

# LEARNING HOW TO FISH

*Catch shares are vital to the future of fishery conservation.*

♦ BY JONATHAN H. ADLER AND NATHANIEL STEWART

**I**n a crowded meeting hall in Portsmouth, N.H., the New England Fishery Management Council voted in January 2013 to recommend drastic new cuts to the catch limits for Atlantic codfish off the New England coast. Over the strenuous objections of local communities and fishermen, the council proposed 77 percent reductions in the allowable harvest for each of the next three years in the Gulf of Maine and a 61 percent cut in next year's catch on Georges Bank. The National Oceanographic and Atmospheric Administration approved the proposed catch limits and other "emergency" measures in May 2013.

New England fishermen and other opponents of the plan fear that the restrictions will doom the centuries-old local fishing industry. Plan proponents, however, counter that the measures are the only way to save the rapidly collapsing Atlantic cod industry. Unfortunately, even these severe new limits may be too little, too late. The latest measures follow years of mismanagement, overly optimistic stock estimates, and misguided fishery policies that failed to align the economic interests of the fishing community with the long-term sustainability of the fishery. In the 1990s, for example, the fishery stock assessments indicated that short-term catch limits and fishing effort reductions could rebuild the fishery stock and ultimately lead to higher long-term yields. Nevertheless, local fishermen and their political representatives vehemently opposed any such reductions.

It would be easy to attack New England fishermen for being short-sighted. To do so, however, would ignore the incentives they face—incentives created by the existing regulatory structure. Incumbent fishermen have little incentive to agree to catch reduc-

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This article is taken from "Learning How to Fish: Catch Shares and the Future of Fishery Conservation," *UCLA Environmental Law and Policy Review*, Vol. 31 (2013).





tions because they would be unlikely to capture the full value of the rebuilt stocks. A rebuilt stock would encourage inactive trawlers to resume fishing and active trawlers to increase their fishing intensity.

Proper fishery management can both conserve fisheries and maintain their value. One approach long recommended by economists has been the use of property rights in fisheries through territorial or catch-share allocation among fishery participants. The ability of such methods to enhance economic efficiency is no longer a matter of academic speculation or economic theory. There is ample empirical evidence that such institutional reforms encourage more efficient fishery exploitation, reduce overcapitalization, and eliminate the dreaded “race to fish”—the wasteful and dangerous effort to catch as many fish as possible in a very short fishing season. The use of property-based management aligns fisher incentives with the underlying health of the resource and appears to reduce the adverse environmental effects of commercial fishing.

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While the theoretical and empirical case for property-based fishery management has become ever more compelling, many policymakers have been slow to embrace catch shares and other property-based reforms. Some mainstream environmental groups have endorsed the growing economic consensus that property-based systems are the key to fishery sustainability, and both the George W. Bush and Obama administrations supported the increased use of catch shares in domestic fisheries. Yet some fishing interests and ostensibly market-oriented policymakers resist. In May 2012, a majority of Republicans in the U.S. House of Representatives voted to bar the adoption of new catch-share programs along the Atlantic Coast and in the Gulf of Mexico. In the process, the alleged party of free enterprise and limited government turned its back on a proven market-based approach to a serious environmental problem.

But the evidence is clear. Moving toward a more property-oriented management approach is the most likely way to maximize the likelihood that a fishery will be managed in a productive and sustainable manner.

#### THE TRAGEDY OF THE OCEAN COMMONS

For most of the 20th century, the world's ocean fisheries provided a classic example of what Garrett Hardin famously called “the tragedy of the commons.” Hardin postulated an open access commons, specifically a grazing pasture owned by none but available to all. (He could just as easily have written of a marine fishery.) As Hardin explained, each herdsman can capture the full benefit of adding an additional animal to his herd using an open access resource while the cost to the pasture (overgrazing) is shared among all users. As a consequence, each individual herdsman lacks the incentive to exercise consumptive restraint, which leads to overconsumption. Thus, in an open access commons, the shared resource is overexploited and eventually will collapse.

The incentives for fishermen to exploit a common fishery are analogous. Ocean fish have long been considered common property. Fish that are in the waters today may not be there tomorrow. This uncertainty creates the incentive to catch as many fish

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today as possible because every fish left in the ocean for tomorrow is one that got away. Because each fisherman reaps the full benefit of his catch, he has every incentive to add boats, crew, and more efficient gear and equipment to intensify his effort and land more fish. The costs to the fishery, however, are borne by all. The result is an overfished and overexploited resource. Hardin's theoretical "tragedy" has been confirmed by the evidence. Many of the world's fisheries are in danger from overexploitation and risk collapse despite substantial regulatory efforts.

The "tragedy of the commons" is not inevitable, however. As Hardin himself recognized (but many commentators continue to overlook), private property limits access to the commons and ameliorates the commons tragedy because property owners have a substantial incentive to maximize the value of the resource they own.

Many believed that individual property rights were unsuitable to the marine context because of the mobility and migration of fish and the difficulty in monitoring property interests in the open sea. Fisheries have traditionally been held in trust by the government for the common use of all, relying upon government regulation to conserve the commons and avert the tragedy of depletion and collapse. Yet it appears that the difficulties of adopting property rights in fisheries were exaggerated—as was the efficacy of command-and-control regulation. There is growing recognition that property-based management can conserve marine resources where conventional regulatory measures failed.

### THE FAILURE OF FISHERY REGULATION

Conventional fishery regulation has been unable to ensure resource sustainability. Worse, traditional regulatory measures often encourage economically wasteful and ecologically harmful fishing practices. In its 2010 assessment, the United Nations Food and Agriculture Organization reported that approximately 85 percent of the world's fish stocks (for which assessment information is available) are fully exploited (53 percent), overexploited (28 percent), depleted (3 percent), or recovering from depletion (1 percent). Recent research suggests that the status of unassessed fisheries is even worse. Thus, although annual fish production continues to rise—largely from the expansion of aquaculture—many fisheries are in trouble.

The failure of fishery management "is entirely manmade," notes University of Iceland economist Ragnar Arnason. "It is the result of an inappropriate institutional framework" governing fishing. For decades, government agencies adopted increasingly stringent control measures in an effort to limit overconsumption of fishery resources. These measures included time and area closures; limits on the types of gear and boats that could be used; and total limits on the amount of fish that could be caught in a given fishery in a season. Because those rules rarely worked, additional measures were tried to limit the intensity of fishing efforts and number of fishers in a given fishery, including limits on investment in fishing efforts, buyback schemes, and boat and license limits.

Despite good intentions, those measures routinely failed to ensure fishery sustainability. License controls and other entry restrictions, for example, limit the number of fishers, but they do not control the intensity of fishing efforts. Limits on the total catch and per-trip catch, even when combined with limits on the number of boats, did not prevent overfishing of the Gulf of Mexico reef fish fishery. Restrictions on the types of equipment that may be used encourage fishers to increase their investment in additional vessels or gear to compensate for the efficiency losses.

Severely shortened fishing seasons encourage fishers to increase their effort dramatically during the season, leading to absurd results. The U.S. North Pacific Halibut Fishery is illustrative. The length of the fishing season was progressively shortened from 65 days in 1980 to only two in 1991. Similarly, the Alaska crab fishery was eventually restricted to seasons as short as three days. Fishermen responded by increasing the number of boats so more fish could be caught in less time. Not only is a three-day season very inefficient, it results in a lower quality and less valuable catch; the entire year's halibut catch reaches the market in just a few days.

The race to fish is not only bad for the fish, it is also bad for those fishing. The race to fish in the Bering Sea crab fishery became so intense that hundreds of boats would line up for each season's opening day and crews would fish furiously, around the clock, until the fishery closed—usually only a week to 10 days later. In a typical year, at least one boat and five crabbers would not make it back. It was for this reason that the Discovery Channel used the Bering Sea crab fishery as the setting for its popular reality show, *The Deadliest Catch*. But what made for good television made for horrible resource management.

### PROPERTY RIGHTS

Hardin may have popularized the tragedy of the commons, but he was not the first to describe the fate of open-access resources. Fishery economists had been writing about the commons problem for over a decade by the time Hardin's essay appeared in *Science*.

In 1954, Scott Gordon published "The Economic Theory of a Common-Property Resource: The Fishery" in the *Journal of Political Economy*. Gordon argued that the overfishing problem has its roots in the economic organization of the industry. "Wealth that is free for all is valued by none because he who is foolhardy enough to wait for its proper time of use will only find that it has been taken by another." Many were skeptical about the use of property rights for a mobile resource like fish, however. It was hard enough to fence property lines and control cattle in the American West. Policing boundaries and monitoring fish would be far more difficult, particularly in the case of migratory species.

In 1973, Francis Christy proposed what would become a groundbreaking solution to such concerns. Christy proposed allocating rights to portions of a given fishery or to a seasonal catch—a quota that would eventually become known as an Individual Transferable Quota (ITQ). An ITQ is a right to an assigned percentage or



proportion of the total allowed annual catch in a given fishery. For example, the owner of a 5 percent quota would have the right to catch 5 tons in a season if the total allowable catch (TAC) were 100 tons, but would be able to catch 10 tons if the TAC were 200 tons. Under the typical ITQ regime, a government agency sets the TAC for a given season, based on an assessment of the sustainability of the fishery by biologists. The agency then allocates shares of the catch—the quota—to individuals, boats, or firms as a transferable

able among fishery participants, quota shares will be reallocated to the most efficient fishery participants, thereby reducing the overcapitalization of the fishery. If quota shares are perpetual, the market value of quota shares will represent the expected present value of the fishery. As a consequence, ITQs will tend to maximize the economic value of the fishery.

Empirical assessments have confirmed the economic benefits of adopting ITQ programs. A 2012 study by Dietmar Grimm et al. examining the performance of 15 catch-share programs in the United States and British Columbia found that catch shares improve efficiency within the fishery. Whereas the race to fish tends to shorten the fishing season, the rights-based security created by the catch-share regimes allowed fishers to extend their fishing seasons on average from 63 to 245 days of the year. And the adoption of catch shares enables fishers to match their capital investment to their share of the catch.

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right. In most such systems, shares or quota are initially allocated based on some sort of formula such as the average volume caught over a set of prior years, or an auction. The rights then continue from year to year without change. Because ITQ rights continue, ownership of a catch share provides the fisher with an incentive to ensure the fishery's sustainability over time.

In 1976, Holland and Iceland, two prominent fishing countries, introduced individual quotas in the North Sea flatfish fishery and the domestic herring fishery, respectively. New Zealand introduced a catch-share program in 1986. Since then, rights-based management programs have been implemented in varying degrees in countries around the world, including Australia, Canada, Chile, Iceland, Namibia, the Netherlands, Norway, South Africa, and the United States.

But so-called catch-share systems still account for only a fraction of global fisheries. According to a 2010 survey, catch-share systems govern only 2 percent of fish stocks around the world, but account for approximately 25 percent of the volume of fish caught annually worldwide.

## CATCH SHARES IN PRACTICE

Since the implementation of the first ITQ programs in the mid-1970s, hundreds of such programs have been adopted in over 20 countries. Evaluations of those ITQ programs provide significant evidence that catch-share and rights-based management systems have a positive effect on fisheries.

**Economic consequences of catch shares** / The essential components of an ITQ program are the imposition of a limit on the TAC over a given time period and the allocation of rights to harvest a certain portion of the catch. If those shares are transfer-

The adoption of catch shares in the United States increased revenues for fishery participants. Under catch-share management, revenues per vessel almost doubled. More efficient fishing methods, longer fishing seasons (which slow the frenetic race to fish and reduce fishing in hazardous and costly conditions), and lower discard rates in catch-share fisheries help raise total revenues. Slower, more deliberate fishing produces higher yields, increases processing product recovery, and improves the quality (and value) of the catch.

**Catch shares and conservation** / Whereas the economic benefits of catch-share reforms are widely accepted, the ecological benefits of catch shares are more contentious. In 2008, Christopher Costello, Steven D. Gaines, and John Lynham (CGL) compared 121 fisheries that installed ITQs between 1950 and 2003 to those that did not. Before 1980, there was no difference in the collapse rates (collapse defined as a harvest less than 10 percent of the maximum recorded harvest) between ITQ and traditionally managed fisheries. After 1980, non-ITQ fisheries continued their rate of collapse while the collapse rate for ITQ fisheries was lower.

In a 2010 follow-up paper, Costello and co-authors acknowledged that “[p]roving rigorously that catch share management causes a reduction in fisheries collapse rates” is challenging, if not impossible. Isolating the effect of implementing ITQ programs is complicated by several competing effects:

- the growing number of ITQ fisheries and the fact that “new ITQ fisheries are drawn from a global pool with an ever increasing fraction of collapsed fisheries,”
- a potentially biased selection of fisheries converted to ITQ management, and
- potential “temporal benefits of an ITQ.”

The authors adopted a number of strategies to account for those complications. Their results did not change. The “picture that emerges from the results ... is fairly clear: ITQ fisheries are less likely to collapse than non-ITQ fisheries, and the magnitude of this effect increases the longer a fishery is managed by an ITQ.”

Skeptics of the CGL 2008 results questioned whether the study was actually measuring the beneficial effects of adopting TAC limits rather than the effect of ITQ systems. University of Wisconsin economist Daniel Bromley, for example, charged CGL’s conclusions were “comprehensively spurious because they failed to make the essential distinction between the effects of total allowable catch (TAC) as opposed to the effects of [catch shares].” In their 2010 paper, Costello et al., acknowledged that “the benefit of switching to an ITQ is stronger when no TAC was in place prior to the ITQ,” but they also noted that there was “a strong and statistically significant benefit to switching to an ITQ system regardless of whether there was an existing TAC in place.” In other words, property-based reforms remain important. Fishery participants have a greater incentive to maintain TAC compliance and facilitate TAC enforcement once they are guaranteed a right to a share of the catch.

The adoption of catch-share reforms also encourages fishers to support lower and more sustainable TAC limits. Under traditional regulatory management, fishery participants have no incentive to push for more precautionary catch limits because they are not guaranteed the benefits of such stewardship. With perpetual catch shares, on the other hand, fishery participants have an economic incentive to support the setting and enforcement of TAC limits that will ensure the fishery’s sustainability.

A survey by Trevor Branch of over 200 peer-reviewed papers on the environmental effects of ITQ programs found that participants in catch-share fisheries often request lower TACs and ITQ programs tend to reduce the rate of TAC violations. ITQ systems seem to have an easier time enforcing fishing limits because ITQs require less at-sea monitoring than traditional regulations “because closed areas and seasons, banned gear types, and vessel restrictions are no longer required,” and ITQs tend to reduce “the number of participants, thus allowing more intensive monitoring of landings and discards and increasing the probability of detecting illegal fishing.”

Over time, the success of catch-share management has allowed some fisheries to increase their total catch limits. In the fisheries studied by Grimm et al., “TACs increase an average of 13 percent five years after catch shares implementation, and 19 percent ten years after catch share implementation.”

In addition to the beneficial effects of catch-share systems on TAC, catch-share systems also lowered “discard” rates. One common objection to catch shares has been the incentive to practice

“high-grading” or discarding less desirable, cheaper grades of fish before landing in order to avoid having those less profitable fish count toward a fleet’s share of the catch. Significantly, Grimm et al. found little evidence of high-grading under catch shares. In fact, the discards-to-retained-catch average in the studied fisheries actually fell 31 percent over five years and 66 percent over 10 years, with almost all the fisheries reporting a lower discard rate under catch shares than under traditional management.

**Social and economic consequences of catch shares** / The most prominent objections to property-based fishery management are not ecological, but social and economic. Some fear the distributional consequences of recognizing transferable rights in a fishery or worry about the possible effect on local communities, particularly if the transferability of fishery shares results in consolidation or if larger companies buy out the fishery shares. This is the basis for much opposition to catch shares among

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Republicans in Congress. Such concerns are legitimate although exaggerated.

The adoption of ITQs inevitably produces some economic dislocation and may create winners and losers, as does any significant regulatory change. But the net economic benefits of such reforms have been substantial. Whereas derby fisheries have too many boats chasing too few fish, in ITQ fisheries the fishing effort is rationalized because there is no advantage to putting extra boats in the water or racing to fish. Typically the number of vessels in a given fishery declines; but the seasons get longer, the income streams for fishery participants become more stable, and fishing becomes more profitable.

Grimm et al., for instance, found evidence that transitioning from a traditional management system to catch shares affects landing patterns, and therefore fish processors. “Under race for fish conditions that result in short annual seasons, the processing industry (along with fisheries) can become overcapitalized to handle the glut of fish in short periods.” But catch-share management programs tend to lengthen and stabilize fishing seasons, allowing for more efficient processing capacity. Such stabilization produces significant benefits for fishery participants and local communities by providing a more stable and predictable source of income.

Transitions to catch-share systems often require shifts in the fishery labor market. For instance, the longer fishing seasons may cause a shift from seasonal, part-time jobs to full-time employment. Such changes often will result in more stable positions with better working conditions, higher job quality, and higher pay.

While some fishers may lose under ITQs, neither allowing fish stocks to collapse nor maintaining derby-style fishery rules benefits local fishing communities. If some identifiable groups lose from property-based reforms, such concerns can be addressed directly through buy-out programs or other compensation measures. Allocating quota shares to fishery incumbents ensures that existing fishery participants are compensated should they sell their quotas and leave the fishery. If traditional fishery controls are used to restrict fishing, there is no such guarantee.

More importantly, concerns about the distributional effects of ITQs should not be an excuse for leaving unsustainable fishery management regimes in place. Given the extent of overcapitalization and wasted effort in most fisheries under traditional management, it should be possible to compensate potential losers from the gains generated by reform. Indeed, adopting catch shares tends to enhance government revenue by increasing the profitability of fishing vessels, generating more tax revenue, and reducing net management costs.

Additionally, catch shares have affected some port communities by reducing the pressure for fishermen to land at the nearest port, and modestly consolidating ports. Catch-share programs could reduce some of the economic consequences of and political opposition to implementing conservation zones because there would be less pressure to fish in the most geographically convenient locations.

Some catch-share skeptics are concerned about the effect of reforms on fishing boat crews, rather than the owners. The adoption of catch-share programs and the elimination of the race to fish appear to result in substantial safety improvements for fishery participants. Mortality in the Alaskan Bering Sea Crab fishery has decreased from five-plus deaths per year to only one death in five years. In other words, the “deadliest catch” became much less deadly. While fishery participants are often skeptical about the adoption of catch-share policies, they often report satisfaction with such reforms after they are adopted. In sum, the available evidence confirms that property-based management regimes can be just as good for fishery participants as they are for the fish—and are much preferable to leaving fisheries on the path to collapse.


## THE IMPORTANCE OF PROPERTY RIGHTS SECURITY

Catch-share systems alter the incentives faced by fishery participants because they give fishers a stake in the fishery itself. The more secure a catch share or other fishing right, the greater its market value. According to the University of Iceland’s Ragnar Arnason, in New Zealand, “ITQs are viewed as perpetual rights

to fish” and an owner may use the quota “as collateral in establishing credit with banks.” Changes in the rights cannot occur without compensation to their owners.

In contrast, ITQ rights in Canada and the United States are less secure. A quota share is deemed to be a “revocable privilege.” Although federal courts have concluded that quota shares are “property” for purposes of the Due Process Clause of the Fifth Amendment, that conclusion only guarantees that the rights will not be taken without providing sufficient process and an opportunity to be heard. The courts’ conclusion does not ultimately protect the right against revocation, nor does it ensure that quota owners would be entitled to compensation under the Fifth Amendment’s takings clause if quota shares were taken for some public purpose. This insecurity reduces the value of U.S. and Canadian rights relative to those in New Zealand.

## CONCLUSION

Strengthening property rights in quotas, enhancing tenure contracts to induce long-term stewardship, and improving the working relationships between fishers and managers are important components of fishery management. Lawmakers, researchers, and resource managers should acknowledge the growing body of empirical research demonstrating the significant role of stronger, longer-tenure property rights and rights-based incentives for improving fishery performance. Although catch shares, like any management regime, have their drawbacks, the world has less to fear from the expansion of property rights in marine resources than from the failure to utilize property rights for marine conservation. 

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