

ON THE REGULATION OF MARINE INDUSTRIAL FISHERIES: THE CASE OF CHILE

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ABSTRACT

For more than 50 years Chilean marine industrial fisheries (MIF) were ruled by a criterion of "historical rights" in the issuance of fishing permits. This form of regulation was basically aimed at controlling access to the fisheries, but it did not solve the common-property issue. Through 1988 to 1991, strong controversies arose on how efficacious and efficient the prevailing regulatory framework was. Most of the initial discussions focused on the *efficiency* of different regulatory instruments. However, there was neither a systematic nor an explicit discussion of alternative options leading to a definition of regulatory aims. Subsequently, the discussion centered on issues of a more institutional nature. Among them, the constitutionality of the State's rights to limit access to fisheries and to sell full property rights over fish-stocks. On the side of the regulatory instruments, one of the key proposed reforms attempted to introduce Individual Transferrable (Catch) Quotas (ITQs) for the most important marine fisheries in the country. After more than three years of discussions, a political agreement was arrived at whereby only a partial (and non-compulsory) use of ITQs is allowed provided that a consensus concerning *biological overfishing* is reached. With respect to previous legal proposals, the role of ITQs is clearly downplayed. This paper offers an analytical review and discussion of this process of reforms and negotiations.

SÍNTESIS

Durante más de cincuenta años las pesquerías marinas industriales (MIF) estuvieron reguladas en Chile por un criterio de "derechos históricos" para el otorgamiento de permisos de pesca. Este tipo de regulación estaba orientada fundamentalmente a controlar el acceso de las pesquerías, pero sin por ello resolver el problema de la propiedad común. En el período comprendido entre los años 1988 a 1991 se originaron importantes controversias acerca de cuán eficaz y eficiente era el marco legal que regulaba la actividad. La mayor parte de las discusiones iniciales se centró en la eficiencia relativa de distintos instrumentos de regulación. Sin embargo, no hubo una discusión sistemática ni explícita sobre las distintas opciones posibles para definir los fines que perseguía la regulación. Con posterioridad, la discusión abordó problemas de índole más institucional. Entre otras, la constitucionalidad de los derechos del Estado para limitar el acceso a las pesquerías y para vender derechos de uso y goce pleno sobre las poblaciones de peces. Desde la perspectiva de los instrumentos regulatorios, una de las reformas fundamentales propuestas intentaba la introducción de Cuotas Individuales Transferibles (de Captura) (ITQ) para las más importantes pesquerías marinas en el país. Al cabo de más de tres años de discusiones, se logró un acuerdo político en virtud del cual se permite sólo un uso parcial (y no obligatorio) de las ITQ, siempre y cuando

exista consenso en relación a la existencia de sobre-captura biológica. Con respecto a las anteriores reformas legales propuestas, en esta última se le baja el perfil en forma significativa al rol de las ITQ. Este trabajo ofrece una revisión y discusión analítica de este proceso de reformas y de negociaciones.

ABSTRACT: "The Response of Short-Term Interest Rates to Weekly Money Supply Announcements and Comments", *Journal of Money, Credit, and Banking*, Vol. 17, 204-210.

ABSTRACT: "Signalling Role of Base and Money Aggregations and Their Effects on Interest Rates", *Journal of Monetary Economics*

For more than 30 years Chilean market interest rates (MIR) were linked to a criterion of "interest rates" in the absence of being permitted. This form of regulation

was basically aimed at stabilizing the interest rate. However, this form of regulation

was not effective in stabilizing the interest rate. However, this form of regulation

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THORNTON, D.L. (1991) "Why Do Market Interest Rates Respond to Money Announcements?", *Journal of International Financial Markets, Institutions and Money*, Vol. 1, 33-60.

SINOPSIS

El presente artículo analiza el rol de las ITQ en la regulación del mercado de capitales y el

impacto de este tipo de regulación en el comportamiento de las tasas de interés y el

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1. INTRODUCTION

For more than 50 years Chilean marine industrial fisheries (MIF) were ruled by a criterion of "historical rights" in the issuing of fishing permits. This form of regulation made it possible to have some control on access to the fisheries, but it did not solve the common-property issue. In fact, historical rights were combined with the (cyclical) use of access restrictions and direct controls on fishing efforts. Global annual catch quotas were suggested in several periods, but always without effective enforcing powers. In the late eighties, an increasing controversy arose with respect to the prevailing regulatory framework for fisheries. Most of the initial discussions hinged on how efficacious and efficient different *regulatory instruments* were. However, no systematic analysis was made to analyse the issue of the different possible objectives of the Regulator. As time went by, factors of a more institutional nature began to be given consideration. Among the latter, a key controversy referred to the constitutionality of the State's rights to limit access to fisheries and to sell "full" property rights over fish-stocks.

On the issue of regulatory instruments, one of the key reforms that was proposed attempted to implement a system of individual transferrable (catch) quotas (ITQ) for the most important fisheries in the country. However, a strong opposition arose from the private sector, both from *some* segments of the entrepreneurial side as well as from workers' lobbies. In order to arrive at a (political) agreement on these matters, it took the country more than three years and six deferrals in Congress until a new Fishing Law was finally enacted in September 1991.

The resulting Fishing Law is clearly a *hybrid* between two earlier proposed bills of law. It retains free access as the general framework, subject to transitory entry restrictions if conditions of *biological* overfishing are agreed on. Direct control mechanisms over fishing efforts virtually disappear, as for instance the

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previously existing limits on fleet's fishing capacity. More biologically-oriented controls on fishing efforts remain within the feasible set of instruments available to the Regulator (such as seasonal closures, minimum net sizes, minimum catch sizes). With respect to quota devices, the new Fishing Law provides for the use of global and individual quotas on catches, but without defining a set of *compulsory* triggering conditions for their use. This and other administrative procedures significantly reduce not only the importance of ITQs within the current set of regulatory instruments, but also their role as defined in the legal reforms as they had been previously proposed. Another novelty of the new fishing Law consists in vesting several private lobbies with partial resolute powers in some of the most important areas of regulatory decisions.

In this paper we attempt an analytical description of the discussion that surrounded the enactment of the 1991 Chilean Fishing Law. Section (2) offers a brief review on the fishing regulatory framework that had prevailed in Chile before the controversies arose over the period from 1988 to 1991. Section (3) briefly discusses the main arguments which are normally used to justify fishing regulations. We argue that the recent Chilean experience shows the need to advance in the refinement and formulation of more precise concept-definitions involved in the discussion of fishing regulations. Sections (4) and (5) concentrate on the recent process of reforming the Chilean fishing law: We pinpoint the sequential negotiations, some of the "dangers" as we perceive them, in the resulting fishing law, and the key "problem-areas" that, in our opinion, are still open to debate and need to be improved.

2. CHECKERED LEGAL BACKGROUND TO THE INDUSTRIAL FISHING SECTOR¹

Among the regulatory decisions concerning fishing industries, a key set of problems is related to the definition, control and enforcement of access schemes and property (user) rights over the natural resource. Let us briefly explore the Chilean experience on these issues.

The first Chilean Code of Civil Laws (1855) defined *fishing rights* for those who first initiated the resource depletion. These rights were defined as "rights of occupation". Additional (access) restrictions were considered in terms of the fishermen's nationality and the territorial area under exploitation. The first specific Fishing Laws (1929 and 1931) retained, in its essence, this basic doctrine of "historical rights". An explicit questioning of this status quo only emerged in the mid-1970s, as will be seen in what follows.

¹ For some comments on the history of Chilean fishing laws, see Montt(1985).

In 1956 *ex-ante permits* for operation began to be required. Initially, this was a pure access regulation. Since the early sixties, however, the legislators tried to link the issuing of new permits (in terms of firms and vessels) to the compliance with objectives of maximum global permissible (annual) catches (MPCs). This regulatory scheme prevailed until the mid-seventies. However, the idea underlying these "permissible" catches always came closer to providing a signalling or a "reference" to the private sector, rather than to an effectively *enforced* quota policy.

In the mid-seventies a wave of criticism was levied against the doctrine of "historical rights", still dominating the issuance of fishing permits within the country. A dominant argument at the time² contended that this type of regulation interfered with an adequate competition between potential investors, monopolizing the resources to the benefit of those who had already established their presence.

Simultaneously, the increasing relevance of other factors helped to promote a rethinking of the prevailing rules. Among these factors we can mention: (i) accumulated experiences around the world showing the failure of free-access schemes aimed at protecting the "economic survival" of industrial pelagic fisheries, now that fish-stocks are no longer perceived as "free goods"³, (ii) a corresponding increasing consensus about the need of combining access restrictions with quotas on harvesting levels⁴, (iii) the increasing economic importance of fisheries for the Chilean economy, as the sector started a booming growth since the mid-seventies until the late eighties. This growing production started to make the alternative costs involved in the expansion and future "sustainability" of the fishing sector more explicit.

As an outcome of these ideas, in 1976 there was a partial decline of the historical-rights doctrine. However, the net result was that a scheme of *free* access was set up. All applications for fishing permits had to be accepted. In terms of catch quotas, the "suggested", but "non-enforceable", character of the global

² This line of arguments was lead by a group a economists who had control of the Government bureaucracy. Most of these professionals had post-graduate training at the Chicago School of Economics.

³ Until the forties, managers around the world did not believe that fishing efforts should be restrained. These beliefs were based on scientific propositions that had prevailed for almost 70 years among marine biologists. Fish-stocks were seen basically as "free goods" (for the period in question, it was probably right to think so). Professor T.H.Huxley in 1884 (then president of the UK Royal Society) wrote for an International Fisheries Conference: "I believe, then, that the cod fishery, the herring fishery, the pilchard fishery, the mackerel fishery and probably all the great sea fisheries are inexhaustible; that is to say, that nothing we do seriously affects the numbers of fish. And any attempt to regulate these fisheries seems, consequently, from the nature of the case to be useless" (Cushing, 1988, page 117).

⁴ The shifting emphasis from global to individual catch quotas is a phenomenon that has taken real force only since the early eighties. (see Scott, 1988).

annual catch quota per species⁵ was now even more explicit. Not surprisingly, this limit was normally overpassed.

The *"de facto"* ineffectiveness of the law was reinforced by a regulation issued in 1980 which omitted any mention of quotas per firm and simultaneously did not specify a clear commitment to a free access principle. This regulation retained the Regulator's right to issue fishing permits, but it left this right subject to discretionary criteria.

In its essence, the style of regulation did not change during the eighties. The decisions were taken most of the time on "discretionary" bases. The schemes were irregular in application, following cyclical patterns (some restrictions replacing earlier ones, to then be revoked, and then repeating the cycle) and normally adopting the traits of unavoidable improvisations in the face of "dangerous" resource levels. This issue deserves a comment:

By "discretionary" or "irregular" regulation we basically mean that the Regulating Authority has been systematically unable to enforce policies based on an *ex-ante* given set of rules, deriving from previously agreed on, widely accepted, and clearly defined regulatory criteria and behaviour protocols. It is true that the "technology" of pelagic fisheries and the uncertainty about Nature's states require *flexibility* in the application of regulatory rules. But the Regulating Agent must be careful not to confuse this need for flexibility with neither *ambiguity* nor *informal* discretionary rulings in the definition of the policy-objectives and the application of the regulatory policies stemming from them.

Since 1986 until very recently⁶, the fishing efforts⁷ in the main (Northern) industrial fisheries were "frozen" at their level of 1985. This meant, in practical terms, a situation of closed access to these fisheries. The measure of freezing fishing efforts, at least partially⁸, was adopted as a response to a dangerous decrease in the stock levels of the main species under exploitation, especially in the case of the Spanish sardine since 1982. Again, global annual catch quotas were "recommended" during this period; yet again, they lacked a real compulsory or enforceable power.

⁵ The definition of these global quotas followed biologically-oriented criteria of regulation and conservation of the natural resource.

⁶ More precisely, until 1992 when a New Fishing Law was enacted and enforced after almost 4 years of discussions and negotiations. The new Law has significantly reduced the (more direct) control mechanisms over the levels of fishing effort, as, for instance, the control on the maximum tonnage capacity of the fleet in operation.

⁷ Defined in terms of the total tonnage capacity of the vessels in operation.

⁸ To freeze one attribute in order to control a production decision that is composed of a complex set of several inputs, even accepting the existence of quasi-fixed proportions in their use, can -at best- be only a partial and imperfect control. This is the already widely accepted weakness of input-controls for regulating fishing industries. (See references in footnote 9).

Table 1 clearly shows, for the main species of the Northern industrial fishery, the divergence between actual annual catches and those "suggested" by the Fishing Regulatory Authorities. This table shows a *systematic* exploitation over and above the proposed catch quotas. Concurrently to this phenomena, pelagic fish-stocks (particularly sardines and mackerel) started to show a decreasing trend towards the second half of the eighties, helping to account for the significant fall in catches during the first years of the nineties (see Appendix 1). Table 1 suggests that in Chile there was enough scientific knowledge to predict this decreasing trend in fish-stocks a number of years before it actually affected catch performances. A tentative corollary suggests that the recent fall in catch performances could probably have been cut down, if the suggested quotas had been properly enforced.

TABLE 1
SUGGESTED ANNUAL QUOTAS vs. EFFECTIVE CATCHES
(3 main pelagic species, Northern Zone)
(tons., thousands)

	Jack Mackerel		Spanish Sardine		Anchovies	
	TSC	EC ₍₂₎	TSC	EC ₍₅₎	TSC ₍₆₎	EC ₍₇₎
1987	na	279.9	1400 ₍₃₎	1782.4	na	178.8
1988	89.4 ₍₁₎	278.7	304 ₍₄₎	1356.0	50	768.5
1989	208.7 ₍₁₎	265.8	333 ₍₄₎	1405.1	768.8	1253.9
1990	na	258.2	na	700.4	na	573.2
1991	na	340.8	na	350.0	na	800.9
1992	103.3 ₍₂₎	*232.8	35 ₍₅₎	*598.7	na	*899.1

Sources: (1): Barría and Serra, 1989, (2): Barría and Serra, 1991, (3): Chilean Economic Development Agency (CORFO), Development Fisheries Institute (IFOP), 1987, AP 87/6, (4): Barría and Serra, 1989, (5): Barría and Serra, 1991a, (6): Development Fisheries Institute (IFOP), 1989, (7): Barría and Serra, 1991b.

Notes:

TSC: Total (Suggested) annual catches.

EC : Effective (industrial fleet) catches.

na : non-available to the authors.

* : Provisional figures.

- Definition of the TSC:

The criterion for estimating the TSC considers what marine biologists call the "instantaneous coefficient of fishing mortality $F_{0.1}$ ". This index corresponds to an estimation of the ratio between catch and average fish-stock, both measured in numbers. The value $F_{0.1}$ aims at keeping fishing efforts within a level such that it will allow the survival of a minimum spawning stock, enough to maintain the long-run sustainability of the harvesting activity, with the definite purpose of attempting to prevent negative overshootings due to random Nature's shocks or to errors in the system of stock assessment (Pope, 1982, and Cushing, 1988, p.263). It is a management measure based on a long-run stability objective. And it is obviously defined by a biologically-oriented objective of regulation and conservation.

Why the Authority has failed to enforce the suggested quotas?. No doubt that this failure reflects institutional weaknesses surrounding the regulatory powers of the Fishing Authority. The question, then, is what factors lie at the roots of those weaknesses? We propose that to answer this we must concentrate on two key issues: (i) credibility problems of quota policies due to incomplete information about Nature's states and (ii) need to refine the concepts involved in the definition and discussion of fishing regulations

i) Credibility problems

Cyclical and uncertain catches imply the need for risk-bearing decisions. Incomplete information about Nature's state gives rise to discussions regarding the proper *estimation* of the risks involved. Regulatory negotiations between private firms and the Regulator can be further complicated by different *risk-attitudes* between them. But the key issue is whether or not the possibility of estimation errors invalidates the usefulness of quota regulations when deciding on strategies of risk-bearing and risk-sharing at MIFs.

The risk problem not only relates to the costs of facing uncertain catch-variability, but also to the danger of collapse in the industry. The latter is, without any doubt, the more controversial issue. History teaches us that an economic collapse of pelagic fisheries can occur, although there is still discussion on the conditions required for this outcome. The lack of full agreement, however, does not imply that the risk of collapse should be ignored. Similarly, the non-occurrence of an (unwanted) outcome in any period t does not imply that its probability of occurrence was zero; nor does it imply that it cannot happen over the next periods. The key point is this: In uncertain frameworks, the decision problem is not only conditioned by the risk of making *estimation errors*, but also by the estimated costs of facing the unwanted outcome.

What type of fishing regulation will be more efficient? This is a question not addressed here. However, accumulated regulatory experiences around the world clearly show that neither direct controls over fishing effort nor pure closed-entry restrictions are efficient instruments to avoid harvesting inefficiencies and collapse outcomes⁹.

This discussion might seem trivial to some readers. However, we believe it is worth emphasizing it, because it is at the heart of the ineffectiveness of the attempted regulations so far. Disagreements on this point have produced mistrust

⁹ See, for example, Munro and Scott (1985), Charles (1988), Townsend (1990), Copes(1986), Heaps and Helliwell (1985), Butlin (1975), Munro (1982), Scott (1985), Mirman and Spulber (1982).

between the parties involved in bargaining regulatory rules. They have even further separated the parties' original bargaining positions. Potentially useful instruments of regulation have lost credibility and power of enforcement. The result has been unstable institutions and wasted possibilities for collective gains.

D. North (1990) gives a remarkably lucid discussion on the importance of solid and stable institutions (and the economic incentives borne by them) in shaping different paths of economic development.

We can imagine institutions as either mechanisms or sets of contracts, enabling us to convert uncertainties into risks or, in other words, to assess the unknown¹⁰. They work through the development of improved mechanisms for measuring, controlling and enforcing individual actions; thereby, they reduce the costs of transacting, allowing us to take advantages, at lower costs, of the potential gains involved in collective exchanges.

When institutions are weak and unstable, non-cooperation and individual non-specialization act as forms of insurance when the costs and uncertainties of transacting are high. The weaker the institutions, the higher the costs of transacting will be: Hence, imperfections in the structure of private property rights will become more binding economic constraints. As a result of this, the possibility of collective losses, owing to Pareto-inefficient outcomes, will tend to increase. Pareto-compensations within potential net beneficial exchanges will tend not to occur.

How strong and efficient the prevailing institutions are depends on the combined interaction of social conventions (values, traditions, codes of conduct), political rules (hierarchies, rights and obligations in the formal structure of the 'polity'¹¹), economic rules (laws defining property rights) and specific sets of contracts (provisions specific to particular agreements in exchange). (See North, 1990).

Institutional weaknesses are what make, in ultimate analysis, the real difference between dissimilar degrees of economic development. Sustainable economic progress does not come from temporary windfalls or transitory advantages in factor endowments. Neither does it come from "de jure" right or wrong economic policies. Their rightness or wrongness depends on how they are enforced and abided by. And this depends on the institutions --with their implicit and explicit promises, rights, obligations and sanctions-- supporting the interactions between different agents within a society.

¹⁰ For the original distinction between uncertainty and risk, see F.H. Knight (1921).

¹¹ An important factor here is the role of the State: to what extent does the State fulfill its role of protector and enforcer of property rights versus its potential role as an additional source of uncertainty and higher transaction costs?

"If self interest does promote economic welfare, it is because human institutions have been devised to make it so". (Pigou, 1932, p.128) .

ii) Concept refinements

Discussions on fishing regulations have at least two very clear complexities: First, the usually *ambiguous* definitions and distinctions between objectives concerning (a) allocative efficiency and (b) aims concerning instability problems and derived risks of collapse.

Second, the *unavoidable simultaneity* in coping with the inefficiencies deriving from incomplete¹² (or, if you want, common) property rights, and the resulting (re)distributive disputes concerning the relative shares in the natural resource's Ricardian rents. In other words, attempts to regulate harvesting activities necessarily imply the need to face bargaining disputes, not only between private firms and the Regulator, but also among the private firms themselves. The property-rights problem makes it unfeasible to cope with the regulatory objectives independently from the need to arbitrate and, finally, decide on the redistributive disputes that will necessarily arise.

This dangerous connection between the incentive (or, if you want, efficiency¹³) problems and the distributive disputes makes it particularly important to be as precise as possible in the definition of the concepts and variables that are involved in the discussion. We need to formalize and to refine the language of discussion as much as we can. Only in this way, will we be able to proceed towards better achieved regulatory aims, in spite of the crucial importance of the distributive issue.

Common (or incomplete private) property and imperfect information (about Nature's states and rivals' actions) introduce significant pressures and demands upon the efficiency of institutional arrangements at MIFs. These arrangements involve not only the regulatory schemes and the corresponding legal system, but also the private decisions involving the size and structure of the productive firm, the market interactions within the industry, and the voluntary (Coasian) contractual arrangements within and across firms.

¹² The property problem is not exclusive to a situation of "commonality". Incentives for an inefficient exploitation of the natural resource can still hold with private property rights if they are not able to fully "internalize" the harvesting interdependences between fishing units. It can be "too costly" to enforce the user rights which are derived from this private property. In this case we will face an externality problem. This situation corresponds to what we call "incomplete" private property.

¹³ Not all incentive problems are necessarily efficiency problems. Under some circumstances, it can be efficient to have Second-best incentive-mechanisms. This depends on the costs of implementing and enforcing those mechanisms.

When we want to analyse and to evaluate fishing regulations, we must consider that there exists this continuum of institutional answers to the incentive and distributive problems that prevail at industrial fisheries. The combination of all of them will define the final answer to the efficiency trade-offs (creation of wealth) and distributive disputes that emerge from imperfect information and commonality.

3. CONTROVERSIAL ISSUES

In this section, we first describe the main arguments and concepts which are normally used in order to justify the need for fishing regulations (subsection 3.1), and second we briefly summarize two main criticisms that were wielded by the Chilean private sector against public fishing regulation during the regulatory controversies over the period from 1988 to 1991 (subsection 3.2).

3.1. Regulatory aims

Regulatory tasks usually involve multi-objectives problems. In fisheries we can find transboundary resource problems¹⁴, calling for intercountry negotiations; we can also find either explicit distributive issues at stake, explicit environmental considerations, problems referring to location-specific fishing developments, or arguments in the line of *industrial policy* aims, and so on. However, it is clear that discussions concerning the regulation of fisheries tend to concentrate on two main issues: (1) Concerns regarding "instability" issues and the "long-run *sustainability*" of the biological systems involved and (2) The problem of *inefficient* resource allocations, essentially defined by the problem of inefficient rent dissipation that arises from the common property of fish-stocks. Both issues imply different definitions of regulatory objectives and policy priorities when thinking of an *overfishing* problem.

The instability problem normally implies *overfishing* definitions based on *biological* criteria. Discussions on the *inefficiency* issue concentrate on the set of marginal *incentives* that dictate the harvesting decisions, leaving out explicit (modelling) considerations related to problems of instability and multiple equilibria. Per se, there is nothing wrong with this *dichotomic* perspective between "biological" and "economic" readings of the overfishing problem. We need to "dissect" problems in order to make way in our understanding. However, we must be careful not to follow this dichotomic view too straightforwardly when we

¹⁴ In the Chilean case, the most important fishery in this situation is the Northern anchovy stock which, according to IFOP (Development Fisheries Institute) estimates, is shared between Peru and Chile in around 60 per cent of the total stock, whereas other Northern species (e.g., the Spanish Sardine) show shared populations in much lower percentages (around 5 per cent in the case of the sardine).

become involved in discussions regarding the definition and implementation of regulatory policies.

In the Chilean case we have the impression that a closer interaction between both approaches is needed in order to improve the regulatory outcomes. This necessarily calls for closer interactions between interdisciplinary teams of experts.

In what follows we attempt some precisions about the *meaning* of "stability" and "efficiency" objectives that invariably permeate the discussions related to fishing regulations. One of our objectives is to promote further debate in order to broaden the "bridges" between the biological and economic "languages" that are used in these discussions.

3.1.1. On the meanings of stability objectives

Instability arguments tend to involve two different issues: The problem of economic *collapse* and/or biological extinction¹⁵, and the intent to reduce the costs of facing a high degree of fluctuation in catch performances.

a) The collapse problem

This regulatory concern is aimed at ensuring economic survival, or if you want, the "sustainability" of the biological system under exploitation. Using different arguments, it proposes that it is "too costly" (in a Welfare sense) to allow the economic collapse of the system, either due to explicit environmental-biological consequences or due to technological irreversibilities in the penalties imposed on geographically "non-substitutable" fishing activities. The key issue in the "sustainability" argument is the proposition that a *profitable* substitution between natural (fish) and artificial (man-made) capital stocks will not take place and that the "high" specificity of the remaining capital stocks will impede a profitable substitution and factor movements to other production processes, hence dooming that geographical location to languish through prolonged inactivity.

The collapse concern is based on the proposition that (especially pelagic) industrial fisheries face a critical level of harvesting beyond which the growth dynamics of the fish-stock enters a zone of high instability, possibly leading to its economic collapse. The arguments as to the roots of this unstable growth zone are well-known (Gulland, 1988); also the historical experiences of collapsed pelagic fisheries, "uncommon" as they are, have become a well-known tribulation: The

¹⁵ A more complete discussion of the relationship between fishing regulations and the long-run Sustainability issue can be found in Peña and Nuñez (1994).

Californian sardine fishery in the early fifties, the Japanese sardine fishery in the early forties, the North Sea herring stocks in the late sixties and early seventies, and the Peruvian anchovy fishery in the years 1972 and 1973.

The unstable-growth zone argument involves a multiple equilibria issue. It proposes that one of these equilibria implies a high "vulnerability" (quoting a term used by ecologists) of the biological system, in terms of its ability to withstand unpredictable, large and discontinuous exogenous shocks, either Nature-triggered or resulting from fishermen's harvesting.

The discussions concerning the collapse argument concentrate on the conditions needed to enter this zone of growth instability (dynamics of species substitution, etc.) and also on the degree of "controllability" of these conditions. *Controllability* means not only the knowledge we have about these conditions, but also the ability that the Regulator has to manipulate or anticipate them. We certainly require more studies on these issues. The information available, however, shows that the risk of collapse is a feasible issue. Therefore, any regulatory framework should consider it.

b) The issue of "undesired" catch-fluctuations

There is a second reading of the instability issue which is less clearly expressed, even though it is also considered in regulatory discussions. This reading aims to avoid "undesired fluctuations" in the industry's catch performances. This corresponds to a classical argument on the costs of facing *cyclical* and/or *uncertain* levels of production and income flows.

From the viewpoint of the Regulator, the justification for this aim arises essentially from the *adjustment* costs generated if and when it is necessary to accommodate the industry's production to different levels of operation. Therefore, the regulatory case is justified more on the basis of the costs of facing *variability* or *cycles* in production levels, rather than on risk-aversion arguments or costs of facing *uncertain* income flows.

It is clear, however, that this dimension of the instability concern is less important, by comparison to the collapse issue, as an argument to justify regulation of fisheries. Despite this, much more work remains to be done to define *both* readings for the instability concern in a more precise manner, and also to pinpoint the Welfare effects ascribable to them.

3.1.2. The inefficiency issue

The key issue here is the incentive problem that is generated by the common (or incomplete private) property of fish-stocks. Under this property structure, even if we have closed-entry to the industry, multiple harvesting firms will have incentives to equate their variable inputs' average product (rather than their marginal product) to the inputs' marginal costs. This proposition assumes that it is "too costly", relative to the expected benefits, to sign and to enforce voluntary and cooperative Coasian contracts among the harvesting firms in order to *coordinate* (or, if you want, to (fully) *internalize* the harvesting interdependencies of) their harvesting decisions. These transaction costs can be thought of as a consequence of *information* costs originated by costly monitoring of rivals' actions (a *hidden action* problem) and *incomplete* information about Nature's states.

If the previous conditions prevail, none of the individual fishermen can claim or enforce exclusive rights over the use of fish-stocks and hence everyone has incentives for harvesting the fish-stocks until their (Ricardian) rents are completely exhausted. This will imply an inefficient dissipation of the producers' surplus. This dissipation will imply *inefficient* resource allocations because in this case average productivity will be the yardstick of competition between harvesting units, without necessarily promoting the increasing operation of those fishermen with the higher marginal productivities. This inefficient rent dissipation is what economists call the *overfishing* outcome. Under this "economic" reading of the problem, the regulatory aim consists in avoiding the inefficient waste of the natural resource's Ricardian rents.

It is important to emphasize that the inefficient rent dissipation may follow different treks: It can imply an inefficient *overuse* of the natural resource, which is the usual association made with the concept of economic *overfishing*. However, the waste of Ricardian rents can also be represented by an (inefficiently) *overcapitalized* harvesting fleet, even if it is not fully used for direct harvesting. Or the rent dissipation can also be represented by "excessive" lobbying actions attempting to ensure access to the harvesting of fish-stocks.

A standard academic way of defining the efficiency yardstick, so as to compare it with the harvesting outcome deriving from common property, consists in assuming a (costless) social planner (with equal informational constraints to those faced by private firms) who is interested in maximizing the discounted (expected) present value of the Ricardian rents generating from the harvesting of the fish-stock during a given time-horizon T . These rents correspond to the difference between the harvest value and the costs of producing it. These costs, of course, include the operational costs of the fishing fleet as well as the alternative costs of the capital (human, physical and financial) inputs used in that production.

The harvesting time path that solves this planner optimization problem is what we economists call the intertemporal *efficient* harvesting outcome¹⁶.

Let us briefly discuss how this definition of efficient harvesting relates to a regulatory criterion which has been traditionally used in fishing management: The Maximum Sustainable Yield (MSY) criterion.

- On the MSY criterion for regulation

Suppose our social planner were asked if his optimizing criterion corresponds to those "traditionally" used in fishing management. If the question is posed by a marine biologist, he is probably thinking of the MSY criterion. One of the pioneers in the field of fisheries science had already defined this concept in 1931. He wrote:

"...it was desirable to keep the fish-stock X at such a level, or to bring X to such a level, that the maximum value of commercially utilizable fish can be drawn from it annually without causing a progressive diminution of X ". (Russell, E.S., 1931).

In simpler words this means "try to catch as much fish as you can in a *sustainable* way"¹⁷. This concept is still frequently mentioned, and widely popular among regulators, as a guiding criterion for fishing management. However, this definition clearly overlooks that the *maximum* value of total production is not always the *optimal* one!

It is quite interesting to note that the concept of MSY has also been quite popular in the discussions among foresters on the optimal rotation period for a forest. Samuelson (1976) offers a remarkable discussion regarding this point, quoting references to this concept as early as 1788¹⁸, where it is recommended that "the cut to be regulated by how much the average tree age is above or below the optimal age that maximizes steady-state lumber yield per acre" (Samuelson, 1976, p. 489).

¹⁶ By definition, this optimization yardstick considers price vectors and discount factors that correspond to shadow (social) values.

¹⁷ Since what ultimately matters are monetary values, this statement requires to assume a price-taking behaviour from harvesting firms.

¹⁸ Samuelson sets out the right solution given by M. Faustmann in 1849 but also quotes several inaccurate solutions given by great economists, among them von Thunen (1826), Irving Fisher (1930), Hotelling (1925) and Boulding (1935). It is well worth reading this paper!

If we assume that the MSY is defined in value terms (not as a physical quantity), our planner's criterion can differ from it basically due to three reasons¹⁹:

- 1) Even within a pure *static* framework, the maximum catch (with given prices) will not be optimal if total harvesting costs are *somehow* correlated with the fish-stock size at $x = x_{MSY}$. More formally, let $C = C(h, x)$ be the total harvesting cost function, where h and x are the current harvesting level and fish-stock level, respectively. A necessary condition for MSY to be optimal is that $\partial C / \partial x = 0$ at x_{MSY} ; that is, when total costs C are independent of the stock level at x_{MSY} . If $\partial C / \partial x \neq 0$, then the MSY is not optimal. For example, if total harvesting costs are negatively correlated with x , that is, it is more costly to harvest when the stock is smaller, the optimal stock is higher than that at MSY, reflecting that a higher level of x is desired in order to decrease total harvesting costs.

The reason is that in a regulation model, such as the MSY criterion, aiming to achieve a maximum level of sustainable catches, the "desired" equilibrium corresponds to a stock level such that the marginal change in sustainable harvesting yield, deriving from a marginal change in the stock level x , is zero²⁰. For a correspondence with Pareto-efficiency, total harvesting costs must be independent of the x level. This is the classic point made by Gordon (1954) and Scott (1955) and it is related to what is currently called the "marginal stock effect" (decreasing profits due to increasing harvesting costs at lower stock-levels).

Let us note that this argument is also valid for fisheries where the species have strong "schooling" behaviour (high densities of individuals of similar size), as is the case of pelagic fisheries, where it is possible that, at lower stock levels, average harvesting costs decrease due to the higher density of the fish-stock²¹.

If we now assume that the MSY criterion is defined as a "net" value-yield (net of operational and capital costs), our planner's criterion may still differ from it basically for two other reasons:

- 2) Even if we concentrate the evaluation of optimality on *long-run equilibrium* levels (as does the concept of MSY), maintaining the analysis within a "comparative statics" framework, but now if we allow for the incorporation

¹⁹ We will not give proofs for these arguments, because most of them are well-reviewed in the literature. See, for example, Munro (1982), Munro and Scott (1985), Neher's introduction to Part III of Scott, A. (1985), Clark, Munro and Charles (1985) and Spulber's survey in Mirman and Spulber (1982) for proofs and further references.

²⁰ This situation corresponds to the unique maximum point that is located on a strictly concave growth function $F(x) = dx/dt$, with $F'(x) < 0$ after x_{MSY} . For example, a logistic growth function.

²¹ In fact, this is a dangerous complexity in pelagic fisheries, because although the fish-stock can have entered a zone of depensatory (negative) growth, the catch performances do not necessarily fall, given the high density of its population.

of a rate of (social) time-preferences, the optimality of the MSY-catch-prescription does require the additional necessary condition that this rate of time preferences be zero. If this rate is positive, the MSY will imply (social) underexploitation of the natural resource (see references in footnote 19).

- 3) If we now introduce explicit *dynamic* considerations into the analysis, in the sense of time-lags or costly rigidities in the adjustment paths of fish- and capital-stocks²², the MSY criterion says nothing about the optimal paths approaching the steady-state optimum as this criterion is defined in static terms.

Finally, the introduction of fish-stock-uncertainty adds new problems to the use of the MSY criterion, given the impact on the time discount rates and the valuation of capital stocks. This uncertainty can imply trade-offs between the expected rents and risks involved. The optimal answer to that may be quite different from the MSY prescription.

Similar criticisms could be raised against other "biological" criteria of fishing management which, in one way or another, are based on this notion of a maximum utilization of the natural resource. For example, the "maximum yield per recruit", the "status quo catch" (the estimated catch with constant fishing mortality) proposed by Pope (1982), the constant instantaneous coefficient of fishing mortality ($F_{0.1}$)²³, etc.

Our main lesson in this subsection is that those who discuss fishing regulations must exert great care in making their assumptions and setting their priorities, with respect to the biological and economic readings of the "overfishing" problem, in the most explicit manner possible.

3.2. The private sector's arguments

The aim of this short subsection is to briefly summarize the two main criticisms that the private-sector²⁴ raised against public fishing regulation, namely, arbitrariness and ineffectiveness.

²² These rigidities or time lagged-responses can be modelled, for example, with the inclusion of multicohort (different age groups) models for the fish stock dynamics, or via the introduction of *sunk* costs in the harvesting technology.

²³ F corresponds to the ratio between the catch in number and the average fish-stock (also in numbers). Its value $F_{0.1}$ corresponds, to a given model of fish growth, to "a level of effort less than that which produces MSY, in order to prevent an overshoot due to errors in the system of stock assessment (VPA or Virtual Population Analysis)". See Cushing (1988, page 263).

²⁴ Despite the presence of several *competing* lobbies within the private sector with respect to their preferences concerning regulatory frameworks, we will consider the sector as a homogeneous group, looking for the main (common to all of them) arguments that criticize public regulation in fishing industries.

i) Arbitrariness and Lack of Information

It has been argued²⁵ that nobody, least of all the public sector, has enough reliable information on the levels, characteristics and behaviour of the fish-stocks under exploitation, to formulate an objective and efficient regulation with relatively complex devices such as individual catch quotas. This lack of information, they argue, will probably produce arbitrariness and distortions in the application of the regulatory devices.

If a genuine justification for regulation is accepted, this position is in favour of simpler and more straightforward regulatory devices such as direct controls over the fishing effort (capacity restrictions or fishing moratoria) and inputs' regulation (type of gear, etc.). The private sector argues that these measures require less exacting information.

ii) Cyclical Substitution among Species

Probably the strongest critiques wielded against fishing regulations, particularly with respect to the Northern Chilean industrial (pelagic) fisheries, are related to the thesis of a *cyclical* substitution among the main species under exploitation²⁶.

The basic idea is that when one of these species suffers a strong depletion, affecting its basis of reproduction, another species will take up its position in the ecosystem. Therefore, any compensatory dynamics in a single-stock will be "quickly" counteracted by an increase in another competing species, allowing for continuity in the fishing activity. Moreover, it is asserted that the depleted species will come back after a while, the specific period of recovery depending on the particular species-growth patterns and the firms' multispecies harvesting strategies.

This argument has been explicitly proposed for species-competition dynamics between sardines and anchovies. We could cite partial evidence justifying this case, but --to our knowledge-- the conclusions are not definite as yet. For information regarding this phenomenon in other pelagic fisheries around the world, see Cushing (1988) and Gulland (1988).

²⁵ See, for example, *El Mercurio* (January 14th, 1990), for the opinions expressed by Felipe Lamarca, one of the top managers of the economic conglomerate which dominates the Chilean Northern fish-meal industry.

²⁶ The Northern fish-meal industry is based on the exploitation of pelagics species. The three most important species are: the Spanish sardine (32.2), the anchovy (48.4) and the jack mackerel (14.1). The numbers between parenthesis show the participation of each species in the total tonnage of catches processed by fish-meal plants in the Northern region of Chile during 1992.

This idea is still controversial among marine biologists. The crucial issues seem to be the time period and natural conditions required for such a substitution to take place. Regulators state that these conditions can be highly uncertain and that therefore the continuity of the fishing activity can also be uncertain. Nonetheless, the crucial point is that this proposition wields a heavy attack against the instability argument as a justification for fishing regulation, and thereby it questions the effectiveness of its role.

4. THE RECENT DISCUSSION ON THE REGULATION OF CHILEAN FISHERIES²⁷

In December 1989 the military government enacted a new Fishing Law (the Merino Law). Its formal implementation was intended to become effective as from March 1990. A few days before the deadline for the regulation which at the time was being enforced, the Executive Branch of the recently democratically-elected government made a proposal to postpone the implementation of the new law until October 1990. This proposal was accepted by the newly elected Congress, on the basis of a commitment to review its structure. This triggered an exhaustive and protracted discussion on the regulation of Chilean fisheries that ended only towards the end of 1991, after six deferrals in Congress to deal with the proposed bill of reforms. The resulting Fishing law was finally approved and enacted only after a "political agreement" was arrived at in the Congress. Some authors have stated that the outcome of this agreement has imperfections which can imply worse consequences than the originally proposed Fishing Law (Vial, 1991, and Jiles, 1992).

In what follows we analyze the reasons why this agreement was reached the way it was. We attempt to learn some lessons in order to minimize future regulatory failures.

4.1. The original proposal (The Merino Law)

This law defined two types of fisheries; those in stage of "full exploitation" and all the remaining ones. The definition of "full exploitation" was based on biological criteria²⁸. Access to fisheries, other than those in 'full exploitation', was free, although there was a registration requirement.

The crucial innovation of the Merino Law was related to the regulation of "full exploitation" fisheries. Access to these fisheries was regulated through a

²⁷ Complementary reviews of this process can be found in Jiles (1992) and the Tasc Report (1991).

²⁸ A fishery is said to be in a stage of 'full exploitation' if exploitation is high enough to offset (exhaust) the "surplus productivity" of the species.

system of individual, permanent and marketable (exclusive) licenses for fishing, freely transferrable and divisible, based on Individual Transferable Quotas (ITQs) which were defined as a percentage of an annual global quota in terms of weight caught. The global quota is defined for a "fishery unit" which exploits a particular species and a given harvesting zone. The licence gives the right to catch a specific weight (tonnage) of fish.

The original allocation of the ITQs was proposed to be a function of the individual average catches in the three previous years to the implementation of the new law (more precisely, the percentage share of the corresponding annual catches of those years). This system of allocation was put under severe attack. New proposals, none of them finally accepted, allowed some percentage of initial participation for new investors, through auctioning of part of the total quota²⁹.

The use of ITQs in the regulation of fisheries was encouraged and supported by several Chilean authors (mainly economists). They argued that the main problem at industrial fisheries is one of common property, which creates incentives for an inefficient Ricardian rent dissipation due to excessive competition among harvesting units. Therefore, they stated that an efficient way to regulate is through the allocation of private property rights over fish-stocks in order to solve the commonality problem. They also argued that the traditional global instruments, such as global quotas or fishing moratoria, even though they might solve the biological problem (risk of collapse), they can not solve the efficiency problem (inefficient Ricardian rents dissipation) because they do not stop "excessive" harvesting competition (See Bitrán, 1989, Gómez-Lobo and Jiles, 1991, and Tasc Report, 1991).

At the institutional level, the newly-created National Fishing Council³⁰ was vested only with *consultative* powers, while the Fishing Authority retained the resolute and enforcing powers.

The main "explicit" arguments behind the new government's proposal to defer and modify the original proposed bill of law on fishing were basically two: First, the government argued that the original proposed bill did not include any budget increase to cover the higher costs required to enforce the new regulatory scheme. Second, it was argued that both (i) the proposed *free-access* regime for fisheries, other than those in a stage of "full exploitation", and (ii) the lack of State's rights to limit access would imply undesired "overfishing" and "overinvestment" in these fisheries.

²⁹ The original proposal also included an absolute restriction for licence renting, together with a restriction for individual ownership of 50% or more of the total annual quota of two or more fishery units.

³⁰ Formed by representatives of different groups involved in the fishing sector, such as entrepreneurs, workers, fishing experts and civil servants.

However, there was also an important "implicit" argument underlying the recently instated Government's decision to postpone the enactment of this law: The already ongoing discussion, on the proposed bill of law on fishing, had resulted in a widespread questioning of the Constitutional validity of the State's rights to apply and enforce some key regulatory instruments at fishing industries. In particular, the State's rights to limit access to fisheries and to sell property rights over the use of fish-stocks.

Under these circumstances, the recently inaugurated government's diagnosis was that the enactment of this law could have challenged the Authority's capacity to enforce regulatory actions at industrial fisheries, as this issue had to be solved by the Supreme Court and the Constitutional Tribunal. This possibility was perceived as a "significant risk", given that ITQs were the *key* regulatory instrument within the Merino Law and, therefore, if ITQs were judged to be unconstitutional, the Authority's regulatory capacity would then have become severely lessened.³¹ Besides, it is worth mentioning that both institutional powers (the Supreme Court and the Constitutional Tribunal) had a "sensitive" (political) relationship with the Government which had taken office only recently. Therefore, the possibility of a political bargaining on this issue, between the Executive Branch and these other two key institutional powers, was something that the new Government probably wished to avoid or, at least, postpone.

Some of the private fishing lobbies also opposed this original proposed bill of law. The Northern entrepreneurs were against the use of ITQs and access limits³². Fishing workers, on the other hand, argued that this law implied a "privatization" of the sea, which was considered to be a negative fact. They also argued that the new legal framework would imply higher unemployment.

4.2. The Democratic Government's proposal

After the postponement of the Merino Law, the Executive Branch prepared its own proposal, trying to include points of view from different groups linked to the fishing sector such as entrepreneurs, workers and fishing experts. In order to do so, a National Fishing Commission was appointed.³³

What differences did this new proposed bill of law have with respect to the Merino law? First, access to all fisheries, excluding those under "full exploitation", was now to be allowed only with the prior approval of the Fishing Authority,

³¹ We are indebted to Joaquin Vial for clarification on this issue.

³² This issue is explained in the next sections.

³³ In order to avoid political conflicts that could damage the recently restored democracy, the newly elected government of President Aylwin followed a consensus-oriented bargaining position in most of the relevant political issues.

instead of the simple registration requirements³⁴. Second, this proposal also included more regulatory instruments than the previous proposal to regulate fisheries under "full exploitation". These instruments included limits on the number of ships, fishing effort regulations, and ITQs allocated completely via "historical rights". At the institutional level, the enforcing capacity of the Fishing Authority was strengthened: In fact, its budget was increased and its full resolutive powers were retained.

Despite these differences, both projects agreed on the following important issues. First, both proposed bills of law clearly recognized the need to (centrally) regulate the fishing activity. Second, both agreed that access limitation and ITQs should become important regulatory instruments to be used. Third, both proposals granted full resolutive and enforcing powers to institutions which are not formally linked to the different private lobbying groups.

However, this new proposal was put under severe attack by the private sector. As of that moment, a protracted bargaining process started.

4.3. The bargaining process and the political agreement

The controversies that arose during the period from 1989 to 1991 were related to three key points:³⁵

- a) *Redistributive* disputes questioning the initial allocation scheme of the exclusive fishing rights, in terms of who were eligible candidates for them, with what proportions of the total quota and subject to what obligations of payment for acquiring these rights
- b) *Constitutional* drawbacks questioning the State's right to limit access to fisheries and to sell "full" property rights over fish-stocks³⁶. The key issue here was what type of rights the State has and hence can transfer to private agents over sea-resources.³⁷

³⁴ Presumably, the approval of the Fishing Authority would be more restrictive concerning access conditions than the simple registration requirements for fisheries, other than those under "full exploitation". However, we were unable to come up with definite information on this point.

³⁵ Other minor issues under discussion included the possibility of unemployment costs and the problem of fish-stocks shared with Perú.

³⁶ The constitutional issue has been a common and very critical problem in the regulation of fisheries. Comments on the case of U.S. fisheries can be found in Keen (1988) and Fletcher (1965).

³⁷ For a legal analysis of this issue see 'Informe Constitucional sobre Ley de Pesca' (Constitutional Report on the Fishing Law), December 3rd 1990.

- c) Private entrepreneurs³⁸ argued that an ITQs scheme implied infeasible *information* requirements for an efficient public management of this regulation. They argued that regulatory bodies do not, and cannot, know the information required --with enough precision-- in order to implement an efficient system of ITQs. This criticism is related to the costs of monitoring the true state of fish-stocks and, with less emphasis, the individual actions of harvesting firms.

The main opposition to the use of ITQs came from the entrepreneurs of the Northern fishing fleet, in contrast with the entrepreneurs of the Southern fleet who supported the use of ITQs³⁹. This asymmetry was probably a consequence of the highly diminished (overexploited) fish-stocks in the Northern region and, therefore, the Northern entrepreneurs' desire to reallocate their fleet's operations to the more abundant fish-stocks at the Southern fisheries. Given this objective, the allocation of ITQs, either via "historical rights" or via public auctioning, would have reduced the Northern entrepreneurs' profits, compared to a *free access* situation. This hypothesis seems coherent with the defensive position of the Southern entrepreneurs, who agreed with the use of ITQs although *locally allocated* via historical rights. (Jiles, 1992, Tasc Report, 1991).⁴⁰

Among the main issues under discussion, the Constitutional debate quickly became determinant. In October 1990, the Constitutional Court ruled that several articles of the proposed Bill of Law on Fishing were unconstitutional. Nevertheless, the Court's statement was related only to minor legal-procedural issues, thereby avoiding to set a clear position with respect to the main issue; that is, the State's rights to limit access to fish-stocks and to sell full property rights over them. As a result of this, the Government was forced to seek an agreement in order to avoid new deferrals of the Fishing Law. By september 1991 a final political agreement was arrived at by the main political parties controlling the Congress⁴¹. Hence a multi-party bargaining problem was finally solved via political procedures, with the Legislative Branch acting as an important arbitrator.

The final agreement substantially restricted the use of ITQs as to the central role they played in the original proposal. ITQs remained as a possible, though *not compulsory*, regulation for fishery units under a stage of "full exploitation", a definition which is based on biological criteria of conservation. Moreover, the use of ITQs in fisheries under "full exploitation" regime is limited, as a maximum, to only half of the total annual catch quota; while the other half remains under a free

³⁸ Especially those involved in the Northern fish-meal industry.

³⁹ If they were allocated via 'historical rights'.

⁴⁰ In order to get access to fish-stocks in the South, the Northern entrepreneurs wanted to eliminate a fleet (size) freezing regulation imposed by the military government in 1985.

⁴¹ By this we refer to the published amendments to the original new Fishing Law, in Diario Oficial (Official Gazette), September 6th, 1991, Law No. 19079 and Law No.19080.

access regime. This maximum value of 50 per cent (of the current annual quota under ITQs) is supposed to be reached through the annual selling, via public auctioning, of 5-per-cent-rights over these total annual quotas.

On the other hand, the political-agreement on the Fishing Law created two other status for fisheries, known as fisheries "under recovery" (after over-exploitation), and those at a stage of "infant development"⁴². In these fisheries there is no upper limit to the use of ITQs, and they are allocated via public auctioning.

Another important aspect of the new Fishing Law is the creation of a National and several Local Fishing Councils composed of representatives of different groups involved in the fishing sector (entrepreneurs, workers, fishing experts and civil servants). These Councils are vested with resolute rights in practically all the most important regulatory issues. (See Table 3).

With the exceptions described above, the general framework of the regulation maintains free-access as the basic principle. Entry restrictions are possible only in the following cases: (i) if proofs are given that the fishery is "under recovery" or in a stage of "infant development" and (ii) if proofs are given that the fishery is in a stage of "full exploitation", by attaching a technical report from the Fishing Authority, and the approval of two thirds of the National and Local Fishing Councils. In case (ii) entry restrictions are allowed only as a *transitory device*⁴³.

On the other hand, the new Fishing Law retains (a) Total Annual Quotas on catches and (b) other biologically oriented controls on fishing efforts⁴⁴ as the core instruments of control. Other (more direct) control mechanisms over fishing effort virtually disappear (e.g. limits on fishing capacity of the fleet).

4.4. Some comments on the current Fishing Law

Table 2 shows the main features in the evolution of the recent discussion about the Chilean fishing law. Rows show the three different proposals, and columns describe the access regimes, the main regulatory instruments and the decision-making mechanisms contained in each proposal. Table 3 shows with more detail the different decision-areas and the corresponding legal requirements for the case of the "Politically-Agreed on" Fishing Law. Let us pinpoint three potential sources of distortions or imperfections within this legal structure:

⁴² The definition of "infant development" and "under recovery" is based on biological criteria. Both types of fisheries represent only a minor proportion of the national fisheries under current exploitation.

⁴³ Entry restrictions, for that part of the global quota which is excluded from the ITQ mechanism, are possible but with an upper limit of one year of duration.

⁴⁴ Seasonal closures, minimum net sizes, minimum catch sizes.

- a) The current legislation is basically *free-access* oriented, and the main regulatory instrument consists of *global* quotas. Empirical evidence has shown that these two instruments are ineffective and also inefficient in solving the "overfishing" problem, both from the biological and economic perspective. However, the final result will depend on the Regulator's powers to enforce the available instruments and the private sector's attitude to cooperate or not when the sector faces regulatory decisions which involve conflictive issues.

Year	Country	Regulatory Instrument	Enforcement Mechanism	Outcome
1980-1985	USA	Individual Quotas	Individual Quota System	Overfishing reduced
1985-1990	USA	Individual Quotas	Individual Quota System	Overfishing reduced
1990-1995	USA	Individual Quotas	Individual Quota System	Overfishing reduced
1995-2000	USA	Individual Quotas	Individual Quota System	Overfishing reduced
2000-2005	USA	Individual Quotas	Individual Quota System	Overfishing reduced
2005-2010	USA	Individual Quotas	Individual Quota System	Overfishing reduced
2010-2015	USA	Individual Quotas	Individual Quota System	Overfishing reduced
2015-2020	USA	Individual Quotas	Individual Quota System	Overfishing reduced
2020-2025	USA	Individual Quotas	Individual Quota System	Overfishing reduced
2025-2030	USA	Individual Quotas	Individual Quota System	Overfishing reduced

TABLE 2
EVOLUTION OF THE RECENT DISCUSSION ON
THE CHILEAN FISHING LAW

	Access Regime and Regulation Instruments	Decision-Making Mechanism
<p>Law No. 18892 (The Merino Law) (Dec. 1989)</p>	<p>1) Full-Exploitation Fisheries:</p> <ul style="list-style-type: none"> - Limited access, conditioned by the use of ITQs allocated via historical rights(75%) and auctions (25%). <p>2) Other Fisheries:</p> <ul style="list-style-type: none"> - Free access, simple registration is required. 	<ul style="list-style-type: none"> - Declaration of full exploitation stage and auctioning of ITQs require technical approval from the Fishing Authority (resolutive power), and an expert report from the National Fishing Council (consultative power).
<p>Aylwin's Government Proposed Bill of Law (July-Sept. 1990)</p>	<p>1) Full-Exploitation Fisheries:</p> <ul style="list-style-type: none"> - Limits on number of ships. - Fishing effort regulations. - Use of ITQs allocated only via 'historical rights'. <p>2) Other Fisheries:</p> <ul style="list-style-type: none"> - Entry permission from the Fishing Authority is required. 	<ul style="list-style-type: none"> - The Fishing Authority has full resolutive rights, and the National Fishing Council has only consultative powers.
<p>Politically Agreed on Law (Sept. 1991)</p>	<p>1) Full-Exploitation Fisheries:</p> <ul style="list-style-type: none"> - Free access, unless the Fishing Authority states the contrary (see decision mechanism). - Limitation of access means to put a limit on the fleet's tonnage capacity. - Possible but not compulsory use of global catches quotas. - Possible but not compulsory use of ITQs, restricted to only a maximum of 50% of the global annual quota. Each year only 5% of the global annual quota can be auctioned. <p>2) Two other fisheries' status are created: fisheries "Under Recovery" and at "Infant Development":</p> <ul style="list-style-type: none"> - Use of ITQs on catches, allocated completely via an auction⁴⁵. <p>3) Other Fisheries: ("traditional").</p> <ul style="list-style-type: none"> - Fishing-permit requirements. 	<ul style="list-style-type: none"> - The Fishing Authority can declare a fishery in stage of full exploitation, and auction ITQs, with the approval of both the National and Local Fishing Councils (absolute majority required). - The Fishing Authority can close access to fisheries under full exploitation stage with approval of two thirds of the National and Local Fishing Councils. - The Fishing Authority can set annual global quotas with the approval of the majority of the National Fishing Council and upon consultation to the Local Fishing Council. - The Fishing Authority can auction ITQs in fisheries "under recovery" and in "infant development" with the approval of the majority of the National Fishing Council and upon consultation to the Local Fishing Council.

SOURCE: Fishing Law, Tasc Report (1991), Jiles (1992). For more details on the "Politically-Agreed on" Fishing Law, see Table 3.

⁴⁵ In the case of the "infant development" status, 10% of the global quota can be allocated through "historical rights".

TABLE 3
DECISION-MAKING MECHANISMS IN THE
"POLITICALLY-AGREED ON" FISHING LAW

Decision Area	Requirements for Legal Approval	Remarks
(I) Declaration of <i>Full Exploitation</i> stage:	<ul style="list-style-type: none"> - Fishing Authority's technical report. - Absolute majority in Local and National Fishing Councils. 	
(1.1) access restrictions	<ul style="list-style-type: none"> - 2/3 members approval in Local and National Fishing Councils. - Fishing Authority's technical report. 	<ul style="list-style-type: none"> - Access restrictions are transitory, with a maximum duration of one year.
(1.2) Return to the <i>General Access</i> Regime.	<ul style="list-style-type: none"> - Absolute majority in Local and National Fishing Councils. - Fishing Authority's technical report. 	
(1.3) Global Annual Quotas	<ul style="list-style-type: none"> - Fishing Authority's technical report. - Consultation with Local Fishing Councils - Absolute majority in National Fishing Council. 	<ul style="list-style-type: none"> - If unexpected favourable natural phenomena do occur, it is possible to increase the global quota with the approval of National Fishing Council.
(1.4) ITQs	<ul style="list-style-type: none"> - Absolute majority in Local and National Fishing Councils. - Fishing Authority's Technical report. 	<ul style="list-style-type: none"> - If ITQs are auctioned, access to the fishery is limited during one year.
(II) Declaration of <i>Under Recovery</i> stage and ITQs(*)	<ul style="list-style-type: none"> - Fishing Authority's Technical report. - Consultation with Local Fishing Councils. - Absolute majority in National Fishing Council. 	<ul style="list-style-type: none"> - If this stage is declared, previous fishing permits are finished. - During first year, 100% of the total annual quota is auctioned.
(III) Declaration of <i>Infant Development</i> stage and ITQs(*)	<ul style="list-style-type: none"> - Fishing Authority's technical report. - Consultation with Local Fishing Councils. - Absolute majority in National Fishing Council. 	<ul style="list-style-type: none"> - If this stage is declared, special transitory permits (for three years) are given to those fishermen already established in the fishery. After that, a new fishing permit is given for other ten years. - If there are fishermen previously established in the fishery, 90% of the global annual quota is auctioned. On the contrary, the whole quota (100%) is auctioned.

SOURCE: Current Chilean Fishing Law.

(*) The declaration of this stage triggers the option to use ITQs.

- b) Even though the use of ITQs is possible, though not compulsory (given a set of ex-ante specified triggering factors), it is limited to only a maximum of half of the global annual quota at fisheries under "full exploitation". There seems to be no *technical* arguments to explain the advantage for only a "partial" use of the ITQ instrument. The "biomass information-requirements" argument is weak, because there seems to exist no significant differences in the information required to apply either the global quota or the ITQ system⁴⁶. On the other hand, the "enforcing costs" argument also seems to fail⁴⁷. In fact, there seems to be no technical argument that makes it possible to assert that an ITQ-system is better than a global quota regulation for only half of the annual quota, but not for the other half of it. The reason seems to be due to distributive considerations. We will take up this issue later.
- c) Another *potential* source of problems is related to the decision-making mechanisms and the Regulator's enforcing powers: In fact, the new Fishing Law gives "potentially dangerous" powers to private lobbies of several groups whose objectives may differ from the social ones. Nonetheless, and even though other authors (Jiles, 1992, Vial, 1991) have emphasized this point, we must also consider the possibility that a higher private participation at the level of regulatory decisions can bring more credibility and institutional-stability to fishing regulations. Similarly, it is not obvious that all private sector's representatives will necessarily behave in a colluded way against the Regulator's aims. Nonetheless, which side of the argument will actually dominate is something that cannot be predicted straightforwardly. More precise comments will have to wait for more empirical evidence on the operation of this new Fishing Law.

By the time this paper is published, the New Fishing Law will have been in operation for almost two years. During this period, we have observed some promising improvements in the results from recent fishing regulatory cases. For instance, the successful application of ITQs in the case of the red shrimp (*pleurocondes monodon*) (Calfucura and Jiles, 1994); and the combined application of (a) seasonal closures and (b) individual catch permits (when harvesting is allowed) in the case of the Chilean abalone (*concholepas concholepas*). In both cases, the current legal framework has made it possible to arrive at promising solutions as an initial step in a situation of biologically-overdepleted fish-populations.

Whether or not these initial promising successes will be repeated in future regulatory cases which involve a conflict, it cannot be predicted on an "a priori"

⁴⁶ ITQ is basically a global quota divided into several individual quotas.

⁴⁷ Some authors have argued that the enforcing costs should be low given that most of the production is exported and hence there is another way (which is an alternative to direct controls on individual catches) in controlling and enforcing the ITQs (Gómez-Lobo and Jiles, 1991).

basis. Nonetheless, it seems clear that the answer will crucially depend on the Regulator's *effective* control and enforcement powers when applying the policy-instruments which are available under this new Fishing Law (global quotas, seasonal biological closures, the controversial ITQs⁴⁸). The effectiveness of these powers is necessarily related to the private sector's attitude to collaborate or not with the regulatory task.

Despite the uncertainties involved in the future performance of this new regulatory framework, there are some lessons that can be drawn from some already observed conflicting issues. This is what follows.

4.5. On sources of conflict and areas for improvement

4.5.1. Developing a "common language"

A clear lesson that emerges from the Chilean recent fishing controversies is the need to make more efforts in order to refine the "language" of discussion. When thinking of fishing regulatory frameworks, we find multiple technical complexities: Uncertain Nature's states, sunk capital stocks, incomplete property rights, dynamic considerations, long-run Sustainability and multiple equilibria issues, among the key ones. Moreover, the regulatory discussion must deal not only with these multiple complexities, but also with "translating" different professional languages (the idiolects of marine biologists, economists, lawyers and engineers), and with arbitrating on and solving important distributive disputes.

The fragility of the attempts to reduce the controversial issues to objective, widely-accepted, and measurable areas of dissent is a key outcome of the above situation. This reflects the lack of a more precise "common language" between the different bargaining parties. This important shortcoming is a challenge to build up more specific arguments and more robust models, when thinking and trying to understand the basic issues under discussion. The need for the previously mentioned concept refinements derives from this.

4.5.2. "Institutionalizing" the increasing scarcity of common-pool resources

History teaches us that the creation of private property is an endogenous gradual response to the increasing scarcity value of common-pool resources with originally free-good features⁴⁹. However, private property rights are not always the

⁴⁸ In the final version of the new fishing law, ITQs define transitory fishing rights (for a fixed period of 10 years), in most occasions only for part of the global annual quota, being allocated through public auctioning, and subject to (simple) majority approval at different administrative stages.

⁴⁹ See, for instance, Libecap (1989), North (1990) and North and Thomas (1973).

optimal (least-costly) institutional response or internalization mechanism for the increasing scarcity value of these resources. We know that the use of private property can often involve significant costs. Private adjustments in the optimal size and structure of the productive-firm are an alternative response. Also private contractual arrangements between firms. Regulatory schemes and the corresponding legal protocols are another option. Which one of these institutions will be the optimal solution, for internalizing the increasing scarcity values, is an empirical problem that necessarily depends on industry-specific conditions.

One important corollary that emerges from this general principle, when applied to the recent Chilean discussion on fishing regulations, is the open-to-the-future challenge for thinking, more carefully, about the efficient evolution of the legal status of originally free-available resources that gradually change their scarcity-values over time and hence their alternative economic costs. This issue directly relates to the Constitutional controversy that arose in Chile with respect to the State's rights to control access to marine fish-stocks and to assign and sell full property rights over them. We have already highlighted the importance of this point. This becomes even clearer when we realize that this issue has far more general applications than only to fishing industries.

In fact, this is a classical example of problems that legislations face when originally free-goods, or public-goods which are not subject to congestion, become more scarce resources, transforming themselves, for instance, into non-exclusive externalities in consumption (air pollution) or "rival- consumption" goods subject to commonality problems (fish-stocks).

4.5.3. Short-run versus long-run aims

Any regulatory framework faces the problem of defining two types of strategies. One is related to those prescriptions that the optimizing criteria define as the most efficient instruments when the regulated sector is behaving according to the expected "long-run" industry's patterns. The other type involves policies related to the transition-solutions for undesired short-run disequilibria; for instance, when a government decides to buy out a given percentage of an overcapitalized fishing fleet which is in the hands of the private sector.

This temporal distinction should give a valuable insight into the "short-run" negotiations between regulators and the private sector: It seems wise to divide the regulatory discussion between, first, trying to achieve an agreement about what is desired for the "long-run"; and second, how we wish to and can approach that situation. This negotiation strategy may reduce the likelihood of getting trapped in vicious loops of disagreement, especially when the rates of temporal discount are high (as they normally are in developing countries!).

4.5.4. Distributive disputes

Another important lesson, for future attempts to improve regulatory schemes dealing with common-pool resources, is the Regulator's need to be fully aware of, and to be prepared for, the distributive disputes that will necessarily arise from institutionalizing the higher scarcity-value of those resources.

The distributive issue was clear in the recent Chilean controversy over fishing regulations. In fact, it suffices to mention the Northern entrepreneurs's strong and systematic opposition to ITQs-proposals. This opposition became one of the main barriers that triggered the dismissal of the first two proposed bills of law. There exists some partial evidence supporting the distributive-motivation underlying this opposition. In fact, we have already mentioned that there are no clear technical reasons to justify the different ITQ-regulations that were finally enacted and accepted for fisheries under "full-exploitation", versus those "under recovery" or in "infant development". However, there exists a clear and important asymmetry between both types of fisheries: Only in fisheries under "full exploitation" status there were already long-established firms, and with significant levels of harvesting operations. Therefore, in these fisheries the perspective of distributive-losses, triggered by a more widespread payment-scheme to enjoy private exclusive harvesting, was clearly more threatening for the incumbent firms. This perception of ITQs, as a losses-triggering regulation for Northern entrepreneurs, was reinforced by the overdepleted stage of the Northern fish-stocks and the resulting desire from these firms to reallocate their harvesting operations more intensively at Southern fisheries.⁵⁰

When a country needs to institutionalize higher social scarcity-values for originally common-pool resources, the Authority must be prepared to deal with quite demanding policy-challenges that will be triggered by unavoidable distributive-disputes. From the Regulator's perspective, the central element of these challenges consists in helping to agree on and design "Paretian-compensations" for the losers that emerge from the institutional recognition that the common-pool resource no longer has a zero shadow scarcity value: Someone will have to start to pay for something that used to be obtained without explicit payments.

However, the design of these compensation-schemes requires to overcome two important obstacles: First, there exists a clear difficulty in attempting to assess the relevant value of the costs and benefits that result from the regulatory changes; this is particularly valid at MIFs, where firms' net income flows are affected by uncertainty on Nature's states and rivals' actions. A clear corollary for the Authority is the need to persevere with investments on information-gathering

⁵⁰ This specific feature helps to understand the Chilean failure in allocating fishing property rights based on "historical presence", although the economic literature quotes this allocation-device as a possible solution for the triggered distributive disputes (see, for instance, Cropper and Oates, 1992).

concerning the fishing sector. The second obstacle relates to the Regulator's credibility to fulfill and to enforce the promised compensation-schemes, once the new legal institutions have been set up. In order to make headway on this issue, the Authority needs to avoid any kind of discretionary policy-improvisation. However, to meet this challenge successfully does require a consistent collaboration from the private sector. "One-sided policy miracles" are an illusion.

5. FINAL REMARKS

This paper by no means attempts to give a complete review of Chilean fishing regulations. There is a whole set of regulatory instruments which have not been mentioned with detail: Seasonal and geographical closures for fishing activities; input restrictions, such as regulations on fleet's harvesting capacity, or restrictions on the type of gear and fishing nets, and restrictions on minimum catch-sizes, among the most important ones. A proper discussion of each of these instruments require very specific information and detailed arguments.

Our emphasis, on the contrary, has been placed on *access-schemes* and *quota-devices*. The reason for this is because both instruments deal directly with the problem of "common property" which is at the basis of this type of industry. The lessons from our historical analysis are clear: Before the recent reforms, fishing regulations were subject to irregular and discretionary policy-criteria. Related to this, fishing regulators did not have effective enforcement powers in several key policy-decisions, when dealing with the common-property problem. This institutional weakness can be partially understood as a consequence of the relatively higher abundance of fish-stocks, before the boom of the Chilean fishing growth began in the mid-seventies. However, we clearly need additional arguments to fully explain the prolonged temporal permanence of sub-optimal regulatory institutions for the Chilean fishing sector. This paper leaves open this challenge.

Does the new Fishing Law imply a "potentially" more efficient regulatory framework than the previous legal setting? We believe the answer is affirmative. First, the main achievement from the recent reforms is the creation of a more unified and more coherent regulatory framework. This benefit overcomes the specific apprehensions that we have already mentioned with respect to the new Fishing Law. In fact, all these apprehensions are avoidable or subject to gradual improvements. Increasing empirical evidence on the effective operation of this new Law can help to advance in this direction. However, to do so requires that this more coherent legal setting effectively translates itself into more consistent and hence more credible policy-decisions. This outcome requires to fulfill a "two-sided-balance": On the one hand, the Authority's definite commitment to fulfill and enforce the behaviour-protocols and instrument-aims which are considered by the new Fishing Law. On the other, the private sector's fair commitment to abide by and cooperate with the decision-making mechanisms and the enforcement of the

agreed regulations. A cooperative partnership between the Regulatory Authority and the private firms is a key element in the success of this new Fishing Law. The private-sector's participation at the decision-making process of several key regulatory-decisions may help to improve the outcomes from such a partnership.

There exists a second line of arguments that leads us to expect a more efficient performance from the current Fishing Law versus historical records. These arguments refer to the "circumstances" under which the new law was finally issued: First, this law slowly arose after a long and widespread discussion about fishing regulations. This had not occurred, at such a scale, at least in the previous two decades. As a consequence, this discussion has produced a partial improvement in our understanding of the key issues subject to controversy. Second, for the first time in a long period, the issue of fishing-regulations was perceived as a national problem with "high" political priority. This surely shook the Chilean "sensitivity" to the "fishing issue". Third, the long controversy has produced a widespread "perception" that some of the Chilean key fish-stocks are more scarce than in the previous decades. This opens the possibility for improvements at the (social) optimality of the internalization-mechanisms which are privately and collectively designed to deal with the higher scarcity value of this natural resource.

Finally, the reader may still have another open question: Could the resulting fishing law have been more efficient? Despite the misleading common-sensical nature of this doubt, and in addition to the obvious answer that it is always "possible" to improve on existing institutions, we want to highlight an important conceptual lesson that emerges from the recent Chilean fishing controversies. This lesson refers to the difference between "possible" and "feasible" institutional outcomes.

In fact, the recent controversies clearly highlight the importance of transaction-costs-based constraints when a social group aims to improve the economic efficiency of a given institutional arrangement. Distributive disputes were an important constraint because it was costly to design side-payments or Paretian-compensation-schemes for the potential losers. These compensation-schemes were a costly and, therefore, a binding mechanism-design-problem because the negotiations faced significant transaction costs. The sources for these transaction-costs could be traced out, and related to, asymmetric and incomplete information-sets. This is a lesson already established in the increasing literature on informational-economics.

A clear corollary that arises from this lesson is the misleading Welfare evaluations that can result from using First-Best optimality prescriptions. This possibility of irrelevant and misleading conclusions is directly related to the presence of significant transaction, or informational, costs. When transactions are not informationally-costless, Welfare prescriptions must consider "constrained" optimality yardsticks (see, for instance, Arnott and Stiglitz (1986)); that is, given

relevant constraints on information-sets and the "feasible" regulatory-instruments which are available to the Authority.

In order to offer a more precise evaluation of the actual operation of the new Chilean Fishing Law, we will have to wait for more empirical evidence. In the meantime, however, the challenge to make collective efforts will remain open, in order to accomplish the already mentioned "two-sided balance" and hence make gradual improvements on this long-awaited new Fishing Law.

APPENDIX 1

Total Catches (ton., 000)

Years	Chile			Peru
	North	South	Total	
1970	813.3	87.6	900.9	12295.7
1971	1008.8	204.5	1213.4	10298.8
1972	358.5	150.1	508.6	4462.2
1973	269.0	159.5	428.5	(3) 1994.8
1974	661.6	193.6	855.2	3801.2
1975	533.8	104.6	638.4	3117.0
1976	960.2	103.5	1063.7	4003.9
1977	926.0	124.3	1050.3	2017.4
1978	1416.3	194.8	1611.1	2811.5
1979	1846.1	307.3	2153.3	2881.7
1980	2078.0	332.6	2410.7	1726.2
1981	2159.3	543.1	2702.5	1850.3
1982	2540.9	708.3	3249.3	2946.0
1983	2708.7	582.5	3291.2	1227.7
1984	3009.5	510.7	3520.2	(4) 2740.8
1985 (1)	3155.2	867.5	4022.7	3597.9
1986 (2)	3604.6	1098.0	4702.6	4995.7
1987	2345.2	1635.4	3980.7	3969.4
1988	2490.6	1847.5	4338.0	6060.0
1989	3039.3	2246.7	5286.0	5486.2
1990	1772.6	2049.6	3822.2	5848.6
1991	1732.7	2675.6	4408.3	6063.1
1992	2066.0	3046.0	5112.0	6587.1
Average 85-89	2927.0	1539.0	4466.0	4821.8
Average 90-92	1857.1	2590.4	4447.5	6166.3

(1) Seasonal closures begin in this year

(2) Freezing on fleet's storage-capacity, in the North and VIII region, starts this year.

(3) May 7th, 1973: Beginning of State-owned firm "Pesca Peru".

(4) Peruvian private fishing sector is "reactivated".

Source: Records from Development Fisheries Institute (IFOP) and private sector firms.

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