Cooperative Rights Based Fisheries Management:
A New Development in the Rational Management of Fishery Resources

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Lima, June 2017
Introduction

• In this lecture, I shall want to discuss new, and as yet uncharted, developments in rights based management of domestic capture fisheries, with the emphasis being on cooperation.

• To illustrate, I am, with the permission of my hosts, going to draw upon Canadian experience. In Canada, rights based fisheries management exists primarily in Pacific Canada, British Columbia (B.C.)., so B.C. will be my focus.
British Columbia Fisheries

- Rights based management in B.C. consists almost entirely of ITQ schemes. Of overwhelming importance are the schemes to be found in groundfish (demersal) fisheries – Pacific halibut, sablefish and a multi-species trawl fishery – ITQ schemes for the three are now integrated.
- I will argue that the lessons to be learned from these fisheries are not species specific; that they apply with equal force to pelagic fisheries.
Some Questions to be Asked

• My hosts have called upon me, when turning to my B. C. examples, to be sure to answer the following questions, with 3 being of key importance:
  1. what allocation method was used when the ITQ schemes were established?
  2. what is the nature of monitoring and surveillance used in the fisheries?
  3. what is the impact of the ITQ schemes upon incentives to protect and conserve the fish stocks?

• The answer to Question 2 will be seen to be critical to the development of cooperation within the industry; the answer to 3 will be seen to be determined by the degree to which cooperation is, in fact, achieved within the industry.
Goals of Fishery Management: An Economist’s View

• Let us begin by reviewing briefly how economists view the goals of domestic capture fisheries management, and then go on to review the stages of fisheries management over time.

• It is now commonplace for economists to regard a nation’s fishery resources as natural capital assets, which are capable of yielding a stream of net economic returns (resource rent) to society through time indefinitely, if effectively managed.

• Ideal management system would be one that does more than lead vessel owners to what I would call static –season by season– efficiency, e.g. elimination of race for the fish. It would as well give the vessel owners the incentive to invest in these fishery natural capital assets –dynamic efficiency.
Fisheries Management – Stage I

• With this in mind, let us turn to the stages of fisheries management, which I see as being three.
  – clearly evident in the Peruvian anchovy (North-Central) fishery

• Historically, the first stage has been what is now commonly referred to as Regulated Open Access – resource manager imposes global season by season harvest quotas (TACs), accompanied by gear restrictions, but has no effective control over fleet size.

• Restricted harvest becomes a type of “common pool” – resulting in massive fleet overcapacity, and threat to resource manager’s control over harvests.
  – perverse incentives for vessel owners

• Collapse of Peruvian anchovy fishery in the ’70s, I believe to be a Stage I phenomenon.
Fisheries Management – Stage II

• Stage II- global harvest quotas are combined with limited entry of vessels to fishery, and decommissioning schemes - but those vessels granted access to the fishery engage in unrestrained competition for TAC shares
  • limited entry and “Olympic” style TACs
  • British Columbia Pacific salmon fishery, the pioneer in 1969.
• In many, many cases limited entry proved ineffective in limiting growth of fishing capacity, e.g. B.C. Pacific salmon fishery, Peruvian anchovy
  – perverse incentives remain – the “race for the fish” – leading to de facto Regulated Open Access.
Fisheries Management – Stage III

- The third stage involves the addition to TACs plus limited entry of harvesting rights schemes. The most common consists of individual harvest quotas, e.g. IVQs, ITQs.
  - first proposed back in 1973
  - now about 23 fishing nations have IQs, accounting for about 25% of world capture fishery harvests.

- We must also include fishermen cooperatives and community based fisheries management schemes (territorial use rights fisheries, “TURFS”).
Harvesting Rights Benefits

• The introduction of harvesting rights schemes has unquestionably brought about major improvements, as evidenced by the IVQ scheme introduced in the Peruvian North-Central anchovy fishery, e.g. impact on the “race for the fish”, much greater control over fishing capacity.

• We claim, however, that more can be done, which will, of necessity, involve cooperation at different levels:
  I. among vessel owners
  II. between vessel owners and resource manager.
Theory of Strategic Interaction - A Digression

• To understand why, we have to digress, whether we like it or not, and say something about the theory of strategic interaction – the theory applies to cases in which the actions or decisions of one “individual” have a clearly perceived impact upon another “individual” - which, of course, happens all the time.

• For historical reasons, the theory popularly known as “theory of games” (unfortunate title). Particularly concerned with “individuals” engaged in competition or cooperation.
  – “game theory” widely used in economics – Noble Prize in Economics awarded 3 times to those applying game theory
  – but also used in political science, international relations, law, and in the natural sciences, e.g. evolutionary biology.
“Games” Played

• Broad classes of “games”
  ❖ Competitive (non-cooperative)
  ❖ Cooperative
  ❖ Hybrids- competition and cooperation
• Competitive – those involved (“players”, or agents) play as individuals, “singeltons”. More often than not, they are forced to adopt courses of action – strategies - that they know to be harmful (Prisoner’s Dilemma).
• Cooperative- assumed that players will cooperate out of self interest alone.
  – effective communication among “players” of critical importance.
  – effective communication, however, a necessary, but not sufficient, condition for cooperation to succeed
More on Cooperation

• Common sense conditions for a cooperative game to achieve stability over time:
  1. individual rationality- each and every “player”, at all times, must expect a return from cooperation at least as great as it would get under competition
  2. collective rationality – there cannot exist another outcome to game that would make all better off.
  3. resilience – must be able to withstand unexpected shocks

• Constant threat of “free riding”- “player” defects and plays competitively against the rest- enjoys benefits of cooperation free of charge- see condition 1. Enforcement critical- unchecked “free riding” will lead to collapse of the cooperative game.
“Game Theory” and Fisheries

• Game theory in fisheries has now been applied extensively to internationally shared fishery resources, e.g. Peru and Chile. Here the “individuals” are fishing states. The strategic interaction is obvious.
  – first introduced to the economics of international fisheries management almost 40 years ago
  – theory has strong predictive power – in most circumstances cooperation really does matter. Problem is how to make cooperative fisheries arrangements resilient to unpredictable shocks - stable over time.
  – has had an impact on policy makers

• As of yet, game theory applied only to a very limited extent to domestic fisheries management. This is now changing, as we shall see.
  – a coming major area of research for fisheries economists.
With the digression now complete, let us return to harvesting rights schemes, and my claim that more improvements can be realized. We will concentrate on IVQs/ITQs.

Professor Ragnar Arnason, of Iceland, great promoter of ITQs, of *The Sunken Billions* fame, well known to Peru, going back to the World Bank Conference on Managing Fishery Resources in Lima 25 years ago, has recently produced an assessment of ITQs/IVQs — what they can, and what they cannot, do.
The Arnason Assessment

• In his assessment, Arnason lists the accomplishment of well designed ITQ/IVQ schemes. They are many: race for the fish curbed, if not eliminated; fleet capacity reduced; economic returns from the fisheries (resource rent) greatly increased.

• BUT, he argues, there are limitations. ITQs/IVQs cannot deal with all inefficiencies, e.g. those arising from timing of harvests.

• What is required, he argues, is cooperation among ITQ/IVQ holders.
The Arnason Assessment, cont.

- Let us look at the Arnason assessment through the lens of “game theory”.
- Go back to Stage II of evolution of fisheries management – limited entry, with “Olympics” style TAC. Among the vessel owners, there is a clear competitive game. Even, if every vessel owner recognizes that the “race for the fish” will dissipate resource rent, each vessel owner has no choice but to participate in the race – Prisoner’s Dilemma outcome.
The Arnason Assessment – Yet More

• Stage III – introduction of ITQs/IVQs, but with vessel owners, still playing as “singletons”, i.e. playing competitively. The ITQs /IVQs mitigates the consequences of competition among vessel owners, e.g. curbing the race for the fish. BUT, the ITQs/IVQs do not fully eliminate the negative consequences of vessel owner competition.
  – as well as continuing inefficiencies, with ongoing competition vessel owners have no incentive to invest in the fishery resources.

• In our quest for optimal economic management of the fisheries, introduction of ITQs/IVQs alone will carry us far, but not all the way.
  – the vessel owner competitive game must be transformed into a cooperative one.
ITQs/IVQs as a Basis for Cooperation

• If cooperation among ITQ/IVQ holders is necessary, to what extent can an ITQ/IVQ scheme serve as a basis for cooperative game among vessel owners?

• Pessimistic answer given by many economists – very limited, only if numbers are small. ITQs/IVQs, by definition, issued to "individuals". General rule in cooperative game theory – larger number of "players" the more difficult becomes enforcement-leading to "free riding".

• Pessimists assuming that such cooperative games have to be self-enforcing, as in international fisheries, where there is no "third party" to help suppress "free riding".

• Wrong! In domestic fisheries there is potential "third party" - the government (resource manager)
Support for Optimism

• I have implied that my fellow economists are unduly pessimistic about ITQs/IVQs as a basis for cooperation within the fishing industry. I now have to provide support for optimism. This I do by drawing upon the experience of the groundfish ITQed fisheries of B.C.

• I am not, because of time, going to review all three fisheries. I will focus on the B.C. groundfish trawl fishery, because this was the least likely of the three cases in which industry cooperation would succeed – very complex fishery.
Overview of B.C. Groundfish Trawl Fishery

- complex multi-species fishery, over 50 species – 60 stocks - operating along entire B.C. coast – bottom and mid-water trawls.

- fishery put under management in late 1970’s – standard limited entry with Olympics style TACs. – pure Stage II.
Bottom area trawled between 1997-2011

~41,000 km$^2$
The State of Affairs in the mid-1990s

• By the middle of the decade, this Stage II approach to management had led to an economic and biological disaster in the fishery.
  — vessel owners playing a highly competitive game among themselves and with the resource manager, Canadian Department of Fisheries and Oceans (DFO)
  — gross overcapitalization
  — vessel owner incentive to protect the stocks- negative! In several cases DFO lost control of harvests. An example – a valuable species - Pacific Ocean Perch. Over several years the reported catch exceeded the allowable catch (TAC) by more than 100%

• The situation grew to be so bad that, in the second half of 1995, DFO closed the fishery – unprecedented.
  • reasons for
Reform of the Fishery

- DFO re-opened the fishery in stages in 1996-1997, with drastic reforms:
  - ITQs introduced, vessel owners given portfolios of quotas for the species/stocks in the fishery
  - Legally, the quotas were and are short term – in fact long term and expressed as percentages of the TACs. Made fully transferable from the beginning – why so?
  - How initially allocated? ITQs “grandfathered” – allocations based on historical catches
    - auctioning quotas infeasible. ITQ scheme resisted by many in the industry. ITQ scheme forced upon the industry.
    - “grandfathering” subsequently a great source of controversy.
Reform of the Fishery cont.

• The ITQ scheme was accompanied by greatly enhanced monitoring and surveillance.

• Prior to the reform, there had been dockside monitoring, but very limited at sea monitoring. As a part of the reform, dockside monitoring was to be accompanied by 100% at sea observer coverage.

• The cost of monitoring – dockside and at sea- to be borne entirely by the industry.

• Industry to receive no assistance from DFO in reducing excess capacity.
Consequences of the Reform

• The ITQs can be said to provide a basis of cooperation within the industry.
  – industry has an association, which enhances communication among industry members, but the association has no control over members.

• But, it can be argued that the draconian monitoring and surveillance program, while this was not its purpose, played a critical role in emerging cooperation within the industry by suppressing “free riding”. Given the nature of the fishery, it is, I would argue, all but inconceivable that a self-enforcing industry cooperative game would have survived.
  – DFO as the key “third” party.
Emerging Cooperation and Incentives for Stock Protection

• While conditions favourable for cooperation within the industry were emerging, it does not mean that such cooperation would in fact emerge. Clear signs of such cooperation, however, began to appear in the 2000s, with major consequences for stock conservation.

• First, the industry, through its association, came to the conclusion that DFO’s stock assessment program was inadequate. The industry members, through the association, imposed a research levy (tax) upon themselves, to hire scientists to supplement DFO’s stock assessment. Payment of levy by vessel owners strictly voluntary.
  – industry hired scientists worked with DFO scientists,
More on Emerging Industry Cooperation

• The second indication of emerging cooperation within the industry was at least two instances in that decade in which the industry, through its association, placed pressure on DFO to reduce its TAC on the resource over a period of several years.

• One of the two was a stock of Pacific Ocean Perch in the waters off northern British Columbia. Let us examine this further.
Pacific Ocean Perch

• I used Pacific Ocean Perch as an example of negative industry incentives to protect stocks, prior to 1997. The resource was then being heavily overexploited, which DFO seemed powerless to prevent.

• In the mid 2000s, the same industry became convinced that the aforementioned Pacific Ocean Perch stock was weak. The industry urged DFO to reduce the TAC on the stock, which DFO did.

• Still not satisfied, the industry hired a scientist to work with DFO on assessing the stock over several years. As a result there were further TAC reductions.

• By 2013, the TAC on the stock was 40% below what it been in mid-2000s - all due to industry initiative.
Pacific Ocean Perch Case - Implications

• The implication of the case is that the industry had more than an incentive to protect the stock. It had an incentive to engage in a positive resource investment program – forgoing harvests today in the hope of larger harvests and a stronger stock in the future.

• Industry was the leader in resource conservation; the official resource manager, DFO, the follower.
Industry Incentives

• What provided the incentives for the industry sponsored resource investment programs in Pacific Ocean Perch and other resources?

• To an economist, this is straightforward – ITQs, as noted, in fact long term and based on percentages of TACs. If resources had been allowed to decline, value of ITQs for the resources would plummeted.
  – collectively irrational to allow this to happen.

• But note, the fear of plummeting ITQ values would have come to absolutely nothing, if the industry had not been playing a stable cooperative game.
The Industry and the Eco-system

• A further example of vessel owner cooperation provided by an agreement with environmental NGOs – ENGOs, e.g. WWF, to limit industry catch of sponge and coral – the agreement a result of industry initiative.

• In the mid-2000s, industry under attack from ENGOs for the eco-system crime of destroying sponge/coral through bottom trawling. DFO at the time lacked the legal power to address the problem. The industry was on its own.
  – economic consequences of the attack.
The Agreement

• With **DFO’s** blessing, the industry negotiated a habitat bycatch limitation agreement with a consortium of ENGOs. Hailed as a global first, the agreement came into force in 2012.

• The industry is given a small annual global sponge/coral quota. ITQ scheme used to spread out this small quota among the active vessels.

• Over the 5 years of the agreement, industry sponge/coral catch has been well below the quota.  
  – industry received a conservation award in 2016.
Industry and Resource Manager- From Adversaries to Partners

• As a further consequence of the industry’s incentive to invest in the resources, the industry’s relations with the resource manager changed. DFO no longer found the industry as a group to be policed and restrained, but rather as a leader in resource conservation. DFO listened to the industry with respect, which of course the industry appreciated.

• The result has been, over time, that the industry-resource manager competitive game has been transformed into a cooperative one.
The Coming of Co-management

• What has developed in the fishery, in an unplanned manner, is de facto co-management.

• It is definitely not industry self-management. The DFO mandated monitoring and surveillance system is, as we have seen, critical to the success of the fishery. Furthermore, the ultimate decision on any management issue rests with DFO, not the industry.

• The industry does, however, influence management; indeed can act, and has acted, as leader.
Co-management: Benefits for the Resource Manager

• There are benefits for the resource manager from the emerging co-management, dynamic efficiencies, I term them, which we do not fully understand.

• For example, there is a piece of economic jargon, “asymmetric information”, applying to regulators and the regulated, where the latter have more information than the regulated. This is clearly applies in the fishery under discussion, but in a positive way for the regulator.

• The industry, in many (most?) instances, has greater information on the state of the resources than does the resource manager. The industry is acting like an “early warning” system, when resources are in a weakened state.
Uniqueness of the B.C. Groundfish Trawl Fishery Experience

• Perhaps the experience of the fishery I have related is unique to that fishery, and of no relevance elsewhere. Not so.

• First off, the experience is not gear specific. The other two ITQed groundfish fisheries in B.C., sablefish and Pacific halibut have had similar experiences – there is a stable vessel owner cooperative game in each. Sablefish is a pot fishery; Pacific halibut a longline fishery.

• Secondly, is the experience relevant to an IQed pelagic fishery?

• The same principles, I would contend, should apply. If not, then why not?
A New Management Stage?

• We are, I would suggest, approaching a new stage in the management of domestic fishery resources, if not Stage IV, then Stage III+, in which harvesting rights schemes lead to intra-industry cooperation, with potentially profound consequences for resource conservation.

• In some cases, the fishing industry cooperative game may be self-enforcing, but we cannot rely on this, which means that we have to look to industry-resource manager cooperation, as well.
An Under Researched Question

• This Stage IV, or III+, is a greatly under researched question. To begin, economists have to ask themselves what conditions must prevail for there to be stable simultaneous cooperation within the industry and between the industry and resource manager. We do not begin to have firm answers.

• We need at the same time develop case studies. My B.C. fishery examples are not unique. There are probably many other cases, from which we can learn, of harvesting rights schemes, which have led to effective cooperation within the industry.
Some Conclusions

• In our discussion, we have talked about extending and improving upon the benefits of rights based fisheries management, to what we have referred to as Stage IV (or III+).

• The key, we have argued lies in developing stable cooperation at two levels: within the industry, and between industry and resource manager.

• Harvesting rights schemes will have the maximum beneficial impact upon incentives to conserve the fish stocks, if and only if, this stable two level cooperation is achieved.
Some More Conclusions

• What we must also conclude is that there is a great deal about this new stage, which we are a long way from understanding fully.
  – we do not really know, with any degree of precision, the conditions that have to exist for the two levels of cooperation to be stable over time

• A major research program lies before us, which will demand cooperation among several disciplines, and cooperation among academics, industry and government.
Thank you for your attention