Towards a Sustainable Fishery: The Price-Cap Approach

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Overfishing is the classic tragedy of the commons. So far, governments have pursued a variety of solutions to incentivize sustainable commercial fishing practices, realizing only mixed results. After describing the costs associated with implementing overfishing controls, I propose a new method of regulating commercial fishing: the price cap. This Article explains the theory of how price caps can incentivize sustainable fishing, analyzes the implementation costs associated with price caps, and compares price caps to existing overfishing regulations. Because each fishery is unique, no single method will produce the greatest benefit at the lowest cost in all fisheries. Accordingly, I analyze the factors that might make a fishery a better or worse candidate for the implementation of price caps.

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I. INTRODUCTION

Overfishing, the practice of catching more of a species of fish than its population can replace through reproduction, is a problem that has not gone unnoticed. Fishermen feel the impact of overfishing in the forms of diminished wages, costly regulations, and, in extreme cases such as the moratorium on Northern cod fishing, the disappearance of their entire livelihood.[1] Skilled cod fishermen once profited from what was thought to be an infinite supply of the popular fish;[2] they now work odd jobs, catch the noxious, slime-secreting Atlantic hagfish,[3] or idly collect government aid, all while waiting for the resurrection of the cod population, an event that may never come to fruition.[4] Consumers feel the impact of overfishing through higher prices and, in many cases, the unavailability of preferred fish.[5] Politicians responding to the interests of fishermen, in addition to those of environmentalists and endangered species advocates, continue to spend the public dollar in pursuit of an effective and politically feasible solution.

Overfishing has attracted significant scholarly interest. In the law and economics literature, it is the classic tragedy of the commons.[6] An unregulated fishery is an open-access commons where any fisherman can catch as many fish as he chooses. Because a fisherman realizes only his own costs, he will catch fish until the marginal benefit (the market

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1. D.H. Steele et al., *The Managed Commercial Annihilation of Northern Cod*, 8 NFLD. STUD. 34, 35 (1992).

2. *See* H. Scott Gordon, *The Economic Theory of a Common Property Resource: The Fishery*, 62 J. POL. ECON. 124, 125-26 (1954).

3. Often called the most disgusting creature in the sea, the hagfish is a far cry from the noble cod. It is, however, commercially viable. Its skin is used to make products such as wallets that are marketed as eel skin, and its flesh is consumed in Korea. The unsurprising consequence of its commercial demand combined with low reproduction rates is that it, too, is being fished beyond sustainable levels. *See* Lee Jean, *Hagfish Aren't So Horrible After All*, 5 J. YOUNG INVESTIGATORS (Apr. 1, 2002), http://www.jyi.org/volumes/volume5/issue7/features/lee.html.

4. BILL BRYSON, A SHORT HISTORY OF NEARLY EVERYTHING 285 (2003); MARK KURLANSKY, COD: A BIOGRAPHY OF THE FISH THAT CHANGED THE WORLD 231-32 (1998).

5. Tasty species such as cod and bluefin tuna, once common on restaurant menus, have all but disappeared, replaced with farm-raised fish such as tilapia, species such as mahi mahi that were once thrown away when caught, or in the more troubling case of grouper, substituted with various species such as basa, a Vietnamese farm-raised catfish, that are labeled and sold as real grouper. Covert substitution is also common with cod, which even when sold as cod, is more likely to be a variety of haddock or pollock. *See* BRYSON, *supra* note 4, at 285; KURLANSKY, *supra* note 4, at 223.

6. *See* Shi-Ling Hsu, *What Is a Tragedy of the Commons? Overfishing and the Campaign Spending Problem*, 69 ALA. L. REV. 75, 76, 100-01 (2005) (describing overfishing as "the classic environmental commons problem"); *see also* Jonathan Adler, *Conservation Through Collusion: Antitrust as an Obstacle to Marine Resource Conservation*, 61 WASH. & LEE L. REV. 3, 10 (2004) ("Ocean fisheries represent the archetypal commons problem.").

price if he is fishing commercially) equals the marginal cost of production. As more fish are caught, the fisherman's catch will be limited by the falling market price and the increasing marginal cost of production as the population declines.[7] If the reproductive capabilities of fish were robust enough to keep up with the market equilibrium level of production, there would always be enough fish to meet consumer demand, and overfishing would not be a concern. During the early years of commercial fishing, this was the case. The fish population was high, the human population—and thus the demand for fish—was low, and due to the limitations of fishing technology, the cost of production was high enough to limit yields to sustainable levels. As a result, fish were able to reproduce fast enough to keep up with the numbers being caught, and their supply was, given the lack of any perceived supply problems, not unreasonably thought of as infinite.[8] In time, however, the market equilibrium yield began to increase, a consequence of an increase in the human population and, with the introduction of more advanced fishing technology, a decrease in the cost of production.[9] Once the equilibrium yield reaches a point where the reproductive capacity of the fish stock cannot keep up, the effects of overfishing begin to appear.[10] As stock size decreases, so too does the size of each individual fish caught, representing the inability of fish to live long enough to reach their full size before being caught. Bluefin tuna, for example, used to be caught at sizes exceeding 1500 pounds, yet the typical size landed today is less than 200 pounds.[11] Lobster and cod can both live for over seventy years and reach massive proportions, but as their population decreases, so too does their average age and size.[12] Effects of overfishing on the fish stock can be drastic and sudden, materializing with significant increases in the marginal cost of production and decreases in fish size over shockingly

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7. *See* Gordon, *supra* note 2, at 129-30. Increasing marginal cost is crucial to the analysis. It can be explained with a hypothetical involving one fisherman and a given supply of fish. If there are fish everywhere, the fishermen needs only lower a net into the water to produce the number of fish required. Indeed, this may not be far from the state of the early Atlantic cod fishery. Early European travelers to the Nova Scotia coast claimed that baskets lowered from the sides of ships would be filled with cod when raised. If the population is smaller, however, the fisherman incurs search costs to find schools of cod. As the population decreases further, he must invest in larger nets, longer hours, and so forth.

8. *See* BRYSON, *supra* note 4, at 284.

9. *See* Gordon, *supra* note 2, at 129-30.

10. *See* Hsu, *supra* note 6, at 101-04.

11. *Mediterranean Bluefin Tuna Stocks Collapsing Now as Fishing Season Opens*, WORLD WILDLIFE FOUND. (Apr. 14, 2009), http://wwwf.panola.org/?162001/Mediterranean-bluefin-tuna-stocks-collapsing-now-as-fishing-season-opens.

12. *See* BRYSON, *supra* note 4, at 285.

short periods of time.[13] When the age of landed fish is lower than the age at which they reproduce, as was ultimately the case with the Atlantic cod, the population collapses to the point of commercial extinction.[14] All this can be explained in ordinary tragedy-of-the-commons terms: overfishing results from fishermen creating externalities by reducing the total supply of fish and internalizing only their own costs.[15] As a result, fishermen catch fish beyond the optimal level.

The economic consequences of overfishing include overcapitalization by fishermen and the resulting dissipation of rents. As fish become scarcer, both the cost of production and the market price increase.[16] Because fishermen will catch fish until the cost of production equals the market price, they will always invest more into production until the market equilibrium is reached. As a result, no rents are available. If fishermen could agree or be made to limit production to sustainable levels, the cost of production for a given yield would be lower than in the unregulated commons. Fishermen would thus be able to extract rents from the fishery, representing the difference between the market price, which is higher due to the reduced supply, and the cost of production, which is lower due to the increased fish population. These economic losses due to dissipated rents are immense; some studies calculate them to exceed fifty billion dollars per year.[17] Solutions to overfishing seek to limit the yield, the total number of fish caught, to sustainable levels. Although such a solution would benefit fishermen as a whole, the incentives to violate any agreement or restriction are great.[18] Each individual fisherman would still profit from catching fish until his cost of production equals the market price, and the implementation of any solution is therefore difficult and highly dependent on incentives to comply.

Overfishing also leads to many severe biological consequences, the economic value of which, although hard to quantify in monetary terms,

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13. *See* Hsu, *supra* note 6, at 100-03. From 1910 until 1913, the average size of landed halibut dropped from 271 pounds to 129 pounds, a decrease of over fifty percent. By 1930, the average size of landed halibut was only 35 pounds, a decrease of nearly ninety percent.

14. *See* BRYSON, *supra* note 4, at 285.

15. *See* Hsu, *supra* note 6, at 93-94.

16. HANNES H. GISSURARSON, INST. OF ECON. AFFAIRS, OVERFISHING: THE ICELANDIC SOLUTION 15 (2000), *available at* http://www.iea.org.uk/publications/research/overfishing-the-icelandic-solution. From 1945 to 1953, the cost of production in Icelandic fisheries rose 1200%, compared to a 300% increase in catch.

17. Ragnar Arnason, *Efficient Management of Ocean Fisheries*, 35 EUR. ECON. REV. 408, 409 (1991). As this estimate is in 1991 dollars, losses today (presuming a similar ineffectiveness of regulations) could potentially be double.

18. *Id.*

increases the total societal loss. As species are connected through the food chain, there are significant cascading effects from overfishing. The elimination or reduction of a species of fish will result in a decrease in the population of the species that prey upon it and an increase in the population of the species it preys upon. Down the food chain, this may result in an elimination of smaller species, all the way down to the levels of individual nutrients or the plant species that help absorb carbon dioxide from the atmosphere. Many of these changes have been observed in the Atlantic and attributed to the collapse of the cod fishery.[19] The environmental impact of these changes in the food chain may be immense, yet, due to the complexity of ocean ecosystems, they are still not fully understood and cannot be accurately quantified.[20] However, some species of fish at risk of extinction are primarily responsible for consuming and keeping the population of organisms that cause human diseases, such as schistosomiasis, under control, and an increase in disease is a more concrete, calculable harm.[21] In many undeveloped parts of the world, such as Africa, the fish themselves are important sources of protein without an adequate substitute, and their elimination would result in a serious degradation of human health.[22] Although difficult to quantify, these biological consequences are real societal harms and demonstrate the seriousness of the overfishing problem.

In theory, any of a variety of methods could be employed to resolve the overfishing problem. A solution needs only to ensure that the number of fish caught equals the number of fish that the stock has the reproductive capacity to replace, an amount referred to as the sustainable yield. Many approaches of varying complexity can theoretically achieve this result, and significant effort has been devoted over the past several decades to proposing and implementing numerous different solutions. These methods can be roughly divided into two categories: bottom-up approaches and top-down approaches. While both methods share similar elements, they are sufficiently distinct to merit separate descriptions.

Bottom-up approaches are those designed and implemented by the fishermen themselves. These approaches are essentially contracts, formal or otherwise, amongst fishermen who agree to somehow limit

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19. Marten Scheffer et al., *Cascading Effects of Overfishing Marine Systems*, 20 TRENDS IN ECOLOGY & EVOLUTION 579, 580 (2005).

20. *Id.* at 580-81.

21. James Owen, *Overfishing Is Emptying World's Lakes, Rivers, Experts Warn*, NAT'L GEOGRAPHIC NEWS (Dec. 1, 2005), http://news.nationalgeographic.com/news/2005/12/1201_051201_overfishing.html.

22. Nancy Knowlton, *Ocean Health and Human Health*, 112 ENVTL. HEALTH PERSP. A262 (2004).

their total catch. A classic example of such an informal approach is employed by the lobster fishermen of Maine. By destroying the traps of outsiders, the local fishermen limit access to the lobster fishery, transforming it from an open-access commons to a limited-access shared property claim.[23] In theory, this should result in more sustainable yields, as fewer lobstermen results in fewer lobsters caught.[24] Moreover, a finite number of fishermen also allows for the prevention of overcapitalization, as the fishermen can agree upon certain technologies and enforce against deviations. Controlling the number of fishermen and the technology employed results in an effective control on the number of fish caught. All bottom-up approaches similarly rely on limiting access to the fishery in order to prevent outsiders, who are not part of the agreement, from entering and catching additional fish. In addition to informal agreements, bottom-up approaches also include formal contracts, such as union agreements. Fishermen unions were common in the early twentieth century, and these formal agreements controlled access by forbidding member processing plants from processing fish caught by nonunion fishermen.[25] Yields were limited by imposing minimum weights or lengths on fish caught, thus ensuring that only mature adults were being caught, as well as by imposing total catch limits.[26] As long as the unions are able to enforce their agreements, these formal bottom-up approaches may also be effective at achieving sustainable yields. Legal enforceability remains significant hurdle for formal agreements, however. Antitrust laws have been used to shut down fishermen unions, and thus, formal agreements are not a likely legal option.[27]

Top-down approaches involve the imposition of regulations, generally upon fishermen, that are enforced by the fishery manager, usually the government. The simplest top-down approach is an output control, or a limit on the total number of fish that fishermen are allowed to catch in a given period of time. The limit may be per boat, per fisherman, or per the entire fishery, and it may be for any period of time.[28] Regardless of the form of the limit, the purpose is to ensure a sustainable yield, and as long as the limit is enforceable, an output limit is

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23. *See* James M. Acheson, *The Lobster Fiefs: Economic and Ecological Effects of Territoriality in the Maine Lobster Industry*, 3 HUM. ECOLOGY 183, 187 (1975).

24. *Id.* at 184.

25. *See* Adler, *supra* note 6, at 26-29.

26. *See id.*

27. *Id.* at 29.

28. *See* GISSURARSON, *supra* note 16, at 14-15. For example, an output control may allow each fisherman to catch five fish per day, or allow each boat to catch twenty fish per day, or allow the entire fishery to catch 10,000 fish per year.

the most direct solution. More common top-down approaches are input controls or limits on the effort fishermen put into catching fish. These include limiting the length of the fishing season[29] and limiting the technology and equipment used, such as the size of the nets or the type of vessel.[30] Input controls work by raising the cost of production for fishermen, resulting in their reducing their total catch. The goal is to make the marginal cost of production equal the market price at a lower, sustainable yield. Another type of input control is to limit access to the fishery by issuing permits. This does not raise the cost of production for each fisherman, but rather reduces the catch by the reducing the number of active fishermen, just as is the case in bottom-up arrangements.

A Pigovian tax, a tax equal to the cost of the externality that is not otherwise reflected in the price of the good, is another form of top-down approach.[31] These are taxes added to the sale price of fish, increasing their price and thus reducing consumer demand. The tax must be set at the level that will result in demand equaling the sustainable yield for a particular species of fish. As fishermen will not supply fish that they cannot sell, they will catch only the sustainable yield. Although a Pigovian tax on fish has yet to be implemented,[32] if the tax is calculated and enforced properly, it will result in sustainable yields.

The most recent top-down approach, and that which currently gets the most attention, is the creation of private property rights in the fishery, specifically the individual transferrable catch quota (ITQ).[33] The most basic property rights approach would be to grant private ownership of individual parcels of ocean. While establishing and finding boundaries may now be technologically feasible with the advent of satellite navigation, the fact that fish move makes the geographic property rights approach, which is well-suited for land, rather untenable at sea. The ITQ combines a permit to control access with an individual output control in

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29. *Id.* at 14.

30. *See* Lee G. Anderson & Dwight R. Lee, *Optimal Governing Instrument, Operation Level, and Enforcement in Natural Resource Regulation: The Case of the Fishery*, 68 AM. J. AGRIC. ECON. 678, 687 (1986).

31. Recent literature suggests that the ideal externality test might be lower than the Pigovian level. *See, e.g.*, Ian W.H. Parry & Roberton C. Williams III, *The Death of the Pigovian Tax: Comment*, 80 LAND ECON. 575, 576 (2004). For purposes of this Article, the term Pigovian tax will be used to represent the ideal externality tax, whatever its appropriate level may be.

32. Ronald N. Johnson & Gary D. Libecap, *Contracting Problems and Regulation: The Case of the Fishery*, 72 AM. ECON. REV. 1005, 1015 (1982).

33. *See, e.g.*, *A Rising Tide*, ECONOMIST, Sept. 18, 2008, at 97, *available at* http://www.economist.com/node/12253181.

the form of a seasonal catch limit.[34] This permit can be bought and sold in an open market, resulting in a property right to catch a certain number of fish. If yields are sustainable and the fish population is able to grow to a normal size, the cost of production will decrease, making each fish more valuable to the fisherman and increasing the value of the permit. This gives fishermen an incentive to obey their catch limit, because they can make money in the sale of their permit if the stock grows.[35] The ITQ system has been implemented in a number of fisheries, and studies indicate promising levels of success in many ITQ fisheries.[36]

While each of the above approaches is based on a sound theory, implementation of any approach is accompanied by a plethora of problems. Once all relevant costs and problems are considered, it becomes abundantly clear that not only is no solution perfect, but also that no solution is better than all others in all situations. Because there is no first-best solution, efficient fisheries management relies on determining which of the many second-best solutions produces the most benefit at the least cost in the unique circumstances of each fishery.[37] With this in mind, I propose one additional arrow in the fishery manager's quiver: the price cap. As is the case with the above approaches, capping the market price of fish sold is based upon sound theory, and when the balance of the various costs is analyzed, it could be that, in certain fisheries, the price cap is the most efficient solution. Part II of this Article summarizes the various costs associated with implementing any overfishing regulation. In Part III, I introduce price caps as a method of controlling overfishing. Part IV explains the implementation costs of price caps and factors that will influence their magnitude in a particular fishery. Part V compares price caps to existing overfishing solutions, and Part VI concludes.

II. COSTS OF REGULATION

For any given fishery, the most efficient solution to overfishing will be that which achieves sustainable yields at the lowest cost. This determination hinges on the fishery manager's ability to quantify the

34. R. Quentin Grafton et al., *Private Property and Economic Efficiency: A Study of a Common-Pool Resource*, 43 J. L. & ECON. 679, 682-83 (2000).

35. *See* Arnason, *supra* note 17, at 411.

36. *See* GISSURARSON, *supra* note 16, at 45-46; *see also* Grafton et al., *supra* note 34, at 689. *But see* Tom Tietenberg, *The Tradable Permits Approach to Protecting the Commons: Lessons for Climate Change*, 19 OXFORD REV. ECON. POL'Y 400, 405 (2003) (noting initial declines in stocks in twenty-four of thirty-seven studied ITQ fisheries).

37. *See* Anthony T. Charles et al., *The Economics of Illegal Fishing: A Behavioral Model*, 14 MARINE RESOURCE ECON. 95, 107 (1999).

total costs of each method. Because costs will vary greatly from one fishery to another, there can be no "one size fits all" calculation. An analysis of the potential drawbacks and benefits of a particular overfishing solution requires an understanding of the costs involved and how they might vary from fishery to fishery. These costs, although roughly divided into categories below, will often have overlapping effects that also must be accounted for in any determination of the most efficient approach in a particular fishery.

A. Transaction Costs

Transaction costs are most clearly a crucial factor in bottom-up approaches, but they must be accounted for in top-down regimes as well, particularly when a consensus amongst fishermen is required to achieve sufficient political support for a regulation. This is a clear issue in fisheries in which skill is particularly heterogeneous. Skill is the most important determinant of financial success, and those who benefit from the existing regime will generally be opposed to changing it, particularly when the new regime has distributional consequences.[38] In fisheries in which success varies greatly, fishermen will be less likely to come together and speak with a unified voice.[39] If skill could be easily quantified, such agreements could be made possible through side payments to the better fishermen to mute any distributional consequences. However, skill is not so easily observed and fishermen will have a strong incentive to overvalue their own ability to receive any benefits. A self-enhancement bias may be present as well,[40] perhaps ensuring that the ability ranking required for side payments will never be agreed upon. With divergent interests and an inability to produce believable information, any transaction that is necessary to mute the distributional consequences of a proposed regime will be very difficult to achieve.

Transaction costs are also caused by cultural differences that are present in many fisheries. In fisheries with heterogeneous populations of fishermen, transactions costs may be created through fear or distrust of those from different backgrounds, or language or cultural differences can

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38. Johnson & Libecap, *supra* note 32, at 1011-13.

39. *Id.* Johnson and Libecap calculate the average weekly catch for good shrimp fishermen to range from 485 to 1098 pounds, whereas average fishermen range from 286 to 652 pounds, and poor fishermen range from 150 to 515 pounds. Good fishermen are thus nearly twice as successful as average fishermen and nearly three times as successful as poor fishermen.

40. *See* D. Walton, *Examining the Self-Enhancement Bias: Professional Truck Drivers' Perceptions of Speed, Safety, Skill, and Consideration*, 2 TRANSP. RES. PART F 91, 91-92 (1999).

make communication difficult independent of any prejudices. The Texas shrimp fishery in the Gulf of Mexico is an illustrative example of culturally based transaction costs that are formed both by prejudices and technical communications difficulties. In the mid-1970s, a large population of Vietnamese immigrated to the Gulf coast of Texas and entered the commercial fishery.[41] Although tensions between the established fishermen and the Vietnamese have eased with the passage of time, cultural and ethnic difficulties have fueled a number of disagreements.[42] For example, the Vietnamese used the practice of dragging large shrimp nets between two boats, a method that the Texan fishermen believed was unfair.[43] In such a situation, any sort of gear or input regulation is likely to have very heterogeneous distributional effects, making a unified agreement unlikely. In addition to differences in technique, the language and cultural differences between the two groups were severe. In the Texas fishery and others with similarly high levels of cultural heterogeneity, transaction costs may prove to be insurmountable, limiting the number of potential solutions.

The most intuitive type of transaction cost is that caused by the complexity of a large fishery. If the fishery is geographically large, fishermen are more likely to face dissimilar situations and thus have different opinions regarding an acceptable approach to overfishing. Geographic dispersion also raises the costs of physically coming together to discuss an agreement. Regardless of the geographic size of the fishery, a large number of fishermen also increases transaction costs.[44] Large numbers of fishermen are more likely to include dissimilar methods, cultures, languages, and interests. The costs of understanding, translating, and determining the necessary side bargains thus become increasingly difficult to overcome as the number of fishermen increases.

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41. Kathleen M. Sullivan, *Fishing in the Media: Mainstream Print News and the Commercial v. Fishing Industry in Texas*, 21 CULTURE & AGRIC. at 31, 33 (1999).

42. *Id.*

43. Johnson & Libecap, *supra* note 32, at 1007. It seems likely, however, that the accusation of unfairness was simply a mask for a dislike of the Vietnamese entirely, particularly the extra competition for scarce shrimp resources. If the two boat method was truly superior, the existing fishermen would have employed it as well, unless they had an existing informal agreement to not do so for the purposes of preventing overfishing. If this were the case, then the transaction costs point becomes stronger, because the difficulty with limiting access to split bottom-up approaches is clear.

44. *See* Jürg Niehans, *Transaction Costs*, *in* MONEY (Eatwell et al. eds., 1989).

B. Enforcement Costs

In many fisheries, particularly large offshore fisheries, the determination of the approach with the lowest total costs is likely to hinge on enforcement costs, which may reach virtually astronomic proportions in some regulatory regimes.[45] A significant component of enforcement costs is the related cost of avoiding the regulation. The traditional deterrence model suggests that a fisherman will cheat if his gains from doing so are greater than the magnitude of the penalty multiplied by the probability of being caught, or the expected penalty.[46] Provided that the fishery manager has accurate information on the potential gain to the fisherman from cheating, he can set the fine and the probability of detection (determined by the level of enforcement) at the appropriate level to deter violations. However, the fisherman has an incentive to incur costs to lower the probability of his being detected, provided that his gain from cheating is greater than his avoidance costs plus his altered expected penalty.[47] Because avoidance costs are generally subject to the law of diminishing returns,[48] in most situations, a little avoidance may be efficient for some fishermen, but the most serious cheating should still be deterrable for most. In situations where enforcement is particularly inefficient, however, it may also be completely ineffective, because fishermen may incur avoidance costs right down to a realized zero probability of detection.[49] A consideration of comparative efficiencies of enforcement and avoidance costs is thus crucial in determining the total costs of a particular approach to overfishing.

Enforcement costs are likely to be impacted by the perceived legitimacy of a regulation by the regulated fishermen.[50] To an arithmetic certainty, most existing regulations are greatly underenforced according to the deterrence model. The probability of detection in regulated fisheries is often near zero, and fines are often set far too low. For

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45. *See* Jon G. Sutinen & Peder Anderson, *The Economics of Fisheries Law Enforcement*, 61 LAND ECON. 387, 388-89 (1985).

46. Gary S. Becker, *Crime and Punishment: An Economic Approach*, 76 J. POL. ECON. 169, 180 (1968).

47. Anderson & Lee, *supra* note 30, at 681.

48. Jacob Nussim & Avraham D. Tabbach, *Punishment, Deterrence, and Avoidance* 19 (Tel Aviv L. Fac. Papers, Working Paper No. 28, 2007), *available at* http://law.bepress.com/taulwps/fp/art28.

49. Charles et al., *supra* note 37, at 99-100, 107 n.7, 108; *see* Anderson & Lee, *supra* note 30, at 681.

50. K. Kuperan & Jon Sutinen, *Blue Water Crime: Deterrence, Legitimacy, and Compliance in Fisheries*, 32 LAW & SOC'Y REV. 309, 309 (1998).

example, in a fishery where cheating resulted in gains of $15,000 per day, the fine ranged from between $3000 and $15,000.[51] With such underenforcement, no rational actor would obey the regulation, as the expected penalty is nearly zero, and, even when caught, the penalty is often less than the daily gain. However, the majority of fishermen choose to obey the regulations anyway, particularly when they view the regulations as legitimate.[52] This legitimacy may be a function of the fishermen placing a high value on the availability of future yields, or it may be because the regulations mirror what they view as fair, established practice. Even when regulations are viewed as highly legitimate, however, there will be a small percentage of self-interested rational actors who will nevertheless violate with impunity.[53] Numerous studies of fishery violations indicate that a small percentage, usually less than ten percent, of fishermen commit nearly all of the violations.[54] While perceived legitimacy may not impact these ten percent, it has a profound effect on the vast majority of fishermen, and the lowest enforcement costs may be achieved by employing a transparent, fair process that leads to regulations that are perceived as legitimate by the regulated fishermen. Heterogeneity amongst fishermen will impact this analysis, however, and if fishermen have sufficiently divergent views on fairness, it may be that no regulation will be sufficiently obeyed based on legitimacy alone in certain heterogeneous fisheries.

As is the case with transaction costs, enforcement costs are also impacted by the size and location of the fishery. Regulations that can be enforced at port are generally going to be less expensive than those that must be enforced at sea,[55] and fisheries with fewer entry and departure ports are going to be more easily regulated than those with numerous, geographically separated ports.[56] For regulations that must be enforced at sea, enforcement becomes more costly the further the fishery is from shore and the greater the area of the fishery.[57] Certain regulations may be detectable only on the fishing vessel itself, requiring random boardings or even permanently stationed enforcement personnel, both of which

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51. *Id.* at 311.
52. *Id.* at 311-12. Despite chronic underenforcement, compliance is usually near ninety percent.
53. *Id.* at 329-30.
54. *Id.* at 339 n.19.
55. *See* Lee G. Anderson, *Enforcement Issues in Fisheries Management Policy*, 6 MARINE RESOURCE ECON. 261, 265 (1989).
56. *See* Dale Squires et al., *Individual Transferable Quotas as a Fisheries Management Tool*, 3 REVIEWS FISHERIES SCI. 141, 158 (1995).
57. Jeffrey K. Randall, *Improving Compliance in U.S. Federal Fisheries: An Enforcement Agency Perspective*, 35 OCEAN DEV. & INT'L L. 287, 295 (2004).

may be extremely costly.[58] All else being equal, enforcement costs will be at their lowest in near-shore fisheries with limited ports of entry and be at their highest in offshore fisheries with numerous, geographically dispersed ports of entry.

C. Political Costs

Because regulations must be passed by a government actor that is accountable to some group of voters, political costs will come into play when top-down approaches are employed.[59] There are a number of political pressures that face the government actor in the realm of fisheries management, only beginning with pressures from the fishermen themselves. Fishermen will strongly oppose any measure that reduces their profits, and in the typical case where transactions costs do not allow fishermen to contract around heterogeneous skill, fishermen will also oppose measures that redistribute profits.[60] Fishermen will, however, generally support measures that increase rents by restricting access to outsiders. As long as the outsiders do not have political power, methods of restricting access such as government-issued permits are popular amongst fishermen and politically viable.[61] The goal of an overfishing control is to achieve sustainable yields, not fishermen profits, however, and the political power of fishermen is often a cost that must be overcome.[62] The determination of political costs must include an analysis of the relative political strength of all parties involved, and depending on the method employed, nonfishermen may have as much or even more political sway than the regulated fishermen themselves.

Political costs imposed by nonfishermen come from many diverse interest groups and may prove insurmountable in some cases. The largest and most powerful unregulated group is the consumer/taxpayer. This group is going to have little to no preference regarding equipment regulations such as net size, but will have a strong preference regarding regulations that will significantly raise taxes on the market price of fish.[63] Pigovian taxes, for example, have never been implemented as an overfishing solution, presumably due to strong consumer/taxpayer

58. *Id.* at 289.
59. *See* Charles Cox, *The Enforcement of Public Price Controls*, 88 J. POL. ECON. 887, 888-89 (1980).
60. Johnson & Libecap, *supra* note 32, at 1005-06.
61. *Id.* at 1015.
62. *Cf.* GISSURARSON, *supra* note 16, at 10.
63. *See* Robert N. Stavins, *Market-Based Environmental Policies: What Can We Learn from U.S. Experience (and Related Research)?* 15 (John F. Kennedy Sch. of Gov't, Working Paper No. RWP03-031, 2003), *available at* http://ssrn.com/abstract=42172.

opposition. The term "tax" by itself may be sufficient to kill any proposed regulation without a large interest group weighing in on the other side.[64] Other political interests include open-access egalitarians such as recreational fishermen who believe that the fisheries should be open to all.[65] There are also strong interests in favor of preserving traditional cultures.[66] If excluding such cultures from regulation undermines the regulatory system or would be costly to employ, these political costs may be difficult to overcome. The political costs imposed by environmental or animal rights groups, particularly endangered species advocates, are also of significant importance. These groups are most likely to become politically involved when a species is on the verge of extinction, and they tend to favor approaches that err on the side of overregulation regardless of economic costs.[67] All of the political costs imposed by these varying groups must be considered, and in order for a top-down approach to be politically feasible, it must be attractive to a group sizeable enough to overcome its opponents. The politically costless regulation is that which is universally approved of or that to which interests are universally indifferent. In most cases, however, political opposition from certain groups will be severe. Many otherwise effective regulations may require subsidies or compromises to gain the requisite support of a particular interest, and these costs must be factored into the total cost analysis.

D. International Cooperation

The issue of foreign fishermen is one that imposes both enforcement and political costs. Even if a regulation can be enforced efficiently at port, as may be the case with boat length, for example,[68] if foreign fishermen are able to enter the fishery and return to their own ports, the regulation will be ineffective. To the extent that access must be closed to foreign fishermen, enforcement at sea is a requirement so that the foreign vessels can be detected and removed. Fisheries with this risk

64. *See id.*

65. *See Stop Guided Sport Fishing Individual Fishing Quotas for Halibut in Alaska—A Public Taking*, CALIFORNIA FISH, http://www.californiafish.org/stophalbutifq.html (last visited Apr. 8, 2011).

66. *See* Tietenberg, *supra* note 36, at 401.

67. Matthew McDermott, *U.S. Should Push for Bluefin Tuna Fishing Moratorium, Conservation Groups Say*, TREEHUGGER (Nov. 17, 2008), http://www.treehugger.com/files/2008/11/United-States-should-push-for-complete-bluefin-tuna-fishing-ban.php.

68. The length of a fishing vessel is both easily observed and impossible to change when out of view, making it an ideal input control to enforce at port. Net size, on the other hand, is difficult to observe without boarding a vessel, and it is easy to swap a smaller net for a larger one when out of view of regulatory authorities.

are likely to have the highest enforcement costs of all. If such enforcement is too costly to be practical, or if the fishery is located in international waters, an international agreement that binds both foreign and domestic fishermen to the same regulations may be necessary. As is the case with the numerous domestic political interests, the interests of each nation will be diverse.[69] The approach that is politically most attractive in one nation may be unfeasible in another, making such agreements very difficult. Nations may also value the existence of a particular species of fish very differently, and some may be opposed to any regulation at all. As a result, side payments from one nation to another may be necessary, and the more nations involved, the more difficult these negotiations will be. For domestic fisheries that are subject to foreign intrusion, the enforcement and international cooperation costs must be considered, and these are likely to vary significantly from one approach to another.

E. Substitution Costs

Substitution is a predictable behavior when fishermen are regulated, and it has been the direct cause of the failure of many previously implemented controls. If a particular input such as net size is regulated, fishermen will simply increase the magnitude of another input if the cost of doing so is less than the marginal gains from catching the additional fish. This practice of substitution is known as "technology creep" when referring to equipment regulations,[70] but it is present with other forms of controls as well. The best-known example of substitution when an output control is used is the so-called "race for fish."[71] When fisheries managers limited the total number of fish that could be caught in a season, fishermen, instead of fishing at a steady pace over the course of a long season, fished at a furious pace over a very short period of time until the limit was reached. In some cases, the fishing season ended after only six days of frantic fishing.[72] This substitute behavior proved to be very costly. Fishermen spent more money to catch the same number of fish, the glut of fish brought to market lowered the market price, and the fish populations were largely decimated before they could reproduce. When

69. Rosemarie Allen, *Fishing for a Common Policy*, 19 J. COMMON MKT. STUD. 123, 123 (1980).

70. Adriaan D. Rijnsdorp et al., *Partial Fishing Mortality Per Fishing Trip: A Useful Indicator of Effective Fishing Effort in Mixed Demersal Fisheries*, 63 ICES J. MARINE SCI. 556, 564 (2006).

71. Parzival Copes, *A Critical Review of the Individual Quota as a Device in Fisheries Management*, 62 LAND ECON. 278, 279 (1986).

72. Grafton et al., *supra* note 34, at 684.

any approach to overfishing is implemented, substitute behavior must be anticipated and its costs calculated. If the costs of the substitute are greater than the costs of the unregulated behavior, then the approach is an ineffective one. In the case of technology creep, regulating an equipment input such as net size may ultimately require the regulation of every other piece of equipment on a boat to achieve the intended yield. Another costly form of substitute behavior is high-grading, a practice that will present itself in any approach that limits the number of fish an individual fisherman can catch while allowing him to capture the rents created by the shortage. High-grading is the practice of throwing back smaller fish so that the quota is filled with fish that will fetch the highest market price.[73] The problem is that many of the throwbacks die,[74] and in cases where the fisherman puts small fish on ice and waits to see if a bigger fish comes along, the throwbacks will already be dead when thrown back. As a result, more fish are removed from the population than are brought to market, and these must be accounted for in order to achieve sustainable yields. A determination of the total cost of any regulation must thus include the costs of regulating all substitute behaviors that would negate the initial control.

F. Skill-Misallocation Costs

Skill-misallocation costs are also a concern, particularly with regulations that limit access. A concept that is not unique to fisheries management is that the economy performs best when resources are utilized by their highest-value users. In unregulated industries, the price mechanism functions to ensure this ever-changing distribution, but if access is limited, the distribution will be less efficient. In the case of the fishery, access to fishing equipment and the fishery itself should be limited to the fishermen who can utilize these resources most efficiently. If access is limited to what is essentially a random group of fishermen, they will utilize that access inefficiently. Less efficient fishermen may mortally wound without catching more fish, or they may catch more fish than necessary, or their costs may simply be higher than necessary. When limited access must be combined with other controls to achieve sustainable yields, inefficient fishermen may be financially unable to implement needed controls that are otherwise feasible. Whenever a fishery manager considers an approach that limits access or imposes

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73. GISSURARSON, *supra* note 16, at 56.
74. Copes, *supra* note 71, at 285.

barriers to entry, he must estimate and include these efficiency costs in his total cost calculation, because they may be considerable.

G. *Information Costs*

The information required to design and implement an efficient regulation will also vary from fishery to fishery. The fishery manager must know how many fish are left in the fishery, the age of the fish population, and the time required for the fish to reach reproductive age in order to figure out how many fish can be sustainably caught in a given period of time.[75] To determine the level of enforcement or the severity of the regulation required, the manager must also know how costly it is for fishermen to catch fish at given population levels, and by estimating the market price at a particular catch level, how much a fishermen stands to gain by catching additional fish. Although these costs are likely to be great and will vary from one fishery to the next, they may not vary significantly from one approach to another. Information such as the remaining size of the fish stock and its reproductive capability is necessary for any method. Cost curves, on the other hand, are clearly just as necessary for approaches that incentivize sustainable yields by manipulating production costs, but perhaps they are not as necessary for approaches such as ITQs that simply set a quota. Regardless of whether information costs vary from one method to another, they are still important to calculate. If the total cost of eliminating overfishing is sufficiently high, no method would be advisable. In this situation, if the existence of a particular fish is valued highly enough, a moratorium may be the ideal approach because the benefits from sustainable fishing would be outweighed by the costs of ensuring sustainability. If, on the other hand, the existence of a species is not valued very highly, it may be most efficient to allow the unregulated commons to ensue until it reaches commercial extinction.

III. PRICE CAPS

In theory, a cap on the market price of fish could be used to control overfishing. The rational fisherman will catch fish until the marginal cost of production equals the market price. Because the marginal cost of production increases as more fish are caught, at a certain yield, additional fish will cost more to produce than the amount for which they can be sold. The market price therefore sets an effective catch limit, and a lower

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75. Arnason, *supra* note 17, at 410.

market price will result in a smaller catch. By lowering the market price, price caps can achieve smaller, more sustainable yields.

The hypothetical cost data in Table 1 demonstrate how price caps control overfishing. In this model fishery, unregulated fishermen will catch forty fish. At a yield of forty fish, the marginal fish costs $15 to produce but can be sold for $15.01. After forty fish, each additional fish costs $20 to produce but can be sold for only $10. As a result, no rational fisherman will catch more than forty fish. Suppose, however, that the sustainable yield in this fishery is only twenty fish. If unregulated, fishermen will catch twice as many fish as the fish population can replace through reproduction. If a price cap limited the price for which fish could be sold to $14, however, no fisherman would catch more than twenty fish, as each additional fish would cost more to produce than its market price.

Table 1

# Fish Caught	Marginal Cost of Production	Market Price
10	$5	$25
20	$10	$20
40	$15	$15.01
60	$20	$10

Compared to existing overfishing solutions, a price cap is most similar to a Pigovian tax, because it is a top-down solution that limits production by altering the market price. Whereas a Pigovian tax increases the market price to reduce consumer demand for fish, a price cap reduces the supply of fish by lowering the market price. Both methods work by removing rents from the fishery. The price cap transfers these rents to the consumer, while the Pigovian tax transfers them to the government.[76] Yet, in both cases, the fishermen are unable to realize the equilibrium market price of fish and consequently limit their catch. Price caps are also enforced in essentially the same fashion as Pigovian taxes. The enforcement of both takes place at the consumer level as opposed to monitoring fishermen at sea.

76. Once in the hands of the government, the government could put the rents to any use that it saw fit, such as giving them back to the consumers, to the fishermen, or to unrelated groups or expenditures. To be certain, funds would be lost in the process, but a transfer of rents to the government in a Pigovian tax regime does not mean that they must necessarily remain there.

An advantage of price caps is political attractiveness. Although Pigovian taxes are theoretically efficient, a tax on anything is potent political poison,[77] and Pigovian taxes have never been implemented as an overfishing control.[78] Price caps, however, are unlikely to meet similar political resistance. Although fishermen will resist price caps in favor of methods that will increase their rents, such as access controls, consumers like low prices and should overcome the fishermen.[79] The political appeal of price caps can be seen in rent control. Even though rent control fails to achieve its primary goal of increasing the supply of affordable housing, it retains enough support to overcome the landlords.[80] Low prices, even artificially low prices, are attractive to voters looking for a free lunch. Price caps also preserve the open fishery. As with lower prices, an open fishery is opposed by fishermen who can earn rents through barriers to entry. But their resistance may be overcome by a widespread appeal to open-access egalitarians, sport fishermen, and those concerned about the ability of traditional cultures to continue to catch fish without regulations.

Price caps may also have efficiency advantages over other regulations. Because there are no barriers to entry for newer, better fishermen, resources will be allocated more efficiently. Although price caps will need to be adjusted as better fishermen lower their costs of production, reductions will be passed onto consumers. The most significant efficiency advantage of price caps is the potential elimination of at-sea enforcement. While price caps will need to be enforced, in some cases, the necessary price enforcement should be less costly than the enforcement of a variety of inputs and outputs at sea.[81]

The theoretical effectiveness of fish price caps can be illustrated by a comparison to a more traditional use of price caps: rent control. While the goals of these two price caps are different, they function in a similar fashion. The goal of rent control is to achieve a larger supply of affordable housing,[82] whereas the goal of fish price caps is to achieve a smaller, sustainable supply of fish. It is well-documented that rent

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77. *See* Stavins, *supra* note 63, at 15.

78. *See* Johnson & Libecap, *supra* note 32, at 1015.

79. *See* Cox, *supra* note 59, at 889.

80. Walter Block, *Rent Control*, LIBRARY OF ECON. & LIBERTY, http://www.econlib.org/library/Enc/RentControl.html (last visited Apr. 8, 2011).

81. *See* Sutinen & Andersen, *supra* note 45, at 391. Quota enforcement requires aircraft, patrol boats, onboard and onshore observers, and judicial personal.

82. Edgar O. Olsen, *An Econometric Analysis of Rent Control*, 80 J. POL. ECON. 1081, 1099 (1972).

control generally fails to increase the supply of affordable housing.[83] By limiting the market price of rent, rent control regimes predictably cause landlords to supply less, not more, affordable housing, as rational landlords will not supply housing units that cannot be rented at a profit.[84] Fish price caps similarly reduce supply, although their goal—reducing the supply of fish—is aligned with this effect.

It can be argued that, because housing may be easier to monitor than fish, it may be more difficult to violate the price cap in a rent control regime than in a fish price-cap regime. In other words, because landlords are less able to cheat than are fishmongers, rent control may be more effective at reducing supply than fish price caps. While cheating will be a problem, as is the case with any regulation, it is not clear that it will be any easier to violate a fish price cap. Landlords are able to cheat in rent control regimes in subtle ways, such as skimping on maintenance and services.[85] In addition, the fish stock is not monitored at sea in a price control regime, but at fish retailers. Retailers may be no greater in number than apartment buildings, suggesting that fish price caps will be no easier to violate than rent control.

For an illustration of the worst-case-scenario magnitude of cheating and its impact of the effectiveness of a price-cap regime, a better comparison is to minimum-wage regulations. The comparison is not as straightforward as rent control because wage controls impose a floor rather than a ceiling, but the effect is similar in that the supply—in the case of minimum wage, of jobs—is reduced. The effect of minimum wage on the job supply is well-documented,[86] even though cheating in minimum-wage regimes is a significant problem. Employers are more diverse and numerous than fish retailers, and evidence such as the size of the illegal immigrant population suggests widespread employer cheating. In addition to the blatant cheating practice of illegally paying workers below the minimum wage, employers can also cheat minimum wage in more subtle ways. Such methods include requiring work during breaks, selectively allocating hours on time cards to avoid overtime, or deducting fees for services not provided. Although wage controls can be avoided, they have been shown to negatively impact the job supply.[87] It is,

83. *Id.*

84. This result will of course differ if there is a subsidy involved, which is often the case with modern affordable housing programs.

85. *See* Steven N.S. Cheung, *A Theory of Price Control*, 17 J. L. & ECON. 53, 63 (1974).

86. 50 Years of Research on the Minimum Wage, JOINT ECON. COMM., 104th CONG. (Feb. 15, 1995), http://www.house.gov/jec/cost-gov/regs/minimum/50years.htm.

87. *Id.*

therefore, reasonable to conclude that fish price caps would at least similarly reduce supply.

IV. COSTS OF PRICE CAPS

Although price caps may be effective in theory, overfishing control is a world of second best, and price caps will not be the most efficient method in all fisheries. Whether they are going to be most efficient in a particular fishery depends on the balance of costs. While price caps have attractive advantages described above in Part III, they also have unattractive costs that, in some fisheries, may prove prohibitive. This Part describes these costs and identifies factors that may impact their significance in a particular fishery.

A. Political Costs

Price caps are likely to appeal to consumers, advocates of traditional cultures, and open-access egalitarians. But price caps will be reviled by other interest groups that, in some cases, may be stronger than the supporters. Fishermen are the obvious opponents of price caps. Although profits will be similar to those in a completely unregulated fishery, most fisheries are currently regulated in ways that aid fishermen, such as access limitations.[88] As a result, price caps would likely increase competition without an increase in profits. Fishermen prefer regulations that create rents, such as tradable permits. If political support in a particular jurisdiction is unlikely to overcome fishermen opposition, then price caps will not be an option without additional subsidies or bargains that will lower their overall efficiency.

Fish connoisseurs are also likely to oppose price caps. If the price of fish is capped, restaurants will have no incentive to invest in expensive preparations. Capped fish are even likely to disappear from fine dining establishments altogether, because the restaurants with the lowest overhead are those that will pay the fish supplier the highest price. As a result, a capped fish may be available only as, for example, a fried fish sandwich or as sushi, or at a fishmonger for home preparation. Although the fish connoisseur is not going to find her favorite fish at a gourmet restaurant if it is fished to extinction, she would prefer overfishing controls that allow restaurants to charge a market price.

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88. Johnson & Libecap, *supra* note 32, at 1015.

B. Enforcement Costs

As is the case with most overfishing regulations, enforcement is likely to be the most significant cost of price caps.[89] There are three possible locations of the price enforcement: at the downstream consumer level (the price at which the consumer purchases the fish from a restaurant or fishmonger), at the retailer level (the price at which the restaurant or fishmonger purchases the fish from the supplier), or at the supplier level (the price at which the supplier purchases the fish from the fisherman). Fishermen will be opposed to all three, because none provide the ability to earn rents.

Only at the consumer level of enforcement are rents distributed to consumers. The alternate methods involve the distribution of rents to restaurants or suppliers. As a result, the primary political advantage of price caps—their appeal to consumers—is lost if the price is not enforced at the consumer level. Black markets are also more likely to form if the cap is enforced at the upstream levels. At these levels, buyers and sellers are repeat players and have incentives to sell under the table at a higher price that would undermine the regulation.

At first glance, the main problem with consumer-level enforcement would appear to be the nearly infinite transaction locations, each of which needs to be monitored to ensure that the price cap is not being violated. While monitoring costs may be prohibitive under regulatory regimes in which both buyer and seller have an incentive to cheat, in a fish price-cap regime, consumers may be employed to monitor the transactions inexpensively. Although repeat customers will have an incentive to overpay (for example, pay an equilibrium price that exceeds the price cap) to get their favorite fish more frequently, not all customers of restaurants and fishmongers are repeat customers. While restaurants may be able to charge off-menu higher prices for customers they recognize, the existence of infrequent customers will prevent across-the-board violations of the price cap. If infrequent customers are given an incentive to report violations, such as an entitlement to a percentage of the fine collected from the violator, sellers should be deterred from selling capped fish at prices exceeding the cap. This is particularly true if sellers have difficultly accurately discriminating between customers looking to establish a black market relationship and those looking to cash in on the fine.

Although consumer enforcers may be less expensive than professional enforcers in this context, additional costs associated with

89. *See* Sutinen & Anderson, *supra* note 45, at 394.

consumer enforcement should be taken into account. Information costs are likely to be higher for consumer enforcement because the fishery manager must disseminate information to the public at large, as opposed to a limited number of trained officials. A mechanism for collecting reports of violations, determining their authenticity, and levying and collecting fines must also be established. To the extent that this mechanism does not perfectly deter, it can be partially paid for by the fines collected. Because the cost of enforcement will increase as deterrence improves, the most efficient level of enforcement, presuming diminishing marginal returns, is likely to be something less than perfect.

Consumer-level deterrence may prove to be quite efficient, however. Sellers of alcohol, for example, consistently ask for age verification from purchasers who appear to be anywhere in the vicinity of the age floor. As is the case of fish sellers, alcohol sellers have an incentive to sell to underage buyers, yet they appear to be effectively deterred by the possibility of being caught by consumer-level enforcement. Compared to underage alcohol purchasers, fish consumers do not have the same all-or-nothing choice in which they either buy illegally or do not buy at all. They are also free of likely social, parental, and legal sanctions for their part in a violation, and are thus more likely to report a violation. Consumer enforcement of fish price caps may therefore be even more efficient than enforcement of alcohol age restrictions.

C. Substitution

An enforcement problem is that, due to the possibility of substitution, determining a fish-price-cap violation is more difficult than determining an age violation. The age requirement for alcohol does not vary with the amount of alcohol purchased. The cigarette tax, another regulation enforced downstream, is levied per pack, which is similarly easy to calculate and collect. A price cap of fish, if it is to mean anything, must be based on a specified amount of fish.

If fish retailers can sell an eight ounce portion for the price of a nine ounce portion, then the effectiveness of the price cap is diminished. The greater the size substitution, or underportioning, the retailer can get away with, the less effective the price cap.[90] There is, however, a natural limit to the underportioning problem. While retailers may be able to cut out an ounce or two, they will not be able to sell a half-sized portion without

90. Underportioning effectively raises the sale price of the fish. As a result, a given quantity of fish will be more valuable to the retailer who will pay more, resulting in fishermen realizing a higher market price and thus catching more fish.

consumer detection. Although the ability to get away with slight underportioning is a problem for price caps, the standard that price caps must meet to merit consideration is not perfect enforcement—no alternative regulation can meet that standard. Further, price caps will not suffer from the underportioning problem when the regulated species is consistent in size and sold in identifiable portions. If the price cap on sardines, for example, were set by the entire fish, underportioning would not be a problem. Mid-sized fish, such as snapper, might be set at a half-fish filet size such that deviations could be detected by the consumer without significant difficulty.

Another form of substitution that hinders the detection of violations is substitution of the species of fish. Species substitution is extremely hard to detect, as demonstrated by the ability of fish retailers in Florida to substitute species such as basa, a Vietnamese catfish, for expensive grouper.[91] Fish retailers may in certain circumstances be able to sell a capped fish as a noncapped fish, charging the higher price of the unregulated fish. But there are natural limits to species substitutions. An uncapped fish, due to its presumably greater supply and lower demand, is not likely to command a significantly higher market price, and if the fish is dissimilar in flavor, appearance, or texture to the capped fish, the substitution is likely to be detected.

Species substitution is likely to be a serious, even prohibitive, problem only when there exists an undetectable substitute with a market price that is greater than the capped price of the regulated species. For example, although grouper has many close substitutes that make it vulnerable to species upgrading (selling cheaper fish as grouper), it may not be vulnerable to species downgrading (selling grouper as cheaper fish). Although grouper and basa taste similar enough to routinely avoid detection, the market price for the Vietnamese catfish is likely to be so low that downgrading is not sensible.[92] If, however, the market price of grouper must be capped so low that basa is more valuable, downgrading will occur. But because even the downgraded price will be significantly lower than the unregulated market price of grouper, yields will still decrease. Species substitution is more likely to be a problem for a species like bluefin tuna. Bluefin, due to its close proximity to extinction,[93] would need to be capped very low in order to achieve yields

91. Brendan Farrington, *Fake Grouper Turns Up Around Florida*, USA TODAY, Jan. 3, 2008, http://www.usatoday.com/news/nation/2008-01-03-2409414939_x.htm.

92. *Id.* (noting that basa sells for $2.50 a pound compared to $6 a pound for grouper).

93. *See Mediterranean Bluefin Tuna Stocks Collapsing Now as Fishing Season Opens*, *supra* note 11.

small enough to allow the stock to rebuild. In addition, bluefin can be downgraded, perhaps undetectably, to another species of tuna such as ahi, which itself commands a high market price. The combination of a low cap and a high-value substitute from the same family renders the price cap ineffective. Such close substitutions are likely to be detectable only through DNA testing,[94] requiring professional enforcement and great expense. Under these circumstances, price caps are unlikely to be an efficient means of regulation.

D. Market Clearing

A cost of price caps that is not associated with other overfishing controls is the cost of clearing the market. Because the market price of fish is capped at a level below the equilibrium price that is set by unregulated supply and demand, there will be a shortage.[95] In the absence of a market clearing price, the market will clear by methods other than price, and these methods may impose significant costs.[96] For example, if the market clears through violence rather than willingness to pay, price caps look like an unattractive solution.

Although some market clearing mechanisms lack such obvious negative effects, each has its own costs and, compared to the price mechanism it replaces, will have some redistributive effect.[97] Downgrading of preparation, for example, may go a long way toward clearing the market. If a fish's value is highly dependent on the preparation, downgrading may even clear the market completely. But downgrading will be costly to connoisseurs and have redistributive effects in favor of those with less discriminating tastes. The remaining shortage may be resolved with a form of queuing, either a first-come-first-served regime, or a reservations requirement. The selected method of queuing is likely to differ from restaurant to restaurant and each will have different redistributive effects.[98] A first-come-first-served queue will favor those who enjoy eating early or do not have typical time constraints, such as retirees.[99] A reservations queue will favor those who are able to plan in advance. Although these market clearance methods do not use the price mechanism, the distribution they create is not

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94. *See* Farrington, *supra* note 91.
95. *See* Cheung, *supra* note 85, at 54; *see also* Cox, *supra* note 59, at 894.
96. *See* Cheung, *supra* note 85, at 54-55.
97. *See* Cox, *supra* note 59, at 889.
98. *Id.* ("Generally, a regime of price controls redistributes income to buyers who have a comparative advantage in acquiring goods under nonprice rationing.").
99. *Id.* at 890.

necessarily inefficient, just as the line at the supermarket is not necessarily inefficient.[100] The actual time spent in line is a deadweight loss, however, and must be considered a cost. In addition, the redistribution is likely to manifest politically.

More problematic methods of market clearance are those that will undermine the effectiveness of the regulation, such as side-transactions. If the additional fish are allocated by methods such as side-payments of cash or services that provide added value to the seller, they will have the same effect as raising the price of fish, resulting in greater yields. To mitigate this problem, the enforcement system must deter offering or accepting such side-transactions.

E. Devaluation

In a price-cap regime, fishermen will have no incentive to maximize the value of caught fish and will thus not take the same care in bringing their catch to market as in an unregulated fishery. This devaluation is the opposite of high-grading—rather than throwing away less valuable fish to bring only the highest value goods to market, fishermen will keep everything landed and take no care to ensure it is kept in good condition. Devaluation costs are most serious to the extent they cause health problems. If a nearly spoiled fish, or even a spoiled fish, is still more valuable than the capped market price, fishermen will cut preservation costs to devalue the fish to this level and, by lowering their cost of production, both catch too many fish and facilitate unsafe consumption.

Although a certain amount of devaluation may be ideal because it helps the market clear, too much is a problem because it may both impose health costs and work to undermine the effectiveness of the regulation.[101] If the price cap is significantly below the market price, devaluation will occur. Additional regulations and professional enforcement may be necessary to ensure that fishermen are meeting minimum health standards, and these costs must also be accounted for. Devaluation may also manifest politically, because consumers are unlikely to be enthusiastic about spoiled, mutilated, or off-flavor fish.

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100. Cheung, *supra* note 85, at 71.

101. Devaluation is efficient if cost-cutting reduces production costs only a little but reduces the demand significantly. This would mitigate the shortage problem and only slightly increase the amount of fish caught. If, however, cost-cutting saves the fishermen a significant amount and only slightly reduces demand, the shortage problem will remain, only to be exacerbated by the more significant price cap required to ensure sustainable yields. It is likely, however, that fishermen have already taken cost-cutting measures that save them significant costs without significantly impacting demand.

The price mechanism helps to mitigate these concerns, however. Consumers will not pay more than the price at which they value the fish, and if fishermen devalue fish too much, the market price will dip below the price cap, setting a natural limit to the devaluation. In addition, as long as consumers are getting what they pay for, their complaints about imperfect fish should be muted, although so too will be their enthusiasm for a price-cap regime, the attractiveness of which is premised on consumers getting more than what they pay for.

F. Information Costs

The price-cap approach requires that the fishery manager incur information costs that are not required for the implementation of many alternative approaches. In some fisheries, these additional information costs may render price caps impractical. To implement an effective price cap, the fisheries manager must first determine the sustainable yield of the fishery. Although this information may be costly to acquire, it is also required for any other overfishing regulation. The potential problem is that, in addition to determining the sustainable yield, the fishery manager must also determine the production-cost information required to convert that yield into a price.

In fisheries with few, relatively fixed inputs, this additional information may be acquired at a relatively low cost. And in fisheries that are not on the brink of collapse, something akin to a trial-and-error approach may be an effective means of converting the sustainable yield into a price cap at a low information cost. In many fisheries, however, the cost of acquiring this additional information may prove prohibitive.

V. PRICE CAPS COMPARED TO OTHER SOLUTIONS

Although certain types of overfishing regulations, such as input controls, have been largely discredited as effective methods of achieving sustainable yields, the most efficient method in a given fishery is determined by the balance of costs. This balance will vary from method to method and from fishery to fishery. It is thus conceivable that, in an ideally suited fishery, even input controls or flat catch quotas would be the most effective method. As my focus is on introducing price caps as a tool for achieving sustainable yields, this Article does not seek to determine the ideal method in any particular fishery. Rather, for the purpose of highlighting the viability of price caps, this Part will make a rough comparison between price caps and existing methods and suggest factors that might make price caps more or less efficient. Because ITQs are currently given the most attention in both academia and the press, I will focus most heavily on that comparison. However, because the most effective method is highly fishery-dependent, ITQs will not always be the dominant strategy, and other methods merit some discussion as well.[102]

A. *Input Controls*

Input controls are generally rendered ineffective by technology creep, the diversion of resources to an unregulated input to compensate for a regulated one.[103] If, however, a fisherman's cost of production is determined by limited inputs without substitutes, technology creep is not going to be a problem. Due to the complexity of most fishing operations, this prerequisite seems unlikely to be met, but that is a factual determination to be made by the fishery manager. Even if substitution were not a concern, however, the efficiency of input controls depends largely on enforcement. If enforcement is particularly efficient, then input controls may be a very effective method. In offshore fisheries or geographically large fisheries, however, enforcement is likely to be both costly and ineffective. For example, even if net size can be monitored inexpensively at port, once at sea, fishermen can twist large nets together to undermine the regulation.[104] This sort of covert cheating is likely to be detected only by the use of onboard regulatory personnel, an enforcement mechanism that may be prohibitively costly. Input controls are, however, among the easiest to implement politically.[105] By preserving the status quo and not redistributing income amongst fishermen, input controls are generally supported by the regulated fishermen.[106] Price caps, on the other hand, may have sufficient consumer support to overcome the fishermen, although this might not be the case in jurisdictions with particularly powerful fishermen interest groups. As a result, the relative effectiveness of price caps and input controls in a given fishery is likely to hinge on enforcement factors because both types of controls should be politically attractive in most situations.

There are two primary enforcement considerations. First is the relative effectiveness of identifying and deterring substitute behaviors. In

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102. See *supra* Part II for a comparison of Pigovian taxes and price caps.
103. *See* Hsu, *supra* note 6, at 131.
104. *Id.*
105. *See* Johnson & Libecap, *supra* note 32, at 1018.
106. *See id.* Note, however, that if fishermen use heterogeneous techniques and equipment, input controls will redistribute income.

the case of input controls, technology creep is the primary concern. In the case of price caps, underportioning and species substitution must be dealt with. This determination will hinge on the availability of these substitute behaviors in a particular fishery, as the costs of detection and deterrence will be dependent on availability. As explained in Part III, species substitution is going to be a more severe problem when a capped fish has an uncapped substitute that commands a high market price. In an input control regime, on the other hand, technology creep is going to be a more severe problem in fisheries where production cost is determined by a large number of complex, scalable inputs. The second enforcement consideration is the cost of ensuring that the regulations are being followed, which, in this case, is primarily a comparison of the costs of enforcing the downstream price control at the point of sale versus enforcing the upstream technology or effort control on the fishing vessel itself. Notably, enforcement of the price control should not vary based on the location of the fishery, whereas proximity to shore and geographic size of the fishery are crucial factors in determining the enforcement costs of input controls.[107] Therefore, in large, offshore fisheries, price caps are likely to be less expensive to enforce than input controls, although this might be outweighed by substitution problems in certain cases. Bluefin tuna, for example, are caught offshore where input-control enforcement is unattractive, but they also have valuable substitutes such as other species of tuna that will make price controls difficult to enforce, and it is thus not obvious which method would be the most efficient in the bluefin fishery.

Although both input controls and price caps should be politically feasible enough to implement domestically, international politics are a significant factor for fisheries located in international waters. Input controls are attractive to fishermen only to the extent they preserve the status quo. To the extent that fishing techniques are heterogeneous, input controls are going to meet significant resistance, as they are likely to have redistributive consequences.[108] Price caps, however, may prove to be attractive internationally for the same reasons that they are attractive domestically. The promise of lower prices resonates with voters in many countries, as evidenced by the popularity of price controls in other nations.[109] However, in domestic offshore fisheries that are subject to

107. *See* Anderson, *supra* note 55, at 265.

108. The fight over the two boat technique of the Vietnamese in the Texas shrimp fishery is indicative. Johnson & Libecap, *supra* note 32, at 1007.

109. *See* Peter Mitchell, *Price Controls Seen as Key to Europe's Drug Innovation Lag*, NATURE REVIEWS DRUG DISCOVERY, Apr. 2007, at 257-58; *see also* Andrew Higgins, *Russia*

foreign intrusion, as opposed to fisheries located in international waters, limiting access to domestic vessels may be easier than achieving any international agreement. If this is the case, then the question is whether enforcement of access makes enforcement of inputs less expensive. If the same enforcement mechanisms can enforce both access and inputs at the same cost as access alone, for example, then where access control is required, input controls are likely to be more efficient than price caps, because they do not require any additional enforcement mechanisms. Whether this is the case in a particular fishery requires a factual determination by the fishery manager, but the impact of any required access controls on the enforcement costs of other at-sea regulations is a significant factor to consider.

B. Informal Contractual Arrangements

Bottom-up approaches, including both formal and informal contractual arrangements, are currently limited by antitrust law to informal arrangements.[110] These informal arrangements, such as those used by the Maine lobstermen, may be efficient options in certain fisheries with low transaction costs.[111] The fact that informal arrangements are so infrequently found[112] suggests that, in most cases, transaction costs are prohibitive. In fisheries where transaction costs can be overcome, bottom-up contracts are created by fishermen independent of any action of a fishery manager. As a result, the question for the fishery manager is not where to implement informal arrangements, but rather, where they already exist, whether to preempt them with top-down controls. Any top-down control, price caps included, requires the creation and intrusion of what is likely to be a hulking regulatory apparatus. This government intrusion is not necessary in an informal contractual arrangement. Top-down controls must be accepted by the political process and then adequately enforced, likely at the cost of the taxpayer. Therefore, even if price controls are more effective than other top-down controls in a fishery with an informal arrangement in place, it does not stand to reason that price controls should necessarily be used to preempt that arrangement.

Returns to Price Controls, INDEPENDENT, Jan. 6, 1993, http://www.independent.co.uk/news/world/Europe/Russia-returns-to-price-controls-1476812.html.

110. *See* Adler, *supra* note 6, at 29.

111. Acheson, *supra* note 23, at 184.

112. Johnson & Libecap, *supra* note 32, at 1007 (noting that voluntary contracting is absent in over ninety percent of the U.S. lobster fishery).

Top-down preemption should take place only if the societal costs of implementing price caps are less than the societal costs of leaving the contractual arrangement undisturbed. Informal arrangements require a privately enforced limitation of access to the fishery. As is the case in any limitation on access, there are efficiency costs to such a scheme because the fishery resources are unlikely to be allocated to their highest value users. In the case of the Maine lobstermen, access was often limited by the destruction of private property,[113] and this itself imposes costs on society, particularly if public law enforcement resources are employed as a result. Informal approaches are also unlikely to be designed based on the same accuracy of information used by the fishery manager. As a result, they may be calibrated to produce yields that are either above or below the optimal level. These costs must be accounted for and compared to those of price caps in a particular fishery. While, in many cases, it may be most effective to allow informal arrangements to remain where they have formed, in situations where the informal arrangement covers only a portion of a larger fishery, preemption may be necessary to ensure that the larger control is effective.

C. ITQs

ITQs, much like the similar cap-and-trade pollution controls,[114] are currently the most discussed solution of the overfishing problem in both academic[115] and mainstream circles.[116] ITQs have been, to varying levels, successful at decreasing yields in the fisheries in which they have been implemented.[117] There are, however, reasons to suggest that ITQs have not been as successful at moving towards sustainable yields as some of these studies suggest. An ITQ system creates a strong incentive to high-grade, and the fish that are discarded in favor of larger, more valuable fish, even if alive when thrown back, have high mortality rates.[118] For purposes of achieving sustainable yields, these throwbacks should be included (at some discount to account for the chance of survival) in the catch statistics, but for obvious reasons, these data are not available.

113. Acheson, *supra* note 23, at 187.

114. *See* Richard L. Revesz & Michael A. Livermore, *Obama's Carbon Cap-and-Trade Plan Can Boost Growth*, BUS. WK., Mar. 10, 2009, http://www.businessweek.com/bwdaily/dnflash/content/Mar2009/db20090310_825431.htm.

115. *See* Adler, *supra* note 6, at 17.

116. *See A Rising Tide*, *supra* note 33, at 97.

117. *See* Costello et al., *Can Catch Shares Prevent Fisheries Collapse?*, 321 SCIENCE 1678, 1678 (2008).

118. *See* Copes, *supra* note 71, at 284-85.

Data-fouling, or the underreporting of data, is also a concern.[119] Yields are often calculated based on catch data provided by the fishermen themselves.[120] Because a fisherman in an ITQ fishery still has an incentive to catch additional fish (which results in significant additional value today and has only a fractional impact on the future value of his permit), if he can inexpensively avoid penalties by simply underreporting his catch, he is likely to do so. For these reasons, data indicating the reduction of yields in ITQ fisheries should be viewed with some skepticism. Past experiences with overfishing controls indicate that data on catch rates are not necessarily indicative of actual reductions in the fish stock. In the Atlantic cod fishery, even while the catch data suggested sustainable yields, the stock was rapidly moving towards commercial extinction.[121] ITQs are almost surely not as effective at a given level of enforcement as the data indicate. While they may indeed be the most effective method in a particular fishery, enforcement may need to be increased over current levels.

A significant factor in determining whether price caps or ITQs will be more efficient in a particular fishery is the political landscape of the relevant jurisdiction. There is evidence that suggests that fishermen support ITQs,[122] whereas they are, to a near certainty, going to oppose price caps. Therefore, there are likely to be jurisdictions, those in which fishermen's interests are supreme, where ITQs are politically feasible while price caps are not. Fishermen tend to support ITQs, however, only when they provide a barrier to entry. ITQs require a limited access fishery (which itself may be politically problematic), and to overcome the efficiency problems that ordinarily accompany limited access, ITQs must be distributed to the highest value users by auction and be freely transferable.[123] If these two conditions are not met, ITQs have the same efficiency problems as other controls that limit access. Unfortunately, fishermen are most likely to support ITQs that are freely given to existing fishermen and have limited transferability, both significant barriers to entry and the efficient allocation of fishery resources. An efficient ITQ system is thus likely achievable only in jurisdictions where fishermen's interests are subordinate to those that prefer the more efficient approach. Therefore, whether adequate political interests exist to outweigh the fishermen and achieve an efficient ITQ system is an

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119. *Id.* at 282-83.
120. *Id.*
121. *See* Steele et al., *supra* note 1, at 65.
122. *See A Rising Tide*, *supra* note 33, at 97.
123. *See* Tietenberg, *supra* note 36, at 411.

important consideration. While price caps appeal to many consumers and should, in many cases, achieve sufficient support to overcome the fishermen lobby, ITQs may have more difficulty developing such support. If a price-cap regime is politically feasible in a jurisdiction in which only an ITQ system with barriers to entry is equally feasible, then the efficiency costs of those barriers to entry must be counted against the ITQ system. That legal battles[124] and a legislative moratorium[125] have resulted from the thorny issue of ITQ allocation suggests that, for political reasons, an efficient ITQ system may be very difficult to implement in many fisheries. Indeed, thus far, the initial allocation of tradable permits has only been through free distribution,[126] indicating that the political costs of an ITQ system without barriers to entry may be effectively impossible to overcome.

In fisheries where an international treaty is necessary to prevent fishermen from other countries from undermining domestic overfishing regulations, ITQs may compare more favorably to price caps than do other top-down regulations such as input controls. Although there are likely to be squabbles over the allocation of permits, the basic political feasibility of ITQs in the international arena has been demonstrated by the adoption of pollution cap-and-trade controls as part of the Kyoto Protocol.[127] Permits can also be allocated to address any redistributive concerns.[128] While an international auction might be ideal from an efficiency perspective, as long as each country allocates its share of permits efficiently and allows for transfers, the cost of a suboptimal international allocation may only be minimal. It is thus not clear that price caps would have the same political advantage internationally that they may appear to have domestically.

The comparison of enforcement costs between price caps and ITQs should be similar to the comparison between price caps and input controls. The primary distinction is downstream versus upstream enforcement. While downstream enforcement is unlikely to be impacted by the location and size of the fishery, the cost of upstream enforcement

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124. *See* Parzival Copes & Gíslí Palsson, *Challenging ITQs: Legal and Political Action in Iceland, Canada and Latin America*, IIFET 2000 PROCEEDINGS 2 (2000), *available at* http://oregonstate.edu/dept/iifet/2000/papers/copes.pdf.

125. Adler, *supra* note 6, at 19.

126. Stavins, *supra* note 63, at 14-15.

127. *See Kyoto Protocol to the United Nations Framework Convention on Climate Change*, Kyoto, Japan, Dec. 11, 1997, U.N. Doc. FCC/CP/1997/L.7/Add.1 (Feb. 16, 2005), *available at* http://unfccc.int/kyoto_protocol/items/2830.php.

128. *See* Tietenberg, *supra* note 36, at 410-11.

is primarily determined by these factors.[129] ITQ enforcement is therefore likely to be more efficient in near-shore, geographically compact fisheries in which enforcement resources need not be as spread out. As is the case with input controls, output limits may be very expensive to enforce in offshore fisheries, and onboard personnel may be necessary to ensure compliance. In these situations, price-cap enforcement is likely to be less expensive. While price-cap enforcement must account for underportioning, species substitution, and side bargaining, ITQ enforcement must account for black market sales of additional fish. As described above, the incentives for illegal transactions in a price-cap regime will vary based on the particular species of fish. For certain species of fish, retailers will be incentivized to incur such high avoidance costs that enforcement may be less efficient than even offshore ITQ enforcement, although this should not generally be the case. As is the case with input controls, in fisheries where the risk of international intrusion requires access enforcement, the economics may favor ITQs, likely to a greater extent because the cost of access control is already factored into ITQ enforcement.

High-grading substitution is likely to be a very costly effect of ITQs, but this must be balanced against the costs of low-grading substitution in a price-cap regime. If low-grading results in consumer health problems, the associated costs may be very significant. While both low-grading and high-grading can work to diminish the fish stock below sustainable levels, the yield effects of low-grading are more easily controlled by reducing the price cap to account for the lower, low-graded cost of production. This does not, of course, mitigate any potential health effects, which may need to be controlled by additional regulations. The impact of high-grading on fish stocks cannot be as easily controlled for, as a dockside count of the number of fish caught when the fishing vessel has returned to port will not reflect the fish that died as a result of high-grading. Because the incentive to high-grade is strong in an ITQ regime, onboard monitors may be required to eliminate this practice, and depending on the profitability of high-grading in a particular fishery, bribery may render even these costly enforcement mechanisms ineffective.

A possible advantage of ITQs over price caps is lower information costs. Both methods, along with any other method, require knowledge of the number of fish remaining and their reproductive ability to determine how many fish can be removed each season. With ITQs, once the

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129. *See* Anderson, *supra* note 55, at 265.

sustainable yield is determined, implementation begins. To implement price caps, however, the fishery manager also needs to determine the cost curves of the fishermen because regulation depends not only on the number of fish to be removed, but also on the level of effort needed to achieve that yield.[130] The magnitude of this information-cost advantage for ITQs will depend on the difficulty in establishing cost curves, which is likely dependent on the technical complexity of the fishing operation. In fisheries where cost curves are very expensive to determine accurately, price caps are less likely to be the most efficient solution. However, in ITQ regimes where avoidance expenditures must be predicted to determine efficient levels of deterrence, it will be necessary to calculate cost curves to determine the marginal gain to fishermen from catching additional fish. When this is the case, the information-cost advantage of ITQs disappears.

The viability of any overfishing solution is likely to be dependent on the aggressiveness of its implementation. Fishermen employ equipment that is designed to be profitable under current, largely unregulated conditions, and this equipment is thus likely to be prohibitively expensive to use if drastic reductions are made in the allowable yield. Because equipment is not linearly scalable, any regulation may need to be gradually implemented to allow fishermen to modify, substitute, or eliminate equipment so that they can profitably achieve the sustainable yield. In a fishery where the sustainable yield is fifty percent of the current yield, for example, the fishery manager may need to cut the allowable yield by a small percentage each year instead of moving straight to the sustainable yield. If this is the situation, the method of regulation employed must be scalable. Significantly, price caps can be slowly lowered from the market price to the price resulting in sustainable yields over any period of time. If, however, the fish stock is close enough to commercial extinction that even moderate levels of overfishing caused by this gradual approach will result in commercial extinction, it may be necessary to lower the cap all the way to the sustainable level, effectively imposing a moratorium until fishermen are able to acquire the proper equipment. Relative levels of scalability are unlikely to vary from method to method, but because price caps will result in the removal of rents from the fishery, it may take fishermen longer to make the necessary equipment reductions than under regulatory systems such as ITQs that allow fishermen to realize rents. This factor

130. Arnason, *supra* note 17, at 410.

must also be taken into consideration by the fishery manager when determining the most efficient solution.

D. The Ideal Price-Cap Fishery

The efficiency of price-cap regulation relative to a given alternative is dependent on factors that vary from fishery to fishery. I have identified some of these factors here, and they can be used to hypothesize what an ideal price-cap fishery might look like. Price caps are most attractive in fisheries where the advantages of retail enforcement over at-sea enforcement are greatest. Thus, the ideal price-cap fishery is located far from shore, but not far enough for international intrusion to be a concern (presuming that international agreements are not possible, or, if they are, that a price-cap treaty is less politically viable than alternatives). The fishery will cover a vast area and ports of entry will be numerous and geographically dispersed. Fishermen will not be incentivized to cut preservation costs to levels low enough to result in health effects, and this should be the case where preservation costs are relatively unscalable and the species is naturally resilient. In addition, the fishing operation will be transparent and technologically simple enough to determine cost curves inexpensively. The fish itself will be easily identified by consumers, have no high-market-value substitutes, and, ideally, will be small enough to be sold and served by the fish, rendering underportioning and species substitution difficult. Finally, the fishery can be regulated by a jurisdiction where price caps are supported by the median voter. This is the ideal price-cap fishery, and it may or may not exist. Price caps, like any alternative method of regulation, are not viable only in ideal fisheries, but also fisheries where they are marginally more efficient than any other alternative. The closer an actual fishery is to the hypothetical ideal fishery, the more likely this is to be the case, but the fishery manager must perform an analysis of all relevant costs to make a final determination of the most efficient regulation.

VI. CONCLUSION

I make no claim that price caps are the most efficient method of solving the overfishing problem, first and foremost because there is no most efficient method. Fishery regulation is a world of second-best, and the most efficient of these second-best solutions is dependent on the sum of the relevant costs that will vary from fishery to fishery. With this in mind, I do make the claim that price caps should be considered by fisheries managers along with the existing solutions and that, in certain fisheries, price caps may prove to be the most efficient second-best solution.

I also make no claim that price caps are a viable solution to all tragedies of the commons. Price caps are certain to be not only ineffective, but counterproductive, in the global warming setting, for example. Although capping the market price of electricity will result in less energy produced, which was demonstrated in California earlier this century, it does not follow that less carbon dioxide will be produced. Forcing utility companies to sell electricity for less will make cleaner forms of power generation prohibitively expensive, resulting in the perverse consequence of locking in dirty energy and more carbon dioxide production. Price caps will not work for carbon dioxide control, because the externality, the production of carbon dioxide, is not primarily dependent on the amount of electricity produced, but rather the technology employed, and cleaner technology is possible only with higher energy prices. Price caps work for overfishing, on the other hand, because the externality, the diminished stock, is directly and solely caused by the supply of fish, which is what the price-cap limits. Price caps are a potential solution only for tragedies of the commons where this type of relationship between the supply and the externality exists. Tragedies of the commons where the externality varies with the technology employed cannot be resolved by the introduction of price caps.

The implications of this Article's findings are thus limited. Price caps are not a general solution to all tragedies of the commons, but only to those where the externality and the supply are directly linked. Overfishing may very well be the only significant example of such a situation, although any other self-replenishing resource at risk of falling below a sustainable level may benefit from the implementation of price caps as well. Even in the realm of overfishing, price caps are not the best method of regulation. At best, price caps share the distinction of second-best with perhaps every other existing method of regulation. In certain fisheries, they may prove to be the most efficient solution, while in others they may prove to be the least efficient. Price caps, however, are worthy of serious consideration by the fishery manager when determining the most efficient solution, as they have some unique advantages, most notably in the areas of political and enforcement costs, that may ideally suit a particular fishery.