrated operations.19

Several major disputes over how to “divide the pie” dominated Alaska fisheries politics in the 1990s. Between 1992-1998, the offshore catcher/processor sector (and a smaller catcher vessel group that delivered to them) harvested 65% of the total Bering Sea TAC. In the last allocation dispute, so-called Inshore/Offshore III in 1998, the Alaska-dominated North Pacific Fisheries Management Council increased the inshore sector’s allocation of the TAC from 35% to 50%, in addition to granting the inshore based “mothership” fleet a 10% allocation commensurate with their historical catch. The offshore sector successfully argued that they could absorb this reduction in allocation only if the Council agreed to allow the offshore sector to set up a producers’ cooperative. After an enormous amount of political logrolling and backroom politics that went all the way to Washington D.C., a complicated piece of national legislation cleared the way for an offshore cooperative to be formed. The cooperative first started operation as a coop in the 1999 season.

Prior to the formation of the offshore cooperative, I interviewed major players in the offshore sector, with the aim of understanding how open access incentives hindered rent creation in the fishery. Of interest before the cooperative was formed is the fact that the industry was conducted by only a small number of companies, several operating more than one boat. Nevertheless, even with 10 entities, it was apparent that vigorous and wasteful open access competition was occurring. One of the questions I asked several surimi technicians was exactly how they competed under (regulated) open access, and

how rents were wasted under open access. The answers were revealing and went
something like “there is a fundamental conflict on catcher-processor vessels between the
catching and the processing parts of the operation. The catching part of the operation is
essentially racing to maximize its share of the resource before the aggregate offshore
quota is reached. But the processing part of the operation is trying to maximize the value
out of each ton of raw fish. There is an optimal throughput that maximizes processing
line efficiency. If throughput is too fast, wastage occurs because cutting operations are
not optimized and because secondary and tertiary recovery processes become inefficient.
If throughput is too slow, processing equipment is underutilized and costs rise. If
throughput is halted from lack of fish, the entire line must be cleaned out and the system
fine-tuned and brought back up to efficiency.” The interesting point here is that even
within an integrated catch/processor operation owned by a single company, there is no
resolution of the race to catch fish under open access. Inevitably, vessels will be led to
compete wastefully for shares of the total TAC, and this will reduce the profitability of
the entire integrated operation.

As a follow-up question, I asked several knowledgeable individuals involved in
the offshore fishery what they would do if they were guaranteed a share of the pollock.
Again, the answers were revealing and suggestive of the expectations that the industry
had of potential rents. Skippers suggested first that they could slow down the fishing
process to feed exactly the optimal amount of raw fish into the processing lines. But they
also talked about targeting harvest to match market conditions in order to fish and deliver
processed products (especially fillet products) when most needed. In addition, skippers
spoke of the ability to fish the mass of pollock in a way that captured only the most
valuable fish. As it turns out, when pollock are aggregating in spawning masses, the roe-laden females tend to be out on the leading edge of the migrating mass of fish. By fishing the edge, it is possible to increase the share of larger females, and also maximize the roe content of fish caught. In addition, skippers talked about timing harvests to optimize the roe quality and quantity in females.

When asked a similar question about the potential for gains under ITQs, surimi technicians also talked about the value of coordinating and optimizing the fish harvesting and fish processing operations. The important opportunities they saw were in slowing the processing down in order to increase marketable yields from fish caught. The pollock fishery is mandated by law to achieve “full utilization”, which means that all of the raw pollock must be accounted for in some form of finished product. Technicians suggested that value is created in the processing line in at least three ways. First, value is created by shifting the portfolio of finished and semi-finished product to higher valued uses. Technicians forecasted big gains in being able to tailor cutting operations to the market, so that, for example, when fillet prices were relatively high compared with surimi prices, they could cut to maximize fillet yield. Second, technicians talked about optimizing cutting operations within a product line in order to increase yield per ton of raw fish. For example, if cutting operations can be adjusted to the average size of incoming fish in order to save even small percentages of flesh, those gains can be converted from waste product to high-quality consumer products. Similarly, if the surimi plant can be optimized to squeeze even small amounts of higher valued end products out of the flesh, more rents are created. Third, since a considerable volume of pollock is converted into industrial products such as fish meal, fish oil, bone meal, and other residual products, improving the
quality of even these low unit valued items can increase rents considerably. In 1998, on the eve of the resolution of I/O III, technicians estimated that they could probably increase the total product recovery rate (saleable product weight divided by raw pollock weight) from the 1998 level of 18% to about 22% if the fishery were rationalized.

The Bering Sea fishery was, in fact, rationalized as part of the Inshore/Offshore III agreement. 20 The I/O III agreement transferred a net uncompensated 5% of the total TAC to the inshore sector, it increased the Community Development Quota allocation from 7% to 10%, and it reserved 40% of the total TAC for the offshore fleet. The enabling legislation, the so-called American Fisheries Act, contained a complex set of provisions that transformed the offshore sector in a major way. Included in the Act was an “Americanization” provision that forced a major Norwegian company to divest itself of some of its vessels, and a buyout of vessels owned by Tyson Foods, Inc. Both of these divestitures were funded by loans backed by taxpayer funds, and the 5% that was transferred to the inshore sector was generated out of the catch record of nine vessels retired by these firms. The most important part of the Act was the permission granted to the remaining offshore firms to form a cooperative. This was subject to multiple sideboard provisions and a sunset clause that makes renewal of the arrangement uncertain. Importantly, however, the provision to allow the formation of a cooperative gave a group of eight firms permission to operate 19 catcher/processor vessels in a coordinated fashion. After some negotiation, the coop reached agreement on a division of the offshore TAC, based mostly on historical catch records. In order to cement the

negotiations, the larger firms gave up some of their full catch records to induce smaller firms to buy in.21

The Bering Sea Pollock cooperative operates in a manner that generates incentives similar to those of other property right-based systems such as ITQs. By holding a share of the TAC, each firm is induced to maximize value of its share holdings by increasing revenues and reducing costs. How has the program fared in the first couple of years? The answer is that it has actually produced gains that exceed the best forecasts that industry insiders discussed with us before the program was implemented. First, several of the more inefficient vessels owned by the larger companies were removed from fishing, since their capacity was no longer needed. In the first year of the coop’s operation, for example, only 14 of the then eligible 20 vessels actually fished, saving the operating costs from these vessels added during the open access phase. Second, the process of fishing was significantly slowed, stretching out the season and allowing firms to concentrate on increasing value per ton harvested. In the first year, daily catch rates of operating vessels were only 40% of comparable rates for the same vessels over the 1995-98 seasons. Catch per haul was 27% lower, number of hauls per day dropped by 45%, and the 1999 “A” season was doubled compared with the 1998 season, even though the amount of pollock available to the sector was almost halved.22

Perhaps the most important effects of the ability to slow the pace of fishing has been, as was predicted, an increase in the value produced per ton of raw pollock. Figure

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21 The offshore TAC is divided between the American Seafoods (45.28%), Trident Seafoods (18.64%), Glacier Fish Co. (8.79%), Alaska Ocean Seafoods (8.21%), Arctic Storm (5.0%), Artic Fjord (4.9%), Highland Light Seafoods (4.82%), and Starbound (4.33%). These are reported in Joint Report of the Pollock Cooperative and High Seas Catchers’ Cooperative, 2000, presented to the North Pacific Fishery Management Council, January 31, 2001.
1 shows the story for most of the significant gains. Note first that before the coop program was implemented, product recovery ratios from the regulated open access system averaged 19.5%. Product recovery ratios are the most significant indicator of value in this fishery, since vessels are roughly similar in costs of operation. They reveal the percent of raw pollock weight that is converted into saleable product, with the remainder mainly water and waste products. In the first year of operation, the recovery ratio shot up to 24.6%, exceeding the estimates of 22% that were averages of my interviews with surimi technicians before the coop. In the second year, recovery ratios jumped another 2%, and in the latest year recovery jumped another 3% to 29%.

Much of the yield increase in the first two years emerged out of being able to slow and hence fine-tune the surimi processing line to squeeze more paste out of the raw product. From a pre-coop yield of a bit over 8 tons of surimi per ton of raw pollock, surimi yields rose in the first two years to about 13 tons per ton of raw pollock. Some of this is a product mix adjustment to market conditions, but a significant amount of the yield increase is a net gain in marketable material from the same raw product. In the latest year, the yield increases came from a shift to the more lucrative fillet market, and from corresponding increases in related byproducts such as minced pollock. Overall, the pollock case illustrates much of what is also illustrated in the halibut case. With pollock, even though it is fundamentally a high volume industrial fishery, the opportunities for increasing value that are unleashed by creating proper incentives is nothing short of remarkable. It should be emphasized that increases in product recovery rates are low-cost or nearly free sources of value wholly attributable to the removal of the open access

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incentives. And an increase in recovery rate from 19.5% to 29.0% represents a proportional increase of 48% over pre-coop conditions.

How much are these changes generating in actual rents? This is difficult to precisely pinpoint, but we can do a back of the envelope calculation by looking at prices paid for raw pollock in several competitive auction settings. One market occurs between individual members of the offshore cooperative and communities that hold CDQ quota. Most communities have arranged long term relationships with catcher/processor vessels in which a price is paid to lease the community quota. These contracts vary in detail and in provisions (for example, some provide employment of community crew members on the vessels) and most are confidential, but industry insiders tend to know what going prices are. Recent CDQ raw pollock quota appears to be leasing at prices of $500-800 per ton. This is up from pre-coop years of levels in the $300 range. The difference reflects willingness to pay of coop vessel owners in the new regime of cost savings and efficiency improvements in the integrated operation. In addition, it represents a significant increase in the market price of pollock roe, which over the past couple of years has jumped to all time high levels. For comparison, revenues per ton of raw pollock in the last few years before the coop ran about $800\textsuperscript{24}. This year they appear to be in the $1200-1400 range, reflecting both stronger roe prices and higher revenues derived from reconfiguring processing lines for more recovery and better market mixes. These figures suggest enormous values are being generated as a result of the newly rationalized offshore Bering Sea cooperative. At a conservative $500 per ton, just the offshore sector’s 40% of the total TAC is generating a half billion dollars worth of rents.
IV. Summary and Conclusions

In the opening remarks, it was pointed out that the long upward trend in fisheries production from world capture fisheries appears to be slowing and perhaps reaching its apex. The kinds of management schemes that emerge over the next decade will determine not only whether the renewable resources of the world can produce more fish, but also what kinds of economic values are derived from them. Up to this point in history, the record in generating value from the world’s marine resources is unimpressive. Evidence suggests that most fisheries are overcapitalized, much of it a legacy of the open access period prior to 1976. Since 1976, some fisheries have begun to be managed with schemes that at least partially mitigate the pure open access conditions that Gordon first discussed. There are many limited entry licensing schemes in place and a modest number of rights-based schemes including ITQ schemes. At the same time, the fundamental truth is that the vast majority of fisheries regulation schemes are focused almost exclusively on biological metrics and stock safety goals rather than rent generation. As a result, most of the wealth generating capacity of the world’s fishery resources is being squandered at this point.

An important thrust of this paper is that rents in fisheries have texture. By that I mean to emphasize that the real world is significantly more complex than depicted in the stylized single-input rent dissipation model popularized by Gordon. We have long known, for example, that incomplete property rights systems focused simply on limiting

24 One other piece of evidence about rents in the pollock fishery comes from the Russian auction market for pollock. Russia puts up for bid raw pollock that is bid upon by Russian catcher/processor firms. This year
access to fisheries do not eliminate incentives to increase other unregulated inputs. This is evident in the British Columbia halibut case in which entry was restricted to 435 vessels participating in 1980. In a short span of ten years, the season was reduced from 60 days to 6 days, implying a productivity increase of 10 fold! This was accomplished by building faster vessels with planing hulls and larger engines that enabled fishermen to race to the grounds. It was also accomplished with fishing practice changes, including the adoption of the much more efficient circle hook, and shaker tables and disgorgers that removed fish from the long line, and GPS and fish finding technology that enhance fish finding.

We also have learned that there are few constraints that limit the process of rent dissipation. In investigations I made of the roe herring fishery in 1974, for example, I found examples of vessels outfitted with 3 very costly side-scan radar units (one on the bridge, one in the wheelhouse, and one near the stern by the seine gear). When questioned about how such apparently redundant gear mattered, skippers responded that missing a set in an intense arena of competition with other fishermen would cost many times the price of an additional radar unit. At that time, the herring fishery was yielding revenues of $4,000 per ton, and it was not uncommon for a twenty minute set to yield $200,000. At the height of the frenzy, fishermen were helicoptering vessels from one opening to another at huge expense. Needless to say, while these “investments” in share garnering capacity seem rational to the individual, when the whole fleet engages, it is simply another way to waste rents by driving costs up to revenues.

We have also learned that the focus on the cost and production input side of the story is likely to miss a significant part of the mechanisms of rent dissipation and rent the prices in the Russian market were in the $500-600 range.
generation. We know this because some of the most spectacular recent gains from the implementation of rights-based systems have emerged in the market side rather than cost side of the ledger. Both case studies discussed here generated major changes in fishing practices after secure rights were guaranteed, but those changes were largely geared to altering the product mix and configuration in order to increase revenues. In the halibut fishery, revenues increased significantly as a whole new marketing structure emerged and developed new markets for fresh halibut. In the pollock fishery, similar fishing practice changes occurred in order to vary the product mix to meet market demand and in order to squeeze more usable product out of the raw product.

What does all of this mean for the world’s fisheries resources? Earlier we presented discussion of evidence that the world’s fisheries are incurring needless costs associated with redundant over capitalization and excess inputs. As the FAO studies pointed out, current fisheries are actually losing money because revenues do not cover expenses. What would happen if it were possible to adopt regulatory systems that generated the proper incentives to maximize values rather than incentives to “race for fish”? We have a hint of the possibilities by reviewing cases in which ITQs and other rights-based systems have been adopted. In both the cases examined here, it looks like significant gains are forthcoming in the market almost from the outset after initiating secure property rights to a share of the resource. Suppose that market gains on the order of 35% are possible with a revenue base of 100 billion dollars in the world’s marine capture fisheries.25 Suppose further that rents in a rationalized fishery after excess inputs are eliminated is roughly 60% of revenues. Then the world’s fisheries ought to be

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25 This might be conservative if the experience of the halibut and pollock case studies are representative of the possibilities.
generating about 80 billion dollars in rents per year, instead of losing 30 billion dollars per year. Resources that generate 80 billion dollars per year on a sustained basis would have a capitalized value of close to a trillion dollars at reasonable real interest rates on the order of 8%. So the literal bottom line is that much is at stake in converting the world’s fisheries into economically productive as well as physically sustainable assets.