The Political Economy of Fishery Reform

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Abstract

Despite compelling evidence that property rights–based management can improve the economic and ecological performance of fisheries, reform proposals are often met with political opposition. Moreover, the opposition sometimes comes from incumbent fishermen and fishing communities that would ostensibly gain the most from rent-enhancing reforms. We flesh out this puzzle by describing the political economy of past and present institutional changes in North America such as bans on fish traps, limited-entry regulations, and individual transferable quotas (ITQs). Our review identifies patterns of distributional concerns surrounding property rights; many of the same groups that opposed limits on entry and fish traps also oppose ITQs. We provide examples of how political opposition to ITQs is mollified by modifications in program design, although these design compromises may have efficiency costs. We conclude by pointing to the need for more research on equity-efficiency trade-offs and for greater attention to fishermen heterogeneity in economic analysis.

1. INTRODUCTION

There is an economic parable in which an assistant professor reaches to pick up a $100 bill lying on the sidewalk. His senior colleague holds him back, pointing out that if the bill were real, it would already have been picked up. After all, there should not be persistent economic waste when markets function properly (see Olson 1996).

The literature on marine fisheries, however, concludes that enormous potential rents have not been captured. Consider the World Bank's recent *Sunken Billions* report (Arnason et al. 2008). It estimates that $50 billion is lost annually because of poor fishery management and that $2 trillion has been squandered over the past three decades. The report also concludes that things have been getting worse, not better. In economic terms, 60% of the world's marine stocks were underperforming assets in 1974; by 2004 75% of the fish stocks were underperforming. Moreover, there has been significant destruction of natural capital. The percentage of exploited and depleted fish stocks has tripled due to overfishing over the past 30 years (Sutinen 2008).

As to the question of why fishery assets underperform, the literature provides a clear answer. Most of the institutions governing today's ocean fisheries do not make property rights to stocks or habitat secure over the long run. Even in rich countries, the rule of capture usually governs, meaning that fish are owned only when caught. Under the rule of capture, individually rational fishermen behave in socially destructive ways because planning horizons are short and incentives to race are strong. The end result has been significant damage to the ecological and economic health of global fisheries, as predicted by Gordon (1954) and Scott (1955) and labeled a "tragedy of the commons" by Hardin (1968).

Over the past several decades, technological and institutional innovations have made property rights feasible, yet systems of property rights are rarely used in practice, even in middle- and high-income countries.[1] We confront this key puzzle in this article. If the economic gains from management reform are so large, why are fishermen (and managers) so reluctant to adopt property rights–based management? Why have big bills been left to sink to the ocean floor? Or, in the words of Karpoff (1987, p. 180): "Why have many traditional fishery regulatory techniques survived the onslaught of theory and data that demonstrate their suboptimality?" In our opinion, this critical question needs to be addressed if future academic research is going to help with modern policy reform.

We focus primarily on individual transferable quotas (ITQs), which are effectively cap-and-trade programs for resource harvest rights and are the most prominent rights-based scheme. Despite abundant theoretical and empirical evidence suggesting that ITQs can improve on ecological and economic performance, they are employed in fewer than 5% of the world's fisheries (Costello et al. 2008). After reviewing the literature on ITQ performance, we ask why there has been such a dearth of implementation. Our focus is primarily on North American fisheries, although we also consider evidence from other global fisheries in our literature review. From the literature we report hurdles that are legal (e.g., laws against fishery consolidation), political (e.g., organized opposition to change), and distributional (e.g., disagreement about how the gains should be divided among fishermen). We also review attempts by fishery regulators to design ITQs in ways that balance competing objectives, albeit with second-best systems of property rights. We conclude by asking if compromised property rights are better than no reform at all and by providing our wish list of questions that we hope future research will address.

[1]The technological innovations include satellite monitoring of fishermen locations and video monitoring systems that record onboard catch. The institutional innovations include individual transferable quotas (ITQs), territorial user rights fisheries (TURFs), and fishery cooperatives that create legal and/or de facto property rights to fish and habitat.

2. THE PROBLEM AND ITS CONCEPTUAL SOLUTION

At least since Gordon's (1954) and Scott's (1955) seminal papers, economists have recognized the fundamental economic problem of the open-access fishery and its conceptual solution. The fundamental problem is that fish are not owned until they are caught. They are subject to the rule of capture, which causes several economic distortions; two are worth highlighting here. First, fishermen have incentives to harvest until the price is lower than the average cost. They do not have incentives to consider the impacts of their fishing decisions on the current profits of other fishermen or on the future stock and distribution of fish. Second, the open-access fishery is characterized by uncoordinated effort and redundant and inefficient investment in fishing capital. Each individual has an incentive to invest in so-called racing capital to encounter the fish before his or her rivals. There is also redundant search because each fisherman has incentives to hoard information about the location of stocks (Wilson 1990). All parties to the search bear these costs, but only one party benefits. Both distortions lead to the dissipation of rents, and the former can lead to drastic declines in stocks over time.[2]

The conceptual solution to both problems is sole ownership of the fishery (Scott 1955). A single owner will maximize the expected long-run return from the stock because the owner will consider how current decisions impact future stocks. Moreover, the single owner will choose its mix of inputs to minimize harvest costs—i.e., the owner will avoid redundant search by coordinating effort among its fleet. Scott (1955, p. 120) emphasizes the benefits of coordination when he says that if the fishery were congested, "the sole owner would rationally lay off some of the boats."

To be clear, the problem modeled by Gordon (1954) is one of an open-access fishery, rather than a common property fishery. Considerable confusion about the distinction between the two terms has clouded academic discourse and misguided policy reforms (see Ostrom 1990). Under common property, the resource rights are to some extent limited to a group of individuals, either formally or informally. That is, in a common property fishery, the rule of capture is not the only effective rule. There may be informal constraints on entry or harvest.[3] For those parties allowed to extract from the commons, fish stocks are often allocated among resource users on the basis of well-accepted systems of private property and priority. The informal systems employed by Pacific Northwest tribal fishermen prior to contact with European settlers, for example, were closer to private property than they were to open access (Higgs 1982, Johnsen 2006).[4]

3. THE POLITICAL ECONOMY OF EARLY REFORMS

Current opposition to rights-based management approaches like ITQs fits within a longer legacy of political resistance to rent-enhancing reforms. We highlight some historical cases here to shed light on the political economy obstacles facing modern reformers.

3.1. Regulation by Inefficiency

Throughout the early and mid-twentieth century, economists argued that "one of the vital objectives of fishery regulation must be the promotion of economic efficiency," but this argument

[2]Rents are completely eliminated with homogeneous fishermen in Gordon's (1954) equilibrium. Some rents can be captured in equilibrium when fishermen are heterogeneous (see Johnson & Libecap 1982).

[3]In some cases, these informal rules could even be enforced with extralegal violence, as in Acheson's (1988) "lobster gangs of Maine." For a discussion of the distinction between common property and open access in a different setting, see Lueck (2002).

[4]In the words of Smith (1969, pp. 189–90), "the 'invisible hand' has an ancient history of endowing societies with an economic wisdom in traditions of fishery resource utilization that have not always been continued in modern societies."

did not have a persuasive effect on early regulations (Crutchfield 1961, p. 131). Some early regulations helped conserve North American stocks, but many of the benefits of having larger stocks were lost through the increased fishing costs that resulted. As Crutchfield (1961, p. 132) points out, the "ability to sustain a maximum physical yield means very little if costs are so high that exploitation would yield losses at current prices."

The early approach to regulation treated the symptoms of open access but not the fundamental causes. The earliest North American regulations that emerged in the late-nineteenth and early-twentieth centuries were merely a hodgepodge of closures and gear restrictions. Area-wide catch limits on halibut did not emerge until the 1920s, when the Pacific Halibut Commission was formed, and limits on salmon harvest were not initiated until the 1924 White Act imposed limits linked to spawning goals (Crutchfield & Pontecorvo 1969). These early regulations, particularly the fishery-wide quotas, were positive in the sense that they reduced the risk of overharvest and extinction. But they left open several margins for the dissipation of rents, and fisheries remained overcapitalized, with too many boats chasing too few fish.

In other cases, state regulations reduced rents by uprooting preexisting systems of property rights. The bans on fish traps in the salmon fisheries of Alaska and Washington are vivid examples. Prior to contact with Europeans, the salmon fisheries were prolific producers for Native Americans, who had relied upon a system of clan- and family-owned fishing sites near river mouths to husband salmon and live off their abundance (see Boxberger 1989, Higgs 1982, Johnsen 2006). Native Americans caught salmon with fishing weirs—stationary traps affixed to rivers—and let some salmon escape to allow spawning and reproduction.

The structure of salmon fishing changed dramatically when salmon became commercially important in the 1860s due to a new canning innovation that made it feasible to preserve and ship long distances. Native American subsistence fisheries were soon replaced by booming non-Native commercial fisheries. More than 150 million pounds of canned salmon were shipped out of the Puget Sound alone in the peak year of 1913, and the growth of the commercial fishing industry was characterized by large-scale entry of all types of fishermen.

In the early years, certainly prior to 1913, the majority of the catch was made by fish traps. These were stationary devices affixed near rivers, like Native American weirs, but they tended to be larger and protruded further out above river mouths. In 1910, the first gasoline-powered purse seine was deployed, and soon after purse seine fishing became a major force in open marine waters (see Colt 1999). Purse seines are large nets, deployed by large boats, capable of intercepting migrating salmon before they reach fish traps on their way to spawning in rivers.

Like the weirs, the stationary fish traps were also highly efficient at catching salmon, but only if the state was willing to preclude marine fishing from purse seines and other boats. Barsh (1977), Higgs (1982), and Colt (1999) describe the efficiency advantages. Ownership of a trapping site could be linked to riparian land ownership, and this meant that fishing sites could naturally be traded and invested in, like land. The tendency of land prices to capitalize the expected value of the fishery created strong incentives for investment in the health of the stock. Moreover, fish traps eliminated search costs, and the unit cost of trapping fish was significantly lower than that of mobile gear, which required more labor inputs and marine fuel—cost savings were perhaps as high as 90% to 95%.[5] Salmon caught with traps also tended to be less damaged and of higher quality (Barsh 1977).[6]

[5]However, the fish traps did require substantial annual maintenance (see Colt 1999).

[6]Additionally, harvest with fish traps allows for a high degree of control over the escapement necessary to regenerate stocks of specific populations and species, because salmon segregate themselves as they migrate upriver but are mixed in open water (Barsh 1977).

In spite of their efficiency advantages, fish traps were banned from Washington waters in 1934 and from Alaskan waters in 1960 (Colt 1999, Crutchfield & Pontecorvo 1969). Higgs (1982) estimates the economic losses caused by the ban in Washington. He concludes that the traps could have saved $1.27 million in harvest costs in 1937 relative to the costs actually incurred by the mobile fleet. This is an annual loss of $20.3 million in 2012 dollars. Colt (1999) estimates that the traps in Alaska saved $4 million in harvest costs per year in 1967 dollars, which is $27.6 million in 2012 dollars. Although one might quibble with the estimates of Higgs (1982) and Colt (1999), their bottom-line conclusions that the bans caused significant social waste are difficult to refute.

Why was the more efficient fixed gear banned in favor of the less efficient mobile gear? It was not because policy makers were misinformed. On the contrary, cost estimates for operating the different gear types were readily available prior to the bans. Instead, the bans appear to have resulted from a conscious choice to equitably divide fishery access at the expense of reduced efficiency.

In both Alaska and Washington, traps were unpopular for at least three reasons. First, their ownership was concentrated among corporations, landowners, and businessmen who were perceived as being separate from the working-class populations. The populist attitude against the traps is reflected in the rhetoric of politicians at the time. For example, a senator from Washington stated: "[I]t is necessary for the government to step in and take control of our natural resource" (quoted in Higgs 1982). Second, the perception was that fish traps were reducing labor opportunities for fishermen. Indeed, Alaska's congressional delegate argued that the elimination of traps would provide employment for 7,500 additional fishermen (Colt 1999). Empirical studies suggest that his concerns were valid; the ban on fish traps caused employment in fisheries to swell.[7] Third, trollers and purse seiners who had invested in capital conducive to intercepting salmon would benefit from eliminating trap men who wanted policies that would restrict outside harvest by mobile capital.[8,9] As we see below, these concerns about equity and the protection of capital investments have remained a significant barrier to rent-enhancing reforms.

3.2. Battles over Limited Entry

At least as early as Crutchfield (1961), economists were espousing limits on entry to address the overcapitalization problem of too many boats chasing too few fish. The intent was to cap the number of vessels permitted to compete for a fishery-wide quota. The licenses would be transferable so that the right to enter could be sold to other fishermen. Economists advocated this approach as a way to keep fishery profits above the open-access zero-profit equilibrium. To be effective, the licensing requirement would have to fix one input, for example, one vessel per license, so that fishermen could not replicate all inputs to circumvent the regulation (see Anderson 1985, Boyce 2004).

The first limited-entry programs were the pioneer programs in Australia, British Columbia, Alaska, and Washington State in the late 1960s and in the early 1970s.[10] Other fisheries followed

[7]Empirically, Colt (1999) finds that stationary fish traps ban caused employment in the fishery to swell by 6,000 entrants. Labor in the fishery also increased in Washington because the mobile fishery was much more capital intensive (Higgs 1982).

[8]As Barsh (1977, p. 25) argues, "...the state originally used Initiative 77 [the ban on traps in Washington] to redistribute the trap fishery to trollers, gill-netters, and purse-seiners, in that order of priority. In other words, each nontrap user group was rewarded in proportion to its relative inefficiency."

[9]A political allegiance between sports fishermen and purse seiners also contributed to the banning of traps in Washington, but this method was apparently a less important force in Alaska (see Colt 1999, Higgs 1982).

[10]In 1968, entry limits were initiated in salmon fisheries in British Columbia and in the lobster and prawn fisheries in Australia. In 1973, Alaska passed its limited-entry act, and the state of Washington also began to limit entry. The roe fishery in British Columbia also began limiting entry in 1974 (see Wilen 1988).

suit after 1976, when coastal nations claimed jurisdiction over waters within 200 miles of their coastlines (see Townsend 1990, Wilen 1988). Limited-entry programs are now prevalent in US, Canadian, and European waters.

Empirical evidence suggests that the limited-entry programs generated significant rents, as predicted by economists. Evidence of rent generation is found in license prices, which have been positive and substantial in many limited-entry fisheries (Wilen 1988). Positive license prices are an indication of positive rents because the market value of a license should reflect the expected present value profit that a fisherman can earn in a fishery.[11]

Was the movement toward limited entry a case of economists prevailing in their promotion of economic efficiency? In general, the answer is probably not. According to Wilen (1988), the generation of rents was not the main impetus for the early limited-entry programs. The real motivation was concerns held by biologists and fishery managers about the potential for fishery collapse. With so many boats in the water, it was exceedingly difficult for fishery managers to control harvest and manage quotas.

Moreover, the process of limiting entry was often a contentious political battle with fishermen composing the strongest coalition against entry limits. Consider the state of Washington. It did not impose a moratorium on entry until 1974, even though limits on entry were first proposed in 1919, and two special committees again recommended limited entry in 1962 and 1968. Opposition from fishermen in the state was fierce, even as fish stocks and profits declined. Fishermen clearly valued the freedom of entry, and some complained that limited entry "smacks of socialism, no matter what you call it" (Barsh 1977, footnote 18). This is an ironic sentiment, as Barsh (1977) notes, because limited entry moves us closer to private property rights, whereas open access creates a regime more similar to communal property. Karpoff (1987) argues that coalitions against limited entry formed due to fisherman heterogeneity. Local, small-scale fishermen benefited from traditional regulations (e.g., season closures and gear restrictions) and therefore opposed entry limits. By contrast, full-time fishermen from outside the geographic area had a comparative advantage in employing large amounts of capital and participated in more than one fishery within a single calendar year. These nonlocal fishermen with better boats and better gear supported limits on entry but lacked the local political clout to succeed politically against local fishermen (Karpoff 1987).

That limited-entry systems were eventually created in Washington and elsewhere indicates that fishermen's opposition was eventually trumped or at least assuaged. In some places, entry was limited only after fisheries were already on the verge of collapsing and strong coalitions against reform were no longer relevant (Wilen 1988). In Alaska, political will to limit entry was aided by the hope that competition from non-Alaskan fishermen would be reduced (Colt 1999).[12] Limited entry was politically viable in other places only because it was coupled with expensive buyback programs in which the state purchased excess licenses (and sometimes vessels). This was the route taken by British Columbia, Washington State, and Oregon, and there is some evidence that those governments paid above-market prices (see Schelle & Muse 1984). In all cases, the limited-entry programs employed generous grandfathering rules to limit potential opposition. That is, they included moratoriums on entry but did not restrict access for incumbent users.

[11]More specifically, in a fishery with heterogeneous fishermen, the price should reflect the marginal fisherman's profit because (if differences in nonpecuniary returns were ignored) the marginal fisherman would have the lowest reservation price for selling a license and would therefore determine the transaction price to potential buyers (Grainger & Costello 2012b).

[12]Alaska's 1973 limited-entry law includes language to reflect the preference toward distributing fishery income to Alaskan residents. It precludes those who do not actively participate in the fishery from profiting from it, which has been an obstacle for later rationalization (see Knapp 2007, Deacon et al. 2013).

In summary, the historic battles over limited entry in North America, and the decisions to ban efficient fish traps in Alaska and Washington, teach us several lessons about fishery reform. First, there are not strong constituencies of economic efficiency, per se. On the contrary, there tends to be a political preference toward policies that spread fishery income among more fishermen than are necessary to catch the fish. Second, there is a political tendency against policies favoring nonlocals who do not live in the geographic area of the fishery or who invest in or participate in multiple fisheries spanning several geographic areas. Third, reform may be viable only when a fishery is on the verge of collapse or when fishermen are paid off through buyout programs. Fourth, fisherman heterogeneity slows down and complicates reforms (Johnson & Libecap 1982, Karpoff 1987).

4. THE RISE OF ITQS AS A CONCEPT AND A POLICY

Although limited-entry systems were an improvement over regulated open access in terms of their efficiency, economists soon began to appreciate their shortcomings. In the words of Wilen (2005, p. 54), "limited access restrictions placed on boats alone did not stifle the open-access process that Gordon described." The problem is now well appreciated among fishery economists. In essence, limited-entry systems leave open many margins for rent dissipation, even though they close off the external margin by capping the number of vessels (see Deacon et al. 2011, Smith 2012). There remains an incentive for individual fishermen to race in the competition for their share of the fishery-wide quota. This incentive has led to several observable distortions in limited-entry fisheries, for example, overinvestment in racing capital, short fishing seasons, low-quality consumer products, and fishing in dangerous conditions (see Grafton et al. 2000, Leal 2005a, Wilen 2005).

A conceptual solution to these problems is the ITQ, first attributed to Christy (1973). An ITQ system is simply a cap-and-trade program in which the regulator sets an overall harvest quota, allocates shares of the harvest to individuals, and allows fishermen to trade those shares. ITQs are not fully delineated property rights, because rights are defined over harvest and not over the resource, but ITQs more closely resemble property rights than the limited-entry systems they supplanted (Arnason 2012).

ITQs fundamentally change the incentives of fishermen because catch is not based on the rule of capture. With secure allocations, fishermen have little to gain from racing, and so there is little reason for them to engage in socially wasteful racing capital. Moreover, fishermen who can harvest additional fish more cost effectively also have an incentive to purchase additional rights from higher-cost individuals, thus reducing the overall costs of achieving a harvest goal.[13] Basic economic reasoning therefore implies that ITQ systems will increase the net value of fisheries, at least relative to that in a limited-entry system with overall catch quotas.

Several case studies find empirical support for the positive link between the economic value of fisheries and the adoption of ITQs. One of the prominent early studies is Grafton et al.'s (2000) assessment of the move to ITQs in British Columbia's halibut fishery. They find evidence of significant cost savings and improved product quality. Newell et al.'s (2005) analysis of ITQ markets for several species in New Zealand provides further evidence. Newell et al. find a strong relationship between fishery profitability (proxied by annual lease values) and ITQ prices. Other studies use empirical techniques to estimate the cost savings that could be accrued if limited-entry

[13]In a study of Norwegian purse seiners, Nøstbakken (2012) finds that an economic model of investment explains investment within firms but does not explain differences between firms, which suggests that allowing trade may have a limited impact on allocative efficiency.

fisheries were converted to ITQ systems. For example, Weninger & Waters (2003) estimate economically large prospective benefits that could be accrued from a move to ITQs in the reef fishery in the Gulf of Mexico.[14]

There is evidence that, in addition to achieving economic efficiency gains, ITQs lead to ecological benefits as well. Costello et al. (2008) use a global data set on fishery stocks and find evidence that the catch shares have helped reverse fishery collapse where they have been implemented. None of this is to suggest that ITQs solve all the perverse incentive problems that exist in marine fisheries. Indeed, a rich literature has evolved to identify the theoretical shortcomings of ITQs.[15] In spite of these deficiencies, however, the empirical evidence suggests that ITQs are a marked improvement over regulated open-access and limited-entry systems with overall catch quotas.

5. RESISTANCE, COMPROMISES, AND SEMIRATIONALIZATION THROUGH ITQS

Despite the persuasive empirical evidence on the economic and ecological benefits of rights-based management, ITQs remain the exception rather than the norm in terms of their worldwide adoption. As discussed above, Costello et al. (2008), for example, estimate that they are employed in fewer than 5% of the world's fisheries. Moreover, where ITQs are used, they are often encumbered with restrictions on consolidation and other constraints that theoretically limit the extent to which they can generate economic efficiency gains.

The adoption of constrained ITQ programs strikes us as a sort of compromise between economic efficiency on the one hand and concerns about equity and adverse distributional effects on the other hand.[16] Although the transition to ITQs increased rents and overall efficiency, the benefits of management change are unlikely to be distributed uniformly across stakeholders. Fishermen, crew, gear suppliers, mechanics, fish processors, and consumers are impacted by a transition to ITQs, and some of the impacts are not obviously desirable.

5.1. Opposition to ITQs and Concerns About the Transition

Opposition to ITQs comes from many of the same sources that historically opposed rent-enhancing fish traps and limits on entry. Perhaps the most prevalent concern regarding ITQs is their impact on jobs and employment in coastal communities, and there is evidence that ITQs do reduce employment in the short run (Abbott et al. 2010, Newell et al. 2005). Many small fishing communities have an intimate connection to fisheries, with many residents employed directly in fishing or related industries. There is often a concern that moving to a market-based management program will lead to consolidation and a loss of jobs in that sector—indeed, consolidation and

[14]Lian et al. (2010) use a similar methodology to estimate cost savings in the range of $18–$22 million as the Pacific Coast groundfish fishery moves to ITQ management.

[15]First, ITQ assignments are based on the number of fish caught, rather than on their net value, so fishermen under ITQs have incentives to discard less valuable fish (see Anderson 1994, Turner 1997) and to race to harvest high-value, low-cost stocks (Costello & Deacon 2007). Second, ITQs do not assign rights to bycatch or to nontarget species, and this creates incentives for fishermen to underinvest in selective harvesting and habitat protection (see Abbott & Wilen 2009, Asche et al. 2007, Boyce 1996, Holland & Schnier 2006, Singh & Weninger 2009).

[16]In the words of Pereau et al. (2012), compromised ITQs may achieve some combination of the triple-bottom-line goals of stock renewal, economic efficiency, and robust employment in the fishing industry.

labor savings are major sources of efficiency gains, which is also true of fish traps and limits on entry. Although real incomes in most non-ITQ US fisheries are low for most fishermen, residents seem to value the cultural significance of fishery employment in coastal communities (Karpoff 1985). Moreover, processors in the community may have invested in capital specific to a non-ITQ fishery and stand to lose the value of that capital in a transition.[17]

A second type of concern that delays the transition to ITQs is about equity across individuals or groups of fishermen and how the initial distribution of ITQs will be allocated. In cases in which ITQs are grandfathered to existing fishermen, the quotas are effectively windfall gains, which naturally invites contention over how the windfalls are distributed. This was also an issue in the movement to limited entry, in which the windfall gains in those cases were distributed to the set of fishermen who were given the salable right to fish. In the case of ITQs, the concerns about quota allocations are sometimes motivated by preferences toward fairness within the current fishing community or by concerns about the costs that an ITQ system would impose on future entrants into the fishery.[18]

A third reason for opposition toward, or a delay in the implementation of, ITQs comes from competition over quota between sectors. For example, processors often oppose an allocation system that gives rights exclusively to harvesters. Similarly, there are often tensions between gear sectors or between commercial and recreational interests. In the Gulf of Mexico red snapper fishery, for example, the recreational harvest exceeds the commercial harvest, and there is conflict regarding the impact of recreational pressures on the commercial ITQ program.

In many cases, an ITQ program manages a stock that is indirectly affected by other sectors, jurisdictions, or individuals. When recreational harvest is large and unregulated, for example, commercial fishermen often raise concerns about potential impacts on the future stock. Similarly, if neighboring jurisdictions have poor management, the stock can be adversely impacted, even if the ITQ program itself is properly designed. Grainger & Costello (2012a), for example, find that illegal harvest activity significantly decreases ITQ asset values.

5.2. Overcoming Opposition to ITQs Through Compromise

Many distributional concerns are assuaged within the ITQ program design, but the attendant restrictions on the property right come at the cost of diminished economic efficiency (Kroetz & Sanchirico 2010). These restrictions take many forms, but we focus here on restrictions related to the method of allocating initial rights, consolidation caps, sunset provisions, restrictions on trades/leases, and environmental participation clauses. In an attempt to synthesize the types of restrictions we see in the United States, **Table 1** shows some examples of design considerations that have been implemented in ITQ fisheries to date.[19]

5.2.1. Initial allocation and distribution. The so-called independence property of tradable permits has been studied in the case of tradable emissions permits (e.g., Fowlie & Perloff 2012) and is

[17]The introduction of ITQs can impact the timing of harvest within a fishing season (Grafton et al. 2000).

[18]These intergenerational concerns could also be framed in terms of the impact of current management on the state of the future resource.

[19]These features were collected and summarized by using the Environmental Defense Fund catch share database and management plans for the individual fisheries. To our knowledge, the table is accurate, although it may be incomplete for cases in which information was difficult to obtain. A more detailed version of the table is available from the authors.

Table 1 Design features of current US catch share fisheries

Fishery	Consolidation cap	Transfer restrictions	Owner/lessee restrictions	Nonuse clause
Delaware commercial black sea bass		X	X	
Maryland black sea bass		X	X	
Maryland striped bass pound net		X	X	
Maryland summer flounder		X	X	
Pacific Coast groundfish limited-entry trawl		X		
US Alaska fixed-gear commercial halibut and sablefish	X		X	
US Atlantic sea scallop	X		X	
US Atlantic surf clam and ocean quahog		X	X	
US Bering Sea Aleutian Island crab (king and tanner)	X	X	X	
US Gulf of Mexico and South Atlantic spiny lobster trap				
US Gulf of Mexico commercial grouper and tilefish	X	X	X	
US Gulf of Mexico commercial red snapper	X	X	X	
US mid-Atlantic golden tilefish	X		X	
US South Atlantic wreckfish	X		X	X
Virginia black sea bass	X	X		
Virginia commercial striped bass (rockfish)	X	X	X	

also relevant to our discussion of ITQs. In theory, the initial allocation of rights in an ITQ fishery should not affect the efficiency of the outcome if the transaction costs of trade and the ex post reallocation are low (see Coase 1960). In practice, however, the wrong initial allocation may be a drag on the efficiency gains if the ITQ program is structured in such a way that constraints are placed on ex post trading.

Although the initial allocation of quota shares in an ITQ program could be done in many possible ways, in practice only two main methods have been seriously considered: free allocation

(grandfathering) and auctioning of rights. Free allocation has been the default method of allocating quota shares in new ITQ programs in the United States.[20]

When grandfathering is used, the eligibility for quota is generally determined by an individual fisherman's harvests during some historical period.[21] The choice of an eligibility window may seem somewhat arbitrary, but once chosen the rights are generally proportional to harvests during that period. For example, if an individual harvested 1% of the overall catch during the allocation period, he would be granted 1% of the harvest rights under an ITQ program. Unsurprisingly, the baseline allocation period is a contentious choice, as individuals prefer the period when their harvest levels were highest to maximize their own allocation under ITQs.

Economists often advocate auctioning because, under that system, the rights are granted to those who value them most (Bromley 2009, Grafton 1995). However, in practice auctions are rarely used for allocating quota shares due to political opposition. Freely grandfathered allocation represents a transfer of rents to fishermen receiving an allocation of shares, so most fishermen would oppose any mechanism forcing them to pay for the right to harvest. Some researchers argue in favor of grandfathering on efficiency grounds (Anderson et al. 2011), but empirical evidence is lacking due to a lack of auctions in fisheries.[22]

Importantly there is often significant heterogeneity in harvest prior to the adoption of ITQs, and even after ITQ management is implemented, there can be substantial variation in harvest. As discussed by Grainger & Costello (2012b), heterogeneity in skill can lead to substantial inframarginal rents under limited-entry management. Under reasonable conditions, inframarginal rents accruing to high-skill individuals may actually exceed traditional resource rents in a limited-entry fishery. Thus, some individuals, namely those fishermen earning significant rents under the status quo, may rationally oppose ITQ management unless they receive a generous initial allocation of harvest rights.

In addition to allocating to individuals, some fisheries (in particular in Alaska) have also included the concept of a community development quota in the allocation process.[23] Rather than shares being allocated exclusively to individual fishermen, some quota shares can be allocated to communities, perhaps to preserve the long-run viability of the fishing sector for a community or group. Restricting the tradability of shares across communities or individuals is likely to result in reduced economic efficiency, but it may be an attractive policy option for ITQ programs that try to balance economic efficiency and distributional concerns through compromise.

5.2.2. Consolidation caps. As we note above, one of the key concerns about ITQs is that they will lead to fishery consolidation and to the concentration of benefits in a small number of large fishing enterprises. Some commentators claim that consolidation will destroy otherwise viable fishing communities. Others raise concerns about market power arising due to consolidation: that a small number of ITQ owners could collude to keep prices high. One way these concerns are addressed in practice is through caps on the amount of quota allocation that can be owned by a single individual or firm.

[20]When fisheries moved from regulated open access to limited entry, the limited supply of licenses was also typically granted through grandfathering. That is, fishermen who had fished in seasons preceding the regime change were typically allocated salable licenses, but others were not.

[21]To prevent inducing a new race for allocation, it is inadvisable to choose a future period for this process.

[22]Anferova & Rögnvaldur (2005) study one example of quota auctions in Russia, which ultimately proved to be unsuccessful. Anderson & Holland (2006) provide experimental evidence regarding the efficiency and revenue-raising characteristics of alternative auction mechanisms.

[23]Another high-profile example is the allocation of quota shares to Maori in New Zealand (see De Alessi 2012).

In practice, there are wide-ranging uses of consolidation caps. For example, the red snapper fishery in the Gulf of Mexico has a consolidation cap equal to the maximum percentage issued to a recipient at the time of the initial allocation. This constrains the largest harvester from getting any larger under ITQ management. In the Alaskan halibut fishery, the restriction is approximately 0.5–1.5% of the overall quota, whereas New Zealand stocks managed by ITQs have consolidation caps of up to 45% (Bonzon et al. 2010).

Anderson (1991) addresses the possibility of market power by demonstrating the conditions under which monopolistic behavior could arise;[24] in most circumstances, consolidation caps are not necessary to prevent market power in fisheries, although these caps could address equity concerns. The distributional concerns, such as maintaining fishing communities and some notion of equity, however, need to be analyzed on a case-by-case basis to determine the inherent trade-offs in such choices.

Ex ante analyses generally predict that consolidation would be a major driver of the cost savings of ITQ management (e.g., Lian et al. 2010, Weninger 2008, Weninger & Waters 2003). These studies predict that the implementation of ITQs would lead to fewer inefficient vessels, and ex post studies of the effects of ITQs also find significant cost savings due to consolidation (e.g., Grafton et al. 2000).

Without a cap on consolidation, the market price of quota shares determines the distribution of harvest. High-cost individuals in an ITQ fishery have an incentive to sell to fishermen with low harvest costs. Once a consolidation cap is introduced, the individuals with the highest harvest may be forced to harvest less (or at a minimum, it prevents low-cost individuals from expanding their operation), which shifts their excess harvest rights to fishermen with higher costs. That is, preventing the lowest-cost fishermen from harvesting more can only lead to higher overall costs for harvesting the total allowable catch (TAC). This increase in costs moves the fishery away from the cost-effective harvest and leads to a reduction in the overall value of the fishery.

Tradable harvest shares (and, analogously, tradable pollution permits) are more cost effective than command-and-control regulations precisely because of the ability of low-cost individuals and high-cost individuals to engage in trade. Any constraints on trade will necessarily push the equilibrium outcome away from the most cost-effective solution, and policy makers should carefully consider the efficiency impacts of consolidation caps. Moreover, the gains from trade arise precisely due to heterogeneity, yet economic studies often abstract away from this important aspect by assuming a homogeneous fleet (Grainger & Costello 2012b).

5.2.3. Sunset provisions. In the United States, there are often concerns surrounding catch shares emanating from those who do not want public natural resources to be given away (or sold) to private individuals permanently. In response to this concern, some fishery regulators and policy makers have considered so-called sunset provisions. A sunset provision effectively makes the ITQ right temporary, with an expiration date (or a renewal date).

Resource economists would be quick to note that an ITQ program with a sunset provision takes away the incentives for long-run stewardship of the resource. Costello & Kaffine (2008) discuss the impact on long-run incentives for stewardship (and on maximizing the value of the resource). Although limited-tenure property rights may adversely affect incentives, many real-world examples of property rights are for a limited or uncertain duration. Sunset provisions in fisheries, expropriation risk in agriculture (Besley 1995), and revocation risk in grazing permits (Libecap 1981) are examples.

[24] A more general model of market power in cap-and-trade programs is in Hahn (1984).

In the United States, the legal definitions of ITQ shares explicitly refrain from referring to them as property. The laws state that quota shares "shall be considered a permit"; "may be revoked, limited, or modified at any time"; "shall not confer any right of compensation to the holder...if it is revoked, limited, or modified"; "shall not create, or be construed to create, any right, title, or interest in or to any fish before the fish is harvested by the holder"; and "shall be considered a grant of permission to the holder of the quota share to engage in activities permitted by such...quota share" [see 16 U.S.C. 1801 (1996); also quoted in Grainger & Costello 2012a].

The New Zealand quota management system differs in many ways from the ITQ programs in the United States, but perhaps the most striking difference is the nature of the property right. In New Zealand, quota shares are explicitly considered property, and quota owners can easily use their holdings as collateral in obtaining credit. Another striking difference is the relative availability of information about the quota markets. Trades are brokered through a central clearinghouse that tracks prices, in contrast to the decentralized (and nontransparent) quota markets in the United States.

These differences in the security and tenure of ITQs could have large effects on the value of quota and, more generally, on the size of the long-run benefits of transitioning from limited entry to ITQs. Grainger & Costello (2012a), for example, study the effects of insecure property rights on ITQ asset prices. They examine fisheries in New Zealand, the United States, and Canada, and they test whether a fishery's property rights security affects its lease-to-sales-price ratio (i.e., the dividend price ratio). They provide evidence that the resolution of a high-profile dispute in New Zealand led to an increase in asset values and that fisheries in countries with stronger property rights had higher asset values than did comparable fisheries in countries with weaker property rights.

Regarding investment incentives, the impact of a sunset provision is immediate. If an asset can be taken away at some point in the future, the willingness to pay to hold that asset will go down. But perhaps more importantly, if long-run ownership of the asset is in question, individuals should have a greater incentive to lobby for a higher TAC now, regardless of what the longer-run consequences are for the resource. This could damage the ecological health of the fishery relative to that of an ITQ regime granting perpetual tenure.

5.2.4. Restrictions on trades or leases. Other ITQ fisheries have adopted rules restricting permanent trades or leases. Some fisheries outlaw leasing or require that asset owners also operate the vessel. These restrictions are included as a response to concerns that quota shares will act as an investment vehicle, whereby a distant investor purchases quota and leases it back to fishermen in the community. Other catch share programs are more draconian in this regard in that they include all-out bans on trades or allow the transfer of only a portion of the ITQ. The Pacific groundfish fishery, for example, placed a two-year moratorium on transfers. After the initial two-year phase in, shareowners will be allowed to freely transfer their quota shares. These restrictions are in response to concerns that a lack of information (or asymmetric information) among fishermen will allow some fishermen to sell their quota shares at below-market prices. Restricting trade for a period of time may enable time to pass for price discovery among its participants.

5.2.5. Environmental participation clauses. A common concern regarding the introduction of market-based management programs is the possibility for nonuse groups to participate in the market. This could take the form of an environmental organization purchasing pollution rights in a cap-and-trade program, an environmental organization buying shares and retiring them in an ITQ program, or an outside investor purchasing shares and leasing back that right to individual fishermen.

Economists would generally favor flexibility in market-based programs such as ITQ fisheries, as it allows people (fishermen included) to participate in the market according to their marginal willingness to pay. In the example of an environmental organization participating, ITQ management allows those groups to participate if they feel that the current management system is leading to overfishing. If they are able to outbid fishermen, and if fishermen are willing to sell their rights to environmental organizations, it would be socially optimal for the fishing right to trade hands. Because this scenario is often unpopular among fishermen, one possible design strategy could be to explicitly restrict participation to groups or individuals who actively participate in the fishery.[25]

Two prominent examples of nonuse participation may help shed light on this concern. First, a high-profile buyback of limited-entry permits and vessels by The Nature Conservancy in Morro Bay, California, proved to be a successful way to achieve conservation in a marine environment. It was the first private purchase of Pacific permits for conservation purposes, and it is a valuable lesson in how private parties can use market-based regulations to achieve a mutually agreeable agreement to conserve a resource (Deacon & Parker 2009).

Second, the acid rain program administered by the Environmental Protection Agency allows for the purchase and retirement of emissions permits for nonuse purposes. In some instances, individuals have participated to buy pollution rights to reduce the effective cap on emissions. Participation levels have been low, but in recent auctions environmental groups and individuals have successfully purchased permits.[26]

6. CONCLUSIONS

We began this article by posing the following questions. Why are fishery managers and politicians reluctant to impose systems of property rights in fisheries when the economic gains from doing so are apparently quite large? Why do fewer than 5% of the world's fisheries rely on ITQs? Why are ITQs often restricted with consolidation caps, sunset provisions, environmental participation clauses, and trade restrictions in the subset of fisheries in which they are employed? In the language of Olson (1996), why do policy makers allow big bills to sink to the ocean floor? In the language of Karpoff (1987), why have fishery managers resisted the onslaught of theory and data indicating the gains to be had from property rights reforms?

The answer, based on our review of the literature, is that political economy obstacles have prevented, slowed, and modified the adoption of ITQs because well-organized interests stand to lose from their adoption. Political opposition comes from many of the same groups who historically opposed fish traps and limits on entry. Local communities—who naturally have political influence—are concerned about job loss and the devaluation of capital that is specific to non-ITQ fisheries (see Boyce 2004). These concerns are legitimate, as one of the main sources of gains in ITQs is the elimination of redundant labor and capital. As economists, we naturally view redundant labor as a cost, but for noneconomists, it is common to think of jobs as outputs rather than as inputs. To the extent that fishery reforms reduce jobs, at least in the short run, their unpopularity is not all that surprising.

[25]We find this strategy somewhat perplexing, as fishermen would appear to gain if markets for ITQs were expanded to a broader group of potential owners. Costello (2012) briefly discusses this phenomenon, and as he points out, the legality of nonuse participation in catch share fisheries has not been resolved.

[26]See Maleug & Yates (2006) for a discussion of the economics of nonuse participation in environmental markets. EPA auction results are posted regularly on the EPA's website.

A related source of opposition to ITQs stems from a populist view that outsiders—that is, fishermen and investors from outside the geographic location of the fishery—should not reap benefits from local fisheries. This view was also an important impetus for the ban on fish traps and for the resistance to limited entry (Colt 1999, Higgs 1982, Karpoff 1987). It is undoubtedly the reason why some ITQ programs include consolidation caps and contain ownership and transfer restrictions. It is also one of the reasons why some ITQ programs include environmental use clauses, because today's outsiders also include environmental groups based in Washington, DC; the city of New York; and elsewhere that might buy up quota in local fisheries for nonuse. These constraints limit the economic performance of ITQs but represent the sort of political compromises that may be necessary to make them feasible.

Perhaps most significantly, the transition to ITQs seems to be slowed by contention over the initial quota assignment. Even when quota is grandfathered, as it usually is, fishermen have incentives to compete for larger allocations in various ways. Anecdotal evidence and theory suggest why some fishermen may prefer the status quo and hence block transition to ITQs (Grainger & Costello 2012b). Heterogeneity, in terms of skill and capital investments, is likely to exacerbate distributional competition and further slow the transition.

The literature on fishery policy suggests that one of two conditions may be a necessary stimulus for modern fishery reform. One condition is that the fishery may need to be on the verge of ecological collapse (Libecap 2008). With a collapsing fishery, there are few parties with stakes in the status quo to block fundamental reform. When the fishery is not collapsing, a second condition may need to hold. Fishery reforms will probably need to be designed so that they are Pareto improving for all with stakes in the fishery to enable "reform without losers" (see Deacon et al. 2013). Such reforms will sometimes have to come at the expense of economic efficiency but will perhaps better enable policies that achieve the triple bottom line of advancing economic, ecological, and social goals (Pereau et al. 2010).

We do not claim to have a complete vision of the type of research needed to guide politically feasible reform, but we can offer the following comments. First, research on the alternatives to ITQs should be fruitful because alternatives to ITQs may be more politically feasible. A leading alternative is to assign fishing quotas to self-selected groups, rather than to individuals, and then allow fishing cooperatives to manage harvest and other dimensions of fishing.[27] Second, detailed research on the long-run benefits and costs of fishery reform should be a fruitful complement to the larger number of studies that study short-run effects. In the long run, increases in the stocks due to property rights reform may reverse some of the negative short-run impacts that ITQs have had on employment and on the value of capital (see Abbott et al. 2010). Third, theoretical and empirical research that explicitly allows for fisherman heterogeneity will be necessary to further advance our understanding of what reform without losers will require. Allowing for fisherman heterogeneity complicates models of fishing behavior and political resistance, but it is a complication with a big payout if it helps our economic studies produce results that lead to positive reform.

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[27]Deacon (2012) provides a comprehensive review of the literature on fishing cooperatives.

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