Property Rights in the Fishery Case

Effendy Juraimin

California State University, Hayward

Abstract

Competitive exploitation of an open-access resource, such as a fishery, depletes its resources and dissipates its economic rent. Property right schemes and other social controls may prevent “the tragedy of the commons” in the fishery. They are community rights, seasonal closure, capital constraints, individual harvesting rights, and individual transferable quota. The British Columbia halibut fishery case confirmed that regulations involving uniform restriction caused an inefficient allocation of capital to maximize catch quantity at the expense of quality. Only transferable harvesting rights offer a complete solution in terms of efficient usage of input, higher output revenue, better product quality, safer fishing, and reduced fish waste.

I. Introduction

We probably wonder why fishermen are not wealthy considering the fact that fishery resources are vast, rich, and renewable. Fishing skills are unique and the occupations are hazardous. Those who become rich are either lucky or under social control. This paper tries to answer these questions in the context of property rights.

The next section explains the rent dissipation of commonly owned fishery resources. Section three introduces property rights and discusses their impact on efficient utilization of open-access resources such as a fishery. In section four, we explore different "social controls" in the forms of property rights and government regulations as solutions to the resource depletion. Section five is a case study of British Columbia halibut fishery that has experienced several changes of property rights and regulations since 1979.

II. Economics of a Fishery

A seminal work by Gordon (1954) shows that a competitive exploitation of a fishery without legal entitlement to a fishing ground results in the dissipation of the rent of the intramarginal grounds.

He imagines two fishing grounds of different fertilities. This implies different marginal and average productivities of fishermen. Under optimal conditions, a fisherman's fishing effort is such that the *marginal* productivities are equal on both grounds. If the fisherman is free to exploit any ground, he or she will shift from one ground to another until the *average* productivities of both grounds are equal in order to gain greater total yield. Free and competitive fishing will equalize the average

productivities and average costs for all grounds in such a way that the intramarginal gounds yield no rent[1].

Gordon then extends his explanation of the rent dissipation question by looking at "bionomic" equilibriums of fishing industry (see Figure 1).

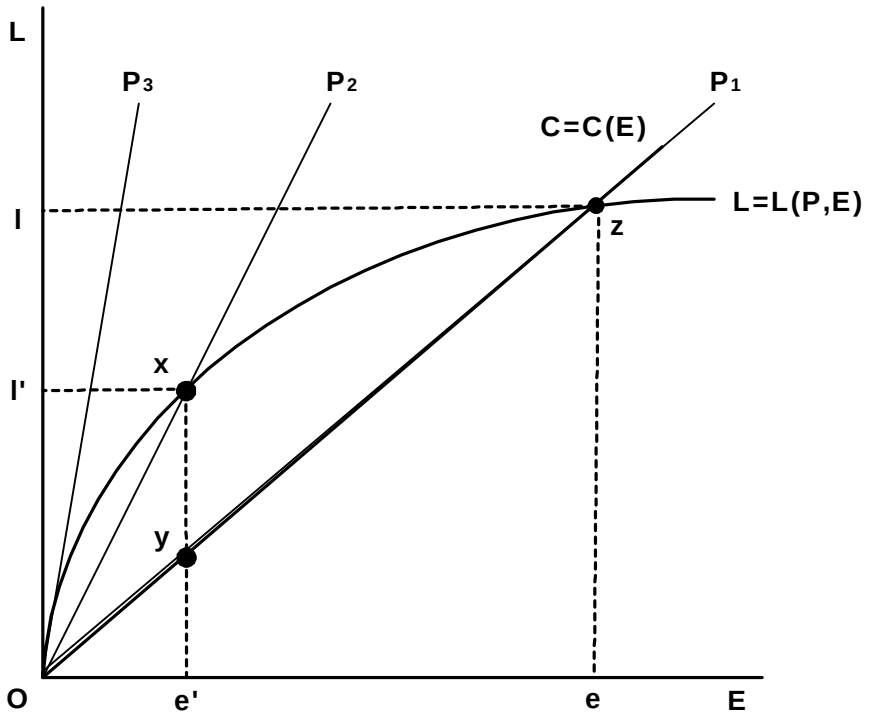

Figure 1: "Bionomic" Equilibriums of The Fishing Industry (Gordon, 1954)

The bionomic of the fishing industry consists of four variables: *P* is the population of a fish species on a fishing ground, *L* for total quantity of fish "landed" by fisherman in value terms, *E* for intensity of fishing or quantity of fishing effort, and *C* for total cost of fishing effort. As fishing effort (E) intensifies, the fisherman lands a higher quantity of fish (L) at a diminishing rate because of the effect of landing on the reduction of fish population (P). But greater fishing effort (L) increases unit costs of factor, thus producing a liner cost function (C). If exploitation of the fishing ground is under some type of social

[1] There is possibility that some grounds are exploited at *negative* marginal productivity.

control, then bionomic equilibrium is fishing effort *e'* and landing quantity *l'* that maximize economic rent *L-C* (*x-y*). Under uncontrolled competitive fishing, the equilibrium condition is fishing effort *e* and landing quantity *l* where the rent is dissipated at *C=L* (*z*). It is clear that social control that defines property rights may improve on the economic rent of the industry and efficient allocation of the resources.

III. Property Rights and Efficiency

Alchian and Demsetz (1973) define a property right as a *bundle* of socially recognized *rights* to use the resource, not *the* resource itself. For example, we may own the right to fish in the sea but not to sell the fishing rights. It is these rights that determine the value of what is exchanged (Demsetz, 1967).

To produce an efficient allocation of the exchanged value, property rights need to have three structural characteristics (Tietenberg, 2000): exclusivity, transferability, and enforceability. *Exclusivity* allows the owner to accrue all benefits and costs from using the resources. *Transferability* enables transfer of ownership of the property rights in a voluntary exchange. *Enforceability* secures property rights from involuntary seizure or infringement by others. If we live in a world with well-defined property rights (following the above characteristics) and competitive markets (allowing people to sell those rights), producers and consumers of resources have powerful incentives to maximize their surpluses with efficient resource outcomes.

For *open-access resources*[2] such as fisheries where no one owns the resources and everyone exploit them on a first-come-first-served basis (*res nullius* property regimes), we can further define characteristics of efficient property rights as follows (Grafton, Squires, and Fox, 2000): divisibility, exclusivity, transferability, duration, quality of title,

[2] Also known as *common-pool resources*

and flexibility. Divisibility defines the partition of the rights, such as the division of rights to fish certain species. Exclusivity consists of the right of access and to enjoy (*ius utile*), the right of withdrawal (*ius fruendi* or *usufructus*), and the right to prevent interference (*ius excludendi*). Transferability (*ius disponendi*) includes the ability of owners to trade, gift, or bequeath the rights. Duration is the length of the property rights, such as annual expiration or perpetuity term. Quality of title (*ius possidendi*) refers to the specification of the rights regarding possession and ownership (*de facto* and *de jure*). Flexibility is how well the property rights accommodate changes in the resource and conditions of the owner(s).

If one of the key characteristics of the property rights, exclusivity, is violated, we have a market failure called *externality*. This is a situation where an economic agent does not bear some of the cost of his or her action that is imposed on other agents. In a fishery, fishermen operating in the current season impose an external cost upon other fishermen in later seasons by harvesting small or juvenile fish.

However if the fishery has none of the above characteristics of property rights, it will lead to a popularly known problem called the "*tragedy of the commons*". A biologist named Garrett Hardin (1968) first used the term to describe a common pasture where everyone was free to let his or her animals use the pasture until it was overgrazed and ruined. It was tragedy because "each person understands what is happening but feels helpless to prevent it." (aplia.com, 2002). As one fisherman off the coast of New England said, "I have no incentive to conserve the fishery because any fish I leave is just going to be picked up by the next guy." (aplia.com, 2002). The outcomes were depletion of the

resources and dissipation of economic rent. What kind of property rights schemes and other social controls are available to prevent this tragedy?

IV. Property Rights and Regulations as Solutions

A. Community Management (Res Commmunes)

People in the community can bind together to develop *community/collective rights* to manage open-access resources in a sustainable way. Well-defined rights set "geographical boundaries for the resources, rules of access and withdrawal that are accepted by the community and that are tailored to the resource and institutions, some monitoring and enforcement of rules with graduated sanctions against transgressors, resolution mechanisms for disputes among members" (Ostrom, 1990). Coastal fisheries in Japan satisfy all these rights to address common-pool externalities in their community. But for this type of property rights to be enduring, participation by most resource users in changes to the rules are critical, as well as the recognition of the rights by outside authorities (Ostrom, 1990).

B. Regulation: Seasonal Closure

Government may issue regulations, such as antitrust legislation, that undermine collective rights. The same regulations subject most fisheries to restriction of the use of capital equipment and/or access to the fishery. One historically popular regulation is seasonal closure (Karpoff, 1987). This regulation limits the effort of fishing fleet by closing the fishery to all commercial fishing at specified times. A regulating agency monitors aggregate fish catches during the fishing season. When the aggregate limit has been reached, the season is closed temporarily. The agency usually preannounces the

closing time and its duration so that the fishermen can anticipate it. Pacific salmon fisheries open for only 2 or 3 days per weeks most of the time (Copes 1978, p. 15).

But this type of regulation imposes substantial costs on fishermen. First, there are *opportunity costs* for fishing vessels and crews not doing anything during closed periods. Alternatively, they can find temporary but lesser-valued opportunities somewhere else. Second, there are also *set-up costs* for locating the fishing area and resetting nets or pots. We can imagine the large set-up costs that are incurred by the Pacific salmon fisheries that are subject to multiple season closures and openings on a monthly basis.

C. Regulation: Capital Constraints

Other type of regulation imposes restrictions on vessel length, vessel tonnage, gear type, mesh size, net length, and the number of nets pots, or traps (Karpoff, 1987). For example, California bans the use of gill nets to capture salmon, steelhead, or striped bass; Florida prohibits the use of purse seines, gill nets, and pound nets; Rhode Island allows only hand-operated gear in its blue crab fishery.

On one hand, this type of regulation promotes efficiency by preventing *premature catch of juvenile fish* and decreasing *incidental catch of other species*. On the other hand, it distorts choices among fishermen to use a *less efficient mix of capital*. In the Bristol Bay (Alaska) salmon fishery, motorized vessels were outlawed until 1955 and fishermen had to catch fish in rough water with sailboats!

Furthermore, uniform restrictions such as capital constraints typically promote *wealth distribution* from efficient to inefficient fishermen. This impact assumes that fishermen have differential non-easily-transferable fishing skills (*heterogeneity* assumption), as Johnson and Libecap (1982) noted: “Repeated success by some

fishermen (higher than average catches) is primarily attributed to knowledge of how to set nets and regulate their spread, correct trawling speed, and the location of shrimp." Even among actual fisheries, there are typically two classes of fishermen (Karpoff, 1987). Type II are outside fishermen with less political influence, who employs more and better capital, which give them a *comparative advantage* over Type I indigenous fishermen with less political clout.

The heterogeneity assumption also increases the "*transaction costs*" of reaching internal agreement among fishermen in regulating the fishery via the government. As Ronald Coase (1960, p. 39) points out, "But the reason why some activities are not the subject of contracts is exactly the same as the reason why some contracts are commonly unsatisfactory—it would cost too much to put the matter right."

D. Individual Harvesting Rights

Because of past failures in state regulated fisheries, fishermen have scrambled for alternative instruments to increase efficiency and income. One instrument form is the individual harvesting right. It has been introduced in the U.S., Canada, New Zealand, Iceland, Australia, and the Netherlands (Grafton, Squires, and Kirkley, 1996). This solution essentially provides a greater *exclusivity* to a fisherman to exploit the resources. The exclusivity allows an individual to control its own output, enables lengthening of fishing season, and gives fishermen ability to adjust his or her mix of inputs (e.g. optimal size of vessels and equipments) to minimize costs.

But individual harvesting rights are not complete property rights. They entitle rights to the *flow* of the resources but not the *stock* of fish and the ocean environment. For example, the Republic of Marshall Islands gives a private company an option to exploit

800,000 square miles of open ocean in payment of a royalty dependent on the amount of fish harvested (Markels, 1998). In terms of property right characteristics, the individual harvesting rights place limits on duration, divisibility, and transferability.

E. Individual Transferable Quotas

This solution adds transferability of the property rights to those of individual harvesting rights. It gives fishermen the incentive to adjust their scale of operations to maximize their profits, the potential to increase the value of the catch, and the ability to raise producer surplus of the fishermen over both the short run and long run.

V. British Columbia Halibut Fishery

Grafton, Squires, and Fox (2000) conducted an impact analysis of "privatizing the commons" in the British Columbia (BC) halibut[3] fishery. This case is appropriate for our discussion because halibut fishery has experienced changes of property right and regulatory solutions similar to what we have discussed previously.

The International Pacific Halibut Commision (IPHC) was a United States and Canada establishment that had provided assistance to the Pacific halibut fishery management since 1923. IPHC also made recommendations to both governments on fishing seasons in specific areas, total catches along the pacific coast, and minimum size limits.

A. Fishery Regulations (1979-1990)

Since 1979, regulations had restricted the number of vessels or halibut fishing licenses to 435 in Canadian waters. Transferability of licenses had also been limited to those vessels no more than 10 feet long. In addition to licenses, the regulation imposed restrictions on total allowable catch (TAC) per fleet, fishing season, type of gear, and

[3] Halibut (*Hippoglossus stenolepis*) are highly migratory species living from northern California to Alaska.

minimum fish sizes. Therefore this regulation was a combination of seasonal closure and capital constraints.

Table 1: Season Length, Number of Active Fishing Vessels, and Total Catch in BC Halibut Fishery

Year	Season Length (days)	Number of Active Vessels	Total Catch (pounds)
1980	65	333	5,650,447
1981	58	337	5,654,856
1982	61	301	5,524,783
1983	24	305	5,416,757
1984	22	334	8,276,152
1985	22	363	9,587,902
1986	15	417	10,240,471
1987	16	424	12,251,086
1988	14	435	12,859,562
1989	11	435	10,738,715
1990	6	435	8,569,367
1991	214	433	7,189,273
1992	240	431	7,630,198
1993	245	351	10,560,141
1994	245	313	9,900,958
1995	245	294	9,499,717
1996	245	281	9,499,717

Source: Grafton, Squires, and Fox (2000)

As shown in table 1, regulation increased the number of active fishing vessels (the fishing effort) from 333 up to the license limit of 435 during the 1980's. Now the pressure was on IPHC to control the TAC by shortening the length of the season over the decade. The seasonal closure tactic was successful in stabilizing the total catch in the beginning. But it intensified fishing effort in the late 1980's. The consequences were detrimental to the fishery industry. Different vessels catch fishes in the same landing area, damaging the lines, and resulting in "ghost fishing"[4]. Fishermen had every incentive

[4] A vessel unknowingly lost its fishing gear but continued to fish. Thus its owner lost time, catches, and income as well.

to catch halibut even in the worst weather, because of shorter season, risking their lives and equipments. When they arrived in a fishing area, the priorities were maximizing quantity over the few days available while compromising quality of the catches. Therefore, they could not sell their products at high prices to the processors. Their revenue went down, the total catch started to drop in 1989, and the industry was on the verge of a crisis.

B. Individual Vessel Quotas (1991-1992)

In 1991, 70 percent of fishermen voted to replace existing regulations with 2-year trial program of individual vessel quotas (IVQs). Fishermen had to cover monitoring costs in the form of landing charges. Quota trading was not allowed during the trial period due to concerns about a possible large catches by processing companies and larger vessels. Each individual quota was calculated as a percentage of TAC, and was allocated free to license holders based on vessel length (30 percent of initial allocation) and the best catch over previous 4 years (the remaining 70 percent). Casey (1995) found that this allocation method benefited larger vessels and marginal fishers. In terms of our property rights solutions, the IVQ was basically Individual Harvesting Rights including its exclusivity advantage.

IVQs extended the length of the season since seasonal closure was not necessary to control TAC (Table 1). The longer season relieved the pressure to use a larger fishing fleet. The total catch stabilized at around 7,000 pounds. But this was not an optimal industry output since fishermen could not exchange quotas to achieve a desirable scale of operation and an efficient input mix. The suboptimal output and input quantities might be due to the uncertainty of the 2-years transitory period as well. Vessel skippers tended to

keep redundant but competent crews, in case the new property rights scheme failed and was discontinued at the end of the trial period.

B. Transferable IVQs (Since 1993)

Since the introduction of transferable IVQs (transferable harvesting rights) trading rights has grown. Almost half of the entire quota was exchanged in 1996. The trade benefited lower cost fishermen who could acquire a greater share of the total catch. Further improvements were evident in table 1. The number of active vessels dropped by almost a half but the total catch increased and stayed at around 10,000 pounds. The season length has remained at 245 days since 1993. The concern about quota concentration in processing companies and larger vessels proved unfounded because most active vessels were still owner operated (Porter, 1996).

A major economic benefit of IVQs in general and transferable IVQs in particular had been a longer fishing season. Extra fishing time allowed fishermen to catch and sell higher quality and higher priced fish. This may have increased their bargaining power relative to the processors (Love, 1995). Overall, The IVQ program increased total revenues by C$23 million from 1991 to 1994, whereas the IVQ management only incurred C$3 million total cost for the same period (Porter, 1996).

In his survey, Casey (1995) found other benefits of IVQs: “72, 73, and 68 percent of respondents either agreed or strongly agreed that IVQs have made fishing safer, resulted in less loss of fishing gear, and reduced wastage of fish.” Wastage of fish is related to incidental catches of other species that were landed rather than “wasted” at sea. Moreover, the Canadian Department of Fisheries and Oceans (DFO) said that IVQs had reduced premature catch of juvenile halibut by half (MacGillivray, 1996).

VI. Summary

Any fishery as an open-access resource faces uncontrolled competitive fishing that depletes its resources and dissipates economic rent. Unless we use the correct property right scheme or some other social control, fishermen will experience the "tragedy of the commons" phenomena.

Community rights need users participation and recognition by outside authorities to be enduring. Seasonal closure imposes opportunity costs and set-up costs on the fishermen. Capital constraints distort input choices toward a less efficient allocation of capital, in spite of preventing premature catch of juvenile fish and incidental catch of other species. Regulations have disadvantages of inefficient wealth distribution and high transaction costs due to the heterogeneity of fishermen. Individual harvesting rights has the advantage of exclusivity but lacks the transferability characteristic. Individual transferable quotas have the best potential to raise the rent of fishermen in both the short and long run.

The British Columbia halibut fishery case confirmed that regulations involving uniform restriction of fishing season and capital caused inefficient use of capital mix to maximize catch quantity at the expense of quality. At the end, the industry suffered because of declining revenue and total catch. Individual Vessel Quotas (IVQs) helped to stabilize total catch, even though it is suboptimal. Transferable IVQs not only increased efficient usage of input, but also improved on output revenue, product quality, fishing safety, and fish wastage.

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