Pelagic Fish Committee

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REPORT OF THE

STUDY GROUP ON THE MANAGEMENT PERFORMANCE OF INDIVIDUAL QUOTA (ITQ) SYSTEMS

International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

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*available on request from the Chair of the Study Group

1. Background

❶ *History of the Study Group*

At the 1993 statutory meeting held in Dublin, Ireland, there was considerable discussion on the potential role of ICES in the study of fisheries management systems. The empirical evidence that scientific advice is a necessary but not sufficient condition for effective fisheries management was noted along with the need for further 'analysis of fisheries management systems in order to understand why some approaches work and others do not' (ICES Annual Report 1995. Procès-verbal de la réunion, p.211).

The 82nd statutory meeting of ICES held in St. John's Newfoundland, Canada in the Fall of 1994 was the first such meeting held outside of Europe. Another "first" at this meeting was the presentation of the theme session entitled "Improving the Link between Fisheries Science and Management: Biological, Social, and Economic Considerations". Organized at the initiative of the Canadian host delegates following on the Dublin strategic planning discussions, this theme session brought together under the ICES umbrella researchers from a broad base of fisheries analysis including economists, fisheries managers, sociologists, decision analysts, and fisheries consultants. The interdisciplinary session exposed the rich range of research beyond fisheries biological science directed at improving the performance and sustainability of fisheries systems as a whole. The session was one of the most popular sessions at the conference, attracting 42 paper presentations, along with poster presentations over 3 days of the meeting.

At the 1995 Annual Science Conference held in Aalborg, Denmark, a follow-up theme session was held entitled "Improving the Link between Fisheries Science and Management II: Can We Manage Fisheries by Technical Measures Alone?". In this session examples were reviewed of the experience gained in adopting new management measures. The theme session was 'very well attended and several possibilities were considered to continue consideration of this type of topic in ICES' (ICES Annual Report 1995. Procès-verbal de la réunion, p.221).

These recent ICES theme sessions discussed in broad terms strategies for fisheries management. Most notably in these sessions, individual transferable quotas, or ITQs, have been often proposed as a promising approach for more effective fisheries management. At the Aalborg conference, the Pelagic Fish Committee recommended the formation of an ICES sponsored *ad hoc* Study Group on the Management Performance of ITQ Systems. The purpose of that Study Group was to examine and assess current work on ITQs and the experience compiled from those systems already in place. The Study Group worked by correspondence and reported to the ACFM and the Pelagic, Demersal, and Baltic Fish Committees at the 1996 Annual Science Conference. The report of the Study Group (ICES C.M. 1996/Assess:19) was presented at the 84th statutory meeting in Reykjavik, Iceland between September 27 and October 4, 1996.

The interest in the ITQ report at the Reykjavik meeting prompted Resolution C.Res.1996/2:38 proposed by the Pelagic Fish Committee for a Study Group meeting to be held in 1997. On the invitation of the ICES American delegate, the Study Group met at the Northeast Fisheries Center in Woods Hole, Massachusetts from May 6 to 8, 1997. This report presented herein has been shaped by the discussions of the 3 day Study Group meeting.

Mandate

The original mandate of the ITQ Study Group was established at the 83rd Statutory Meeting of ICES held in Aalborg, Denmark and recorded in Resolution C.Res. 1995/2:39 of the Annual Science Conference (ICES Annual Report 1995. Procès-verbal de la réunion, p.250). This led to the Report by Correspondence of the Study Group, ICES CM1996/Assess:19 presented at the Annual Science Conference and 84th Statutory Meeting of ICES held in Reykjavik, Iceland. Resolution C.Res.1996/2:38 of the Reykjavik meeting stated that the Study Group:

> "...will meet at a venue in North America for three days to:
>
> a) develop an ITQ Performance Appraisal Survey to measure the status of a fishery system with respect to the biology, economic performance, social status, compliance, and decision making dynamics of the fishery;
>
> b) prepare a cross-sectional list of international ITQ fisheries to be included in the ITQ Performance Appraisal Survey, and establish contacts in each of these fisheries to permit follow-up for survey details;
>
> c) describe a multidisciplinary consultative committee membership structure for each fisheries case study, including critiquing the fishery system infrastructure in place in support of the ITQ management.
>
> The Study Group will report to the Advisory Committee on Fishery Management and the Pelagic, Demersal, and Baltic Fish Committees at the 1997 Annual Science Conference. The report will be made available to the Comprehensive Fisheries Evaluation Working Group." (ICES Annual Report 1996. Procès-verbal de la réunion, pp.213-214).

Justification for the Study Group meeting was made in order to carry out the following agenda consist with the mandate:

1) Establish a general model of a fisheries management system, including all operational components (fisheries science, regulation, statistics, economics and planning, resource allocation, and institutional decision making) within which an ITQ approach could

operate. Within the framework of the general model, establish an ITQ Performance Appraisal Survey to measure the status of a fishery system with respect to the biology, economic performance, social status, compliance, and decision-making dynamics of the fishery. The Survey should record relevant quantitative measures for specific fisheries to describe: (1) the long-term anticipated annualised state of the fishery system, (2) the average annual pre-ITQ state of the fishery system, and (3) the average annual state of the fishery under the ITQ scheme.

2) Include the direct input and contribution of the fishing industry and other stakeholders in the evaluation of ITQs.

3) Prepare a cross-sectional list of international ITQ fisheries to be included in the ITQ Performance Appraisal Survey. Establish contacts in each of these fisheries to permit follow-up for Survey details.

4) Establish, through contact with the identified fisheries contact (Recommendation 3), a multidisciplinary consultative committee membership structure based on the general fisheries management model (Recommendation 1), for each fisheries case study. The committee membership would include existing or recommended positions that would represent roles of activity to support ITQ management within each fishery management system. Critique the fishery system infrastructure in place to support ITQ approaches within each case study fishery.

❸ *Report of Study Group meeting, NEFC Woods Hole, May 6-8, 1997*

All Study Group meetings were held in the Northeast Fisheries Science Center (NEFSC), 166 Water Street, Woods Hole, MA 02543-1026 in the Aquarium Conference Room. All meetings began at 9am each morning and ended between 5 and 6 pm except on the third and last day which ended at 1pm in order to permit travel arrangements from Woods Hole.

The agenda of the Study Group meeting was ambitious. The purpose of the meeting was to draw together the observations of experts in diverse disciplines who have been directly involved with the development, analysis, and operation of ITQ systems around the world in order to share their perceptions about the pros and cons of these systems. Consensus positions where sought to enable a better understanding of the issues, problems and benefits of rights-based approaches within fisheries management systems. The meeting agenda was set in order to provide basic guidelines to assist in meeting the mandate of the Study Group. However, the participants, by their personal interventions in open and informal discussions, ultimately determined the direction and extent of progress of the meeting.

The highlights of the meeting are itemized below:

1. Introductions - The Study Group meeting was opened by the Science and Research Director of the Northeast Fisheries Science Center and ICES U.S.A. Delegate, Dr. Michael Sissenwine. There were 18 participants at the meeting including 3 observers from the USA. All 15 Study Group participants were from either Canada (4) or the host country, USA (11). Other members included invitees from Iceland, Denmark, the Netherlands, New Zealand, and Australia who all expressed interest in the meeting but were unable to attend.

2. Meeting mandate - The Chair, Dr. D. Lane (Canada) reviewed the mandate of the Study Group and its history. Copies of the 1996 Report by Correspondence were distributed. The Study Group agreed that under the circumstances and in concert with the group's mandate, the meeting agenda would discuss: (i) developing a general framework through which performance analyses of fisheries management systems - including ITQs - may be carried out; (ii) providing a list of ITQs currently in place around the world that would be representative of ITQ performance in general, and would be possible candidate fisheries for further evaluation; and (iii) establishing contacts of individuals directly involved in the operations of these ITQs in order to maintain an on-going record of data and information on management performance

3. Fishery Management Systems - It was agreed that understanding the institution, its problems and its role, would help define how ITQs play a part in fishery management as a whole. Institutional arrangements were not seen as impediments to successful fisheries management, however, there was consensus that ITQs bring about institutional change. Successful ITQs that created wealth tended to be characterized by increased user participation and enhanced industry responsibility. Together these changes caused shifts in the institutional arrangements of these fisheries.

4. Management Objectives - A long list of fishery management objectives were developed. It was generally agreed that this list could be categorized according to: (1) biological; (2) economic; (3) social; and (4) administrative objectives. Other levels of classification of objectives were by strategic or operational; quantitative or qualitative; and static or dynamic. These objectives were generally applicable to any management system and would include impacts from various management policies including an ITQ system.

5. Quantitative Measures - It was noted that reduction in capacity will itself lead to more profitable fisheries and thus could create less incentive to circumvent the regulations and undermine conservation. There were concerns regarding the level of discarding and dumping under ITQs, but there is little hard evidence in specific fisheries to measure the extent of this potential downside effect. There are also instances where fishing fleets have implemented, on their own initiative, conservation measures, such as moving to larger mesh sizes, or halting fishing in particular areas. It was pointed out that ITQs are a privilege rather than a right, which had not been the case under open access. However, there was also the sentiment that cost recovery was an important element of any successful

ITQ system and would ultimately lead to a simplification of the implementation process. This raised the debate again on the point that ITQs confer a privilege to fish and are not a general right, and that a more efficient ITQ system would likely result in reduced access in comparison with the 'fishing as a right' perspective. The discussion on quantitative measures of ITQ systems ended with consideration on the need to define measures of conservation and the social impacts of ITQs. There was no consensus on either the particular measures or their need in evaluating ITQ performance. What was evident is that implemented ITQ systems cover a spectrum of designs and purposes, and that it would be useful to categorize these on the evidence of various case studies. The criteria provided by Scott for categorizing property rights systems identified four elements: exclusivity, duration, security and transferability (Scott, A.D. 1996. The ITQ as a Property Right: Where it came from, how it works, and where it is going. In B. L. Crowley (ed.) *Taking Ownership*. Atlantic Institute for Market Studies (AIMS), 31-98.) It was generally agreed that this categorization could be employed in the examination of the ITQ case studies to compare and contrast different examples of rights based fisheries.

6. Case Studies - The Study Group participants presented a series of ITQ case studies meant to illustrate many of the problems, issues, successes and failures of quota systems and their implementation in practice. A description of the case studies discussed are listed in the table below.

No.	Stock(s)	Area/Country	Presentor(s)	Year of ITQ Transition
1	Pacific Halibut	British Columbia, Canada	Chris Dewees	1991
	Snapper, roughy	New Zealand		1986
2	Atlantic Herring	Scotia-Fundy, Canada	Rob Stephenson	1983
3	Atlantic groundfish: cod, haddock, pollock	Scotia-Fundy, Canada	Les Burke, Bob O'Boyle	1991
4	Pacific Halibut and sablefish	Alaska	Joe Terry, Phil Smith	1995
5	Atlantic surf clam, ocean quahog	New England, United States	Lee Anderson, Bonnie McCay	1990

The analysis of individual cases was seen as an important step in providing an illustration of possible evaluation methods, measurement metrics and parameters for inclusion in the study. It was noted that selected examples should include a diversity of fisheries and rights based applications in order to show the variety of ITQ designs and purposes and the context in which they were implemented.

7. Analysis Framework - A report on an expansive study for the Organization for Economic Co-operation and Development (the OECD), in Paris on the economic aspects of fisheries management was presented by principal investigator Jon Sutinen. This study

has recently been published under the title *Toward Sustainable Fisheries: Economic Aspects of the Management of Living Marine Resources*. This report examined the economic impacts and consequences of various management measures and institutional arrangements on marine resources. In this study, the analysis of management measures was described by the three step process:

1. Develop the set of expected consequences for a specific management measure with respect to the multiple objectives of the policy makers.
2. Collect data on the actual impacts of the management measure.
3. Assess the theory on which policy is based and draw conclusions regarding its actual effects on fisheries management objectives.

The assessment was carried out by correlating data obtained from OECD member countries with the adopted management measures. Dr. Sutinen noted that this exercise was constrained by the lack of consistent and relevant economic data needed to carry out the task of fisheries management evaluation. The results of the OECD study suggest that rights-based management systems (including ITQs) are conducive to more successful fisheries management. Overall, the evidence is that they lead to improvements in economic performance. However, they do require an appropriate administrative framework and adjustment which may increase costs, and they may lead to structural adjustments in the socioeconomic system by consolidating capital and labour. The study also showed that successful management is enhanced by the active participation of the fishing industry in policy setting and by the transfer of management responsibilities. While the Study Group noted the standardized approaches to gathering and analysing fisheries biological information, it was also noted that no such mechanism existed for socioeconomic data sources related to fisheries management. There was complete consensus on the need for: (i) a common language (i.e., performance measure definitions across disciplines) for evaluation of fisheries management, (ii) an interdisciplinary peer reviewed evaluation system, and (iii) a coordinated data management process. It was generally agreed that the ICES Study Group report should acknowledge these shortcomings of evaluation methods and make steps toward suggesting ways to alleviate this problem of acquiring standard data sources.

8. General discussion and feedback - The Study Group agreed that the framework and methodology for the comparative analysis of ITQs should pay close attention to that used in the OECD study. The particular elements discussed for the ICES ITQ evaluation framework are summarized as follows:

1. Describe the *status quo* fishery system prior to the establishment of ITQ management. Provide information on specific and attainable metrics including: (i) administrative/institutional conditions; (ii) biological/ecosystem conditions; (iii) economic/industrial conditions; and (iv) social/community conditions.

2. Specify the objectives and expectations of management relative to the descriptive indicators of (1) above. Criticize the *status quo* management on the basis of achieving

these objectives and relative to the presumption of management change and anticipate the impacts of management change (including ITQ management).

3. Collect data on the relevant metrics established above and evaluate the actual impact of management change.

4. Assess, explain and criticize the results of (3) above for the ITQ management approach.

The following section presents the plan of the current report of the Study Group on the Performance Evaluation of ITQs.

2.Introduction

❶ *Purpose of the Report*

The objective of this report is to respond to the mandate of the Study Group. That mandate has a threefold requirement consisting of: (1) the development of a framework for an ITQ Performance Appraisal Survey to measure the status of a fishery system with respect to the biology, economic performance, social status, and administrative dynamics of the fishery; (2) the preparation of a cross-sectional list of existing international ITQ fisheries along with published information about these case studies, and (3) the description of a multidisciplinary arrangements and processes for providing a source of ongoing data on these cases.

❷ *Plan of the Report*

The report proceeds by first defining ITQs. The breadth of policy options within the full spectrum of what characterizes ITQs is noted. Having characterized ITQs, the report then describes the general framework for the integrated evaluation of these right-based management regimes. The evaluation methodology consists of using quantitative data measures to analyze the biological, economic, social, and administrative implications of ITQs. Evaluation methods consider the dynamic aspects of the management problem against its multidisciplinary objectives in a direct and relative comparison scheme. The importance of reliable and available data in support of the evaluation methodology is noted. In this respect, issues with respect to the data requirements and problems of consistent and standardized data across different fisheries case studies in different countries are presented.

Case studies of implemented ITQ management regimes are discussed relative to the proposed evaluation framework and data availability issues. General observations are drawn from these case study examples and compared to the expected impacts from the formal theory on ITQs. Finally, the conclusions of the report are itemized together with Study Group recommendations. These recommendations are provided in the sprit of improving the methods and means of evaluation of fisheries management policy options toward ultimately improving fisheries management itself.

❸ *Report Dissemination*

The results of the Study Group report will be presented to the Annual Science Conference to be held in Baltimore in the Fall of 1997. At that time, the report is to be filed with the Pelagic, Demersal, and Baltic Fish Committees as per the Study Group's mandate. ICES has also requested that the Study Group report be provided to the Advisory Committee on Fishery Management (ACFM) and the Comprehensive Fisheries Evaluation Working

Group (CFEWG). A draft unfinished reports was circulated to all Study Group meeting participants and to an extended list of interested individuals for their feedback and suggestions. The final report for the Annual Science Convention was completed on receipt of this feedback and submitted to ICES in time for the Baltimore meeting. Copies of the final report will be disseminated through ICES at the Annual Science conference in Baltimore, September 25 to October 3, 1997, and by the Chair, D. Lane (Canada) to all meeting participants and interested individuals.

3. Characterization of ITQs

❶ *Definition of ITQs*

What is an "individual transferable quota"? The fisheries literature is mainly indirect in answering this question. In general, we define a "quota" as a proportion of a "total allowable limit" determined for a fishing period, i.e., a season, and allocated in the harvesting activity to an "individual" as a "property right" (Scott 1996, Muse and Schelle 1989). A fishery operating under an ITQ system regulates its seasonal harvest through the allocation of such quotas to a finite number of "individuals". "Individuals" may refer to a specific person or groups of persons, or to a fishing unit such as a vessel, or even to a collective such as a community. The "total allowable limit" on which the quota is based may refer to a prespecified harvest output limit measured in weight of fish yield or numbers of fish as determined by an outside source. Alternatively, it may refer to a unit of fishing effort input, e.g., days fished, numbers of nets hauled, etc., relative to a predetermined upper bound on the relevant input. Finally, as a "property right", the quota permits some degree of ownership over the harvesting activity that empowers the owner of the quota to: (i) manage the use of the quota in a discretionary manner, (ii) transfer the quota to another party, and (iii) reap the benefits of quota use (Scott 1996). The degree of ownership establishes the level of transferability, "T" of the ITQ. Quota systems that are strictly not transferable are denoted as IQ systems.

This broad definition of ITQs arise from the wide-ranging applications of quota systems that exist. Examples of the more restrictive IQ systems predate the current popularity of more transferability in quotas. Similarly, community quota systems and effort quota systems have also been implemented in fisheries around the world.

The underlying notion of all manner of ITQs as a form of property rights - regardless of the meaning of "individual" or "quota" - enables us to establish more clearly a delineation of these systems along the lines of ownership of a private good. The characteristics of ITQs as property rights are considered below.

❷ *ITQ Characteristics*

Scott (1996) presents four tangible characteristics of a property right. These are: exclusivity, duration, security, and transferability. These measurable (on some scale) characteristics are defined in detail as follows:

1. *Exclusivity* - the right to use and manage a resource without outside interference. All owned property is characterized by a level of exclusivity to the owner.

2. *Duration* - the length of time the owner of a quota may exercise ownership powers to manage, transfer, and use the resource.

3. *Security* - the strength of the entitlement of the quota with regard to how susceptible it might be to being undermined by other quota holders or by adjustments in the total allowable limits set by the outside source, e.g., government regulators.

4. *Transferability* - the extent to which the entitlement of quota can be disposed of by selling, leasing or trading divisible units of the quota.

The degree to which an ITQ system can be described as being a full property right depends on the extent by which each of theses characteristics are realized. For example, an open access fishery with "free" entry and exit exhibits property rights characterized by low exclusivity (since outsiders may freely interfere with right of resource use), negligible transferability (since ease of entry makes this unnecessary), high duration (given by continual short-term renewal of seasonal licences), and high relative security of access ("free" entry). Alternatively, a "full property" fishery is fully exclusive (i.e., limited entry), fully transferable and divisible, perpetual in duration and secure (i.e., not subject to cancellation). The radar plots of Figure 1 provides a relative scale illustration of the property characteristic comparison of the open access or "competitive" fishery and the property rights fishery.

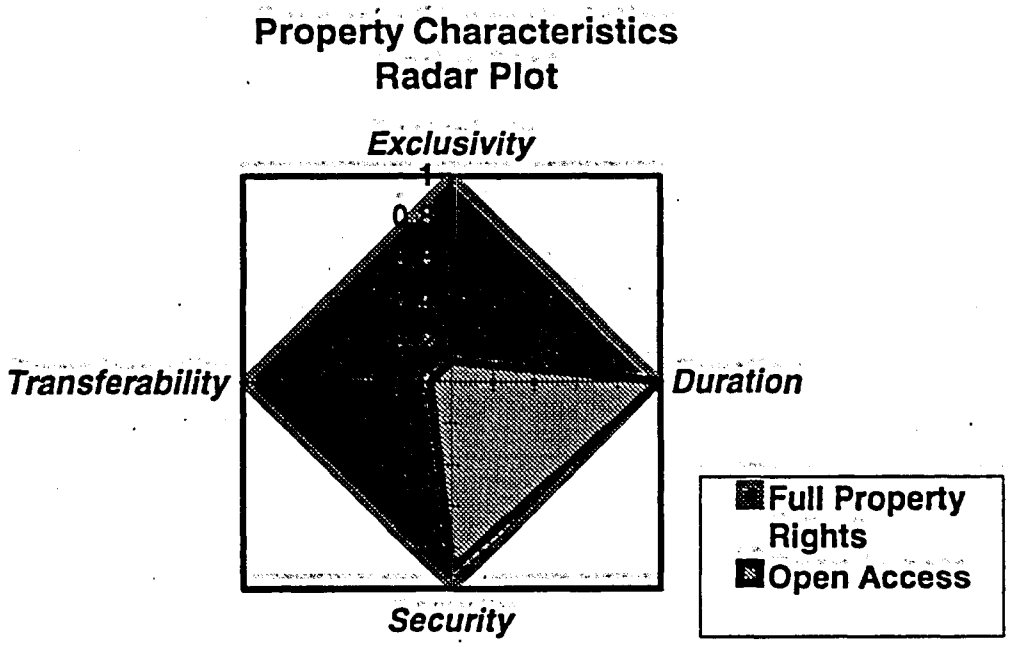

Figure 1. Property Characteristics for Open Access versus Full Property Rights Fisheries

As Scott (1996) suggests, the property characteristics "gap", exhibited in Figure 1 especially along the axes for Transferability and Exclusivity, denote the opportunity that ITQ systems may offer in moving away from "common property" problems that have characterized fisheries to date and toward property rights in fisheries.

❸ *Management Impacts of ITQs*

Previous studies, especially in the economics literature, have generally portrayed ITQs in a favorable light. (See also ICES C.M. 1996/Assess:19 for further discussion of the literature on ITQ evaluation.) Published empirical evidence also tends to support the formal economic theory that ITQs provide a viable alternative to common property rights systems.

Nevertheless, ITQs are not without detractors especially with regard to the difficult issues of: (i) implementation and the assignment of the initial quota allocations, (ii) sociological concerns over wide-scale consolidation by corporate interests under liberal transferability regulations, (iii) biological fears over the extent of high-grading and discarding of catches, and (iv) the definition of the roles and responsibilities of fishery interest representatives and regulatory agencies under a property rights regime. To date, we lack clear empirical evidence in these areas to understand fully the overall implications of quota systems. However, as an illustration of the importance of these issues, sufficient pressure by fishing interests in the United States culminated in 1996 in a moratorium on ITQs until such time as a review of quota systems by the U.S. National Research Council Committee to Review Individual Fishing Quotas has completed its work scheduled sometime in 1998.

To date, the recent comprehensive empirical evaluation of fisheries management systems among OECD members (OECD 1997) concludes that rights based management fisheries systems (and ITQs in particular) are beneficial to fisheries management where they exist and lead to improvement in economic performance of the fishery. It is also noted in this study that such systems require adjustments to the administrative framework which may increase costs. It is also acknowledged that they may lead to structural adjustments in the socioeconomic system by consolidating capital and labour. As well, the study showed that successful management is enhanced by the active participation of the fishing industry in policy setting and by the transfer of management responsibilities.

Scott (1996) reiterates this last point in his evaluation of the importance of property rights for the future of fisheries management. In his argument based on the characteristics of property rights identified above, he argues that increased exclusivity will result in lower operating costs, more transferability will lead to efficient consolidation, lower transaction costs for acquiring fishery information, and increased involvement and participation by the fishing industry in cooperative and responsible decision and policy making. At the same time, the role of government agencies as paternalistic protectors of the resource will change to a more protective - of their property rights - role in support of enhanced industry self-regulation.

4. ITQ Evaluation Framework

❶ *Evaluation Methodology*

The Organization for Economic Co-operation and Development (the OECD) report entitled "Toward Sustainable Fisheries: Economic Aspects of the Management of Marine Living Resources" examined the impacts and consequences of various management measures and institutional arrangements on marine resource management. In doing so, the OECD report provides a model methodology for the evaluation of fisheries management measures that is directly applicable to the issues of this Study Group in evaluating ITQ management approaches.

The analysis of management measures in the OECD report was carried out in an integrated bioeconomic framework methodology. In summary, this methodology is described by the three step process: (1) develop the set of expected consequences for a specific management measure; (2) collect data on the actual impacts of the management measure to determine the extent to which the expected consequences are supported or refuted by the data; and (3) assess the theory on which the policy is based and draw conclusions regarding its actual effects on fisheries management objectives.

The focus of the analytical assessment of management measures was on the economic consequences. The assessment was carried out by correlating data obtained from OECD member countries with the adopted management measures. The results of the OECD study suggest that rights-based management systems are beneficial to effective fisheries management. Overall, the evidence is that they lead to improvements in economic performance. They do however require an appropriate administrative framework and adjustment which may increase costs. As well, these may lead to structural adjustments in the socioeconomic system by consolidating capital and labour. The study also noted that successful management is enhanced by the active participation of the fishing industry in policy setting and by the transfer of management responsibilities from the exclusive purview of the government agency to the industry.

The framework and methodology for the comparative analysis of ITQs adopted by the Study Group pays close attention to that used in the OECD study. The particular elements discussed for the ICES ITQ evaluation framework are summarized as follows:

1. Describe the *status quo* fishery system prior to the establishment of ITQ management. Provide information on specific and attainable metrics including: (i) administrative/institutional conditions - the pre-ITQ regulatory program and infrastructure (management measures in place, monitoring and enforcement, decision making process); (ii) biological/ecosystem conditions - the status of the resource stock (including dynamic mixing with substocks or other species), and spatial-temporal behaviour; (iii) economic/industrial - the status of the fishing industry (size, composition, gear characteristics, malleability of capital

and labour, concentration profile of participants, vertical integration, cost components, markets, and value of the harvesting and processing sectors); and (iv) social/community conditions - employment levels, communities spatial-temporal reliance on the fishery, other opportunities

2. Specify the objectives and expectations of management relative to the descriptive indicators of (1) above. First, based on historical data, project the impacts of continued *status quo* management on the administrative/ institutional, biological/ecosystem, economic/industrial, and social/community metrics. Compare these relative to the desirable objectives of management in each area. Criticize the *status quo* management on the basis of achieving these objectives and relative to the presumption of management change. Second, anticipate the impacts of management change (including ITQ management) relative to these same objectives, expectations, and metrics. Evaluate a suite of management alternatives (e.g., input controls, output controls, technical measures, and combinations thereof) relative to these measures.

3. Collect data on the relevant metrics established above and evaluate the actual impact of management change. For the case of ITQ management regimes, compare the observed results of selected case studies against (i) the expectations of *status quo* management (from (2) above), (ii) the anticipated results of the new management regime (as in (2) above), and (iii) the overall objectives and expectations specified by management (also from (2) above).

4. Assess, explain and criticize the results of (3) above for the ITQ management approach. Apply methods of total quality management (TQM) and continuous improvement by recommending ongoing adjustment in the management policy, and improved metrics to monitor the movement over time toward any specified but underachieved objectives.

❷ *Evaluation Procedure*

The step-by-step fisheries evaluation methodology assumes the existence and availability of descriptive cross-disciplinary data (economic, biological, etc.) about the fishery throughout the study period, as well as the specification of fisheries short and long term objectives. For most fisheries however, standardized absolute data measures that would enable easy comparison of performance within and across fisheries may not be readily available. This fact limits the possibility for comparing the performance of different fisheries in the evaluation procedure.

Alternatively, the relative changes that occur within each fishery can be evaluated over time assuming some basic data are available at the level of the operation of the fishery. In this sense, the methodology can be applied by evaluating the operating performance of each fishery relative to its own expectations over time, e.g., as a result of

implementing an ITQ regime. Similarly, different fisheries can be compared and contrasted by examining similarities and differences in their abilities to meet their own operations expectations over time.

This fisheries-based, dynamic evaluation can be developed by using generally applicable metrics and adapting them to correspond to the case at hand. For example, economic evaluation of the fishing operations can be expressed in standard *pro forma* statements for net operating income, profit, or after tax cash on a seasonal basis. While each fishery may have different data requirements needed to calculate these statements, the year-over-year indicators are consistent and generally knowable even with a minimal amount of information.

Similarly, a model of stock dynamics over the planning period based on standard population analyses for stock assessment will provide a basic means for tracing relative stock changes from period to period.

The exercise of developing linked dynamics models at the level of operation of the fishery serves to focus attention on the actual data needs as well as leading to an improved understanding of the actual dynamics of operation of the fishery. Finally, the operations model should also permit the exploration of alternative policy and management options for the fishery. These specific policy alternatives can then be evaluated to examine the short -term effects of change. This bottom-up approach to applying the evaluation methodology is in lieu of the more general, formal - and often aggregated - fisheries theoretical models that exist within the paradigms of each of the disciplines of the fishery system.

In summary, the evaluation procedure to apply the performance methodology should be developed by first constructing a model of the fishery in question and then exploring the model in anticipation of actual observations that one would accept from the real system. In this way, actual observations are anticipated and the evaluation of the system proceeds relative to anticipated results.

5. Data Issues

The results of the OECD study on management measures referred to above affirmed that data availability problems presented a serious need to be addressed in attempts to evaluate and assess the value of management policy. The Study Group noted the existing standardized approaches for gathering, analysing and reviewing information required for biological and fisheries science research. At the same time, it also noted that no such parallel mechanism exists for social or economic data sources related to fisheries management. The call was reiterated by the Study Group for a common language of measurement among disciplines in the fishery system, an interdisciplinary peer reviewed evaluation, and a coordinated fishery data management process. It was generally agreed that this report to ICES should acknowledge this shortcoming of evaluation methods and make steps toward suggesting ways to alleviate this problem.

❶ *Data Requirements*

The multidisciplinary nature of fishery systems led to itemizing the description of the fishery according to: (i) administrative/ institutional conditions; (ii) biological/ecosystem conditions; (iii) economic/industrial status; and (iv) social/community conditions. An appropriate description along these axes requires that specific metrics be identified for each item.

In its discussion on data, the Study Group presented a long list of such metrics with respect to management objectives. In the course of this exercise, it became obvious that some measures (e.g., spawning stock biomass, level of profit, seasonal employment figures) may be generally relevant data applicable across many fisheries. However, other supplementary measures may be important in the context of each particular fishery. The Study Group thus concluded that a concise list of data requirements aimed at describing or evaluating many different fisheries did not exist. However, it was recognized that the categorization of cross-disciplinary metrics was possible. The importance of developing consistent, accurate, cross-disciplinary databases for measuring the status of individual fisheries was noted. The experience of the OECD management systems study in this regard, reinforces the need for a consistent fishery-by-fishery database of information.

❷ *Data Measurability*

Available data make take several different forms that are relevant to the evaluation of ITQ or any other management regime. The Study Group recognized several measurable data types. These include:

1. cross disciplinary data related to the biological, economic, social, and administrative categories of the fishery system to be evaluated

2. dynamic versus static data
3. disaggregated versus aggregated data
4. absolute versus comparative/relative data measures, and
5. historical versus projected data

The importance of these data to the performance evaluation of the fishery depends on the context of the fishery, its expectations and performance objectives. Recognition of the different types of data on the management system contributes to the performance evaluation of all aspects of the system.

❸ *Presentation of Data*

The evaluation of the management system benefits from the appropriate presentation of data and the ensuing results of the performance measures. The complexity of the fishery system and the potential for large amounts of data to be analysed would encourage a simplistic presentation of results.

Tabular data displays of quantitative results, e.g., as in *pro forma* income statements, together with graphical results would provide a concise and parsimonious presentation of results. Together with the modelling approach referred to previously, these presentations could be developed in computer spreadsheets where ease of access and automatic graph and table building possibilities would facilitate the analysis and presentation of data and performance results for management systems.

6. Selected Case Studies

The analysis of individual cases was seen as an important step in providing an illustration of possible evaluation methods, measurement metrics and parameters for inclusion in the study. Selected cases should include a diversity of examples in order to show the variety of ITQ designs, intended purposes, settings for which they were implemented as well as pointing out areas of successful and failed implementation.

The Study Group examined several ITQ case studies illustrating many of the problems, issues, successes and failures of quota systems and their implementation in practice. A list of ITQ case studies are given in the table below.

No.	Stock(s)	Area/Country	Year of ITQ Transition
1	Pacific Halibut	British Columbia, Canada	1991
	Snapper, roughy	New Zealand	1986
2	Atlantic Herring	Scotia-Fundy, Canada	1983
3	Atlantic groundfish: cod, haddock, pollock	Scotia-Fundy, Canada	1991
4	Pacific Halibut and sablefish	Alaska	1995
5	Atlantic surf clam, ocean quahog	New England, United States	1990
6	South east fishery	Australia	1992

Discussions on these case studies with regard to evaluation of their adopted ITQ programs is presented below.

❶ *Case Study Descriptions*

1. *The B.C. halibut fishery and the New Zealand fisheries.* Follow-up surveys in New Zealand (1987 and 1995) (described in Dewees 1997) compared and contrasted the impacts and noted the management history of the transition to the ITQ regime. An increased level of fishery sector concentration across all fisheries and at the same time the expansion of the fishery in terms of numbers of vessels and value added over this time period were noted.

With respect to the B.C. halibut fishery, it was noted that the fishing industry had approached the Canadian Department of Fisheries and Oceans in order to request the move to ITQs. After this occurred in 1991, there was a marked increase in the length of the season for the same number of fishermen, with increased fishing power under the same level of TAC. A decrease in crew size and the subsequent increase in crew share values

also occurred. In general, the move to ITQs have benefited this fishery in all aspects. The success of the British Columbia fishery, in part, enticed the Alaskan Pacific halibut fishery to consider a quota licensing system. The Alaska quota system was introduced in 1995 for halibut (and sablefish). (See also the Alaskan case study example below.)

2. *The Scotia-Fundy commercial herring fishery.* The Scotia-Fundy herring fishery was almost totally a fish meal fishery prior to 1976 leading up to vessel quotas in the dominant purse seiner gear sector. (See also Stephenson *et al.* 1993.) The fishery opted for nontransferable vessel quotas with trip limits in 1976 in order to ensure a more manageable move from a pure meal fishery to a food fishery. Initially, the harvesting sector operated independently from the processing sector. Later, arrangements among harvesters and processors led to a breakdown of the independence system. In 1983 a system of individual quotas with restricted transferability was established and has continued since that time. The stated objectives of the ITQ system were fleet reduction, stock restoration, and enhanced economic stability for the industry.

The actual implementation of the herring ITQ system was flawed: quotas were ensured for a fixed 10 year period after which time it was implicit that a renegotiation would occur, misreporting of catches were rampant so that quotas did not incur any real harvesting limitations on vessels, markets for herring roe constricted the fishery to short time windows on spawning grounds thereby limiting the opportunity for operators to take advantage of the potential for further economic efficiency. Accordingly, the anticipated benefits of ITQs did not materialize in this case.

In 1995 a perceived stock crisis led to significant changes in this fishery. During this period there was concern for the sustainability of particular spawning areas. Consequently, annual TACs were cut back by half. At the same time, the industry was incurring more costs (for dockside monitoring, and increased license fees). The combined stock status and rising costs problems engendered more direct industry involvement in their own affairs. In 1996, an in-season management working group of purse seiners worked together with DFO science and management personnel in efforts to acquire more information and to pay closer attention to the in-season management of individual spawning groups. The in-season decision making process has led to more direct participation of the harvesting and processing sectors, it has provided more information on in-season stock status, and has fostered an integrated, conservationist view to fisheries management.

3. *The Scotia-Fundy groundfish fisheries.* The multispecies, multigear groundfish fishery in the Scotia-Fundy region of Atlantic Canada adopted an ITQ system in 1991. From the evidence on fishing effort and capacity in the Scotia-Fundy cod, haddock, and pollock fishery, the motivation for quotas in the mobile gear sector was to reduce excess capacity in an orderly fashion that could be sustained and viable based on the resource availability. Quotas offered an alternative to the political realities of declining TACs and fishery closures, and permitted a share of fishing activity, albeit at low levels, that provided each individual with the "right to go broke".

Initially, transferability took the form of species transfer but there were no permanent transfers of quota. One major difference resulting from ITQs was the relief quotas provided to the "race for fish" competitive fishery. In this sense, the management change to ITQs was a positive change. Since 1991, many events have conspired to complicate the evaluation of the ITQ management regime including the dramatic decline in groundfish abundance that is a northwest Atlantic Ocean phenomenon. In the ITQ fishery licensed vessels have declined slightly since 1991 and there has been a corresponding increase in the fleet concentration profile. Highgrading is a reported problem, but the extent is not quantified. The number of license conditions reported annually for the ITQ fleet has decreased significantly compared to the non-ITQ fleet fishing the same resources. In this sense, under ITQs, the fishery is being conducted in a more business-like manner without the many conflicts experienced under the competitive fishery.

Recent developments in this fishery may see the transition of the fixed (longline) gear fishery (currently on global quota) moving to ITQs. Issues include the equitable suballocation of global quotas to competing gears, gear selectivity, sharing by historical arrangements, selective area closures, and social impacts (see also document [5]) related to increased stewardship and fishermen participation in management decision making.

4. *The Alaskan halibut and sablefish fisheries.* An overview of the objectives and problems of the Alaskan halibut and sablefish fisheries (converted to an Individual Fleet Quota (IFQ) system in 1995) included resolving the allocation conflicts among competing gear types and harvesting groups, and stock conservation concerns arising from the effects of exploitation (including "derby" fishing, ghost fishing, and highgrading).

The experience of the institutional management transition to the IFQs including dealing with the initial allocation process, the large number of appeal requests (and denials), and the legal questions that arose. In spite of the apparent complexity of the program, there has been general acceptance because it was clear that the 2 day derby fishery was no longer reasonable. While therefore, the administrative burdens are severe, the program appears to be meeting its social objectives as well as its cost reduction and benefits targets. Thus, the transition to IFQs in Alaska did not seek to remove excess capacity explicitly. There still remain a large number of fishermen from heterogeneous backgrounds in the fishery who are apparently viable operators.

From an economic rent perspective, Alaskan halibut are now sold more for the higher valued fresh market than was the case before the IFQ program. This has had a negative economic impact on some local processing operations and communities dependent on processing employment.

5. *The Atlantic surf clam and ocean quahog fisheries.* This fishery experienced severe overcapacity of the fleet and a moratorium on open fishing was announced in 1978. Processors were content with the restrictions that limited the fishing period of individual vessel owners to a total of 6 hours every 3 weeks. This ensured a smoother delivery to processors and a balance of power in their hands. It took over a decade to convince the

industry that an ITQ scheme would assist in a more orderly and viable prosecution of the fishery. However, while the Mid-Atlantic Fisheries Management Council preferred ITQs (versus effort control) despite the uniform disapproval of the industry and its fear of the unknown (ITQs) it was finally adopted in 1990.

The major difficulties were establishing rules for the initial allocation as well as in adjusting to the different management regime (clam versus quahog days) and determining the appropriate management units for stocks. These problems arise in this fishery with regard to the quota assignments based on stock assessment. These essentially stationary stocks are comprised of individuals that may be as much as 30 to 40 years old.

The results of the quota system have led to a decrease in the number of boats (smaller, marginal operators sold out leading to increased concentration in few firms), an increasing length of season, and incentives for resource stewardship. Efficiency increased as vessels logged more fishing time at higher productivity. Conflicts have arisen however between industry ITQ holders and those who simply rent ITQs.

6. *The South East trawl fisheries*. This multispecies demersal fishery in south east Australia has experienced many ups and downs. The initial quota allocation process was established in 1992 so that a history of the impacts of ITQs is more than 5 years old. Fishing power has increased and effort has risen steadily while overall annual landings have remained stable resulting in falling catch rates and profitability. Lack of quota trading and capacity reduction is explained by the fact that the industry has remained cash strapped. Tilzey (1994) provides a scientific review of the quota management systems for this fishery.

❷ *Comparative Analysis of Case Studies*

The property rights characterization of Scott (1996) provides a means of comparing the application of ITQs to the various case studies referred to above. Although the measures for exclusivity, duration, security, and transferability are subjective, they do provide an aggregated and relative evaluation for the comparison of different ITQ systems.

As in Figure 1, we provide in the following, radar graphs of ITQ property rights characteristics applicable to three selected case studies described above. On the basis of this information we can compare and contrast the different ITQ implementations relative to "full" property ownership, as well as compare the relative values across all fisheries.

The Scotia-Fundy commercial herring fishery.

The ITQ regime in the Scotia-Fundy herring fishery is restricted by the limitations on quota transferability (e.g., restrictive ceilings on quota holdings, indivisble transfer amounts or all-or-nothing transferability). As well, the first ten years of the ITQ (1983-1992) were set out as an adjustment period. It was generally understood among fishermen that any extension of the quota scheme after the ten years were up would result in a complete re-allocation of the quotas. Accordingly, the Duration characteristic of the property right is diminished.

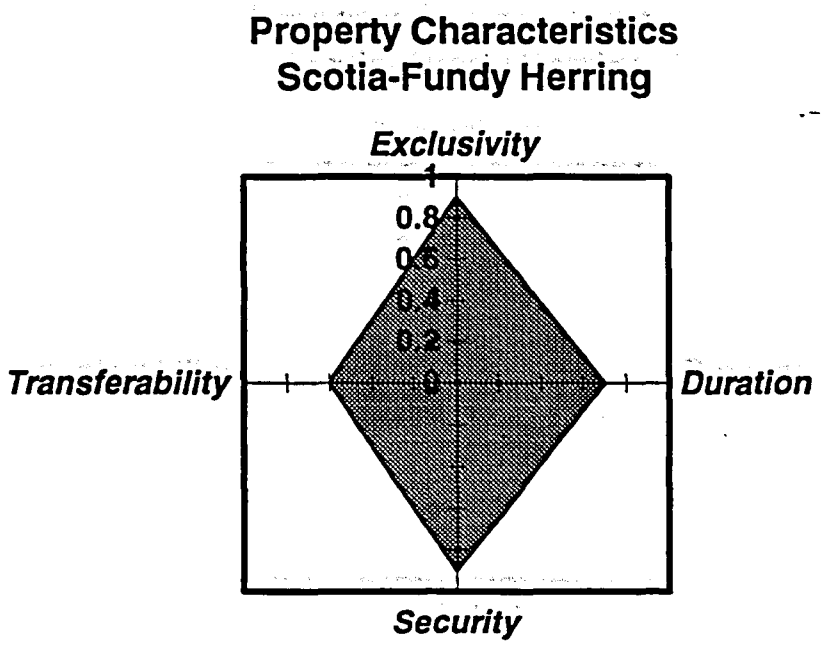

Figure 2. Property Characteristics for the Scotia-Fundy Herring Fishery.

The implications of this graphical display would suggest that the effectiveness of the ITQ regime could be further increased through the relaxation of the transferability restrictions and an increased confidence among fishermen regarding the duration of their owned quotas.

The Scotia-Fundy groundfish fisheries.

Events in this multispecies, multigear fishery tend to restrict the property rights in this fishery relative to "full" common property and relative to the herring fishery above (see also Figure 3 below).

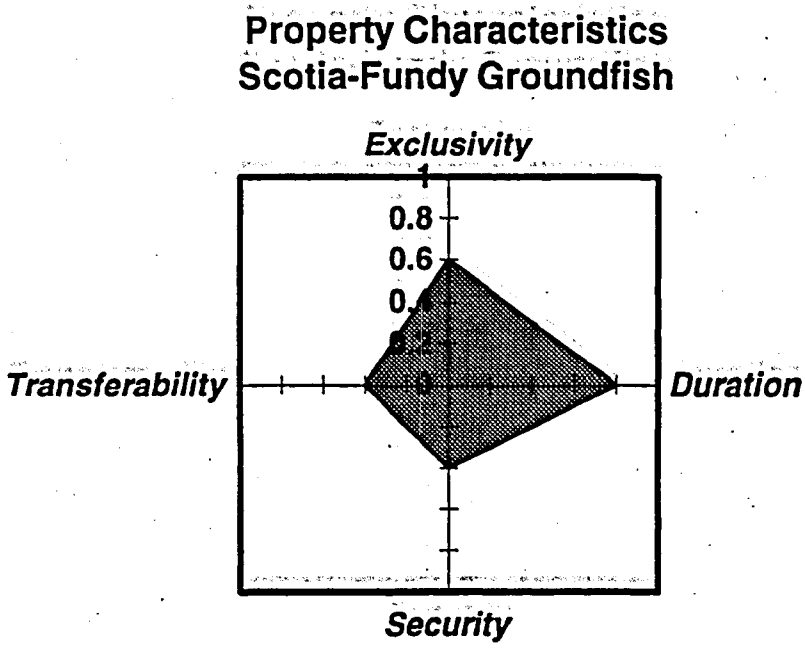

Figure 3. Property Characteristics for the Scotia-Fundy Groundfishery.

In this case, Security is driven back toward the origin due to the events of 1993 when the fishery TAC was set and then abruptly change by one-half in the middle of the season. Similarly, transferability restrictions coupled with social welfare opportunities and declining catches decrease the measure of Transferability for the purpose of illustrating property characteristics. Finally, the presence of other gear (fixed gear - longliners) not managed by quotas, but fishing in the same fishery, pose a source of interference for the mobile fleet and a reduction therefore in Exclusivity.

The Alaskan halibut and sablefish fisheries.

The Alaskan fisheries ITQ was designed as a socioeconomic policy tool to maintain the participation in the fishery while eliminating the waste of the "derby" fishery. The consequence is ownership among a large number of licence holders (that effectively reduces Exclusivity) but with extended duration ownership rights attached to the quota. Transferability of quota is limited if allowed at all (Figure 4).

As a result of the property characteristics of this fishery there may be a tendency to diagnose its performance as underachieving its goals. However, by all indications, the participants in the fishery are content with the quota regulations. Thus, in the context in which it was designed, and despite the apparent inefficiencies, one could argue that th fishery is reaching it goals as planned.

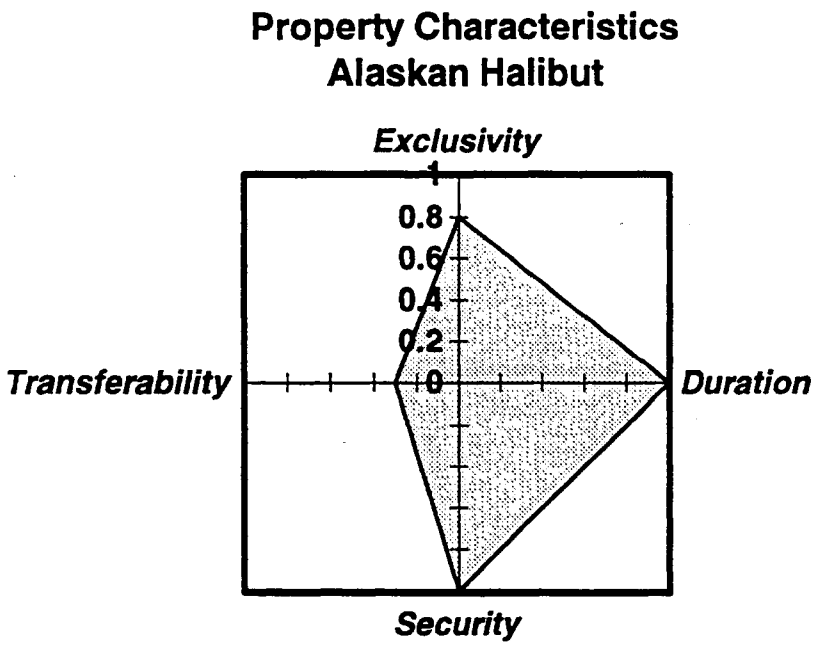

Figure 4. Property Characteristics for the Alaskan Halibut Fishery.

The presentation of these subjective (i.e., non-quantitative) property evaluations illustrate the potential for further comparative analysis on the performance evaluation of ITQ management systems. As well, the variety noted in Figures 2 through 4 also show the flexibility that may be attached to ITQ implementations. Depending on the context of the fishery and its objectives, ITQ can be designed - according to Scott's property characteristics - in many different ways and for many different goals. This potential range in ITQ applications suggests that such a scheme could be developed to fit the requirements of many different fisheries settings.

7. Conclusions and Recommendations

Conclusions

The Study group strongly endorses the need for an evaluative framework for fisheries management policy. While this report endeavours to make some progress in this direction, with regard to the evaluation of ITQs in commercial marine fisheries, continuing importance should be placed on management evaluation, accountability and decision monitoring over a wide range of interdisciplinary areas and alternative management approaches.

In the course of this study on the evaluation of ITQ systems, a number of conclusions have been noted. Firstly, the implementation of an ITQ management approach requires corresponding change in the institutional arrangements in order to support the greater participatory roles and responsibilities of the fishing industry.

Secondly, as a consequence to the above point, the management policy setting and decision making processes must also be adjusted under an ITQ regime. In particular, the paternalistic role of fisheries central agencies is required to move into a decision support role rather than a strict decision authoritarian role. The ownership power attached to the industry forces the industry through its membership to become more directly responsible for managing the resource (Scott 1996).

Thirdly, further quantitative analysis of ITQ performance can only be carried out with the aid of cross-disciplinary fisheries data and an infrastructure in support of the ongoing collection, analysis, and presentation of these data over time.

Finally, a model of the operating system of the fishery is required in order to monitor and anticipate all the impacts of management decisions. This exercise will assist decision makers to understand better the limits to our ability to manage the resource in a highly uncertain environment.

Recommendations

Following on the results of the Study Group activities, it is recommended that research be continued in the area of ITQ management performance evaluation in order to:

1. **Provide further detail on the multidisciplinary evaluation framework** for fisheries management alternatives and the process of evaluation including institutional aspects, bureaucratic adjustments and ensuing transaction costs (which have not been adequately treated in the past).

2. **Reiterate the problem of insufficient data** available and acknowledge the need to improve on establishing standards to ensure adequate data sources in socioeconomic and administrative metrics as well as in the biological data.

3. **Include in the ICES study methodology a clear definition of ITQs** on the spectrum of other management measures and the range of possibilities contained in the notion of quota as property, and present a diversity of case study examples comprised of successful as well as unsuccessful cases that illustrate the variety of options and problem areas in ITQ management implementation.

4. **Present case study examples** in a descriptive and concise manner, e.g., using tables and graphics, to summarize evaluative arguments and comparisons and contrasts across case studies.

5. **Maintain a longer-run focus within ICES** for the provision of information and education to ICES on the issue of the evaluation of ITQs through developing the multidisciplinary systems evaluation framework.

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Notes on the bibliography: *The citations of the bibliography are divided into three major categories: I. Cases Studies by Country, II. ITQ Formal Analyses, III. Fisheries Systems. Within each category, citations are numbered according to the alphabetical ordering of the list. Case studies are also subdivided by country designator. The extensive database includes many of the cross-listed citations reported in the bibliography of the original ICES ITQ Study Group Report, ICES CM 1996/Assess:19.*

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