

Institutional designs to face the dark side of total allowable catches

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Setting total allowable catches (TACs) is an endogenous process in which different agents and institutions, often with conflicting interests and opportunistic behaviour, try to influence policy-makers. Such policy-makers, far from being the benevolent social planners many would wish them to be, may also pursue self-interest when making final decisions. Although restricted knowledge of stock abundance and population dynamics, and weakness in enforcement, have effects, these other factors may explain the reason why TAC management has failed to guarantee sustainable exploitation of fish resources. Rejecting the exogeneity of the TAC and taking advantage of fruitful debate on economic policy (i.e. the rules vs. discretion debate, and that surrounding the independence of central banks), two institutional developments are analysed as potential mechanisms to face up to misconceptions about TACs: long-term harvest control rules, and a central bank of fish.

Keywords: central bank of fish, decision framework, discretion, harvest control rule, institutions, rules, TAC.

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Introduction

The definition and implementation of the total allowable catch (TAC) system has become one of the cornerstones in present-day fisheries management. Advice on TACs mark the culmination of a long process based on stock assessments and population dynamics, which involves complex calculation and modelling. Scientifically advised TACs have been generally aimed at attaining conservational goals based on biological criteria. Although sovereignty of the biological science is evident in the process, willingness is sometimes offered to incorporate socio-economic and ecological factors into the computational framework.

Since the first TACs were implemented in the second half of the 20th century, the complexity of underlying models and the approaches developed to calculate appropriate catch options have risen exponentially. In particular, great attention is now being paid to incomplete knowledge and different types of uncertainties, although structural uncertainties (Charles, 1998; Young, 1998) are not easy to deal with, even with the most advanced methodologies developed recently. Recognizing the difficulties in facing structural uncertainties through analytical tools, there has been burgeoning effort to design frameworks that are less sensitive to uncertainty, such as the precautionary approach or adaptive management, and that therefore should provide more reliable results even when knowledge is limited or incorrect.

Despite major breakthroughs in methods of calculation, the model of public decision-making behaviour assumed in the policy process leading to final TAC decisions seems still to be anchored in the 1960s (Tinbergen, 1956; Kirschen *et al.*, 1966), explicitly or implicitly. Surprisingly, fisheries economists have been primarily concerned with the socio-bio-

economic consequences of alternative management instruments. After starting with overall quota regimes, attention since the 1980s has focused on individually transferable quotas (ITQs), a system by which overall quota is divided into tradable shares through a quota market. With the consequences of this system and policy objectives in mind, one might select the socio-bio-economical allocation that is closest to optimal. Implicit in such an approach to policy design is to view the policy-maker as a passive agent who can be programmed like a machine, a scientific community that calculates the TAC using best available knowledge, an administration that merely implements decisions, and an industry that unconditionally accepts and adapts to these decisions.

For now, though, let us accept the traditional view of policy-making in the 1960s and assume that the TAC set for a stock is substantially higher than that which guarantees its sustainability. Obviously, such a condition might jeopardize the conservational goal to which the decision process is subordinate. A TAC may be incorrectly set for different reasons. The first is related to a lack of accurate data and knowledge of stock size and dynamics. In fact, there seems to be growing scepticism that fisheries can somehow be managed through the use of quantitative biological models, because despite the advancing knowledge, the theory may not be sufficiently well developed to provide a basis for sufficiently reliable TAC-setting (Massod, 1997; Batstone and Sharp, 2003). However, even if the information at this stage would be perfect and the proposed TAC would match the conservational criteria accurately, the final decision may still be incorrect owing to institutional complexities and uncertainties surrounding the decision-making process.

Rejecting the simplified model of the 1960s, we look at the institutional side of the TAC-setting process, identifying the main actors and their roles, not only those in the decision framework (DF), but also those in the influence-projection framework (IPF) and the option-generating framework (OGF). Far from being exogenous to the decision framework, setting a TAC is a complex process in which different agents and institutions, often with conflicting preferences and interests, advise, influence, and decide (Astorkiza *et al.*, 2006; del Valle *et al.*, 2006). Next we deal with the advantages of long-term agreements such as harvest control rules (HCRs), to alleviate institutional uncertainty, agency relationships, opportunistic behaviour, and perverse influences that may endanger stock conservation by pushing for an inappropriate TAC. However, agreeing on HCRs is not a guarantee of compliance. This is why further institutional development needs to be discussed: the delegation of conservation policy to an independent agency that would take care of the sustainability of the resources in the same way as central banks take care of inflation.

The institutional framework

Who are the actors in the process of TAC setting, and what is their role in that process? The answers to these questions depend to a great extent on the underlying model of public policy that we adopt. Let us first describe a conventional and simplified model that is inspired by traditional economic policy and welfare-economics views. Once its restrictive assumptions have been clarified, a more powerful and realistic scenario can be presented.

According to the conventional model of public decision-making, any economic or related policy should be viewed as the result of a rational process of elaboration that manipulates certain instruments (e.g. setting an overall TAC and dividing it into individual quotas) in order to attain some objectives (e.g. a stated conservation target, raising efficiency, or specific distribution goals). Once a social-welfare function has been defined according to the hierarchy among objectives emanating from social preferences, a benevolent, fully informed, omnipotent and altruistic policy-maker emerges who only pursues common welfare and determines optimal policy (i.e. that maximizing the social-welfare function). This is in fact a technical and objective characterization of public decision-making, in which instruments and objectives are established through separate and independent processes. The social-welfare function is the translation of social preferences, which may be revealed by diverse mechanisms, the most relevant being voting preferences in elections. Although the definition

of objectives incorporates highly normative elements, the optimal policy and instrument choice is not related to the preferences, evaluations, or personal interests of policy-makers.

This simplistic theoretical approach is not far from that frequently adopted in fisheries policy and specifically in the process of TAC setting. Accordingly, a scientific research agency is asked to advance a proposal based on the best self-validated knowledge that primarily conforms to conservation criteria, relying almost completely on the results of formal stock assessments (del Valle *et al.*, 2006). Once the advice is provided, the politician makes the final TAC decision: the one that maximizes the benefits to society. The administrator is then responsible for its implementation.

This basic model clearly misses important details which have been broadly documented in different schools of economic thought. First, even if stakeholders are left outside the decision framework (DF), which is not always the case, they still influence the system through the political arena, especially if incentive-generating mechanisms (such as those driven by ITQs or cost recovery) are used. Second, one of the main contributions of the school of public choice is ignored, namely the translation of rational and opportunistic behaviour to public decision-making. Therefore, it is not just individual, private, micro-economic agents seeking their own interests and maximizing utility, this hypothesis can be extended to all stakeholders. This implies that policy-makers and the rest of the agents inside and outside the decision framework may pursue self interest and personal goals when advising, deciding, implementing, and influencing. These self interests are related mainly to asymmetric information and agency relationships, and might involve minimizing the costs of enforcement, maximizing budgets, pursuing best science, personal and professional advancement, avoiding criticism, or simply being re-elected (Tirole, 1994; Townsend, 1998). Third, issues such as ideology, loyalty, a search for legitimacy, or transaction costs are also omitted, despite their also determining the behaviour of agents and policy-makers, as defended by the discipline of New Institutional Economics.

It is more realistic to consider the TAC decision-making process as the result of the dynamics of political exchanges in which a great number of actors intervene, all with their own preferences, asymmetries, and limited rationality. The decision is therefore taken in an arena where conflicts of interests exist between different agents and institutions (bureaucracy, advice institutions, fishers, policy-makers etc.). What is needed is to introduce political and institutional factors as endogenous variables (Arias, 1996) in the structures and bio-economic models. Therefore, it is important to reject simplistic institutional assumptions, in order to obtain a better understanding of the specific processes, links, and influences that a particular approach to setting TACs may have.

Figure 1 is an adaptation to the TAC-setting process of an institutional diagram associated with the renewed vision of political economy (Frey, 1983; Levacic, 1987). It reflects a general model in which specific realities are put aside, and includes the set of agents and institutions (from inside and outside the government system) that, to a greater or lesser extent, take part in decision-making, and the interrelationships among various agents. Three areas can be distinguished in the diagram: (i) the decision framework (DF), (ii) the influence-projection framework (IPF), and (iii) the option-generating framework (OGF).

Decision framework (DF)

The DF is the main core of the process: decision-making by public authorities with constitutional competences designed to bear responsibility for their actions. Therefore, the three traditional political powers should be included in a DF: executive (represented in this case by the Minister of Fisheries, or MoF); legislative (parliament); and judicial (courts). Although the MoF represents the highest agent in the hierarchy, his proper functioning depends largely on his interconnection with the bureaucracy. Precisely, and differently from traditional economic policy, bureaucracy is included here in DF. In reality, the intervention of bureaucracy takes place before and after the actual decision on a TAC, which is the direct responsibility of the MoF. The role of bureaucracy inside a DF is essential. The collection, management, centralization, and exploitation of data, as well as the calculations of catch options from which a TAC can be chosen, usually land on specialized technical consultancies

that are either part of the government or dependent on the MoF, named here the Ministry-dependent agency (MDA). Implementation of the TAC is the responsibility of the administration, another part of the bureaucracy.

Different considerations support the inclusion of bureaucracy in the DF. The obvious information advantage generates dependence between the MoF and the bureaucracy. Also, the bureaucracy is established as an element that serves to de-politicize politics. Because TAC setting needs sound technical expertise, a bureaucracy serves as a means to ensure the technical solvency of the decisions made. Moreover, governments may have incentives to increase the power and autonomy of its bureaucracy in order to minimize the political cost of decision-making, especially when unpopular reductions of TACs are necessary. In short, the leading role of a bureaucracy is based on the unavoidable necessity that to take and implement their decisions, governments have to trust a bureaucratic system that guarantees two basic conditions: continuity and technical competence.

Influence-projection framework (IPF)

A wide variety of typologies of agents and institutions interact in the IPF to seek an impact on the DF, in particular on the decisions of the MoF. A spectrum from international organizations to political parties involved in environmental issues, especially scientific advisory bodies and different pressure groups, tries to influence policy-makers so that they make the decisions that best suit their organizational interests, or conversely, cause them the least possible harm. Their techniques for exerting pressure are varied, and range from intervention in political spheres by direct contact with authorities, collaboration with the administration or research centres specialized in data collection, to campaigns using experts and mass-media communication aimed at influencing public opinion.

The pressure groups conventionally located in the IPF surrounding the process of TAC setting are fishers, fish retailers, processors, and ecologists. Fishers generally press for higher TACs and longer fishing seasons in the interest of the group to which they belong, whereas ecologists mainly request greater protection for the resources and the use of selective fishing techniques. The strengths of their powers are asymmetrical and depend largely on the institutional environment, their degree of organization, their socio-economic reality, and the state of the stocks. As a rule, groups that represent clearly defined interests with large purchasing power have greater chances to have a say in the process and to become favoured by the measures adopted.

Pressure groups tend to behave strategically. With the aim of achieving their own interests, often at the expense of others, they offer selective information, with the intention of masking losses that specific decisions could cause to other agents. They attempt to make the effects of their activities as opaque as possible to external observers. When making their requests, they apply subtle forms of pressure to try to conceal the fact that they are defending their own interests. They also tend to exert pressure by emphasizing the situation of their weakest or defenceless members, although all members would benefit should their proposals be granted.

Last but not least, we include institutions in the IPF that carry out advisory, orientation, and support tasks to the policy-makers. The high degree of technical expertise demanded by stock assessments and forecasts makes any TAC decision highly dependent on expert advice. Depending on such factors as connections with the MoF or with interest groups, and funding, a variety of advisory bodies may exist. We classify them into four groups: the MDA closely related with the administration and decision centres have been included in the DF; the sector-dependent agencies (SDA) connected to certain interest groups (mainly fisher associations); mixed councils (MC) made up of representatives of several interest groups (e.g. regional fishery councils); and international advisory organizations (IAO) such as ICES (the International Council for the Exploration of the Sea), NAFO (the Northeast Atlantic Fisheries Organization), and ICCAT (the International Commission for the Conservation of Atlantic Tunas).

It is common for different fishery advisory bodies to co-exist. Broadly speaking, advisory tasks may present two big problems: a lack of unanimity when interpreting the same issue; and potential antinomy between the experts' and the policy-makers' points of view, resulting

from their different utility functions. These two common problems can of course only become larger when different advisory bodies offer their best advice to policy-makers and/or when different countries share the same resources (straddling stocks).

Option-generating framework (OGF)

All actors, irrespective of their other involvement in the process, intervene in the OGF, because this is where their preferences become manifest, and based on those, where the hierarchical structuring of objectives that reach the powers of decision takes place. Unlike the conventional vision, such a hierarchical structure moves towards the DF not only by the votes of society expressing its preferences during elections, but through all actors taking part in a DF and an IPF (Figure 1). Therefore, presentation of the preferences is a complex process in which several distorting elements may have a bearing, and in which some agents, especially definitive stakeholders (Mikalsen and Jentoft, 2001), exert the most pressure.

In short, setting TACs is a complex process, not only because the biological models are complicated or because their outcome is imprecise, but because of the large number of agents involved from the start to the end of the process, all with their own, frequently opposing preferences and interests. Even when scientific knowledge would be capable of generating an accurate proposal, the ultimate decision may easily diverge considerably. The need arises to find anchoring mechanisms in order to minimize the effect of potentially pernicious incentives in taking the final decisions. HCRs may help in this intricate objective, because they raise the fruitful rules vs. discretion debate in economic policy.

Illuminating the darkness: rules and independent institutions

The rules vs. discretion debate

Taking advantage of some of the powerful arguments supporting the establishment of rules to guide and constrain economic policy decisions, we deal here with their translation to the TAC-setting framework. To begin, let us distinguish between rules-based and discretionary processes in setting a TAC. The process is rule-based when short-term (annual) decisions are subordinated to a long-term HCR agreed on by the main stakeholders. In contrast, the process is discretionary when the policy-maker has his hands free to adapt the announced TAC in deference to short-term political or economic needs.

Broadly speaking, discretion is a remarkable advantage for any authority, because it confers maximum flexibility in its choices. Rules are established prior to decisions, with less information available than when decisions are made. Despite this apparent limitation from the information side, rule-based setting of TACs may have six advantages: (i) HCRs operate as a brake to opportunistic behaviours; (ii) HCRs serve as a guide in facing up to economic decisions under uncertainty; (iii) HCRs allow agreements to be reached in a complex scenario of conflicting interests; (iv) HCRs push in favour of increasing the credibility of public policy that suffers from its dynamic inconsistency; (v) HCRs constitute a guarantee of technical instead of political decisions; and (vi) HCRs help to alleviate a policy-maker's dilemma.

A brake on opportunistic behaviour

The collapse of the idealized process of public decision-making has been one of the main factors in the debate of rules-based vs. discretionary processes. The superiority of a discretionary process is easily defensible from the assumption that the policy-maker is seeking only common well-being. However, detection of opportunistic behaviour of every agent involved in the process constitutes a weighty argument in favour of introducing rules. Rules decrease the excessive volatile nature of political actions stemming from the presence of opportunistic behaviour similar to "the ropes keeping Ulysses firmly tied to the mast of his ship prevented him from giving in to the siren calls" (Elster, 1984; 2000). Through establishing a long-term HCR to control the evolution of annual TACs, the "political" TACs that pursue interests other than those of resource conservation could be avoided. In that sense, HCRs may help to achieve decisions consistent with conservation.

Help to face uncertainty

Rules are established prior to decisions, obviously based on less information than available when the actual decisions are made. This may be interpreted as a severe limitation from the information point of view. However, rules shape the signals that the authorities send to individual agents and, in this way, help to face up to the uncertainty surrounding decisions on TACs. These signals are the rules of the game, the basis for formulating individual expectations, and a guide to drive individual actions. Therefore, an HCR not only acts as an automatism for controlling the biomass at a theoretically safe level, but it also guarantees a stable framework in which the economic activity is developed. A rule that is clearly identifiable and accepted by all stakeholders aids in creating expectations on which their own mid- and long-term economic decisions can be based. In such a sense, rules help one to face uncertainty.

Promote agreements in situations of conflicting interests

According to contractual or constitutional economic policy (Buchanan and Tullock, 1962; Buchanan, 1987, 1991), decisions taken on economic policy are made as a result of a complex structure based on exchanges among individuals, a structure within which the individuals collectively try to reach their own objectives. However, if the political decision is exchange, putting this into practice requires consensus among the different actors. Would the main players (Figure 1) be able to reach consensus on a TAC that would favour the interests of the community? Unfortunately, the Paretian basis of the agreement (i.e. unanimity) would be highly restrictive, unless decision-making took place under a thick veil of ignorance that would not allow the agents to identify themselves with the option favoured (Rawls, 1971).

Consensus would be especially hard to reach at the post-constitutional stage, when the TAC options have been quantified, just before the fishing season is opened. Insofar as the decisions at the constitutional stage affect variables, agents, and specific periods, the interests of different individuals and groups can be anticipated. This becomes a hurdle that is unlikely to be surpassed when trying to reach consensus. The chances of reaching agreements would be noticeably better at the constitutional stage of trying to establish a long-term HCR, because the veil of uncertainty is thicker: “the interest of any individual or group is less easily identified in a choice where there are rules” (Brennan and Buchanan, 1985). This may favour acceptance by some of the actors, with different and opposing interests.

Improving the credibility of public policy

Since Kydland and Prescott (1977) published their analysis, the reputation and credibility of public decisions have been placed in the centre of the debate in favour of rules. If agents have rational expectations (i.e. they make no systematic mistakes and use the available information correctly to forecast the evolution of the main decision variables), the discretionary intervention of policy-makers leads to temporary inconsistency of policy. Rules generate greater credibility. An intuitive example of the problem of temporary inconsistency is the optimum decision to make in a hostage situation. As a rule, the optimum policy in general situations where hostages are involved is to refuse to negotiate with kidnappers in order to eliminate any form of incentive. However, once kidnapping has taken place, the incentives to negotiate, and to avoid tragic consequences, become self-evident: the optimum *ex-ante* policy does not coincide with the optimum *ex-post* policy. The problem is that from that moment on, the *ex-ante* policy will no longer be credible.

To take the argument of temporary inconsistency to the realm of stock-conservation policy, let us suppose that, within an ITQ framework, the policy-maker announces a considerably reduced TAC, which has immediate consequences for the ITQ. If the agents have rational expectations and the decision of the policy-maker is credible, it is logical to expect that fishers would lower their expectations of the volume of their catches, and hence follow a cost-minimizing strategy by decreasing their inputs. This reduction of inputs of every participant in the fishery should have a positive effect on stock biomass. However, if after having announced his first decision, the policy-maker succumbed to the pressure of some fishers on the margin of becoming bankrupt, and instead decided to increase the TAC, he

takes advantage of the fact that other agents had already adjusted their expectations and consequently their decisions, matching the aimed conservationist policy. Therefore, although the optimum *ex-ante* policy meant decreasing the TAC, the optimum *ex-post* strategy would be to “succumb to the kidnappers”, i.e. to invoke a higher TAC. If the decisions of the policy-makers and the reactions of the fishers are analysed from the perspective of a repeated game, fishers, faced with systematic deception by the authorities, would eventually stop believing the decisions. The obvious way to solve these reputation and credibility problems caused by temporary inconsistency is to define a set of rules that bind the decisions of politicians to meet long-term conservation objectives, thereby bestowing politics with more credibility.

Guarantee of technical rather than political decisions

Providing TAC advice requires considerable technical expertise and investment. However, under pressure from lobbies, the final decisions may deviate substantially from the recommendations of the experts. HCRs help in removing the final decision from politics while easing the pressure to which the scientific community is subjected when formulating its advice. Therefore, rules offer society a guarantee that conservation policy is not being used to promote personal interests, and that it will be stable, based on long-term scientific criteria.

Alleviate the policy-maker's dilemma

This dilemma goes back to the difficult choice a policy-maker often has to make when faced with necessary but unpopular measures, as for example when a fishery has to be closed (TAC = 0). A rule takes away some of the individual responsibility for a decision that is necessarily *ad hoc*.

Summary of the debate

Notwithstanding these obvious advantages, rule-based policy in general and HCRs in particular may also have disadvantages. Supporters of discretion maintain different reasoning, among which, and worthy of mention, are those related to extolling the virtues of flexibility and to perseverance of the problems of opportunistic behaviour, even if rules exist. It is defensible that policy-makers need room to manoeuvre when faced with unexpected and radical changes in bio-economic situations. Moreover, the breach of constitutional mechanisms, which in effect is what an HCR is, could undermine not only the credibility of a resource-conservation policy, but also the principle of authority itself, because it is not the existence of rules as such, but rather the compliance with the rules that helps to solve problems related to the six arguments presented above.

Unfortunately, reality teaches us that, in times of crisis, the probability of breaching constitutional rules increases, as does the pressure exerted in lobbies. We should not forget the real risk that HCRs may be violated, nor the derived negative externalities of such events. Perhaps additional mechanisms might have to be investigated to tie up Ulysses firmly. Although not yet having been contemplated in the fisheries-economics literature, another theoretical alternative could be the delegation of the resource-conservation policy to an independent body.

A central bank of fish

The main reasoning in favour of delegating the power of decision to an independent body may be found in the six arguments presented in favour of HCRs. Because of space limitations here, we refer only to the two contemporary formulations of economic theory discussed earlier, constitutional economy, and the theory of temporal inconsistency. These two approaches prescribe a need to define a set of rules that governs the process of public decision-making. Further, because reaching agreement on those rules by consensus is somewhat utopian, with a considerable probability of rupture in practice, the constitution of independent agencies to which the political powers can delegate functions for developing an economic policy would appear as a potential solution to the problems described.

One of the most important institutional reforms that influenced public decision processes since the 1980s has been the increased level of autonomy granted to many public agencies.

Although the central banks have been the main protagonists of this evolution (Cukierman, 1992; Alesina and Summers, 1993; Blinder, 1998), this trend has become manifest in many other types of organization. For instance, some environmental and sectoral agencies have evolved from being part of the administration of the State to having their own statutes that guarantee them ample capacity for independent decision-making.

In the same way as many governments have delegated the objective of price stability to the central banks after increasing difficulties in controlling prices (partially caused by the interdependence of monetary and fiscal policy; Persson and Tabellini, 1990; Blinder, 1999), delegating responsibilities for fisheries management to an independent body might help to promote a more transparent and reliable process of TAC setting. Speaking in parables, we denote this institution the central bank of fish (CBF). The CBF objective would be to ensure sustainable exploitation and conservation of marine living resources, guaranteeing that TAC decisions are free from perverse external pressures and reflect the most accurate estimates of stock status, taking into account the state of the art (i.e. uncertainty). Of course, the objections could be manifold. We therefore discuss legitimacy issues, coordination problems with other policies, potential opportunistic behaviours inside the agency, and the possibility of not fulfilling or suspending the legal statute.

First, the legitimacy of the CBF to take independent public decisions would be, to say the least, hazy, although not that different from the Central Bank of Europe. This may not be a real problem, because the executive staff would be appointed by legitimate bodies. However, if a radical disparity emerged between the criteria of the political powers and those of the CBF, should strict criteria regarding sustainability prevail, even against the wish of the government (or of the majority of the population) to protect fishers. Ultimately, only society at large may answer this question, but for the time being any attempt to draft policies outside the political process would have a slim chance of succeeding.

Second, the logical consequence of issuing a statute of great autonomy to a CBF is that conservation and sustainability policies are more easily isolated from other policies remaining in the hands of governments, such as structural policies, taxes, and subsidies. However, is the policy of conservation truly an isolated and independent objective? As the answer may not be negative, we can be confronted with a serious anomaly that could lead to a situation where the conservation policy fails to head in the same direction as the other measures affecting the fishing sector. The global coherence of fishing policies could be seriously damaged.

Third, the possibility must not be forgotten that opportunistic behaviour may well exist among the executives of the CBF, i.e. they may have personal interests that have nothing to do with those of the community. If, with the passage of time, a consolidated structure of conflicting interests were to be established, an important distorting element could arise in the procedure of these organizations.

Finally, the potential consequences of not fulfilling the legal statute should be also taken into consideration. Given that the autonomy recognized by law could well be breached by the executive power in situations of fisheries hardship or stock collapse, the credibility of the CBF could be threatened were this to occur. To preserve its independence, the CBF might attempt to maintain good relations with the government, which could make it yield to political or bureaucratic pressure. Because its legal statute would not allow the CBF to admit this reality openly, the consequence might be that its procedures would become more and more secretive and opaque. This experience has struck some Central Banks (Cukierman, 1992).

Concluding remarks

Despite the almost universal criticism of the system, both theoretically and empirically, the TAC system appears to be here to stay, not only because TACs still represent one of the key components of fisheries management throughout the world, but also because one of the most praised as well as most criticized management instruments, the ITQ system, is TAC-based. It would appear that economists and social scientists have accepted the fact that TACs represent exogenous parameters coming from a black box and are calculated in a world protected by the neutrality of science. Nothing is further from the truth. We have shown that the setting of

TACs involves a complex and endogenous process in which a great number of agents interact, all with their own personal and conflicting preferences. This may favour decisions that do not ensure the sustainability of the resources, and that is exactly the reason why we analysed the sequential aspects, the actors involved, their respective roles, and the basic factors surrounding the games of power and decision-making.

The complexity of the institutional framework justifies the need to find mechanisms that help restrain behaviour that leads to multiple non-sustainable equilibrium paths, randomizing the final allocation. Two alternative institutional designs have been discussed: first, taking advantage of the debate on rules vs. discretion in economic policy, the well-known instrument of long-term HCRs; second, inspired by the literature favouring the independence of central banks, an independent institution for which the main objective would be to look after the sustainability of resources. The six most important advantages of HCRs discussed above appear to apply equally to a CBF. However, whereas long-term HCRs have been tested in real scenarios, proving that maintaining consensus among agents is sometimes difficult, with a certain probability of failure, a CBF represents no more than a hypothetical possibility, with evident potential but also shortcomings, such as deficient legitimacy, eventual coordination problems, lack of credibility and transparency, and scope for opportunistic behaviour.

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Figure 1. A schematic of the agents involved in the TAC-setting process, and their linkages, ordered in terms of a decision framework, an influence-projection framework and an option-generating framework (MoF: minister of fisheries; MDA: Ministry-dependent agencies; MC: mixed councils; IAO: international advisory organisations; SDA: sector-dependent agencies).

