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Evaluation of New Zealand's QMS system

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Comparative Evaluations of
Innovative Solutions in
European Fisheries Management

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Evaluation of innovative approaches to fisheries management outside the European Union:

The cases of Alaska (USA), Canada, Iceland and New Zealand

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Disclaimer

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Foreword

Work Package 3 (WP 3) is the first technical stage of the project CEVIS "Comparative Evaluations of Innovative Solutions in European Fisheries Management". The aim of WP3 is to evaluate innovative approaches for European fisheries management such as participatory governance, right-based management, decision rules and effort control. The first stage of WP 3 consisted in reviewing the existing literature on innovations to management focusing on four locations in the world where innovations to management have been introduced, as are: Canada, Alaska, Iceland and New Zealand. The second stage was the study trip which was planned at a WP meeting held in Bergen. The WP3 consists of 8 researchers from a variety of social and natural sciences. The multidisciplinary composition of the team has allowed for a better understanding of the driving forces and outcomes in each case.

The most important source of information in all cases has been the interviews carried out where stakeholders as diverse as fishers, conservationists, scientists and managers have illustrated well what has happened in each case. Interviewees have expressed their views and relate the story from their variety of academic and professional perspectives identifying which decisions and circumstances have been good and which have been deleterious to their fisheries systems. The first part of each report consists of a review of the case including historical background and rationale of each regime inception and a qualitative evaluation of the innovation performance. A second part of each report consists of a synthesis of the best practices that our team has drawn from the visits and interviews. To help the reader navigate through this deliverable a guide through the chapters is provided at the end of the introduction.

Our outsider's view helps in being objective when trying to understand the mechanisms that have led these systems either to success or failure. We sincerely thank all the people that have welcomed us to their regions, allowing us to be in real touch with each case. We believe this deliverable will contribute to the knowledge required to implement management innovations in the near future.

Contributors and acknowledgments

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Introduction

The last decades have witnessed the emergence of a new thinking in fisheries management which seeks to counteract and/or prevent the deleterious outcomes of traditional fisheries management based on TACs and command and control (C & C) management. A variety of systems being referred to as innovations to management that include participation of stakeholders, right based management, harvest control rules (HCR) and effort based management, have been implemented all over the world and are continually evolving. The objective of CEVIS's WP3 is to gather information on fisheries management regimes in four developed regions where innovations have been implemented in order to begin the process of evaluating their suitability for the EU fisheries management system. These regions are Alaska, Canada, Iceland and New Zealand.

The Cambridge Dictionary (http://dictionary.cambridge.org/) defines innovation as *"the use of a new idea or method"*. In the world of fisheries, innovations have been mainly introduced during the last three decades. Some of them arose as a tool to expand country influence on recently incorporated Exclusive Economic Zones during the late 1970s, others emerged as contingency measures to stock collapses, others arose as a result of conflicts between fishery sectors and others emerged in search of efficiency (e.g. overcapacity reduction). Innovations seen in the following chapters see the introduction and modification of institutional structures to allow participation and the development of a sense of ownership as fundamental in achieving the intended objectives of management. Stakeholder's participation is usually led by protection of individual and collective interests and assets, resource protection and government understanding that participation is a key factor to build transparency and legitimacy of the management processes.

The design of management innovation shall take into account a variety of factors such as resources being managed, fishing technology, fishing communities, geographical location, the value of fisheries as a source of food and income for a given region, the state of scientific expertise and management capabilities and resources. It is extremely complex to address all these issues within a management system and it may require the use of complementary mechanisms such as cost recovery or industry led research. The introduction of new concepts and tendencies in fisheries management, such as the precautionary approach and ecosystem based management may modify the original design for a given innovation. It seems that bringing together scientists and stakeholders allows learning from errors and to accept and deal with concepts that were exclusive to scientists in the past such as uncertainty.

The shape that each management innovation takes seems to be mostly determined by internal forces while it usually entails external components. In this regards, the innovative management of shared resources managed between two or more countries would not be the same as the management of a resource exploited by a single country. New Zealand is a good example of an approach to management that has evolved without much external influence and a process of constant adjusting to the changing nature of its management system led by an in-depth market based regime. Iceland is somehow similar as it has growth without much influence since it is not part of the European Union and has not embraced the Common Fisheries Policy.

Innovative measures to counteract resource declines have, in several cases, meant the exit of some agents and the entry of new participants. Trade offs among the different management objectives shall be counterbalanced when introducing an innovation. A pure market based solution, for example, may cast aside overcapacity and introduce efficiency in the system but it may harm the wellbeing of the communities while not being able to assure sustainability of stocks, which depends on many factors other than market. Participation assures legitimacy but turns the process of management into a very long, costly and complicated process. It is difficult that all stakeholders may have the same degree of representation since participation could demand important technical and economic resources. Effort management constrains effectively harvest activities but it could be undermined by input substitution. Innovations rest on the pillars of an effective system of MCS, wide participation and legal mechanisms that empowers the decision maker to take decisions for the sake of sustainability.

Since perfect innovation does not exist, many innovations will lack the adequate design to counteract negative outcomes. A combination of innovations taking the best of each system may probably have the scope to simultaneously deal with several issues. Flexibility to change may be another of the aspects that may help the system to work. Alaska and Canada are two cases where a combination of innovations have emerged to deal with the complexity of managing fisheries shared by old fishing communities and exploited by a variety of technologies.

Fisheries management, as any other human activity dealing with economic interest and the protection of resources, very much depends on the economic context, the market, people's and communities' new expectations and the changes in resources due to environmental factors. This system in constant change may require quick, and some times, tough decisions.

The objective of the following chapters is to analyze each case and to draw useful conclusions to EU fisheries. Reviewing the reasons for the introduction and the forces that have shaped each system and its current performance will help us to draw lessons to European fisheries managers. We aim at going further from what literature can tell us in each case. Our aim is to mirror the voices of the diverse actors allowing them to tell their story, conveying the reasons behind each introduction and its current performance and outcomes. In each case we analyze the performance and evaluate the outcomes. In each chapter we draw best practices for the introduction of innovations to management.

Structure of the deliverable

Chapter 1 discusses findings on two innovations in Alaskan fishery management. The first of these innovations is the Overfishing Level (OFL) tier system, which is a decision rule that is part of the TAC setting process and applies to all fish stocks. The second innovation is the system of industry cooperatives that jointly harvest Pollock in the Bering Sea (BS) region. This chapter describes the two innovative management systems and assesses them against their biological robustness, economic efficiency, cost-effectiveness of management and stakeholder acceptance. The chapter concludes with a best practice section.

Chapter 2 reports on the visit to the province of Nova Scotia in Canada. It discusses the recent history and outcomes of rights-based management in Nova Scotia, with a particular focus on the inshore mobile gear fishery. It also focuses on different innovations under the general category of participatory governance. This chapter describes the local fisheries co-management initiatives called Community Management Boards (CMB) and the combination of innovations such as the CMBs' transferable rights-based system. It also reviews on the advances the Canadians have been making in participation in scientific and decisional aspects. This chapter concludes with a discussion of the case implications for Europe. This includes some hypotheses about what kinds of things might work well in particular circumstances and a best practice section.

Chapter 3 discusses the Icelandic ITQ system. It reviews the history of the innovation and assesses and evaluates the outcomes of the system in terms of the major goals of fisheries management such as biological robustness, cost-effectiveness, economic efficiency and social robustness. Complementary innovation to management is also discussed such as Harvest Control Rules for cod and temporarily closed areas. This concludes with best practice guidelines conveying ideas on what is recommendable when introducing an ITQ management system.

Chapter 4 describes and analyses the New Zealand quota management system. It describes the history of the innovation and the reasons for the introduction of the market based solution. The chapter reviews the backbone of the innovation being the MCS system and the quality of the property rights. Then it looks into the complementary innovations of the QMS *inter alia* participation, the cost recovery system and the deemed value instrument. Finally, it reviews the outcomes from the system with regards of industry development, indigenous people and communities and resources sustainability. This chapter concludes with a discussion of the case implications for Europe. This includes some hypotheses about what aspects of the innovation might work well in particular circumstances and it draws best practice guidelines.

Chapter 5 distills best practices from the precedent chapters aiming at drawing more general recommendations from the four study trips. It synthesizes the best practices regarding the following objectives of management: economic efficiency, biological robustness, social robustness and cost effectiveness of management.

Methodology

Four teams of two people, each of them comprised of a natural scientist and a social scientist, carried out case studies of areas of the world where innovations of the kind that CEVIS is examining have been implemented. These areas were Alaska in USA, Maritime Canada, Iceland and New Zealand.

The aim of the case studies was to have a more practical and operational focus on implementation; monitoring and enforcement issues associated with management innovations than can be found in usual discussions of management innovations in the fisheries literature. Moreover, the study trips were designed to identify day-to-day issues in the management of fisheries and contingency measures that are being undertaken to counteract threats to resource wellbeing such as non-compliant behaviour.

The first stage of the WP was a desk study including review of the technical literature and web pages. This first approach allowed us to become acquainted with the case and to identify main sources of information that led us to key people and institutions. Prior to the study trips, the WP team held a meeting where the team discussed preliminary issues on the nature of the cases, scheduled the trips and discussed a draft questionnaire that was designed to guide the interviews (see Appendix). This questionnaire was not designed to be strictly followed but to serve as a basis for the interviews in the field.

The second stage was the study trip that allowed us to get in closer touch with the case and its actors, while seeking the sources of success or failure during the QMS implementation. The interviews covered the history and development of the innovations, the changes in costs and benefits for fisheries management operations associated with the innovation, what indicators are used to monitor and improve outcomes, and what is seen as the best practices in implementing, monitoring and enforcing the innovations and resulting management measures. Moreover, participants in the interviews were asked to identify potential threats and future trends in the evolution of the fishery.

In all 84 interviews were conducted with people from a variety of academic disciplines and belonging to a wide professional spectrum, including managers, researchers from the realm of natural and social sciences, fishermen, industry representatives and conservationists. Interviews comprised a wide geographical distribution covering Juneau, Anchorage and Seattle in Canada; South West Nova Scotia in USA; Reykjavik in Iceland; and Wellington, Auckland and Nelson in New Zealand. Interviews were carried out between November 2006 and March 2007.

The outcome of this research is this deliverable in which we attempt to mirror the voices of the actors conveying the reasons behind each introduction and its current performance and outcomes, and to evaluate the reasons for success or failure from our outsider's perspective. In addition, we draw best practices for the introduction of innovations to management for the European Union and elsewhere. Many historical facts given by the interviewees have been framed and backed by the comprehensive literature reviews carried out in the early stage of the WP and subsequent revision of literature provided by the interviewees. Finally, each team has had a free hand in elaborating their case study reports.

Chapter 1

Fisheries management innovations in Alaska: A case study report

Franziska Wolff and Kjellrun Hiis Hauge

Contents

1 Introduction

This report discusses findings on two regime-level innovations in Alaskan fishery management gained through expert/stakeholder interviews[1] and the study of secondary literature. The first of those innovations is the Overfishing Level (OFL) *tier system*, a decision rule that is part of the TAC setting process and applies to all managed fish stocks in Alaska.[2] The second is the system of *industry cooperatives* that jointly harvest Pollock in the Bering Sea (BS) region. Analytically, the Pollock cooperatives are a mixture between a rights-based approach (quotas are allocated to industry sectors which may form cooperatives) and a form of participatory management (within these cooperatives, micro-management is carried out by the fishery participants themselves).

The two innovations have been selected for study because of their uniqueness and the fact that relatively little is yet known about their combined biological, economic, and social effects. Furthermore, especially the tier system, which is based on the precautionary approach may be an interesting model for EU fisheries and may be integrated into the upcoming Work Packages of the CEVIS project.

In this paper, we will describe the two innovative management systems and assess them against their biological robustness, economic efficiency, cost-effectiveness of management and stakeholder acceptance. While the tier system is an innovation that has some potential to make fisheries more biologically robust (without having significant economic and social effects), the cooperative model scores high with regard to economic efficiency but is socially rather contentious; it also has impacts with regard to biological robustness and cost effectiveness of management but these are less significant.

2 Background

The Eastern Bering Sea contains a huge continental shelf and makes it one of the most productive marine ecosystems in the world. Until the middle of the 20th century, fishing off the Alaska coast was dominated by the domestic Alaska fishermen. The principal interest of these fishermen was salmon and crab and to a certain extent halibut. The groundfish species, like cod and pollock, were not targeted until the early post-war years, the late 40s and the 50s, when the foreign fishing fleets arrived. This was when the national policy in Europe and Japan was to revitalize the industry. Trawlers were built, capable of crossing great distances, and fleets sent to the Bering Sea, an area the US seemed to focus little on. The foreign trawl

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1 Altogether, 22 respondents from the fishing industry, fisheries management, civil society, and academia were interviewed which were based in Juneau, Anchorage and Seattle. The interviews were carried out in January 2007.

2 This includes a number of groundfish species (walleye pollock, Pacific cod, sablefish, yellowfin sole, Greenland turbot, arrowtooth flounder, rock sole, flathead sole, Alaska plaice, “other flatfish”, Pacific ocean perch, northern rockfish, shortraker and rougheye rockfish, “other rockfish”, Atka mackerel, squid, shallow and deep water flatfish, rex sole, flathead sole, arrowtooth flounder, Pacific ocean perch, shortraker/rougheye rockfish, northern rockfish,“other slope” rockfish, pelagic shelf rockfish, demersal shelf rockfish, thornyhead rockfish, Atka mackerel, and skates) and some non-groundfish species: crab, scallop, halibut, and salmon (cf. NPFMC Management Plans for 2005).

fleet first targeted yellowfin sole in the Bering Sea and maximized their catches around 1960. In the Aleutian Islands and the Gulf of Alaska, the main target of the trawlers was Pacific Ocean perch and the longliners sablefish and rockfish. By the end of the 1960s, the foreign trawl fleets shifted to walleye pollock as catches of Pacific Ocean perch and yellowfin sole decreased (NPFMC, 2006a). The total catches of pollock in the Bering Sea (The Eastern Bering Sea, Asian waters and international waters; the Donut hole) peaked in 1986 with almost 7 million metric tons. The catches in the Eastern Bering Sea (now U.S. waters) has been rather stable at 1.3 tons since 1970 (Ianelli, 2006). Total catches in the Eastern Bering Sea has been almost 2 million tons the last 20 years (See Appendix) (NPFMC, 2006b) and around 200 000 tons in Gulf of Alaska in the same period (NPFMC, 2006c).

Fig. 1. Alaska’s geographical setting

In institutional terms, evolution of Alaskan fishery and the Alaskan fishery management systems was significantly affected by Alaskan statehood in 1959 – with the Alaska constitution codifying open access to state water fisheries[3]. The Magnuson Fishery Conservation and Management Act from 1976 (renamed MSA in 1996), was the beginning of several major aspects of fisheries management in Alaskan waters. The purpose of the Act was to extend the nation’s ocean boundaries out to 200 nautical miles and develop a management system that allows decisions to be made at the regional level, with the affected public having a say in those decisions (NPFMC, 2006a). The Act contained the concept of Allowable Biological Catch, ABC, which meant the beginning of quota regulations. By the (unilateral) establishment of the Exclusive Economic Zone through the US in 1977, the EEZ extended from three to 200 nautical miles off the coast. This almost corresponds with the area of the

[3] Article 8, Section 15, of the Constitution reads: ‘No exclusive right or special privilege of fishery shall be created or authorized in the natural waters of the State.’ This was amended later to provide for the possibility of Limited Entry Programmes.

productive continental shelf in the Eastern Bering Sea. As a consequence of the EEZ, management of the commercial fisheries off Alaska falls under a mix of state and federal management jurisdictions. The North Pacific Fishery Management Council (NPFMC, or 'Council') has authority for the majority of groundfish fisheries in the Exclusive Economic Zone off Alaska, i.e. between 3 and 200 nautical miles off the shore. This includes management of pollock, cod, flatfish, mackerel, sablefish, and rockfish species in the Gulf of Alaska (GOA) and Bering Sea and Aleutian Islands (BSAI). The NPFMC is one of nine such co-management bodies in the US in which industry and public administration, advised by scientists and NGOs, jointly manage federal water fisheries. Its primary management tool is Fisheries Management Plans (FMP).[4] The National Oceanic and Atmospheric Administration (NOAA Fisheries)[5] has the competence for monitoring and enforcing fisheries management at national level. With the Alaska Board of Fisheries and the Alaska Department of Fish and Game (ADF&G), analogous structures exist for Alaskan inshore waters.

The foreign dominance in the fisheries off Alaskan is held to be a significant precondition for the establishment of a rather precautionary overall management system (Eagle/Newkirk/Thompson 2003: 16). This includes the Tier system, which is a set of harvest control rules for maximum acceptable biological catch (max ABC) and which will be studied in Chapter 3. It furthermore encompasses a strict bycatch regulation (also following the Tier system), a cap on total catches[6] of all species in defined ecosystem and an early observer programme.[7] At this time it was basically the foreign fishermen that were regulated and monitored, so that there was little resistance in the regional political processes.
In recent years, with overcapitalisation, ever shorter fishing seasons and the respective adverse effect on both the harvesting and processing sectors, including with the loss of boats and life at sea, rights-based management (locally dubbed 'rationalisation') has been introduced to limit access to and reduce capacity in a number of fisheries (Queirolo/Benjamin 2005, Madsen/Fina/Oliver 2006). Legally partitioning the Bering Sea pollock TAC among a limited set of participants which are granted usufructuary rights is one instance in this chain of rationalization programmes; the cooperatives which emerged in this context will be studied in Chapter 4.

3 Harvest control rules and TAC setting

The Tier system is a set of harvest control rules and is the basis for setting the TAC for all

4 The Council has established five Fishery Management Plans (FMPs) for GOA Groundfish, BSAI Groundfish, Crab, Scallop and SE Salmon troll. Since their establishment, the Council only regularly amends the management plans. Approval and implementation of these FMPs is carried out through the National Oceanic and Atmospheric Administration (NOAA Fisheries), a division of the United States Department of Commerce, which is responsible for the management, conservation and protection of living marine resources within the U.S. EEZ. The Management Plans stipulate that all groundfish is managed in accordance with the Tier system.

5 formerly National Marine Fisheries Service NMFS

6 This 'Optimum Yield' (OY) amounts to 1.4 - 2 Mio metric tons for BSAI groundfish, and to 116 to 800 thousand metric tons for GOA groundfish (National Standard Guidelines; National Standard 1 – Optimum Yield; cf. also Witherell 1997, DiCosimo 2001).

7 The industry had to, and still has to, pay for the direct costs of putting observers on the boats. NOAA certifies the observers. The requirements depend on the size of the vessel, the fishery etc. The base coverage levels are as follows: Any vessel that is more than 120 feet long has to take one observer full time, (which means 2 or 3 observers per trip), and this concerns the whole groundfish fisheries. Vessels from 60-125 feet require observers 30% of the fishing days while smaller boats have no requirements. Some of the processing plants have observer requirements depending on the quantities of fish they process in a month. The observers on the AFA-fleet (the pollock vessels) and some other fisheries have to take samples of every haul. Compliance is not considered an issue at the 100% coverage vessels while there may be some problems at the 30%. The observers also play an important role in the bycatch regulations and prohibited species regulation. They collect data on everything in the hauls: fish, mammals, birds, bottom habitat and lost nets.

groundfish stocks managed by the North Pacific Fisheries Management Council. The bycatch, endangered and non-commercial species are also assigned to a tier. The TAC is set each year for all stocks. The Tier system is defined in the Management Plan for the BSAI and for GOA, and is thus the council's interpretation and operationalization of the fisheries management strategy stated in the MSA. This strategy is based on several concepts: optimum yield (OY), maximum sustainable yield (MSY), overfishing and rebuilding of stocks. MSA, National Standard 1, states that "Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the OY from each fishery for the United States fishing industry." The MSA defines overfishing to signify "a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce the maximum sustainable yield on a continuing basis." OY is defined as the amount of fish which

- "Will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems."
- "Is prescribed as such on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factor."
- "In the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery."

The Maximum Sustainable Yield is defined as "the largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological and environmental conditions." In this context, a "MSY control rule" is defined as "a harvest strategy which, if implemented, would be expected to result in a long-term average catch approximating MSY."

The total allowable catch (TAC) for each groundfish stock in BSAI and GoA is based on three principles

- The Tier system, which provides a quantity of the maximum allowable biological catch (max ABC) for each groundfish stock,
- The groundfish cap, which sets an upper limit for the total TACs for all stocks in a certain ecosystem,
- OY (optimum yield), which may stay at or reduce the TAC from ABC by economic, social or ecological factors.

The Tier system defines the overfishing level (OFL) and the maximum acceptable biological catch (max ABC), which sets the upper limit for the ABC, which again sets the upper limit for the TAC. ABC and OFL are based on estimates of current stock status (if they can be provided) and on harvest rates corresponding to the MSY concept. The rule contains a strategy for rebuilding stocks to MSY levels when they are estimated below the MSY biomass level.

The FMPs have set constraints for the total catches of groundfish, one cap for GoA and one for BSAI. The underlying idea of the cap is that there is a long-term maximum sustainable yield of groundfish for each ecosystem, and which will vary according to the productivity of the system. The range of MSY was estimated by an early version of EcoSim (an ecosystem production model). The range for BSAI groundfish was estimated at 1.8 to 2.4 million metric tons (NPFMC, 2006). For precautionary reasons, the OY was set at 85% of the TAC range or 1.4 – 2.0 million metric tons. The OY for GOA groundfish is set to 116 to 800 thousand metric tons (Witherell 1997, DiCosimo 2001). In accordance with the FMPs the sum of total groundfish catches must always fall at or below the optimum yield. In practice, the cap for the GoA has not been reached and only the upper limit of the range for the BSAI OY range has been used. The cap of 2 million metric tons for the BSAI was introduced in 1982 and was decided by law in 2005, legislated as an amendment.

Max ABC is a preliminary quantity for ABC, which again is the upper limit for the TAC. Max ABC is a result of the Tier system where the Tier is agreed in advance. The assessment author might recommend an ABC below the maximum value due to ecosystem considerations (e.g. low zooplankton abundance), uncertain data (e.g. incomplete survey coverage) or switching to other assessment models. It is not possible to recommend an ABC above the maximum level. The Plan Team decides the ABC. The TAC can be further reduced by other factors, like when the ABCs for all stocks amount to a higher level than the total Cap, of economic reasons or when the ABC is not expected to be taken because of bycatch problems and the strict bycatch regulations.

3.1 *The annual TAC cycle*

TAC setting is organized in a regular annual cycle. Scientists from the NOAA Fisheries and the ADF&G collect and update data on catch, age and size composition, as well as biomass, on a yearly basis for the Stock Assessment and Fishery Evaluation (SAFE) report (as required by the Guidelines for Fishery Management Plans). The SAFE reports summarize the best available scientific information concerning the past, present, and future condition of the stocks, marine ecosystems, and fisheries under federal management. The agencies' stock assessment scientists analyze the data and calculate estimates of population parameters, biomass, and age structure. They use stock assessment models to integrate the information, except when the data is not sufficient to construct such a model. The assessments determine the ABC and OFL.

The BSAI and GOA Plan Teams meet each September to discuss methodological issues and preliminary stock assessments. In October, the Scientific and Statistical Committee (SSC), the Advisory Panel (AP) and the NPFMC convene. The SSC focuses on assessment methodology, while the AP recommends and the NPFMC sets preliminary TACs based on extrapolations from the previous year. By November, the individual chapters of the SAFE reports have been prepared by the assessment scientists, and another group of scientists has completed the section on Ecosystem Considerations (EC). This is made official and there is a public hearing. The Plan Teams meet again in November to review the SAFE reports and make ABC recommendations. In December, the SSC reviews and evaluates the SAFE reports, the Plan Team recommendations and comments from the public, and has the final say in terms of the ABC recommendations. The AP recommends TAC values, which are traditionally lower than the ABC values recommended by the SSC. The NPFMC then sets final values of ABC and TAC, subject to confirmation by NOAA Fisheries (NOAA Fisheries 2004 c: 11).

Neither the authors of the SAFE report, the Plan Team nor the SSC recommends TAC.

3.2 *The evolution of harvest control rules*

The fisheries were virtually unregulated through 1965 and thereafter only minimally regulated until the mid-1970s (NPFMC, 2006). During this period, the foreign fleet dominated and the catches were only limited by closed areas and gear restrictions. The first catch limits on some species were set in bilateral agreements in 1973. The initial question of that time was how to manage a stock that is clearly declining as the management of a group of rockfish allowed catches that seemed to lead to stock decline.

The first goal of the early management was to get estimates of fish stock biomass and harvest rates for management purposes. This was the beginning of the scientific surveys, and. the early assessments were basically using survey data to get point estimates. The first management strategy was based on fractions; say a catch of 15% of the biomass estimate.
The tier system was developed through 2 sets of amendments of the FMPs. While the concept of ABC already existed, the definition of overfishing came in as an amendment in 1976. A two-parameter (two-part) harvest control rule was adopted for the Alaska groundfish in 1990, which was modified to a three-parameter form in 1996. In 1998, the U.S. Government issued a set of National guidelines (U.S. Department of Commerce, 1998), which assigned a fundamental role to the further development of the harvest control rules (Thompson, 1999). These control rules are the basis for the Tier system, first established in 1994-5 by Amendment number 44, and supplanted by Amendment 56 (1998). The last is still valid and relatively similar to today. It contained the concepts of overfishing levels, maximum sustainable yield and acceptable biological catch. The Agency thus required the scientists to determine whether the stocks were overfished. The national guidelines include requirement specifications for the precautionary approach: 1) target harvest rates are less than limit harvest rates, 2) harvest rates at low stock sizes are less than harvest rates at high stock sizes and 3) the buffer between limit and target harvest rates widens as uncertainty regarding a stock's size or productive capacity increases (U.S. Department of Commerce, 1998). The Tier system fulfils these requirements, except that the size of the buffer not necessarily increases with uncertainty (Thompson, 1999; confirmed on interviews).
The scientists develop the harvest control rule, NOAA Fisheries evaluates the tier system to see whether it complies with the national guidelines and scientists assess the stocks on a regular basis and determine whether the stocks are overfished. As assessment models were more and more used globally, the scientists in charge of assessing the stocks in Alaskan waters and the Bering Sea started doing assessments by virtual population analysis (VPA). However, they found the VPA too data demanding and developed their own models that were less data demanding and more statistically based.
The harvest rate (F_{MSY}) and biomass levels (B_{MSY}) that determine the concept of maximum sustainable yield, are based on stock-recruitment relationship At that time the amount of data was considered not to be sufficient to estimate this relationship for quite many of the Alaska stocks, so they had to come up with proxies for F_{MSY} and B_{MSY}. They ended with $F_{40\%}$, which is the harvest rate associated with an equilibrium level of spawning per recruit equal to 40% of the equilibrium level in the absence of any fishing (NPFMC, 2006b).

This means that the F-value will be lower for species with lower egg production. The scientists decided on $B_{35\%}$ for Bmsy. The accepted biological catch (ABC) is set below this (see appendix). The scientist respondents regard the MSY-proxies as a bit ad hoc, but yet robust.

3.3 *Description of the Tier system*

The Tier system is a 6-tier set of harvest control rules that applies to all the Alaskan groundfish stocks (Appendix). The bycatch, endangered and non-commercial species are also assigned to a tier.
The amount and quality of data on a particular stock, decides which of the tiers goes with the stock. Tier 1 is assigned to those species with the highest level of data and biological information (a stock-recruitment relationship), while Tier 6 to those with very low data and biological information. Each tier contains a formula or set of formulae defining ABC and OFL. ABC and OFL are based on calculations of MSY, but only Tier 1 follows the theoretical MSY concept. Proxies for MSY are used in Tiers 2 – 4. Tiers 1 to 3 basically require age-structured models, and each of these Tiers consists of a 3-part rule, reflecting the state of the stock. One part applies when the biomass estimate is higher than Bmsy, the other two when it is lower, implying no catch when the stock is below a critical level (defined as 5% of the BMSY level). The intention is thus to keep the biomass level above an MSY level, or, if necessary, to rebuild the stock to this level. Tiers 4 to 6 are a one-part rule. The requirement for Tier 5 is a minimum of biological information and for Tier 6 that there is a reliable catch history for a certain period. Tier 6 is thus constructed in such a way that if there is no data, it is not possible to develop fisheries on new species. Because of the substantial observation program and scientific survey information, however, it has been possible to provide enough data to categorize non-harvested species as Tier 5. The FMP lists all the targeted species, so for a fishery to develop, there has to be an amendment.
Of the stocks in the BSAI area, only BSAI pollock is in Tier 1, 12 stocks are in 3, 8 stocks in 5 and 2 stocks in Tier 6 (NPFMC, 2006b). Of the 13 stocks considered enough information to have a 3-step rule, 10 are assessed to be above the BMSY level, while 3 stocks are assessed to be below, but considered above the critical level. Of the 18 stocks that are assigned to a tier in GoA, 10 stocks are at 3, 3 at 4, 4 at 5 and one stock is at level 6. 8 of 10 stocks are assessed to be above the BMSY level. In the BSAI area, tier 2 and 4 is presently not used, and 1 and 2 is not used in the GoA. According to our respondents Tier 2 has never been used and Tier 4 has not been common. Some of the stocks are likely to be shared between the two areas.

Stocks can move from one tier to another. Most often it is upwards, but occasionally downwards. A stock may go down a tier if the survey coverage was not sufficient or if there is some decrease in the quality of the data input to the stock assessment. Reasons for going up are improvements in the data quality or stock assessment model. Although the Tier system is constructed to take uncertainty into account by defining a buffer (between OFL and ABC), the buffer does not increase with increasing uncertainty. In practice the harvest rate decreases with increasing tier but not necessarily.

3.4 *Assessment*

3.4.1 The Tier system and the resource situation

Assessing the impact of the Tier system on the resources is impossible without taking into account compliance, the observer program, fisheries regulations besides the TAC and the role of the NPFMC. All parties, including the environmental organizations, express that compliance is not an issue. Full compliance and the observer program together result in a situation where the control of what is caught by the Alaska fisheries is extremely high compared to the case in European waters. So, the status of targeted, bycatch, endangered and non-commercial species hinges also on the success of the observer program. In addition the catch, including the bycatch regulations, have been very strict so that the TACs have been followed more or less. The TAC regulations have also been restricted by ecosystem considerations. The total Cap for total groundfish catches has restricted, especially the pollock, TACs, prey fish (e.g. mackerel and capelin) is not targeted in federal waters of ecosystem considerations and relatively vast areas are closed to fishing. In contrast to many other U.S. regional councils, the NPFMC follows the principle that the TAC should never exceed the max ABC level set by the scientists.

Compared to other fisheries around the world, the tier system provides precautious management. Stock abundances are historically high for several stocks. Most groundfish stocks are considered to be above the BMSY level and few below. The fishing mortality rate is very low compared to European stocks. The FMSY level is lower than 0.4 for all stocks in the BSAI and GoA, but for most stocks it is lower than 0.1. The history of harvest rates indicate that the stocks have been harvested at about these levels the last 10 –20 years.

A general comparison with the European situation, the Tier system provides cautious harvest rates, is more cautious with long-lived species, is generally more cautious the less data there is and prevents new fisheries to develop before there is a certain minimum amount of data. However our respondents have pointed to some aspects that may indicate that there may be possible ways of improving the Tier system.

Starting with the more technical aspects, the scientist respondents pointed at some weaknesses with the Tier system: the difference between ABC and OFL is not prescribed on uncertainty and it is not necessarily more precautious down the tiers, tier 2 has never been used and the results from switching tier level has been somewhat unpredictable. They suggested that the Tier system should change to a rule that enables to take uncertainty into account in a general way, maybe exchanged with one single rule, and that more stability in TAC levels should be built into the rule. Other parties did not address such extensional changes, but tier 6 was criticised for its arbitrariness and that it in principle allowed a stock decline, and the environmental organizations argued that the assessment uncertainty wasn’t properly taken into account. This is also expressed through a concern that the Council did not always follow the scientists’ recommendations on reducing the ABC of ecosystem or uncertainty reasons.

A common complaint from the environmental organizations was the huge quantity of fish removed from the ecosystems of the Eastern Bering Sea. Although they considered the ecosystem in a healthy state at the moment, they argued that the fisheries in the federal waters is relatively young, that the present abundance is sheer luck and that eventually the stocks will decline and become depleted, just like history has developed elsewhere. Especially they point to the extreme catch level of the BS pollock stock. They argue that this level, because of its size, must have a considerable impact on the ecosystem.

Several issues have been addressed by the respondents which they denote as weaknesses with the Tier system, but are more likely to be complementary issues. There are related to spatial management, ecosystem function of a particular stock and that the total Cap should consist of a range, depending on the productivity of the ecosystem and not set at a single value.

The Alaskan natives have been worried about local depletions of stocks. There were claims that they have to go further and further away from the coast to get fish and that because of the big, federal, fishing vessel fishing within the 3 mile zone. Spatial management has been an issue at the Council because of worries about local depletions. Managing the stock on spatial grounds may probably solve this problem without changing the Tier system. Other reasons for spatial management that have been voiced by the greens are protection of nursery areas, spawning grounds and bottom habitat.

The fisheries in the BSAI and GoA are not minimum fish size regulated and environmentalists argued that small fish should be more protected.

Again, these last issues are possible to solve without changing the Tier system, but is of course highly relevant in the more general resource management context.

3.4.2 Trust in science and resource management

In general all parties seem to have confidence in the Tier system and how it is used. Fisheries cannot develop without a minimum of data, bycatch regulations have to follow the Tier system, harvest rates seem sustainable and management is takes ecosystem considerations into account. The industry respondents, the managers and the scientists themselves all confirm that the industry seems to have trust in science and especially in the Tier system. . The pollock fishery in particular, prides itself on respecting the max ABC, supporting sustainable fisheries and contributing to an ecosystem friendly management. The explanatory factors for this trust may be diverse. Early experience had demonstrated that the main salmon stock in Alaska was recovered from depletion with science advice and the depletion of fish stocks on the U.S. east coast was a warning. The precautionary management from its start was welcomed as it was regarded as a means to diminish the foreign fleet, regarding the ABCs, the strict bycatch regulations and the total Caps. The bycatch regulations have again been a reason for accepting lower TACs and the total Cap because the industry has seen that the TAC would have been impossible to take anyway. The productivity of the ecosystems, especially the Eastern Bering Sea, has provided abundant stocks so that the market oriented fisheries, which dominates the federal waters of Alaska, has found it suitable to restrict the quotas. The remaining actors after the foreign fleets had left and after the several rationalization programs have made good profits on fishing. The Tier system is transparent in that the principles of all the tiers are stated, and combined with the participatory nature of the Council, the interested parties have their say in deciding the TAC and how it is allocate.   Non-industry respondents claim that the industry has never lobbied to get a higher TAC than the ABC. On the contrary, when the scientists changed model for pacific cod, and it showed twice as much as the old one, the industry recommended to follow the old one. They were satisfied with their share.

Although there are several examples where the industry goes for a lower TAC than the recommended ABC by the scientists, the industry does challenge the scientific reasons for lowering the ABC below the max ABC. The industry perceives these reasons as subjective as they are not included in the assessment model calculations. Since the scientists agree that science is respected, this may mean that they consider the max ABC as precautionary enough in itself.

The critical voices to the tier system are basically from the environmental organizations. Their concerns are the harvest rate levels, uncertainty considerations, local depletions and the lack of ecosystem considerations. They criticize the fact that the scientists' recommendations for lowering the ABC can be overruled by the industry through the Plan Team and suggest that science recommendations should not be negotiable. While the managers, the industry and the scientists seemed content with the management system and enjoyed mutual trust, the environmental organizations were far more critical. Apart that values and attitudes may be the main reasons for this difference, the fact that the environmental organizations have never had a representative at the council may also play a role. The other three parties may have developed a general common understanding through cooperation in the Council, while the greens have tried to influence the decisions mostly through testimonies. The scientists think the environmentalists exaggerate their criticism of the management, while the greens question the scientists' credibility by referring to industry funded research. This does not mean that the environmental organizations are powerless actors. It is quite the contrary. They have won two significant court cases against the Council. One was on violating the Federal Endangered Species Act by jeopardizing the continued existence of endangered species, and the other on violating the National Federal Policy Act. These led to the protection of Stellar Sea Lion and its prey and impact assessments of the groundfish fisheries. This power of the environmentalists may have contributed to change the attitude of the industry and the Council towards a more environmental friendly policy.

4 Bering Sea Pollock cooperatives: Economic efficiency at the cost of social acceptance?

In the following, we will describe and assess against the CEVIS criteria the system of industry cooperatives that evolved in the Bering Sea pollock fisheries in the US (EEZ) waters off Alaska. The cooperatives represent a specific form of rights based management, where the fishing industry negotiates in a self-governance approach among themselves quota shares after access to the fishery had been limited to a defined (and quite low) number of participants. Within the North Pacific/ Alaskan fisheries management, the pollock cooperatives represent one example within a string of rights based management systems ('rationalisation' programmes) that have been introduced over the past 15 years.

Walleye pollock is a semi-pelagic schooling fish widely distributed in the North Pacific. The Alaska pollock fishery accounts for over 20% of the total US landings (Felthoven 2002: 184) and is the largest single segment of Alaskan fishing industry with 1,48 Mio metric tons of harvested fish in 2005 and a real ex-vessel value exceeding $ 350 Mio (Hiatt 2006: 13, 17). The low-priced Walleye pollock – in 2005 it achieved ca. $0.13 per pound at the market (ibid: 7) – had become popular with the decline of whitefish populations such as cod that resulted in the search for substitutes.[8] While there are four major Pollock stocks – the Gulf of Alaska (GoA), Eastern Bering Sea (BS), the Aleutian Islands (AI) and the Central Bering Sea/ Bogoslof Island pollock –, cooperatives were only introduced in the BSAI region. Since the AI region has been closed to fishing due to the decline in the Stellar Sea Lion population, the cooperative fleet is currently only active in the BS. The fishery is highly industrial, dominated by a number of large factory trawlers with a crew of ca. 100 and a length of 80-100m and smaller catcher vessels[9]. These vessels are typically owned by non-Alaskan residents and operated from Washington State. The dominant gear type is midwater trawling and harvesting takes place in an 'A' season in spring (roe) and a 'B' season in summer/autumn. Pollock products include the higher value products roe and frozen blocks as well as surimi, mince, and fish meal. As regards international markets, competitors to the Alaskan Pollock industry are the Russian pollock industry which has suffered from declining stocks in the past years and, in a wider sense, other international whitefish industries including aquaculture.

4.1 *Evolution and characteristics*

The pollock cooperatives emerged as a result of ongoing conflicts ('Pollock Wars' according to one interviewee) between the inshore and offshore Pollock sectors. The inshore sector consists of Catcher Vessels (CVs) that deliver to shore-side processing plants, while the offshore sector includes Catcher/Processor Vessels (C/Ps) (i.e. large 'factory trawlers') on the one hand and the Mothership sector (MS) on the other. Motherships do not themselves harvest fish but process the Pollock a fleet of CVs delivers to them. These three sectors of the Pollock industry have developed differing interests and these are crucial to understand the evolution of the coop system.

Historically, with the Pollock fishery being largely foreign, efforts were politically supported to first form joint ventures between US and foreign companies and then fully Americanise the industry (Wilen/ Richardson 2003). At the same time, there was an interest by the State of Alaska to settle processing plants at the Alaskan coast in order to improve community infrastructures, to create employment and generate revenues through the taxing of landings. Mainly Japanese investors were approached to build up processing/ surimi factories. These plants were also in the interest of CVs which could now deliver to the shore processors and not only to MS or C/Ps.

In problem underlying the Inshore-Offshore conflict was the huge capacity of the C/Ps which

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8 Among others, McDonald's and Unilever as large customers started to source Alaska Pollock as an alternative to cod.

9 4-6 crew members, 30-60 m long.

threatened to deprive the smaller CVs of harvesting opportunities. These were less efficient since they needed to land fish to shore-based plants between trips. Allying with the processors and supported by significant players such as Alaskan Senator Stevens, the CV sector in the late 1980s started to fight in the (Alaska-dominated) Council for a separate share of the resource to be set aside for them. In 1993, the first Inshore-Offshore deal was struck which resulted in a quota allocation of 35% for the inshore sector (i.e. CVs) and 65% for the offshore sector (both C/Ps and MS). In the subsequent years, the inshore quota was raised continually, to the massive discontent of the offshore sector.

To make up for their losses, the C/Ps envisaged the creation of harvesting cooperatives which had been successfully introduced among C/Ps in the State of Washington Pacific Whiting fishery in 1997. The institutional innovation of cooperatives allowed circumventing the US moratorium on introducing new Individual Transferable Quota (ITQ) systems in the mid-1990s.[10] However, beforehand legal concerns with regard to US anti-trust law[11] needed to be overcome, which declares agreements among competitors allocating resource outputs to be per se illegal. While the 'Fishermen's Cooperative Marketing Act' in principal extends an anti-trust exemption to collective harvesting arrangements, legal cases had suggested that coop members needed to have a low level of vertical integration (Sullivan 2000: 2-3). Catcher/processors, however, are vertically integrated to a high extent. Forming of the 'Whiting Conservation Cooperative' – the participants of which also operated C/Ps in the Bering Sea Pollock fishery – became possible on the basis of a Business Review Letter by the Department of Justice which accepted the argumentation that a harvesting cooperative would be pro-competitive.[12] After this precedent, which had triggered substantial efficiency gains in the whiting industry (ibid: 5-6), creating a cooperative for Bering Sea Pollock catcher/processors analogous to the pacific whiting coop seemed legally possible. However, technically it required that the offshore sector was formally divided into a catcher/processor sector and a mothership sector. This split was demanded by the representatives of the C/P sector in the third Inshore-Offshore negotiations in 1998. After lengthy deliberations, however, the Council rejected the claim (NPFMC 1998).

The C/Ps then turned to Congress. In Washington D.C. at the time, a draft bill (the American Fisheries Act,[13] or "AFA") was being negotiated. It originally aimed at increasing the US ownership requirement for US fishing vessels and at revoking the fishery eligibility of certain C/Ps that Senator Stevens believed had entered the BS Pollock fishery in violation of the Commercial Fishing Vessel Anti-Reflagging Act[14] of 1987 (Sullivan 2000: 6).[15] The

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[10] The Sustainable Fisheries Act of 1996 stipulated a four-year moratorium. This was triggered by distributional and fairness concerns resulting from experiences with ITQ programmes such as for the Sablefish and Halibut fisheries off Alaska.

[11] The basic US antitrust law is the Sherman Act.

[12] The argument was that while coop participants had an imminent interest to fully harvest their TAC allocation and *not* to curb market supply, the arrangement would increase efficiency and productivity. It would hence benefit consumers as more products would be produced at a lower unit cost from the same amount of fish (Sullivan 2000: 5).

[13] Division C, Title II of U.S. Public Law 105-277

[14] Pub.L. 100-239

[15] A number of vessels had been built or rebuilt in Norwegian shipyards (which were subsidised by Norwegian oil revenues to maintain their world leadership); in order to qualify as US vessels, however, the boats needed at least to contain specific components (such as the keel) from the US.

withdrawal would in effect have made possible a further increase of the inshore sector allocation at the cost of the offshore sector. Since the vessels to be withdrawn were Washington-based, Washington Senator Gorton opposed the draft bill. By mid-1998 negotiations were at an impasse. In this constellation, the lobbyists of the catcher/processor sector managed to convince Congress that their suggestions could solve the problem. As a result, the draft was substantially redesigned.

The AFA as it was passed in 1998 facilitates the creation of cooperatives in the Bering Sea Pollock fishery by establishing a separate and permanent allocation of Pollock for both the C/P, mothership[16] and CV sectors. It also determines the eligibility criteria for vessels to participate based on a catch history (1995-1997), and actually lists the eligible vessels. In addition, the AFA provides for a buy-out of nine C/Ps, thus achieving the capacity reduction desired by Senator Stevens. While not providing for a legal framework governing the coop formation in the case of the C/Ps, the AFA does lay down criteria for the formation of cooperatives among the inshore catcher vessels,[17] the owners of whom had in the meantime become interested in the idea of coops as well. Key to the complicated regulation of inshore coops is that these cooperatives are plant-specific. They form on an annual basis around an affiliated shoreside processor to which they agree to deliver at least 90% of their pollock catch allocation. The contentious tying of vessels to a specific processor 'is intended to promote win-win rationalization in both the overcapitalized harvesting and processing sectors' (Matulich/ Sever/ Inaba 2001: 13). The AFA also established 'sideboards' (i.e. catch limits) on the participation by AFA-vessels in the non-pollock BSAI groundfish fisheries and GOA groundfish fisheries.[18] These shall prevent the 'spillover' of capacity into other fisheries to protect the interests of fishermen and processors who have not directly benefited from the AFA; the C/P's sideboards are defined in the AFA on the basis of historical catches. Finally, AFA subjects the cooperatives to annual reporting requirements (see PCC/HSCC 2006).[19]

After the AFA had been passed, the cooperatives formed and participants contractually allocated percentage shares of the total allocation, based on their historical catch levels. Today, the system of cooperatives looks as follows: There are ten coops, one (active one) in the C/P sector,[20] two in the mothership sector and seven in the inshore (CV) sector. Each of the latter is associated with a shore plant. The coops are entitled to the Total Allowable Catch (TAC) of BSAI Pollock after certain shares have been subtracted from it. These include a 10% allocation of the TAC to the Alaskan Community Development Quota (CDQ) programme plus allowances for the incidental catch of Pollock by vessels harvesting other groundfish species.[21] From the remainder of the TAC, the catcher vessels receive 50%, the

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16 Note that most of the catcher vessels that deliver to the three motherships are qualified for fishing in the inshore sector of the BSAI pollock fishery.

17 AFA, Section 210.

18 AFA, Section 211.

19 Cf. Section 210(a)(1)(B) of the AFA.

20 Formally, an additional co-op exists in the offshore-sector, the "High Seas Catcher Cooperative" (HSCC) exists, the shares of which have however been leased to the second (and active) cooperative.

21 AFA, Section 206.

catcher/processors 40%[22] and the motherships 10%. Company-specific allocations allow the firms to freely choose which and how many vessels to operate and to coordinate their efforts. While the C/P coops started cooperative fishing in 1999, the mothership and inshore coops did so only in 2000. No new entries are possible except when a company purchases an AFA vessel or its coop share.

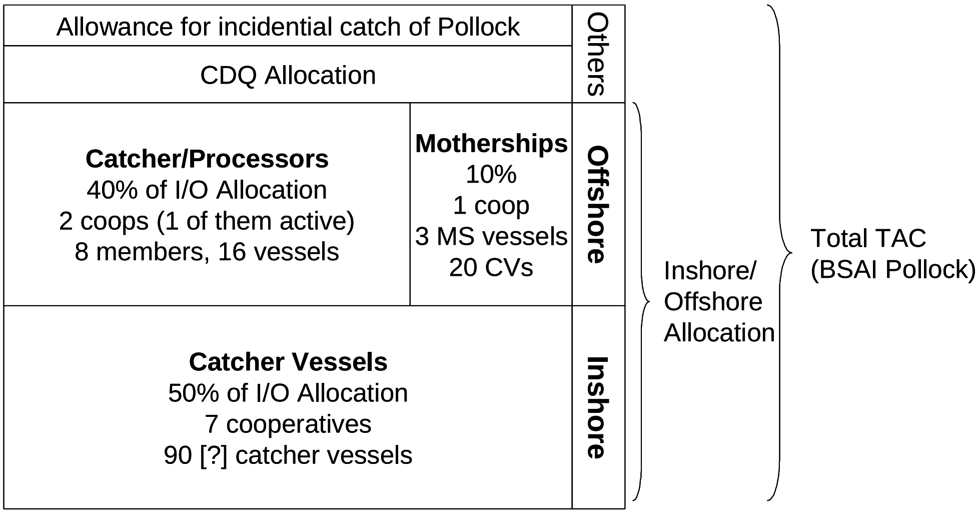

Fig. 2. The system of BSAI Pollock cooperatives (2007). Source: own.

How exactly do the cooperatives work? Basically, the cooperatives fulfil three functions: a. allocation of quota shares and of sideboards, b. bycatch reduction, as well as c. the respective monitoring and enforcement. Of these, the foremost function is to allocate within each sector, and respectively within each cooperative, the allotted quota share of Pollock. This happens on a contractual basis, in the form of a Membership Agreement. In practice, the cooperative system is similar to an ITQ system. However, beyond deciding on the allocation of harvesting privileges coop members also decide on the system for trading, selling or enforcing them. Both leasing and selling fishing privileges among members of the cooperative are allowed. The leasing and sale of harvesting privileges to an outside party are allowed only if the buyer agrees to abide by the rules set forth in the cooperative's contract. The buyer must also harvest and process the quota with one of the vessels already permitted or a replacement vessel that meets specific criteria (NOAA Fisheries 2004b: F8-11). The cooperatives' Membership Agreements provide for contractual remedies to enforce sanctions should a member exceed the quota allocated to them. In addition to harvest shares, within the inshore and mothership cooperatives, sideboards (see explanation above) need to be allocated.[23] Membership Agreements govern these issues within each coop, and in addition an "Intercooperative Agreement" was developed to govern the allocation *between* the CV and MS coops. Like harvesting shares, sideboard restrictions can be traded among cooperative participants and between the different cooperatives.[24] In practice, coop managers handle the trades of both harvesting shares and sideboard limits within each coop. An inter-coop manager handles the trades between the coops. Most trades take place at the end of the fishing

[22] In 2007/08, the share of the seven C/V coops in this TAC allocation ranges from 2.9% to 31.8% (NOAA Fisheries 2007).

[23] The sideboards for the C/P cooperative have been allocated in the AFA.

[24] With the exception of the C/P cooperative, cf. Footnote 23.

season when it comes to pool and 'clean up' the remaining tons of TAC.

A second function which was not originally foreseen has been developed in 2001. The cooperatives concluded a further Agreement[25] which contains a 'rolling hot-spot' programme to avoid salmon bycatch.[26] Salmon bycatch is a crucial issue not only because of the economic importance of salmon to Alaskan communities, but also because Salmon bycatch counts against the Salmon TAC so that the Pollock fishery may be closed down when the Salmon TAC is exhausted. In the rolling hotspot programme, areas with the highest bycatch rates are identified as 'Savings Closures' two times a week and are closed to fishing based on each coops' bycatch performance. Each coop is also assigned to one of three tiers on a weekly basis: those with low bycatch rates don't have to respond to closures, those with medium bycatch rates are restricted by the closures for four of the days, and those with high rates are restricted all seven days (Fahn 2005: 24). About 85 percent of the AFA Pollock harvest is observed by NMFS through observers, and this data, shared among all the coops, forms the basis for the bycatch reduction system.[27] Vessels that experience an incident of high salmon bycatch are required to provide a fleet wide notification of the 'hot spot', disseminated by satellite communication to the participating vessels. This and weekly bycatch reports help captains avoid areas of potentially high bycatch. A similar system (the "Calamari Triangle") was devised when bycatch of squid (a non-managed species) reached alarming levels in 2006.

The third function of the coops is monitoring and enforcement of the above mentioned functions. This is done by a third party, the private company "Sea State Inc". On the basis of catch data reported to NOAA Fisheries, Regional Office data and direct communication with the boats, Sea State verifies on a company-by-company basis that the coop's pollock catches don't exceed their allocations. Contractual remedies are foreseen when a company overfishes the allotted quota share. Sea State is also responsible for monitoring compliance with the Salmon Bycatch Agreement. Among others, a weekly ranking of the twenty boats with the worst bycatch record ('Dirty 20' lists) helps to determine whether there is a systemic problem or just unlucky accidents. Enforcement measures include a 50-percent-of-catch penalty for a first closure area violation and a 100-percent penalty for a second one (ibid; Holland/Ginter 2001: 40). The private monitoring system constitutes a kind of in-season micro-management with the aim to maximise the harvest by avoiding closures driven by by-catch.

We will briefly add some more details on the coops' operation for the economically most important and politically most high-profile of the cooperatives, i.e. the Catcher/Processor cooperative "Pollock Conservation Cooperative" (PCC). The PCC is the only coop active in the C/P sector, although formally a second cooperative (the "High Seas Catcher Cooperative", HSCC) exists, too. The HSCC consists of catcher vessels only, which had traditionally delivered their harvest to the C/Ps. Once the AFA was in effect, the members of the HSCC started to lease out and in the meantime have now sold out their shares to the PCC. The PCC

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[25] The "Salmon Bycatch Management Agreement" of 2001, renewed in 2006.

[26] It is mostly Chinook Salmon and Chum Salmon that are caught as by-catch by pollock boats.

[27] While beforehand, the bycatch rates were already available at NOAA Fisheries, since most of the vessels had observers on board, no mechanism existed to merge this information in real time and make it available to the vessels. One reason for this was that the information was confidential – making the data public would have revealed the locations of individual vessels. Hence, an agreement between Sea State, NOAA Fisheries and the participating companies allows Sea State to retrieve observer data and calculate bycatch rates per ton.

formed in a two months negotiation late 1998. In 2006, the percentage share for the eight PCC companies ranged from 5.0% to 43.7% (PCC/HSSC 2007: 10). Theoretically, an annual meeting should take place at the beginning of each year to establish a "Harvesting Plan" which, however, turned out not to be necessary in the past years. The members meet monthly back-to-back with meetings of their trade associations[28] to discuss operational issues, but the meetings are said to be very short.

4.2 *Assessment*

4.2.1 Biological performance: Support for cautious management as long as the profit flows?

To analyse the cooperatives' impact on the natural resources, we will take into account the impact on pollock stock, sideboard and prohibited species. Also there are discussions on ecosystem impacts like bottom habitat destruction, Stellar Sea lions, local depletions and fuel consumption. We will have a look at what influences these impacts, the coops or other management features.

Table 1. Stock Assessment of Walley Pollock (Nov. 2006)

Status and catch specifications (t) of pollock in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2007 and 2008 are those recommended by the Plan Team. Catch data are current through 11/4/2006.

Area	Year	Age 3+ Bio.	OFL	ABC	TAC	Catch
EBS	2004	11,000,000	2,740,000	2,560,000	1,492,000	1,480,550
	2005	8,410,000	2,100,000	1,960,000	1,478,500	1,483,279
	2006	8,050,000	2,090,000	1,930,000	1,485,000	1,486,004
	2007	6,360,000	1,640,000	1,300,000	n/a	n/a
	2008	n/a	1,500,000	1,300,000	n/a	n/a
AI	2004	175,000	52,600	39,400	1,000	1,158
	2005	344,000	39,100	29,400	19,000	1,621
	2006	130,000	39,100	29,400	19,000	1,742
	2007	95,000	21,400	16,800	n/a	n/a
	2008	n/a	21,400	16,800	n/a	n/a
Bogoslof*	2004	198,000	39,600	2,570	50	0
	2005	198,000	39,600	2,570	10	0
	2006	253,000	50,600	38,000	10	0
	2007	240,000	48,000	5,220	n/a	n/a
	2008	n/a	48,000	5,220		

*The approach used by the Plan Team for recommending Bogoslof ABC in 2007-2008 differs from the approach used by the SSC and Council in previous years.

Source: NPFMC (2006: 10)

The pollock cooperatives catch the major part of the TAC of the EBS pollock stock. The pollock cooperatives have no influence on the max ABC, but have their say on the ABC and the TAC setting through the council. Table 1 shows that the catch level is pretty close to the TAC, and the TAC is considerably lower than the ABC. In addition to pollock the coops catch

[28] The „At-Sea Processor Association" (APA).

bycatch species divided into sideboards and prohibited species. The pollock fisheries is considered a clean fishery as the percentage of bycatch is very small. However, since the catch level is so high, the bycatch is considerable in terms of absolute numbers.

The EBS pollock catch level the last 20 years has been relatively stable at about 1.3 million metric tons (Ianelly 2006). This we explain by decisions on low harvest rates, a strict fisheries regulation regarding TACs on pollock and sideboards and prohibited species, the BSAI Cap and the observation program providing control on what is actually caught. The TACs have been quite lower than the ABC, and the coop members have realised that with their bycatch levels, especially on salmon, it would be impossible to take their quota before bycatch levels would have closed the fishery. The environmental organizations do not expect TAC level to maintain as they don't consider the management sustainable. In any case, the abundance of pollock is not likely to be much affected by the coops of these reasons. However, the acceptance of these regulations among the coop members may partly be explained by the construction of coops. The coops have reduced the fleet capacity, made it more profitable for the members, made it possible to plan in longer terms and pollock stock has been abundant. Closure of areas (e.g. to protect the Stellar Sea lion) and other environmental issues has caused discontent among fishermen, but the pollock fleet could cope with it because of the economy in the fleet. The initiating of pollock coops reduced the number of pollock vessels, and the remaining AFA vessels are prohibited to fish in other areas to avoid these "mammoth vessels" to deplete stocks elsewhere. An indication that the fleet capacity matches the TAC levels is that their sideboards has not yet be taken but given to the actors outside the coops. Overcapacity is considered a major cause of stock depletion.

The coops have shown to be an incentive to innovative solutions, which again affect the resource situation. The most important issue was how to deal with salmon bycatch. After the coops had been established, the bycatch and discards (prohibited species must be discarded) has declined considerably. The information in connection with Sea State is so current that the coops claim to never have been further away from the TAC than a ton. A PCC vessel has (by self-policing) to shut off the fishing at 10t before their share is taken, in case the last bag comes in with a little too much. The coops themselves decide on their own penalties and fines in case the members exceed the quota, but there have never been significant violations. This means there are no incentives to push the limits of any of the agreements and that the only incidents are due to confusion. The coops make the bycatch easier to manage, but its success is also connected to the low number of quota share owners.

Cooperation through the coops makes it possible to improve present practice and be prepared for future environmental requirements. The Marine Conservation Alliance (MCA), a business NGO, organizes several research programs through the tax exempt to solve common problems within the coops, including projects to reduce bycatch and development of gears to reduce damage on bottom habitat.

Against the backdrop of a stable public pollock management through and improvement with regard to the bycatch issue, the at-sea trawlers' trade association applied for a Marine Stewardship Council (MSC) certification of the GAO and BSAI Pollock fishery. This application, after a lengthy assessment process, turned out successful. However, a network of environmental organizations has opposed to this certification because they claim there are local depletions in spawning aggregations, because of the Stellar Sea lion issue and damage of bottom habitat. The Stellar Sea lions issue is a complex one. There are no strong scientific indications that the lack of AI pollock prey is the reason for the declining Stellar Sea lion population. Other explanations have been suggested but not proved. Still the coops did agree with a closure of pollock areas to protect the population. The environmental organizations think that management should be precautious due to the uncertainty and that greater areas should be closed.

The midwater trawls that are used for targeting pollock are estimated to be in contact with the bottom floor 44% of the time. In specific periods, the big pollock stay close to the bottom. It is however a disagreement whether this has a significant impact on the bottom habitat. These areas do not consist of rocky habitats, so that coral reefs and sponges are not affected. One of the scientist respondents thinks that the trawling is not a great problem, but admits that the scientific knowledge is not sound. There is a concern among the conservation groups that e.g. the total amount of Sea Pens caught is considerable.[29]

Although there is a considerable disagreement between the pollock fisheries actors and the environmental organizations about the impacts of the pollock fisheries, the NPFMC has made the two parties work out and agree on what areas to close for bottom trawling. However, the greatest concern of the environmental organizations is what will happen if the EBS pollock stock declines significantly. With low pollock abundance, insignificant rights to target other stocks and the political power of the coops, will they still embrace an environmentally friendly fishery?.

4.2.2 Economic performance: Stability and sectorally differing levels of efficiency gains

How has formation of the coops impacted on the Pollock industry's economic performance? We found that passage of the AFA allowed for substantial efficiency gains, both with regard to the fleet structure, harvesting operations and processing. So some extent, however, the improved performance of the pollock industry, as indicated by ex-vessel and product values, was caused by other factors, too.

Since 1998, the year when the AFA was passed, real ex-vessel value of the pollock catch has increased compared to the ex-vessel value of other groundfish species (see **Fig.** 3).[30] Though the figures include the value of Pollock harvested in the Gulf of Alaska (GOA), which is not managed by co-operatives, as well as that of pollock by-catch from other fisheries they are strongly indicative of developments pertaining to co-operatively harvested pollock.[31] In

29 One of our respondents suggested the development of a censor to tell how much of the time the gear has been in contact with the bottom. Fishermen who can document less than 20% contact could get a 10% reward an incentive to change practice.

30 Note that the value added by at-sea processing is not included in the estimates of ex-vessel value as presented in **Fig.** 3 (Hiatt 2006: 43).

31 In 2005, the estimated pollock catch in the Bering Sea and Aleutian Islands was eighteen times the catch in the Gulf of Alaska (Hiatt 2006: 18).

accordance with the ex-vessel value, real gross product value of pollock products increased markedly (*Fig.* 4).

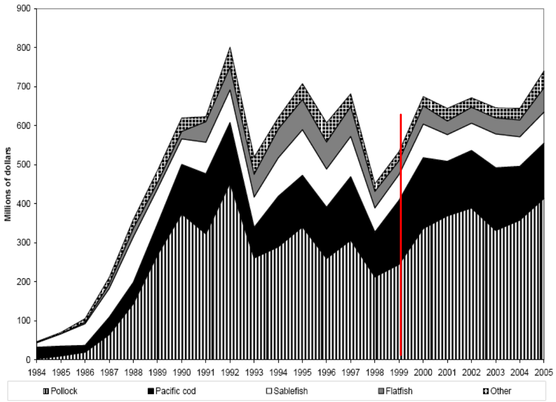

Fig. 3. Real ex-vessel value of the groundfish catch in the domestic commercial fisheries off Alaska by species, 1984-2005 (base year = 2005). *Source: Hiatt (2006: 13). Red line marks year of introduction of co-ops.*

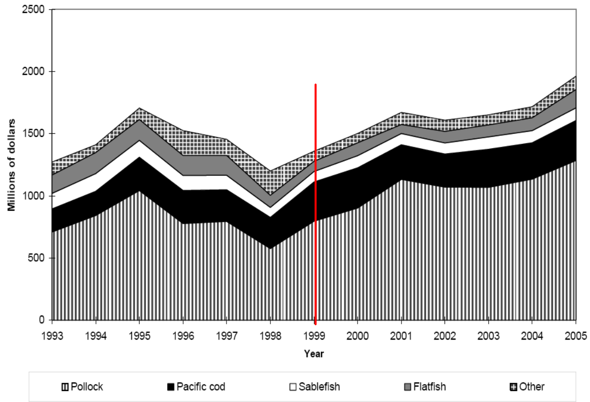

Fig. 4: Real gross product value of the groundfish catch off Alaska, 1993-2005 (base year = 2005). *Source: Hiatt (2006: 15). Red line marks year of introduction of co-ops.*

The increase of ex-vessel value and gross product value resulted to a significant extent from the capacity reduction and access limitation that the AFA provided. However, coinciding with this institutional driver, market developments at the time contributed to these developments. Firstly, the effects of the Asian currency crisis of 1997 which had hit the surimi market waned.[32] Secondly, a more general trend of the late nineties was that the number-one competitor of the US Pollock industry, i.e. the Russian pollock fishery went into serious decline after years of overexploitation. Also, with collapsing cod stocks in the US and North Sea and other dwindling stocks, the supply of whitefish on the world market was generally low.

Fleet efficiency rose due to the removal of marginal vessels from the fishery. Through the AFA-induced buybacks and through a transfer of fishing quota within the cooperatives to the most efficient operators, marginal vessels were scrapped or retired. This included small vessels and large vessels that were inefficient, either because of high fuel or high maintenance costs. During the first year of the Pollock Conservation Cooperative’s operation, for example, only 14 of the 20 eligible vessels fished, thus saving the operating costs of these vessels that would have fished had the cooperative not formed (Wilen/Richardson 2003: 7). It is expected that permanent fleet reductions will be ‘on the order of 30 percent for all three sectors of the industry’ (NOAA Fisheries 2002a: 5). Felthoven (2002: 196) estimates that for the group of C/Ps, introduction of the cooperatives lead to a fall in total fishery effort of around 30% in 1999, though it slightly rose again in 2000.

Through the guarantee of a fixed harvest for each coop participant and through some

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32 Waning of the Asian currency crises may explain why real ex-vessel value and real gross product values began to improve in 1998, while the coops actually started running only in 1999 (offshore sector) and 2000 (inshore sector).

additional influences,[33] the race for fish ended and fishing seasons prolonged – from 55 days per year for catcher/processors in 1997 (MacGregor 2006) to a historical peak of 140 days in 2000 (Felhoven 2002: 196). For the first year of cooperative fishing within the PCC, *Fig.* 5 shows that the length of the A season was doubled compared to that of 1998. Slowing of the fishing operation allowed the use of smaller bags for hauls so that the fish had a higher quality (less damage): In 1999, in the PCC, 'Catches per haul was 27 percent lower, the number of hauls per day dropped by 45 percent' (Wilen/Richardson 2003: 7). Furthermore, the end of the race for fish made it possible to target a more specific size range of pollock for fillet or surimi processing, to range farther in order to locate higher quality catch, and to better time deliveries and serve different markets (NOAA Fisheries 2002a: 5). Finally, the TAC could be more fully exploited due to the cooperative 'mopping up' of TAC remains: fish could be harvested that had traditionally gotten lost through management 'buffers' in the closing of seasons, which had served to prevent an over-exploitation of the TAC (Sullivan 2000: 6).

With regard to processing operations, too, introduction of the coops increased production efficiency. The time and resources freed from the race for fish could be invested in the retooling of boats and new on-board production technology.[34] As *Fig.* 6 shows, the product recovery rates of Catcher/Processors increased some 50%, from a little less than 20% of finished product per ton of harvested fish in 1998 to slightly more than 30% in 2006. Among others, fish caught in the A season – the carcasses of which, after having been stripped from roe, had been thrown away under the Olympic system – after passage of the AFA were fully processed and parts such as backbones, heads, stomachs etc. that had so far been waste were now being processed.[35] The increased product recovery made possible above all production of additional lower-grade surimi or mince products. The utilization rates of the inshore and mothership sectors increased likewise, though at smaller rates.[36]

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33 These include e.g. the buyout of nine Catcher/Processor vessels. Also, under cooperatives, 'processors may chose to operate at different times of the year than their competitors for logistical or market reasons. (…) And finally, differences in markets may lead one processing operation to operate at different times of the year from its competitors' (NOAA Fisheries 2002a: 5).

34 For example, while the at-sea processing vessels before AFA had largely produced either surimi or fillets, retooling meant that now the boats produce both.

35 As an industry representative put it: "Back in the Olympic days it was important to just catch as much as you could because otherwise somebody else did. And you did not really care what you were making because there was no cost associated with the fish. You just caught it as fast as you could and if some of it got wasted it did not matter."

36 NOAA Fisheries (2002a: 6) specify that the inshore sector processors increased their overall utilization rates from 35.8% in 1998 to 36.6% in 2000, and the mothership sector from 20.7 percent (1998) to 26.6% (2000).

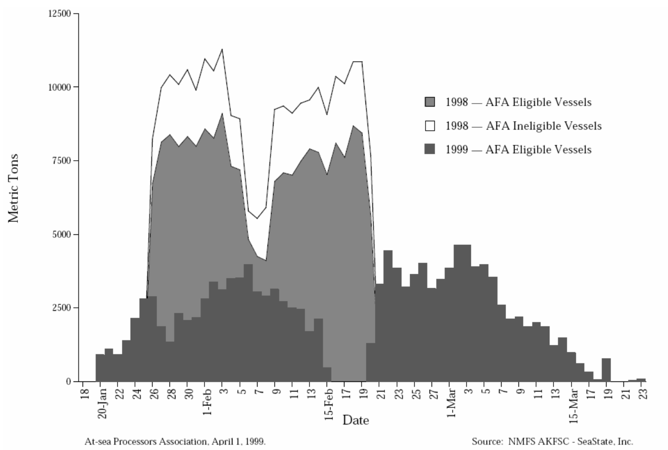

Fig. 5. Length of A-season and daily catches of Bering Sea Pollock Catcher/Processors in 1998 and 1999. *Source: Wilen/Richardson (2003).*

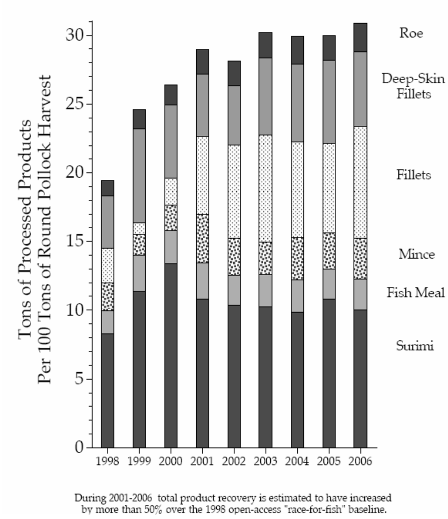

Fig. 6: Total product recovery and mix in Catcher/Processor sector. *Source: PCC/HSCC (2007: 24).*

Disentangling different types of economic gains induced by the AFA, Felthoven (2002: 197) summarises that 'most of the perceived gains of the AFA seem to be related to processing and the associated increases in product recovery rates and product grades [rather than to harvesting efficiency]. In fact, it is likely that tradeoffs were made between harvesting efficiency and the quality of processed products, as evidenced by the observed slowdown of operations.' In accordance with expectations formulated by economic theory, an industry representative underscored that the end of the race for fish had shifted the logic from 'Maximise your dollar per day' to 'Maximise the dollars earned per ton of fish harvested'.

When looking at the development of employment, there have been lay-offs in the BSAI Pollock industry linked with the reduced harvest allocation and accompanying buy-out of nine vessels in the offshore C/P sector. Industry representatives estimate the number of employees lost to amount to 900-990, while cautioning that some of the retired boats would not have been able to stay in the market much longer anyway; i.e. some jobs might have been lost without the coops, too. This was to do with the generally dire economic performance of the sector in the mid to late 1990s, which had resulted the race for fish combined with overcapitalisation (MacGregor 2006), apparently also with bad loans, and with the Asian currency crises that hit the major surimi markets.

With the longer seasons, annual crew use has increased, too. As regards income, there is no detailed data available on how crew income developed as a consequence of the cooperative fishing. The fact that renumeration is said to be share based and to depend on the value of products (which has increased) may lead us to infer that crew income was at least stable, if not ascending.

Introduction of the coop system in a wider sense contributed to the economic stability of the US pollock industry. With the AFA limiting access to the fishery and reducing fishing capacity, there had been no bankruptcies any more since 1999. At the same time, the secure harvesting rights – signalling a safe future of the industry – made access to capital less costly as risk premiums were cut. Looking at the effects on other fisheries, there is some fear and anecdotal evidence of investment from the well-performing Pollock companies in vessels and licences to harvest in other fisheries, among others in cod fishery. This is ‘Dollar spillover’ and may occur independent of the spillover-prevention through sideboard limits.

4.2.3 Cost effectiveness of management: Easing the burden of the public sector

How cost-effective is the system of cooperatives in terms of its management? Which costs are borne by public administration, which by the private sector? Distinguishing between costs of design, of implementation and operation, we find that the co-op system has caused very few additional costs for fisheries management and has rather freed public resources especially with regard to the operation phase. Some of these benefits are inherent in the coop system, others stem from the specific design and implementation of the system. Our analysis of management costs is qualitative only; a quantitative analysis would be beyond the scope of this study.

With regards to the design of the cooperatives as a management system, public costs were low. The idea of a sector allocation and of cooperatives developed among private sector actors and was negotiated between major players of the Pollock industry and with a small number of political actors in Washington DC (Matulich et al. 2001: 2-3, Sullivan 2000: 6-7).[37] The subsequent design of the cooperatives and elaboration of their internal rules was subject to private negotiations among the coop members.

Costs for implementing the coop system encompass the AFA buy-out, the initial quota allocation, and annual public research and management tasks. Apart from the latter, these costs are largely born by the pollock industry. Buy-out and scrapping of nine C/P vessels from the offshore sector had been a precondition for the AFA deal to make possible separate sector allocations and hence cooperatives. The buyout was funded through a combination of $20 million in Federal appropriations and $75 million in direct loan obligations to the companies of the inshore sector:[38] with this loan, the inshore CVs bought out the offshore sector C/Ps, as a compensation for the increase of their overall TAC allocation. The CVs paid off the loan through a delivery fee of 0.6 cent per pound of pollock they harvested. As regards the initial quota allocation, negotiations were carried out exclusively among industry participants, which thus covered the related transaction costs. The relatively low number of participants (ca. 100 companies), divided into 3 sectors in which interests are relatively homogenous, implies that these costs were probably lower that the typically high up-front cost of initial allocations in the case of ITQs (Sutinen/Soboil 2003). Finally, there remain some implementation costs for the public sector. These include the Annual Stock Assessments by NOAA Fisheries that feed into the TAC setting process within the North Pacific Fisheries Management Council. Since these costs accrue for all managed fisheries in the Council’s jurisdiction, they are no additional costs caused by the co-op system. Further public implementation costs are related to the

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[37] These included above all Alaska’s Senator Ted Stevens, then-head of the US Appropriations Committee, and Washington’s Senator Slade Gorton.

[38] Cf. Section 207 of the American Fisheries Act.

annual application procedure of inshore cooperatives required by the AFA.[39]

The costs of operation include costs of running the co-ops, of monitoring and sanctioning their operations. These costs are mainly private expenditure. Firstly, they include funding of observer coverage – the catcher/processors are required to have two observers onboard at all times, which annually sample 99% of all hauls. Secondly, the private operation costs include subcontracting of Sea State Inc. by the coops. The main cost item is said to be management of the harvest, i.e. remaining within the quota, sideboards, and bycatch limits. With establishment of the coop self-governance system, public in-season management tasks related to BSAI pollock were reduced, hence freeing public resources for other purposes.[40]

Public enforcement through NOAA Fisheries' Office for Law Enforcement, the US Coast Guard and the Alaska State troopers is ongoing, but the AFA coop system is reported to have substantially relieved burdens off enforcement. This is because the day-to-day activities of the boats are less important: controls relate to coops rather than to individual companies. As coop members can even out landings and bycatch-rates amongst them the potential for violations sinks; also, the collective responsibility for violations spurs peer control (Holland/ Ginter 2001: 40). A law enforcement officer commented: 'Now it is more of a monitoring type of an operation as opposed to harder enforcement.'

4.2.4 Stakeholder acceptance: Insider vs. outsider attitudes

Is the coop system socially accepted by Alaskan fishery stakeholders? To answer this question, we need to differentiate between groups of stakeholders which can be expected to have different material interests and possibly 'ideational' orientations. While we find that members of the Pollock cooperatives themselves are highly supportive of the system, other industry stakeholders are somewhat sceptical of the economic and political power which is felt or feared to go along with the property rights created through the American Fisheries Act. Non-industry stakeholders, above all conservationist organisations, have focussed on ecological management and community issues rather than institutional aspects such as rights-based management, and criticise the pollock fleets' direct and indirect ecological impact. In the following, we will elaborate these positions.

Among the coop members (i.e. AFA vessel owners), satisfaction with the regime is high: 'We are really firm believers in the coop system here', as a PCC participant told us. Not only did the vessel-owners' political deal set an end to the cumbersome distributional conflicts between the inshore and offshore sector, but it increased the industry's general security of expectation. And it boosted its economic performance – if to differing degrees in the three sectors (Matulich et al. 2001, NPFMC 2002) – in a way that overcompensated the offshore

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39 When the prospective coops have submitted copies of their coop contracts and a list of participating companies at 1st of December, a NOAA Fisheries unit checks whether the applied-for coop composition is correct, i.e. in accordance with the previous year's catch/ delivery data. The 1st of December, the fishing year starts.

40 For example, prior to the coop system NOOA Fisheries would estimate the catch to determine closure of the fishery (NPFMC 2002a: 47). The American Fisheries Act, which for catcher/ processors observer presence and flow scales weighing all fish brought onboard, made such catch estimates superfluous.

sector's loss of allocation shares vis-à-vis pre-1998. Even Alaskan communities, in the form of CDQ Groups, profited from the new wealth of the industry: they leased the historically unique share of pollock allocation which they had been allocated and invested in some of the AFA companies. Not least, according to a participant 'the beauty of the coop system is that people are managing themselves'. This new extent of self-governance[41] – e.g. development of cooperatives' voluntary rolling hotspot system led to an exemption of AFA vessels from regulatory salmon bycatch savings areas[42] – has increased the sense of ownership of Pollock management. Some researchers even describe the fact that the AFA companies can collectively decide on how and when to harvest fish as a form of community management (McCay 2001: 181-182). The positive attitude of the Pollock industry towards the coops is mirrored first and foremost in the functioning of the system[43] and in the high level of compliance with both coop and public provisions.[44] As regards the coop's Membership Agreements, no operator is reported to have gone beyond their allocated catch levels. Likewise, there were no substantive violations of the intercooperative agreement, and infringements of the bycatch programme are said to have been minor and 'confusion-based'.[45] This positive storyline was confirmed by public law enforcement records which, as was mentioned above, gave evidence of declining infringements (NMFS 2006). Acceptance of the coop system by its participants is finally reflected in a low level of conflicts within or between the coops – a factor that is certainly fostered by the small number of operators. Interestingly, it is at the crew level of the pollock industry that the overall enthusiasm with the coop system is to some extent qualified, among others on 'cultural' grounds: a number of crew members were reported to miss the old Olympic days in which fishing was the embodiment of the 'American dream', with experienced captains taking credit for tracking down maximum amounts of fish in the shortest possible time. Also, it was felt to be disadvantageous that seasons were longer with more trips.

Louder criticism is being voiced by non-pollock industry stakeholders. Without being able to base this on a broader number of fishermen interviews, key informants related a scepticism of non-pollock fishermen operating off Alaska vis-à-vis the new wealth of what was nicknamed the 'big pollock guys', created through the AFA's secure property rights to a vast and profitable resource. Many suspect that AFA vessel-owners could use their revenues to invest and compete in other fisheries. At the time when the AFA was being devised, a more acute feeling of disfranchisement prevailed among a number of (medium sized) mixed species 'Head & Gut' trawlers that had also harvested minor amounts of pollock, and especially among two companies with somewhat bigger pollock catch histories. However, these being still small compared to those of the larger pollock-only C/Ps, the vessels were not made eligible in the American Fisheries Act deal and hence could not participate in the fixed

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41 Note that the fishery had been *co*-managed already before the AFA, through the North Pacific Fisheries Council.

42 Cf. Amendment 84a to the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area, October 2005.

43 Even in the inshore sector with its more precarious balance between harvesters and processors the system has worked out so far, with the successful forming of coops each year. The latter is not a matter of course, due to an AFA requirement (Section 210) that cooperatives may form only if an annual contract is signed by the owners of 80% or more of the qualified catcher vessels that delivered the majority of their pollock for processing to the particular processor in the prior year.

44 Though there are probably other factors that is likely to have contributed to this positive record, such as the comparative 'simplicity' of the pollock fishery as a single species fishery and one that is relatively clean with regard to bycatch.

45 Such confusion may be caused by frequent changes of areas that are closed (ca. twice a week) and the respective timelines.

allocation system: 'The line is always drawn somewhere', as a PCC member summed up. It was drawn right above the level of the two boats, in a backroom decision process which the non-eligible companies contest still today.

More generally, the Pollock cooperatives' new wealth is felt or feared to go along with increased political power, both within the institutional structure of the North Pacific Management Council and in Congress. While the Council is formally the prime institution for Alaska fisheries management decisions, by addressing Congress the Pollock industry had gone 'forum shopping' to assert their interest in another forum. This precedent has since been repeated by other industry groups – a move which is felt to gradually undermine the Council's authority and devalue its co-management approach. Also, less well-off fishing industries feel compelled to equally invest into lobbying activities in Washington D.C. Tight relations between the pollock industry and senior US Senator Stevens (R-AK), his son (former State senator and former Alaska Fisheries Marketing Board Chairman Ben Stevens), and one of his former office aids have in the meantime sparked rumours of political corruption and conflicting interest, resulting in a number of FBI investigations.[46]

When it comes to non-industry stakeholders, we will focus on environmental organisations. Typically, these groups have not strongly commented on the American Fisheries Act, being 'a lot more engaged in how much fish should be taken, and how and where it should be taken, than *by whom* it should be taken'.[47] In this vein, they have not taken any action against the cooperatives as such, though a range of aspects of pollock management have been protested against, including through legal challenges.[48] With the expansion of rights-based management in the fisheries off Alaska, there was however some discussion of cooperatives and ITQs among the NGOs. A split exists between those that reject exclusive rights to a common pool resource versus those that consider rationalisation at least as a means to reduce fishing capacity. Opponents of rationalisation, however, argue that the latter is typically linked to the consolidation of fleets by a few corporations, which again tends to promote a short-term profit orientation that is at odds with eco-system and community concerns. With regard to the pollock industry in a wider perspective, a number of marine conservation NGOs oppose large-scale industrial fishing for which the Bering Sea pollock fleet stands as a stark example (Stump/Hocevar/Baumann/Marz 2006: 36-39). They criticise harvest levels as unsustainable considering declines in pollock abundance in several stocks, depletion in outlying population centres, poor recruitment levels in recent year classes and draw attention to the resulting effects on the food web (ibid). They also point to bycatch-levels which in absolute terms are striking (AMCC 2004); and to the not insignificant bottom-impact that even mid-water trawlers have. In 1998, to get across their message, Greenpeace used non-violent action to prevent the trawler fleet from leaving Seattle for Alaska. Furthermore, some organisations are concerned that the substantial research funds which the pollock industry donates might indirectly affect fisheries management, among others by neglecting research on species without commercial

46 Cf. Maurer (2005, 2006), Metcalfe (2006), Wolfe (2007).

47 Interview with representative of environmental NGO working on Alaska fisheries.

48 Most notably, this concerned the protection of Stellar sea lions (Greenpeace v. National Marine Fisheries Service, April 1998 - March 2003, cf. McBeath 2004) and the adequacy of Essential Fishing Habitat provisions and Environmental Assessments in fishery management plan amendments (American Oceans Campaign et. al. v. Daley et al.). On grounds of ecological concerns, an NGO network had also launched an objection procedure in the Marine Stewardship Council (MSC) certification process of the BSAI (and GOA) pollock fisheries.

significance. More generally, the NGOs are worried about conflicts of interest in the co-management structure of the Council[49] and demand a better representation of non-fishing public interests and native Alaskan communities in its voting positions (cf. Eagle/Newkirk/Thompson 2003).

5 Conclusions

We analysed two rather different innovative management regimes implemented in Alaska – the tier system as a harvest control rule, and the Pollock cooperatives as a mixture between a rights based management and self-governance system.
The study of the tier system revealed that its strengths lie in the fact that harvest rates are relatively precautionary, that the system is transparent and is used for bycatch regulations, too. The tier system is based on the fundamental assumption that it is impossible to develop fisheries without data. Its weaknesses are that so far, the system is not linked to ecosystem considerations; tier 5 may not be precautionary; and that the proxies for Fmsy are contested.

The case study of cooperatives in the Bering Sea pollock fishery showed that in terms of biological robustness of the regime has its merits, though to a large extent the relatively favourable condition of the BSAI pollock stocks is caused by cautious measures of public fisheries management – the absolute TAC cap, counting of by-catch against the by-catch species' TACs, an extensive observer programme, to name a few. The most significant value-added in biological terms of the coops hence lies in their self-managed by-catch reduction programme. Whether the industry will in future be as supportive of precautionary management as they presently claim to be, might depend on the then abundance of the stocks and the related profit margins in the fishery. In terms of economic performance, the stable allocations and quota share system of the cooperatives have undoubtedly created efficiency gains, mostly but not exclusively with regard to processing, which result from the slower pace of fishing. The gains seem to be distributed slightly unequally among the three sectors (catcher/processor, motherships, inshore catcher vessels). In terms of management costs, introduction of the coop system has shifted some of the previously public costs of pollock management to the private sector, without actually causing too much added costs altogether. Some of these effects have been caused by a specific design of the AFA and the coops, rather than by introduction of cooperative harvesting per se. The overall benefits in terms of efficiency and public management costs and the high acceptance of the coop system by the coop members themselves are somewhat counterbalanced by a certain distrust, partly even sense of disenfranchisement, of industry and non-industry stakeholders that are not coop participants. The experience of the Pollock cooperative system seems to reflect some of the experience made with ITQs both in Alaska and elsewhere: social acceptance might be most difficult to accommodate.

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[49] For example, Section 302 (j) of the Magnuson-Stevens-Act exempts voting members of fisheries management councils from specific conflict-of-interest provisions.

6 Best practices guidelines

6.1 *Participation*

Fisheries management should involve stakeholders in addressing management issues and in evaluating management decisions. Although this may be time consuming, involvement can improve the communication between the different parties, which again can improve acceptance of the different views. Involvement may improve the quality of the management decisions as more aspects are brought to the table. Involvement will trigger negotiations, which can result in innovative solutions. From the interviews carried out in connection with the Alaska fisheries, there seemed to be a mutual trust between the industry, managers and the scientists within the North Pacific Fisheries Management Council. The environmental organisations had less trust in the council and the other parties, but they were not represented in the council.

6.2 *Monitoring, Control and Surveillance*

In a fishery, the surveillance and enforcement should be adequate to avoid cheating. This will provide fairness to fair players, and the marine resources will be better managed. In addition, fishing vessels in IFQ systems should have good observer coverage on board. This avoids cheating and provides fairness to fair players. This makes it easier to manage bycatch problems and other potential ecosystem considerations (damage of bottom habitat, undersized fish etc). Sustainability labelling will be easier and the fish may get a higher value on the market.

6.3 *Harvest control rules*

Legal decisions on HCR

The management objectives concerning the biological resources and the basic ideas of a HCR should be decided by law in order to avoid negotiation on the TAC thus ensuring sustainable fisheries. There will always be room for negotiations (ecosystem concerns, data, models etc.), but there should be drawn some kind of border for what can be negotiated.

It is also advisable to decide on HCR for non-harvested species and criteria for developing a new fishery. It allows for precaution when developing a new fishery to avoid a depletion of the stock.

Ecosystem based caps

A cap for total catches should be set in a defined ecosystem. This creates a buffer against uncertainty if the cap is set at a level so that the sum of single stock sustainable harvesting hits the cap once in a while. If there is a cap for total prey species and for total predator species it takes one ecosystem consideration into account: enough prey for predators.

By catch quotas

Total bycatch quotas for each species should be set, and the fisheries taking Bycatch should be stopped when this quota is taken. (This requires observers on the fishing vessels to avoid cheating). Bycatch is a problem in many fisheries. This is an incentive to learn to deal with the problem. In the European fisheries, it is difficult to tell whether the fishermen are able to avoid bycatch species or not, and there is no strong incentive to solve the Bycatch problem.

6.4 *When rationalizing a fishery (dividing quota rights)*

Identification of sectors

Collect information on characteristics of the fisheries to be rationalized. Different fisheries need different solutions. The Alaska fisheries have several rationalization programs that are very different

Setting of objectives

Consider socio-political objectives, establish community rights etc. In order to take care of social aspects to strengthen the community economy, social welfare, etc.

Initial allocation of rights

Start with the simplest fishery to collect experiences before the difficult ones. Simple fisheries are those where the same gear type is used, the same species caught, similar vessels used and similar interests held.

Subjects to allocation

Give rights not only to vessel owners, but also to the captains and the crew. This allocation increases legitimacy and acceptance to the process. Consequently, power is not concentrated on a few hands or a few geographical locations. This practice depends on available data. In Alaska there was a problem with collecting data on how much the crew (other than the captains) had worked on a fishing vessel.

Openness of the process

There should be an open process when the criteria for different rights are decided. The aim is to increase the legitimacy and acceptance of the process. The rationalization of the pollock fishery in Alaska was based on the amount of pollock caught in a certain year. One of the involved parts felt this very unfair and claimed that they weren't allowed their say.

Micromanagement

Create incentives so that the participants in the fisheries will take over some of the micro-management of the fishery. This allows saving administration costs for the government. The industry may be forced to cooperate and come up with innovative solutions to solve common problems. The pollock coops hired Sea State, which manages the bycatch of the fleet by closures of areas. This is more efficient that what the management administration was able to do.

Fleet changes

Make sure that the resulting fleet after a rationalization can afford to solve problems that eventually will come up, like lower stock levels and ecosystem concerns that will affect the way the fleet is operating. There is a lot of capital in the pollock coops, so that they have been able to adjust to changes. Otherwise, the fleet may suffer economically, or ecosystem concerns may not be resolved.

Buy-out programmes

Make sure there is an adequate buy-out program, either supported by the remaining fleet or by the government. This increases acceptability of the program and gives compensation to those who have to leave the fisheries.

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Acronyms List

ABC	Acceptable Biological Catch
ADF&G	Department of Fish and Game
AFA	American Fisheries Act
AFSC	Alaska Fishery Science Center
AI	Aleutian Islands
BS	Bering Sea
BSAI	Bering Sea/Aleutian Islands
CDQs	Community Development Quotas
EAI	Eastern Aleutian Islands
EEZ	Exclusive Economic Zone
FMP	Fishery Management Plan
GHL	Guideline Harvest Level
GAO	United States General Accounting Office
GOA	Gulf of Alaska
HCR	Harvest Control Rule
HSCC	High Seas Catchers Cooperative
ITQs	Individual Transferable Quotas
MSA	Magnuson-Stevens Fishery Conservation and Management Act of 1976
NPMC	North Pacific Management Council
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OFL	Overfishing level
OY	Optimum Yield
PCC	Pollock Conservation Cooperative
TAC	Total Allowable Catch
TALFF	Total Allowable Level of Foreign Fishing

Appendix

The OFL Tier System (NPFMC, 2006)

Tiers used to determine ABC and OFL for BSAI groundfish stocks.

(1) Information available: Reliable point estimates of B and B_{MSY} and reliable pdf of F_{MSY}.

1a) *Stock status:* $B/B_{MSY} > 1$
$F_{OFL} = m_A$, the arithmetic mean of the pdf
$F_{ABC} \leq m_H$, the harmonic mean of the pdf

1b) *Stock status:* $a < B/B_{MSY} \leq 1$
$F_{OFL} = m_A \times (B/B_{MSY} - a)/(1 - a)$
$F_{ABC} \leq m_H \times (B/B_{MSY} - a)/(1 - a)$

1c) *Stock status:* $B/B_{MSY} \leq a$
$F_{OFL} = 0$
$F_{ABC} = 0$

(2) Information available: Reliable point estimates of B, B_{MSY}, F_{MSY}, $F_{30\%}$, and $F_{40\%}$.

2a) *Stock status:* $B/B_{MSY} > 1$
$F_{OFL} = F_{MSY} \times (F_{30\%}/F_{40\%})$
$F_{ABC} \leq F_{MSY}$

2b) *Stock status:* $a < B/B_{MSY} \leq 1$
$F_{OFL} = F_{MSY} \times (F_{30\%}/F_{40\%}) \times (B/B_{MSY} - a)/(1 - a)$
$F_{ABC} \leq F_{MSY} \times (B/B_{MSY} - a)/(1 - a)$

2c) *Stock status:* $B/B_{MSY} \leq a$
$F_{OFL} = 0$
$F_{ABC} = 0$

(3) Information available: Reliable point estimates of B, $B_{40\%}$, $F_{30\%}$, and $F_{40\%}$.

3a) *Stock status:* $B/B_{40\%} > 1$
$F_{OFL} = F_{30\%}$
$F_{ABC} \leq F_{40\%}$

3b) *Stock status:* $a < B/B_{40\%} \leq 1$
$F_{OFL} = F_{30\%} \times (B/B_{40\%} - a)/(1 - a)$
$F_{ABC} \leq F_{40\%} \times (B/B_{40\%} - a)/(1 - a)$

3c) *Stock status:* $B/B_{40\%} \leq a$
$F_{OFL} = 0$
$F_{ABC} = 0$

(4) Information available: Reliable point estimates of B, $F_{30\%}$, and $F_{40\%}$.
$F_{OFL} = F_{30\%}$
$F_{ABC} \leq F_{40\%}$

(5) Information available: Reliable point estimates of B and natural mortality rate M.
$F_{OFL} = M$
$F_{ABC} \leq 0.75 \times M$

(6) Information available: Reliable catch history from 1978 through 1995.
OFL = the average catch from 1978 through 1995, unless an alternative value is established by the SSC on the basis of the best available scientific information
ABC ≤ 0.75 × OFL

Chapter 2

The South West Nova Scotia case

Doug Wilson and Clara Ulrich-Rescan

Contents

1 Introduction

1.1 *Purpose and Methodology of the Case Study*

This case study is part of the Comparative Evaluations of Innovative Solutions in European Fisheries Management (CEVIS) Project. The last decades have witnessed the rise of innovative fisheries management systems which have been proposed as alternatives for traditional command & control regimes. These include a wide range of alternatives such as participatory governance, rights based approaches, effort controls and various kinds of decision rule systems. The purpose of the CEVIS project was to evaluate these alternative approaches for their usefulness in European fisheries management. We made visits to four places outside of Europe, that A) have fisheries similar to Europe's, B) have implemented innovations that contain various degrees of participatory governance, rights-based, effort-control and decision-rule based systems. These places were Alaska, Maritime Canada, Iceland and New Zealand.

This chapter reports on our visit to the province of Nova Scotia in Canada. We focussed our inquiries mainly on the management of the inshore ground fish fishery but also included other fisheries in our discussions about how the Canadians were structuring their fisheries science institutions. This area attracted us because of several kinds of innovations, the main one being the different ways they combine a rights-based management system built on individual quotas will participatory governance. We began our investigation with a literature review on fisheries management in Nova Scotia and then followed up in February of 2007 with a two week study tour during which we interviewed 20 people: five fisheries scientists, five fishers, five managers and five "others". The latter category included two conservationists, an academic expert in Nova Scotia fisheries, a council member in a fishing village, and a woman who heads a society working to bring together scientists and fishers.

A literature review and a study tour do not create experts in Nova Scotian fisheries. Our job was to learn about what was happening in Nova Scotia while keeping our own problems here in Europe in mind. We were looking for experiences and lessons we could take back with us, and new ideas that might create an "Ah Ha!" experience helping us to look at management issues in a new way. The following report consists of four main sections. We begin with some brief background material on groundfish management in Nova Scotia. Section 2 discusses the recent history and outcomes of rights-based management, with a particular focus on the inshore mobile gear fishery. Sections 3 and 4 focus on two different innovations under the general category of participatory governance. Section 3 looks at the local fisheries co-management initiatives called Community Management Boards (CMB). Here we discuss in particular a combination of innovations that we found very interesting: one of the CMBs has created, in effect, its own transferable rights-based system. Section 4 looks at some of the advances the Canadians have been making in participation in the scientific and decisional aspects of fisheries management.

We conclude with a discussion of the implications of what we learned for Europe. This includes some hypotheses about what kinds of things might work well in particular circumstances and some "best practices", meaning ideas we found in Canada that we feel might be particularly useful in Europe.

2 Background to the Case Study Innovations

2.1 *Changes from Round Fish to Invertebrate Fisheries*

The state of fisheries in Atlantic Canada is still very much a result of the collapse of the Northern Cod stock and the depletion of most other groundfish stocks in the late eighties and early nineties. In the early 1980's, Canadian catches of Atlantic groundfish peaked at 775,000 tonnes, gradually declining to 688,000 tonnes by 1988. This decline then continued rapidly, dropping to 418,000 tonnes in 1992, and to 250,000 tonnes in 1993. The 10 principal cod and flatfish stocks went from 500,000 tonnes in 1988 to less than 100,000 tonnes in 1993 (http://www.dfo-mpo.gc.ca/communic/statistics/commercial/landings/sum_e.htm). This means a decline in catch of 90 percent in five years. Following the collapse and a subsequent moratorium imposed on commercial fishing for cod in 1992, industry restructuring and social dislocation in coastal communities across the Atlantic coast led to approximately 40 000 persons out of work (Harris, 1995, cited in Potts, 2003).

Extensive literature exists about the causes of the collapse, evidencing human errors rather than environmental causes. Sinclair et al. (1999) acknowledged that "*failure to meet the objectives was due to deficiencies in the groundfish management system as a whole, rather than to problems with any particular component*". Overfishing and juvenile discarding are considered as the main factors (Hutchings and Myers, 1994; Myers et al., 1997), but errors in stock assessment assumptions and over optimistic forecasts leading to unsustainable TACs have also been advocated as a major reason of the collapse (Walters and Maguire, 1996, Shelton and Lilly, 2000).

Post-moratorium analyses have also underlined the role of over optimistic scientific advice in management. Rice et al. (2003) stated that the observed changes in productivity made the projections of recovery time severely overly optimistic, which consequences are more grievous and lasting than the costs of being overly pessimistic, because re-opening criteria were based on erroneous assumptions on productivity. A slight improvement was observed in the late nineties, leading to partial reopening of the fisheries. As a consequence, the recovery process reversed and main Atlantic stocks were closed again in all areas between Labrador and Gulf of St Lawrence.

More than a decade after the collapse and the moratorium, most groundfish stocks have failed to recover at predicted rates, and are still at very low biomass levels, for the whole Canada Atlantic. Shelton et al (2006) indicate that recent productivity in ground fish is much lower than before, due to increased natural mortality, decreased body growth, and in a few cases, reduced recruitment rates. Continued fishing in directed and bycatch fisheries is also an important factor, and fishing mortality is further delaying recovery.

Although the collapse was not as severe in the Scotia-Fundy area, and thus no moratorium is currently in force, groundfish stocks in areas 4W and 4X are still in poor state with low productivity. Most of the groundfish fishery is found in areas 4X and 5 between Halifax, Nova Scotia and the Canada-U.S. boundary and in the Bay of Fundy. This means that it is shared between the provinces of Nova Scotia and New Brunswick, with the Nova Scotia fleet being much the larger of the two. There were 900 active groundfish licences in 2003, over 700 of these were fixed gear vessels. Approximately 55,000t of groundfish were landed in 2003 with a value of about $90 million (DFO 2004a).

Invertebrate fisheries, on the other hand, have become increasingly important. Frank et al. (2005) argue that the Scotia Shelf ecosystem has experienced a "*trophic cascade*" driven by what they describe as the "*virtual elimination*" (2005: 1621) of the structural influence of commercial fish species on the ecosystem. One result was a marked increase in the abundance of small pelagic fish and benthic macroinvertebrates. According to the Nova Scotian government the landed value of invertebrate fisheries in 2004 was $ 596 million or 80% of the overall landed value from all species. The major species include lobster, snow crab, shrimp and scallops http://www.gov.ns.ca/fish/marine/sectors/invert.shtml. The value of fish landed in Nova Scotia reached $701 million in 1987 and then declined to $482 million in 1997, however landed values in 1997 were double what they were in 1970. The reason for this is increased landings of high value invertebrate species (Charles et al. 2001).

One main characteristic for these stocks is that the traditional VPA-based methods used for fish cannot be applied to the stock assessment of such species, both because the age determination is almost impossible and because the time-series are not long enough to apply the methods. As a consequence, more ad-hoc methods are used, mostly on a case-by-case basis.

2.1.1 Institutional Changes in Canadian and Nova Scotian Fisheries Management.

In addition to, and to some degree in response to, the ecological changes major changes took place in the early 1990s in the way that Nova Scotian fisheries are managed. These changes are interrelated and driven by a complex mixture of management ideology, the changes in the fishery, and bureaucratic imperatives.

One major change was an accelerated shift to quota management through individual quotas based on historical participation in the fishery. Individual quotas (IQs) and, indeed, individual transferable quotas (ITQs) had existed in Canada for some time. More than half of Atlantic Canada's fisheries have some sort of fishing right or privilege within a quota system. The Bay of Fundy herring seine fishery had IQs boat quotas in 1976 and became an ITQ system in 1983. The offshore ground fishery got Enterprise Allocations, essentially ITQs, in 1982 (Apostle et al. 2002). Our discussion here focuses on two fleets, both of which are based on an individual quota system but structured very differently. The inshore (< 65') mobile ground fish fishery currently managed under an ITQ system. The inshore (< 45') fixed gear fishery, which uses long lines, gillnets and hand lines, is managed through community quotas based on the aggregations of individual quotas. The change was a very difficult one, involving open public protests and demonstrations as well as considerable private anguish.

A second major institutional change in Nova Scotia fisheries management was severe cutbacks in the budget of the Department of Fisheries and Oceans (DFO). In the period leading up to 1999, DFO's budget was cut by a third and they lost a quarter of their staff. The scientific resources have been shifted to include other areas besides fisheries but industry initiatives have been filling the gap (Land and Stephenson 2000). Sinclair et al. (1999) argue that the shift toward co-management was strongly related to a shift in government philosophy towards user fees and cost cutting. Management costs were broadly transferred from government to industry including monitoring and surveillance functions, day-to-day management of the quota system as well as small things such as DFO no longer paying stakeholders' travel and per diem for meetings.

The third major change, which followed directly from the introduction of the individual quota approach was the development of an effective monitoring system. The heart of the system is a privatized "hail in hail out" monitoring system for fish landings. The IQ Committee, which was charged with the developing the IQ system as described in detail below, and the Groundfish Advisory Committee cooperated with DFO in setting up the monitoring system (Apostle et al. 2002). DFO started to put together a commercial catch monitoring system in the fall of 1990. Their key objective was to develop a system such that one could not move fish from the wharf until it had been weighed and recorded, an important point of this being that the truckers were responsible for the contents of their vehicles. In June of 1992 they created a user-pay system based on a percentage of the landings. DFO was still paying a share of this because non-ITQ species were involved. The monitoring system moved to a fee-for-service approach in 1993 because it faced a financial crisis as a result of quota cutbacks (Apostle et al. 2002). In the fall of 1992 quota cutbacks created financial pressures on the system and some people, especially in eastern Nova Scotia, did not pay their share. In 1996 a new company took over and instituted an "arms-length rule" meaning that the fishing industry now had nothing to do with running the monitoring system (Apostle et al. 2002).

In the current system independent companies collect the data based on a contract they make with the individual fisher. This is a requirement for the fishing license. This kind of system is now ubiquitous across Atlantic Canada. Thirty five companies take care of all the data collection, including an electronic log book system. The role of DFO is policing the system to ensure full compliance but not to be involved directly. There is also a required observer program for larger boats, who must contract with the observers directly. Finally there are obligations for satellite tracking with the industry bearing the costs for installation and transmission. Comments by some of our respondents indicated that the fact that the government is not actually carrying out the monitoring, it was being done by "*normal people*" hired from the fishing communities by the private sector seemed to increase the legitimacy of the system.

A fourth change is the evolution of the legal framework for fisheries management that occurred for the whole of Canada. Canada's original Fisheries Act was passed in 1868 and it still gives the government the basic power to make regulations for "*the proper management and control of seacoast and inland fisheries*" (Haward et al. 2005 p17). In response to the cod crisis, the 1996 Oceans Act gave DFO the role of integrating the activities of marine agencies operating at the federal, provincial, territorial and local levels. The Oceans Act is "*an extraordinary piece of legislation*" (Haward et al. 2005 p17) that commits Canada to integrated, ecosystem-based precautionary management. The Oceans Act expands the role of DFO to integrate all ocean use activities and users rather than simply fisheries only. Emerging pressures from the international community, including FAO Code of Conduct, have lead DFO to develop Objectives-based Fishery Management (OBFM) which provides a broad operational framework for addressing ecosystem and precautionary considerations. A key part of this has been the development of Integrated Fishery Management Plans (IFMP) as operational tools for achieving consistency in management processes since 1995 (Auditor General 1999, cited in Potts, 2003). These are regulatory instruments that set the basis for licensing and regulatory requirements. Finally, the Species at Risk Act came into force in 2003 and has increased the focus on bycatch species. It has evolved into a very restrictive law-driven constraint on fisheries management.

Finally, the last major institutional change in the background of this case study is a general move towards a more participatory approach to fisheries management, albeit a participatory approach firmly under the control of DFO. Both of the fleets we examine closely below have their own industry advisory committee. The community management boards, examined at length below, are perhaps the most ambitious example of a participatory approach to management.

Another aspect of this is the Fisheries Resource Conservation Council (FRCC). This is a stakeholder body with diverse stakeholder membership that considers a wide range of issues. The main focus, however, is on conservation. The FRCC is charged with preparing formal recommendations to the Minister. This body has been through a considerable evolution since its formation. It has become a more open and participatory as indicated by both the number and kinds of spokespeople and it has become a forum for the open discussion of scientific issues (Sinclair et al. 1999). The FRCC and its role in science are discussed below in Section 4.4.2.

The history of the introduction of rights-based management through the IQ Committee, which later became the ITQ Committee, is a good example of the problems and possibilities in this more participatory ethos. The Committee was selected by DFO but only after a survey indicated that fishers, and especially the processors, wanted this approach rather than selection through communities. Sixty percent voted for this approach and DFO agreed to this scheme while expressing reluctance. The system is not a co-operative management scheme but was based on DFO wanting to make a clearer distinction between conservation and allocation and this was a means of transferring some allocation decisions (Apostle et al. 2002). The IQ Committee process worked well internally. It was a fairly homogeneous group, especially in comparison to the old Groundfish Advisory meetings where offshore, mobile and fixed gear reps could not get along. There was also some external hostility (death threats) that the authors believe helped increase the internal legitimacy The ITQ Committee also has real roots in the community and this has limited the ideological assertion of property rights (Apostle et al. 2002).

3 The Right-based System

3.1 *A Brief History of the innovation*

When the decision was made to introduce an ITQ system, the inshore mobile fleet had the biggest capacity problem in the Scotia-Fundy region. It was four times the size required to harvest its quota at the target fishing mortality rate (F0.1) (Liew 2001). Stock decline in the late 80s led to early closures especially in 1989 and these closures were the immediate catalyst for the Minister of Fisheries and Oceans' action to get an Order-in-Council to create IQs. This decision set aside for later the issue of transferability and the issue of initial allocations (Apostle et al. 2002).

Quota allocation began in February 1990 with a Working Group of representatives from the catching sector and the ground fish industry associations, provincial governments, and DFO. The Working Group was charged with identifying the stocks to include, the operational guidelines including that sharing and appeal system, and monitoring. The Working Group met with fishing communities in the summer of 1990 to explain the programme and hear the views of licence holders. Later in the fall these meetings began to also include discussions of transferability options, limits on quota accumulation and the overall duration of the programme. The programme began on 1 January 1991 (Liew 2001).

Further modifications were carried out by an IQ Management Committee, which was created in late 1991, and later became the ITQ Management Committee. They quickly made some major changes such as making the IQ system permanent and allow permanent transfer, thus creating a true ITQ system. They also expanded the system to include Georges Bank cod and haddock. Working with DFO they designed the self-financed dockside monitoring system described in the previous section (Apostle et al. 2002). During the summer of 1992 the DFO adopted these recommended changes and also recognized the decision-making authority of the IQ Committee (Apostle et al. 2002).

Vessel owners were given the option of joining the ITQ system, fishing under a competitive quota reserved for fixed gears, or joining a "generalist" category that would also fish under a competitive quota. Of the 455 eligible vessels 325 chose to remain in the ITQ system. The 325 dropped to 213 in three years and estimates at the turn of the century were in the range of 100 give or take 20 (Apostle et al. 2002).

McCay et al. (1996) compare the ITQ systems in Canada for groundfish and in the USA for surf clams and ocean quahogs. The SCOQ system was delayed for years because of struggles between independent and vertically integrated firms. The IQ committee in Nova Scotia came to a decision on how to set up the system and make allocations in less than a year. The use of history in SCOQ was a source of delay because of accusations of cheating by the larger firms. There was less concentration in Nova Scotia. The issue of stratification was important but so were differences in process, in Canada it was controlled by one agency that did not have to convince any co-management type body similar to the US Regional Management Council (Apostle et al. 2002).

In 1993 the Fisheries Resource Conservation Council (FRCC) was created. It was the first formal role for the industry in advising the minister. Soon after its creation the FRCC recommended a mid-year quota cutback. This raised the issue of the durability of fishing rights in a new way as ITQ holders were faced with these cutbacks. Fears emerged in respect to both the legitimacy and the stability of the system. If they could not have a guarantee that the quota would not be cut in the middle of the year then it was really no different from a competitive fishery - there would be a race to fish up the quota before the cutbacks were announced (Apostle et al. 2002).

In 1994 serious consideration was given by the ITQ Committee for allowing quota to be pooled by up to 20 licenses which would allow this group to further rationalize their fishing. This would substantially benefit processors and larger quota holders, but would be open to, and benefit, smaller holders as well. DFO was supportive because the paperwork in handling transfers would be reduced as it would be an internal matter for the pools. Lawyers at the Justice Department, however, pointed out that it might not be possible to enforce an individual stopping fishing after the pool quota was exhausted and they also felt it would be difficult to enforce penalties against a pool that overran its quota. The ITQ Committee then dropped the idea (Apostle et al. 2002).

After this point the structure of the ITQ system for the inshore mobile fleet itself seems to have stabilized and the main issues are treated as settled. This does not mean that there are no serious controversies in the fishery. Perhaps the key current issue is that of "trust agreements" discussed below. These agreements raise serious challenges to the fleet separation policy that severely restricts the transfer of quota between the main fleets as well as to the policy of requiring fishers to be owner operators.

3.2 *Structure of the individual access rights*

3.2.1 Core Fishers

Since 1976, the overall fishing for all species has been limited through a licensing system. On the order of 2400 fixed gear licences exist, for example, of which about 385 are actually fishing. To acquire a license you have to be a full time fisher but the definition of full time fisher varies. The ownership of fishing quota, fishing licenses and the basic access rights are technically separate issues in the Nova Scotia inshore (< 65') fleet because being a "core fisher" and a license are not the same thing. The status of the core fisher was created in 1996 and included 700 individuals identified in the mid nineties as being, as one manager put it in an interview, a "*bona fide professional fisher*". The official definition (DFO 1996) reads: "*A Core Enterprise means a fishing unit composed of a fisher (head of enterprise), registered vessel(s) and the licences he holds, and which has been designated as such in 1996 under approved criteria*". The criteria are that the fisher must: "*(a) be the head of an enterprise; (b) hold key licences (or, for some Scotia-Fundy fishers, a vessel-based licence); (c) have an attachment to the fishery; and (d) be dependent on the fishery*". Our DFO respondent told us that what they were "*really deciding was who was really dependent on the industry and who was dabbling at it*". The core designation is not necessarily the same thing as a full-time fisher but the fishers who were prevented from becoming core were the ones who DFO judged were not active enough. Non-core fishers were allowed to keep the licenses they had, but when they die the license dies with them. Any certified professional fisher can become core by buying in an existing core. However, if a fisher transfers between national regions he cannot take it with him, he gets rid of what he has here and enters their fishery according to their rules.

3.2.2 Fleets and Quota Allocation

In Nova Scotia ground fish are allocated to individual fleets as shown in Table 1. There is an attempt to make these "sharing arrangements" as stable as possible. The Groundfish Management Plan shown in the table covered two years, the subsequent one covered five. However, shifts or swaps of quota between fleets have take place but they are considered extraordinary actions.

Table 1. Nova Scotia Groundfish Fleets and their Allocations – 2000

Gear	Fleet	Management System	Active licences	Cod Allocation in Percentage	Haddock Allocation in Percentage	Pollock Allocation in Percentage
Fixed	< 45"	Community	883*	55	25	28
	45" - 65"	ITQ	20	5	4	1
	> 65"	ITQ	11	1	1	0
Mobile	< 65"	ITQ	131	32	56	23
	65"+	EA (ITQ)	35	7	13	49
Figures are taken from the Scotia-Fundy Groundfish Integrated Management Plan 2000-2002 (DFO 2000). *Includes 47 active licenses in New Brunswick						

The management "systems" in fact are built around these quota allocations. Each fleet has a system for administering their quota (Table 2). Consultative bodies such as the Fixed Gear Committee with representatives from each of the Community Management Boards and the ITQ Committee that represents the inshore mobile fleet exist for each of the fleets. Cross-sectoral consultative bodies also exist, such as the RAPs that address scientific issues (see Section 4.2.3).

3.2.3 Historical Participation and its Problems

We began our interviews using fairly open-ended questions to try to get a sense of what our respondents thought was important before we started asking about what we were thinking was important. It was quite striking that the dominant subject in the early part of nearly all of our interviews was the problems in the early 1990s with the introduction of the IQ system and especially the distribution of the initial IQs. While economic theory might suggest that the best way to allocate IQs, at least from the point of view of society's overall economic welfare, would be to auction them to the highest bidder, political reality has dictated that nearly every such distribution tries, in some fashion, to reproduce the pre-IQ status quo distribution of the resource. The main technique for this is to base the distribution on the "historical participation" of individual fishers in the fishery in question.

As is often the case, in Nova Scotia the argument quickly became what "history" one was going to base the allocation on. IQ systems are almost always introduced in fisheries that have been under other kinds of management systems for a long time and these other management systems have partly determined who was going to have the largest and smallest fishing "histories". In the Nova Scotia case is was the prevailing record keeping system in particular that turned out to be critical. Before 1986 DFO had kept very sparse records of catches in the inshore fleet. So most suggestions about when "history" should begin started at that point. After that there was any number of ways that history could be defined. It could be an average percentage over certain years, but which years? Groups formed around the years that would give them the best allocations. A Shelburne fisher explained how his group wanted a "*straight forward 1986-1993 and nothing else.*" But another group was formed to lobby for 1989-1993 years.

Different gear types had kept different kinds of records. In the 1980s there had actually not been very much control, especially in relation to the smaller boats using fixed gears. Hand lines were particularly hard hit by a lack of records. One respondent explained that many people had been more interested in getting unemployment benefits than in recording fish landings. They would ask their friends to put their fish in the friend's name so they could get unemployment. "*They were cheating the system and cutting their own throats at the same time*". Whole areas were disadvantaged for technical reasons. A man from the port of Digby explained that in his area fish for salt processing was not counted, nor was the fish that they had been selling to the mobile gear fleet.

In the end DFO and the IQ committee managed to get the allocations made in a year through an intense round of meetings and consultation. A number of accommodations were made, and formulas were developed for estimating under recorded catches and distributing them as fairly as they could be. It was a painful experience that still seems to play the role of foundational myth for the current Nova Scotia fisheries management system. Apostle et al. (2002) offer a quote from one fisher describing what these meetings were like that seems an apt summary: Fishers "*were looking at the generated numbers and realizing they were going to end up with 60 tonnes of fish, and realizing they were finished. It was a really tense, tough, emotional time and we did that for a year*".

In the end, however, each fisher had their historical allocation assigned and this allocation became the basis for the new management system. For the mobile fleet and the > 45' fixed gear fleet it became the basis for the individual ITQs. For the < 45' fixed gear fleet the individual allocations were pooled and on that basis the community quotas were identified that would be managed by the Community Management Boards.

3.3 *Impacts of the Rights-based System*

3.3.1 Enabling the Transition to a More Sustainable Fishery

A central point that one manager in particular wished to make to us was that people tend to conflate everything together. The individual quotas system, the hail-in hail-out monitoring system, the cutbacks in the overall magnitude of the quota driven by the ecological situation, and the transferability of the ITQs are lumped together and called “the ITQ system”. His argument was that the huge drops in numbers of active boats, processing plants and the geographical concentration of fishing activity (see Section 2.3.2) were all going to happen anyway if you combined massive quota cuts with effective enforcement. People involved in the fixed gear fishery were seeing large numbers of fish plants being closed down and blaming the ITQ system for this, when in reality it was the quota going down and a number of those plants had been kept alive by black landings and were no longer viable because of the new enforcement system. He pointed out that the same thing, at least as far as operational concentration even if not nearly as much geographical concentration happened under community management boards where no ITQs were in play. What the ITQ did was determine the process by which fishing and processing capacity was reduced, not the reduction itself.

Another of our respondents, a commercial fishing representative, supports this view. He believes that the main reason there was a good deal of reluctant support at the time was that people believed it was the only way to avoid chaos and mass bankruptcies. While he is basically critical of the ITQ system he admits that there *“are a hundred stories”* of fishers consolidate appropriately with money changing hands and people not losing their houses. He suggests that as a mechanism to reduced capacity the ITQ is a good mechanism because it allows fair trading and real value to transfer. A manager suggested to us that the central question that ITQs pose for fishers is what they really want to do with their business. They can decide to have the groundfish be a supplement to what they are doing with lobster or harpooning or do they want to fish for groundfish full time. The sentiment was echoed by many of our respondents, both fishers and managers and both strong supporters of the ITQ idea and those who had many reservations about it. In the late 1980s and early 1990s fishing capacity in Nova Scotia had to be reduced and the ITQ system was the fairest and least painful system for accomplishing that goal.

The process is not over. The smaller and less efficient operations continue to be marginalized. The price of fishing has gone up. Global competition is intense. More and more of the costs of management have been placed on the industry. DFO is requiring increased monitoring and observer coverage. Other government agencies are putting pressure on fishers for “professionalization” meaning more training and required certifications, greater investments in safety precautions, workmen's compensation, and insurance. Meanwhile the groundfish resource is still very small by historical standards.

3.3.2 Geographical and Organizational Concentration

The creation of the Nova Scotia ITQ system case was heavily influenced by the fact that the communities involved were very dependent on fishing (McCay et al. 1996). This led to the requirements that ITQ holders be bona fide fishers and a rule that no one could own more than two percent of the total quota (Apostle et al. 2002). However, Apostle et al. (2002) conclude that concentration of ownership has increased since 1990 in spite of the provisions to avoid this. They base this conclusion on interview data with cross-references of estimates as non-confidential records are not a good indicator because of problems identifying true ownership because of the many routes available for getting around ownership limits. Their interview data identified 19 groups of three or more licenses controlled by a single entity. Within a short time of after the implementation of the ITQ system, Creed et al. (1994), found vertical integration with in the community where they did their field work. Only two or three out of 30 mobile-gear vessels there were not tied to one of the fish plants. They found people who believed that the ITQ system favoured those with capital and fishing rights rather than those who work hard at catching fish.

Table 2 summarizes some indicators of concentration. These data should be read keeping in mind concentration was very evident in the 1980s. Indeed there is a dip with some measures going down in the early 90s then back up again (Apostle et al. 2002). There has also been a very clear geographical concentration with a big drop in the cod landed in eastern and central Nova Scotia. These areas accounted for 33% of the cod landings in 1991 but only 4% in 1997 (Apostle et al. 2002). Some of this difference, however, can be attributed to changes in stock distribution.

Table 2. Percentage of Landings Going to..

	1990	1997
The top 12 fishing vessels	13	28
The top 10 fishing ports	57	73
The top 11 fish buyers	39	60
Abstracted from Apostle et al. 2002 pages 61-63		

In their ethnographic investigation of the impacts of ITQs on the Scotia-Fundy mobile gear groundfish sector Creed et al. (1994) found significant differences in perceptions of social power and access to resources between ITQ holders and non-holders. One of the social impacts they found through ethnographic studies was that people in communities with significant quota became gatekeepers to the fishery. This changed relationships in ways no one liked, even the gatekeepers themselves. (Apostle et al 2002).

Two other policies that are in place to limit organizational and geographical concentration in Nova Scotia fisheries are the Owner-Operator Policy and the Fleet Separation Policy. Both policies are aimed at separating processing and harvesting (DFO 2004b). Under the owner-operator provision, licence holders who are restricted to using vessels less than 65 feet in length are required to fish their licences personally. There exist some grandfather provisions for fishers who had previously designated an operator for one or more of their vessels and substitute operators are also allowed when circumstance prevent a fisher from fishing personally. One of the key Canadian policies in respect to the inshore (< 65') fleet is the 1979 "fleet separation policy" The policy restricted corporations from holding any new fishing licences for inshore vessels, while it did allow for corporations, including processors, to maintain licenses held before that time. The fleet separation policy was in place before the ITQ system was introduced.

In 2003 DFO produced a "discussion document" (DFO 2004b) based on interactions with stakeholders on the subject of fisheries policies in Atlantic Canada. These discussions uncovered industry views regarding the owner-operator and fleet separation policies that were highly polarized. The problem from the perspective of the inshore fishers was "trust agreements" which they saw as undermining the fleet separation policy. Trust agreements are a legal agreement which allow a license holder to enter into an agreement with a third party which allows them to control the use of the license. These consultations found wide concerns that the trust agreements were eroding the two policies. There were also proposals to make the owner-operator and fleet separation policies more flexible without limiting the use of trust agreements which provoked widespread opposition. The document argues that DFO might have the power to prevent the separation of the license and the benefit if they do so "for fisheries management reasons" and DFO should have to demonstrate this linkage. The consultations have found opposition to the trust agreements is very strong. Many people believe that DFO should pursue a regulatory solution to reducing or eliminating trust agreements and this debate is still ongoing.

3.3.3 Retirement and Recruitment

The entry and exit of fishers into the fishery is an important area of concern among our respondents in respect to the ITQ system, as well as the Community Management Boards discussed below. Several respondents emphasized that ITQs facilitated the retirement of fishers by providing them with an asset they could sell when leaving the business. This, in fact, was one of the major ideological fault lines in debates over the system. One respondent who was deeply involved in the Community Management boards considered a desire to leave the fishery to be perhaps the main determinate of people's attitudes towards ITQs. This respondent observed that people who are planning to keep on fishing are generally opposed to the ITQs system because their increased costs through taking on debt to buy quota would be greater than their benefits. But those wish to leave fishing say yes because it provides a mechanism for doing this. Another respondent said that he thought it was more common to sell a license in order to buy a license in another fishery than to sell a license in order to retire.

Respondents pointed out, however, that the market for small licenses is currently weak. Transfers in the inshore fishery have traditionally tended to take place between a father and his son or other relative. "*But if you look at the papers there are licenses for sale everywhere*". A young man can become a fisher after two years in terms of being able to qualify as a "professional fisher" to buy a license. Then have to buy a license and it may not be possible to use the license to secure a loan from a bank. The ITQS have not usually been recognized as assets for the purpose of loan collateral but very recently court cases have suggested that the licenses, i.e., the access right itself is an asset in the legal sense. While ITQs have been argued to be a block to a young person getting into the fishery because of the cost of quota, but in Nova Scotia licenses for non-ITQ species (e.g. lobster or crab) are just as expensive. With costs of entry as high as they are and the status of these assets being so unclear, for many young fishers only real choice they have it to go to the processing plants for a loan. This then ties the new fisher to that plant and is one source of the "trust agreements" discussed in the previous section. Finally, many Nova Scotia young people are choosing to going out west drawn by the oil boom in Alberta. This has implications for both finding future boat owners and finding adequate crew now.

The transfer of licenses on leaving the fishery is an issue with wide resonance. The government is easing the very significant capital gains taxes if a license is transferred from a parent to a child. This was the subject of a large debate in the last election. The resulting legislation allows a tax exemption of 500,000 CAD on all licence transfers and an additional 500,000 CAD if the transfer is to an immediate family member. This is one area that has been a particular challenge for the Community Management Boards, with several respondents saying that retirement is perhaps the most contentious disagreement they fact. People with good catch histories go into a community group, but when the time comes that they want to sell their license to retire the group asserts control of the license of the quota attached to it.

3.3.4 Crew

The ITQs have changed some of the shares systems used through which crew members are paid. Owners of larger firms have placed the cost of ITQ on "the top of the lay" in other words the cost of the quota is considered a cost of fishing and deducted from the crews share of the catch and not only from the share of the ITQ owners (McCay et al. 1996). A respondent from the industry explained that while some inventors in quota are still very concerned with communities and the quality of life others are focussed only on maximizing profit and return to crew members is less today than it was 20 years ago. "*Once people started buying the quotas they had another debt and the less reputable ones would shovel that cost on to the crew members".*

Other factors are at work as well. Changes in skill requirements are one. One respondent who works in the industry told us that even in the 70s a generous portion went to the crew because they took a risk, they had to be skilled and they had to manage the trip. But now fishing has become safer and electronic equipment is reducing the level of skill required. Another fisher explained *"there are four of us in our boat. I used to carry seven. This is because of the lower number of fish we have to catch. I used to fish 7-8 days hard, but now I can't so I only take four. The way they are paid is being changed because you have no fish to catch and you have to buy fish before you come then it has to be paid for".*

Recruiting crew has become very difficult. The smaller firms employing kin have often chosen not to decrease the crew share. The crews in Canada are having to work longer hours and are very unhappy; in some cases they are not getting an increase in pay (McCay et al. 1996). A manager working with the informal ITQ system in Shelburne (see Section 2.6

below) told us *"last summer I think the guys started realizing it was a lot harder to find crew. If they didn't like who they had they used to shift faster… It is particularly hard to get the older more experienced people. I don't think there are a lot of young people who want to go fishing. It is cold hard work.* "A respondent in the mobile fleet told us that because the crew share has decreased it is not so easy to find crew for groundfish now. An important factor here is that there is that the lobster fishery is paying relatively well. His community has responded directly to this problem because *"there are still good young people in [his community]"*. *"The community is built on hard workers ... who stayed together and saved money, they adapted to the changes"*. The community has bought some ITQs as a community an there are, in fact, more vessels and larger vessels than before the change. This quota they are buying is from the other villages in the area that are not so organized, another aspect of the geographical concentration discussed above.

3.3.5 Markets, Quality and Price

One claim that was made during the introduction of the ITQ system is that it would improve fish quality because fishers could fish more slowly and time their fishing in relation to the market. Some evidence exists of increases in quality. The prices gotten by the inshore mobile sector of cod and haddock, but not pollock, have converged with those of the fixed gear fleet that traditionally got better prices because of higher quality (Apostle et al. 2002).

Among our respondents, however, even those who are very supportive of the ITQ system expressed some disappointment that the improvement in quality and price has not been as great as they would like. A fisher with a large boat and some processing interests explained that the market is not that well organised in Nova Scotia. Fish buyers in New York and New England are the main driver and this has kept Canadian prices low. He argues that Nova Scotia is hurt by the lack of vertically integration created by the fleet separation and owner-operator policy. This weakens the ability of Canadian firms to resist the influence of the American market and set their own prices. Currently fish from the inshore mobile fleet is sold with little processing, mainly fresh and whole. The large trawlers are able to process the fish onboard. For the inshore fleet the ITQs gave stability and security for the investment. The prices went a little up but not so much. The market structure is such that the reward for quality is not really worth the investment.

Another respondent from the commercial sector agreed that product quality and prices has not improved as much as expected. He argued, however, that the market was constrained by the small number of large companies in the off-shore industry who had blocked attempts to set up port-based auction markets in Canada. *"So a lot of what we do here is controlled by auction markets in the US in Portland and New York where we truck in unprocessed fish"*. So while there is some variability in fish quality in the market but the price response has not been enough to generate much change". A third respondent said that the ITQ system did not really help the skippers planning their fisheries and stop the race for the fish because in reality, the owner decides when to go out when the prices are good, whatever the weather.

3.3.6 Fishing Behaviour and Conservation

Evidence for a link between ITQS and stewardship is not readily evident and what is there gives mixed signals (Apostle et al. 2002). People are becoming more concerned with enforcement, as protection of their investments. They did decide to adopt a square mesh net. Creed et al. (1994) also heard reports of increased compliance, even claims that illegal landings had almost disappeared. However, some observer data suggests that discarding, dumping and high grading have increased in the ITQ fleet (Apostle et al. 2002).

Apostle et al. (2002) analyzed violation statistics. The found that ITQ system seems to have had a strong downward impact on both the number violations and the severity of the offences. They report that the inshore mobile fleet recorded 331 violations between 1986 and 1990 before the ITQ system and 74 violations between 1991 and 1995. They also did a random sample of 30 cases, 20 from the first period and 10 from the second, to get an idea of the kinds of cases being brought. They found a marked difference with the violations in the earlier period being considerably more serious in addition to being more frequent (Apostle et al. 2002).

ITQ have raised a couple of questions about their direct implications for conservation. An ITQ is probably perfect in a single-species context, argued one respondent from the fishing industry, but bycatch is the Achilles heel of the ITQ system. In a multi-species context such as Nova Scotia, bycatch makes an ITQ system a "*nightmare*" from a business perspective. A Nova Scotia fisher can be dealing with up to six quota species as well as other species with bycatch restrictions. A fisher has a basket of holdings of quota and catches more of one species and less of another. The economic theory would assume the market would operate and you would buy or sell this quota. But quite quickly it becomes apparent that it is easier to discard the fish you have caught than it is to buy quota to cover it. While there are certainly people on shore who had the quota needed to cover the incidental catch, they will be asking three and four time its market value because they know that the fisher will not be able to catch the target species without some quota for the bycatch. This same observation was confirmed by other respondents from the industry.

ITQs also have an impact on conservation because they lock in a particular management system, including a particular definition of the stock that attaches to the ITQ. One industry member, with the agreement of a scientist, explained how they are caught in a situation now where they are finding that what they thought was one stock is really two stocks with a high degree of mixing. The managers at DFO *"tear their hair when we say this as they have already been subdividing and subdividing"*. It is a downside of an ITQ system that it locks ecological realities into hard institutional boxes. The science is saying that we should split 4X cod, 4X haddock and pollock. But right now fishers own a quota of 4X cod and there is not good way to determine if that quota they own is all eastern or all western or should somehow be divided.

3.4 *Conclusion*

The benefit of the ITQ system is that it provided a mechanism for removing capacity from the fishery that reduced the inevitable disruption in fishers' lives by providing a transparent system for the reallocation of value. The ITQs smoothed the process by which fishing and processing capacity was reduced, but were not the main engine of the reduction itself. The main engines were much smaller quotas and the introduction of effective enforcement. Most of the unfairness that was experienced stemmed from the initial allocation of individual quota based on the reconstructed historical participation rather than the system developed for trading those individual quotas.

The ITQ system in Nova Scotia has had the same negative impacts that have emerged in other areas where such a system has been implemented. It has intensified the organizational and geographical concentration of the industry that would likely have accompanied capacity reduction however it was carried out. It has shifted more of the burden of reducing excess capacity to crew members than is perhaps fair. Attempts to reduce these negative impacts through the design of the system and closely related policies have not been very effective and remain controversial. The impacts of the system on conservation are both unclear and mixed, but from a legal and institutional perspective it has reduced potentials for adaptive management by locking ecological realities that evolve either naturally or as a result of greater scientific understanding – for example the definitions of particular fish stocks - into hard institutional boxes.

The most interesting aspects of rights-based management in Nova Scotia have emerged in its interplay with the reforms toward greater participation that have taken place, especially in the form of the Community Management Boards. It is to this subject that we now turn.

4 The Community Management Boards

4.1 *A brief history of the innovation*

The Community Management Boards (CMB) were formed for the management of small vessel fixed gear fleet. The Board's were formed in the wake of organized protests focussed on resistance to the introduction of ITQs. Charles et al. (2005) suggest that this happened because the fixed gear fishers did not like what they saw happening in the inshore mobile fishery after ITQs were introduced.

Many of these fishers were also lobster fishers. Charles et al. (2005) describe the lobster fishery as a *"relatively stable core"* of multi-gear inshore fishery. In Nova Scotia inshore fisheries the lobster fishery is strongly place-based and there is a long history of local management going back at least to the 19^{th} century (Haward et al. 2005). The fishers were used to using effort control for lobster and so there was a lot or resistance when DFO introduced quotas for groundfish in the late 1980s. The fishers wanted trip limits because they saw them as more equitable because larger boats can start fishing earlier in the year and this gives them what was perceived as an unfair advantage under a competitive quota approach. In 1994 when DFO decided not to enforce the trip limits there was conflict and the outcome was the establishment of 18 management units, basically counties, each having a quota. This in turn led to the creation of the Sambro pilot management board and the subsequent allocation of the entire fixed gear quota for cod, haddock and pollock into community quotas (Charles et al. 2005).

The Sambro community, as describe by Loucks (1998), was on the cusp between two quota areas and was competing hard for an area where they had had very high historical participation. They took their complaints to DFO and, once they established this high historical participation, began to negotiate what to do about it. They requested an experiment with a "community quota" allocation. This was approved in the spring of 1995. They ensured the plan would be enforced in a democratic way by designing a Fishing Conservation Harvest Plan that was adopted by fishers through a formal contractual agreement. The contract shifted much of the management responsibility from DFO to the Association.

The fishers understood that they had to demonstrate full compliance if the co-management approach was going to work. This was the first community quota in Atlantic Canada and the first time a group of fishers in Scotia Fundy signed a contract committing themselves to a specific harvesting regime. It required that they hire, for one percent of the catch, one of the independent monitoring companies that were involved in the “hail in hail out” system originally set up to monitor the ITQ fleets. DFO would also do random monitoring and if violations were detected the contract would be cancelled.

One of our respondents was a manager who was involved in these activities from the DFO side. He explained that DFO had become very frustrated trying to develop a single management plan for everyone. They were continually running into problems such as different lobster seasons, differences in tides, one area not wanting to start fishing for pollock until June because they were still fishing for lobster but in danger of losing their quota to other areas if they waited. DFO started to address this by basing management on gear types. They created a gill net group, a long line group and a hand line group. They had the fishers choose which group they would belong to and then we used our data to divide the quota. The system worked more or less well for different groups depending on the fishing history information and other factors. But overall it was not a very satisfactory system.

Then came the Sambro experiment. It was requested by the community but agreed to readily by DFO because of dissatisfactions with the gear group approach. During the first year the other groups ran through their quota while Sambro kept right on going through the year. The shift of responsibility to the group, Loucks (1998) argues, resulted in high community cohesion. The Sambro community purposely under fished their quota by five percent.

The success of this system led to DFO formalizing "community quota regions" throughout Nova Scotia in 1996. After the successful first year, as our manager respondent described the events, in fall of 1995, the rest of the groups got together had their own meeting and invited people from DFO. Two hundred people came and said they wanted to try community management. It was not that easy to arrange. There were a lot of different opinions and the county-based groups put fishers together who did not agree. At one point DFO arranged for independent arbitration. Yarmouth and Shelburne, for example, wanted to be one big group; this was not allowed because DFO wanted to avoid mixing the slower fishers from Yarmouth in with the high liners from Shelburne. They did not want "*piggy backers*". Once the communities finished their negotiations DFO met with them and a final decision was made.

The most contentious area was Shelburne County which is by far the most important area for fixed gear, nearly half of the fixed gear fishing takes place there. Sinclair et al. (1999) describe the complexity of the Shelburne County fishery, with more than 800 fixed-gear < 45' licences. They suggest that the fishers were basically forced to organize. Shelburne County could not come to an agreement and in the end DFO had the divide them into two management boards, Shelburne A and Shelburne B. This arrangement continues to this day.

DFO is very satisfied with the division of responsibilities. "*The boards do a whole bunch of things we did before, we have downloaded responsibilities. We had very little support before in trying to manage fisheries, now they can do their own thing*" explained the manager who had been involved in the process. The boards have the responsibility for defining entitlements on how to harvest the assigned allocation (Peacock and Hansen 2000). The communities have taken a number of approaches, which range from a competitive fishery (by gear type) within an overall community-quota on a per species basis, to an industry-developed and delivered ITQ initiative.

Enforcement is carried out under the CMBs based on the Conservation Harvesting Plans that are the basis of their contracts with DFO. Within communities and/or quota groups it is up to the participants to develop allocation rules and this process has been extremely divisive in some communities, and it is creating tensions among fishers and groups as quota becomes associated with fewer individuals. Some licence-holders see themselves being squeezed out of the fishery. Under an overall competitive quota for the fixed-gear licence holders, all fishers could fish until the global quota was reached. Under community quotas, some groups and/or individuals are being closed down quickly while others are distributing their quota throughout the whole year.

For most of the CMBs the shifting of fishers between boards is not an issue. It is only possible between the two Shelburne A and B without moving to a different county as they are the only ones who have two boards in one county. Shifting never happens within a year. Once a community quota was created, if people want to move between boards the board must approve this decision. They negotiate these things. The boards decide if you are taking any quota with them, so what they take is usually limited, so the new boards are reluctant to take them as they come with no or little quota.

The management boards are all operate differently which was part of the idea of local control. Charles et al. (2005:8) identify the following characteristics are shared by all or most management boards:

> *1. The boards were established and are run by fish harvesting organizations, and strive for inclusive decision-making processes.*
> *2. The boards sub-allocate the community quota among different gear types and devise rules for all licence-holders in the form of a community management plan.*
> *3. The management plans are enforced through contractual arrangement between the*

board, the licence-holders, and the catch monitoring companies.
4. Management plans are consistent with basic conservation requirements set out by DFO and each licence holder must follow the conditions of licence as determined by the government.
5. Management boards have infractions committees to judge alleged violations of management plans and impose penalties.
6. Seasonal adjustments are made to management plans and in a number of cases these adjustments include the sale or trade of unused quota between different management boards.
7. Individual licence holders can still choose to fish under a generic management plan devised by DFO for the whole Scotia-Fundy region instead of under a community management plan devised for local conditions".

The Community Management Boards are organized around previously existing fishermen's associations and are influenced by other place-based networks. Shelburne A for example is made up of three previously existing groups and Shelburne B is made up of five. These groups often reflect the three gear groups of long lines, hand lines and gill nets. The "Fixed Gear Committee" represents all of the boards in meetings with DFO. Each board has three representatives on this committee, one for each gear group, and a CMB is required to present a unified position to the meeting when an issue is decided. Bull (1998) reports that the Fundy Fixed Gear Council, a CMB, has been an initial success because it comprises well defined geographical area, a relatively unified membership and good working links between the three fishers' organizations involved. The Council is organized into three committees by types of gear, an infractions Committee was set up with representatives of the three organizations and a chair but these all rotated secretly so nobody knew who was going to be up to serve.

The significance of the fishing history was a commitment to a particular place not just to an amount of fish that was legally entitled to (Loucks 1998 p57). Haward et al. (2005) argue that the key to Canada's community based approach lies in its reliance on a specific coastal community or logical component of the coastal zone. They also point out that the implementation of community quotas has increased the management role of the already existing regionally-based fishermen's associations.

Davis and Bailey (1996), on the contrary, argue that consideration of how small-boat fishers are rooted in the community is missing. The approach to co-management taken here had entrenched the elite. One of our respondents from the fishing industry, kind of an elite himself, argued that is his experience the government only wants to deal with the bigger local players, they want to deal with one person and have that one person deal with the rest of the industry.

4.2 *The CMBs and the Costs of Management*

No quantified information exists on the implications of the Community Management Boards for the costs of management. Even if such data did exist the comparison would be between the current system and a counterfactual alternative. Nor is there any data on who is paying what costs, but it is very clear that the overall system relieves DFO of a number of tasks they had previously. We believe it is a reasonable hypothesis that many costs are more cheaply born by community groups than by others.

In comparing the costs of management between the CMBs and the ITQ system a DFO manager said that they have some significant costs dealing with quota transfers within in the mobile fleet. This activity is not necessary for DFO to do on the CMB side because they manage the fisheries internally according to their harvesting plan. Only when quota is shifted between CMBs must DFO must keep track of the exchange. There is not a "*humungous amount*" of this, but enough so that DFO has two or three people involved in keeping these records. Even the CMB that uses individual quotas (Shelburne B) does so internally and this creates no costs for DFO. DFO does have responsibilities for making sure that the harvesting plans are honoured. Most of the information needed for this is developed by the privatized hail-in hail-out monitoring system which also involves little or no costs to DFO When asked if he is sure that DFO's costs for the CMB system are less than that for the ITQ system his response was *"I'm sure it is because it is a lot less paper work"*.

Sinclair et al. (1999), however, are concerned about overall costs. They believe that the strategic decision to use community quotas as an organizational tool to transfer responsibility to the small vessel fixed-gear sector has changed the annual planning process as organizations have evolved, in a somewhat forced fashion, from the bottom up (Sinclair et al. 1999). They further argue that the overall costs of management have risen with the introduction of a more complex institutional structure. The division of responsibilities includes the government licensing and registering vessels, limiting gears, and describing the area to be fished or controlled. Much of this work is carried out through the DFO-administered licence systems and DFO enforcement activities (Peacock and Hansen 2000).

4.3 *The CMBs, Sanctions and Compliance*

Once a fisher has finished his quota for one species he must stop fishing for groundfish and the same is true for the group quotas in the CMB. This is a major incentive for group organization. As one fisher explained "*some fellow would just go to Georges and catch all the cod they could catch and shut everything down for everyone. We do not want radicals shutting everything down*". When a group fishes more than its quota this must be corrected, this usually means having to find (buy or trade) quota from somewhere else.

The groups develop strict enforcement mechanisms so that they do not have to stop fishing. In respect to penalties the fishers are tough. In CMBs the penalties, which are normally reductions in quota or time at sea, are harsher than those the government would impose, there is no appeal and the enforcement is quite effective (Peacock and Hansen 2000). People who commit infractions can be put right out of the group. They go into Group X because no one else will take them. This is not common; one respondent from Shelburne B said that he could remember it happening with "*only three or four boats with any significance.*"

Group X is the quota of people who are not affiliated with a CMB. Because DFO created

Group X the boards are not forced to accept all fishers. The most serious sanction available to the Community Management Board is to exclude a fisher so that he must move his IQ into Group X. Group X has almost no management services, it is fished competitively and when the Group X quota is exhausted then the entire group is shut down. This completely unmanaged quota does not last very long and so there is a strong incentive for a fisher to remain within the Board system. As one fisher described it to us *"To belong to no group is not good, nobody wants to touch you, and people do not want you fishing on their boat"*.

When a boat goes over its assigned catch or otherwise breaks a CMB rule they are taken before an infractions committee. One respondent explained how this worked in his CMB. The membership of the infractions committee is different every time it meets and is kept more or less secret. More or less in this context means that it is officially secret but people know who represented their group and the representatives, of course, know who was there. The infractions committee reviews an anonymous file. They begin with warnings for small infractions but sanctions can be serious. The largest sanction has been five years with no contract, which means that the person is forced into Group X. There is an appeals system in that the fisher has a right to take the matter to the Board itself. When they do this they loose their anonymity. His Board has allowed alternatives sanctions, such as a fine instead of lost fishing. Each CMB organizes itself in its own way.

4.4 *The Case of Shelburne B*

We focused a good deal of our short stay in Nova Scotia on the Shelburne B CMB because it is an interesting example of combining a community approach with a rights-based system. This CMB has chosen to use an internal transferable quota system to solve their allocation problems. This suggests itself as a way to gain the benefits of both community management and ITQs. Community involvement may aid in helping to avoid the quota busting, high grading, and misreporting that are the common problems associated with quota-based fisheries management. Copes and Charles (2004) question the compatibility of the two approaches, however, arguing that community management requires a planned approach and that ITQs cannot contribute to this as markets make decisions in ways that automatically exclude community interests.

The Shelburne B set up, according to two respondents active in its management, gives everyone have some access even if it is only a small share because of their fishing history. The members of the community are able to fish in that community and even people with very little history, and hence small IQs, can collect enough for a summer's work. Another respondent described the benefits of the system this way: *"you go the time of the year you want, if you want to go, you go, and you set the fish aside if you want to go swordfishing. When you want to go you can go, that is how the IQ will make things work for an individual if you are small like we are"*.

The community basis of the system is strongly supported. Our respondents explained that the reason their group has been (mainly) against adopting a full-scale ITQ is because it would harm the smaller communities in the county. They believe that fish would move to the larger

ITQ gear and would never come back to their area. The fish will not be landed here or worked on in Shelburne. Another respondent from Shelburne B believes that equity is what fishers really want out of a management system, and it was the inequality under the quota system, a perception rooted in the struggles over "history", that caused so much resistance. In community management you get local enforcement. If he were to go down a dock with, for example, undersized lobster, he would be confronted by fishers with various ways of expressing their anger over an infringement that they see as affecting them personally, *"but if you cheat on a quota you are just cheating the government"*.

While these internal sales are not usually permanent, in Shelburne B fishers can still sell out their licenses and retire. If a fisher decides to stop fishing he can get a reasonable price from the community. These prices, however, are not nearly as high as he would get if their were a official ITQ system. One fisher explained *"If I want to retire I can sell my license and then they [the buyer] would become a part of the group [the CMB]"*.

The swapping system in Shelburne B is entirely internal to the CMB and DFO has nothing to do with it. This is in contrast to the official ITQ system in which DFO bears the costs of recording when quota changes hand. A DFO respondent said *"We could not care less what they do as individuals"*.

The Shelburne situation, including the formation of Shelburne B and the internal ITQ system, has seen a lot of conflict. One fisher said that he see fishers divided into two ideological camps. On the one side are those who want to chase fish wherever they are. They see the others as lazy, and on the other side are those who want to wait for the fish to come closer so they don't steam as far. They say the others are greedy and wasteful. These two attitudes are expressed in their disagreements about management and was, in the opinion of several respondents, an underlying reason for the division of Shelburne into Shelburne A, the lazy group, and Shelburne B, the greedy and wasteful group. While this conflict was very intense ten years ago the groups have settled and seem now to coexist. *"We are not enemies"*. Over the years there has been some movement between the groups. Most of the movement is toward the B side. Some changed simply because they thought the group was working better, but more of the shift was people selling licenses. The B group, being the more business oriented, were simply the more likely to be the purchasers.

A substantial group within Shelburne B would like to move to a full ITQ system. The process that DFO has set up for making such a decision is a demanding one and it does not look like this group has the support to prevail in the near future. The true ITQ groups are also a bit resentful of the Shelburne B system as they have the benefits of ITQs without their costs. These costs being the allocation fee and the more extensive dockside monitoring the DFO requires of the ITQ fleets.

4.5 *Conclusion*

The Community Management Boards have developed an international reputation as an experiment in fisheries co-management. All of the respondents we interviewed were very supportive, some even quite proud, of the CMB system. Even industry respondents who were not entirely satisfied, such as those that would like a more traditional ITQ approach, considered the CMBs to be as good a deal as they can expect to get at this time. The CMBs seem to have worked particularly well from the perspective of DFO. They have greatly reduced taxpayer costs while giving them effective local institutions for working with the fishing industry.

We found the Shelburne B experiment to be particularly interesting. On the one hand the ITQ impact that leadership in coastal communities fear the most, the loss of a local fisheries base through industry concentration, has not happened. On the other hand, the CMBs that have not allowed the transfer of IQ among members have had problems dealing in a fair way with exits from the fishery. They have also no doubt paid a considerable cost in economic efficiency in comparison to a formal ITQ system, as is evidenced by the lower price that Shelburne quota gets in comparison with the mobile gear quota. On the other hand the Shelburne CMB takes on management costs that are bourn by the Canadian taxpayer in the mobile gear ITQ.

The CMBs are only one of the institutional platforms for fishers' participation in fisheries management in Nova Scotia. They have developed into an important resource that contributes to the success of other initiatives, such as the individual quotas and the monitoring system. Science is another area in which participatory approaches, facilitated by both the CMBs and other institutions, have been beneficial in Nova Scotia. This is the subject for Section 4.

5 Participatory Approaches to Science and Management decision

5.1 *History of Innovation*

5.1.1 Increased Industry Participation in Science

The collapse of groundfish stocks and the perceived role of science in it through over optimistic assessment have sharpened the mistrust of the industry to the traditional ways of providing scientific advice to management, and they have demanded the chance to participate in the scientific process. Furthermore, the development of new fisheries almost from zero, with emerging data-poor target species, has weakened the established model-based scientific system, because of the needs of new methods for scientific advice. This has created incentives for industry participation, as the scientific knowledge on biology and abundance for these new species could not been based on historical scientific data, and thus could be more open to industry's empirical knowledge. Finally, the drastic cuts in DFO budget (see Section 1.2.2) have also reduced the possibilities of scientific surveys and analyses. As a consequence, a major trend in Atlantic Canada over the last fifteen years has been towards an increasing participation of industry in the whole scientific advice, and a real educational process of the industry into stock assessment and research.

5.2 *Participation in Stock Assessment Processes*

5.2.1 Groundfish Stocks

In spite of some flaws in the traditional VPA-based assessment methods revealed by the groundfish stock collapse, these methods are still used for stock assessment and scientific advice to management for most fish stocks. Some alternative indicator-based approaches were tried back in time (see Section 4.5) but have not replaced the existing system. All groundfish stocks are handled in the same way. It has meant that industry participation has been subordinate to that existing scientific system, and has been conditioned to its format and requirement. Potential input from industry should be quantitative and scientifically validated evidence that could fit into the modelling, and potential criticisms from the industry to the scientific hypotheses first required in-depth understanding of the scientific methodology. As such, the participation of industry is formal and controlled.

An initiative jointly created by the industry and DFO scientists was the so-called "sentinel fishery", a survey mostly designed for maintaining information flow during fishery closures, primarily in Atlantic Canada and Gulf of St Lawrence. Sentinel fisheries have succeeded not only in providing crucial information for stock assessments, as a supplement to research vessel surveys, but also in becoming well-established and accepted among fishers, playing an instrumental role in creating a more co-operative atmosphere between scientists and fishers. (Charles, 1998).

Some other initiatives were launched in the nineties by the industry alone, in order to provide alternative surveys that would supplement the scientific surveys used in assessment. A main one is the so-called "ITQ survey" performed by the trawler fleet >45' entitled ITQ in 4X area. DFO used to have a regular trawl survey, but which could not sample along the shore in shallow waters because of the size of the research vessel. The industry proposed to cover that area and started a systematic survey with scientifically validated protocols in 1996. The costs are fully born by the industry, through some unallocated quotas which are used for science instead of being redistributed to each quota owner. The survey has been added to the scientific survey and is used into stock assessment. "*This is a success story, with willingness and commitment from both parts. The industry makes good and objective job, and the science branch has been willing to modify their methods*" said a fisherman engaged in that survey. Similarly, an industry halibut survey has been in force in ten years. It was initially proposed by scientists but was designed in collaboration between the scientists and the industry. The results of that survey have been quite consistent with scientific findings, giving fishermen confidence in assessment results.

However, including industry-based surveys in the assessment is not always straightforward, if the results differ significantly from scientific findings. A longline fleet also launched a survey, as their perception of stock abundance was the opposite as observed with trawl-based surveys ("*we see cod and few haddock, they see haddock and fewer cod*") said a longline fisherman. The industry survey lasted six years, but was never included in the assessment.

5.2.2 Invertebrate Stocks

The situation is quite different for invertebrate stocks, as usual assessment tools cannot be used. Every single invertebrate species is so unique there has to be a new technique. This has lead to a system with DFO scientists almost full time dedicated to one particular stock over several years. This is changing now, as not all persons leaving are replaced, but this has been the case since invertebrates became major target species. Assessment methods vary from stock to stock, depending on data available and scientist's background, but also on industry demands and funds. A number of scientific studies are paid by the industry, as a source of knowledge for their own goals.

The specificity of invertebrate species is also found in the industry exploiting them. Except for lobster, which is mostly targeted seasonally by a large number of fishermen with other activities year round, most invertebrate stocks have smaller spatial distribution and mobility, and are targeted by a limited number of specialised fishermen forming a rather homogeneous and cohesive group. As a result, the full-time involvement of a DFO scientist on a stock exploited by a limited number of stakeholders often lead to close collaboration and high commitment between the scientist and the industry. These long-lasting relationships strengthen the trust and credibility of science and ease the data collection process.

However, this system leads to two types of issues. First, the scientists may get too accustomed to their routine work, and do not have the chance to compare with methods used on other similar species. This leads to some inconsistencies between stocks, which may not be so problematic ("*we are sort of disjointed and inconsistent according to some, but it is not inconsistency it is specificity to a situation*" advocated a DFO scientist), but still raises some issues regarding science quality and equity. DFO works now towards higher scientific communication across scientists assessing invertebrate stocks, with support from statisticians and modelling experts. "*We are seeing more of this cross stuff, partly because Canada is so big and we need consistency, and industry is complaining that one area is being treated differently from other ones*" explained a DFO Science Branch manager.

The second issue relates to scientific independence and integrity. The high level of embedment with industry creates the risk that industry put pressure to obtain the scientific evidence they want. There have been some good examples, where industry trusted their scientist and followed their recommendation of decreasing catches. These were cases where a real relationship of trust existed "*I said they should cut back, and (…) they said OK. They said you were with us when we went up and this was, importantly, based on my history with this group of people*" said a DFO scientist. But this is not true for all cases, and there are suspicions on scientific manipulation, also acknowledged by the professionals. "*Some places it just does not make sense and we see manipulation*" said a groundfish industry representative. Some industry pay parts of the salary of the scientist involved, and may even be involved in their selection. In such cases, peer scientists do not suggest obvious scientific manipulation, but rather claim over secrecy, lack of transparency and absence of peer-review of scientific results.

5.2.3 Participation in the Regional Advisory Process (RAP)

As most stocks in Scotia-Fundy area are under sole Canadian jurisdiction, their assessment is under the responsibility of DFO and not NAFO, and is conducted within RAP meetings. These meetings have been opened to industry and NGO participants as a way to improve collaboration between industry and science after the groundfish collapse. And indeed, this has facilitated the dialogue with the industry and the improvement and acceptance of scientific results. The industry feel involved, and feel that they have to ("*If you don't ask question they will say whatever they want*" said a fixed gear representative). When they do not agree with scientific findings, they try to come with samples for supporting their hypotheses. The industry is involved in helping to write the evaluation report, and industry's comments and concerns are written down ("*We have to go in with them. They are fair and willing to listen, it does not mean they will change the report, but I don't feel slighted*" said another fixed gear representative). Some communities are also organising local science meetings with DFO scientists prior to the RAP, in order to collect information from fishermen who do not attend the RAP. These open meetings also help the industry to understand the difficulty and complexity of stock assessment, and that uncertainties are inevitable. But it is clear that some mistrust is still there, although less radical than before. Some particular issues occurs with fixed gear industry, as most of the science is based on surveys using mobile gears, which do not accurately catch species such as cusk, pollack, hake and halibut, leading to high uncertainties in assessment.

The major issue of such open science meetings is the risk of distortion because of political issues. The industry may put pressure on the meetings to get the results they want, looking at detailed wording instead of reviewing science and methods. The quality of interaction with industry depends on the level of the stock. "*At one part they were invited to the assessment meeting, they started bringing lawyers and it became a very political discussion*" said a DFO Science Branch manager. "*They are going to change and go back to an invitation only meeting, reenforcing that participation is about bringing scientific inputs. It got to the point where people did not want to chair the meeting as they were afraid of being sued.*"

5.2.4 Conclusions

It is clear that the scientific process has dramatically changed over the last fifteen years. A real effort has been made toward transparency and openness for effective governance. The Science Branch has been willing to improve dialogue and communication with the industry, to include their comments and concerns into assessment reports, to include some relevant surveys under certain frames. On the other side, the industry has been willing to participate at own costs, and has gone through a real educational process to be able to be proficient in collaboration with scientists, as the perception of reality and time frames differ strongly between both worlds "*We were told that we had to do 5 years. 5 years is long time for a fisherman to think ahead, we mostly think one week ahead.*" said a former longline fisherman.

Regular meetings between scientists and industry have created some particular situations of long-lasting and personal relationships with high levels of commitment and trust, especially in invertebrate fisheries. But this cannot be generalised, as it appeared clearly that the own personality of the scientist is a decisive factor in the establishment of such relationships. The industry praises scientists confident with their analyses, and able to explain simply and well about issues.

Participation of industry in the stock assessment process has though not always been straightforward. A degree of mistrust is still present between both worlds, especially when scientific results are based on comprehensive models and with input numbers based on extrapolation of sampling data. This has neither solved all uncertainties in stock assessment results, bringing sometimes more uncertainty in when industry and scientists perceptions of stocks trends go in opposite direction.

In comparison with the previous system which was completely closed to industry participation, the open process risks "*to go way the other way*", with a too large role accorded to the industry. Some uncomfortable situations were observed, with industry putting pressure on science meetings outputs for political reasons, especially when the level of scientific uncertainty is high.

All actors recognised the progress achieved in including fishermen's knowledge and point of view in the scientific advice, although some scepticism remains "*I think it has improved, but on a scale 1-10 it has only improved 1, and it should be 10.*" said a fisherman. This process has improved social robustness, by reducing the feeling of industry of being unheard. It has also improved biological robustness, by increasing the feeling of ownership and responsibility for the resource and improving the commitment to scientific advice.

5.3 *Participation in other Scientific Work – the FSRS*

A notable initiative launched in Nova Scotia in the aftermath of the groundfish collapse was the creation of the Fishermen and Scientists Research Society (FSRS), a voluntary organisation for collaborative research and co-education of fishermen and scientists and the first of its kind in the world. The initiative was initially paid by the government, which also provides continuous office facilities. But it is now an independent non-profit society, which financial support includes industry funds and governmental research grants. FSRS promotes science relevant to the long-term sustainability of the fishery. The Society stays away from controversial management issues, being prohibited by law to engage in lobbying and other management activities. In 2007 it counted 367 active members, mostly fishermen and scientists.

The Society provides a frame for collaborative research. Scientists provide guidance in developing scientific protocols with fishermen; fishermen have a key role in identifying research priorities. Research programs are conducted within self-financed projects dealing with specific scientific issues about various species, and the Society promotes continuity in the projects for insuring suitable time series of data.

The FSRS has played a key role in the educational process of the industry and in the restoration of the credibility of science. Fishermen trust data they collect themselves "*If fishermen are doing the science, they believe it to be true. How can you argue about something you collected*." explained the FSRS manager. FSRS worked towards increased understanding of the scientific rationale for data collection protocols and increased participation in RAP meetings. It also educated the scientists to give timely feedbacks on their project results. The main success was about helping communication, discussion and dissemination, which helped "*humanising*" each group in the eyes of the others.

However, in spite of these positive initiatives, some of our industry respondents, although part of the educated elite, were little supportive of the FSRS. In particular, its status of non-profit organisation creates a constant chase for grants and funds for maintaining its existence, which precisely distorts its image of non-profitability. Secondly, most of the initiatives are still proposed and piloted by scientists. The FSRS is still perceived by some as a governmental body, which did not necessarily supported industry's own initiatives such as the "ITQ survey".

However, it is clear that in spite of criticisms, the FSRS has existed over fifteen years, surviving the massive DFO cuts in research programs. This longevity is the main proof of success, as the Society would not have survived without support from the industry.

5.4 *Industry Involvement in Management Decisions*

5.4.1 Harvest Control Rules and Management Plans

Traditionally, management decisions about single stocks TACs were taken based on clear Harvest Control Rules (HCR) such as F0.1. Shelton (2007) showed that the management strategies have however changed over time, including changes in reference points and time-scales. This is due both to an increasingly complex legal framework for fisheries management (see chapter 1.2.2), and to increasing participation of industry in management decisions and scientific understanding. TACs are no longer set based solely on forecasts conducted by scientists, but are now based on a number of considerations, of which stock assessment is a major component.

Management decisions for groundfish are taken as part of the Groundfish Management Plan established for the period 2002-2007. Annual fishing plans are developed in consultation with the fishing industry and are reviewed annually to update quotas and introduce new measures considered appropriate by DFO and the fishing industry, as part of this long-term GMP. Consultations also occur on an ongoing basis to ensure successful implementation of the plan. TACs have been fairly stable over the recent years, reflecting general commitment towards stability and long-term sustainability "*as the crucial starting point for improving relationships with industry, stakeholders and other resource users*" stated fisheries Minister Hearn (http://www.dfo-mpo.gc.ca/media/newsrel/2006/hq-ac07_e.htm).
Shelton (2007) acknowledged that this leads to increased flexibility in the harvest control rules, and weaken the use of the scientific knowledge as decisions are now taken ad-hoc.

Indeed, there is a clear reluctance both from the management bodies and from the industry to use clear and pre-agreed harvest control rules, as the final management decision is taken from consensus and negotiation. Precise control rules would remove this negotiation buffer, as HCR does not account for uncertainty. Some situations happened where the industry, the scientists and the managers agreed on some control rules before the assessment, but refused them after the assessment as they would have meant major cutbacks. The final decision process is not always fully clear and transparent. "*Management has fisheries roundtable discussions, but I don't see that there is an open process for taking science advice and moving to decisions, which is why these discussions bleed into our science meetings.*" said a DFO Science Branch manager. Existing lack of consensus across various industry groups undermines the possibilities for real co-management, and the decision power still resides with the Minister of Fisheries and Oceans. "*Co-management was a concept a few years ago, but not now*" deplored a groundfish industry representative. A DFO manager explained that the scientific advice is followed for the most part, but that the management framework has become more complex and more restrictive with law-finding acts requiring drastic decisions.

To improve the transparency of the decision process, The Science Branch is currently trying to introduce simulation-based Management Strategies Evaluations (MSE) (first initiated by IWC 1993) that aim at identifying management strategies robust to various sources of uncertainties. These simulations can be used as a tool to support discussions and negotiations between stakeholders in a quantitative and transparent manner, as alternative scenarios are compared based on a set of plausible hypotheses. First trials were conducted in 2007 on Artic surfclams and ocean quahogs with DFO- and non-DFO scientists as well as members of the fishing industry, DFO managers, and provincial representatives (Boudreau and O'Boyle, 2007). Results were used for providing advice for the 2007 and beyond fisheries. This is still too new to get real feedback on such a process and the immediate feelings about this approach are mixed. "*Many questions industry has are with the whole picture, and if you hear some of their questions then maybe you hear this idea about strategies and decision rules.*" said the DFO Science Branch manager. But "*regional management folks were a bit negative, I did not know if this was distaste for formalized management or just that they don't like something new, they do like to be flexible in how they use advice*".

5.4.2 The FRCC

A particular initiative of increased participation of the industry in the decision process was the creation in 1992 of the Fisheries Resource Conservation Council (FRCC), funded right after the groundfish collapse. The initial mandate (until 2004) of the Council, consisting of industry and academics, was to provide advice to the Minister on conservation issues for the groundfish resources of Atlantic Canada. FRCC was meant as a consumer, not a producer of science. They got DFO peer reviewed science and traditional knowledge, and provided advice based on those two during open and documented meetings. It worked as a "*depoliticised advisory process, providing written public recommendations to the minister, which then should be able to justify publicly why if it doesn't listen to FRCC.*" explained a FRCC industry member. Since 2004, the FRCC mandate has changed from annual management advice for groundfish to long-term conservation issues including other key species such as snow crab and lobster, and looking at sustainability issues from ecologic, economic, social and institutional perspective.

In spite of its laudable mandate, some critics were raised about FRCC, mostly because significant conflict of interests problems. "*they kept reappointing these people and you kept seeing obviously manipulated quota allocation*." said a groundfish industry representative. Needs for consensus can create dangerous "*hostage*" situations if a party brings conflicts of interests in. But it has nevertheless given a real frame for co-management with a legitimate mandate to the industry, and keeps being a major institution in the region.

5.4.3 Conclusion

It is here again clear that some progress have been towards industry participation into the final management decisions using agreed scientific advice. Charles (1998) illustrated how the opening of the scientific process to industry helped reducing uncertainty in cod stock status in area 4X. However, fifteen years of co-management have also shown some limits, as decision will always result from a combination of legal framework and management objectives in one hand, and negotiations on the other hand. A transparent and legitimate decision cannot always be reached from consensus, especially when industry groups are numerous and heterogeneous.

5.5 *Indicators and the EBFM*

The initial choice of innovation with regards to science in the original CEVIS project was the use alternative tools for providing scientific advice and moving away from the traditional model-based and forecast-based methods. Canada is moving towards integrated management with clear objectives accounting for ecosystem and socio-economic sustainability, and set in agreement ("shared stewardship") with a number of stakeholders. This has naturally led to a growing need of identifying reliable and measurable sustainability indicators systems SIS, using "pressure-state-response"-type frameworks (OECD, 2001), and Canada has gone a decade of development and exploration of these systems.

5.5.1 The Precautionary Approach Framework

Shelton and Rivard (2003) described the history of development of the precautionary approach (PA) since the cod collapsed. Over the 10 years following the collapses, Canada has been engaged in a process of developing a precautionary framework that is consistent with the 1999 United Nation Fisheries Agreement (UNFA). Development of this framework has been given high priority since the concerns raised in 2002-2003 that post moratorium TACs had been unsustainable and were jeopardising stock recovery. The framework adopts a notion of "serious harm" as the definition of a conservation limit reference point. The term "precautionary approach" should be used only to refer to situations that can result in harm that is serious or difficult to reverse. Activities which simply reduced yield were economically inefficient, but could not be interpreted as serious harm. Serious harm is defined as the SSB below which productivity is impaired. In terms of recruitment, impaired productivity is consistent with the notion of “recruitment overfishing”, i.e. the SSB level consistent with a marked decrease in recruitment.

In 2007, the PA framework was routinely implemented in a way similar to ICES procedures, on a single-species basis with traffic-light based coloured zones as indicators for management advice.

5.5.2 The Traffic Light Approach

The Traffic Light Approach (TLA) was developed in the Maritimes as a method to incorporate PA and decision rules in fisheries management, following initiatives from Caddy (1998). DFO Maritimes initiated an investigation of the TLA in 1999. It is to be used as part of stock assessment, broadening the approach to include non traditional information. The key appeal of the TLA is a means of visualisation of indicator data as a series of traffic lights categorising indicators in relation to target and limit reference points. The basic TLA includes three steps (Halliday et al., 2001) : (i) uses a multiplicity of indicators of system status; (ii) classifies the current state of each indicator in relation to reference points using a system of green, yellow and red lights; (iii) establishes management rules associated with the number of lights of each category. The TLA was initially designed for implementing the PA in data poor situations, but was thus adapted to data rich situations. The main interests of the method are the ability to include all new sources of information, and a way to propose a visually pleasing and transparent process for communication and understanding among users. ”*You say “this is all the information we have fellows, now you know as much as I do” and we can start talking about all the inconsistencies*” reported a DFO scientist.

In 2007, the TLA was only part of routine stock assessment for the small eastern Scotian Shelf shrimp stock (DFO, 2005), with a summary indicators being a simple average of equally weighted indicators:

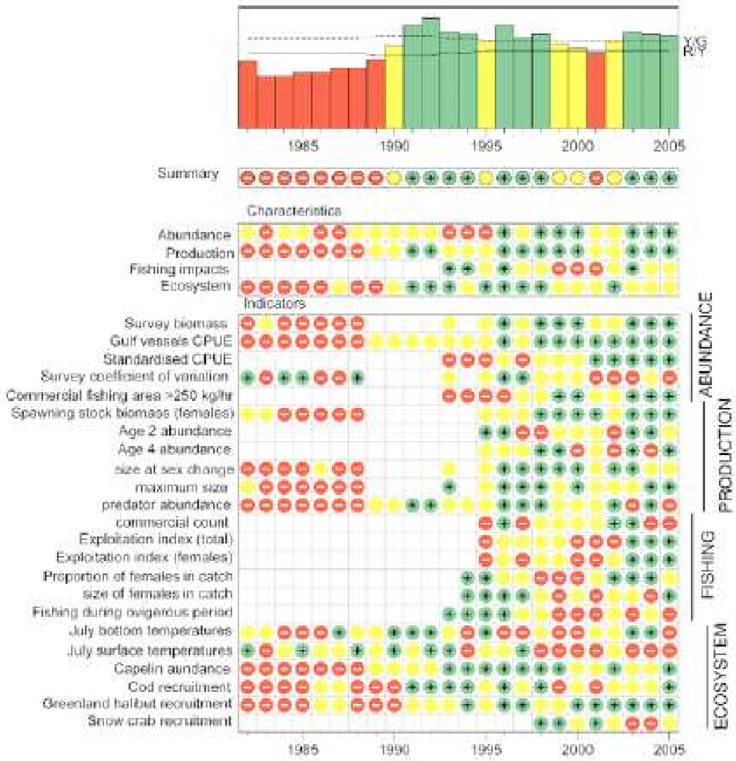

Fig. 1. Example of Traffic Light Analysis (DFO, 2005).

The success of the method for a small stock of shrimp was partly explained by the strong relationship of trust between the industry and the scientist. As Koeller (2007) explained, "*the Total Allowable Catch (TAC) exactly tracks my mental integration of the indicators and judgment of how it might affect my patient's health. Surprisingly (or not depending on how one analyses their motives) the stakeholders have always sought and taken my advice on the TAC verbatim, and this has included significant decreases with accompanying economic consequences.*" In that case, the industry trusted the management strategies proposed by the scientist, without arguing of scientific uncertainty for requiring higher quotas.

The traffic light method was applied as a trial basis for some Scotia-Fundy groundfish stocks. As such a complete trust in scientific advice as in the shrimp case is not always existing, it was felt necessary to formalise the method and the harvest control rules that could be applied from it, in a wish to proposing objective and transparent indicator-based management decisions. Main criticisms, also from industry side, dealt with the too strong simplification of the results, the loss of information and the need for more formal and causal mechanisms, as well as the issue of combining disparate lights into summary lights: "*First is happy with red, the other is happy with green, if you make yellow as a compromise nobody catches anything*" said a fixed gear representative. Furthermore, as industry has gone through a major educational process with regards to stock assessment in the recent years, simplification for communication is no more necessarily a major need. Halliday et al. (2001) conducted a thorough analysis of the technical aspects of the method, including the choices of indicators and reference points, the summarising ("integration") and the establishment of decision rules. The trials made to make the method more quantitative through using fuzzy logic lost its simplicity without solving the issue of integration, and its use did not proceed beyond the pilot stage (Koeller, 2004). As Koeller (2007) noticed, this final product was essentially a compromise between two irreconcilable philosophies, and collapsed under its own complexity.

However, its simplistic approach as taken for shrimp suggests that summary statistics may track "stock health" more comprehensively and usefully than individual indicators, and might be more precautionary than traditional methods (Koeller, 2004). In particular, it accounts for some other parameters than traditionally used in assessment, which could be indicative of stock status, as for example the r productivity parameters (Hutchings and Myers, 1994). And it avoids relating on comprehensive models. "*Fisheries science is not rocket science but it has been mistaken for rocket science and we got a lot of rocket scientists on to the problem*" said the DFO scientist. Furthermore, it is expected that such a traffic light categorising could indeed be applied to any kind of indicators used in PSR-type framework.

In 2007, during our study tour, the method was though gaining a revived interest, and was to be tested on two invertebrate stocks of primary importance, the Gulf snow crab and the Northern shrimp. To which extend this approach will receive commitment and support from a larger industry group as for the eastern Scotian shrimp cannot be answered now, but it would be very informative to follow-up the future development of these cases.

5.5.3 Ecosystem Approach to Fisheries Management (EAFM)

The renewed interest for indicators is related to the ecosystem approach, to which Canada is committed by law. Indeed, Choi et al. (2005) tried to use a similar traffic light approach as a descriptive tool for the Scotian shelf, choosing indicators in collaboration with scientific experts from the various relevant fields but without trying to combine indicators for potential management action. This seemed to work well to track strong dramatic changes, as the Scotian shelf has experienced over recent years, but not so much for weak changes.

Many years of discussion about implementation of the ecosystem-approach in fisheries management have lead to some progress. Influent scientists are acting towards a pragmatic and urgent approach based on current knowledge, rather than on developing comprehensive models trying to include all ecosystem processes. Clearer management objectives have been defined in the frame of Oceans Act. Productivity, Biodiversity and Habitat are the three main Canadian ecosystem objectives. The Management Branch in DFO is formulating one to three priorities under these objectives, as well as associated strategies and performance indicators (Figure 2). For each type of fishery, the level of importance and knowledge is qualitatively assessed (not important, important, unknown), in order to define priorities of action and priorities of research. Progress has been made towards collaboration with other branchs and other departments, with the purpose of formulating integrated assessment and advice. However, the operationalisation of this is not straightforward, as the traditional assessment cannot easily account for such information. And in most cases, assessment and management meetings are still attended almost uniquely by traditional Fisheries Management science group and industry representatives, with little support from environmentalists and ecosystem scientists.

	Strategies (performance indicator)	Managed Activity			
		GF	HF	SF	L/CF
Productivity					
Primary Productivity	• Control alteration of **nutrient concentrations** affecting primary production at the base of the food chain by algae				
Community Productivity	• *Manage **trophic level removals** taking into account consumption requirements of higher trophic levels*				
	• *Manage **total removals** taking into account system production capacity*				
Population Productivity	• Keep **fishing mortality** moderate				
	• Allow sufficient **spawning biomass** to escape exploitation				
	• Promote positive **biomass change** when biomass is low				
	• Target **% size/age/sex** of capture to avoid wastage				
	• Limit disturbing **activity in spawning areas/seasons**				
	• Manage **discarded catch** for all harvested species				
Biodiversity					
Species Diversity	• *Control **incidental mortality** for all non-harvested species*				
	• Minimize **change in distribution** of invasive species				
Population Diversity	• Distribute population **component mortality in relation to component biomass**				
Habitat					
	• *Manage **area disturbed** of bottom habitat types*				
	• Limit **amounts of contaminants, toxins and waste** introduced in habitat				
	• Minimize **amount of lost gear**				
	• Control **noise or light level/frequency**				

Fig. 2. Steps towards EAFM: Management objectives, performance indicators, and managed activities. Strategies highlighted in blue are those that are considered of high relevance that currently receive attention; Red highlighted strategies are of potentially high relevance but with major uncertainties remaining, and would require additional attention; White strategies are considered of low relevance. (source L. Burke, DFO Management Branch).

6 Best practices –What Might be Useful for Europe?

As a concluding chapter, we intend to consider the example of Nova Scotia from the perspective of our own management issues in Europe. This case study was particularly interesting, because it has gone through many stages ahead of what has happened or could happen in Europe. For example, it gives an interesting insight of what could happen if the cod stocks were to collapse in eastern Atlantic area as well. Furthermore, a similar “cultural shift” towards an integrated and ecosystem-based approach with stakeholders’ participation has also emerged in Europe in the most recent years, and interesting lessons might be drawn from the Canadian example. Finally, its size, diversity, complexity and history make it a comparable scale to the EU, probably more than the other case studies of Iceland, Alaska and New Zealand.

We first summarise our main findings in our evaluation of Nova Scotian innovations. Then we focus more in-depth on five “best practices”, i.e. five processes which we found were particularly interesting and positive, seen from a practical and field-based perspective and considering how they have developed over their ten to fifteen years of existence.

6.1 *Summary – Evaluation of Nova Scotian Innovations*

The purpose of CEVIS was to evaluate innovations with regards to four criteria: Cost of management, economic efficiency, biological robustness and social robustness. The literature review and the study tour helped formulating a number of hypotheses for the evaluation of the innovations described in this chapter. These hypotheses were used as the basis of developing the CEVIS research work in Europe. Various processes are identified within each innovation, but not all processes can be evaluated with regards to all four criterias. The findings are summarised in the table below (-) means "decrease" while (+) means "increase" :

Table 3. Evaluation of Innovations by CEVIS Objectives

Innovation Process involved	**Costs of Management**	**Economic Efficiency**	**Biological Robustness**	**Social Robustness**
1. Right-based management				
facilitating transition to lower capacity	-	+	+	+
fishing rights passed within the community				+
recruitment of crew and crew wage		-		-
fishers retirement				+
reduction of risk of bankrupcies and dislocation		+		
licensing separted from quota ownership				+
flexibility of system to biological reality			-	
management of mixed-fisheries issue			-	
increasing pressure for effective monitoring	-		+	
2. Community control				
community responsible for quota allocation	-			
exclusion of non-cooperating fishers		+	+	+
local stocks exploited by local communities only			+	+
local support to ecosystem approach			+	
3. Role and form of science				
Industry responsible for monitoring	-		+	- / +
industy involvement in science meetings			+	+
industry surveys			+	+
collaborative research			+	+
industry involvement in management decision			+/-	+
scientists commitment with industry			+	

The detailed description and functioning of each process is described in the relevant chapters. It is clear that a number of effects intermingle within each innovation, and some processes may counteract each other. Generally, we found that both community control (innovation 2) and participatory approaches to science (innovation 3) mostly brought positive aspects in. However, some of their effects are still unclear. Especially their practical implementation is not always straightforward and painless. Nevertheless, both innovations have clearly helped in the sustainability of fisheries activities, both in terms of biological robustness, by increasing industry commitment and trust and thus decreasing cheating, and in terms of social robustness by maintaining fisheries activities in the local communities and increasing the feeling of involvement and ownership of the industry into the scientific and decisional process. The main costs of the participatory approaches are related to their establishment, once functioning institutions are in place they clearly become an important asset for implementing further innovations.

Our analysis of the ITQ system is more mixed, as the ITQ has brought both positive and negative long-term effects. The direct impacts on efficiency are clear in theory and what limited data we have from Nova Scotia (and elsewhere) suggests that ITQs increase efficiency the way they are expected to. The ITQ system has also shown other benefits beyond gains in efficiency. In Nova Scotia the ITQ system helped reducing the number bankruptcies and other forms of dislocation resulting from the required reduction in fishing capacity. A rights-based system using individualized rights increases economic efficiency by granting the individual fishers the ability to decide as an individual when and how to fish their fish. Transferability then increases this gain in efficiency by concentrating the quota in the hands of those who are able to take advantage of it. While for political reasons is these people may be referred to as “better” or “more efficient” fishers, what this means in the real world is concentration in the hands of those who already control other assets that give them the ability to both buy the quota and use it in more flexible ways. Geographical concentration happens for similar reasons as well as because of the comparative advantage given places by ports, markets and processing capacity. The gains are real but so is the concentration. It is difficult to see how organizational concentration could be separated from increases in economic efficiency and attempts to hinder such concentration face myriad problems with both political resistance and people finding direct ways to circumvent the regulations in place to reduce concentration. Geographical concentration is a similar and related phenomenon that is somewhat easier mitigate through policy. Other negative impacts such as placing greater costs on crew members and (as one factor among many) increasing the difficulty for new entrants to the fishery also seem difficult to avoid.

The impact on costs of management of the rights based approached seems entirely dependent on design, the Shelburne example suggests that they can be nearly costless to the public. ITQs have created a complex set of positive and negative impacts with regards to social robustness. The positive effects of ITQs with regards to biological robustness are mixed and quite unclear. Surely, the ITQs have had positive effects because of the increasing pressure for effective monitoring they have implied. But they have not helped with the issues of bycatch they might be expected to help with because it is still often easier to discard fish hand buy quota to be able to keep it.

The main policy question remains how to balance these gains with their costs. The experience in Nova Scotia is that the owner-operator policies and the fleet separation policies are having some effect but they are under increasing pressure both politically and through the proliferation of trust agreements. For us the most interesting thing we came across was the Shelburne B CMB which seems to be pioneering a rights-based approach that balances its advantages and disadvantages in a flexible manner with a great deal of local input from the fishing community.

6.2 *The Monitoring System*

The arms-length, user pay monitoring system they have designed works very well. The system is able to keep very detailed track of the fish that are landed without any cost to the taxpayer. The fact that the government is not actually carrying out the monitoring seems to increase its acceptance in the community. The monitoring system also links up very well to both the ITQ system and the CMB system. In both cases local fishers and CMB officers are very interested in keeping a close, real time eye on landings.

6.3 *The Community Management Boards*

The CMBs have worked very well from the perspective of DFO. They have greatly reduced taxpayer costs while giving them effective local institutions for working with the fishing industry. As they move toward ecosystem-based fisheries management they will be a valuable tool, one DFO manager called them "vital" if they are going to create an effective EBFM. The Nova Scotian CMBs have perhaps realized the practical promise of fisheries "co-management" better than any similar attempt in Western countries. Several aspects of their approach seem to contribute to this effectiveness: they are linked to specific, relatively small geography; they have available effective sanctions including in extreme cases the ability to exclude non-cooperative members; and the use of legal contracts with detailed specifics in the form of the Conservation Harvesting Plans.

6.4 *The Informal ITQ System*

The Shelburne B system combining the limited transferability of IQs with community control of fisheries also suggests itself as an experimental model for Europe. The pure ITQ system, the CMBs using non-IQ management methods, and the Shelburne B board have all vastly reduced fishing capacity because the main driver for this was tight quotas combined with effective monitoring and enforcement. The pure ITQ system has had the expected negative impacts. It has reduced potentials for adaptive management by locking ecological realities into hard institutional boxes. It has led to geographical concentration of the industry. On the other hand, the CMBs that have not allowed the maintenance and transfer of IQ have had problems dealing in a fair way with exits from the fishery. They have also no doubt paid a considerable cost in economic efficiency in comparison with the ITQ system. The Shelburne B system, because it places strong limits on transferability, is not going to be able to match the pure ITQ system in terms of efficiency. This is clearly reflected in the lower price that Shelburne quota gets in comparison with the ITQ system. But it much less expensive for the taxpayer, makes a strong contribution to maintaining the economic health of a peripheral community, while at the same time dealing effectively with the problem of exit from the fishery.

6.5 *Collaborative research and industry participation in management decision*

The groundfish collapse has been a traumatic forcing driver, which has though led to positive changes in the ways of providing scientific advice and taking management decisions. The scientific world has been forced to learn from the errors that lead to misleading advice, and has opened its processes to industry participation. Although this collaborative research and co-management is far from being straightforward and error-free, it is clear that increased communication and industry involvement has helped restoring the credibility of science. It has also helped learning to accept uncertainty as inherent to fisheries science and management, and to live with it as a key factor to be accounted for in decisions. Because Europe has not experienced such a large scale collapse jeopardising the existence of a whole region, such changes in mentalities are slower to come up. The established system for scientific advice is fairly rigid, normalised and conservative, and is still providing deterministic advice based on projections and forecasts. Similarly, management decisions are still taken in a centralised way during negotiation between the Commission and fisheries ministers, without stakeholders participation. Some progresses have been made in that direction with the creation of the RACs (Regional Advisory Councils). But the mandate of these RACs should be extended from the consultative bodies they are now to partners engaged in scientific processes and management decisions. Furthermore, few initiatives of collaborative research have been already launched in the recent years in Europe, dealing with specific industry-based surveys. Such initiatives should be encouraged for improved communication and trust between scientists and fishermen.

6.6 *Integrated Fisheries Management Plans*

Management decisions for groundfish fisheries in Nova Scotia are not taken within short-term frames with large variations from year to year. Management is decided within Integrated Fisheries Management Plans with emphasis on long-term sustainability, inter-annual stability and commitment to the ecosystem approach. Moving in that direction in European fisheries would remove the pressure from the marathon negotiation of TACs in December, and would insure better stability while relying less on precise assessment. Extensive discussions are currently undertaken in the European Commission to go along those lines, and this should be supported.

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Acronyms list

CMB	Community Management Boards
VPA	Virtual Population Analysis
IQs	Individual quotas
ITQs	Individual Transferable Quotas
DFO	Department of Fisheries and Oceans
OBFM	Objectives-based Fishery Management
IFMP	Integrated Fishery Management Plans
FRCC	Fisheries Resource Conservation Council
CAD	Canadian dolars
CMB	Community Management Boards
RAP	Regional Advisory Process
FSRS	Fishermen and Scientists Research Society
GMP	Groundfish Management Plan
HCR	Harvest Control Rules
MSE	Management Strategies Evaluations
FRCC	Fisheries Resource Conservation Council
EBFM	Ecosystem Based Fisheries Management
OECD	Organisation for Economic Cooperation and Development
UNFA	United Nation Fisheries Agreement
TLA	Traffic Light Approach
EAFM	Ecosystem Approach to Fisheries Management
RACs	Regional Advisory Councils

Chapter 3

Evaluation of Iceland´s ITQ system

Anne-Sofie Christensen, Troels Jacob Heglan and Geir Oddson

Contents

1 Introduction

The fisheries sector is tremendously important in Iceland, which is - despite its modest population of little more than 300,000 - the twelfth largest seafood-producing nation in the world measured in terms of volume of catch and even higher measured in value. From the mid-1990s to 2004, fishing and processing represented between 8 and 13 percent of the overall Icelandic gross domestic product (GDP). The export of fish products accounts for more than 60 percent of the value of exported goods and around three quarters of the export value of fish products goes to European Union (EU) member states - the biggest importer of Icelandic fish products is the UK (Ministry of Fisheries 2005b). Thus, the state of the Icelandic fisheries sector strongly influences the overall state of the Icelandic economy.

Fisheries policy in Iceland is, consequently, of national importance to a degree, which is not comparable to any of the EU member states where the fisheries sectors in comparison seem insignificant – with the possible exceptions of the most fisheries dependent regions: *"Due to the size, scope and importance of fisheries in Iceland, policy formulation and decision-making on marine issues has far-reaching effect on the standard of living"* (Ministry of the Environment *et al.* 2004, p. 4). Iceland has never applied for membership of the EU, not least due to an unwillingness to accept the fisheries policy of the EU, which has been perceived as severely flawed. Sharing the responsibility for managing Icelandic fish stocks with the EU member states has, considering the importance of the sector, therefore not been considered an attractive option. The Icelandic emphasis on national jurisdiction over fish resources has long roots and includes dramatic incidents like the so-called Cod War(s) with the UK.

Demersal fish species (including cod, haddock, saithe, redfish and Greenland halibut), flatfish and shellfish constitute almost 80 percent of the value of landings even though around 70 percent of the total volume of landings is constituted by pelagic species. Cod, which is mainly caught in the Icelanders' own exclusive economic zone (EEZ), is the economically most important fish (Ministry of Fisheries 2005b). In fact, most of the Icelandic fish are caught in Iceland's own, highly productive waters, but the share caught outside own EEZ has been increasing in recent years. In 2002, catches from outside own zone constituted 24.3 percent of the total value of landings (Ministry of the Environment *et al.* 2004).
The number of persons employed in marine fishing has been gradually declining over the past years. Official estimates indicate that the number employed has dropped from approximately 7000 to under 5000 in the period from 1992 to 2004 (Ministry of Fisheries 2005b).

1.1 *Description of the Management System*

The Icelandic fisheries management system, of which the cornerstone is the Fisheries Management Act nr. 116/2006 (previously nr. 38/1990), is based on a system of individual transferable quota shares (ITQ). Iceland extended its EEZ to 200 nautical miles (nm) in 1975 and the current ITQ system, which has remained in essence the same since the beginning of the 1990s, evolved from an initial individual vessel quota (IVQ) system, which took effect for the first time in 1984. The development of this system was a reaction to the failure of a system of effort controls, which over the period from the 1950s to the 1970s had been unable to prevent overexploitation of Icelandic ground fish stocks.

1.2 *Historical Development and Basic Features*

As from 1984, the most important Icelandic fisheries have been managed by means of IVQs and subsequently ITQs. The IVQs were distributed based on historical catches in the period from 1981 to 1983. Initially the IVQ system was only adopted for one year, 1984; however, the system was subsequently reinstated for one year (with minor changes in allocations between vessel categories) and afterwards extended in two more - still time limited - periods, which resulted in the system running throughout 1990. In connection with the last extension, quota transferability was furthermore increased. Alongside, it was after the first year of the IVQ system decided to create an alternative, optional system of effort quotas. This system persisted more or less unchanged alongside the IVQ system until the next big change happened in 1990 with the adoption of the Fisheries Management Act (Gudmundsson *et al.* 2004; Ministry of Fisheries 2005a).

The Fisheries Management Act entered into force 1 January 1990 for the fishing year 1990/91[50]. The act extended the IVQ system without time limits and made quota shares completely divisible and transferable, although with certain restrictions applying – effectively converting the IVQ system into one of the purest ITQ systems in the world. The effort management system was furthermore abolished for all vessel groups besides the smallest vessels of less than 6 gross registered tonnes (GRT), which were offered the possibility to stay in an effort management system. Until this option was abolished by the end of 1993, vessels between 6 and 10 GRT could likewise choose to fish under a separate ITQ system or a hook and line system. Small boats under 6 GRT became part of the ITQ system in 2004, which means that all segments are managed under an ITQ system from 1st September 2006 (Gudmundsson *et al.* 2004). Special conditions apply hereafter for vessels under 15 tonnes, which is now the legally defined limit for being a small vessel. This includes that quota can be transferred to the small vessels from vessels larger than 15 GRT, but not the other way around.

The ITQ system entails that the Ministry of Fisheries sets a total allowable catch (TAC) for individual species after having received advice from the Icelandic Marine Research Institute (MRI). The TAC for each species is subsequently divided among those holding rights to catch a percentage of the species in question. The Minister is for most species not obliged to follow the advice from MRI, although in reality this will most often be the case. Importantly, however, a ‘harvest rule’ for cod was introduced in 1996 following a series of years where the TAC for cod had been set higher than recommended by MRI. The same years witnessed a series of declining recommended catches, TACs and actual catches. In 2000 the catch rule was amended to give room for flexibility if following the catch rule strictly results in major changes in the TAC from one year to the other (Gudmundsson *et al*. 2004; Ministry of Fisheries 2005b).

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50 The fishing year is from 1st September until 31st August the next year.

As the latest significant amendment some of the resource rent from the fisheries has from September 2004 been collected by means of a special tax imposed on quota holders (Ministry of Fisheries 2005a).

Table 1 contains an overview of the most important Icelandic fisheries policy-developments in the period from 1983 to 2005.

Table 1. Main Icelandic fisheries policy-developments 1983 – 2005

1975	The Icelandic EEZ is finally extended to 200 nm after a series of expansions of the EEZ in the previous decades.
1984	A system of IVQ quotas is applied from 1984. The system is in the following years changed and expanded.
1985	An alternative, optional system of effort quotas (days-at-sea) is introduced alongside the IVQ system.
1991	The Fisheries Management Act (nr. 38/1990) enters into force: Catch quotas without time limitations become divisible and fully transferable as from 1 January 1991 - effectively introducing an ITQ system. Vessels under 10 GRT (as from 1994 only vessels under 6 GRT) can operate under alternative management schemes.
1995	A catch rule for the Icelandic cod stock is introduced. The rule states that the annual TAC shall be set at 25 percent of the fishable biomass.
2000	The catch rule for cod is amended. Consequently, it becomes possible to deviate from the catch rule if the TAC would otherwise vary more than 25 percent in either direction from one fishing year to the next.
2004	A resource rent tax in the form of a fishing fee is introduced from the fall of 2004. The last segment of boats (under 6 GRT) is changed from optional effort management to the ITQ system (last boats go into the system in 2006).
(Gudmundsson *et al*. 2004; Ministry of Fisheries 2005a)	

1.3 *Research methods*

The report is based on two sources of information: 1) Desk studies including review of literature and WebPages, and 2) field studies producing qualitative interviews with key persons.

The desk studies were conducted both before the field study to get acquainted with the field and after returning from the field to check up on data etc.

19 interviews were conducted with people closely related to the Icelandic ITQ system. See Table 2 for profiles of the interviewees. The interviews focused on the four main areas: economic efficiency, cost-effectiveness of management, and social and biological robustness, but the individual interviews, of course, often favoured one or two of the perspectives depending on the person being interviewed. The interviews also covered the context of the ITQ system: The history and development of the ITQ system, the changes in costs and benefits for fisheries management operations associated with the innovation, what indicators they use to monitor and improve on outcomes, and what they see as the best practices in implementing, monitoring and enforcing the innovations and resulting management measures etc.

Table 2. Profiles of the people interviewed in this research

	Government	**Industry**	**Research**	**Green**	Total
Biologist	2	1	1	1	5
Economist/Law	4		4	1	9
Anthropologist/ social scientist			3		3
Fisheries candidate		1			1
Fisherman		1			1
Total	6	3	8	2	19

In the following sections, several technical aspects regarding the implementation of the ITQ system will be described in more detail as these contribute to the performance of the Icelandic management system.

2 Biological robustness

Copes and Pálsson (2000, p. 1) states from the sceptical perspective that *"ITQ systems, incidentally, cause significant adverse impacts on* [...] *biological conservation"*. Specifically according to Gundeman (cited in Pálsson 1998, p. 175) the Icelandic ITQ system is fundamentally built upon the idea *"that the human and natural world can be organised and subjected to rational, totalised control"*. It is believed, it is argued, that through privatisations the 'rational economic man' will organise himself so that the resources, upon which he depends, will be utilised optimally. Nevertheless, problems associated with unpredictability caused by natural fluctuations in resource abundance and to some extent the overexploitation caused by the dynamics of the 'tragedy of the commons' may not be overcome by the implementation of an ITQ system.

However, much of the reviewed literature seems to indicate that the Icelandic ITQ system has so far performed rather well in this respect. Some stocks have increased in size, most remarkably the haddock, some have maintained their size, e.g. wolffish, and some have declined, most seriously shrimp. It is hard to tell what has caused the different results for these different species, but it is likely that changes in the oceanic environment have contributed to the increase and decline observed (see Table 2 and Figures 1-4).

Table 3. Recent general trends in several important commercial species in Icelandic waters. A number of these stocks have shown changes in distribution and/or migration behaviour over the last few years. This has been attributed to environmental changes, mostly higher ocean temperatures, in the waters around Iceland. (Source MRI).

Table 3. Recent general trends in several important commercial species in Icelandic waters.

Positive	**Negative**
Haddock	Cod
Saithe	Halibut
Ling	Gr. halibut
Tusk	Shrimp
Flatfish stocks	Scallop
Monkfish	
Wolffish	
Nephrops (lobster)	
Herring	
Capelin	
Redfish	

It is likely that the result would have been much worse over this period of time if there had not been an effective management system in place. The status of the same stocks around the North Atlantic would indicate that the Icelandic Fisheries Management System has done better than most others in maintaining fish stocks. The most recent annual report by the Marine Research Institute (MRI) recommended a serious reduction in cod TACs for the fishing year 2007/2008, but at the same time a considerable increase in haddock TACs. The reduction in cod TACs was instigated by the continued poor recruitment of the cod stock and the increased risk of collapse of this most important stock in Icelandic waters. The Ministry of Fisheries (MoF) headed the advice and cut down the cod quota to 135 thousand tonnes, the lowest level ever. It remains to be seen if this action by the MoF is sufficient to ensure the continued viability of the cod stock, but at least it is a sign that there is currently a political will to work within the boundaries of the fisheries management system in times of crisis.

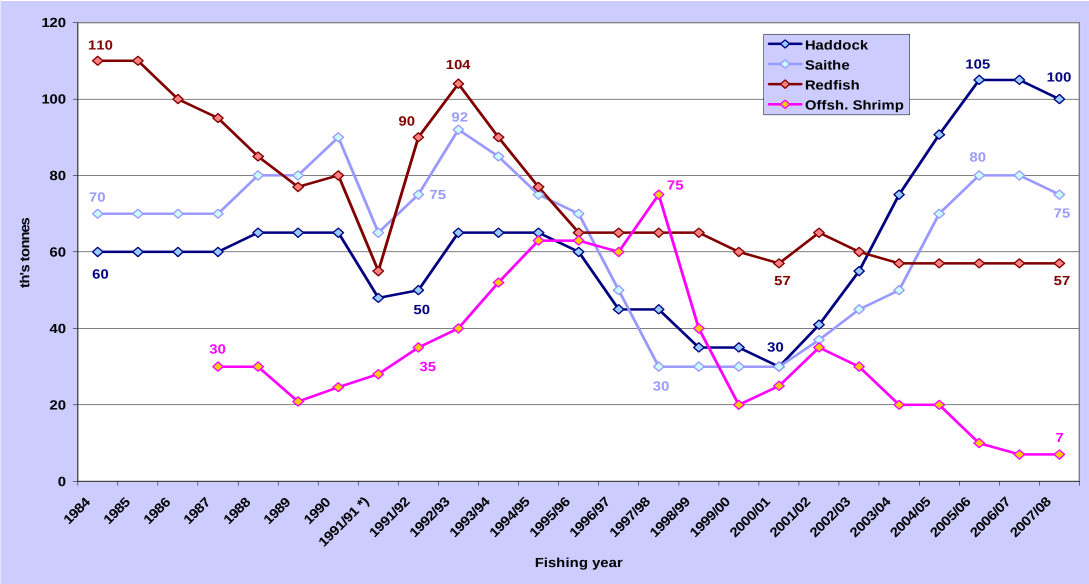

Figure 1. The trends of four different important commercial species that have been quite different as reflected in annual TACs. Haddock and saithe have been increasing greatly over the last few years, redfish has been stable after a sharp decline in the early 1990s and offshore shrimp has declined by almost 90% from the high in 1997/98. (Source: MRI and Directorate of Fisheries)

The change in the fisheries management regime into the current ITQ system, first reflected in the Fisheries Management Act of 1983, was largely a response to the declining recruitment of cod in Icelandic waters and the inability of the existing effort limitation management system to address the decline. The declining recruitment resulted in a great decline in the fishable biomass of cod and highly diminished catches. The stock (4 years and older) had grown from 844 thousand tonnes in 1973 to 1,500 thousand tonnes in 1980 (source: various MRI Status Reports). In 1983, however, the stock was down below 800 thousand tonnes and drastic measures were deemed necessary to arrest this development. Despite great hope for the rebuilding of the cod stock and some apparent success in the 1980s the cod stock was down to 550 thousand tonnes in 1995. The status of the stock was reflected in catches, which went from being 392 thousand tonnes of cod in 1987 to 187 thousand tonnes in 1994/5 (source: various MRI Status Reports, see Figure 2).

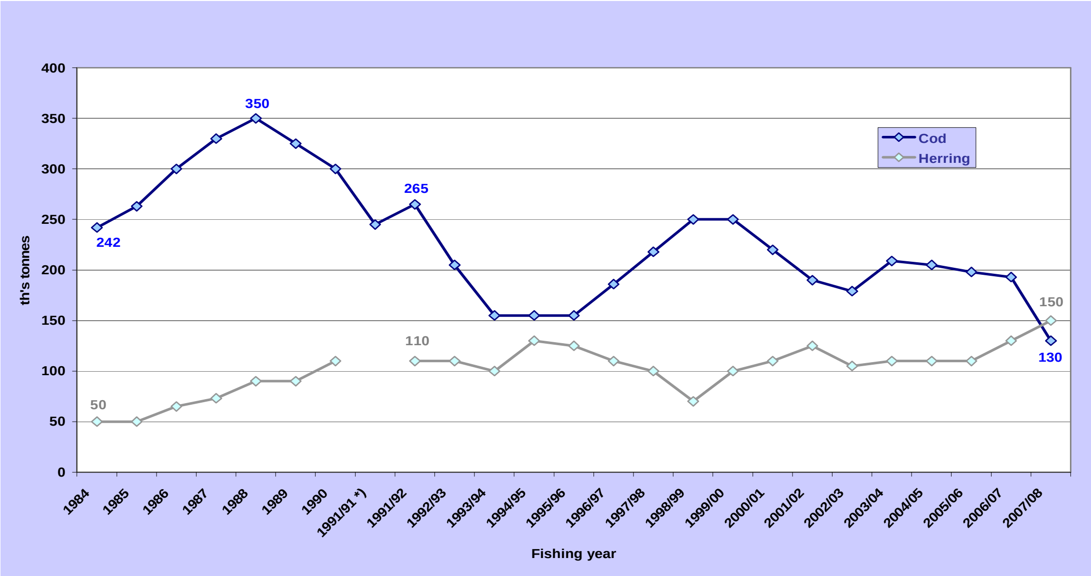

Figure 2. The trends in two important commercial stocks, cod and herring, as seen in TACs. Cod has been declining more or less continuously from 1987, while herring has been continuously increasing over the same time period. (Source: MRI and Directorate of Fisheries)

2.1 *Harvest control rule*

The Minister of Fisheries, in response to concerns over the declining status of stocks, formed a working group in 1992 that was intended to form recommendations for the long term sustainable utilization of fish stocks in Icelandic waters (Anon 1994). The main conclusion of that work was the formation of a harvest rule for the cod stock in Icelandic waters. The proposal for the harvest rule was that the TAC for cod would be 22% of the average of fishable biomass at the beginning of the year and the quota allocation of the previous year (Agnarsson *et al*. 2007). The MRI recommended a harvest rule that would allow a catch of 22-25% of the average of the fishable stock of the current year and the stock estimate for the coming year.

In the end, the MoF decided to enforce a harvest rule that allowed a catch of 25% of the fishable stock, but never less than 155 thousand tonnes (Agnarsson *et al*. 2007). This was first in force the fishing year 1995/6. In the year 2000, it became apparent that the size of the cod stock had been overestimated for a number of years. As a result of that the harvest rule was changed in such a way that the minimum of 155 thousand tonnes was abandoned, instead a buffer of a 30 thousand tonne maximum change in either direction was implemented (Agnarsson *et al*. 2007).

In 2001, the Minister of Fisheries formed a committee to look into the result of the harvest rule set in 1995 (Anon 2004). The committee found that despite the discrepancies between the recommendations of the working group from 1994 and the final version of the harvest rule implemented by the MoF, the harvest rule had had a positive effect on the cod stock (Anon 1994). The committee proposed that the recommendations of the working group from 1994 would be implemented, i.e. a harvest rule of 22% of the average of the fishable stock of the current year and the stock estimate for the coming year (Anon 2004). This was not implemented by the MoF. The last changes to the harvest rule were made in 2006, the fraction still being 25%, but now of the average as proposed by the 2004 committee and the max buffer is no longer in effect (Agnarsson *et al.* 2007).

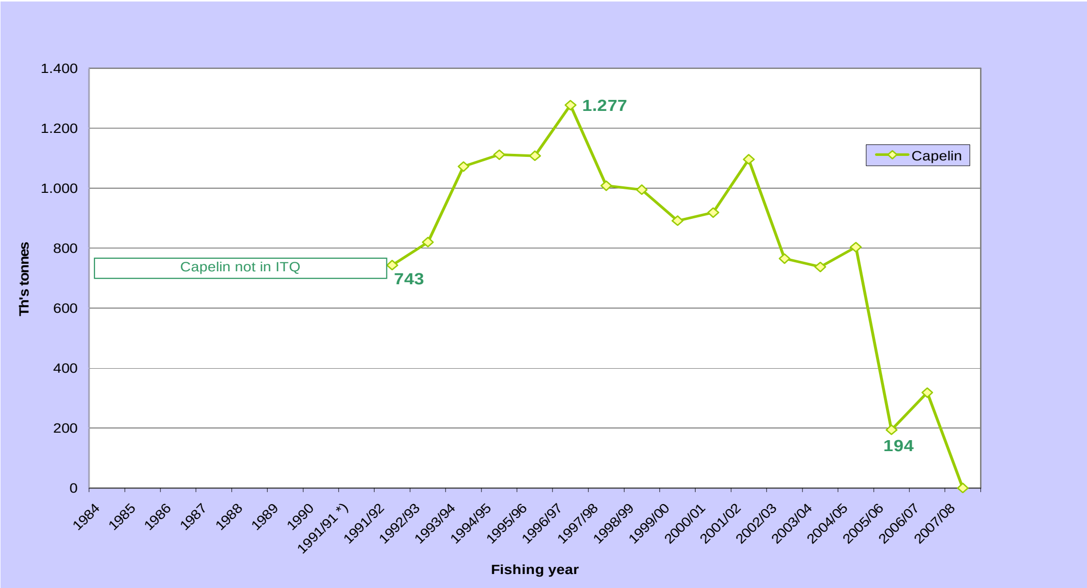

Figure 3. The decline in TACs for Capelin in Icelandic waters. No TAC had been determined for the fishing year 2007/08 at the beginning of the fishing year explaining the zero for that year. (Source: MRI and Directorate of Fisheries)

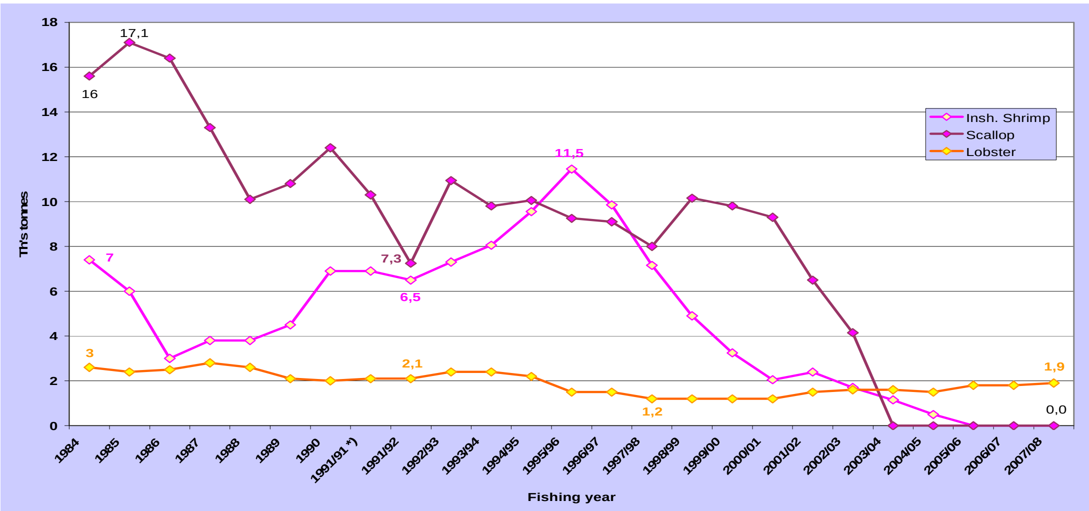

Figure 4. The trends in TACs for three important commercial species in Icelandic waters. Inshore shrimp and Scallop have almost disappeared from the fisheries while the Nephrops lobsters is stable and increasing. (Source: MRI and Directorate of Fisheries)

2.2 *Cod equivalents*

All commercial fish species in Icelandic waters that fall under the ITQ system (25 species in all) are allocated annually according to so-called *cod equivalents* (Ice. Thorskigildi) where cod is assigned a value of 1. According to the Fisheries Management Act no. 116/2006 (originally no. 38/1990) Article 19, cod equivalents are calculated as the proportion of the value of individual species to the value of gutted cod. The basis of the calculation is statistics for the total catch and total value of these species from the Directorate of Fisheries. For example, if we assume that the value of one kg of gutted cod is 150 ISK, the value of one kg of Redfish is 75 ISK and the value of one kg of lobster tails is 750 ISK, then one tonne of Redfish is half a cod equivalent tonne but one tonne of lobster equals five cod equivalent tonnes. The cod equivalent index would then be 0.5 for Redfish and 5.0 for lobster. The Directorate of Fisheries publishes cod equivalent tables annually (see Table 4). The cod equivalents fluctuate considerably between years, e.g. Capelin between 2005/06 and 2006/07 by +67%, Redfish between the same years by +28% and lobster between 2006/07 and 2007/08 by -27%. This is mostly due to changes in market prices.

Table 4. Examples of cod equivalent indexes for several important commercial species from 2000/01 to 2007/08 (source: Directorate of Fisheries http://www.fiskistofa.is/get_page.php?page=161).

	2007/08	2006/07	2005/06	2004/05	2003/04	2002/03	2001/02
Cod	1	1	1	1	1	1	1
Haddock	0,82	0,81	0,75	0,68	0,94	1,2	1,2
Saith	0,43	0,42	0,37	0,36	0,43	0,48	0,45
Redfish	0,6	0,69	0,54	0,47	0,5	0,54	0,55
Herring	0,1	0,13	0,14	0,09	0,1	0,16	0,06
Capelin	0,09	0,1	0,06	0,06	0,05	0,05	0,04
Lobster (tails)	5,05	6,42	6,45	6,52	6,74	7,15	6,95

2.3 *Temporary closed areas*

The Marine Research Institute (MRI) has for decades had a legal mandate to temporarily close off areas for fishing. These closures are generally based on information received from fisheries inspectors monitoring catch composition of vessels at sea. (Law nr. 79/1997, article 10). The main criteria for closure are that the proportion of undersized (juvenile or immature) fish reaches a certain level. The MRI sends out a closure notice to the fleet. Such closures can last for up to 14 days. If longer closures are deemed to be necessary the Ministry of Fisheries can publish a closure regulation stipulating the details of the closure (e.g. fishing gear, area and time). Other seasonal or permanent area closures or protections are also in force as stipulated in the Law on Fishing in Icelandic Waters (nr. 79/1997 with later changes).

3 Cost-effectiveness of management

In relation to cost effectiveness, Arnason *et al.* (2000) compares the costs of fisheries management with the value of landings in Iceland, Norway and Newfoundland, which are argued to have comparable fisheries. The article employs a narrow definition of fisheries management including only the activities carried out in order to counteract the problems, which arise from the common property nature of fish stocks (ex. weather forecast services, quality control and support for marketing are left out).

However, notwithstanding the narrow definition, the research reported in the article underlines that fisheries management costs are significant, especially in comparison with actual or attainable economic rents from the fishery, which is only a limited part of the value of landings. Arnason *et al.* (2000: 233) states that "[t]*aking it for granted that the purpose of fisheries management is to increase the flow of net economic benefits from the fishing activity, the costs of operating the fisheries management system itself are obviously among those that have to be subtracted to arrive at the net benefits of fishing."*

Arnason *et al.* (2000) conclude that Iceland has the lowest relative costs of management compared to the value of landings of the three cases. The costs of management on Iceland have remained rather stable in the period from 1990 to 1996, and it is concluded that the resource rents "in the Icelandic fisheries undoubtedly exceed the current 3% level of management expenditure" (Arnason *et al.*, 2000: 242), which means that benefits exceed costs. Compared to Iceland's 3 percent, Norway used between 8 and 13 percent in the period, and Newfoundland used between 15 and 25 percent. The main cost categories on Iceland are research and control/enforcement. The third category is administration costs in the Ministry of Fisheries and the Directorate of Fisheries.

The fact that Iceland is currently implementing a resource tax will naturally affect the ratio between public costs of management and public revenues.

4 Economic efficiency

The implementation of the Icelandic ITQ system was justified in several ways. It was argued that the system would create predictability and flexibility in comparison with the former TAC quota system. With the transferability of quotas, the system would be more flexible and capital used more efficiently. What the national economy would loose by giving away the resource, economists argued, would be regained through resource rents and sector efficiency (Eythórsson 2000).

From the perspective of the fishermen it did, of course, make sense to support the ITQ system when it was implemented, since they were offered large values for free (Copes and Pálsson 2000). In addition, there is no doubt that the leading fishing companies have benefited from the ITQ system. Many quota holders have through large-scale operations earned much profit and been able to expand their activities to international waters. This has, according to those in favour of the ITQ, led to increased international competitiveness, further benefiting the industry and possibly leading to increased employment in the long run (Eythórsson 2000).
One of the main anticipated benefits of the ITQ system was a reduction in fleet capacity and resulting increasing efficiency in the industry. After almost 20 years of IVQ/ITQ, Gudmundsson *et al*. (2004) provides evidence indicating that the Icelandic trawler fleet is becoming increasingly efficient, as the following example from the cod fishery describes. "[I]*n 1990 three fishing companies owned 10 vessels measuring a total of 6,850 GRT. The three companies held quota of about 20,000 metric tons in cod equivalent values or 5.6% of*

the overall TAC measured in cod equivalent values. By 2004 these three companies had merged into one. The new company controlled about 20,000 metric tons of cod equivalent value (5% of the overall TAC), but it now used only five vessels to harvest this quota. These five vessels measured 3,850 GRT. Three new vessels were bought instead of the eight vessels that the company either sold domestically or abroad or scrapped" (Gudmundsson *et al*. 2004, p.12). In the trawler fleet, which catches more than half of Iceland's demersal catch by volume (Ministry of Fisheries 2005b), there seems, consequently, to be an ongoing development where fewer vessels are needed to catch the same volume of quotas. The companies are increasingly taking advantage of economies of scale - as an adjustment to the incentives in the ITQ management system (Gudmundsson *et al*. 2004).

In a recent article, Arnason (2005) reviews the Icelandic fisheries management system and presents the economic benefits, which, he argues, have been provided by the ITQ system. Arnason concludes that there has been a significant, voluntary decrease in the number of vessels licensed to fish in Icelandic waters. This has happened in response to the incentives provided by the ITQ system. Since harvests have increased rather than decreased in the same period this development has lead to *"a substantial gain in economic efficiency"* (Arnason 2005, p. 259). Furthermore, the total market value (annual rental value) of the Icelandic quotas has increased sharply from a little more than 20 million US$ in 1984 to about 450 million US$ in 2002. The rental value is an indicator of the net rents, which the fisheries generate. This development leads Arnason to conclude: *"1. Since 1984, under the ITQ fisheries management system, the efficiency of the fisheries has increased dramatically. 2. Currently, the economic rents generated by the fisheries, as measured by the quota price evaluation, constitutes a substantial fraction of the average landed value"* (Arnason 2005, p. 259).

The Icelandic ITQ system has, it seems, shown to be successful in minimising the overcapacity (and increasing efficiency) of the fisheries industry - by many considered the biggest challenge of the fisheries sector worldwide. Moreover, when fishing capacity decreases and fishermen sell their vessels, the ITQ system may facilitate and smooth this transaction because earnings from the sale of quotas compensate fishermen leaving the industry. However, from the opposing perspective it has been argued that people in local communities who are not fishermen, but nevertheless depend on the fishing sectors (e.g. people in the processing or gear industry), are not compensated for their lost earnings, which creates unfair imbalances between those privileged with free quota shares and those not (Eythórsson 2000).

4.1 *Statistics*

All catches landed in Icelandic harbours are weighed by a licensed weight-master at accredited harbour scales upon landing (Regulation nr. 224/2006 replacing earlier regulations from 1996). All the 60 accredited harbour scales in Iceland are connected to a Directorate of Fisheries (DoF) database (called GAFL, DoF and Harbour Joint Database). The DoF publishes landings per boat per species and the resulting changes in quota status per species per boat every day (see DoF homepage where it is possible to access information on the quota status of individual vessels by species and by year http://www.fiskistofa.is/aflastodulisti.php). Special provisions are made for ice landed with iced fish and for gutted versus un-gutted fish. For catch processed at sea there are processing efficiency indexes (nýtingarstuðlar) accounting for the loss in the processing process.

Catch statistics are collected on a continuous basis in the Icelandic fisheries. Every licensed vessel is mandated to report catches electronically trough an electronical logbook system (latest regulation nr. 557/2007) to the Directorate of Fisheries. When combined with a satellite vessel monitoring system (VMS) this provides very reliable information to the Directorate of Fisheries for enforcement purposes and reliable statistics to the MRI for stock assessment purposes. The information reported in the electronic log book are: 1) name of ship, registration number and call code, 2) fishing gear, kind and size, 3) latitude and longitude of start of fishing, 4) Catch by weight and species composition, 5) date and 6) landing harbour.

The collection of fisheries related data in Iceland is accomplished through what is probably the most advanced data collection system currently in operation for a whole sector. This system presents the opportunity to monitor in near real-time the harvesting sub-sector both regarding individual species and particular vessels. The opportunity to manage the fisheries by for example adaptive, regional, species specific criteria exists. Such measures would probably detract from the economic efficiency of the current system, but could address some of the emerging and pressing biological and social issues facing the current management system.

4.2 *Fleet composition and development*

After the implementation of the IVQ system in 1984, it was expected that there would be a reduction in the Icelandic fleet. However, the fleet increased in both numbers and displacement. This is especially marked in the displacement of the trawling fleet and in the numbers of the open boats (see Figure 5 and Figure 6). The number of boats reached a maximum in 1990, the year before the new Fisheries Act was implemented. That year there were 2,321 vessels registered, an increase of 666 vessels from the implementation of the initial quota system in 1984 (see Figure 5). Most of this increase can be attributed to a great increase in open boats, from 825 in 1984 to 1,325 in 1990, an increase of 61%. Decked vessels remained fairly even during this period of time, reaching a maximum of 883 in 1990 and a minimum of 675 in 1997. The number of trawlers increased slowly from 107 in 1984 to a maximum of 121 in 1996. From the high in 1990 the overall number of vessels has decreased dramatically, with the number of fishing vessels in the Icelandic fleet in 2006 being 1692. Most considerable is the decrease in number of open boats, by 548 vessels, a 70% decrease and in trawlers by 58 vessels, a decrease of 92%.

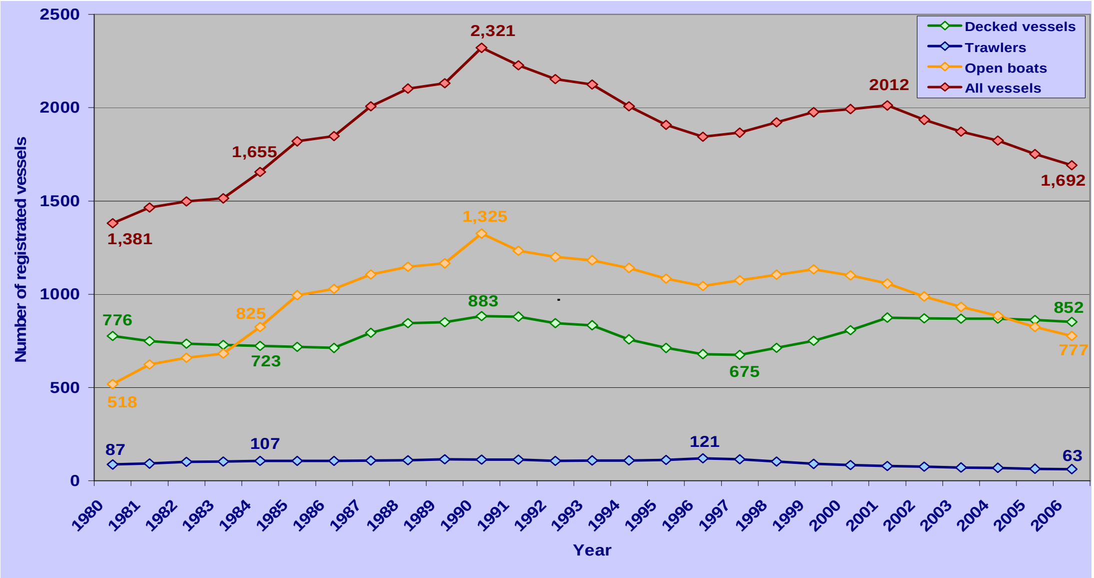

Figure 5. The number of registered Icelandic fishing vessels by class, 1980 – 2006 (source: Fiskifélag Íslands and Statistics Iceland).

These trends for trawlers and open boats have different explanations. It is inherent in ITQ systems that effort can be concentrated on larger more efficient vessels. This is precisely what happened in the Icelandic fisheries. Larger vessels were brought into the fisheries, and quota was moved from less efficient vessels to more efficient vessels within the same fishing company. This trend continues until 1997, after which we observe a decline by almost half in the number of vessels, but only by 41% in GRT (see Figure 6). That is a definite trend towards a fleet consisting of a fewer larger trawlers. Exactly, what one would expect.

The trend for open boats is quite different. Initially open boats were excluded from the IVQ system. This loophole resulted in an explosive growth in the number of small vessels (the initial cut off was at 10 GRT). In 1980, there were 518 small vessels. In 1984, there were 825 and in 1991 after the advent of the ITQ system, the number peaked at 1,325. The share of catch, especially in cod, caught by the small vessels increased commensurately, from less than 5% in 1983 to more than 20% in the 1990s. The small vessels have now been incorporated into the ITQ system although with some special provisions, and the observed decline in the number of small vessels continues unabated.

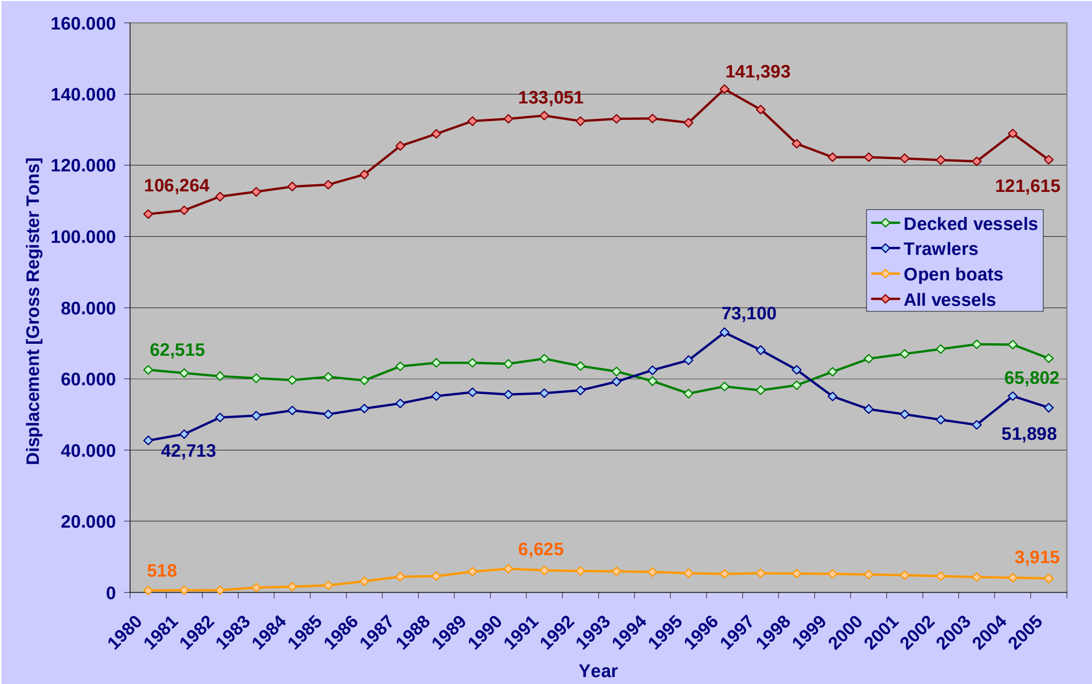

Figure 6. The displacement of the Icelandic fishing fleet 1980 – 2005 (Fiskifélag Íslands and Statistics Iceland).

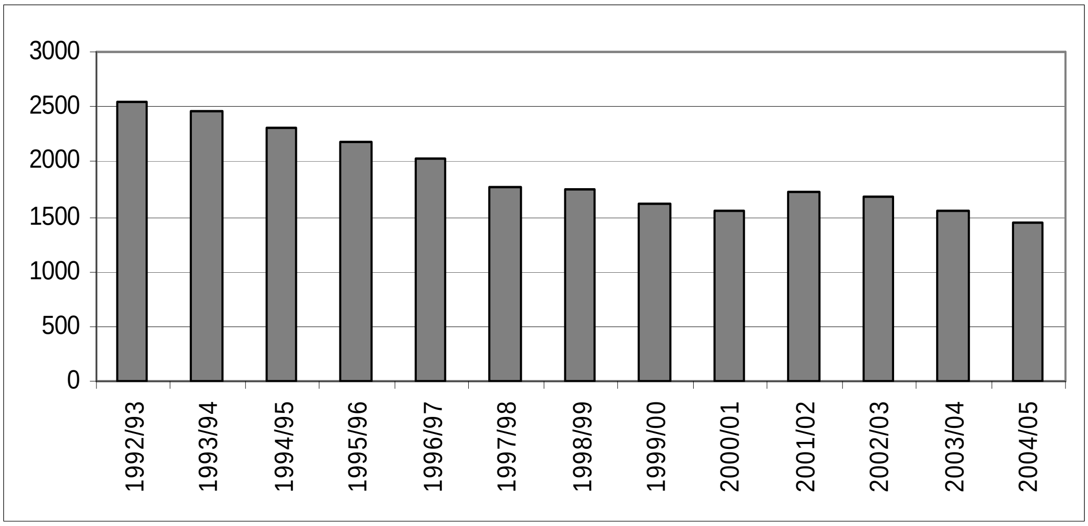

Figure 7 shows the number of commercial fishing permits issued 1992/93-2004/05. In this period of time the number of fishing permits has been reduced by over 1,000. As all fishing vessels are required to have an official fishing licence to engage in commercial fishing within the Icelandic exclusive economic zone (EEZ), this is a good indicator of fleet reduction (The Icelandic Ministry of Fisheries).

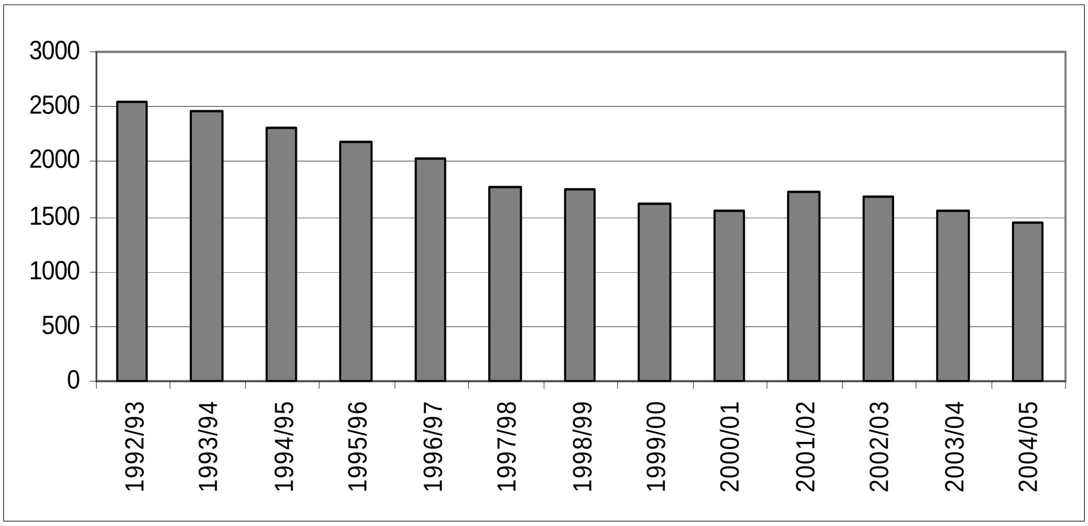

Figure 7. The number of commercial fishing permits issued 1992/93-2004/05.

Figure 8 shows an overall distribution of vessels and their shares of the catches in both tonnes and Icelandic króna for the year 2005 (The Icelandic Ministry of Fisheries, www.fisheries.is). This figure shows that a small part of the fleet, the 63 trawlers and multi purpose vessels (six percent of the fleet in terms of numbers) catch more than 40 percent of the harvest in value and more than 20 percent in weight. It also shows that about 40 percent of the Icelandic fleet (small vessels) catches less than 1 percent in terms of tonnes and less than 4 percent in terms of value.

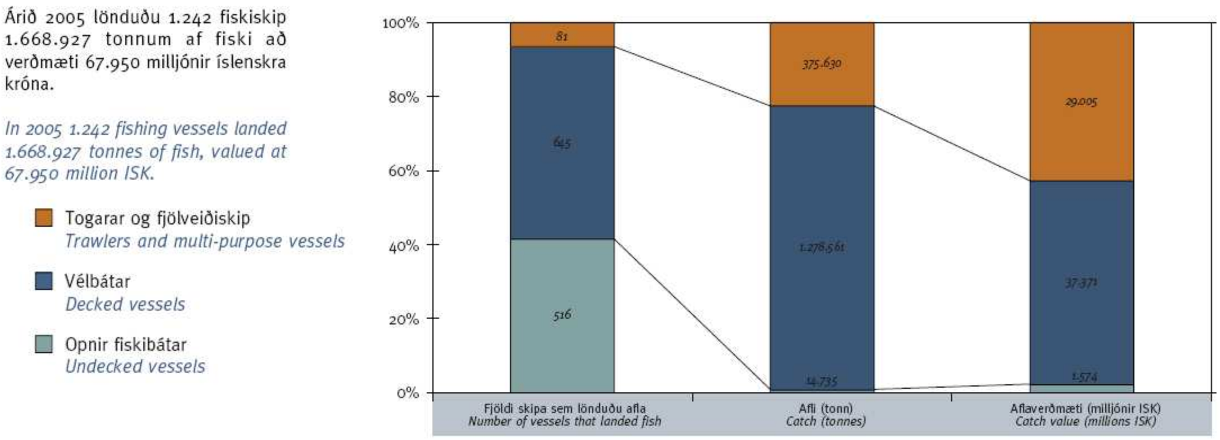

Figure 8. Overall distribution of vessels and their shares of the catches in both tonnes and Icelandic króna (The Icelandic Ministry of Fisheries, www.fisheries.is).

Trends in the fishing fleet composition, both in numbers and displacement fit with the expectations of how an ITQ system works. Fewer, larger more efficient vessels catch a majority of the fish both in value and weight. This consolidation is clearly seen in the declining number of fishing permits[51]. At the same time, both newcomers and established fishermen are exploiting all possible loopholes in the system. This is well expressed in the

51 There is also a consolidation in the processing sub-sector, as per section 5.3.

historical trends in the small vessel fleet.

5 Social robustness

The literature review has uncovered several debates relating to the performance and effects of the Icelandic fisheries management system. However, the debates seem on an overall level to be related to two different discourses on the ITQ system on Iceland. On one side is a discourse, which focuses on the positive effects of the system. The literature belonging to that discourse looks mainly at increases in economic efficiency and to some extent at the story in relation to conservation, which has, it seems, turned out being not nearly as negative as anticipated by some sceptics. One of the main authors from this perspective is Ragnar Arnason (Arnason 1996; Arnason *et al.* 2000; Arnason 2005; Arnason 2006). On the other side is a discourse, which is more sceptical towards the system – or at least focus on the negative aspects. The literature belonging to this discourse focuses largely on the distributional affects of the ITQ-system from different angles. One of the main authors from this perspective is Gísli Pálsson (Pálsson and Helgason 1995; Pàlsson and Helgason 1996; Pálsson 1998; Copes and Pálsson 2000).

The two discourses question only to a limited extent whether the other camp is right or wrong. They rather seem to focus on different issues and objectives of fisheries management. The reason for the discrepancy between the two sides can be illustrated by the use of the idea of conflicting fisheries world views. Charles (1992: 379) argues that *"conflict can often best be understood as rising from natural tensions between three differing fishery paradigms (or 'world views'), each based on a different set of policy objectives"*. Charles (1992) identified the three paradigms to be: *conservation*, which focuses on the policy objective of conservation in the sense of resource maintenance; *rationalization*, which focuses on economic performance in the sense of productivity; and *social / community*, which focuses on community welfare in the sense of equity, see
Figure 9.

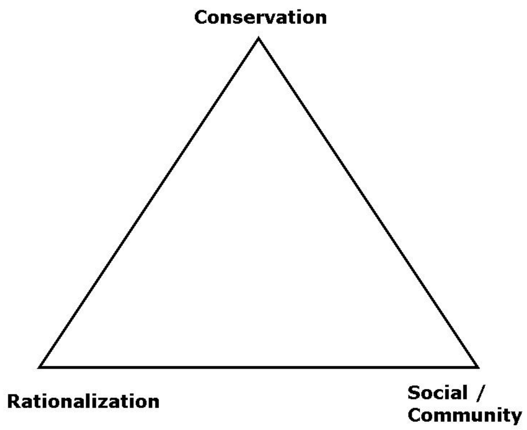

Figure 9. The Paradigm Triangle (Charles 1992).

The two conflicting discourses in the Icelandic debate can be understood as representations of respectively the rationalization and the social / community corner of Charles' (1992) triangle.

In the following, we will briefly look at the two discourses and some of the issues they have focussed on.

5.1 *Quota Concentration*

The debate over quota concentration has mainly focussed on two interrelated aspects: the concentration of quotas in larger firms and the regional concentration of quotas.

The negative consequences of the ITQ system for the remote fishing communities have, it seems, been significant. These problems have mostly been associated with perceptions of unfair distribution of opportunities, concentration of wealth and structural changes removing fisheries related activities away from small communities traditionally specialised in fisheries. As summed up by Copes (cited in Copes and Pálsson 2000) the *"gratis quota allocation gives windfall gains to the privileged few. Capitalization of quota rights at high values encourages their accumulation in the hands of corporations and wealthy investors. This facilitates financial and geographical concentration of fishing operations, with substitution of capital for labour, causing irrational excessive job loss. High quota costs deprive crewmembers of the traditional opportunity to become independent owner-operators, as they can no longer afford to purchase vessel with quota privileges. Communities historically dependent on adjacent fish stocks, find their economic viability – and sometimes their very existence – threatened when their resources are alienated to outsiders. Members of the public are scandalised by the gifting of access rights to public resources, privileged an emerging class of 'armchair fishermen' who become retires, living off the avails of quota leasing."*

As the following numbers illustrate, the ITQ system has resulted in a concentration of quotas (fisheries access rights). In 1999, the 20 biggest quota owners held 57 percent of the total quotas in comparison to 1991 where the 22 largest quota owners held only 26 percent of the total quotas (Eythórsson 2000). Similarly, there has been a dramatic reduction in the number of quota holders from 535 in 1984 to 391 in 1994, a reduction of 144 quota-holders - or 27 percent. Moreover, the quotas have been concentrated among large-scale quota-holders, whereas the number of people owning small amounts of quotas have diminished (Pálsson and Helgason 1995; Pálsson 1998).

A result of the ITQ system has according to Eythórsson (2000) been marginalisation of some fishing communities. This has especially been the case for the smallest communities under 500 inhabitants. These small communities have lost to the larger communities in a competition for quotas. The ITQ system has supposedly not only led to a consolidation in terms of larger companies but also a relative concentration of activity in larger fishing communities leaving the smaller communities with fewer sources of income as the processing plants loose their source of raw material when fleets move elsewhere.

For many of the smaller fishing communities of Iceland one of the fundamental difficulties has been that many of the people do not have the means to obtain fishing rights. And, when excluded from the fishery, they find that alternative livelihood activities are scarce (Eythórsson 2000; Orebech 2005). When these people see large quantities of fish quotas being traded, they may wonder whether the ITQ system has created a fair balance between what fisheries contribute in respect to welfare maximisation as opposed to wealth maximisation.

Where financial resources used to circulate in the local communities, they are increasingly transferred to non-local institutions in larger urban centres or worldwide (Orebech 2005). Not only do the local communities have few alternative employment opportunities outside the fisheries sector, the contract fishing, which earlier was an employment option for the people of the small communities, has also diminished and re-entry into the sector through the purchase of smaller boats is not economically feasible for most people of the communities. Moreover, the land based fish processing has also declined as processing increasingly occurs on the vessels (Eythórsson 2000).

5.2 *Salary of Employed Fishermen*

With the introduction of the ITQ system, the access to fisheries has become a tradable commodity. The system allows for quotas to be transferred between vessels and hence, the ITQs have increasingly been subjected to quota leasing. This typically occurs when a vessel is short of quotas and therefore enters into a contract with a quota owner. Under these agreements the fisher is frequently obliged to sell his/her fish for a fixed price from which the quota price is subtracted. This has led to the Icelandic cod fisheries experiencing that fishermen sell raw fish for approximately half the free marked price. The people suffering from such arrangements are often crew members as they usually receive their salary as a fixed share of the fish price on delivery. In 1998, after many protests from fishing crews, a ‘share-price office’ was established to secure minimum prices for fish and hence minimum wages for the fisheries crew (Eythórsson 2000).

5.3 *Community quotas and coastal communities*

The community quotas (byggðakvótar) were introduced in the fishing year 2002/03 (regulation nr. 909/2002) to address some of the criticism of the ITQ system, specifically the reputed effect of quota consolidation in larger communities resulting in movement of people away from smaller communities.

The term ‘community quotas’ refers to a small part (currently around 4000 tonnes of cod-equivalent) of the Icelandic quota allowance that is given to small communities (about 20 communities get the quotas). Introducing the regional quotas was a highly political decision, which caused legal problems. The distribution of the regional quotas is based on a formula of employment, how much they are dependent on fisheries, if quotas have been transferred away from the areas and so on. This is not in any legislation; the Minister himself decides on the distribution of these quotas annually by a special regulation (nr. 909/2002, nr. 596/2003, nr. 960/2004, nr. 722/2005 and nr. 439/2007). Some years the Minister has not distributed the entire community quota. But there seems to be consensus on the process and most people have accepted the system of distribution under the new regulation.

Table 5. Community quota allocations in cod equivalents and the number of communities that have received the

quota 2002/03 to 2006/07 (source Ministry of Fisheries and Directorate of Fisheries).

	Cod equivalents (mt gutted fish)	**Communities**
2002/03	2000*	--
2003/04	1500	36
2004/05	3200	41
2005/06	4010	43
2006/07	4385	47

*2002/03 allocations in un-gutted fish

The regulation on community quotas was reviewed before the fishing year 2007/08. Until now the small villages have decided for themselves who in the community should get the quota. This has caused some problems within the local communities, where everybody knows everybody; and everybody wants the quotas. The changes to be made are to ensure that these processes are running smoother. In some cases, the system has worked okay, in others the system has failed. The local communities do not have the means to distribute the quotas in proper ways. The quotas are supposed to support communities, not the vessel owners.

Aside from the regional quotas, another measure has been introduced to improve the situation of the coastal communities: "Línuívilnun" means that the quota for the longliners having their lines prepared on shore is reduced by 16 percent less than for other vessels. Hence, this measure enhances both the use of longliners, which are considered to be biologically sustainable, and preserves jobs on shore.

It is still highly contentious if indeed trading quota shares away from (or towards) a community has any effect either way. Looking at the trends in proportinal employment in the fisheries sector in Iceland (see Table 6.) the overall trend is clearly moving towards a diminished importance of fisheries as a source of employment.

Table 6. Employment in the fishing industry as a proportion of total employment (Source: Statistics Iceland)

	1998	**2002**	**2005**
Reykjavik area	2,7	2	1,7
Sudurnes	23,8	18,1	15,3
Vesturland	19,3	17	15,5
Vestfirdir	37,7	32,2	28,6
Nordurland west	16,8	13,7	11,2
Nordurland east	17,8	14,7	13,4
Austurland	28,3	26,2	17,5
Sudurland	14,9	11,8	9,9
All Iceland	10,1	7,9	6,6

The most recent published study on the effect of quota trading on community development by Hall *et al.* (2002) does not find any patterns or trends. Agnarsson has recently presented a further analysis on the subject at the IIFET conference in 2006 and at a recent conference in Reykjavik showing no significant relationship between landings (presenting local quota share ownership) and population change in Iceland. There is however, not surprisingly, a weak relationship between fish processed in the local community and population change (see Table 7.).

Table 7. Changes in population and bottom fish catch in Vestfirdir 1998-2006 (Source: Directorate of Fisheries, Statistic Iceland).

	Population	Landed catch (mt)	Processed catch (mt)
Bildudalur	-125	-1,874	-2,125
Bolungarvik	-116	2,864	-408
Drangsnes	-39	1,001	379
Flateyri	19	5,56	9,965
Hnifsdalur	-84	0	5,501
Holmavik	-45	573	-1
Isafjordur	-213	-5,747	-18,858
Patreksfjordur	-125	-2,471	-428
Sudureyri	-18	-2,041	1,497
Sudavik	-19	624	85
Talknafjordur	-50	-1,361	1,164
Thingeyri	-59	-139	197

People stay in the communities if there is work available commensurate to their expectations of income and services (or new labor will replace the emigrants). The changes in suitable employment opportunities in the fishing communities around Iceland is therefore of great interest when examining migration patterns. As shown in Table 8. the number of facilities in Iceland that are processing bottomfish has diminished by somewhere between 20-50%. These numbers fit very well with the concentration in quota discussed earlier.

Table 8. Number of facilities processing cod and other demersal species 1992 to 2004 (Source: Directorate of Fisheries, Statistic Iceland).

	Cod		**Other demersal species**	
	Frozen	**Salted**	Frozen	**Salted**
1992	50	41	50	34
1993	48	39	49	34
1994	50	40	50	34
1995	49	46	49	37
1996	49	47	50	34
1997	48	45	49	37
1998	46	42	44	29
1999	43	43	44	33
2000	40	45	38	34
2001	43	38	44	27
2002	40	35	42	26
2003	40	37	42	24
2004	34	34	35	25

5.4 *Legality and Fairness*

The Icelandic ITQ system has led to much debate over definitions of ‘property and access rights’. Not least because the Icelandic government continues to argue that even under the current ITQ system the Icelandic fisheries resources can be characterised as a common property, albeit under the supervision of the state on behalf of the public. However, arguments such as the “*transactions of uncaught fish violate the rule of capture and the common property nature of the fishing stock*” (Pálsson 1998, p. 283) have been numerous in the debate. While quota-holders/fishermen under the ITQ system have private property rights in the sense that their share of the right to utilize the resource can be traded on a free market, their utilisations of their particular share of the resource is submitted to rules entirely defined by the state.

When the IVQ system was introduced in 1984, fishing vessels were allocated unequal shares of quotas based on their catches the previous three years. This, as well as the semi-perpetual awarding of ITQ shares by the Fisheries Management Act, has since led to many disputes over the fairness and legality of the process by which a public property resource was handed over to individual fishermen. Eythórsson (2000) argues that a number of court cases indicate that the legislation relating to the ITQ system was not sufficiently well designed from the outset and that the Parliament would probably have been reluctant to award the ITQ shares for free without time-limits if the implications had been realised in 1990. However, the Fisheries Management Act represents *de fact*o a ‘point of no return’. On the other hand Helgi Áss Gétarsson, specialist at the Law Institute of the University of Iceland, has pointed out that firstly almost all of the current quota shares have changed hands since the initial allocation, i.e. have been traded and secondly that the allocation in 1990 was based on catch records/history going back at least to 1980. The argument of fairness or lack thereof, has to be viewed in light of this fact.

According to Eythórsson (2000) one of the main legal problems has been the need to uphold a paradoxical status of quota shares, which means that they are by law public property, but for all practical purposes functions as private property. Because of this paradox, the sector experienced several court cases in the late 1990s. An important example is the 1998 case (Kvótadómur) regarding a fisher who was denied obtaining a fishing licence and a catch quota because he had not been an active fisherman in the 1980s when quotas were allocated. Eythórsson (2000:490) describes the outcome of the case in this way: "*Considering the Icelandic constitution, which claims equal employment rights for every citizen, and the Fisheries Management Act of 1990, which defines the fish resources as public property, the majority of the Court found* […] *that by introducing the ITQ system the government had given away exclusive rights to the publicly owned Icelandic fish resources. These had been given away as perpetual rights to a group of people who happened to be the owners of active fishing vessels at a certain point in time. Such an act could not be justified by the need to preserve the resources or by the best public interest*".

In short, the implementation of the IVQ/ITQ system was declared unconstitutional due to the *de facto* perpetual character of the allocation of ITQ shares. The High Court (Hæstiréttur) was not unanimous, a minority opinion pointed out that the statement made by the majority of the Court about giving away perpetual rights to an exclusive group of people in 1983 is simply not right since the allocation in 1990 had been based on much wider criteria. The research by Grétarsson and others, mentioned earlier, seems to support this minority opinion. However, the ruling resulted in an amendment to the Fisheries Act 38/1990 giving Icelandic citizens a general right to obtaining a fishing license on demand. This did, however, not change the fact that newcomers still had to either buy permanently or lease temporarily a costly quota to be able to fish. The need for a quota was later challenged in the courts. However, the fisher, who had fished without quota, lost the case in the High Court after having won in a lower court. In this case, the majority of the High Court found that the quotas were not formally defined as private property, and that they were justified on conservation grounds. It is notable that neither of the rulings were unanimous (Copes and Pálsson 2000; Eythórsson 2000).

As opposition towards the ITQ system has increased, one major concern has been that it may be very difficult to reverse the ITQ system. Many citizens feel that they have lost, definitively, what used to belong to them. To compensate society, the discussion about 'resource rental' has become increasingly central in the ITQ debate. While the public largely supported the idea, in the light of the large resources having been handed over to the quota owners, the industry saw resource rentals as yet another tax that would diminish their competitiveness. Another alternative which was put forward in the Icelandic fisheries debate was the idea that the fishermen annually instead of resource rentals return a small percentage of their quotas to the state which would then be auctioned at an open auction (on auctions in quota systems see e.g. Anderson and Holland 2006). Consequently, the public would, in the long run, regain their ownership over fish resources (Eythórsson 2000). The outcome of this debate was the resource tax, which is described earlier.

It has been pointed out, e.g. by Agnarsson *et al.* 2007 and Hall *et al.* 2002 that the ITQ system has become a synonym for everything negative that happened in the development of small coastal communities around Iceland. It is hard to see how any other management system would have done any better, considering the circumstances and changes in the economy and society in general. In the end, the decisions to sell or lease quotas out of the communities really come down to the individuals or enterprises that own the quota shares, not the "system".

Regarding the issue of fairness, Orebech (2005, p. 166) adds by arguing that *"technically, the privatization policy of ITQs involves robbing the excluded fishermen of their assets (open access) without the payment of compensation"*. The excluded fishermen refer to coming generations of fishermen or newcomers into the sector that are underprivileged because they must buy quotas that the first generation of quota holders got for free. Consequently, in the transition period between first and second generation of quota holders, the relative competitiveness of the second generation to the first generation is imbalanced (Orebech 2005). It has therefore been increasingly difficult for newcomers to enter into the fishery, since the price of the right to fish is too high to make their activities profitable. On the other hand it can be argued that larger enterprises often have a larger group of shareholders, and therefore there are probably many more owners/participants in the Icelandic fisheries sector than at any point in time.

The conclusions Orebech draws are possibly not specifically applicable to the Icelandic case. Both in the initial 1983 allocation and in the 1990 allocation, the quota shares went to boat owners (in most cases not fishermen as such) that had history in the fisheries. This implicates that the individuals/enterprises that were allocated the quota got it because they had made a considerable investment into the harvesting sector. This raises the question of the fairness of newcomers getting access and quota shares without similarly making an initial investment. This has been pointed out numerous times in the literature (e.g. Arnason 1996, 1999 and 2005, Hall *et al.* 2002, etc.)

6 Conclusions

The Icelandic fisheries were, along with the New Zealand fisheries, one of the first in the world to be subjected to a comprehensive quota system. Initially the quota was on a vessel basis, non transferable and an option along with effort management for a part of the fleet, albeit the most important part of the fleet. Over the last 23 years several changes have been made to the quota system and currently all commercial fisheries in Iceland are subject to ITQ management. It is important to realize that the ITQ system is only a part of the fisheries management system in Iceland. The ITQ system ensures that the Icelandic fishing fleet adheres very precisely to the annual TACs of the 25 commercial species contained in the system. The MRI recommends an annual TAC for all commercial species. This recommendation derives from catch statistics, independent survey data and other scientific information available. Based on the advice and discussions with stakeholder representatives, the Minister of Fisheries decides on the TACs for the coming fishing year. The biological performance of the fisheries management system is deduced from a scientific process that precedes the ITQ mechanism of distributing annual catch allowances. Biological performance is therefore more related to the vagaries of politics than anything else. It depends on how closely the Minister of Fisheries follows the advice of the fisheries scientists at the MRI.

The ITQ part of the fisheries management system has ensured that the economic performance of the fisheries sector in Iceland has been good. However, the resulting consolidation of quota shares and processing capacity has been hard for many small fishing communities in Iceland. A large part of the Icelandic public relates the ITQ system directly to the changes in population and employment patterns that have occurred over the last two decades. That is certainly oversimplification of causes and effects.

The evolution of the Icelandic fisheries management regime over the last two decades contains a number of lessons both of success and mistakes. These lessons are important to have in mind when considering future development of fisheries management.

7 Best practices

7.1 *Initial allocation of quota*

Initial allocation should be made in percentages of the quota

The ITQ systems of Iceland and New Zealand have many similarities, but they handled the initial allocation of the quota differently. In New Zealand they made the initial allocation in fixed tonnages, which caused severe problems afterwards. Fixed amount quotas put managers in a difficult position when having to set down the TAC, as they will then have to buy back quota, which they cannot necessarily afford. New Zealand therefore changed the system into allocation in percentages of the quota. In Iceland, they made the initial allocation in percentages, and hence avoided the issues they had in this respect in New Zealand.

ITQs should not be given out in perpetuity

The ITQs on Iceland is not given out in perpetuity. But the Icelandic system gives the same benefits, as one would expect from a right-based system. Hence there is no need to hand out the quota shares in perpetuity, as in New Zealand, as the Icelandic system performs marketwise as well as the New Zealandic system. Hence, giving out quota in perpetuity would just take potential flexibility out of the ITQ system.

7.2 *Effects of the ITQ*

ITQ is a powerful tool to make the fleet adapt to the TAC:

In Iceland’s ITQ system, operators can plan their activities in order to be most efficient. Since the implementation of the ITQ system the Icelandic fleet has not overshot the annual TAC.

7.3 *Flexibility of the ITQ*

All quota systems face the challenge of fishermen not being able to control the catches. Hence, all quota systems have to deal with the differences between the allowed catches and the unintended catches. In Iceland, discard is banned. The Icelandic fisheries management system has developed a number of flexibilities in the quota system to minimise discard. These flexibilities are essential for the success in order for the quotas to match the fluctuations of nature and unpredictable fisheries:

Flexibility of quota over both previous and next year is essential if introducing a discard ban.
Flexibility in buying/leasing quota is essential if introducing a discard ban.
Flexibility in buying/leasing quota between fishermen is essential for an ITQ system to work.

7.4 *Enforcement*

Strong enforcement framework accompanied by an accurate system of monitoring:

The enforcement system in Iceland is supported by a real time, online catch reporting system, which is coordinated with the amounts of quota of the vessel. Everybody has access to the information of this system.

The enforcement system has to be flexible and reviewed regularly.

Giving the biologists authority to close down areas up to two weeks without political amendment:
This ensures a fast response from the observation of undersize fish in an area to the closure.

7.5 *Participation by fishermen*

When deciding upon technical measures:

Fishermen’s expertise should be incorporated when establishing technical measures to reduce by-catch. In Iceland, fishermen formally play a small role in the management system, but in practise they have easy and direct access to the Minister, who has the final say in most matters.

When setting TACs:

In Iceland, a Harvest Control Rule on cod, HCR, has been introduced. It makes the setting of TACs robust to both economic and biological changes. The fishermen were part of the formulation process for HCR, but formally the fishermen do not play a role in the setting of the TACs: In Iceland, the Minister has the final say in setting the TAC, and the fishermen do not play any formal role in the management system, but in practise they have easy and direct access to the Minister.

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Acronyms list

GDP	Gross Domestic Product
EU	European Union
EEZ	Exclusive Economic Zone
IVQ	Individual Vessel Quota
GRT	Gross Registered Tonnes
TAC	Total Allowable Catch
MRI	Icelandic Marine Research Institute
MoF	The Ministry of Fisheries
DoF	Directorate of Fisheries
GAFL	Icelandic acronym for DoF and Harbour Joint Database.

Chapter 4

Evaluation of New Zealand's QMS system

Martin Aranda and Anne-Sofie Christensen

Contents

1 Introduction

The rise of the Extended Fisheries Jurisdiction (EFJ) during the 1970s encouraged states to devise mechanisms to occupy and exploit their recent enlarged maritime jurisdictions. Before this change, most countries in the world had maritime domains up to 12 nautical miles. Outside these boundaries, fishing was carried out by industrialised fishing nations able to operate distant water fishing fleets (DWFF). Albeit the extent of the exploitation carried out by DWFF in the high seas will never be known, DWFF discovered a large variety of fishing resources and opened seafood commercialisation channels.

After extending their maritime jurisdictions to 200 nautical miles, many nations encouraged the development of their national fishing industries. New Zealand was not an exception and declared jurisdiction on the 200 nautical miles off country’s littoral. The emergence of a wide Exclusive Economic Zone (EEZ) encouraged government to promote growth of the local fishing industry, especially the deep-water sector. New Zealand’s government soon recognised that protective measures generated a rush for fish and subsequent overexploitation. Consequently, government turned its attention to a market-based solution.

Although the seeds of the New Zealand’s Quota Management System (QMS) can be tracked back to ideas emerged in other places of the world, there is a meaningful component developed in New Zealand. These features of the QMS are shaped by the particular characteristics of the country and its fisheries, which have not had a long tradition before the QMS inception. New Zealand consists of two main islands and does not share any resource with neighbouring countries. Thus, the country can perform as a sort of laboratory in which experiments on fisheries management have taken place without much influence from outside.

New Zealand has developed a management system that is unique. Since the introduction of the EFJ, New Zealand’s fisheries have substantially changed. It has been the result of a long process of learning and adjusting steered by a government belief that market has to guide the evolution of this industry. This is a *sui generis* case in which most of the intrinsic characteristics of the fishery were propitious to a system based on individual transferable quotas (e.g. limited number of harbours, a relatively small initial number of species to manage).

Government’s aim of reducing responsibilities and management costs and a permanent seek for value adding for the industry has changed the structure of New Zealand’s fisheries. The system is based on property rights and has many complementary mechanisms that are innovations to management on their own such as private research, cost recovery, and stakeholder participation. Moreover, several auxiliary instruments such as the paper trail instrument and the discount rate mechanism to reduce sea mammals discard deserve to be described.

2 Rationale and methodology

The CEVIS project aims at evaluating innovative approaches for European fisheries management such as participatory governance, right-based management, decision rules and effort control. The CEVIS WP3 team planned visits to four places outside Europe that have implemented innovations to fisheries management. These places were Alaska, Maritime Canada, Iceland and New Zealand. The case of the New Zealand Quota Management System (QMS) was chosen due to its in-depth implementation of right-based management and the various complementary innovations such as participation, cost recovery, and private research.

Our aim was to find the reasons for the inception of such a comprehensive right-based management and find out how particular conditions of the country and its fisheries have reshaped what originally was an application of a theoretical approach, from which many expectations emerged, into what is now a referred example of successful management. We also aimed at knowing what the unexpected outcomes were and what adjustments were required to counteract these negative outcomes, in order to understand how the QMS has managed to survive and to reach relative success.

Twenty years have passed since the QMS inception and both foreign and native researchers have drawn many lessons. We have gathered evidence from these lessons through a literature review carried out in the first stage of the WP. The literature review allowed us to get acquainted in touch with the case and to identify key sources of information that led us to key people and institutions. The second stage was the study trip that allowed us to get in closer touch with the case and its actors, while seeking for the sources of success or failure during the QMS implementation.

The interviews took place in three cities (Wellington, Auckland and Nelson) where main management and harvesting activities are based. Interviews took place between November 13^{th} and 28^{th}, 2006. Prior arrangements were done to interview four key representatives from the Ministry of Fisheries, Seafood Council, conservationists and academic realm. These representatives directed us to a broader group of conservationists and private researchers and customary representatives belonging to a variety of academic disciplines.

23 people (see Table 1) were interviewed and their main contributions to our study are presented in this report. Informants were addressed by introducing the aim of the CEVIS project and by assuring recordings and information provided will be kept anonymously. We asked two kinds of questions: 1) Open questions on how the system had evolved during the last 20 years from their perspective, and 2) specific questions focusing on those aspects in which the informant contributes the best according to his/her background and the new information he/she was providing. These questions were more focused.

The New Zealanders we interviewed were all open in expressing their views and helpful in directing us to other people and providing printed information such as scientific papers and informative documents. The first informant told us that "*Public is part of our culture, it's the New Zealand way*". All other informants confirmed this. This could be one of the reasons for the openness of the people in the system.

Table 1. Professional affiliations and academic background of the interview participants

	Government	Industry	Research	Green	Academic	Customary	
Biologist	3	1	2	2	1	1	10
Economist	5	1	1		1		8
Anthropologist			1				1
Fisheries representative		2					2
Journalist	1			1			2
	9	4	4	3	2	1	23

3 The New Zealand Quota Management System (QMS)

3.1 *Background of the innovation*

When the government, in 1978, extended the maritime jurisdiction to 200 nautical miles, a range of fish stocks came under national control. Harte (2000) reports that foreign fleets previously exploited offshore fisheries with few controls on catching operations. In the early 1980s, the country had a low yielding fishery since overexploitation led inshore fisheries into crisis, and licensed foreign fleets largely dominated the deep-sea fishery within the EEZ. Government issued financial aid and tax reductions to encourage the development of the offshore fleet. Stakeholders used economic support to develop larger and more efficient offshore capacity that finally was diverted to the already depleted inshore fisheries (Strakker et al, 2002). Consequently, DWFF predominated until the early 1980s, while inshore resources were seriously threatened.

Thus in the Fisheries Act 1983 the government introduced a quota based mechanism to manage the seven deepwater fisheries, which is also known as the Deepwater Allocation System (DAS). This can be considered the precursor of the current ITQ system (called QMS for quota management system). Quotas for the deepwater fisheries were allocated for ten years and were not transferable (Lock and Leslie, 2007). Clark (1993) reports that one of the goals of the DAS introduction was to encourage and secure the development of the deep-sea fishery. In 1985, quotas allocated for deep-water species were granted in perpetuity. After a long appeal process for inshore fisheries that lasted for 12 months, both deep and inshore fisheries were brought into the QMS from October 1986, following the Fisheries Amendment Act 1986 (Lock and Leslie, 2007).

In a more general economic context, the New Zealand government introduced many changes in the early 1980s since economic crisis called for immediate and drastic actions. Minister of Finance, Roger Douglas, propelled the introduction of liberal measures in many key economic activities aka *"rogernomics"* (Dewees, 2006). The general liberalisation plan included telecommunications, postal services, health services, education, etc. Hanneson (2004) points out that the general economic plan aimed at making the economy more competitive and open by lowering tariff barriers and dismantling subsidies. One senior manager illustrated the radical decision of privatising a public asset with this statement: *"the inception of the QMS was a brave decision back then, but seen in context there were many brave decisions at that time in history"*.

According to Connor (2001a), the property right solution was preceded by a substantial consultation process before finalising the allocation process in legislation. This process included all interests but the Maori's. A key management officer informed us that this process consisted of a pole carried out among all boat owners in all fisheries ending up in a majority supporting the property right alternative. Connor (2001a) reports that the consultation process aimed at rising support and commitment from the fishermen. To achieve this aim government produced documents outlining the proposal and held meetings around the country.

3.2 *The introduction of the QMS*

In October the 1st 1986, the QMS was extended to all inshore and offshore fisheries. This system performed a fixed fish tonnage allocation to be held in perpetuity (Symes and Crean, 1995). These rights were allocated for free to the existing participants, they were transferable, and imposed a 20% limit in ownership for inshore stocks and a 35% limit for deep-water stocks[52].

The QMS assured the right to use the resource, while the fishing permit remained as the right of access. Initial fixed amounts of fish were allocated according to historical catch. Although rights were allocated for free, requirements for initial allocation were rather demanding. Rights were allocated to holders of fishing permits in May 1985. To receive permits under the new QMS, fishermen were required to demonstrate that they received 80% of their income or NZ$10,000 from fisheries in the fishing year 1982/1983. 2,260 permit holders (46%) could not meet this requirement and were considered part-timers. Thus they were excluded from the rights allocation (Strakker *et al*., 2002).

Fishermen were left the sole decision of keeping their rights or transferring them. Rights were considered an asset from the very beginning. Social scientists criticized that the informative process was poor, and many boat owners sold their quota because they found the process of keeping control of their catches and other formalities extremely complex: *"Some fishermen didn't even bother getting quota. Others sold fairly quickly to companies, understanding they would be able to lease them back"*. Fishermen therefore decided to sell their rights to big companies. Leasing back hardly happened and many were expelled from the system.

In 1990, the original specification of QMS in fixed tons was changed into percentages of the Total Allowable Catch (TAC) (Connor, 2001b). Regarding characteristics of the property

52 According to Deewes (2006), the original design of the QMS was sketched by Ministry of Fisheries' economists, who were inspired by a paper by Maloney and Pearce, published in the Journal of the Fisheries Research Board of Canada in 1979.

right, it seems that a combination of desirable qualities such as durability, transferability and security have most likely been the seeds of the steady growth of New Zealand' fishing industry. Bess and Harte (2000) report that during the first ten years of QMS the positives outcomes were a rise in industry profitability, high levels of investment and improved fish availability due to developments in assessment and recovery strategies.

In the beginning, the setting of the TACs had to face a limited knowledge about stock abundance and distribution. Other difficulties were encountered in finding the criteria on how to allocate rights among stakeholders. An inexperienced Monitoring Control and Surveillance system (MCS) had to face the challenge of controlling and keeping track of illegal activities as quota busting, black marketing, and high grading. Quota busting, for instance, demanded effective and strict control. New Zealand enjoys some advantages such as having a limited number of harbours where vessels can offload and, hence, a reasonable control can be carried out.

The enforcement apparatus effectively backed up the implementation process. Enforcement and punishment actions were strong. For instance, penalties for quota busting were hard, including immediate confiscation of boat and gear. At the same time to stop 'black marketing' of fish, a computerised paper trail was set up to accompany all fish entered and sold in shops in New Zealand. By-catch and high grading problems also needed time to be resolved. New Zealand has responded to these challenges implementing innovations to enhance the MCS by installing the first satellite fishing tracking system in the world, the Vessels Monitoring System (VMS), in 1994.

Fig. 1. Map showing the fisheries management areas (FMAs) in New Zealand. Source: Ministry of Fisheries.

3.3 *The core of the QMS*

3.3.1 Characteristics of property rights

According to theory, property rights comprise six characteristics (Scott, 1988): transferability, duration, quality of the title, exclusivity and flexibility. The informants pointed out that all these characteristics are inherent to the QMS to a high extent. Economists mainly aiming at economic objectives such as development of offshore fisheries, reduction of government intervention and rise of exports designed the system. Most informants considered the system to be of success since it has added a meaningful source of income to New Zealand and has allowed for the development of a modern and competitive national fishing industry.

The characteristics of the QMS have generated the restructure of the industry mostly in hands of vertically integrated companies. These factors criticised by social scientists and conservationists have meant the growth of fish exports (see Figure 3).

The initial allocation was carried out in fixed tonnage. When government decided to cut Total Allowable Commercial Catch (TACC) for orange roughy due to stock declines, high quality of the property titles encouraged stakeholders to oppose decisions and even to challenge government. Government reacted accordingly and expressed rights as percentages of the TACC[53]. This measure improved resource protection and shifted risk from government to stakeholders (Stakker et al, 2002).

It is worth saying that decisions of TACC cuts always have been surrounded by controversy and hot debate. Stakeholders have in several opportunities opposed substantial reductions of TACCs and even taken government to court. At the time of writing this report, the decision of the Minister of Fisheries, Jim Anderton, to reduce the TACCs in the orange roughy fishery from 914 tonnes to 870 tonnes in waters from Bay of Plenty, north to Cape Reigna and through to east coast of the North Island (ORH 1) was challenged by Antons Fishery in the High Court (The Independent Financial Report)[54]. A similar announcement in late September 2006 provoked a judicial process started by the same fishing company. On that occasion, the Minister did not defend the case in tribunals. Instead he introduced the Fisheries Amendment Bill that will give the Minister great powers in resource sustainability. This proposal has not been approved by the parliament yet. Antons Fisheries found that the decision "*was unjustified on any scientific, rational and legislative decision*".

In a very different case, decision to cut down quotas for hoky by 10% to 90,000 tonnes have

53 The Fisheries Amendment Act 1990 modified quota entitlements from fixed tonnage of fish to a proportion of the TACC. Each fishery stock was divided in one hundred million shares.

54 At the time of writing this report (09/2007) the Minister of Fisheries, Jim Anderton, has recently announced various measures for the sake of sustainability. Among these measures is the rise of deemed value for the West Coast North Island snapper and the closure of the orange roughy fishery off central West Coast of the South Island (ORH 7B). The Minister has also decided on the reductions of the TACCs for various stocks such as the stock of orange roughy of the South and East Chatham Rise (ORH 3B), the orange roughy stock in waters from Bay of Plenty, north to Cape Reigna and through to east coast of the North Island (ORH 1), and hoky in all New Zealand waters (Ministry of Fisheries Web Page).

been welcomed by the two giants of the New Zealand industry, Sealord and Sanford. These two companies requested the Minister to downsize the TACC to 80,000 tonnes. On the other hand, smaller operators have recently requested to the Minister to keep the TACC for hoky in 100,000 tonnes since a substantial reduction of 20% will harm small operators. It seems that a process of negotiation has taken place in which government has managed to counterbalance both factions and sustainability goals.

It is remarkable that the government has changed attitude towards its mind many times in order to let the market guide the process. In the beginning there was a belief that the government would buy quotas back and sell them later functioning as a bank. It has never happened. Stakeholders have ended up buying and selling quotas directly among them.

The introduction of annual catch entitlements (ACE)[55] as an instrument allowing companies to fish a certain amount of fish according to the annual TACC and to trade it without needing to sell their rights forever have smoothed the process of ownership change. However, nobody is obliged to trade ACE. ACE can be considered as an instrument to open a wide variety of possibilities for stakeholders.

Some other rules launched by the government establish limitation on quota ownership. A government officer pointed out that *"theoretically four or five companies could own the entire fishery"*. Government position is consistent to this market based approach and that officer stated that if market determines that only the four fittest companies own the fishery, it would enhance a more accurate monitoring and, consequently, it would reduce costs. The market-based solution has also allowed reducing costs that are huge in other countries such as collection of economic data on fleets characteristics and operations. In addition, the threatening ghost of overcapacity is not considered as such. Therefore no subsides and decommission schemes are carried out.

The philosophy of no government intervention has also established that cost for research and management must be recovered from users. Some costs for recreational and customary activities are still borne by the government, but all other costs are covered by the industry (see 4.2). The system of cost recovery has led some of our informants to make controversial statements on the research focus.

The QMS is widely accepted by the stakeholders, a fact that is considered advantageous for its application. A comment by one industry representative illustrates this fact well *"Many people are satisfied with the system because they got something for nothing. It means that now they are owners of a quota that they can trade. In the past they just had an allowance to fish"*.

3.3.2 The compliance system

An effective Individual Transferable Quota (ITQ) system has to be backed up by an effective

55 Although ACE was introduced in the Fisheries Amendment Act 1996, technical limitations delayed its implementation until 2001.

judicial system able to punish infractions on the established rules (Arnason, 1992). In New Zealand, such judicial apparatus together with an efficient MCS system are the backbone of the QMS.

The Ministry of Fisheries' infrastructure includes patrols, a boat tracking system supported by satellite and an experienced staff, in cooperation with the military forces. Major offences include falsifying of records, misreporting, dumping, illegal fishing and declaration of catches from other areas than those where boats are not allowed to fish. In the latter case, the Ministry uses forensic science and DNA analysis to determine whether or not fish have been caught in a given area. Compliance staff compares catch compositions from vessels with observers on board with those from vessels without observers in order to identify misreporting and possible dumping. There may be an important amount of misreporting in offshore fisheries. A green pointed out that *"fish caught on vessels with observers on board are smaller on average than on the boats with no observers"*. In spite of this, it seems that compliance officers consider stakeholders essential in identifying non-compliant activities and active in denouncing them. A manager pointed out *"We depend on quota holders to prevent dumping activities because it is their assets that are being eroded"*.

Informants considered punishment as draconian. The punishments include confiscation of fishing vessels and gear, withdrawal of licenses and quotas, and penalties and sometimes even imprisonment. Several of the informants pointed out that discarding of species with low economic value is likely to take place in spite of the deemed value system, which is designed to counteract discarding. The MCS system controls the paper trial system and fulfilment of the technical measures such as mesh size, size limits, area restrictions and limits imposed on effort in the squid fishery. However, technical measures are not a major issue in the management of New Zealand fisheries, which according to a management officer is in line with the philosophy of market-based regime. Costs of compliance are recovered from the industry. The government pays compliance costs for recreational and customary fishermen.

4 The complementary innovations of the QMS

The QMS system in New Zealand is best known for the distribution of quotas through ITQs. But a number of innovations complement the ITQs in regulation of the fisheries. The QMS is not solely market based; some parts of the system are highly regulated by government. One of the most remarkable innovations of the QMS is that parts of the system (e.g. research, administration, fisheries observers, etc.) are paid by the industry through *the cost recovery programme*. Another noticeable innovation is the system of *deemed value,* a fee that allows fishermen to over fish the TAC in order to prevent discard. The prices of both schemes are calculated and set annually with the TAC. These two innovations and the innovations of *paper trail* and *discount rates* are further discussed below. Active participation and consultation are other features that accompany the system and that are in line with both the government's philosophy of openness and the stakeholders' sense of ownership.

4.1 *Participation*

One of the most apparent things about the management system in New Zealand is the active participation of actors in the process of management. The system is steered by the Ministry of Fisheries, but an active process of consultancy with stakeholders is taking place. Consultancy can be tracked back to the days prior the QMS inception when Ministry's officers were sent to harbours to discuss with fishermen on the possibility of introducing an ITQ system in New Zealand (Connor, 2001 a).

Early in the process decisions started to change the face of New Zealand fisheries, while participation started to shape up when companies gathered in commercial stakeholder organisations (CSOs) under the umbrella of New Zealand Seafood Council (SeaFIC). This is especially the case when management issues are in hearing. Industry representatives pointed out that organisation of the industry is complex and that there is poor collaboration between CSOs. Within a CSO differences in interests are complex and in many case conflictive. Industry participates actively in discussion papers such as the initial position review of the TACCs, conversion factors, and final advice paper.

Stakeholders, including industry, conservationist and customary interests participate together with the Ministry, science providers and other government departments in the research planning process as part of the planning groups and coordinating committee. Stakeholders revisit and contest the outcome from the stock assessment working groups in the plenary held yearly in May. The main outcome of the plenary is the Plenary Report, which is the basis for management recommendations. Stakeholder participation is said to bring about stakeholder understanding of research needs and improve assessment with meaningful input. On the other hand, stakeholders' participation in said to be complex and time consuming.

It is interesting to see that the setting of some technical measures such as excluding devices for sea lions include the industry as an input-giving factor. Participation also involves conservationist groups. They have an increasing role, but the lack of funding was pointed out as one of the main reasons for the greens to lack active participation. A management officer suggested that may be the government "*will help the green next - who knows. Otherwise their representation will drift away from the intention*". The bigger green organisations can be found in some stock assessment meetings, but they too are constrained in funding.

Even though the Minister of Fisheries takes ultimate decisions, stakeholders' participation is meaningful in some of the key aspects of management such as MCS. The government and the industry have borne together some responsibilities and costs of the MCS system.

Stakeholders participate actively in the setting of management objectives. This aspect internalises responsibilities and produces legitimacy and, consequently, enhances compliance. Stakeholders' involvement in the process of management is such that they have proposed banning bottom trawling and dredging from 31% of the EEZ and 6% of the territorial sea. The Ministry of Fisheries needs a range of inputs from stakeholders to assist them in making good fisheries management decisions. Each year the Ministry and stakeholders undertake a research planning process that results in the Proposed Fisheries Research Plan. The Minister of

Fisheries as part of the Ministry's work plan or Statement of Intent approves the revised document. A substantial portion of the costs of many of these research projects is recovered from the commercial fishing industry.

4.2 *The cost recovery regime (CRR)*

The cost recovery programme was introduced in 1994 substituting a system of resource rent. According to Stokes *et al.* (2006) the principles supporting Cost Recovery Regime (CRR) request individuals to pay for exploitation of resources from which they are benefiting and taking into account that exploitation may cause harm and risk to the aquatic environment as stated in the Fisheries Act 1996. The CCR aims at recovering the costs of management, including compliance, and research for all commercially exploited stocks. Costs are allocated to individual fisheries whenever possibly. On the other hand, the government pays for the costs of public interest, which involves customary and recreational fisheries. Costs for multi-sector fisheries[56] are shared between industry and government.

Stokes *et al.* (2006) describes the various objectives aimed at by the actors involved in the CCR: For government objectives are efficiency, accountability and reduction of the dominance of the provider of services. For the industry objectives are reduction of costs, interest in services provided, purchase and delivery of services by the industry. For research providers objectives are independence in collaborating with either industry or government and competitiveness determined by the range of potential providers of services.

According to Peacey (2007), CCR allows the Ministry to recover about 30% of annual budget (30 million NZ$). One of the main advantages of the CCR is that it is said to provide strong focus on cost-effective research methods. On the other hand, it is administratively complex, and scientific merits are clouded by cost considerations. Harte (2006) sees among the various advantages of the CCR the improvement of accountability and transparency in the delivery of management services, involvement of industry in the determinations of management services and generation of efficiency in the delivery of services.

The way the CRR works through consultation is a huge driver in the QMS since CCR is a comprehensive system of commercial fishermen paying the expenses of fisheries management, research, and enforcement. A scientist suggested that the CRR is restricting research. Usually scientific advice is followed, for example, in 1999 the TACC for orange roughy was cut down from 48,000 to 8,000 tonnes. Since in many cases scientific advice suggests reducing TACCs, it is a strong incentive to reduce research. Moreover, conservationists point out that industry's paying of research somehow direct research to most profitable species.

4.3 *The deemed value instrument*

[56] Based on resources being exploited by inshore, customary and recreational stakeholders such as snapper.

Discard is often one of the biggest problems of a quota system, but banning discard in a quota system without allowing some degree of flexibility into the system may not work. In New Zealand, they created the system of deemed value to address the issues of discard twenty years ago. The original idea behind deemed value was to create an instrument that encourages fishermen not to target above the TACC instead of dumping catches in an ever-changing market. A manager put it simple: *"The incentives needed to be such that they didn't target outside the TACC"*.

The deemed value instrument is applied when fishermen exceed their quota (and cannot/will not buy or rent more quota). Thus they have to pay the deemed value to the government. The deemed value is set annually and balanced so that the fishermen should neither gain nor loose economically from exceeding the quotas; hence there are no economic incentives to discard and no incentives to keep fishing after the quota is caught. The system of deemed value is very flexible: If a fisherman go fishing without ACE or ITQ, or over-fish, he has to pay deemed value of the catches on the 15^{th} of the following month. Until then he can buy ACE or ITQ to fit his catch and hence not pay the deemed value. If he pays deemed value, but buy ACE or ITQ within the end of the year, he can have the deemed value refunded.

One of the key points is setting the deemed value. The equilibrium in the deemed value system is difficult to achieve. The setting is based on economic calculations of prices. To set the deemed value so that the system obtains the required effects is almost impossible as the deemed value is interactive with the prices of fish and of ITQ/ACE. When the deemed value is set too high, the deemed value undermines the quota/ACE-prices by encouraging people not to buy quota or to discard, which is illegal, but nevertheless it is happening around New Zealand according to many of our informants. When the deemed value is set too low, the fishermen have strong incentives to over-fish the TAC within the legal boundaries.

This system was one of the most criticised features of the QMS. An economist stated that he did not consider deemed value to enhance sustainability because it allowed the TACC to be over-fished; he considered the deemed value to be yet another tax. A biologist who said that deemed value has resulted in an economic invitation to exceed TACC supports this. There were many polarised opinions on the deemed value as an effective instrument of management, and conservationists pointed out that due to crews paying deemed value they tend to discard when the deemed value is too high. On the other hand, a relevant faction of conservationists believes a rise in deemed values may support conservationist measures. At the time of writing this report a key representative of the Environment and Conservationist Organisation (ECO) has welcomed the decision of government to rise deemed value in one of the most important commercial fisheries: *"The big increases (of deemed value) in fisheries like the West Coast North Island snapper should help to bring catches back within quota limits"*. [57] (Scoop Independent News).

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[57] At the time of writing this report (09/2007) Ministry of Fisheries Jim Anderton has recently announced various measures for the sake of sustainability. Among these measures are deemed value for the West Coast North Island snapper and the closure of the orange roughy fishery off central West Coast of the South Island (ORH 7B) (Ministry of Fisheries Web Page).

However, strong compliance may discourage crews to discard. Although confiscation of the boat may be a threat only to the boat owner, crews can be prosecuted. On the other hand, a low deemed value allows crews to make good profits. A management officer let us know that this instrument has been changed many times, and is thus slowly being improved by both government and industry. A working group composed of industry and government representatives has sent out a discussion paper on this issue. The big question is, however, whether this tool is suitable for mixed fisheries. In a mixed fishery it is more likely that low value species will be dumped, and that fishermen will pay deemed value for the species obtaining higher prices, which will at least allow them to recover the deemed value paid.

4.4 *The paper trial system*

The paper trail system has been one of the pillars of the QMS since the beginning of the system. Management officers considered that the paper trial is antiquated now because of problems with compliance due to emerging ways of regulation circumvention. Early during the QMS inception, managers realised that strong compliance measures were required for the QMS to be effective. Penalties for quote busting, for instance, were hard, including immediate confiscation of boat and gear. At the same time, to stop ‘black marketing’ of fish, the computerised paper trail emerged to accompany all fish entered into and sold in shops in New Zealand.

Currently, the paper trail system is being broadly criticised. Some fishermen criticized the paper trail system for not working well: “*the paper work is too heavy and complicated and it is followed buy substantial fines if it is not done right*”. A fishermen representative stated that the Ministry refused to give instructions in how to fill out the papers, as the Ministry did not want to risk getting sued if wrong advice was given. Hence, the Ministry tells the fishermen to seek legal advice if they have doubts to avoid the risk of giving wrong advice. This was confirmed in the department of compliance in the Ministry; this had to be seen as an unfortunate consequence of QMS.

Other people pointed out that the paper trail system had caused damage to local communities: The paper trail system is based on inspection leaving only means to sustain the larger landing sites. As New Zealand geographically covers a large area most landing sites were closed down in order for enforcement of the system to be possible. Not only the landing sites are controlled – also the receivers of the fish are controlled. A large number of fish receivers (e.g. local fish markets, restaurants, etc.) were refused license, as the amounts of fish were too small. One of the results is that it is impossible to buy fresh caught fish in most local areas of New Zealand.

4.5 *The discount rate instrument for reducing sea mammal by-catch*

The discount rate can be seen as a system of incentives for the fishermen to adopt technical measures to avoid by-catch into the fisheries. The system of discount rate applies to squid trawlers in the southern waters of New Zealand. The problem in the squid fisheries is that sea lions feed on squid. Hence, sea lions are often caught when fishermen target squid. Often the sea lions are by-catch of squid fisheries and are killed in the process, and the rate of survival for the sea lions that manage to escape from the fishing gear is very low.

In order to reduce the number of sea lions killed, the industry was proactive in developing new technology of excluding devices by employing people from overseas to help developing technical measures. *"Fishermen are active in developing gear for avoiding seabirds and sea mammals"* said encomiastic a key management officer. Fishermen managed to come up with an excluding panel which releases the sea lions by a slide leading up to the top of the trawl.

The squid fisheries are managed by a dual system: the normal TACC system and a maximum allowance of killed sea lions per vessels. The system of maximum allowance of killed sea lions per vessel works through calculated averages: For example, the Minister can decide that the fishery related mortality limit (FRML) is 200 sea lions a year. This setting of the FRML can be based on both political and biological objectives. Often the greens in New Zealand have strong protective attitudes towards sea mammals and work intensively to reduce the FRML. From FRML the Minister can calculate backwards: He knows that the by catch rate for sea lions equals 6 sea lions per 100 tows. The squid fisheries have to end up either before 3.333 tows are made or when the TACC is caught. The result is that the squid fisheries are stopped before the TACC for squid is caught. The system of discount rate fits into this system. If the fishermen voluntarily install the excluding panel in the trawl, they get 20% extra tows as about 20% of the sea lions survive an encounter with the excluding panel.

5 The outcomes of the QMS implementation

5.1 *Fishing industry development*

Since the introduction of the QMS, a substantial increase has happened in both quantity of harvest and its value for many species in the QMS system. During the first years, the system allowed the rise of employment mainly in the processing sector due to the fact that rights allow a long term planning horizon that stimulates investment in technological improvements, hence diversifying and adding value in a competitive processing sector (Annala, 1996 and Batstone and Sharp, 1999). However, trends in employment levels in the inshore sector are reverting due to the fact that bigger companies prefer to process abroad.

Broadly speaking, security of tenure and other attractive characteristics of the New Zealand's property rights model have encouraged operations planning and technological development, not only in infrastructure investment, but also in research and technological innovation. These positive spill-over effects have spread onto other sectors outside the QMS such as aquaculture. The case of the Greenshell™ is a good example of the latter (Bess and Harte, 2000). Furthermore, Bess (2005b) points out that investment in innovation has allowed for the development of some highly vertically integrated fishing companies that compete worldwide. The inception of the QMS has meant the transformation of a local supplier fishing industry into one of the most dynamic and developed export sectors in New Zealand.

Most of the fishing industry growth was experienced in the offshore sector between 1986 and 1989. At that time, local fleet lacked offshore capability and charter vessels carried out fishing. Between 1990 and 1992 a sharp increase in exports is registered and local companies invested heavily in deep-water capabilities and sea farming (Bess, 2005a). Batstone and Sharp (1999) suggest that the introduction of the system has been fleet developmental, probably because it did not start facing a strong overcapacity problem. For example, Connor (2001) reports an increase in the overall fleet size of about 43% during the period 1987-1998 and it is mainly due to the growth of the offshore fleet (>33m), which was built to replace charter vessels and to increase specialization. In the case of the inshore fleet it has shown little variation in size although it has experienced significant restructuring including vessels replacement, ownership patterns, gear configuration, and changed targeting. The capacity of the core inshore fleet in the range 12-24m has been kept constant from the mid 1970s.

The only sector of the fleet that has experienced a significant reduction has been the inshore segment of <12m. The drop in its capacity is estimated to around 70%. This fact seems to be an effect of a shift towards larger average size vessels. For instance the segment 24-33m has developed from a few boats in the middle seventies to a significant sector of the fleet. These boats are being devoted to harvest species other than the inshore species, which means an overall decrease in the capacity devoted to these species since the introduction of the quota. Since in general terms the changes in fleet structure have been more developmental than capacity reductive, it seems that the predominant change in industry has been quota concentration without meaningful capacity reduction. Connor (2001) argues that gains in efficiency were located outside the harvesting sector, for instance, returns to scale in the processing and export sector, synergies between the inshore and offshore operations, new and larger companies, and rationalization among the existing medium firms, but without important impact on fleet capacity.

One of the expected consequences of an ITQ inception is quota concentration. Stewart *et al.* (2005) have studied quota concentration in New Zealand. This team has elaborated a profile of exiters. They have found out that most exiters were boat owners without involvement in processing. These stakeholders had several years of involvement in the industry and made a rather quick decision of leaving. According to Stewart’s study, exiters left the industry voluntarily and for a variety of reasons other than loss of competitiveness. Exiters have not met many problems in finding alternative labour opportunities outside the industry while many of them continue working in the fishing industry. One should be careful in drawing conclusions about the extent of the impact of the QMS introduction on fishermen. The issue of quota concentration has been addressed in the design of the QMS through mechanisms that impose quota limitations with the aim of avoiding excessive quota concentration in few hands (Strakker *et al.*, 2002).

Changes in fleet technical characteristics, structure and capacity reduction are expected outcomes of an ITQ inception. New Zealand has been partially an exception to what theory says. According to the interviews capacity has not been reduced, but has expanded in a way that has generated spill-over effects on international waters or foreign EEZs. It is obvious that there has been a capacity reduction in the inshore sector, but capacity has been expanded in the offshore sector because of strong incentives for entrepreneurs to exploit deep water resources that were fairly abundant during the first years of the QMS and in great demand in foreign markets (e.g. orange roughy). The management officers interviewed pointed out that in a comprehensive QMS like the one in New Zealand, overcapitalisation cannot be a concern for the management, but an issue for the firms having to take decisions in order to succeed which includes decisions on investing heavily in fishing capacity.

Consequently, there are not subsidies for fuel, decommissioning schemes, vessel construction or renovations programmes. New Zealand as well as Australia has not taken any action in implementing the International Plan of Action for the Management of Fishing Capacity (IPOAMC). Australia and New Zealand are two of the countries in which property rights have been widely adopted. On the other hand, the IPOAMC has been widely adopted by most FAO member states (Pascoe, 2007). As pointed out, with the aim of improving processes and increasing efficiency the firms invested heavily in fleet capacity expansion and improvement in the offshore sector.

As regards processing capacity firms invested accordingly. The resource economists interviewed pointed out that when the QMS was introduced the inshore fleet shrunk and consequently labour suffered a contraction. The economic system showed resilience and absorbed the impact by social security mechanisms and alternative labour opportunities. It seems as if the right of tenure brought security and allowed for long planning horizons. However, since resource availability has dropped in many cases, firms are seeking to reduce costs by processing fish in China and other countries in the Pacific Region, where labour costs are lower, or by chartering Ukrainian fishing boats that have lower operating costs. A respondent to the interviews pointed out that competitiveness in New Zealand is understood as reducing costs and improving the quality of the products.

Nowadays, with prestige conquered in the global fish market some firms such as Sealord process their products abroad and label them. Thus there is a tendency to get rid of capacity and the current overcapacity could disappear in the short run. Good natural conditions for aquaculture and prestige in the world market for New Zealand’s seafood are allowing for a rapid expansion of aquaculture. The interviewed people pointed out that there is an increasing synergy between the fishing and the aquaculture sector. However, increasing aquaculture is perceived by the industry as a threat to fisheries since they occupy large portions of the sea.

Fig. 2. Evolution of fishery exports in tonnes for the period 1989-2006. Notice the rise in exports from 1990. Exports have not dropped below 1,000 tonnes since then. Source: Ministry of Fisheries.

Fig. 3. Value of fish exports in million New Zealand dollars for the period 1989-2006. Source: Ministry of Fisheries.

5.2 *Indigenous people*

Proper fisheries management and restructuring of the fleet were the obvious challenges for the quota management system in New Zealand. QMS inception aimed at economic efficiency, and social objectives were not taken into account at the very start. The QMS was not designed for encountering the Maori people's claim for their rights as stipulated in the Treaty of Waitangi. Yet the system has managed to encounter the Maori. How can it be that traditional Maori claims could be combined with modern capitalistic management systems? Hersoug offers an explanation: '*… the QMS provided the "currency", making it possible to sort out the Maori commercial claims*'. (Hersoug, 2002:69). He further argues that the QMS is an innovative attempt at establishing the better of two worlds, keeping Maori in touch with the cultural roots of fishing while also participating in the modern commercial sector.

Maoris issues have to be seen in the light of the status of indigenous peoples around the world. New Zealand has a different history than other colonized countries as it was not conquered and forced under the Crown: The Maoris signed a contract with a representative of the English Crown in 1840 (The Treaty of Waitangi[58]). This treaty states that the Maori have rights to their natural and cultural resources – including fisheries resources.

In 1957, the ILO (International Labour Organization[59]) adopted a Convention (Convention No. 107 of 1957 concerning Indigenous and Tribal Populations) to be applied to indigenous and tribal populations in independent countries and aimed at protecting these people. Since then, indigenous peoples have increased the political impact of their countries claiming back rights and resources lost in and after the colonization. In 1989, the convention was revised (Convention No. 169 on Indigenous Peoples) in the light of changes in the position of indigenous and tribal populations and of greater understanding of their position by governments, employers and workers. Whether the adoption of these conventions on supra-national level was a result of increased focus on indigenous peoples' lost rights or the other way around is hard to say. In New Zealand, the Maori had made many claims in vain, but in the left wing orientation period in the early 1970'es things started moving.

In 1975, the Waitangi Tribunal was established to make recommendations to the Government on how the Waitangi Treaty should be applied in current political matters. This, however, did not prevent the part-time fishermen - of which many were Maori - from being excluded from the initial allocation of quota in 1983. The initial allocation concerned 29 species, which corresponded to more than 80 % of commercial fisheries.

The Waitangi Tribunal affirmed to the Maori that the Treaty of Waitangi guaranteed the Maori the full rights to their traditional fisheries (Waitangi Tribunal, 1988). Numerous Maori organizations protested and applied for injunction in High Court, which was granted in 1987. In order to avoid long discussions and trials, the Government and the Maori compromised on the fishing rights – the government arranged for buy-back schemes to be finalized by the end of 1992. The Parliament passed the temporary Maori Fisheries Act in 1989 (Hersoug, 2002). From a non-commercial customary Maori perspective, this settlement of a share of the ITQ was not satisfying. Hence, the Government established the fisheries task force to advice on appropriate legislative change and reform. The task force saw a need for the Maori to be involved in management of the fisheries. The task force suggested two components for addressing the issues of traditional fisheries: a harvesting right and exclusive rights (Kerins and McClurg, 1996). Hence, the customary fisheries were ensured to the Maoris by giving them exclusive rights to certain inshore areas.

Other people see the development differently: Boast sees the development from a legal perspective: He argues that the system is rooted in political pragmatism rather than in the

[58] http://www.treatyofwaitangi.govt.nz/

[59] The UN specialized agency which seeks the promotion of social justice and internationally recognized human and labour rights

legal constitution, and further that its complexity, especially as to customary fisheries, has prevented a clarification of the Maori fishing rights (Boast, 2000). Dewees argues that the Maori people has a hard time adjusting their fisheries from the traditional fisheries as fisheries now require a new set of skills in order for fishermen to manoeuvre in the bureaucratic system (Dewees, 1997). Representatives from the Ministry of Fisheries, Hooper and Lynch, argue that the process sketched above is an expression of the recognition of and provision for the rights of the Maori and the coastal communities. They argue that resources need to be protected if the resources are not to disappear more than they already have. Hence it is also of Maori interest that they are given some tools to ensure sustainable use of the marine resources (Hooper and Lynch, 2000).

5.3 *Fishing communities and recreational fisheries*

As regards fishing communities, social scientists pointed out that many communities have disappeared because QMS propelled a movement in which the small boat owners got rid of their rights to avoid big bureaucratic processes with the hope of leasing rights back later. Leasing back has not happened to the extent expected. It is thought that information was not sufficient and that the small-scale operators were not advised to be cautious in the use of their rights in a scenario of fast changes. Even management officers recognise that the QMS has had a negative impact on communities. A key management officer pointed out that *"the QMS from a macro economic perspective is good; if you want to maintain communities it is bad"*. Managers did not consider this a failure of the QMS since *"social objectives including customary rights were not in the original agenda"*.

What is clear is that introducing such a comprehensive ITQ system definitely transformed the face of fisheries. The actors did not easily foresee QMS outcomes in the beginning. The most efficient companies that had better management capabilities to plan their operations absorbed many other small operators. Other informants pointed out that the complicated paper trial system required fewer points of offloading to make it easier to handle. As a consequence, many small offloading points were closed. Local fishermen were not allowed to sell fish locally as restaurants were not considered as fish receivers. Moreover, occasional fishermen were expelled from the system. It was necessary to demonstrate an annual income of more than 10,000 NZ$ to remain in the system and get quota. The study carried out by Stewart et al (2005) suggests that former boat owners took the decision to exit fisheries on their own, and that they were absorbed by the fishery system where they found alternative labour opportunities.

Both the government and the public in general consider recreational fisheries as an important source of satisfaction: fresh fish for home consumption and an important source of income for fishing communities with neighbouring fish spots as recreational fishing create jobs in retailing, entertainment and services. The economic value is estimated at $ 973 million for the major recreational species (Lock and Leslie, 2007).

Management of recreational fisheries is a hot issue in New Zealand. Recreational fishing is considered a threat to resource sustainability by many groups such as commercial fishermen and conservationists since it is not strongly regulated and its extent is not well understood and quantified. What is doubtless is that this activity is an old and strong tradition considered by New Zealanders as a birthright. Recreational fisheries are practised by New Zealanders from a wide range of ethnic and social backgrounds (Hawkey, 2004 quoted by Lock and Leslie, 2007). This is well understood by Government, and the non-economic and economic value of recreational fishing is being considered when allocating the share of the TAC.

It seems that a conflict for space and resources between increasing recreational fishing, marine farming, conservationists, commercial and customary fishing will rise in near future. Lock and Leslie (2007) see the creation of a management mechanism to facilitate interaction among these factions as a necessity.

5.4 *Resource status and assessments*

Many will disagree to the statement that the QMS is a success in terms of biological sustainability. However, from the increase in total fish exports it is clear that most stocks are in good health (see Figure 3). Low mobility species such as rock lobster, scallops and abalone populations have increased. Such increases may be due to the QMS and the participatory approach and co-management in these fisheries. Moreover, there is little illegal practising coming from outside. However according to fishermen, recreational fisheries accounts for a meaningful share of the rock lobster fishery: *"There is too much recreational fisheries for the quota system to work; hence in the rock lobster fishery about 25%-50% of catches are not reported"*.

Assessment of inshore resources is quite accurate since their biology is well known and data used in the assessment is not undermined to the extent of offshore species as illegal activities are easily detected and denounced by inspectors, fishermen and people in general. In the interviews, recreational fisheries were acknowledged by all fractions as a factor that threatens stock's health due to scarce regulation. A conservationist had this comment: *"The quota system is being undermined by the other kinds of fisheries, which are not included in the QMS"*. Recreational fishing, which cannot be measured, is considered an impediment to evaluating resource status in the inshore fisheries. The extent of recreational fishing is evaluated through voluntary surveys, but there is a belief that many fishermen do not know the imposed daily limits (Lock and Leslie, 2007). In addition, customary fishing can also be considered an impediment to accurate assessment of the status of inshore resources and their management. According to Bess and Rallapudi (2006), customary activities are not subject to size restrictions, bag limits and other management measures.

Other problems arise when assessing what has actually happened with slow growing deep water populations such as the orange roughly stocks. The case of the orange roughy fishery in the Challenger area is a good example for reflection on the role of the knowledge basis in the setting of TACC. During the first years, TACC was based on catches for earlier years, which may work in well-established fisheries, but this was not the case here. There were many new fisheries in middle- and deep-water. An accurate setting of TACC demands a thorough knowledge, but this is especially difficult as regards exploitation of deep-water resources where assessment is expensive and difficult (e.g. orange roughy poorly reflects sound in acoustic surveys due to lack of swimming bladder).

Moreover, initial TACC for orange roughy was based on educated guesstimates based on a revision of the - at that time rather scarce - grey literature on the dynamics of orange roughy stocks in the world. Growth rate was overestimated. Fish behaviour was misunderstood. According to the interviewed biologists, this species gathers in compact aggregations to feed, and this behaviour makes the species highly vulnerable. Furthermore, scientists suggest that this species may have not steady recruitment. The setting of an initial fixed TACC for orange roughy brought judicial demands when the government decided to cut TACC down because of overexploitation (see figure 4).

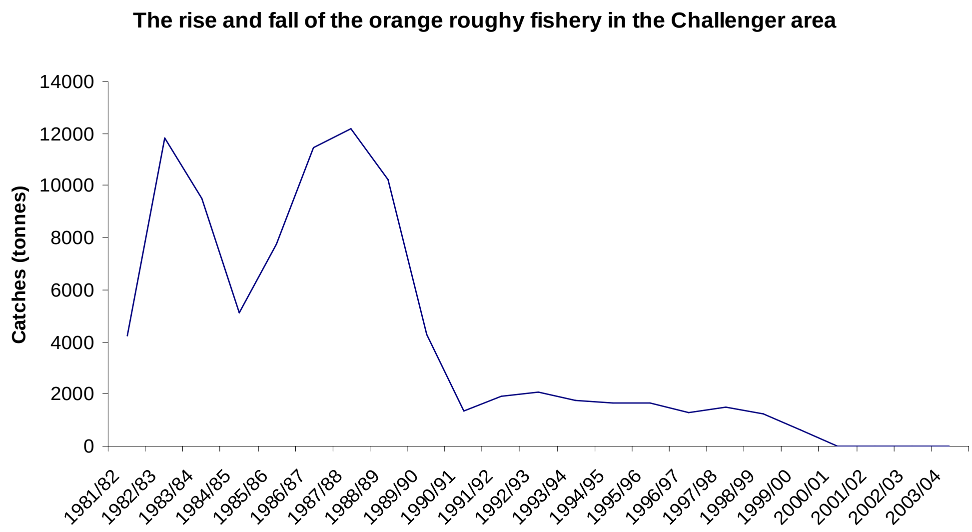

Fig. 4. The rise and fall of the orange roughy fishery. The fishery collapsed in 2001 and was finally closed. Source: Ministry of Fisheries.

The Minister of Fisheries, Jim Anderton, has announced this 25th of September the closure of the orange roughy fishery in waters off central West Coast of the South Islands (ORH 7B) due to *"In this particular case, the best information shows the stock is well below the sustainable target, indeed around 17% of original biomass, and there is nothing to suggest that it is improving"*. Moreover, the Minister has also decided on reductions of the TACCs for various stocks such as the stock of orange roughy of the South and East Chatham Rise (ORH 3B), the orange roughy stock in waters from Bay of Plenty, north to Cape Reigna and through to east coast of the North Island (ORH 1), and hoky in all New Zealand waters (Ministry of Fisheries Web Page). It is clear that sustainability is high on the agenda of the Ministry of Fisheries and even in the case of such a comprehensive property right system government continues to be the main player.

Out of the 592 stocks, 220 stocks are managed through a TACC based on catch history, 75 on CPUE analysis, and 75 (about 8 species) on full stock assessment including acoustic and trawl survey. Species included in the latter are among the most profitable species such has snapper, hoki, orange roughy, rock lobster and oyster. Stock assessment is carried out by 13 stock assessment working groups (e.g. orange roughy stock assessment). The Ministry of Fisheries runs the process in which National Institute of Water & Atmospheric Research Limited (NIWA) participates as a provider of some of the best local scientists. The industry also participates in hiring leading international researchers. Managers are supposed to participate in assessment, but they usually find it hard to follow the technical aspects of the process. Assessment services for resources commercially exploited are purchased by the Ministry and then recovered from stakeholders.

The plenary is carried out the 31st of May to have everything ready for the fishing season starting in October. This is usually a long process because of the various consultations to be carried out among the groups concerned. According to a management officer, there is a need to increase the budget for research. Industry constantly discusses specific research programmes, for instance orange roughy. A report assessment could be consulted four times. New Zealand has water area eleven times its land area. Hence, much research is needed to do proper stock assessment. The stock assessment process gives room to research directly purchased by industry, for example, tagging for rock lobster, fine scale harvest data for abalone (paua), acoustic surveys of orange roughy, catch sampling, habitat mapping and development of excluding devices for sea lions (Peacey, 2007).

A representative of the official sector argued that: "*one of the main outcomes of the QMS has been conservation ethics*". An example of this is the industry suggestion to ban bottom trawling and dredging operations in 31% of the EEZ. It is said to be the largest marine protective action even proposed within a nation's EEZ (Bess and Rallapudi, 2006). Even though it sounds like a good example of growing environmental ethics, it is worth pointing out that the areas the industry are proposing to include in the ban are deep-water areas in which - so far - fishing is unfeasible. However, since fishing technology is progressing so quickly the interviewed representative pointed out that industry is going to lose opportunities in a near future. This issue has also generated polarised opinions between conservationists, some of them considering industry's proposal as good since industry offers banning trawling in areas in which trawling has never been undertaken. Other factions of the greens considered that this is just a first step in a negotiation process in which industry will request aperture of seamounts and other closed areas.

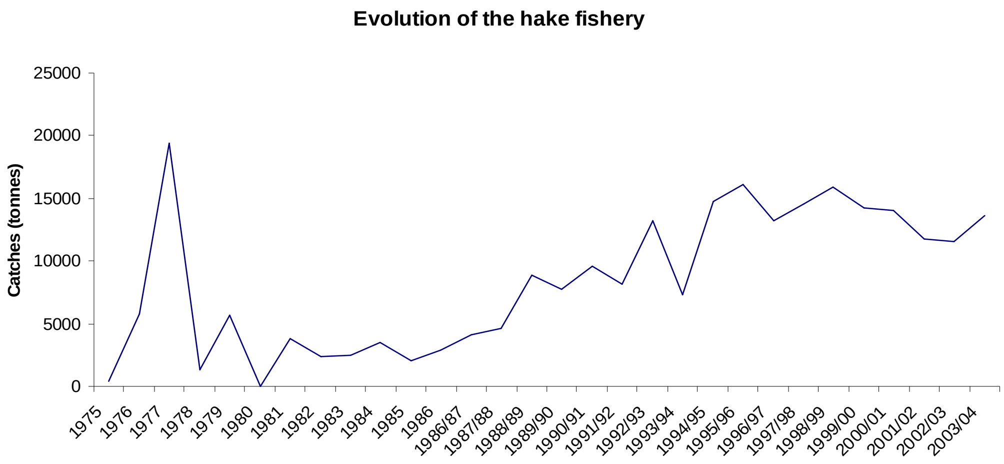

Fig. 5. Evolution of the hake fishery during the last 30 years. Notice that after QMS inception the fishery has experienced a substantial growth. Source: Ministry of Fisheries.

6 Summary: Evaluation of the New Zealand QMS

The purpose of CEVIS is to evaluate innovations with regard to four criteria: Cost of management, economic efficiency, biological robustness and social robustness. The literature review and the study trip helped formulating a number of hypotheses for the evaluation of the innovations described in this chapter. These hypotheses were used as the basis of developing the CEVIS research work in Europe. Various processes are identified within each innovation, but not all processes can be evaluated with regard to all four criteria. The findings are summarised in the table below (-) means 'decrease' while (+) means 'increase':

Innovation	Economic Efficiency	Biological robustness	Social robustness	Costs of management
Property rights				
Characteristics of high quality	+	+	-	
Processes involved				
• Fleet capacity adjustment	+	+/-	-	+
• Pressure for effective monitoring		+	-	+
• Seek for value adding	+	+/-	-	
• Seek for participation		+	+	+
• Introduction of deemed value measure		+/-	+	+
• Introduction of ACE measure	-	+	+	+
• Paper trial and other enforcement measures		+	-	+
Participation				
Industry involvement in research		+	+	
Consultation		+	+	+
Technical solutions to by catch and other technical measures		+	+	
Devolution of responsibilities				
Cost-recovery	+	+/-	+	-

As it has been described in previous chapters the most important innovations in New Zealand is the introduction of a *high quality title*, which was pointed by informants as the main driver in the evolution of the QMS system. High quality has caused a rise in economic efficiency allowing only the most efficient to remain in the fishery and to increase competitiveness through *value adding* of products.

Biological robustness has also increased due to these characteristics, but not in the case of deep-water species where the lack of a solid knowledge basis was the reason for the decline of the orange roughy fishery. Changes in fleet structure have been more developmental than reductive. In the inshore sector property rights inception has determined a reduction of capacity, but in the offshore sector the result has been excess capacity, which is not considered deleterious for New Zealand, but for the boat owners. Sense of ownership has determined an intense *seek for improving of monitoring* and seek for participation which is also determined by the cost-recovery system.

The *deemed value system* is highly criticised for being an invitation to overfish, but it has been also a good measure to avoid discarding. *ACE* has smoothed the process of ownership change. In this way, many operators can lease their right without getting rid of them for good. In terms of economic efficiency, this could be considered negative, as the introduction of *ACE* has ensured that a broad range of fishermen can participate in the fisheries. On the other hand, it has also caused a positive impact in terms of social robustness.

The *paper trial system* is considered positive in terms of biological robustness since actors are discouraged to cheat. However, social scientists pointed out that many points of offloading were closed, as they were considered too small. This affected small-scale commercialisation of fresh fish and the small communities. Paper trial is considered expensive and complicated. In general terms enforcement is strong in New Zealand, even if complicated and a source of litigation between managers and users.

Participation is the second main innovation in New Zealand. Many positive outcomes are found related to this innovation. *Industry involvement in research* through participation in working groups, hiring of international experts and support in data collection are considered to increase biological robustness. *Consultation* of management issues increase social robustness since actors including conservationists and customary groups feel part of the process, which determines that they feel comfortable with the system and increases compliance. But consultation also makes the process complicated and costly. *Technical alternatives to problems of by-catch* for example involve the fishermen in determining meaningful input and strengthen the links with managers.

Finally, *the cost recovery system* is the innovation that has allowed substantial costs of management reduction, even if some aspects of management are still covered by the government. Cost recovery has meant wider involvement of the industry in all processes of management albeit it is criticised due to its focus on the species with higher economic value.

7 Best practices from New Zealand

Initial allocation should be done in percentages of the TACC

Initially, the quota allocation in New Zealand was done in fixed amounts in tonnes. The idea was that the TACC should work like a national bank; buying up quota when stock was low and sell quota when stock was high. This became a problem when stock declines forced government to buy back large amounts of fish. Since fixed shares were property rights, some stakeholders took government to court. The solution was to split TACC in percentages, which is recommended by scientist every year. Thus any variation in TACC will mean an immediate adjustment of the shares since they are percentages of this overall quota. In this way, government shifted the risk to quota holders.

Keep a share for the TAC for other uses

Managers should remember that when allocating in perpetuity, it is not possible to return to the original status of the fishery. Hence, it is a good idea for the managers to hold a percentage of the TAC for uses other than what is allocated for ITQ (Total Allowable Commercial Catch). Other uses of the TAC comprise scientific, recreational fishermen and even a share for precaution.

Annual catch entitlements

An annual catch entitlement enables fishermen to transfer the right to catch a given tonnage of fish to other fishermen without needing to sell the perpetual right. This is meant to soften the impact on ITQ inception so that changes in industry structures would not be too drastic and swift.

Keep an eye on changes in the fishery system

Introducing ITQs in a given fishery is a brave decision. Changes may arise all the time and many of them will be irreversible. Managers shall remember that an open mind to changes may indeed help the process of management. Arising claims from groups with a right to exploitation of the resources such as indigenous people, recreational fishermen and groups with interest in resource protection such as conservationists should be taken into account.

Include fishermen's technical expertise

The setting up of technical measures related to the harvesting operations should include the industry as an input-giving factor. Working groups dealing with technical measures are a good instrument for allowing fishermen to participate and share their expertise in finding solutions to by-catch problems. In New Zealand, for example, fishermen, scientists and foreign experts have managed to come up with technical solutions such as the mammal excluding panel, which is accompanied by incentives to introduce it.

Develop participation structures

The inclusion of all stakeholders' factions into the management process enhances legitimacy and commitment. It is a long, costly and complex process but outcomes would be positive. It is advisable for managers to enable all to expresses their thoughts and to help those without the economic means to participate (e.g. conservationists).

Request stakeholders to bear part of all costs of management

Cost recovery encourages industry participation, transparency and interest for cost effectiveness of research. But be careful that industry would tend to focus on most profitable species which may not be in line with an ecosystem approach to management. Rules shall be established and agreed between government and players on the latter. Industry shall be let free to invest on their own in issues related to research on species of major economic interest. This fact expands the knowledge basis and contributes to resource sustainability.

Review enforcement rules regularly

Reviewing enforcement rules regularly protect the system against fishers' inventive ways of circumventing enforcement. This is as important as setting up strong rules. Even though draconian measures are expected to discourage non-compliance economic incentives to cheat are always strong. New Zealand lessons are to build a strong enforcement apparatus in which an effective judicial apparatus, experienced MCS staff, infrastructure, collaboration between Ministry, policy and army and informative material inviting people to denounce a poacher builds a network to deter illegal practices.

Managers should always have the last decision on resource sustainability

The authority of managers to take hard decisions on resource sustainability must not be questioned. Even in such a comprehensive market based system such as the New Zealand's, the fisheries minister takes decision that may harm the interest of the fishing industry. The New Zealand's experience teaches us that quick decisions shall be taken for the sake of sustainability and based on the best available scientific knowledge. Therefore, none economic interest shall interfere when deciding to close fisheries when stocks are in risk.

8 Conclusions

Although it is difficult to draw conclusions about what the main forces have been in shaping a rather successful QMS, it is noticeable that qualities intrinsic to the right such as high transferability, security and durability have been determinant factors. These characteristics have enhanced the quality of the titles that has developed a sense of ownership, which has generated stakeholder's involvement in management and enhancing of competitiveness. This participatory aspect has been among the driving forces in developing the New Zealand fishing industry. It has allowed for a growing concern about how to improve the management systems through cost-recovery, participation in research and growing concern about the impact of fishing activities on the ecosystem.

From the side of the government, withdrawal of subsides have enhanced industry inventiveness, which has been expressed in the development of products through research and development, improvement of sea and land capabilities, and the expansion of export markets. Although many point at the impact on equity as one of the negative outcomes of a system that gives efficient actors the opportunity to prosper at the expense of the inefficient actors, it seems that the New Zealand system has offered the exiters alternative economic opportunities.

The issue of indigenous people and their degree of involvement in the system also means that New Zealand has taken decisions to respect customary rights. Therefore integration of the Maoris and white New Zealanders into the system is also acknowledged to be successful.

New Zealand’s experience tells us that managers shall consider carefully the introduction of property right systems by defining clearly what the objectives are from the very beginning. Trade offs are to be carefully taken into account. If a country or region aims at economic efficiency as the overall objective the New Zealand experience tells us that introduction of high quality property rights is the path to be followed. However, if social concerns are the objective, property right cannot be applied comprehensively and the quality of the titles will diminish.

Experiences show us that this innovation work fairly well when applied in a relatively new fishery, but there is a big doubt whether they will work in traditional fisheries where many actors will be expelled from the system. How to balance economic efficiency and social objectives?

New Zealand government still keeps control of many aspects of the system. It has a share of the TAC booked to recreational fisheries, which they consider a strong tradition in the country and an important aspect of citizens’ well being, while another share of the TACC belongs to customary groups. These are measures that soften social impacts of the QMS. Within the scope of the commercial TAC, the lack of intervention of government in the trade of quotas among commercial stakeholders is one of the main reasons for the increase in exports and value of the fishery.

Lessons from New Zealand are to shift risk from government to commercial stakeholders, to consider industry the sole responsible to invest in capital, to consult the industry on management decisions, to recover costs, to contract research from research suppliers, to take input from the fishermen when introducing technical measures and to pay attention to further uses of sea in order to avoid or smooth a conflict among factional groups such as fishermen, sea farmers, recreational fishermen, customary interests and conservationists.

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Acronyms list

ACE	Annual Catch Entitlement
CCR	Cost Recovery Regime
DWFF	Distant Waters Fishing Fleets
EEZ	Exclusive Economic Zone
FAO	Food and Agriculture Organisation of the United Nations
FMA	Fisheries Management Areas
ILO	International Labour Organisation
IPOAMC	International Plan of Action for the Management of Fishing Capacity
ITQ	Individual Transferable Quota
MCS	Monitoring Control and Surveillance
NIWA	National Institute of Water & Atmospheric Research Limited
QMS	Quota Management System
TAC	Total Allowable Catch
TACC	Total Allowable Commercial Catch
VMS	Vessel Monitoring System

Appendix
Facts and figures on the New Zealand fisheries

TACC	589,000 tonnes
Total effective catch	517,000 tonnes
Exports	90% of total production
Value (2006)	0.7 billion Euros
Wild capture	NZ$ 1.1 billions
Aquaculture	NZ$ 240 millions
Total quota value	NZ$ 3.8 billion
Fleet	1,372
Quota owners	1,678
Direct employment	7,155
Direct subsides	None

Source: Peacey (2007)

Chapter 5

Syntheses of best practices guidelines to European fisheries

Martin Aranda

Contents

Objectives of management

Objectives of management of fishing resources fall into four broad categories: economic efficiency, biological robustness, social robustness and cost effectiveness of management. These four general objectives are common to most fisheries management systems in the world. Connor Bailey and Sven Jentof (1992) stress that undertaking any objective of fisheries management usually produces effects or trade offs on other intended objectives. Although it may be not hard to define objectives, it is indeed hard to carry out actions to achieve them since trade off among objectives may arise and be hard to counterbalance. Hard decisions in fisheries management means that in some situations the sacrifice of some objectives, for the sake of goals that are more relevant to a given fishery in a given situation, is unavoidable (e.g. stock collapses). This may generate conflict and hurt individual and group interests. Innovations to management applied in other regions of the world such as the ones studied in this report, show that smart mechanisms can be introduced to diminish negative effects of managing fisheries management when aiming at one or all of the aforementioned objectives.

Most cases of innovative management in the world consist of a combination of innovations. All the innovations studied in this report consist of a mixture of innovations in which a backbone innovation is accompanied with several complementary ones. These structures support their management systems. Many of the complementary tools have been developed during the innovations' life span, arising when dealing with problems, and in many cases through a participatory process which is a good platform to launch modifications to the original model when necessary. In this context, it is remarkable that the EU now is investing considerable time and funds to develop the Regional Advisory Councils (RACs). We believe the development of such a platform will enable the EU to improve fisheries management while building flexible structures to face problems through a continuous process of learning and adjusting to the ever changing management context. The following section will synthesise general best practices from the previous chapters on how to pursue the four general objectives of management

Economic efficiency

In broad terms, economic efficiency is understood as the maximisation of resource rents. Economic efficiency is related to indicators such as reduction of government intervention in terms of subsides and aids; the construction of industrial competitiveness; and the reduction of redundant fishing and processing capacity. The comprehensive property right system applied in New Zealand (see Chapter 4) is probably the best known example of a system that has achieved most of the intended economic goals. Economic efficiency has been reached by letting the market guide a process in which the most efficient operators have survived and built a modern and competitive industry. Iceland is another good example of capacity reduction and increase in the value of the fishery which has increased from 20 million US$ to 450 million US$ in 18 years (see Chapter 3). Despite the focus on economic efficiency, New Zealand and Iceland have devised mechanisms to diminish the impact of economic measures on other aspects of the fishery. The New Zealand and Iceland experiences with comprehensive ITQ systems are good examples to draw useful conclusions from when aiming at economic efficiency.

In a different context, the Pollock cooperatives in Alaska (see Chapter 1) are other good examples of right based management that have shown effectiveness in meeting economic efficiency. In fact the coops manage a proper ITQ system by letting the dynamics of right base management operate within each coop by allowing leasing and selling of fishing privileges among members. In this way, the fittest operators predominate, while marginal capacity is eliminated. Another modality of ITQs is found in Nova Scotia in Canada where the allocation has been carried out on a fishing gear basis bringing about a substantial rationalization of the fleet (see Chapter 2). From the cases mentioned above it is clear that property rights have introduced a powerful driver to economic efficiency with especial regards to reduction of marginal capacity. These experiences are a good source of ideas to achieve the intended goals while counteracting the negative outcomes of introducing measures aiming at economic efficiency. Lessons from the cases revised comprise:

Introduce exclusive, durable, transferable and secure rights if you aim at economic efficiency

If managers aim at reaching economic efficiency, the implementation of ITQs may help them to reach their objectives. Property rights may introduce a powerful driver to economic efficiency. Rights that hold the most attractive characteristics of property rights such as exclusivity, security, high transferability and duration may enable the most efficient stakeholders to remain in the activity and to grow competitive while eliminating unnecessary harvesting and processing capacity. Regarding duration, this characteristic has been addressed differently by New Zealand and Iceland. It seems that Iceland have managed to obtain efficiency in the system without allocating permanent rights as New Zealand did. In addition, managers should keep in mind that social distress may arise. They shall counterbalance the trade offs and establish measures to diminish social distress. These measures may diminish economic efficiency but may help to meet social objectives. Allocation of rights to fishing communities, skippers, crews and buy out programmes shall smooth changes in ownership and fleet restructuring.

If the decision is to introduce a long term property right, establish a mechanism to transfer the annual share of the right

When managing permanent or long termed ITQs, the introduction of an annual catch entitlement similar to the ACE used in New Zealand allow stakeholders to buy and lease the share for the current year -which varies according to stock status- in such a way that quota owners do not need to transfer their property right forever, but they are able to transfer or lease the share that corresponds to the current year. The introduction of an Annual Catch Entitlement is meant to soften the impact on an ITQ implementation so that changes in industry structures would not be too quick and drastic.

Initial allocations should be done in percentages of the TAC

The inception of comprehensive property rights builds ownership and quota owners will be ready to challenge any decision that threatens their assets. Managers should carry out the original allocation of rights in percentages of the TAC. In this way, further stock declines will not need to be economically compensated as was the case in New Zealand. Allocation in percentages of the TAC shift risk to quota owners. In this way, further reductions of the TAC due to changes in resource status will not be easily contested and challenged in court.

Biological robustness

Biological robustness has been, for a long time, the main focus of management. Concerns for achieving sustainable levels of exploitation and recovery of stocks after collapse, have determined that biological objectives have been top priority in agendas and that biology has been the main support to decision making. Governments have devoted large amounts of economic resources and technical expertise to achieve biological aims. Despite efforts devoted by governments and international organisations biological robustness is likely to be the hardest issue to deal with since managing marine resources faces high uncertainty. In the cases reviewed in this report many mechanisms have been introduced to approach biological robustness. Mechanisms comprise participatory approaches to gather the empiric knowledge of stakeholders, industry hired research, enhancement of MCS systems and introduction of tools in line with the Precautionary Approach to fisheries management such as the HCRs. Challenges may keep arising and the ecosystem approach to management stands as one of the major challenge to reinforce resource and environmental wellbeing. This fact may determine that innovations shall keep evolving and adapting to new situations. The lessons that can be drawn from the cases revised are:

Review enforcement rules regularly and establish a strong and flexible MCS system

Reviewing enforcement rules regularly protects the system against fishers' inventive ways of circumventing enforcement. This is as important as setting up strong rules. Even though draconian measures are expected to discourage non-compliance economic incentives to cheat are always strong. Strong enforcement system in which an effective judicial apparatus, experienced MCS staff, infrastructure, collaboration between Ministry, policy and army and informative material inviting people to denounce a poacher builds a network to deter illegal practices. Strong enforcement will provide fairness to fair players and the marine resources will be better managed.

Establish good observer coverage on board and let communities participate in MCS

Efficient observer coverage on board helps managing bycatch problems and other potential ecosystem considerations (damage of bottom habitat, undersized fish, etc). This will make sustainability labelling easier and the fish may reach a higher value in the market. In addition, a real time, online catch reporting system similar to the one held by Iceland and open to everybody is expensive but backs up monitoring effectively. Monitoring carried out by fishing communities may increase its acceptance in the community. The arms-length user pay monitoring system developed in Nova Scotia in Canada, for example, works well (see Chapter 2). This modality of monitoring system might link up very well to both an ITQ system, for example, and to community based management. In both cases local fishers and officers should be very interested in keeping a close, real-time eye on landings.

Enable collaborative research and encourage industry initiatives on research

Although collaborative research and co-management is not error-free, it is clear that increased communication and industry involvement helps strengthening the credibility of science. It has also helped to learn to accept uncertainty as inherent to fisheries science and management, to live with it and to take it into account for decisions. The case of ground fish fisheries in Nova Scotia in Canada are a good example of the latter. Such initiatives should be encouraged to improve communication and trust between scientists and fishermen. In New Zealand, scientists working for the industry as consultants increase the quality of research which is benefited by a process of continuous peer reviewing. Industry shall also be free to invest on their own in issues related to research on species of major economic interest. This fact expands the knowledge basis and contributes to resource sustainability. Research hired by industry speeds up knowledge production and helps to facilitate management. This is especially feasible when self management is in place. This is the case of Pollock coops in Alaska which hire scientific services to undertake the by catch reduction programme.

When setting TAC establish an HCR

It makes the setting of TACs robust to both economic and biological changes. The fishermen should be part of the formulation process for HCR as it has been the case in Iceland, for example. Although in most cases fishermen do not play any formal role in the management system, in practice they should have easy and direct access to the decision makers. The management objectives concerning the biological resources and the basic ideas of an HCR should be decided by law in order to avoid negotiation on the TAC thus ensuring sustainable fisheries. There will always be room for negotiations (ecosystem concerns, data, models etc.), but some kind of border should be drawn for what can be negotiated. It is also advisable to decide on HCR for non-harvested species and criteria for developing a new fishery. It allows for precaution when developing a new fishery.

Include fishermen's technical expertise

The setting up of technical measures related to harvesting operations should include the industry as an input-giving factor. Working groups dealing with technical measures are a good instrument to allow fishermen to participate and share their expertise in finding solutions to by-catch problems, for example.

Keep a share for the TAC for other uses

If managers decide for a perpetual rights allocation they should remember changes will be irreversible. Hence, it is a good idea for the managers to hold a percentage of the TAC for uses other than the share to be allocated for the commercial activity (Total Allowable Commercial Catch). Other uses of the TAC comprise scientific, recreational fisheries, customary and even a share for precaution. New Zealand provides an example of segmentation of the TAC into the main sectors of the fishing activity: commercial, customary and recreational.

Managers should always have the last decision on resource sustainability

The authority of managers to take hard decisions on resource sustainability must not be questioned. Even in a comprehensive market based system, the fisheries minister has to take decision that may harm the interest of the fishing industry. The case of a recent closure of one fishery for orange roughy in New Zealand provides a good example of quick and brave ministerial decisions when resource wellbeing is at risk (see page 130). Quick decisions shall be taken for the sake of sustainability and based on the best available scientific knowledge. Therefore, no economic interest shall interfere when deciding to close fisheries when stocks are being threatened.

Social robustness

Social robustness has an increasing weight in the agendas of fisheries managers. Modern management steps a side of aiming merely at economic efficiency and biological robustness - the traditional main objectives of management- and turns its attention to social aims. Social goals involve stakeholder's acceptability, institutional sustainability of the regime and legal conformity of the innovation to the legal context. Experiences in the world (e.g. New Zealand) show that even when agendas do not include social aspects among its aims social distress will demand modification of the original model. In this context, institutional adaptation to new demands is a key factor of success. In New Zealand, the involvement of Maoris into the QMS -although contentious at a first stage- demanded modification of the original property rights model. It seems that adaptability of New Zealand institutions to this change has been successful and in conformity with law, specially the Treaty of Waitangi. Other systems in the world have been developed by taking social aspects into account from the very beginning. The case of New Scotia in Canada shows that mechanisms can be found to allocate rights in such a way that conflict, if not eliminated, is at least smoothened. Participatory management and transparency of the process contributes to social robustness, building legitimacy which facilitates stakeholder's acceptability. It is possible that in Canada the social objectives were high in the original agenda since the particular characteristics of its fisheries based on traditional fishing communities facilitated the development of structures in which stakeholders have tangible participation in decision making. The lesson that can be drawn from the case revised are:

Identification of sectors

Prior to undertaking a rationalization process, managers should collect comprehensive information on characteristics of the fisheries to be dealt with. Different fisheries require different solutions. The information collected should comprise historical catches, characteristics of fishing fleets, fishermen, economic and social dependency on the resources being exploited, alternative labour opportunities and identification of organisation structures and rules within the fishery that can support a reorganisation of the fishery activity.

Limit transferability of fishing rights to fishing communities

The experiences reviewed in this report show that property rights holding unlimited transferability and high duration introduce high efficiency but undermine social robustness. Fishing rights allocation limited to the fishing community such as the model applied in Nova Scotia presents a very strong alternative to rights with unlimited transferability. The Nova Scotia experience of community based ITQs shows a strong balance between social and economic objectives. It is not just conflict resolution, there is still plenty of conflict, but it also shows that the system can maintain rural employment, viable fishing communities, broad participation in decision making and smooth the entry of new fishers into the fishery, while at the same time achieving most of the benefits of increased economic efficiency including smoothing the exit of fishers who want to retire or who represent surplus fishing capacity.

Subjects to allocation

Giving rights not only to vessel owners, but also to the captains and the crew shall increase legitimacy and acceptance of the process of rights allocation. Moreover, it would impede power to be concentrated on a few hands. This practice requires comprehensive data. In Alaska, for example, there was a problem with collecting data on how much the crew (other than the captains) had worked on a fishing vessel.

Develop participation structures

The inclusion of all stakeholders' factions into the management process enhances legitimacy and commitment. It is a long, costly and complex process but outcomes would be positive. It is advisable for managers to enable all to expresses their thoughts and to help those without the economic means to participate (e.g. conservationists). Fisheries management should involve stakeholders in addressing management issues and in evaluating management decisions. Although this may be time consuming, involvement can improve the communication between the different parties, which again can improve acceptance of the different views. Involvement may improve the quality of the management decisions as more aspects are brought to the table. Involvement will trigger negotiations, which can result in innovative solutions.

Cost effectiveness of management

Large funds and expertise are devoted to managing fishing resources with regards of research, administration or MCS. Concerns on increasing budgetary requirements may determine the generation of mechanisms that allow effective reduction of management expenses. Mechanisms to recover the cost of management from the stakeholders are in use in many places in the world. They recover, all or part of the management costs. It is a highly debated aspect of modern management and many managers and scientists disagree since the cost recovery tool may become a powerful tool of combat for the industry to contest management decisions. Costs of management shall rise since tendencies of modern management are to consider ecosystem issues into account. This requires development of research and technical capabilities. Increasing use of the seas, not only by fisheries but also to aquaculture and other activities, will require strengthening the enforcement apparatus which will increase management expenses. The main lessons that can be drawn from the cases revised are:

Request stakeholders to bear part of all costs of management

Cost recovery encourages industrial participation, transparency and interest for cost effectiveness of research. But care must be taken because industry will tend to focus on the most profitable species, which may not be in line with an ecosystem approach to management. Rules shall be established and agreed between government and players on the latter. Industry shall be let free to invest on their own in issues related to research on species of major economic interest. This fact expands the knowledge basis and contributes to resource sustainability.

Allow the industry to independently hire research services

Industry may have particular interest in some species with a higher economic value. Managers should consider giving facilities to the industry to hire research on their own. This contributes to the biological knowledge base for management. It allows the development of private providers of research services and gives agility to the assessment process. Research produced in this way enables stakeholders to contrast their findings to officially hired research. This in turn improves the research process. Industry hired research is not an expense to the government but a benefit of the whole system.

Allow communities to undertake MCS activities

In a context of self fisheries management, allowing groups to undertake MCS activities may reduce the cost of management to a great extent. MCS activities carried out by the community or cooperatives may also produce legitimacy and enhance compliance since participants are permanently controlled by their colleagues. The case of Pollock cooperatives in Alaska is a good example of the effectiveness of a system of MCS carried out by the members themselves.

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Appendix

Guide questionnaire

A brief revision of the history of the fishery

- What was the situation of the fishery two decades ago?
- What were the main problems at that time?
- When were the ground breaking measures that allowed the improvement of the fishery management system introduced?
- Did those measures yield immediate positive results?
- Was that innovative model a creation of the involved managers and scientists of that time?
- Was that model 'imported' from somewhere?
- Did you encounter legal problems when the measures were introduced?
- Did you have to adjust the measures due to legal problems (law suits etc.)?
- Was the legitimacy of the measures questioned when they were introduced?

The current situation of the industry

- How do you perceive the current situation of the industry?
- What are the causes of success / failure of the industry?
- Who are the key persons behind this situation?
- What have been the key factors that generated the current situation?
- What are the challenges the fishery faces?
- What are the constraints?
- What are the comparative and competitive advantages?
- What are the threats?

The policy

- Are the goals and objectives of the policy accurately set?
- What are the strengths of the policy in use?
- What are the weaknesses?
- Does the policy include any goal on innovation or at least shows flexibility to accept new approaches?
- Did the policy developed involve the participation of users and wider stakeholders? Was participation balanced (e.g. were 'minorities' involved)? How were transparency and accountability of the process ensured?
- Is the inclusion of stakeholders in the management process stated in the policy?
- Does the policy encourage investment and added value?
- Does the policy control fishing capacity and effort?
- Does the policy protect the resources and the environment?
- Does the policy seek an improvement in labour and protein supply?
- Does it seek economic efficiency?
- (How) Does it seek to improve social conditions, e.g. create sustainable communities?
- Have there been major modifications of the policy/management innovation over time?

    - If yes, were these induced by learning processes or rather by external circumstances?
- Is the policy designed in a way that it accounts for uncertainty/ long-term dynamics and promotes learning (e.g. through adaptive management structures: monitoring, feedback processes, responsive decision structures, experimenting)?
- Does the central government devote attention to the fishery as a meaningful sector of the national economy?
- Does the central government devote economic and human resources accordingly?
- Are there any known conflicts of the measure with national law (e.g. constitutional law or state aids)?
- Are there any known conflicts of the measures with international law (e.g. trade law, competition law etc.)?

The management

- Is this a top-down management system? If not
    - Can the current system be described as an innovative management system?
- Does the current system include active stakeholder participation?
- Do you consider stakeholder participation positive in all cases?
- Does stakeholder participation speed up the process or does it delay decision making?
- What are the more radical positions of stakeholders?
- Is there a conflict between certain stakeholder groups?
- Are the final decisions normally based on what was debated and decided with the stakeholders?
- Do the various stakeholders (fishermen/industry, processing sector, civil society e.g. conservationist, etc.) accept management innovation?
    - Were there conservationist's protests, legal challenges or the like when the management innovation was introduced?
    - Are there high levels of infringement by fishers?
    - Do the stakeholders (industry and broader society) participate in the institutional arrangements (formal and informal channels of participation), or do they oppose them?
- Is there a good communication between the scientists, government officials and stakeholders?
- How do you deal with the gap regarding communication between the scientists and the industry?
- How do you assure compliance with regulations?
- Do you have an efficient MCS system?
- Does the industry participate in MCS? Does the industry finance part of the costs of MCS?

The production of knowledge

- Does the current management system encourage multidisciplinary participation in assessment, advice and decision making?
- Is the traditional knowledge included in the knowledge basis? If so,
- Is there evidence of an improvement of fisher compliance?

- What are the sources of error in data collection that undermine assessment?
- Does the industry support part of the research costs?
- Does the industry participate in assessment?
- Is training of scientists and technicians an important part of the production of knowledge?
- Does the current system include any kind of stakeholders training in the understanding of assessment tools (seminars, workshops)?

The future

- How do you see the fishery in one decade?
- Do you expect the system to improve?
- Do you suggest any means to improve the system?
- Is there any dangerous trend that can threaten the sustainability of the exploitation in the near future?
- In the event of collapse of the current exploited stocks: What would the impact on the social and economic side be?
- Are there escape valves for a situation of social and economic distress?
- Are there any potential resources for the development of new fisheries?